STAR JPSS 2018 Annual Conference

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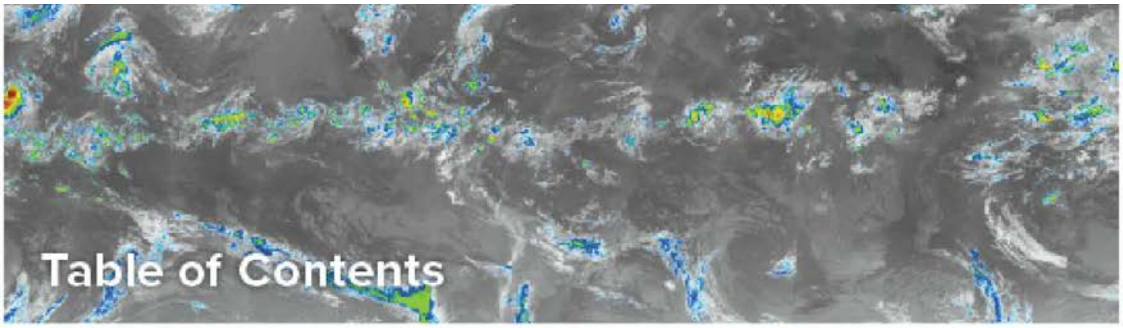

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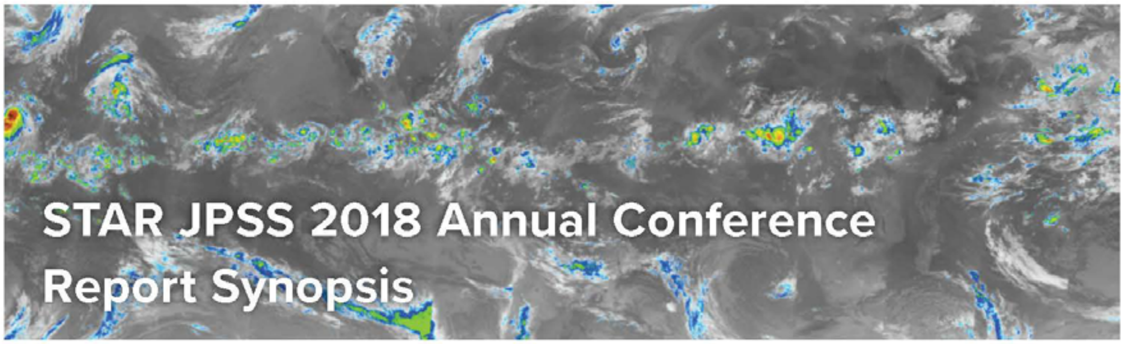


STAR JPSS 2018 Annual Conference Report Synopsis

On 27-30 August 2018 more than 250 scientists gathered in College Park for the fifth STAR JPSS Annual Conference. The meeting this year, with a theme of "User Applications", featured a condensed format that focused on the Proving Ground Initiatives across the broad array of JPSS product groups. Based on feedback from previous year's conferences, this year's meeting closed with a daylong session focusing on Blended Products.

In response to feedback from past meeting attendees, the format for this year's meeting was condensed so that there were no overlapping sessions. Each of the nine product sessions (outlined in the block schedule below) featured talks from the team leads detailing the progress of algorithm development and implementation in the NOAA-20 era. The product sessions also featured presentations on the relevant Proving Ground Initiatives and from users. This combination allowed attendees to get a broad sense of how the various JPSS products are performing, how they are used in the real world, and what is coming next.

The JPSS Proving Ground Initiatives have proven to be an important part of the effort to provide the public with effective tools based on JPSS data. The science teams work within the PGI framework to create innovative products based on users' requirements, provide pathways to improve transitions from research to operations, and streamline improvements to operational products. The PGRR teams also provide outreach and training activities for user communities. In addition to the nine product group sessions, there were several stand-alone sessions – on the Trends and Drivers that are moving satellite science forward, on research to operations, and a special brown bag seminar by Dr. Steve Volz on STAR's role within NESDIS.

Continuing a tradition started at last year's meeting, each day started with an invited talk on an important topic by a speaker from outside of the program. This year, the talks, which were well received, were from Peter Schussel on the plans for the EUMETSAT Second Generation of polar-orbiting satellites and from Jorg Schluz, who provided an overview of the CEOS/CGMS climate working group and how operational satellite programs can contribute to long term climate records. A well-attended poster session early in the week gave attendees the opportunity to interact and to see new research.

Follow-on in-depth discussions through side meetings with the STAR SDR teams, experts from ECMWF and EUMETSAT, and other user agencies resulted in multiple data exchange requests and collaborative experiment proposals. Individual product teams also held smaller side meetings to cover much of the material that in previous years would have been covered in the concurrent product specific sessions.

Among the major takeaways from the meeting is that the recently launched NOAA-20 is producing high quality data products currently provided through S-NPP, along with additional products as a direct result of the instrument upgrades and science improvements. Additionally, STAR JPSS and other stakeholders were able to apply lessons learned from S-NPP to improve the speed at which NOAA-20 algorithms reach the various maturity levels and become available to users.

Furthermore, the availability of two down-link stations for NOAA-20 allows assimilation of observations into regional rapid refresh models with improved latency for many real-time applications. The S-NPP/NOAA-20 satellite data products have been proven to be invaluable over the data-sparse polar regions. The ability to derive JPSS products at a much higher latency through Direct Broadcast networks using CSPP has been found to be extremely fruitful for many regional real-time applications.

The meeting was a success with in-depth presentations, face to face side meetings, and informal discussions that helped to resolve many issues, ambiguities, and mitigate risks. Positive feedback indicated that the objectives envisioned for the meeting were met.

JPSS Meeting Block Schedule and Agenda

	Monday 27 August	Tuesday 28 August	Wednesday 29 August	Thursday 30 August
0830 - 1015	Keynotes + Program Overviews	Soundings, Ozone, and Trace Gas EDRs Soundings Initiative	Hydro EDRs (including GCOM) Hydrology Initiative	Blended Products Workshop
1015 - 1030	Break	Break	Break	Break
1030 - 1200	SDRs Data Assimilation Initiative	Land EDRs Flood & River Ice Initiative	Trends & Drivers	Blended Products Workshop
1200 - 1315	Lunch	Lunch	Dr. Volz Brown Bag Lunch Talk	Lunch
1315 - 1445	Ocean EDRs Oceans Initiative	Smoke & Fire Initiatives	Imagery EDRs Monitoring and Visualization	Blended Products Workshop
1445 - 1530	Break	Break	Break	Break
1530 - 1700	Atmosphere EDRs (Aerosols, Clouds, Volcanic Ash) Aviation Initiative	Cryosphere EDRs Arctic Initiative ——— Cal/Val System and Science Supports Minisession	Wrap Up	Blended Products Workshop
1730 - 1900	Poster Session			

NCWCP	ESSIC 4102	ESSIC 3rd Floor

ESSIC is located across the street from NCWCP in the MSquare Bldg., 5825 University Research Court

Monday, August 27, 2018
Session 1.
Keynotes and Program Overviews
8:30AM–10:15AM

Summary: The first session featured presentations from the leaders of the JPSS program on the state of the program from the perspective of JSTAR management, the JPSS Program Office, AMP, STAR, and the Program Scientist. These speakers highlighted the utility of JPSS data, the great progress in getting NOAA-20 data operational, and the future path for the program.

The STAR JPSS Science Program Manager, Lihang Zhou, welcomed attendees to the Fifth STAR JPSS Annual Conference and provided a formal introduction of keynote speakers from the STAR and JPSS Programs. She emphasized the importance of the meeting and provided examples of how feedback/ recommendations from NOAA stakeholders and JPSS data users at past meetings has helped to maximize contributions to the JPSS Program.

Lihang highlighted that recommendations from earlier meetings have resulted in organizing in-depth workshops on enterprise algorithms, reprocessing efforts, cal/val activities, product operations, and now blended products. User requests and recommendations on the blended products resulted in organizing the Blended Product workshop as part of this year's meeting to discuss enhancements, blending and approaches commonly adaptable for deriving baseline and emerging products, and future improvements to meet end users' needs through synergistic use of enterprise products. The welcome talk concluded by describing the agenda of the meeting. The theme is 'User Applications'. Every session of this meeting included presentations from both the users and stakeholders, with the timing of the meeting coinciding with two JPSS satellites (S-NPP and NOAA-20) having full functional capabilities to provide excellent data for many user applications.

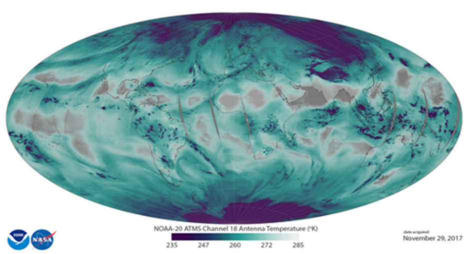
The keynote addresses from both the STAR Director, Harry Cikanek, and the JPSS Program Director, Greg Mandt, provided insight into JPSS Program efforts to realize and exploit the capabilities from the JPSS and other satellite missions, as well as STAR strategic initiatives for continued support and improvement towardsw NOAA mission skills. Both parties acknowledged the critical roles played by the JPSS Flight System, Ground System, JSTAR science teams and management, the AMP, and the user engagement teams. The speakers congratulated the JPSS teams for their outstanding efforts on JPSS-1 prior to launch and operationalizing the JPSS-1 satellite as NOAA-20, and on all of the efforts necessary to deliver the data rapidly to the NOAA stakeholders. Citing commendations from the NOAA Assistant Administrator for Weather Service, the JPSS Director lauded the JPSS Program efforts in feeding the new NOAA-20 data into weather models in a record 6 months of time.

The STAR science teams have also provided critical contributions in providing the manpower, along with the hardware and software, in science algorithm development and cal/val for all of the S-NPP/NOAA-20 science data products. The presenters also acknowledged the STAR science team's efforts in ensuring S-NPP and NOAA-20 data products are consistent with each other.

The benefits of having both S-NPP and NOAA-20 separated by only 50 minutes in the afternoon orbit, providing higher temporal refresh rate in the high latitudes were a focus of this talk. Other highlights discussed through the presentations include the criticality of providing global observations from polar orbiting satellites for NWP assimilations accompanied by the need for high-resolution JPSS products tailored towards operational forecasting and applications in the northern high latitudes, where the observations from the geo-stationary satellite systems have difficulty providing data at better resolutions.

The keynote addresses also noted the long-term coverage and availability of high quality JPSS satellite observations through the year 2030 and beyond with the current and follow-on suite of JPSS satellites (J2, J3, and J4). Long-term collaborations with EUMETSAT, JAXA, and other international agencies as part of the JPSS program provides continued support with additional products as a pathfinder for future mission-agnostic, measurement-based product generation.

The STAR Director discussed the current operational configuration of JPSS with two satellites in the 50 minutes apart in the early afternoon orbit providing large amounts of data for many applications. He thanked all of the STAR science team members for operationalizing the NOAA-20 products very rapidly, starting from the first light images for public release, to realizing validated maturity for all of the SDR/KPP with a record setting pace, and augmenting the ICVS and other monitoring tools for both S-NPP and NOAA-20.

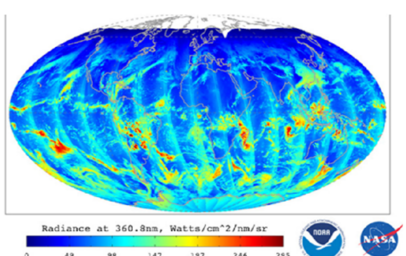


ATMS L+11 days

ATMS L+11 days

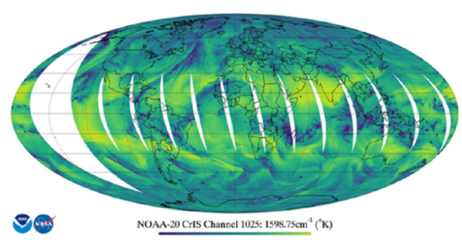
VIIRS L+25 days

VIIRS L+25 days



OMPS L+48 days

OMPS L+48 days



CrIS L+48 days

CrIS L+48 days

Figure. NOAA-20 first light images for all four instruments

(note to xxx - tese are figures 1a (ATMS), 1b (VIIRS), 1c (OMPS), and 1d (CrIS)

The Director emphasized the record number of submissions and closing of DRs, and cal/val maturity reviews, leading to both the S-NPP and NOAA-20 satellite systems functioning extremely well. He also praised the effort accomplished jointly by the STAR civil service, support contractors, Cooperative Institutes, university partners, other parts of NOAA, other government agencies, and the JPSS prime contractors. The STAR Director also stressed that this science team meeting is at a pivotal point: from getting the system developed and into operations, to realizing and exploiting the capabilities from the JPSS to enable NOAA to continually improve its mission skills.

The core objectives of STAR in support of the NESDIS mission include its strategic plan to ensure continuity and success of key satellite missions (GOES-R, JPSS, MetOp, Jason, etc.) by building a comprehensive, reliable, science-based enterprise in support of NOAA's mission. As part of STAR's responsibility, the STAR Director also stressed delivering top-quality, cutting-edge, user-valued products, continuing to build confidence and trust with stakeholders and users; maintaining leadership in satellite meteorology and remote sensing; and working closely with CLASS to ensure appropriate stewardship for very valuable environmental data.

On the operational front, the STAR Director stressed the need for high quality control, integrating or blending a wide variety of flavors of the same geophysical parameters into unified information products, providing them to operational forecasters. To accomplish this task, the Director also stressed the need to incorporate advances in computing and learning technologies (cloud computing, artificial intelligence, high performance computing, Internet of Things) to open up new frontiers of performance at lower cost, opening new business models such as expanding the use of commercial weather data to commercial satellite data. He highlighted the strong demand for improving NOAA's ability to forecast tracks and intensities of hurricanes and to improve tornado warning lead time to an hour ahead of the event (current average is 9 minutes). This can be enabled through the maximal value extraction from a fusion of models, in situ ground based measurements, sub-orbital aircraft observations, and data from both polar and geostationary satellite instruments. GOES-R GLM and ABI provide high temporal refresh products and complement JPSS's global, high-resolution products - for better insight into the real time status of the weather. There is no one single organization that can meet these strong demands, and the way to meet these challenges is to have partnerships, adapt to enterprise algorithms to optimize investments and returns, and use the latest technologies to extract higher information content for the products.

The JPSS Director, Greg Mandt, provided an overview of the continuity of the JPSS suite of satellites and reiterated the exciting stage of the "new generation polar and geostationary satellite" paradigm that will provide users with extensive data sets for decades to come. He provided a chronology of satellite development since 1960 to reflect the work done over the years as stepping-stones for the current POES/GOES complements and associated algorithm enhancements considering the user needs. He also reiterated the highlights of the JPSS Program in providing NOAA-20 SDR data within a record time of 6 months and congratulated STAR science teams for this achievement.

JPSS and other POES satellite data are critical in providing better initialization of the model inputs to achieve improved forecast skills and reducing uncertainty even for 5-7 day forecast skills. The presentation included animations of ECMWF forecasts of Hurricane Irma with and without satellite data as a testimony to the criticality of the satellite data in NWP model assimilations. The presentation also discussed the on-going efforts of the JPSS Program with the NESDIS OSAAP on the next generation/decadal satellite plans, meeting the challenge of the coming world of small satellites and distributed architectures, accompanied by the challenges to STAR algorithm science teams of piecing them together. He also discussed some of the JPSS program organizational changes, associated management and infrastructure changes, and the roles and responsibilities of the JPSS Flight System, Ground System, JSTAR science teams and management, AMP, and the user engagement teams.

The JPSS Program Scientist, Mitch Goldberg, discussed the PGRR program initiatives. The PGRR program works closely with NOAA mission areas to enhance applications by optimizing the use of JPSS satellite products in moving from observations to services and decision-making. The Program Scientist leads PGRR activities, provides overarching science oversight. The PGIs develop innovative products based on users' requirements and provide pathways to improve transitions from research to operations, and streamline improvements to operational products.

The PGRR teams also incorporate feedback from users for product improvements and provide outreach and training activities for user communities. The presentation discussed some ongoing PGIs in detail such as: River Ice and Flooding, Fire and Smoke, Hurricanes, and listed many other PGIs such as Soundings, Data Assimilation, Imagery/Nowcasting, Ocean/Coastal applications, and Hydrology, Arctic, and Land data assimilation.

Other risk reduction initiatives for ocean applications exploit the availability of both S-NPP and NOAA-20 (with 50 minute separation), and Sentinel 3A products to alleviate issues with sun-glint in order to provide exceptional daily global coverage. The availability of two satellites in stable orbit is also conducive to climate change related studies through the extension of the AMSU time series with ATMS.

The AMP Lead, Arron Layns, provided a report on JPSS programmatic progress, organizational updates, and lessons learned during the NOAA-20 pre-launch and post-launch commissioning to apply them for the J2 launch. The presentation discussed changes in the reporting structure to bring together all of the activities (IDPS in the common ground system, Raytheon, NDE, and PDA with OSPO) in a cohesive manner leading up to the JPSS-2 launch. The presentation also discussed strategic priorities regarding S-NPP and NOAA-20 data products.

S-NPP is in the monitoring phase with necessary table and algorithm changes that continue to allow it to produce high quality products. Most of the S-NPP algorithms have been transitioned to the enterprise algorithms and are operationalized in OSPO. It was reported that the IDPS generated EDRs (except VIIRS Imagery EDRs) will be turned off effective December 31, 2018, and users should begin moving to use the enterprise products.

For NOAA-20, as of the time of the meeting, all of the KPPs were in operations; the Active Fires EDR is in operations, and the rest of the EDR products are transitioning to operations. The presentation also discussed many algorithm improvements and enhancements driven by user requests that are currently being undertaken, such as removing CrIS NSR processing, removing the dependency on gridding software for OMPS SDR, adding terrain corrections to the VIIRS Imagery EDRs, expanding production of VIIRS Imagery EDRs from the current 6 bands to all 16 M-bands, and so on.

Looking ahead towards JPSS-2 preparations, the presentation also discussed JPSS-2 instrument status, early efforts on JPSS-2 algorithm development, and steps taken in expediting JPSS-2 product algorithm operationalization. The NOAA-20 experience of using pre-launch test data flows during the JCT events, creating instrument waivers and mitigation, and staging the EDR algorithms has affected the NOAA-20 EDR algorithms implementation schedules into NDE operations and provided a large scope for improvements for JPSS-2.

Late access to the JPSS-1 instrument waiver information delayed the science teams' mitigation efforts

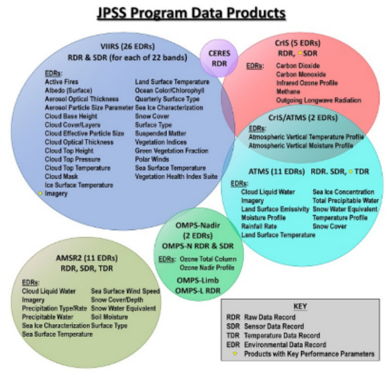


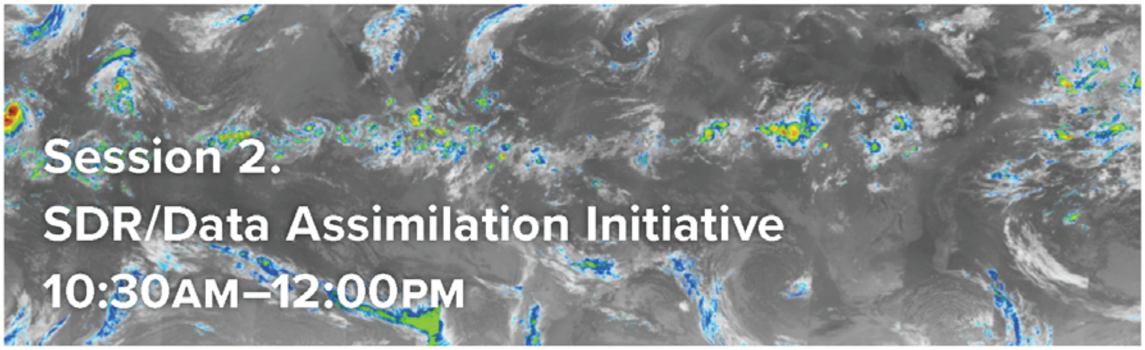
Figure. JPSS data products

and the associated JPSS-1 ready algorithm updates. Issues identified for one of the algorithms during end-to-end test data runs did not get a second chance of test data run verification. These issues and lack of NOAA-20 ready algorithms on NDE before launch delayed the operationalization of NOAA-20 EDR algorithms. The AMP teams have walked through these lessons and worked with IDPS and NDE to make necessary configuration changes to run JPSS-2 test data twice through NDE before launch. The proposed solutions suggested preparing good quality JPSS-2 test data that closely represents the sensor characterization, running algorithms through IDPS and NDE at least two times, and providing science teams with test data run results for verification and any algorithm updates and deliveries pre-launch.

The AMP team held meetings with the Flight and science teams for their active participation in the monthly instrument PMR meetings, which allowed for quick dissemination of JPSS-2 waiver related information by the Flight teams to allow sufficient time for the science teams to mitigate and update affected science algorithms. Suggestions and updates to the algorithms implemented on IDPS and on the NDE will be followed through DRAT reviews and NDE monthly maintenance review/algorithm builds. Finally, the presenter reiterated the healthy science program that the JPSS has through Program Science and PGI, and welcomed suggestions, improvements, and enhancements from the user communities.

To close the session Zhou provided an overview of the JPSS cal/val processes and discussed the status of S-NPP and NOAA-20 product maturity. She thanked all of the cal/val team members for their outstanding work. She also discussed the enterprise algorithms status and reprocessing plans on S-NPP SDRs and EDRs for mission-long consistent data record generation. Most of the S-NPP SDR/EDR products have reached validated maturity as well as the NOAA-20 KPPs. She also briefed on JPSS-2 pre-launch and post-launch cal/val preparations. The JSTAR management and SDR teams are collaborating with the flight and vendor teams for enhanced pre-launch TVAC measurements, which will be used for analysis later to assess impacts and waiver mitigations. The discussion included milestones on pre-launch test activities, post-launch algorithm/LUT changes for all of the JPSS-2 instruments, estimated amount of efforts related to code changes, and expected schedules of deliveries prior to launch freeze.

After many keynote addresses, the presentation from the ECMWF by Peter Weston provided user perspectives on ATMS and CrIS data assimilation activities at the ECMWF. The presentation included the timeline on assimilating the NOAA-20 ATMS and CrIS observations into the ECMWF model, experimental setup on assimilating these data sets, and the quality of the NOAA-20 ATMS and CrIS observations and impacts of assimilating these observations in improving ECMWF forecasts. The NOAA-20 ATMS data showed smaller biases, smaller standard deviation of first guess departures and diagnosed observation errors, and reduced striping signal in comparison to S-NPP ATMS. Following similar data assimilations procedures as those of S-NPP, preliminary evaluation of NOAA-20 ATMS TDR observations led to improved forecasts of geopotential height, temperature, humidity, and wind, particularly in the stratosphere. Follow-on in-depth discussions through side meetings with the STAR SDR teams resulted in multiple data exchange requests and collaborative experiment proposals.



Session 2. SDR/Data Assimilation Initiative 10:30AM–12:00PM

Summary: Following the keynote session, the STAR SMCD chief and all four STAR SDR teams (VIIRS, CrIS, ATMS, and OMPS) presented overviews of the SDR teams' efforts in meeting NOAA-20 maturity deadlines, along with highlights of NOAA-20 SDR products performance characteristics, and NOAA-20 EDR product performance as a testimony to the high quality SDRs. The session also included presentations on the impact of NOAA-20 data assimilations into NWP forecasts.

The STAR SMCD chief, Satya Kalluri, presented an overall summary of the NOAA-20 SDR product maturity status and a timeline of the NOAA-20 SDRs reaching given maturity statuses compared to S-NPP. The presentation included performance verification charts of the NOAA-20 ATMS, VIIRS, CrIS, and OMPS instruments, comparisons of NOAA-20 SDR products with the S-NPP counterparts, results of experiments conducted through assimilation experiments at NCEP and NWP centers worldwide, and results of verification of some of the NOAA-20 EDR products as a testimony to the NOAA-20 SDR performance. The NOAA-20 SDRs have beaten the specifications by a great margin, and in most cases have proven better than their S-NPP counterparts. The presentation also included a summary of the large number of LUTs and code change deliveries after launch by each of the SDR teams.

The SMCD Division Chief lauded the tremendous effort by the STAR SDR teams, NASA flight teams, Cooperative Institutes, and instrument vendors, and thanked all of the partners on bringing the NOAA-20 SDR products from pre-launch to the commissioning after the post-launch. All of the SDR products have met scheduled validated maturities in record time and their data products are reaching a vast number of users for utilization. Following the presentation, the VIIRS, ATMS, CrIS, and OMPS SDR leads provided presentations that included sensor/algorithm overview, product performance, major risks/issues and mitigations, milestones and deliverables, future plans/improvements to the SDR products, and JPSS-2 preparations.

The VIIRS SDR lead, Changyong Cao, in his presentation, thanked all of the team members starting with the STAR contractors, UMD/CICS, the Aerospace team, the NASA VCST team, UW, and the JPSS team, acknowledging the roles and responsibilities of each team in quickly achieving NOAA-20 validated maturity. Some of the major accomplishments noted were the timely diagnosis of the ground-processing anomaly to support the mission critical First Light Image, post-launch updates of LUTs in support to mission operations, IDPS updates, and meeting major milestone deliveries achieving Beta, Provisional, and Validated maturities. Notably, the VIIRS instrument performance has been very comparable between NOAA-20 and S-NPP. All of the VIIRS bands (with the exception of M4, M6, and M7/I2) have met the requirements, in general, NOAA-20 has a 2% bias relative to S-NPP with the exception of M5, M7 and M4 where NOAA-20 is different from S-NPP.

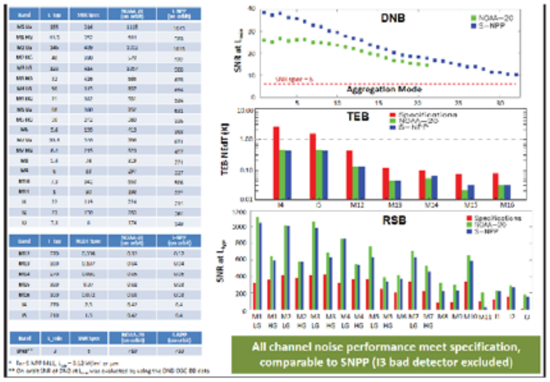


Figure. Performance metrics versus specifications (red) for the VIIRS DNB, TEB, and RSB for S-NPP (blue) and NOAA-20 (green)

S-NPP biases were higher for these bands based on the analyses done by the Cloud and Aerosol teams. Other than the aggregation differences, the NOAA-20 DNB performance is excellent and calibration is consistent with the S-NPP product. The SDR teams have been supporting monthly operational lunar calibration, LWIR degradation investigations, evaluation, and improvements of NOAA-20 VIIRS geolocation accuracy. The SDR team has engaged with many applications teams to incorporate and satisfy user needs over many application areas. With regards to one of the user needs for high quality reprocessed SDR data sets, the SDR team demonstrated the feasibility of on-demand reprocessing of S-NPP VIIRS SDRs with the latest methodologies (annual oscillation mitigation in SD F-factors, Kalman filtering using DCC, SNO, and lunar F-factors). In addition to the continued NOAA-20 and S-NPP VIIRS support and future SDR improvement plans, the VIIRS SDR team has been providing support for JPSS-2 VIIRS instrument waiver mitigations and associated code changes.

The ATMS overview presentations by Ed Kim and Mark Liu started with a display of the first light image of the ATMS channels and thanked the NG team for exceptional pre-launch work in fixing many issues with the ATMS to produce an excellent instrument with outstanding performance characteristics onboard NOAA-20. As part of the Beta, Provisional, and Validated maturity assessment, the science teams have found equal or better NOAA-20 ATMS performance compared to S-NPP with (1) lower reflector emissivity, (2) smaller side lobes indicating higher antenna efficiency, (3) low NEdT, (4) smaller channel noise correlation, and (5) less striping.

Feedback from the MiRS EDR Team has indicated that the NOAA-20 ATMS EDRs quality is slightly improved relative to S-NPP derived products. The NOAA-20 SDRs have shown smaller bias corrections between the observed and calculated radiances using the CRTM. NWP teams are currently evaluating the forecast impact of ATMS radiances. One of the lessons learned from the NOAA-20 mission is that it is good policy to delay the launch in order to address known hardware issues that affect science performance rather than trying to implement software fixes after launch. Decisions taken to perform full pre-launch calibration in TVAC (all 3 cold plate temperatures each with 11 scene temperatures, detailed SRF measurements, and measurement of reflector emissivity and adjust SDR algorithm) were found to have paid-off with an ATMS instrument with outstanding performance characteristics aboard NOAA-20

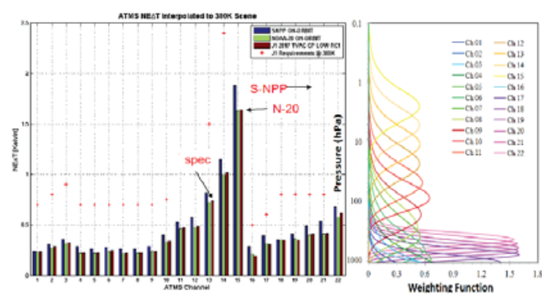


Figure. NOAA-20 ATMS NEdT shows that NOAA-20 is performing better than S-NPP and meeting spec

The CrIS SDR team lead by Flavio Iturbide-Sanche provided the status of the NOAA-20 CrIS instrument performance, discussing many major events the SDR team has taken from projecting the first-light images to the optimally calibrated and validated CrIS SDR observations. The SDR team made significant progress through code deliveries to (1) detect and correct interferogram spikes and (2) improve SDR calibration by using extended interferogram data points, and achieved many other 2018 milestones. The IDPS system has been producing CrIS SDR products in both nominal and full spectral resolution operationally, and the SDR team has achieved Beta and Provisional maturity of the CrIS SDRs and is working towards achieving Validated maturity. Lessons learned through S-NPP have helped to achieve maturity reviews three times faster, thus providing the CrIS SDR data products to the NOAA stakeholders and user agencies at an expedited pace. Both the S-NPP and the NOAA-20 CrIS SDRs meet requirements and are showing consistent long-term stability. In addition to the maintenance support and performance monitoring of CrIS SDRs through ICVS, the SDR team is working on many SDR improvements through enhancements to the radiometric, spectral, and geolocation validations. The team is also working on pre-launch support plans for the JPSS-2 CrIS instrument and trade studies related to the CrIS FOV spatial resolution from 14 km to 7 km.

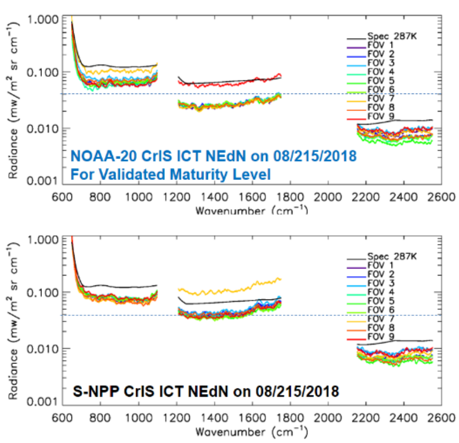


Figure. NOAA-20 (top) and S-NPP (bottom) CrIS NEdN

The OMPS SDR lead , Trevor Beck, presented an overview of the OMPS instrument and the additional capabilities achievable with the NOAA-20 OMPS products with increased downlink bandwidth and FSW data compression capabilities. The NOAA-20 OMPS TC is capable of 10×10 km ground pixel size and the NOAA-20 OMPS NP measurements can produce 50×50 km data products (25 times the ground samples for the NM compared to S-NPP). The presentation included the performance requirements for both the S-NPP and the NOAA-20 OMPS instruments. The S-NPP OMPS meets all of the performance requirements, and the NOAA-20 OMPS instrument meets most of the performance requirements except a couple of important parameters due to non-optimal flight tables currently in operations.

The SDR team solved four major issues delivering updated ground and flight tables to solve/mitigate (1) missing SDR granules due to 16 scanline RDRs, (2) striping in low-resolution mode caused due to poorly chosen at-launch sample tables by switching to medium-resolution mode, (3) FOV matching between the TC and NP and reducing significant retrieval error in OMPS ozone profile EDR, and (4) unexpected outliers due to non-linearity correction for OMPS NP. The NOAA-20 OMPS has reached Provisional Maturity in July 2018 and the team is working towards validated maturity.

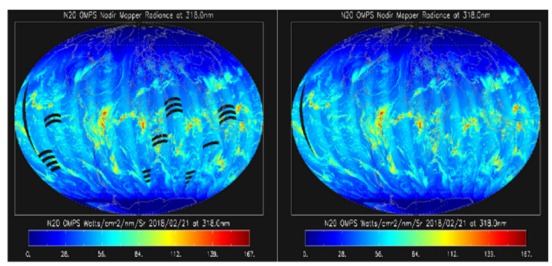


Figure. Global OMPS maps highlighting post-launch software fixes. The unexpected virance in packet times used to create the RDR caused a missing granule problem (seen on left), and mitigated in the subsequent IDPS build (right).

The NWP feedback presentation by Andrew Collard discussed the operational data assimilation of ATMS and CrIS by NCEP. The presentation included the data assimilation configuration in the context of evaluating the CrIS and ATMS SDR data quality and forecast impact analysis. For evaluation purposes, EMC has run experiments at reduced resolution using the operational 4DEnsVar Hybrid GSI, and the team is evaluating this configuration to eventually implement it in the operational global GFS and pre-operational FV3-GFS parallel systems. The quality assurance and impact evaluation studies performed so far suggest that the NOAA-20 ATMS data quality to be comparable/slightly improved to that of S-NPP with smaller biases (removed through bias correction procedures) and less striping. The forecast improvements are neutral to slightly positive. Similar studies of quality assurance and impact evaluation for the CrIS radiances have shown comparable or slightly better NOAA-20 CrIS SDR quality with neutral forecast impacts. Future work includes implementation in global GFS and pre-operational FV3-GFS parallel systems, and cloudy scene radiance assimilations.

Session 3. Ocean EDRs and Initiatives 1:15PM–2:45PM

Summary: The Ocean EDRs and Initiatives session started with an overview talk by the SOCD chief, Paul DiGiacomo, followed by the Ocean EDR Team leads. Presentations included the assimilation of JPSS Ocean EDRs into ocean circulation models, additional experimental product development and utilization through PGRR initiatives, and cal/val shipboard validation cruises for JPSS Ocean EDR products.

The SOCD chief, Paul DiGiacomo, provided an overview of the SOCD activities and incorporating feedback by listening to the user expectations as a way forward in tailoring (a) existing products and generating mission-agnostic products, (b) new product needs by the user community and PGRR initiatives towards generating new products, and (c) downstream services. He referred to the OceanWatch and CoastWatch meetings which happened earlier, and the user needs assessed from those meetings. The users of CoastWatch and OceanWatch products have acknowledged the high quality products from the JPSS, and called for high quality, consistently processed mission agnostic products from multiple sensors (NOAA, non-NOAA, and foreign data) using enterprise algorithms for SST (from VIIRS, AVHRR, MODIS, ABI, and AHI), and NOAA MSL12 OC (VIIRS, OLCI, SGLI).

In this context, SOCD cited some of the PGRR initiative projects on multi-sensor high-resolution gridded, collated SST ACSPO L3C/L3S products. For fisheries and related inter-annual and seasonal variability studies, the user agencies expressed a demand for retrospective mode mission-agnostic data sets of fully merged/integrated JPSS and other multi-sensor (MODIS, AVHRR, SeaWIFS, etc.) time series, extending as far back into the past as possible.

The second area of focus is towards new product development. Many users from NMFS, NOS, and the NWS projected the need for phytoplankton functional types, distinguishable using satellite derived OC products. The presentation iterated a couple of PGRR initiatives for VIIRS ocean color data (by the Northeast Fisheries Center), for example by extending and evaluating VIIRS ocean color neural network retrievals of harmful algal blooms and inherent optical properties. Other areas of new product development that were discussed are the ocean heat content product, created by putting together the SST product from multiple platforms, ocean acidification, and primary productivity. The presentation also focused on improving downstream services meeting user needs. These include tailored products based on downstream users' needs, common gridded products to compare and contrast correlative data sets (e.g. MSL12 OC and ACSPO SST), imagery products to complement VIIRS (e.g. Sentinel-2, Landsat-8, GCOM-C SGLI), in situ measurements, data sets needed for modeling, and data portals for easy search/access to facilitate the use of ocean/aquatic satellite data in the value chain from observations to decision making. The presentation ended with demonstration and use of correlative data sets, and website links for CoastWatch, PolarWatch, and OceanWatch data portals.

Following the SOCD overview presentation, the SST and OC team leads presented algorithm and product status, improvements, and plans for their respective algorithms. Presentations on the use of JPSS ocean products in ocean-model domains and ship-borne cal/val cruises conducted by OAMO followed the algorithm overviews.

The SST team lead, Sasha Ignatov, introduced the SST team members and highlighted the NOAA enterprise ACSPO algorithm, including threshold requirements, accuracy, and precision performance for the SST products derived from S-NPP and NOAA-20. The SST algorithm, a regression algorithm trained with in situ measurements, uses separate sets of VIIRS channels for day and night and retrieves SST at every cloud-free VIIRS pixel. The algorithm reports the SST, estimates SST bias and standard deviation, and produces L2 EDR products organized into 144 ten minute granules per day. The team also produces a gridded L3 product by mapping the SST L2 EDR product into equal 0.02o grid boxes. The L3 SST product shows comparable performance with L2 EDRs, and the product is used by several major international NWP centers. The SST team is working on algorithm improvements towards clear-sky mask/QC, error characterization supporting user needs and data fusion, in situ, and other correlative data match-up code maintenance for ACSPO, SQUAM, iQuam, and ARMS, and pattern recognition and front detection algorithms as part of future ACSPO SST versions. The team also produces the reprocessed SST (RAN1) product and is actively pursuing (with the SDR teams) the application of the Ltrace algorithm as a mitigation to the VIIRS instrument WUCD maneuvers (currently occurring once every three months, and changed to once per year) during which the retrieved SST produces a spike of increased bias with in situ measurements.

Following the SST presentation, Alexander Kurapov discussed VIIRS SST assimilation in the WCOFS 3-D ocean circulation model to provide daily updates of three-day forecasts (e.g. SST fronts, currents). The users of the forecasts include fisheries and environmental hazard response teams (including oil spills and search and rescue teams). The presentation also discussed the ROMS that uses NAM atmospheric forcing and ROFS boundary conditions, and assimilates the VIIRS SST L3U product from the STAR SST team to produce HFR surface currents (IOOS, NDBC). The ROMS system plans to assimilate future along-trace altimetry data from NESDIS STAR.

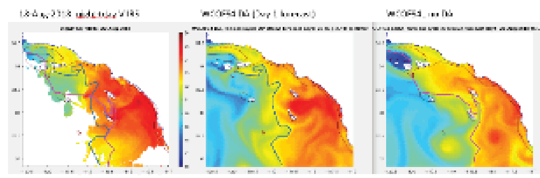


Figure. The geometry of the upwelling front is improved qualitatively, compared to the case without assimilation. (left) 18 Aug 2018: night+day VIIRS; (middle) WCOFS4 DA, Day 1 forecast; (right) WCOFS4 , no DA

The STAR OC team lead (Menghua Wang) discussed the VIIRS OC EDR products from the NOAA MSL12 system for both near real-time and climate applications. The MSL12 product system, developed through collective team efforts from STAR, NIST, OSU, and other organizations, produces 10 operational products and a large number of experimental products. The operational products include Normalized water leaving radiances at VIIRS visible bands M1-M5, chlorophyll a concentration, diffuse attenuation coefficients for the downwelling spectral irradiance at the wavelength of 490 nm, diffuse attenuation coefficient of the PAR, and the recent inclusion of I-band (638 nm) normalized water leaving radiances. The MSL12 OC team also produces a large number of experimental products (~29). Two experimental products, chlorophyll a anomaly and chlorophyll a anomaly ratio have been introduced recently. The addition of nLw at the 638 nm wavelength at 375 m resolution proved to be quite useful both spatially and spectrally providing continued spectral information of nLw for detailed algae bloom exploration.

In addition to MSL12 OC processing system NRT products (meeting latency requirements), the OC team also produces science quality products at the expense of latency for applications requiring better accuracy and for incorporation into longer time series needs, such as the integrated ecosystem approach for fisheries management applications. The near real-time product may have gaps in the data while the delayed science quality is of global nature with no data gaps and using the high-quality SDR product. The OC team also produces VIIRS reprocessed ocean color products for the best quality mission-long S-NPP OC data products to benefit users worldwide.

The OC team cal/val activities include on-orbit vicarious calibration using MOBY data and other collated annual ocean cruise measurements. With the availability of NOAA-20 VIIRS, the team has started producing a merged product using the OC data from both the S-NPP and NOAA-20 providing OC products with increased coverage, coverage over sun-glint areas, and improved OC products over end-of-the scan. The team is also producing a merged global chlorophyll a data product from S-NPP and NOAA-20 VIIRS and Sentinel-3A OLCI data for many user applications.

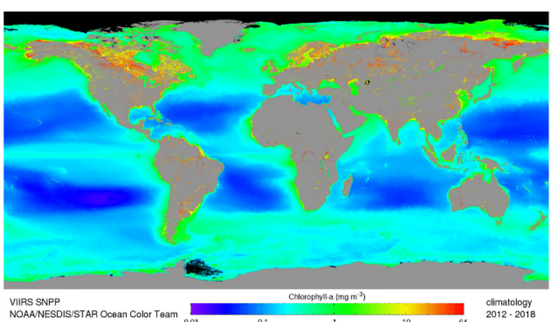


Figure. VIIRS Climatology Ocean Color Product image, S-NPP (2012–2018)

Following the OC team products discussions and requirements, Daniel Tong presented user applications on one of the OC team derived products - marine isoprene. The presentation discussed isoprene, a biogenic hydrocarbon emitted by trees, grasses, and ocean phytoplankton to combat abiotic stresses and its role as a precursor for surface ozone and aerosols that contribute to cloud condensation nuclei. The isoprene algorithm requires two important inputs, the chlorophyll a concentration and the emission factor. The emission factor depends on the phytoplankton functional groups. Since the phytoplankton functional types are not a JPSS product, the teams are using 10 years of SeaWIFS climatological data. Currently the marine isoprene algorithm is using the VIIRS chlorophyll a and the Kd(490) data products. Washington State University is adapting the JPSS isoprene product into model domains for local forecasting.

In support of OC product validations, STAR has been involved in shipboard validation measurements for many years, and Mike Ondrusek presented a summary of the cal/val cruises to validate the VIIRS JPSS OC products, primarily the water leaving radiances, the prime product used to derive other products.

Starting in 2014, the OMAO has conducted annual ship-based dedicated validation cruises and preparations are ongoing for the 2019 validation cruise. The cruise has many different on-board instruments for near simultaneous measurements of water leaving radiances, along with other products that are derived from the water leaving radiances such as chlorophyll, phytoplankton physiology, total suspended matter, and many other parameters to better understand the water leaving radiances.

At the end of each cruise, a best estimate is determined for water leaving radiances over different stations, with uncertainty and error bars to validate the satellite-derived MSL12 VIIRS water leaving radiances. Another objective embedded in the cruise data set collection is to provide uncertainties among the in situ validation measurements. This is achieved through replicating observations from multiple identical instruments in near simultaneous mode deployed in parallel in both the bulk water and in-water, and observations of the same in situ parameters but using different types of instruments for different types of water, such as blue water spectral signatures and near-shore water spectral signatures. The presentation also discussed the data sets collected during 2014, 2015, 2016, and 2018 campaigns collected over 24 stations resulting in a good set of cloud-free matchups with VIIRS. The NOAA Technical Reports (FY2015-NOAA-TR-NESDIS-146, DOI:10.7289/V52B-8W0Z; FY2016–NOAA-TR-NESDIS-148, DOI:10.7289/V5/TR-NESDIS-148, and FY2017-NOAA-TR-NESDIS-151, DOI: 10.7289/V5/TR-NESDIS-151) provide a complete list of measurements made during these shipboard cruises and the availability of data sets.

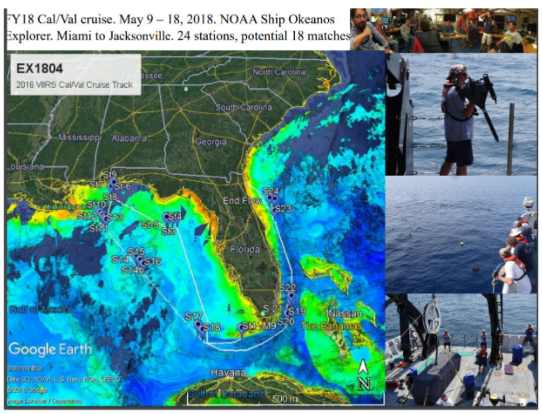


Figure. 2018 OC cal/val cruise track map (left) and images of the scientists taking measurements.

Mike Ford presented the last talk in this session giving an NMFS perspective on the use of NOAA satellite oceanographic products and appreciated many JPSS initiatives to aid NMFS, and on developing an early science portfolio on developing NFMS future missions. The NMFS covers three million square miles of open ocean and surveys for fisheries and for protecting endangered and threated species. The NMFS also covers 95,000 miles of coastline for which they are responsible and maintains 474 fish stocks and 46 fishery management plans. The large-area high-resolution satellite imageries provided of ocean products are incorporated into fishery management plans for prediction of fisheries populations, current and future status of stocks, and/or the status of the whole ecosystem. The NMFS uses many satellite products such as sea surface height, SST, and chlorophyll, and envisions the need for, (1) the highest quality long-term time series of satellite products such as chlorophyll, (2) the advancement of all capabilities, including both algorithms and sensors, to measure phytoplankton functional groups/size classes on the continental shelf, (3) the continuation to develop products at high resolution that resolve mesoscale features (e.g. Lagrangian coherent structures, chlorophyll fronts etc.) for use in our best models, and (4) the cross-platform integration of products to generate mission-agnostic blended ocean products. The results of these advancements are working well to provide the nature of ecology around the fisheries that was not available before. The presentation ended with a couple of joint PGRR initiatives between NMFS and the JPSS teams.

Session 4. Atmosphere EDRs and Initiative 15:30PM–17:00PM

Summary: This session focused on the atmospheric products including aerosols, volcanic ash, and cloud products. The users highlighted how they use these products to forecast the quality of the air we breathe, and to detect any issues which might hinder aviation.

Andy Heidinger and Jeff Weinrich chaired the atmospheric EDR and initiatives session. A series of presentations covered JPSS aerosol products (ADP, AOD), user feedback, and forecasting applications. The presentation by Aerosol EDR Team co-lead Shobha Kondragunta discussed the ADP enterprise algorithm currently operating on a variety of instruments (VIIRS, ABI, and TEMPO). Depending on the spectral coverage offered by the instruments, the algorithm can provide smoke detection (ABI with IR/VIS), dust and smoke (TEMPO that has UV and visible coverage in the deep-blue region), more confident dust and smoke products, and separations from VIIRS that provide extensive spectral coverage from deep blue to IR. The ADP product is a qualitative product and shows about 85% and 92% probability of correct detection for the smoke and dust. The ADP team has provided algorithm patches for the NDE operational algorithm to mitigate some of the risks, such as minimizing false detections for smoke, distinguishing clouds, and handling thick dust/smoke plumes. At the time of the meeting, the NOAA-20 ADP product is currently of Provisional maturity.

Following the ADP presentation, Aerosol team co-lead, Istvan Laszlo, discussed the AOD algorithm with details on team members, APU assessments, maturity status, risk mitigation, and future plans and improvements. The AOD enterprise algorithm currently running on the NDE system for S-NPP requires observed spectral reflectances from a set of visible and NIR bands and many ancillary data sets. Unlike traditional retrieval algorithms, the AOD algorithm compares the VIIRS observed spectral reflectances for selected visible and NIR bands with reflectances calculated for a set of AOD and aerosol models. The algorithm then selects the AOD and the aerosol model for which the calculated reflectances best match the observed ones over dark and bright surfaces. The algorithm computes actual exponents at two wavelengths to use as a proxy for the aerosol product itself. The output includes AOD at 550 nm, APS at 550-860 nm and 860-1610 nm, aerosol model(s), fine mode weight over water, AODs in the M1-M11 VIIRS bands, and diagnostic data. The algorithm is currently operational for the S-NPP, and both the S-NPP and NOAA-20 (running off-line currently) products generated through the enterprise AOD algorithm meet or exceed the requirements. The NOAA-20 AOD product generated currently using S-NPP LUTs will attain provisional maturity with updates to LUTs for NOAA-20. The EPS AOD algorithm has shown improved bias characteristics over the IDPS algorithm, including retrieval of the AOD product over an expanded measurement range, over bright surfaces in desert and semi-arid dry regions, and over inland water bodies. The EPS algorithm has been used to reprocess AOD products for one year, and the AOD team is planning to reprocess the AOD product for the rest of the years after identifying dedicated hardware resources. As part of future improvements to the AOD algorithm, the algorithm team is considering including more aerosol models to capture regional variability over land, and updates to the retrieval over bright surfaces to avoid discontinuities seen occasionally between ocean and land.

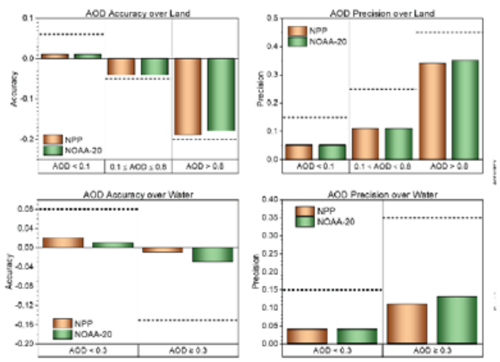


Figure. Aerosols product performance summary (7 Jan 2018 - 4 Aug 2018): Accuracy (top) and precision (bottom). (left) AOD over land; (right) AOD over water

Following the ADP and AOD product presentations, Amy Huff discussed the use of aerosol products in air quality forecasting using the AQI (http://www.airnow.gov) based on EPA air quality color codes. The air quality forecasts, issued typically by mid-afternoon (3:00 PM), are valid until the next day and identify the days and areas that exceed EPA standards that affect human health and inform human populations to take protective actions. The forecasts include ozone forecasts and particulate matter (PM2.5 and PM10) for the commonly forecasted pollutants in the US. The presentation also discussed evolving air quality issues faced by the forecasters due to wildfires with increased intensities, nitrogen oxides (NOx) and volatile organic compounds that arise from wildfires and act as precursors for secondary formation of ozone and PM2.5, as well as the increase of ambient ozone and PM2.5 due to wildfire plume mixing to the surface downwind.

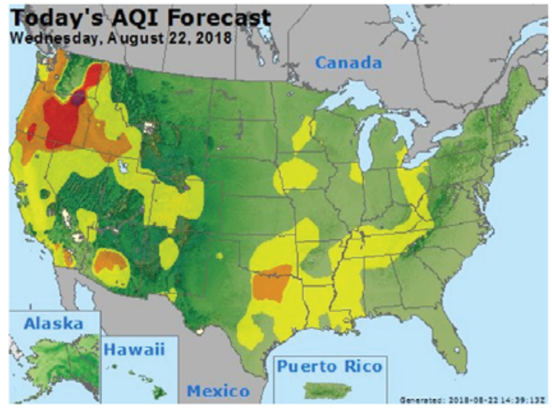


Figure. Sample AQI map and color key for 17 Aug 2018 produced by EPA

Currently, the forecasts include three different levels, primarily for PM2.5 and PM10 smoke aerosols that are of direct threat to health. Satellite imagery currently provides one of the best tools for forecasters to identify smoke. The high spatial resolution data available from VIIRS, the smoke and dust mask, and the trajectories are critical for forecasters to identify and analyze exceptional events and EPA can use this information to identify the exceedance of the NAAQS and whether each exceedance is due to local conditions or caused by exceptional events. The presentation also covered examples of NOAA HMS fire and smoke analysis and how it has helped to study air quality impacts over many areas.

Following these presentations, Andy Heidinger discussed the cloud algorithms and the status of maturity for S-NPP and NOAA-20, and also covered some of the issues and mitigations. A set of seven algorithms are used on the VIIRS SDR data to derive 14 EDR cloud products. These products are of Provisional maturity for S-NPP and some of the products are at Beta maturity for NOAA-20. Some of the issues, such as the missing granules (fixes implemented effective August 2018) impaired the use of cloud mask in many EDR products. The VIIRS M5 calibration still poses issues for cloud products for S-NPP but is improved for NOAA-20. The Enterprise Cloud Mask is used by most of the downstream EDR products, and NCEP uses the cloud mask and cloud height in the selection of CrIS clear scene FOVs and in resolving some of the artifacts in the CrIS clear-sky radiances. NCEP is also exploring using VIIRS cloud products to improve high latitude ATMS assimilation and has expressed interest in the VIIRS All-Sky Radiance product, which uses cloud mask and cloud height. As part of the DB services, GINA at the University of Alaska Fairbanks implemented the cloud algorithm to serve the Alaska weather service and the aviation community. The vertical profile of cloudiness and the cloud cover layers are of interest to aviation interests, and in addition to displaying each layer independently, the cloud team is working on generating a RGB product combining five layers of clouds at the flight level for aviation use.

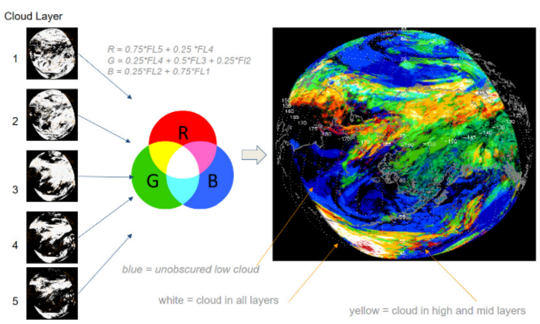


Figure. A demonstration of the RGB weighting used to create the Cloud Layer RGB from five individual cloud layers.

Mike Pavalonis presented the status of the Volcanic Ash EDR product. The algorithm, adapted to VIIRS from the GOES-R baseline algorithm, uses the M14-M16 infrared bands to be consistent between day and night. The algorithm identifies pixels that have ash and estimates ash height and ash loading using an optimal estimation technique. Validation of the volcanic ash product is a challenge due to the very small percentage of pixels that both 1) contain volcanic ash and 2) have coincident independent observations. The team uses correlated observations of space-based lidar and comparisons with other well-characterized satellite products for validation of the JPSS VA product. The algorithm performs well, meeting the requirements for both ash height (accuracy threshold 3 km) and loading (2 tons/km2) derived from S-NPP as well as NOAA-20. The team is currently updating NOAA-20 LUTs and is preparing for provisional maturity. While the NDE algorithm for JPSS uses only one sensor (VIIRS), the team has developed a significantly improved multi-sensor algorithm using all relevant measurements (JPSS and non-JPSS) and integrating all relevant components of the volcanic hazard problem. This development is based on strong user needs from aviation, keeping up the with NOAA mandate to monitor volcanic ash while fostering connectivity with the VAACs worldwide. Through PGRR, the team has started a Volcanic Ash Initiative utilizing the expertise from a core research team consisting of experts in SO2, remote sensing and validation, and dispersion modeling (such as HYSPLIT), and representatives from volcanic ash advisory centers to address key operational challenges. The team has developed the VOLCAT, a collection of algorithms and tools to make volcanic alerts, and has produced volcanic track time series of key variables needed for dispersion models (HYSPLIT). The ARL team developed the HYSPLIT model and a vast number of registered users from the United States and overseas use the model for calculations, simulations, and meteograms.

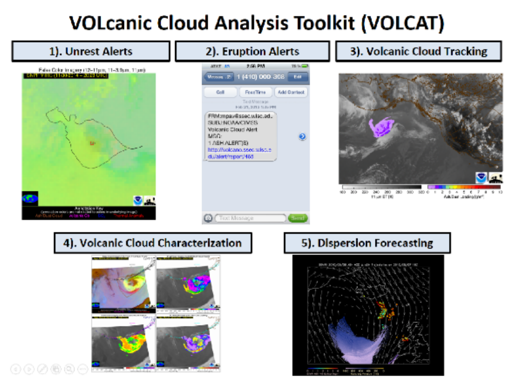
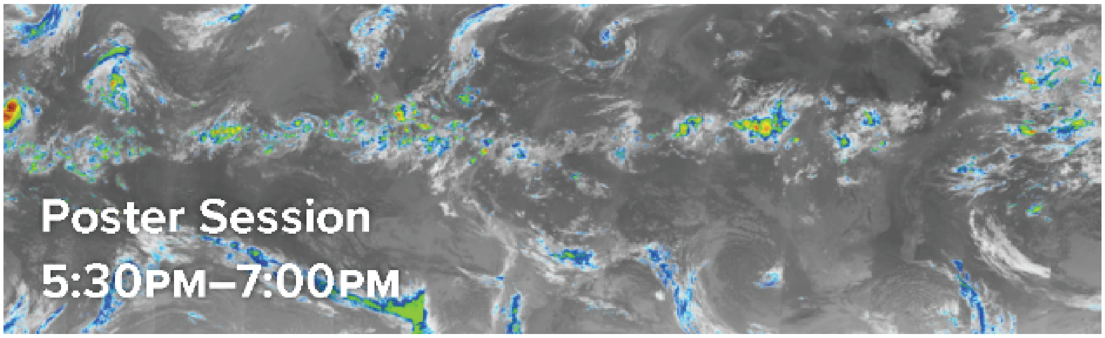


Figure. Sample functions in VOLCAT

Ariel Stein's (OAR/ARL) presentation provided a detailed discussion of the HYSPLIT model and the use of JPSS data products within HYSPLIT for atmospheric transport and modeling applications. The presentation discussed ARL team activities towards understanding atmospheric transport and dispersion process to improve HYSPLIT model quality, uncertainties and applicability of model products in helping NOAA and other organizations in R2O and other applications. Many weather forecast offices use the HYSPLIT model for operational applications and the model is also used to forecast transport and dispersion of hazardous materials from industrial accidents to protect life and property. The HYSPLIT website (READY HYSPLIT) provides many details on HYSPLIT applications and provides the ability to run dispersion calculations and trajectories.

The Aviation Initiative talk presented by Jeff Weinrich discussed the polar/high-latitude data needs, using the Alaska region as the focus. The initiative is aimed at addressing clouds, icing, turbulence, and cold air aloft , and this initiative partners with the FAA, Alaska Aviation Weather Unit, NWS forecast offices, NOAA Arctic Testbed and Proving Ground, and GINA. The FAA provides weather briefings, flight planning, emergency services, search and rescue and notices to aviators. With the limited amount of surface observations, reduced geostationary satellite coverage, and only seven sites of NEXRAD weather radars over a vast area, JPSS data provides the best source of very useful information. The members of the aviation initiative collaborate with many JPSS teams to provide VIIRS imagery and cloud products to the CWSU area using DB sources for improved latency. The JPSS cloud products of interest include cloud top altitude, cloud base altitude, geometrical thickness, and cloud cover at all flight levels.



Poster Session 5:30PM–7:00PM

Summary: The poster session and the icebreaker reception was another highlight that allowed lot of discussions, social gathering, and on-hands training/demonstrations. The poster session was organized in the M-Square building and a total of 69 posters were presented. There were eight student posters, and three of the student posters received awards. (Need to add a little more on training/ demonstrations)

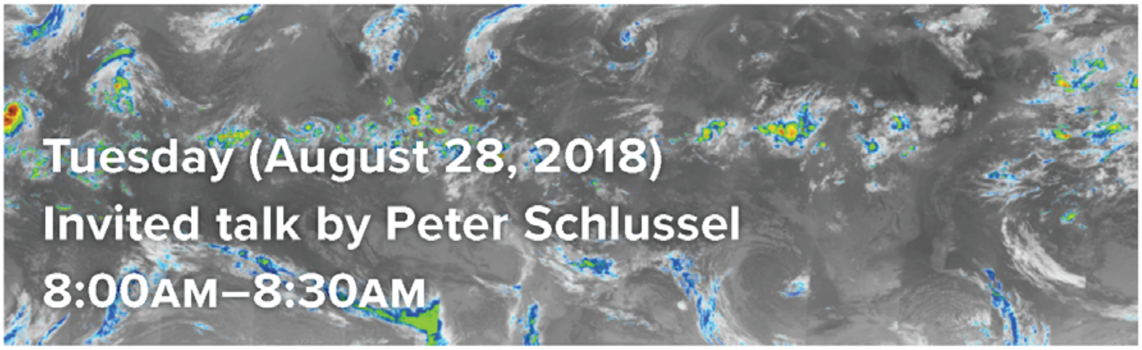
During the poster session the EDR LTM team demonstrated the JSTAR Mapper, an interface which allows users to explore the vast scope of JPSS EDR products. The audience was shown how to use JSTAR Mapper as a tool to analyze two recent events; the Carr Fire in California and Hurricane Chris over the Atlantic ocean. For the Carr fire Active Fire, the VIIRS Active Fires product from both S-NPP and NOAA-20 was overlaid with VIIRS True Color to observe where the detected fires were for a given overpass. While looking at Hurricane Chris, the VIIRS I5 band was overlaid on the VIIRS True Color to show where the cooler cloud temperatures were relative to a true-color image of the storm. Other products such as VIIRS SST were also used in this example.

Karlis Mikelsons from the NOAA STAR ocean color team demonstrated the OCView online tool featuring interactive display of the global true color and ocean color data product imagery. The OCView tool features imagery from multiple sensors (S-NPP and NOAA-20 VIIRS, Sentinel-3A OLCI, GOCI), for the entire the mission. The true-color imagery is sampled at highest available resolution (~375 m for VIIRS), while most ocean color data products are displayed in ~2 km resolution, and also have the 8 day, monthly, and mission long time averages. OCView primarily uses a rectangular projection, though most of the data are also available in the polar (Arctic and Antarctic) stereographic projections as well. Additional data layers include granule boundaries, which allows for an easy identification of the L2 data granules for a particular scene, as well as the coastlines, and the latitude/longitude grid lines.

CICS scientists demonstrated the basic functionality of AWIPS, including enhanced functionality for the NUCAPS profiles. They next highlighted examples of JPSS products that have been incorporated/optimized in AWIPS, including the NESDIS snowfall rate and blended rain rate products.

Poster Session

Author	Poster title
Banon, Ysabel	Thermal Stress and Bleaching during 2014-2016 Caribbean Bleaching Event
Bloch, Callyn	Near-real time Surface-Based CAPE from Merged Hyperspectral IR Satellite Sounder and Surface Meteorological Station Data
Blonski, Slawomir	NOAA-20 VIIRS Early On-orbit Geolocation Calibration
Bombach, Christopher	Open Loop Tracking of GNSS Radio Occultation for LEOs
Borg, Lori	JPSS Radiosonde Program
Cantrell, Louis	Benefit of IJPS To NOAA's Mission Services
Chen, Mingshi	Multiple Temporal-Spatial Resolution Vegetation Products Derived From JPSS VIIRS Data For Environmental Modeling and Monitoring
Chen, Nan	New neural network cloud mask algorithm based on radiative transfer simulations and its application on VIIRS data
Chu, Mike	Evaluation of NOAA-20 VIIRS RSB radiometric perfomance using intersensor comparison
Das, Bigyani	JPSS ASSISTT and Change Request Packages for IDPS Implementation
Davies, James	CSPP NUCAPS
DeSlover, Dan	Detecting Climate Trends Using AIRS, IASI and CrIS High Spectral Resolution Brightness Temperature Spectra
Dong, Jun	Cal/Val of ATMS Snowfall Rate Product for S-NPP
Ellicott, Evan	VIIRS Active Fire Products: Applications and Capacity Building
Elvidge, Chris	Annual summary of VIIRS boat, IR source, and land light detections
Elvidge, Chris	Nighttime gems from VIIRS - lights, boats, fires and flares
Fan, Yongzhen	Reliable retrieval of atmospheric and aquatic parameters in complex environments based on multilayer neural networks and comprehensive radiative transfer simulations
Feltz, Michelle	CrIS Spectral Ringing
Flores, Adrian	Towards Site Atmospheric State Best Estimate (SASBE) over Maryland Using Radiosonde and Remote Sensing Measurements
Fu, Dejian	Satellite observations of isoprene from the Cross-track Infrared Sounder
Gartzke, Jessica	Preliminary Case Study of Geostationary IR Sounding Data from FY-4A GIIRS
Gonzalez Abad, Gonzalo	Observing BrO using OMPS measurements
Huang, Jingfeng	JPSS/STAR ICVS Severe Event Watch System Development and Applications
Huang, Min	Utilization of JPSS/S-NPP data for air quality modeling analysis during field campaigns
Jiang, Zhangyan	Preliminary calibration of NDE SNPP VIIRS green vegetation fraction product
Jin, Xin	Enhanced Capabilities on ICVS System to Monitor CrIS Instrument Performance and Data Quality
Knuteson, Robert	NUCAPS Surface Emissivity Validation
Kongoli, Cezar	Calibration and Validation of the S-NPP Snowfall Detection Algorithm
Kuciauskas, Arunas	NUCAPS applications in Saharan Air Layer Events
Ladner, Sherwin	Spatial (Subpixel) Characterization and Uncertainty in Validation of SNPP VIIRS Inherent Optical Properties in Highly Variable Water Masses
Lance, Veronica	NOAA in situ validation activities for satellite ocean color products
Liang, Xingming	A Machine Learning Trained ICVS VIIRS Clear-Sky Mask Algorithm Applicable for Multiple Satellites
Liang, Ding	ICVS monitoring of NOAA-20 OMPS Performance
Lin, Lin	On-Orbit Calibration of S-NPP and NOAA-20 ATMS Upper Level Temperature Sounding Channels Using GPS RO Observations
Liu, Yuling	Preliminary Quality Assessment of NOAA-20 LST EDR Product
Lyu, Joseph C-H	NOAA-20 ATMS Active Geolocation Test Report
Menzel, Paul	Constructing Sounder Radiances and Products at Imager Resolution
Meyers, Patrick	CICS-MD Contributions to JPSS Water Cycle Products & Services
Mikelsons, Karlis	OCView - interactive visualization and monitoring tool for satellite ocean color imagery
Mindock, Scott	CSPP SDR 3.1
Miura, Tomoaki	Validation of VIIRS Vegetation Index Time Series Data
Moradi, Isaac	Radiative Transfer Intercomparison for Supporting GSICS and JPSS Satellite Data Calibration and Validation
Nauth, Dilchand	Investigation of Outlier Identification and Removal and Noise Reduction for OMPS Measurements by Using Nearest Neighbor and Principal Components Analysis
Nowlan, Caroline	Formaldehyde Products for the OMPS Instruments on Suomi NPP and NOAA-20
Pan, Chunhui	J1 OMPS SDR Performance
Peng, Jingjing	The VIIRS Sea Ice Albedo Product Algorithm and Preliminary Validation
Porter, Warren	Application of A 2D DCT-PLS Smoothing Algorithm for ICVS Hurricane Event Watch
Rao, Yuhan	Cross-comparison of Land Surface Temperature Product between JPSS and GOES-R missions: Towards the Enterprise Algorithm
Ravindranath, Arun	Linear Statistical Models for Cloud-Clearing Hyperspectral Sounders
Reale, Anthony	Sounding Product Assessment and Uncertainty
Roman, Jacola	Near-realtime Precipitation Potential Algorithm for Polar Orbiting Sounder Data
Sun, Bomin	Leveraging the strenths of dedicated, GRUAN and conventional radiosondes for satellite geophysical sounding assessment
Sun, Junqiang	SNPP VIIRS On-orbit RSB Calibration Update; NOAA-20 RSB On-orbit Calibration; NOAA-20 RSB Polarization Effect Correction
Tan, Changyi	On NOAA-20 OLR Status
Wang, Dongdong	A gap-filled global land surface albedo product
Wang, Wenhui	Improving VIIRS SDR Radiance Limits Verification and Saturation Rollover Flagging
Wang, Heshun	JPSS-1 gridded land surface temperature product
Wawrzyniak, Tyler	ATMS Brightness Temperature Plotting with Limb-Correction Algorithm using Python
Wilson, Mike	Recent Upgrades to the NUCAPS Algorithm
Wimmers, Anthony	The Devilish Details in Morphological Compositing: Latest Improvements of MIMIC-TPW2
Xiong, Xiaozhen	Verification of NOAA-20 OMPS Radiance Products Using SNPP Data and Model Simulations
Yang, Wenze	VIIRS-based high resolution spectral vegetation indices for quantitative assessment of vegetation health
Zeng, Ning	Near-real time data assimilation for land vegetation and carbon cycle using JPSS space-based observations and in-situ data
Zhao, Feng	Validation of SNPP/VIIRS VI/GVF product with high frequency CubeSat data



Tuesday (August 28, 2018)
Invited talk by Peter Schlussel
8:00AM–8:30AM

Tuesday morning's presentations started with an invited talk by Peter Schlussel on the scientific developments associated with the EUMETSAT Second Generation Polar Satellite System and collaborations with the JPSS and the broader NOAA program. EUMETSAT is planning the first launch of the EPS-SG mission in the year 2021 with a follow-up of six satellites going until 2040. The EPS-SG A mission mainly focuses on sounding and imagery while the EPS-SG B mission concentrates on microwave imagery with different payloads. The EPS-sounding and imagery mission consists of IASI-NG infrared atmospheric sounding, MW sounding (MWS), RO sounding, visible and infrared imaging (METimage), Copernicus Sentinel-5 Nadir viewing UV/Vis/NIR/SWIR sounding for continuation of the whole GOME, GOME2, hyperspectral UV instrument datasets, and an advanced polar multi-viewing polarization imager (3MI). The EPS-SG B mission contains microwave imagery with a scatterometer for ocean measurements (SCA), Radio Occultation (RO), microwave imaging (MWI) for precipitation, Ice Cloud Imaging (ICI) for cloud microphysics parameters, and an Argos-4 advanced data collection system. These instruments provide enhanced capabilities benefitting many applications for NWP, nowcasting, climate modeling, and atmospheric composition. The EPS-SG series will have RO on each of the satellites, while the new 3MI instrument provides enhanced capabilities for aerosol detection, along with many additional channels for land and ocean remote sensing applications. The presentation further discussed the objectives and scientific preparation for ESP-SG, as well as details on product generation, cal/val planning, and early user involvement during the commissioning phase based on the EPS first generation experience.

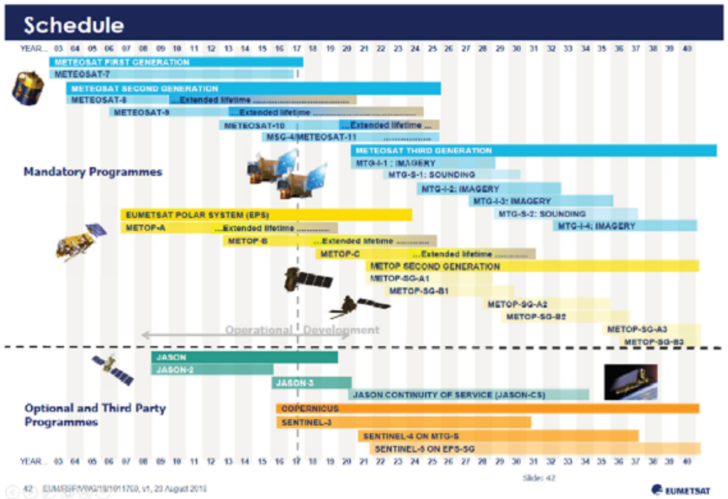


Figure. Flyout chart of current and future EUMETSAT programs

EPS-SG benefits to activities of NMSs

Main Payload	Enhanced Capabilities	Innovative Capabilities	Applications Benefiting
High-Resolution Infrared Sounding **(IASI-NG)**	+75% information in T-profiles +30% in WP-profiles	More trace gases and their vertical profiles	NWP, NWC, AC, CM
Microwave Sounding **(MWS)**	Enhanced spatial over-sampling	Ice-cloud info in support of water-vapour profiling	NWP, NWC, CM
Radio Occultation Sounding **(RO)**	Large increase of number of radio-occultations	Tracking of Galileo, Beidou and QZSS signals	NWP, CM
Nadir viewing UV/VIS/NIR/SWIR Sounding **(Sentinel-5)**	Drastic increase of spatial resolution	Additional trace gas measurements; CO_2 being studied	Air Quality, CM, AC
VIS/IR Imaging **(METimage)**	Better radiometric and spatial resolution	Far more variables measured with higher accuracy	NWC, NWP, CM
Scatterometry **(SCA)**	Higher spatial resolution and coverage	Cross polarisation for higher wind speeds	NWP, NWC, CM
Multi-viewing, -channel, -polarisation Imaging **(3MI)**	New mission	Aerosol parameters	Air quality, CM, NWC
Microwave Imaging **(MWI)**	New mission	Precipitation observations	NWP, NWC, Hydrology, CM
Ice Cloud Imaging **(ICI)**	New mission	Cloud microphysics parameters	NWP, NWC, Hydrology, CM

NWP: Numerical Weather Prediction; NWC: Nowcasting; CM: Climate Monitoring; AC: Atm. Composition

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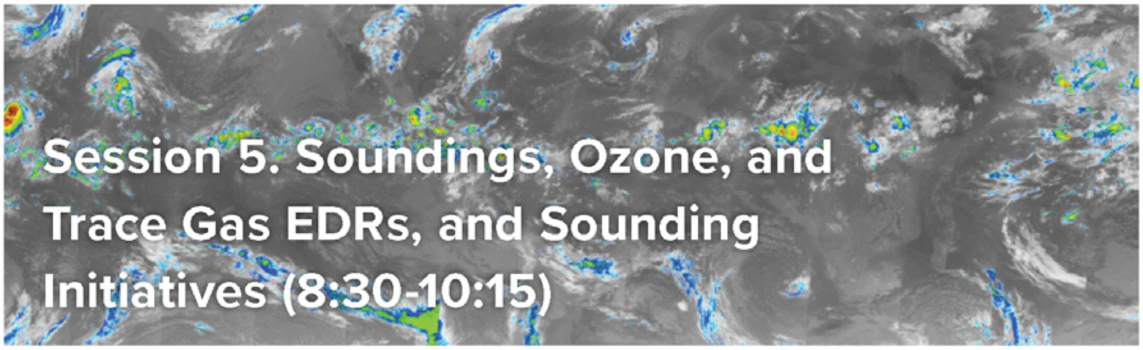
Figure. Description of EPS-SG payloads



Session 5. Soundings, Ozone, and Trace Gas EDRs, and Sounding Initiatives (8:30-10:15)

Summary: The fifth session deal with trace gases, ozone, and soundings. The users for the ozone product focused on the climatological applications of JPSS ozone products, while the Soundings user highlighted the nowcasting applications of NUCAPS data.

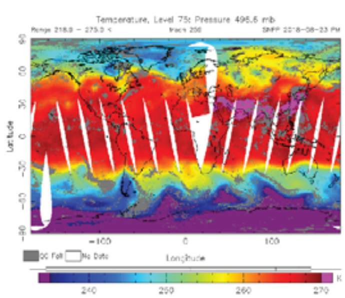
Following the invited talk on EPS-SG scientific developments, the sounding session chairs provided a brief outline of the session topics and the speakers for the NUCAPS, MiRS, and the OMPS sounding product sub-sessions. Antonia Gambacorta provided details to the NUCAPS system, current status and activities, validation plans, and future NUCAPS enhancements. The NUCAPS system development originally started with the AIRS science team algorithm and emerged as a sensor-agnostic enterprise system leveraging experiences from many contributors across different agencies. The enterprise nature of the NUCAPS framework allows running the code for different hyperspectral and microwave combination of radiances, and the system only requires the GFS surface pressure to define the surface boundary conditions to generate the retrieval products.

Currently, NDE operationally produces CrIS/ATMS NUCAPS products. The NUCAPS algorithm is also part of the CSPP and is implemented through Direct Broadcast services with improved latency for regional applications. The ASSISTT team adapted the NUCAPS algorithm into a unified HEAP capable of producing the NUCAPS products from SNPP/NOAA-20, Aqua AIRS, MetOp-A, MetOp-B, and eventually MetOp-C when it is operational. The goal of this package is to help keep the retrieval algorithm consistent and up-to-date between both instruments and all satellites. The HEAP will be in operations by 2019.

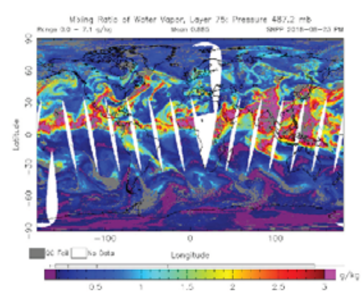
The NUCAPS team is currently working on improving the surface emissivity regression, the training methodology of statistical regression to remove cloud contamination and supersaturation cases, and improving methane, nitrous oxide and carbon dioxide retrieval modules. The team is also working on minor inconsistencies in the NUCAPS products derived from the S-NPP/NOAA-20, and MetOp, and towards reaching the validated maturity for NOAA-20. NUCAPS products derived from all of the satellite instruments are in use for many applications through integration of the NUCAPS products into AWIPS, RealEarth, and IDEA-I. Many data assimilation experiments are experimenting with the NUCAPS trace gas and Saharan Air Layer dust products. Currently, the NUCAPS team is concentrating on improving the trace gas products retrievals. Some of the recent updates include improvements through mitigating N2O interference and RTA bias corrections to mitigate spurious CO retrievals and biases.

Nick Nalli presented an overview of the S-NPP/NOAA-20 NUCAPS product validation status and acknowledged a large number of agencies in providing the necessary truth data for the EDR product validations. The S-NPP/NOAA-20 product validation methodology uses a hierarchy approach perfected over the years through validation of legacy systems (Aqua AIRS, MetOP) and applied to the NUCAPS EDR product validations. The validation hierarchy process starts with a comparison of NUCAPS products with matched model forecast/analysis fields. The second step in the validation hierarchy involves inter-comparisons of satellite sounder focus-day data products from multitude of satellites (AIRS, ATOVS, COSMIC), conventional PTU/ozone network collocations, and dedicated/Reference PTU/ozone matchups (ARM sites, AEROSE, CalWater/ACAPEX, BCCSO, and PMRF). Intensive field campaign measurements that include dedicated sondes and aircraft campaigns (e.g. AEROSSE, RIVAL, CalWater, JAIVEX, AWEX-G, and EAQUATE) provide the opportunity to validate both the SDR and EDR products. The trace gas product validation also follows a similar hierarchy approach starting with model comparisons, inter-comparison of satellite sounder products, surface-based network of measurements such as TCCON, and intensive field campaigns (ATom, WE-CAN, ACT-America, FIREX, etc.).

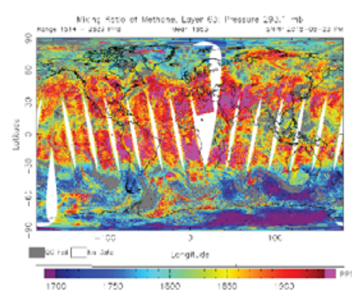
The NUCAPS temperature, water vapor, ozone, and OLR products for S-NPP have attained the validated maturity stage, and the trace gas products are now at provisional maturity status. The NOAA-20 NUCAPS temperature and water vapor products have reached provisional maturity, and other NOAA-20 NUCAPS products (OLR, ozone, carbon trace gases) are at the Beta maturity stage. The presentation also discussed the L1RD documented requirements temperature, moisture, and ozone and the requirements for the trace gases. Recent NUCAPS upgrades have focused on upgrades/optimization of the CO trace gas EDR products, and preliminary evaluation of the trace gas products with AIRS and truth data sets like TCCON and ATom have shown these products reach the requirements very closely. The NUCAPS methane and CO2 validations with the available truth data sets from ATom reveals the need for further improvements into the NUCAPS algorithm. The NUCAPS teams also contribute to the long-term monitoring of these products, and support EDR user applications to AWIPS, atmospheric river/SAL, and atmospheric chemistry users. The teams are also working on applying averaging kernels in NUCAPS carbon trace gases and ozone profile EDRs to show that the current products meet the requirements only in those regions where the instruments have sensitivity.



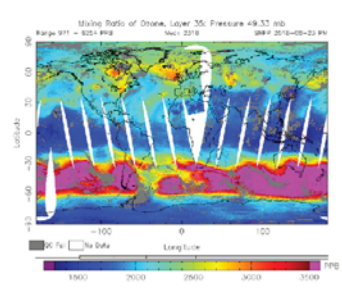
AVTP w500 hPa)



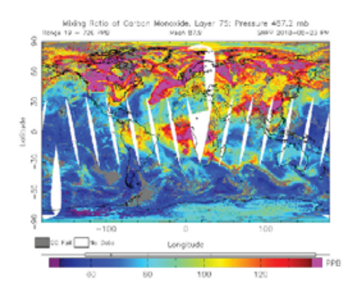
AVMP (500 hPa)



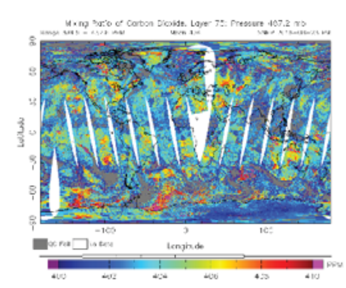
Methane (300 hPa)



Ozone (50 hPa)



Carbon Monoxide (500 hPa)



Carbon Dioxide (500 hPa)

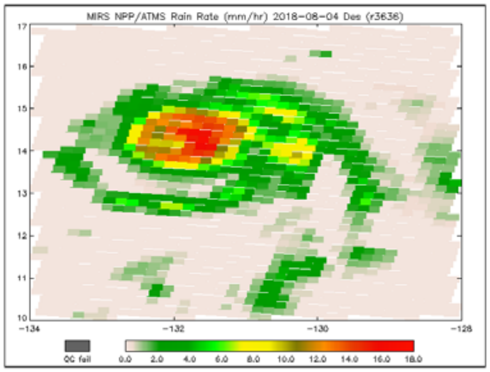
Figure. NUCAPS products

Following the NUCAPS algorithm status and validations presentations, Nadia Smith (STC) presented the PGRR Atmospheric Soundings initiatives for nowcasting applications. The presentation stressed the importance of collaborative efforts with the forecasters to find out the utility of the NUCAPS products, develop application-based product development and evaluation, and tailor the operationally produced and validated NUCAPS products for weather forecast scenarios and decision-making. Some of the application areas focused in this initiative are the use of NUCAPS temperature, moisture, stability indices, ozone and trace gas profiles for (1) severe weather nowcasting applications in the boundary layer, (2) severe weather turbulence, SAL, and fire weather applications in the mid-troposphere, and (3) cold-air-aloft, turbulence, and stratosphere/troposphere exchanges of trace gases in the upper troposphere. The presentation also discussed the efforts placed through this initiative on interactive face-to-face NUCAPS product evaluations and capabilities on addressing forecasters' needs, and efficient solutions on achieving those needs. The presentation ended with displays of NUCAPS product use in AWIPS-II and the HWT, and recommendations from the 2018 HWT (http://goes-rhwt.blogspot.com /search/label/NUCAPS).

Lessons learned from this initiative suggested the need for (a) improved latency and high temporal frequency of the products (S-NPP, NOAA-20, and MetOp), (b) high quality visualizations, (c) understanding product uncertainties and trace gas parameters, and (d) a detailed guidebook on the NUCAPS products available through netCDF. In responding to some of the questions and comments, the JPSS program office reiterated the efforts to ensure access to the products with high latency. Real time users can access the CSPP DB and RealEarth products and the products are available via GEONetCast. The JPSS program also welcomed everyone to be part of the initiative meetings by contacting the POCs to learn on-going efforts on improving latency, availability of product visualization tools, product dissemination sources, and to suggest user needs for further improvements.

Chris Grassotti presented an overview of the MiRS sounding products algorithm, product maturity status, algorithm improvements and fixes, and recently introduced new products. S-NPP MiRS products reached validated maturity, and the NDE system operationally produces a large number of MiRS products. The NOAA-20 MiRS products attained Beta Maturity within eleven days of the NOAA-20 launch, and reached provisional maturity status in March 2018. Many cryosphere products and other products such as rain rate are going through product validation exercises, and the team expects to deliver a final DAP by early 2019 for NDE operations. The S-NPP MiRS products are also available through CSPP/DB services, and the NOAA-20 MiRS products will be available through CSPP/DB starting July 2019.

The team is evaluating some of the recently introduced algorithm changes/improvements such as forest fraction emissivity correction in the SWE algorithm, estimation of light rain over land through incorporating CLW into the RR algorithm, and miscellaneous fixes and changes to metadata. The presentation also discussed some of the down-stream applications. The Hurricane Intensity and Structure Algorithm developed at CIRA provides TC intensity estimates (maximum sustained wind, minimum surface level pressure, surface wind radii estimates). The moisture influx storm tool, also under development at CIRA, detects and quantifies dry air intrusions, a potential predictor for statistical TC intensity forecast models (SHIPS, LGEM, and RII). The blended layer precipitable water application tool combines MiRS products from up to seven polar satellites for Rapid Refresh and Advection. The team is also working on developing a future surface classifier using machine-learning techniques. The presentation ended with a discussion on MiRS RR product display over Hurricane Hector, and the advantage of having S-NPP and NOAA-20 satellite systems in the depiction of complete storm structure. The MiRS products are available at CLASS as well as at the STAR FTP site (S-NPP ATMS, NOAA-20 ATMS, and GPM GMI) and the software package is available for download from https://www.star.nesdis.noaa.gov/MiRS.



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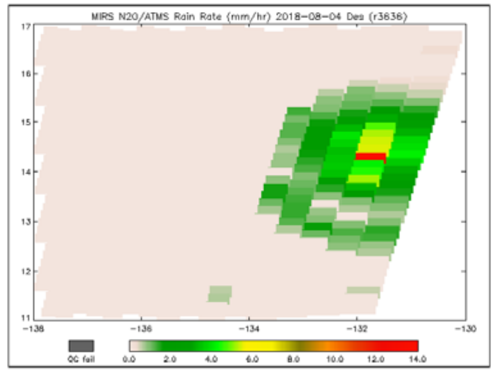

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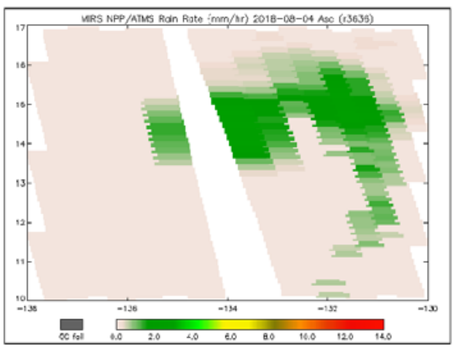

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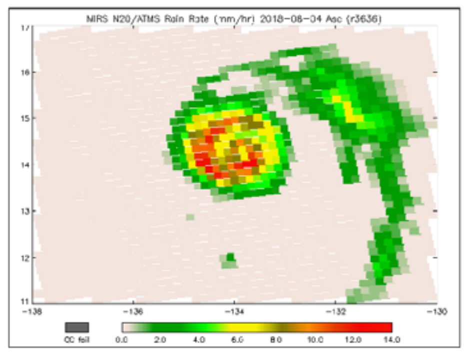


Asec: N20 2018-08-04, 2213 UTC

Figure. Two Operational ATMS Better Than One: MiRS rain rate for Hurricane Hector on 4 Aug 2018. Doubling the number of ATMS overpasses increases odds that TCs fall within the (near nadir) "sweet spot" of swath.

The Ozone EDR Team lead Larry Flynn provided an overview of the OMPS ozone EDR products from the OMPS NM and NP instrument suite. The presentation included a brief description of the version 8 total ozone algorithm (V8TOz) and ozone profile (V8Pro) algorithms and status. The presentation also discussed the implementation for deriving total zone and ozone profile products from the S-NPP OMPS NM and NP instruments, respectively. The V8TOz and LFSO2 algorithms are from the NASA ozone science teams and have been implemented to process OMPS NM and NP granules to create OMPS EDRs. The algorithm combines radiance/irradiance ratios at 12 channels with climatological information and radiative transfer tables for standard ozone profiles to compute estimates of total column ozone, effective reflectivity and aerosols. The LFSO2 algorithm uses the measurement residuals from the V8TOz retrievals to estimate SO2 using three sensitive channels and adjusts the final ozone estimate for the SO2 absorption interference effects.

The V8Pro algorithm, developed by NASA and implemented for OMPS NP granule processing, combines radiance/irradiance ratios at 12 channels with climatological information and radiative transfer tables for standard ozone profiles to compute maximum likelihood estimates of ozone vertical profiles and effective reflectivity. The OMPS V8TOz EDR products are in netCDF file format and contain estimates of total column ozone and SO2, effective reflectivity, UV absorbing aerosols, error flags, measurement residuals and retrieval sensitivities from the algorithm. The OMPS V8Pro products are also in netCDF file format and contain estimates of vertical ozone profile, total column ozone, effective reflectivity, error flags, a priori profiles, averaging kernels, measurement residuals and retrieval sensitivities from the algorithm. The S-NPP V8Toz and V8Pro algorithms currently in operations in NDE have been adapted to process and generate NOAA-20 OMPS data sets to derive similar products.

Pius Lee from NAQFC and Craig Long from NCEP discussed some of the applications and usage of OMPS EDR products. The NCEP usage of OMPS EDR products falls into three connected categories, (1) towards continuation of the long term climate data record and climate monitoring that began with the SBUV/2, (2) towards near real-time monitoring of the ozone hole, and (3) towards UV index forecasts and for stratospheric intrusion/monitoring forecasts. The total ozone long term climate data record is the longest satellite record to date to monitor ozone depletion/recovery and study the effects of climate change on ozone trends in various part of the stratosphere. With the addition of new data products from emerging instruments, and ozone processing modifications, the climate data record may require reprocessing. With regards to NRT monitoring of the ozone hole, the S-NPP and NOAA-20 satellites with the OMPS NM instrument provide additional ability to monitor the ozone hole, and the fact that these satellite are in very stable orbit provides better aerial coverage than the earlier POES that suffer from drifting orbits. NCEP EMC has been assimilating NOAA-19 SBUV/2 profiles and NASA OMI total column ozone in the GFS. The team is monitoring NOAA-19 orbital drift and associated declining coverage from SBUV/2. A large number of OMI's scan position data are also unusable. The CPC is currently monitoring S-NPP NP and NM V8 products for assimilation and with an eye towards replacing SBUV/2. The CPC is also currently evaluating OMPS Limb Profiler products and plans to assimilate OMPS once the data products become available in BUFR format. Future plans include evaluation of NOAA-20 OMPS products.

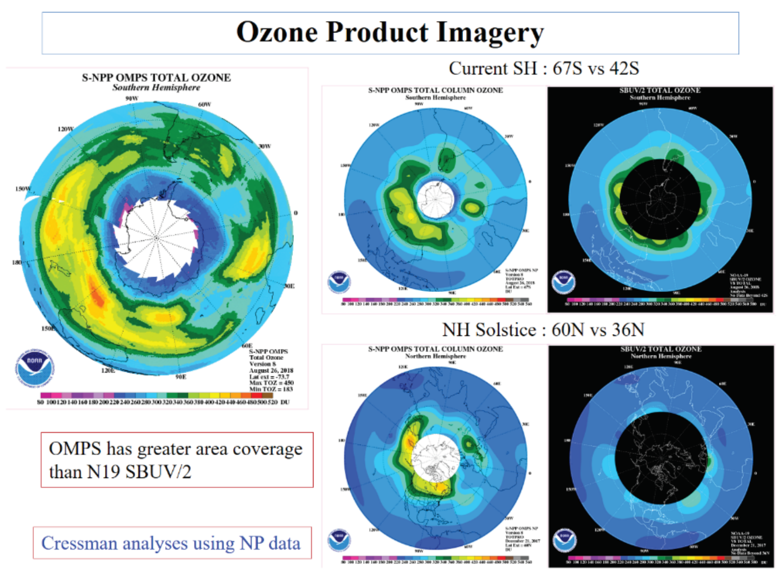
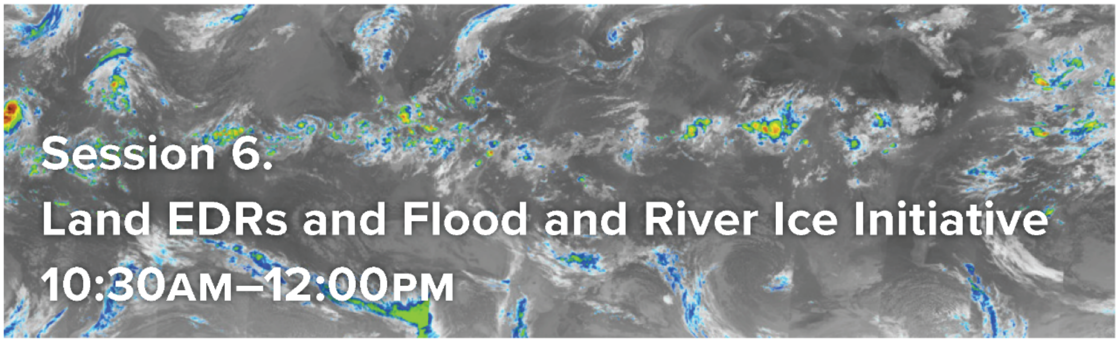


Figure. Comparison of S-NPP OMPS ozone to NOAA-19 SBUV/2 ozone showing that S-NPP provides greater coverage



Session 6. Land EDRs and Flood and River Ice Initiative 10:30AM–12:00PM

Summary: This session focused on the suite of land surface products, which are moving towards a common gridded format for use in land surface modeling and numerical weather prediction. It also included presentations on the innovative PGRR work being done to map flooding and river ice.

Bill Sjoberg started this session with an overview of the PGRR Program and detailed the River Ice and Flooding Initiative. Bill presented a large list of PGIs (e.g. River Ice and Flooding, Atmospheric Chemistry, Fire and Smoke, Soundings, Data Assimilation, Imagery/Nowcasting, Ocean/Coastal applications, Hydrology, Arctic, Land data assimilation). He noted that flooding accounts for more than 50% of disasters. Notably, the River Ice and Flooding algorithm was first applied with great success during the 2013 Galena Flood in Alaska, and follow-on attempts have occurred for the Alaska-Pacific, Missouri Basin, North Central, West Gulf, Lower Mississippi, Southeast and Northeast regions. The river flooding algorithm from GMU and the ice algorithm from CUNY have been combined to generate the products. The DB services from CIMSS are used to collect data inputs. The products are accessible by RealEarth and the products are provided to AWIPS using Local Data Manager. The product is used routinely by NWS River Forecast Centers and also by FEMA.

Following the overview on River Ice and River Flooding PGI, Sanmei Li (GMU) discussed the basics of the scientific approach for flood mapping, algorithm development, flood product development and case study applications using S-NPP VIIRS. Issues and mitigations with the current algorithm and improvements applied to the current algorithm (including examples) are discussed. The NOAA-20 VIIRS data has been integrated into the flood software and quality checked for consistency. The team envisions release of the flood detection software for GOES-16 ABI, AHI, and development of the blended algorithm to merge VIIRS, ABI, and AHI flood products to produce a blended 375 m flood product.

The land product session started with Xiwu Zhan's presentation on the VIIRS ST product. The ST product team started working on the S-NPP VIIRS surface type product in 2012 and utilized daily composites of surface reflectance to generate monthly composites. The monthly composites along with training data sets are used to generate global annual metrics. The initial classification map generated using decision trees and support vector machine is quality checked in the post-processing to generate the final global ST map. Recent improvements on global compositing using the self-adaptive algorithm mitigated some of the limitations and produced better results. The 2017 VIIRS Annual ST product, available in sinusoidal and rectangular projections, can be downloaded from ftp sites. The ST team has also performed studies on surface type changes due to long-term conversions (deforestation, urban sprawl, desertification, revegetation, etc.) and short term changes (vegetation phenology, seasonal snow cover, flooding and short term inundation, and wildfire) to produce daily surface type change products. The team is also working on VIIRS surface type comparisons with the European surface types. The VIIRS ST product meets the requirements slated in the L1RD document for global surface types that include 17 International Geosphere Biosphere Programs classes with an overall accuracy of 77.6 ±0.6%.

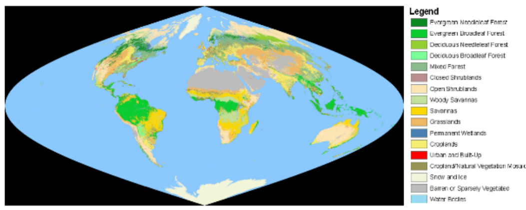


Figure. 2017 S-NPP Annual Surface Type product map

Next up, Ivan Csiszar provided a short overview on the JPSS land products followed by Bob Yu's presentation(s) on NVPS, LST, LSE, and LSA products. Bob Yu's presentation(s) included team members that worked on each algorithm and product development (from STAR, UMD/CICS, STAR contractor support from IMSG, and University of Hawaii), product validation, status of NOAA-20 product maturity, feedback from users, active collaborations, efforts towards gridded product development, long-term monitoring, and future plans on product improvements.

The NVPS includes a variety of VI products and the GVF product. The VI product algorithm is inherited from the MODIS and AVHRR VI, and the product suite consists of top-of-atmosphere NDVI, top-of-canopy NDVI, and the EVI. The product suite contains daily, weekly, and biweekly global and regional (North America) products at 4 km and at 1 km spatial resolution, respectively. The VIIRS GVF product provides continuity with the NOAA AVHRR GVF product. The algorithm is based on the EVI global minimum and maximum values, and the current NDE GVF algorithm produces weekly global and regional (North America) products at 4 km and 1 km spatial resolution, respectively.

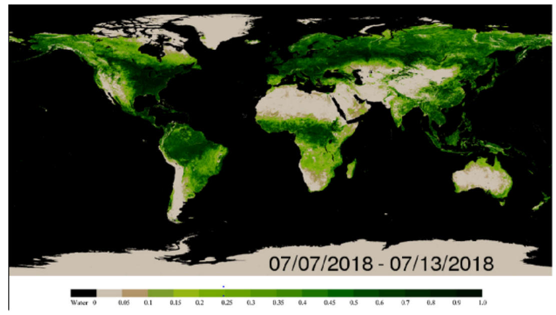


Figure. S-NPP VIIRS weekly Green Vegetation Fraction, 7 Jul -13 Jul, 2018

The VIIRS VI and GVF algorithm performance has been evaluated using MODIS products, along with 35 Flux Tower sites providing in situ data from EOS Land Validation Core sites. The GVF products have been validated with the EOS data sets and Google Earth derived GVF. The land team has adapted S-NPP NVPS algorithms to produce similar products from NOAA-20. The delayed availability (at least six months from the observed date) of in situ measurements imposes limitations into product validation schedules and the team is preparing for NOAA-20 product provisional maturity scheduled for early next year. The team is also developing long-term monitoring tools to aid automated validation with in situ measurement. The NVPS products are used to derive NDE downstream products, and the NOAA ESRL HRRR model, the NCEP EMC land surface model, and SMOPS use these products. The users' feedback on the data quality is positive. The land product teams are also working on NVPS code improvements for robustness, removal of redundancies, data layer re-arrangements, and quality flag upgrades.

Following the overview on the NVPS, Bob Yu also discussed the JPSS enterprise LST/LSE algorithm, product details, status of the NOAA-20 product performance, efforts towards gridded product development, emissivity development efforts, long-term monitoring, and active user interactions. The LST enterprise algorithm is a regression algorithm and produces day and night products at the granule level. The NDE algorithm has been producing products in near real-time at the ASSISTT facility and is expected to be in operations later this year. The VIIRS LST product evaluation is performed using cross-comparisons with MODIS Aqua and the validation through in-situ measurements using SURFRAD and BSRN ground measurement sites. Overall, the product evaluations revealed good quality with outliers attributable to limitations of ground data quality control, cloud filtering procedures, and upstream data quality.

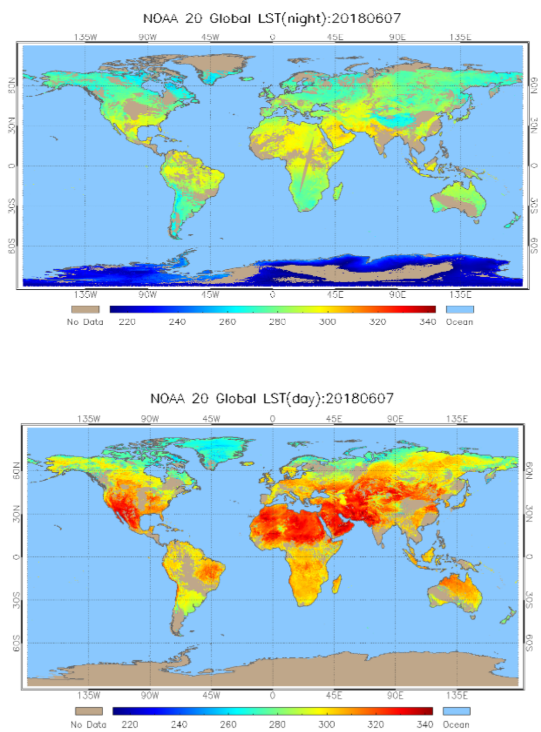


Figure. Night time (left) and Day time (right) LST for June 2018

The presentation also provided some examples of the NOAA VIIRS LST product inter-comparisons of S-NPP vs. NOAA-20, as well as cross-comparisons with Aqua MODIS products for day and night. The team is currently working on gridded LST product development in concurrence with the overall land product enterprise architecture for consistency across products, and in order to satisfy current and future user needs for consistent set of land products delivered on the same grid resolution (1 km). The team is also working on the gridded emissivity product development efforts for VIIRS and ABI split window channels, and validation of the LSE product using ground LSE measurements in the 8-15 µm broad band for four bare sites in northwest China. A large number of users (USDA, UMD, ARL, EUMETSAT, and many others) use the product and the team has received positive feedback.

The team has provided LST/LSE test data sets to NCEP/EMC for model output verifications, and to the land surface air temperature prediction model. The gridded LST products are expected to be in operations by September 2019 and the LST long-term monitoring site is at a matured stage of development. The teams' future plans include comprehensive validation for NOAA-20 provisional maturity, extension of product cross-comparisons with Sentinel 3 products, international collaboration on the ground data collection for LST validation, and active user communications.

Following NVPS, LST and LSE discussions, Bob Yu presented the land surface albedo product and appreciated the active support on the product development from UMD/CICS. The NDE LSA product algorithm has significant improvements rectifying many issues such as missing values and product uncertainties seen in the IDPS algorithms, and provides a gap-filled, noise reduced product. The STAR ASSISTT team is running the NDE enterprise algorithm in near real-time (started in June 2018) and the NDE Operational Readiness Review is planned for September 2018 for operational implementation in NDE. The LSA algorithm uses surface-specific LUTs for generic, desert, snow, and snow-ice types, and uses climatology to fill data gas and reduce retrieval uncertainties. A Test Readiness Review evaluation of the LSA product with limited SURFRAD 16-day mean albedo measurements showed the VIIRS NDE LSA product meets the accuracy and precision requirements. The S-NPP NDE algorithms has been adapted to NOAA-20 and evaluation of NOAA-20 LSA product shows consistent results with the S-NPP product, and shows excellent correlation with the MODIS collection 5 derived surface albedo product. The team is also working on making the gridded LSA product synergistic with the overall gridded land data products architecture. The team is working with the NCEP modeling team to test the application of the customized new gridded, gap-filled, noise-reduced product, with the addition of the sea ice surface albedo product. The team's future plans include comprehensive validation for NOAA-20 provisional maturity, reprocessing of Albedo data and evaluation, and active user communications.

Yihua Wu from NCEP made the final presentation of the session and discussed the applications of land surface products in NOAA NWP models. The importance of land surface modelling as an essential component of modern weather and climate forecasting systems was highlighted. The parameters used in the LSM are poorly constrained due to sparse land surface observations, and satellite-derived land data products provide an opportunity to improve LSM initial conditions for improvements of environmental modeling, weather predictability, risk assessment and decision making. The presentation provided a list of remotely sensed land surface products/parameters used in the NWP LSM data assimilation, and provided examples on the usage of various land products (snow products, SMAP soil moisture, vegetation type, soil type, GVF, etc.) to initialize certain land properties and impacts. Many of these inputs are obtained from a variety of satellite products with varying resolutions and most of them are used to derive annual/monthly/weekly climatologies to provide fixed values. The use of near real-time data products vs. climatological values fixed in the models have shown to improve model prediction performance through reducing biases. Modelers envision active collaboration with several remote sensing product development teams for coordinated exercises in improving satellite data quality and improving utilization into NCEP NWP.

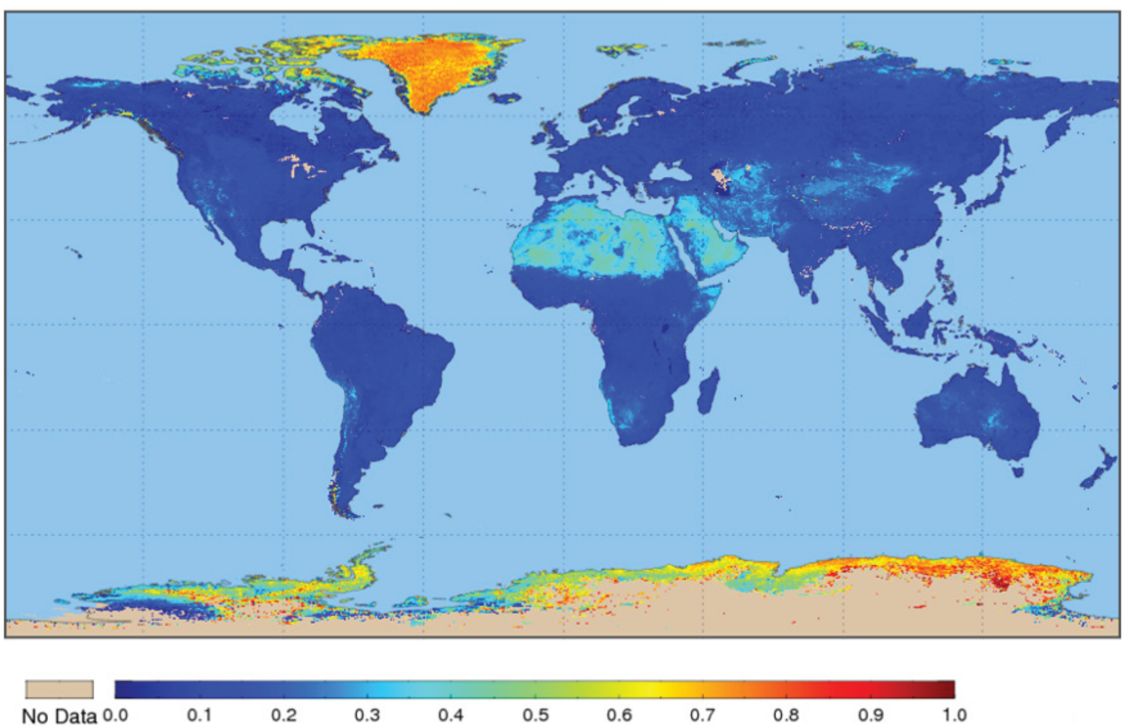


Figure. September 2016 S-NPP Land Surface Albedo

Session 7.
Smoke and Fire Initiatives
1:15PM–2:45PM

Summary: The Smoke and Fire Initiatives focused on the successful use of VIIRS data in forecasting smoke plumes using the HRRR-Smoke and RAP models. Presentations included information on the EDR inputs to these models, as well as results. A new project to produce Burned Area estimates from VIIRS data was also presented.

The Smoke and Fire Initiative session started with an overview from Bill Sjoberg. The main objectives of the smoke and fire initiative are to: (1) allow stakeholders supporting development of the Fire and Smoke products to interact with key users, (2) understand the use of geostationary and polar orbiting satellite capabilities in support of the Fire and Smoke detection and forecasting mission, and (3) identify the current JPSS and new GOES-16 Fire and Smoke data and capabilities that have the potential to improve support to this mission. The initiative started with experiments on assimilating the VIIRS Fire Radiative Power (FRP) product into the HRRR smoke model. The first smoke forecast provided through this initiative alerted the public on visibility and public health during a Yosemite National Park fire and received positive feedback from the field offices and user community. The presentation also discussed an array of fire events (e.g. King Fire, Ft. McMurray, Thomas Fire, etc.), evolution of these fires from day to day, and use of DNB NCC imagery on the estimated fire perimeter. The initiative plans on implementing GOES-17, NOAA-20, and other satellite fire products to the HRRR smoke model and to help transition the smoke parametrization into the global FV3 in the future.

Active Fires team lead Ivan Csiszar provided the status of the VIIRS Active Fire product, the primary input to the HRRR smoke model. The NDE enterprise VIIRS day and night fire algorithm has the MODIS baseline algorithm as heritage and uses M-band 750 m resolution data, with M13 data dedicated for hot-spot detection, characterization, and FRP calculations. The current operational 750 m NDE product meets the threshold requirements slated by the L1RD. The S-NPP NDE fire algorithm has been in operations since March 2016, and the NOAA-20 algorithm has reached operational status starting August 2018. The team is currently working on a 375m enterprise algorithm product that combines the advantages of high spatial resolution I-band data with the good radiometric signal of the M-band for FRP. NOAA STAR is producing 375 m fire products in offline mode from both S-NPP and NOAA-20, and based on internal evaluations the product is expected to meet the L1RD objective requirements. Currently, the HRRR-Smoke PGIs receive non-operational 375 m products through STAR FTP downloads, and in future will be able to access these products through PDA after operationalization of the product in NDE. The presentation discussed S-NPP and NOAA-20 fire detection consistency, fire temperature RGB products generated from the VIIRS bands, and studies related to night time characterization using the DNB. Examples of Western US fire events, fire product displays available through JSTAR Mapper web site, and OSPO web-based Hazard Mapping System contributions to the Fire and Smoke initiatives were discussed. Future plans of the team include improvements to the 750

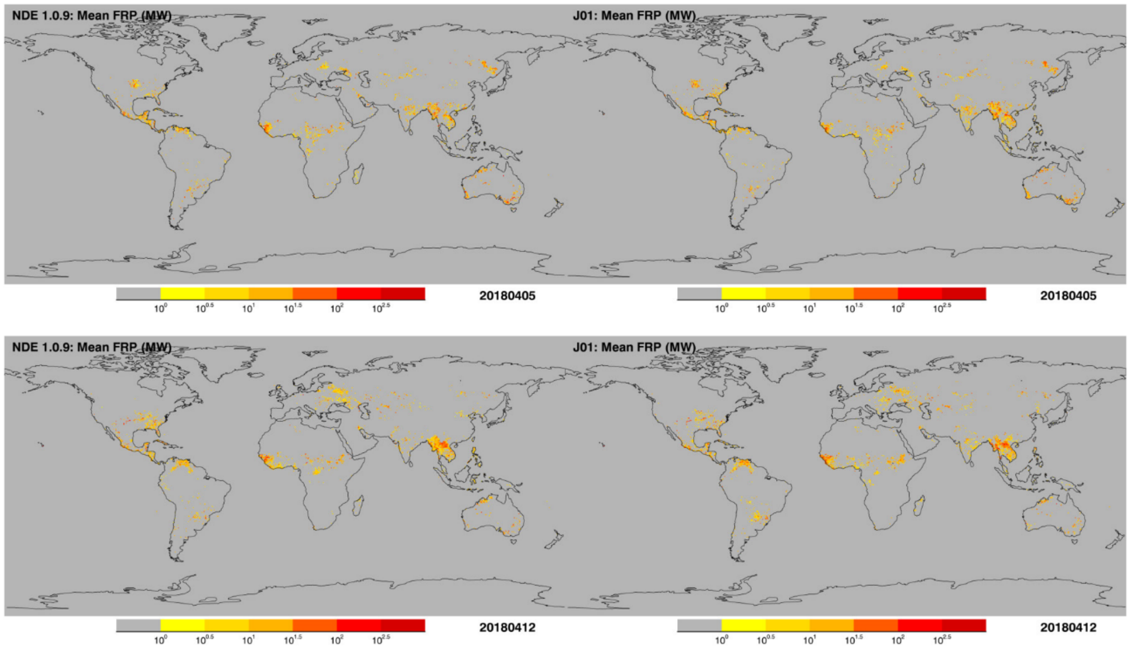


Figure. S-NPP vs. NOAA-20: 750 m mean FRP shows good agreement. “Perfect” agreement is not expected due to the 50 minute orbit separation.

m product, validation and transition of fire products to 375 m resolution, development of multi-satellite fire product observing system leveraging spatial and temporal use of polar and geostationary data sets.

The next presentation by Shobha Kondragunta discussed the use of fire and aerosol products and their applications in the fire and smoke initiatives. The presentation highlighted the HRRR smoke model as one of the important tools in providing forecasts for various applications, including guidance to field forecasters as well as to the NWS. The HRRR smoke model needs inputs such as the location of fire, FRP (a proxy to calculate emissions from the source), the fire duration (available from geostationary satellite products) and the plume injection height.

The HRRR model currently receives fire location and FRP from the VIIRS fire products, where the model does the best effort in estimating the amount of emissions. As part of the fire and smoke initiative, the team presented preliminary results of HRRR smoke model forecast performance (column integrated aerosol concentration) evaluations using the VIIRS AOD products. Preliminary results from one week (in August 2018) of analysis of the HRRR smoke model evaluations with the VIIRS AOD product were presented. Some of the caveats of the AOD product are gaps due to the cloud-mask misinterpreting the thick smoke plumes as clouds and/or flagging AOD as missing value when the AOD retrieved is beyond the measurement range. These deficiencies in the AOD product require careful attention when evaluating the model performance because the model may be predicting well in these areas where the satellite AOD product has deficiencies.

Some of the caveats of the HRRR smoke model noted in the presentation are simple scaling of particle concentration to AOD and absence of secondary aerosol information of hygroscopic particle growth. However, hygroscopic particle growth is not very important for smoke, since smoke doesn't produce any hygroscopic particle growths like sulfates or nitrates. The presentation discussed some of these limitations through the analysis of VIIRS imagery, smoke masks, the fire hot spots, and AOD product overlays over fires in California, as well as British Columbia, Canada.

In conclusion, the HRRR smoke model spatially captures well both the source region location and movement of the smoke fields. This qualitative information is invaluable for the field forecasters, incident meteorologists and others who use this product in the field. The HRRR surface smoke concentrations may be accurate, however, in this comparison the team has evaluated integrated AOD column values with the AODs produced by VIIRS and GOES-16. The HRRR smoke model may be performing well with the smoke source regions, but when the smoke is transported for long distances, the model is not able to retain the information. The team is planning to process all the data available for August from both VIIRS and GOES-16 and to stratify the analysis into near-source regions and regions where the smoke transport is predominant to evaluate the performance.

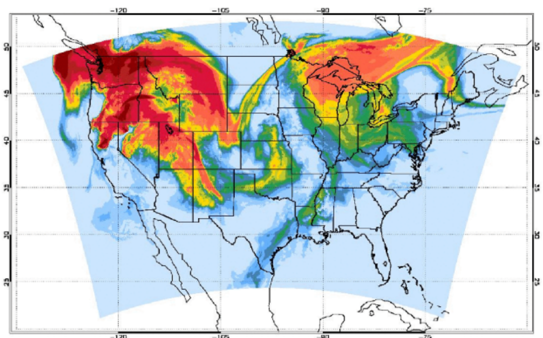


Figure. HRRR-Smoke model output for 19 Aug 2018

Ravan Ahmadov provided an overview of the RAP and HRRR-Smoke experimental forecast models. The presentation discussed the need for high-resolution smoke forecasts for many applications such as air quality, visibility (e.g. for transportation and aviation), and smoke impacts on chemistry and meteorology to improve weather forecasting. The presentation emphasized the strengths of the HRRR-Smoke modeling system (3-D, high spatial resolution, complex terrain modeling, full coupling between meteorology and smoke, GSI boundary conditions from RAP), and capabilities of HRRR model for various applications (biomass burning, forest fires, etc.) in comparison to many other smoke and air quality forecast models available to date. Another advantage is the familiarity that weather forecasters have to the HRRR model and its outputs, due to its basis on the WRF meteorological model.

The model uses meteorological input data prepared by the GSI data assimilation system and boundary conditions from the RAP. A single tracer (smoke) added to the GSD's HRRR model provides fire emissions from biomass burning, forest fires, prescribed fires, and so on. A wide array of spectral aerosols and anthropogenic aerosols are not included at this time due to limitations of computational power required for operational or semi-operational setup. The model takes all of the available observations within 24 hours prior to the simulation start time, then uses a clustering procedure to combine all of the detected fires from VIIRS and MODIS to the model spatial resolution and grid configuration. In addition to the emissions, the model also takes the FRP data to compute heat flux and simulate inline plume rise. The presentation also discussed some of the visuals and animations of various parameters (e.g. FRP, near-surface smoke, vertically integrated smoke, surface visibility) accessible by the public in real-time from the HRRR-Smoke website (rapidrefresh.noaa.gov/hrrr/HRRRsmoke/).

The team has also implemented the smoke tracer into the experimental RAP, (https://rapidrefresh.noaa.gov/RAPsmoke/) that provides forecasts at 13.5 km spatial resolution over a larger domain covering all of North America. The model has the advantage of longer forecast lead time (48 hours) with a new forecast that starts every 6 hours. One of the goals of this project is to help forecasters, incident meterologists, air resource advisors, and the public with experimental forecasts in real time. The model webpage provides the VIIRS active fire user guide and visualizations on an interactive map (surface smoke, surface visibility forecasts) for public access.

Andy Edman provided an overview of the Fire Weather/HRRR-Smoke initiative, and the outstanding progress made by the initiative in showing the value of satellite observations and their impact to modeling. He thanked all the teams involved and great team work in improving OSPO FRP in operations. He discussed some of the fire events that happened during the summer of 2018 and showed very successful HRRR smoke animations that received very good acceptance from the public on knowing where the smoke was and how it was changing, as well as from the WFOs. The training provided by the initiative to WFOs on interpreting HRRR-Smoke forecasts and active e-mailing of major changes received widespread acclaim. The presentation also reiterated some of the points made by earlier speakers, specifically that the HRRR-Smoke is really capturing events of fires and fire/smoke evolution, and has captured the interest of the public, community, and managers through public media posts. One of the benefits that came out of the project is the wide publicity and acceptance by a wide range of people and the project has far exceeded expectations.

Sam Batzli's presentation discussed the new forecast activity of burned area debris flow using VIIRS NDVI and thanked the PGI management for getting him into the Fire and Smoke initiative working group. The new project is trying to help NWS forecasters in forecasting mud and debris flow following large wildland fires. Currently, the BARC maps produced by the US Forest Services and US Geological Survey are the gold standard for burn intensity estimates. However, they are often not available for forecasting debris flows at times when they need information. The team is trying to improve the latency by developing a semi-automated method for getting burn intensity information into the hands of forecasters using VIIRS data. The data is of relatively coarser spatial resolution than Landsat but comes faster, and by automating processing to lower latency and using web-based tools to initiate processing and collect GIS-ready results, there is value in the product that help the forecasters.

The presentation discussed the feasibility studies performed by Brad Pierce, Ivan Csiszar, and Katherine Rowden and their earlier research to provide a rapid assessment of intensity of burns by taking the difference of NDVI before and after burn events. The aim of the project is to automate the process using the VIIRS Delta-NDVI imagery. The proof of concept in automating the product (such as a manual handling data, finding the imagery, and streamline, automate, extend, and ultimately operationalize production) has been laid out and the team is finalizing the implementation. The new product expected from this initiative, the BRIDGE map, is based on the idea of the BARC map. The BRIDGE map evaluates TOA, TOC, and EVI NDVI products in potentially developing a surrogate to the normalized burn ratios that are not available as an operational and routinely produced VIIRS product.

The initiative goal is that the integration of BRIDGE will result in improved situational awareness and will support decision making, especially before BAER assessment teams can deploy (typically at 80% containment) or before BARC maps are available. The presentation ended with the team's intention of testing the BRIDGE maps for historical Washington debris flow events that followed the Peavine Fire (29 June 2012), Wenatchee Fire (4 Aug 2013), Colockum Tarps Fire (13 Aug 2013) and the Carlton Complex fire (21 Aug 2014). This testing includes various component tasks involved in automating web-based dashboard with RealEarth maps, producing BRIDGE maps for recent large fires and historical fire analysis, delta-NDVI BRIDGE map production, scaling and format conversions from raster to vector shape files, and evaluating the effectiveness of BRIDGE maps in debris flow forest models.

Session 8.
Cryosphere EDR Products and Arctic Initiative
3:30PM–5:00PM

Summary: The Cryosphere EDR session focused on the status of the various cryosphere EDR products relating to snow cover, sea ice, and winter precipitation. Additionally, presentations discussed new experimental products like sea ice leads and sea ice motion, as well as a user's view of the utility of JPSS cryosphere products.

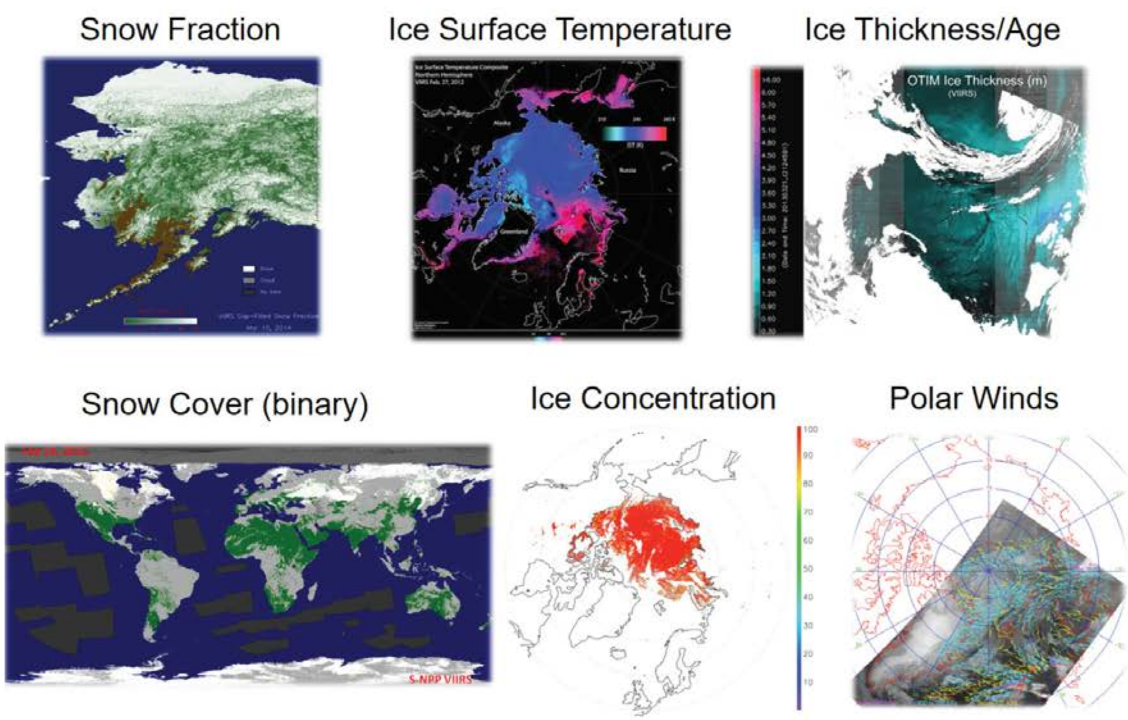


Figure. Examples of VIIRS operational Cryosphere products.

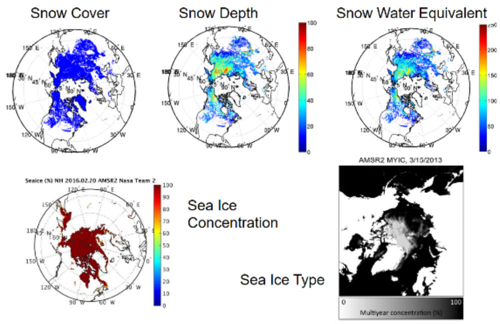


Figure. Examples of GCOM AMSR2 operational Cryosphere products.

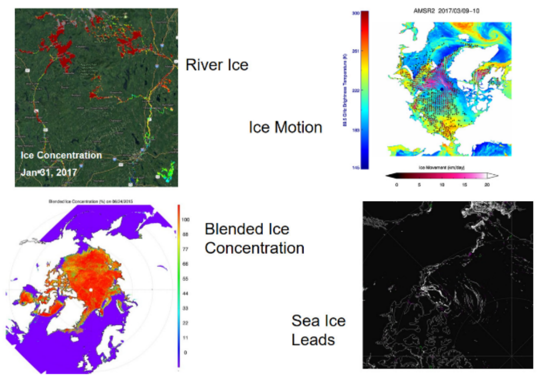


Figure. Examples of VIIRS experimental Cryosphere products.

The first presentation discussed the NWS Alaska Sea Ice Program (ASIP) and the abstract provided by the presenter (to be presented at the AMS 2019 Annual Meeting), and reproduced here gives a complete detail of the Arctic Initiative: "Use of High Resolution Polar-Orbiter Imagery and Evaluation of JPSS Ice Products in Sea Ice Analysis and Forecasting"

The amount of detail required to track and analyze the concentrations and stage of sea ice is best provided by high-resolution polar-orbiting satellite imagery. The diminished temporal frequency of imagery, as compared to geostationary satellites, is balanced by the superior spatial resolution they provide. High-resolution imagery is capable of providing a plethora of information on sea ice. Concentration of ice is the most apparent data from the two dimensional top-down view, however, the appearance of ice over time can be used as a proxy for stage (thickness/age). The NWS ASIP makes use of a multitude of satellite platforms and imagery to construct the daily analysis of ice concentration and stage from the Bering Sea through the Beaufort and Chukchi Seas as well as Cook Inlet. Visible and true-color imagery from MODIS and VIIRS continue to serve well, sensing ice in cloud-free scenes. Infrared imagery becomes increasingly useful during the long winter as daylight is scarce while the NBCC product allows for a consistent and comparable view with respect to visible imagery. Multi-channel RGB imagery combinations help discern ice from clouds and other land features. SAR and AMSR2 provide much needed microwave data coverage during prolonged cloudy periods as the signal is unaffected by clouds and precipitation. Despite the many and varying types of imagery available, there are still many days in which the imagery is insufficient for current meteorological conditions. The lack of data facilitates creates a need to collaborate with other agency partners for new analysis and forecasting techniques. In April 2018 the ASIP participated in an evaluation of ice products from JPSS. Products provided to the ASIP included analysis of SIC, IST, Ice Thickness, and Blended Ice Motion. Examples intended for display will include the JPSS evaluation products, S-NPP true-color imagery, S-NPP land cover, SAR, AMSR2 Sea Ice Concentration, infrared and NCC.

The second presentation by Mark Tschudi (CCAR/CU) provided the status of VIIRS ice products, namely, the IST, SIC and Ice Thickness. The presentation discussed S-NPP/NOAA-20 product similarities over the Arctic and Antarctic regions, histogram plots of differences showing each of these ice products similarities, and validations of the products (as applicable) with the NASA P3 aircraft KT19 flight observations. The VIIRS IST is the radiating, or "skin" temperature at the ice surface and includes the aggregate temperature of objects comprising the ice surface, including snow and melt water on the ice. Histogram plots of differences between NOAA-20/S-NPP products for the Arctic show a lot of agreement, and over the Antarctic, the biases are slightly larger between S-NPP and NOAA-20 products. The presentation also included validation of the IDPS as well as NDE enterprise IST algorithm products with the NASA P3 aircraft KT-19 instrument-produced IST values for a four year period. The results of validation show very good agreement.

SIC is the aerial extent of ice, calculated as the fraction of each pixel covered in ice. The concentration of sea ice varies within the ice pack due to deformation, new ice development, melting, and motion. Comparisons of SIC products from S-NPP and NOAA-20 show in general, high consistency and very good agreement over the Arctic and Antarctic. Minor differences between S-NPP and NOAA-20 products could be attributed to the NOAA-20 cloud-mask that may require more optimization. The team is currently investigating other factors that may be contributing to these minor differences.

The Sea Ice Characterization EDR is a 3-category product that measures the extent of ice with thickness less than 30 cm (new/young ice), more than 30 cm thick, and no ice. The enterprise product provides a continuous ice thickness range from 0 to 2.5 m and the teams are working on a better depiction of the three categories. Ice thickness validations performed with up-looking submarine sonar data reveals that the EDR product tracks well with the sonar data.

Comparison of NOAA-20 ice thickness product with the IceBridge ice thickness produced from NASA-P3 aircraft observations matches well in mean value (3.014 m vs. 3.113 m) but with high standard deviation of differences and very low correlation. This could be due to the spatial resolution differences between the data sets (40 m footprint of IceBridge vs. 375 m for NOAA-20) and/or due to NOAA-20 product deficiencies. The team is also working on the evaluation of NOAA-20 ice thickness products with the Cryosat-2 products. The NOAA-20 ice products are expected to reach provisional maturity later in this year.

The third presentation, by Peter Romonov (CREST/CUNY), discussed VIIRS Binary Snow Cover and Fractional Snow Cover products starting with definitions, requirements, the NOAA-20 product status, and future algorithm improvements. The binary snow map and snow fraction products are clear-sky daytime-only land products derived at 375 m resolution using VIIRS imagery bands. The Binary snow map product provides snow/no snow discrimination over climatologically snow-affected areas with 90% of correct typing. The accuracy estimates for the binary snow cover are provided based on the snow possible regions and boundaries and exclude areas of permanently snow covered and permanently snow-free areas within the time period the product is produced during the year. The binary snow algorithm is a two stage algorithm. The first stage is spectral based classification and identification of snow covered pixels, and is followed by consistency and quality checks to eliminate spurious snow pixels. The algorithm uses a land/water mask and applies the algorithm only to land, daytime, confidently clear sky scenes. The NDE generated binary snow cover generated for VIIRS granules is aggregated and gridded to 0.01° and the product quality performance is evaluated by visual examination (via comparison with true-color imagery), and comparison with IMS and in situ data.

Overall, the VIIRS binary snow map agrees well with the IMS maps, although the IMS maps showing more snow than the VIIRS derived product. Evaluation of the NDE binary snow product with the IDPS product shows consistency, and the differences that do exist arise from the cloud mask used between the two products. The NDE cloud mask appears to produce more clear sky pixels especially during the December time frame, and hence provides better areal coverage, and also produces a more accurate product particularly in the transition zone between the snow to no-snow region.

With regards to VIIRS snow fraction, the NDE snow fraction retrieval has two algorithms, one based on visible reflectance, and the other based on NDSI that has MODIS heritage. The team has found many issues with the NDSI-based snow fraction and currently generates the snow fraction product using the reflectance-based approach. There is no direct way of validation for the snow fraction since there is no in situ measurement of snow fraction. The product evaluation is based on comparisons with Landsat-based estimates, and consistency tests include negative correlation with forest cover, positive correlations with in situ snow depth, and robust reproducibility of spatial patterns of snow fraction. The product has an accuracy of 20% and depends critically on the VIIRS cloud mask. The presentation discussed comparisons of S-NPP and NOAA-20 produced IDPS products of snow cover and snow fractions and reported 99% agreement between S-NPP/NOAA-20 snow cover, and 6% mean difference in estimated snow fraction. The NDE algorithm for S-NPP/NOAA-20 is expected to show similar agreement. The NOAA-20 product has reached Beta maturity and the product is expected to reach Provisional maturity in October 2018. The presentation ended with some discussions on algorithm enhancements and new products. The team plans on utilizing the snow depth vs. snow fraction correlations to derive snow depth. However, the technique has limited applicability due to saturation beyond 30-40 cm of snow depth. Further, the snow depth retrieval is applicable only to plain non-forested areas. The team is also working on the development of a gap-free blended snow product using snow cover maps generated from VIIRS and microwave sensors. This blended product development involves the use of GCOM AMSR2 or DMSP SSMIS snow retrievals along with VIIRS snow cover maps and uses the GMASI approach in merging VIS/IR and MW data. This could potentially replace the current GMASI system for future operational needs.

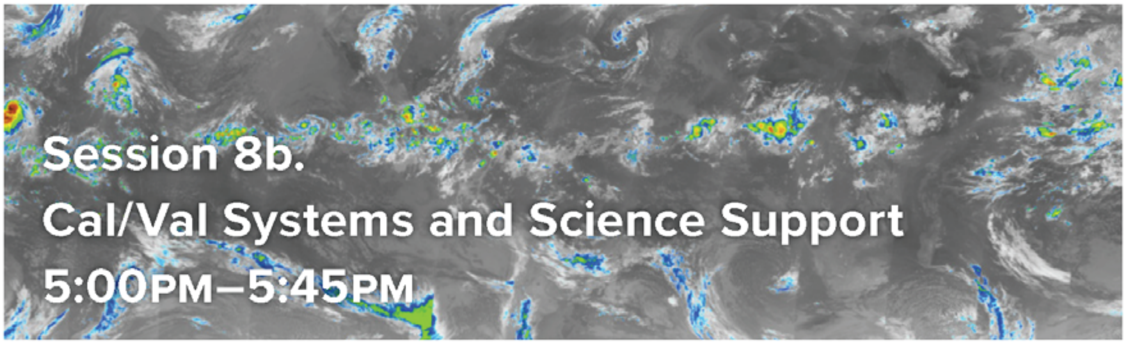
Ralph Ferraro's presentation discussed the importance and use of snow products in microwave precipitation retrievals. His talk provided a quick historical perspective on how snow products were used earlier in precipitation estimates, current status, and impacts on the precipitation products from using and not using the snow products. In the microwave spectrum, precipitation over land has a similar radiometric signal to surface snow and arid land, and can even be compounded by day and night differences. For different microwave frequencies, the measurements are correlated making it difficult to separate the signatures from one another, leading to misclassification impacts. The decision tree approach that was used in early years has misclassifications. With the availability of NWP modeling, better instruments with high spatial resolution and sounding capabilities, climatological data to screen some of the spurious interpretation, and physical retrieval algorithms, microwave research has undergone a paradigm shift to use satellite data in a much more sophisticated manner.

Many NASA GPM passive MW retrievals products using the GPRO algorithm begin by using the GMASI-Autosnow to separate different surface types uniquely. The current GPROF algorithm uses daily snow maps from NOAA's Autosnow product to update the climatological surface classes. The GPROF thus constrains the retrieval scheme by a priori surface emissivity classes and surface type in advance to do better retrievals. The presentation also covered GPROF V6 snowfall rate retrieval improvements achieved through the use of dynamic snow cover data. When Autosnow is used, the scatter plots of radiometer snowfall rates with the GPM radar snowfall rate show a 15% improvement in bias. With the availability of snow cover data for the past 20 years, a 15% improvement in bias in the snow fall rate retrievals could mean a lot in improving trends. The NOAA GCOM team is currently evaluating the latest GPROF 2017 for snowfall rate retrievals, and refers to it as NOAA GPM GCOM to avoid false rain retrievals.

Jeff Key's presentation provided the status of the Polar Winds products derived from the VIIRS longwave infrared channel. The VIIRS Polar Winds (VPW) products are derived over cloudy areas and include wind speed, direction, and height throughout the troposphere poleward of approximately 65 degrees latitude. The algorithm uses enterprise cloud height and phase, and provides an accuracy of 5.79-5.99 m/s meeting the requirements. VPW products derived from both the S-NPP and NOAA-20 compare well with each other and show almost identical characteristics, and the S-NPP product will be reaching validated maturity in early October. Polar Winds products derived from MODIS, AVHRR, and VIIRS are used operationally by thirteen NWP centers worldwide, and model impact studies have demonstrated improvement in forecasts with the forecasts potentially being extended by 2-6 hours depending on the location. NWP users reported similar model impacts from the VIIRS and MODIS Polar Winds products.

The last two talks of this session provided details on sea ice leads and sea ice motion experimental products funded by NASA ROSES. The objectives of the sea ice leads project is to develop an algorithm to identify the spatial and temporal distributions of sea ice leads (fractures) in the Arctic using MODIS and VIIRS data. The second objective is to provide a record of temporal changes of sea ice leads in the Arctic using about 15 years of data. The main input to the product is the 11 μm brightness temperature from either MODIS or VIIRS, and the data product development includes three steps: (1) apply multiple masks (cloud mask, ocean mask) and detect initial sea ice leads pixels through thermal contrast among pixels, (2) apply multiple image processing techniques to remove those pixels that are not sea ice leads, and (3) determine the characteristics of the sea ice leads. The study area included ten regions within the Arctic. The wider swath of the VIIRS instrument and consistent along-swath resolution presents an advantage over MODIS in providing better thermal contrast and more ice leads in the regions where scan angles are greater than 30 degrees. The presentation included animations of sea ice leads using MODIS 2003-2017 data and future steps include adapting the algorithm to generate VIIRS sea ice leads product in near-real time.

The final presentation described the experimental sea ice motion product derived through computations of displacements of similar features between two separate satellite images. The algorithm looks into the brightness temperatures from one image in the gridded box, and looks into the second image to guess the location of the brightness temperature fields seen from the first image. The target window size, search range, and time between the images can be edited. An automated, maximum cross-correlation procedure is used to detect features within the target window. The algorithm uses the AMSR2 (89 GHz) data, a couple of VIIRS bands and the DNB band, and furthermore combines the outputs produced from different sensors into a blended AMSR2 and VIIRS sea ice motion product. The blended product combines the advantages of high spatial resolution VIIRS and all-weather condition AMSR2 data, and currently the team is providing sea ice motion over the Alaskan region and daily updates. The product is also bring produced experimentally to produce near-real-time ice motion every 3 hours.



Session 8b. Cal/Val Systems and Science Support 5:00PM–5:45PM

Summary: This session had three presentations giving details of computing resources (GRAVITE), CRTM as a resource for cal/val activities, and the CLASS as a resource available for the archival and dissemination of science data to users worldwide.

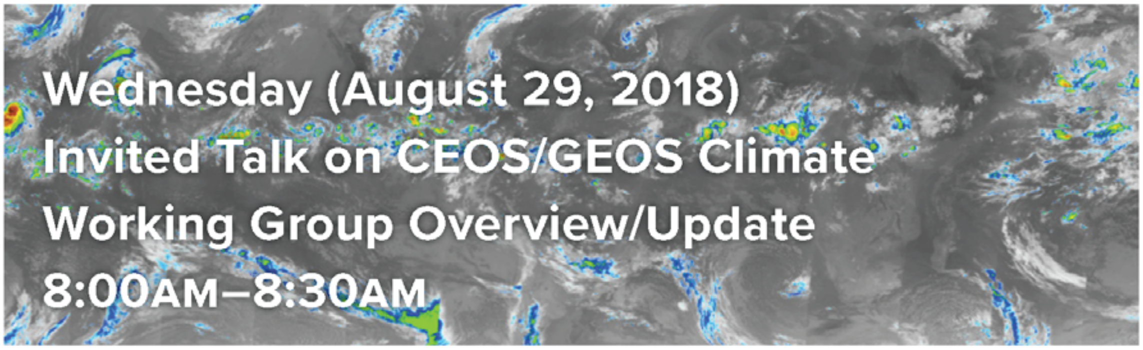
Wayne McCullough's talk provided an overview of the GRAVITE system and the resource availability for the cal/val teams. The talk also presented the use of GRAVITE for an urgent reprocessing of NOAA-20 VIIRS data for the period ranging from November 2017 to the end of February 20, 2018 due to on-orbit LUT changes. The GRAVITE system stores huge amounts of data from the JPSS satellites, keeps all of the RDRs from the JPSS satellites for the life of the mission, and a 34 day archive of rolling storage of all the science data products produced from the IDPS. The presentation also discussed the availability of various resources available for the cal/val community to use, such as the work stations at the Goddard campus, ICF servers that connect to data directly, and the PGE servers to run algorithms with the available data. In addition, GRAVITE can provide disk space for cal/val teams, maintain licenses of IDL, Matlab, etc., can install other tools as needed by the cal/val teams, and can also process large amounts of data using ADL. The presentation then discussed the support provided by the GRAVITE to reprocess NOAA-20 VIIRS data by applying new LUTs as needed to produce SDR products for the period from November 2017 to the end of February 2018. The system utilized many copies of ADL installations and dedicated three GRAVITE computers to accomplish the reprocessing task within the shortest time (eleven days). The presentation provided an open invitation to all of the cal/val teams for any computational need and for utilizing the GRAVITE as a resource to run large amounts of data.

Kevin Garrett presented the current status of CRTM, planned science improvements in support of STAR cal/val activities, future plans, and priorities. The presentation provided a brief history of the CRTM, capabilities embedded and improvements incorporated into various versions of the CRTM, and the latest improvements expected to be packaged into the next release of CRTM V3.0 scheduled for January/February 2019. The presentation also discussed CRTM improvements in concert with the latest suite of satellite instruments in general, and specifically for the JPSS suite of instruments. These science improvements are mainly related to the NOAA-20 coefficients, ATMS snow and sea ice emissivity models, and modeling capabilities for both MW and IR including hyperspectral IR.

ICVS, MiRS, ACSPO, and the enterprise cloud and volcanic ash products have been using CRTM as a forward operator for radiance simulations, and comparison with the observed radiances. Some desired enhancements by individual teams include better accuracy in simulating radiances, improving IR and MW surface emissivity, better handling of aerosols (species and scattering), and for having more accurate shortwave transmittances and cloudy transmittances. The presentation also included some of the major developments and positive impacts/improvements of integrating them into the new version of the CRTM. One of the current developments is the release and integration of the CSEM that computes emissivity and BRDF over all surfaces in the MW, IR, and visible spectrum. Improvements on the brightness temperature differences between the observed and the background from the current TELSEM CRTM (V2.3) to that of enhanced physical model CSEM adapted CRTM shows much better coverage with improved quality and agreement between the background simulations to the observed brightness temperatures.

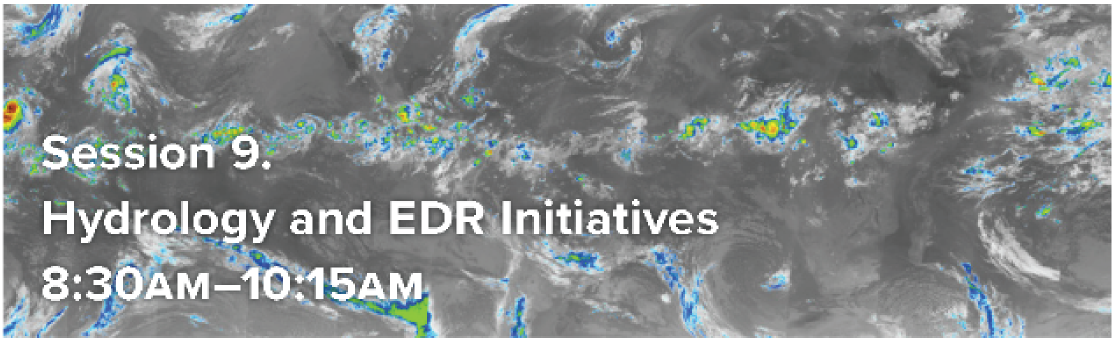
Switching into data assimilation activities, the presentation discussed one of the key projects of optimizing the assimilation of JPSS ATMS observations. The objective here is to increase the number of ATMS observations over non-ocean surfaces that are assimilated into NOAA GDAS/GFS. The presentation showed some of the improvements of using background emissivity from TELSEM 2 in the current CRTM. Replacing the background to use TELSEM2 increases the number of observations up to two times especially over the desert regions. In summary, the CRTM team is aligned to address STAR's scientific and technical priorities, and is also planning science/coordination support for data assimilation of land (LST, GVF, soil moisture), ocean EDRs (SST, OC), cryosphere products (IST, SIC, snow cover/SWE), and trace gases (V8TOz/Pro, AOD), and to utilize that information in different NWP models.

Brent Hefner (CLASS Program Manager) presented the last talk on CLASS Access and Future Trends for S-NPP and JPSS data. CLASS provides long-term, secure storage of NOAA-approved data, information, and metadata and enables access to these data through a website for users and Machine to Machine (M2M) API for software developers to create access clients capable of searching for and ordering datasets held within CLASS. CLASS does not support NRT nor mission-critical product deliveries. CLASS completed the development phase in June 2017 and transitioned to sustainment mode attending minor problem resolution and enhancements through Sustainment Software Releases scheduled once per quarter. The presentation provided details of the CLASS website, multiple options (ad-hoc, subscriptions, FTP, bulk) for ordering data from CLASS and the average time to process these orders, and limits on the number of files from subscriptions (standing orders), NPP-FTP (rolling 90 days), Ad-Hoc (historical/older data), and Bulk (Large/non-typical) access services. CLASS is now investigating making the M2M interface available to STAR. Some of the recent archive and dissemination metrics including the number of files and data storage in terabytes for the S-NPP and NOAA-20 archives are also included in the presentation.



Wednesday (August 29, 2018)
Invited Talk on CEOS/GEOS Climate Working Group Overview/Update
8:00AM–8:30AM

Jorg Schluz's invited talk provided an overview of the CEOS/CGMS climate working group and how operational satellite programs can contribute to long term climate records. He provided a short history of CEOS plenary meetings held in early years and the focus towards encouraging collaborative activities between the worlds' major space agencies in the area of climate monitoring. Climate working group agreements for systematic observations from the GEOS, collection of correlated responses, and reviews on the adequacy of the observing systems (both satellite and ground-based) to capture climate system needs were presented. The presentation discussed two important actions. (1) Action G11: Review the availability of CDRs and provide a structured, comprehensive, and accessible view as to what CDRs are currently available, and what are planned to exist, together with an assessment of the degree of compliance of such records with the GCOS requirements for the ECV products; and (2) Gap-Analysis of climate data records Action G12: Establish a gap analysis process and associated action to: (a) address gaps/deficiencies in the current availability of CDRs; and (b) ensure continuity of records and address gaps through the appropriate planning of future satellite mission for the ECV products. Following the two actions, the presentation discussed the ways to achieve these actions through moving in cycles by (1) developing a Essential Climate Variables inventory that fully describes current and planned implementation arrangements (ECV-by-ECV) within the architecture, and (2) Gap analysis and recommendations to the space agencies on what needs to be done in certain areas that culminates in a coordinated response/action plan to be executed by CEOS and CGMS. The presentation later discussed the role of NOAA in providing large numbers of climate data records and the EUMETSAT contributions to climate monitoring.



Session 9. Hydrology and EDR Initiatives 8:30AM–10:15AM

Summary: The presentations in this session dealt with microwave derived products including soil moisture, wind speed, and hydrological products from GCOM AMSR2 and the JPSS Series. The final presentation, from an Alaska user, lead to an agreement from the related product leads to work to meet the data needs of these users.

Ralph Ferraro presented a brief overview on the hydrology products. He emphasized the importance of monitoring the hydrological cycle and the satellite product systems that NESDIS has that measure various parameters (e.g., precipitation, water vapor, snow, ice, soil moisture), and categorized these products as JPSS operational, POES legacy, and JPSS PGRR emerging products. He mentioned that traditionally, these products have been driven by microwave sensors.

Chris Grassotti (UMD CICS) presented an overview of the MiRS product system, including the hydrology products retrieved and their applications on several case studies of extreme rainfall. MiRS is a 1DVAR integrated system that retrieves vertical profiles of temperature, water vapor and hydro-meteors, and surface parameters. Through post-processing, MiRS produces an array of derived products such as Total Precipitable Water (TPW), Cloud Liquid Water, Rain Water Path, Graupel Water Path, Rain Rate (RR), Snowfall Rate (SFR), and some of the cryosphere products such as Sea-Ice Concentration and Snow Water Equivalent (SWE).

There are some downstream blended products developed by applications developers such as the blended TPW (bTPW), layer PW (lTPW), and products that estimate the intensity of tropical cyclones. The presentation included cross comparisons of the rain rate product from S-NPP/NOAA-20 and validation of the products using 5-day CONUS averages of the stage IV radar rain-gauge analysis showing that the products track the rain rate reasonably well, and both of the satellites are producing identical performance in terms of Heidke Skill scores and false alarm rates.

The presentation later focused on several case studies of extreme rainfall, such as rain rate and TPW fields produced over Hurricane Harvey (24 Aug 2017), Hurricane Irma, and a major northeastern snow storm. Another application presented was the bTPW that combines MiRS water vapor from up to seven polar satellites for Rapid Refresh and Advection, showing an example that sometimes the lTPW provides details that may not be apparent in the total precipitable water retrievals. The presentation also demonstrated the advantage of two satellites (S-NPP/NOAA-20) looking into Hurricane Hector and doubling of the number of ATMS overpasses to analyze the events closely within the near-nadir swath. The presentation ended with a note on how engaging the stakeholders and collaborating with users helped in refining MiRS hydrology products retrievals.

Huan Meng (NOAA/STAR) presented the ATMS snowfall rate product (SFR), and introduced the development team involved in integrating the algorithm as one of the MiRS operational algorithms. The SFR consists of two components: snowfall detection and rate estimation. The snowfall detection is based on a statistical model trained using in situ observations. The snowfall rate is a 1DVAR based physical model calibrated with Stage IV radar and precipitation gauge analysis. The algorithm uses 11 ATMS channels from 23.8 to 183 GHz including window, temperature, and water vapor sounding channels. The S-NPP snowfall detection and SFR have reached provisional maturity and the NOAA-20 SFR has reached Beta maturity. The team anticipates NOAA-20 SFR reaching Provisional maturity as part of the FY19 milestones. SFR has grown in popularity among the NWS forecasters, especially those in the western U.S. and Alaska. SFR is also being used with the CMORPH integrated precipitation product. The NCEP CMORPH team commented that the SFR product significantly enhances winter precipitation estimates and substantially expands the utilities of CMORPH2 for global blended precipitation analysis. Many of the NWS WFOs provided positive feedback on the usefulness of SFR product in weather forecasting and improving forecasters' situational awareness, especially in filling radar gaps.

Paul Chang's presentation provided an update on the GCOM-W1 AMSR2 operational products at NESDIS. The STAR GCOM team developed the operational GCOM-W1 AMSR2 Algorithm Software Processor (GAASP) package and the package has been operationalized through software integration efforts by the ASSISTT team. Several important products are generated from AMSR2, including RR, soil moisture, SST, ocean surface winds, TPW, snow and sea ice parameters. Additionally, the AMSR2 radiances at 37 and 89 GHz are used extensively by the National Hurricane Center for storm center fixing and intensification forecasting. Several of the products are undergoing upgrades that will be transitioned into operations during the next year. The presentation also included examples of new wind speed product applications to analyze Hurricane Jose and Maria from September 2017, and produce product validation statistics.

Two new products, the SST anomaly product calculated using the climatology, and the TPW anomaly product (TPW Percent Normal) calculated using the NVAP-M daily L3 data set are being produced in research mode. Application of these new products are presented for Hurricane Jose and Hurricane Maria. The STAR AMSR2 Product Monitoring and Data Portal (https://manati.star.nesdis.noaa.gov/gcom) provides a complete description of the products as well as the maturity status. The GCOM products are also being implemented through DB to exploit the advantages of high latency for regional applications.

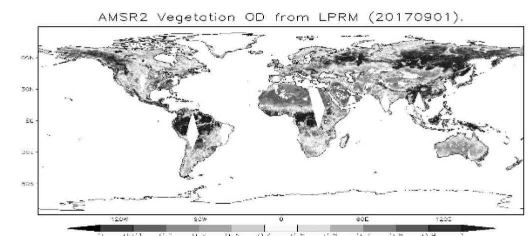
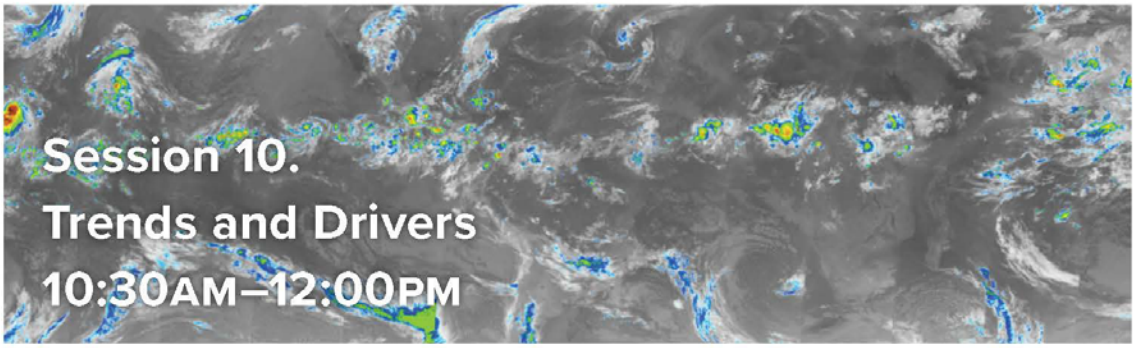


Figure. JPSS GCOM-W1/AMSR2 Soil Moisture

The next speaker, Xiwu Zhan (STAR), presented an update on the SMOPS system, which is an integrated microwave based soil moisture product. Currently, SMOPS version 3.0 ingests soil moisture product derived from AMSR2, the European NRT SMOS and ASCAT, NASA GPM, and NASA SMAP to produce the SMOPS blended soil moisture product. The presentation discussed the importance of soil moisture, objectives and architecture of the SMOPS, algorithm updates, and support to the NWC and NWM through PGRR initiatives. He showed performance of the product compared to in situ measurements (which is meeting performance requirements) as well as some applications. A companion project supported through the JPSS PGRR program is focusing on comparing SMOPS with the soil moisture in the NWS National Water Model and may include a downscaling component to the product through the use of VIIRS data. The presentation concluded with results from the PGRR initiative on satellite derived soil moisture evaluations against modeled soil moisture from the NWM using in situ soil moisture measurements over CONUS, and ground radar network precipitation data available during major hydrological events (e.g. hurricane caused flooding).

The final speaker featured an end user from the Alaska River Forecast Center (ARFC), Jessica Cherry, who presented remotely. She described the current status and challenges in determining QPE in Alaska, which has very sparse ground and radar data. Although they use the Multi-Sensor Precipitation Estimator (MPE) interactive method, they really need to exploit the JPSS satellite products for precipitation and snow water equivalent. However, such products need to be improved for the specific climate of Alaska. There appear to be several products that they can consider using from JPSS and GCOM. Pingping Xie, Chris Grassotti, and Huan Meng commented on her data request in relation to their respective products, i.e. CMORPH, MiRS, and the SFR products, and expressed the willingness to work with the Alaska users and meet their data needs.



Session 10. Trends and Drivers 10:30AM–12:00PM

Summary: In the most wide-ranging session of the meeting, the presenters discussed various external and internal factors (drivers) that are moving STAR JPSS in certain directions (trends).

Walter Wolf's presentation provided an overview of the SDR and EDR algorithm transition to operations, on-going efforts in speeding up the process, plans, and progress on the MSN. At STAR the ASSISTT team works in close concert with the JSTAR science teams to transition algorithms to operations for both the IDPS and the NDE implementations. The SDR algorithm upgrades and improvements during various phases of cal/val activities are accomplished through the use of Giver/Receiver Schedules, Algorithm Discrepancy Reports, and CCRs prior to eventual operational implementation in IDPS. ASSISTT works with science teams to implement algorithm updates in ADL, verifies the algorithm updates provided by the science teams with sample test data sets to ensure the integrity, and then delivers the algorithm change package to the DPE team.

The DPE team tests the updated algorithm on the GRAVITE ADA system, and after science verification of the output for the test data sets, delivers the updated algorithm to Raytheon for implementation to the IDPS. The JSTAR program management team coordinates with AMP and ASSISTT and maintains the Giver/Receiver schedules between agencies working in transitioning SDR algorithms to IDPS operations. All of the SDR and Imagery EDR product generation will continue using the IDPS processing system, while the other JPSS EDR products are transitioned to operations through NDE.

The transition of algorithms to operations follow a standard set of product lifecycle reviews, requirements and risk tracking, documentation, and stakeholder interactions. ASSISTT tests the algorithms and ensures with the science teams on the science integrity of the output, and then prepares the DAP for the NDE team. The NDE team implements the algorithm on the development machine and shares the outputs with STAR ASSISTT for mutual concurrence on output verification. The NDE team then implements the algorithm on the I&T string. Operationalization of these products in NDE will follow after an evaluation of the current NDE processing loads and performance, and after an assessment of the current/future NDE operational processing capability needs. All the enterprise algorithms for S-NPP have been delivered to NDE and only a few land products are currently not in operations. Most of the NOAA-20 algorithm have been delivered to NDE recently and are currently in the testing process before transition to operations (pending provisional reviews).

With regards to speeding up the transition to operations process, the SDR transition process to IDPS is well streamlined, and the ASSIST team is concentrating on the EDR transition to NDE operations. The team is planning to reduce the amount of test data to test the algorithms. After the algorithm delivery, the team plans for improved communications with NDE. Currently, ASSISTT has two planned deliveries for most EDR products to NDE, and part of the TTO process includes running the algorithm in the framework with 10 weeks of test data as required by the science teams. Test data runs may take about four weeks of time, and after a verification of the test output by the science team, the end to end TTO process (algorithm updates, algorithm testing, algorithm dependencies verification, and science team validation) take approximately six months. The ASSISTT team, through break-out sessions and side meetings (during this conference) with the science teams, are working to define a reduced representative test data for algorithm updates. The plan is to use 7-10 days' worth of data to test the algorithm updates without scarifying the science integrity. The reduced test data set can be run within 10 days and the testing and verification can be accomplished in 3-6 weeks of time depending on the complexity of the algorithm. The smaller testing data sets will also enable quicker turn around on any interim algorithm fixes.

With regards to communications, ASSISTT is working very closely with AMP on tracking the status of algorithms, understanding NDE schedules and how the algorithms fit into the schedules, setting up short term schedules on the implementation, coordination with the PALs for their active involvement, and interactions with the science teams through ESPDS product generation IPT meetings.

The presentation also discussed an overview of the MSN, an IT platform that will provide enterprise services for the algorithms implementation and transition to operations through a cost-effective, secure, and cloud capable infrastructure. The MSN will enable: (1) research and development of science data and applications as we have been performing, and (2) support to operational transition of the algorithms, and management of data through its full lifecycle from research to operations and eventual archival of the data with new capabilities. The implementation is planned in two phases with phase 1 concentrating on setting up the STAR and NCEI infrastructure within one security boundary (to be completed by October 2019), and phase 2 towards developing agile, scalable, and secure architecture for future science missions (to be completed by Fall of 2021).

Connecting the existing systems and consolidation plans as part of phase 1 will have minimal impacts on the algorithm development while phase 2 implementation may have some impacts. Some of the current ASSISTT implementations that run the algorithms in the HTCondor cluster, as well as implementation of the Kubernetes cluster using Docker containers, should translate easily into the cloud based infrastructure. To this effect, ASSISTT is planning to implement the real-time implementation of the algorithms into the Kubernetes cluster before MSN Phase II is complete. Thus, the on-going ASSISTT efforts on migrating to the MSN will minimize the impacts of the new infrastructure on the science algorithm development

The second presentation by Ninghai Sun provided an overview of the on-going S-NPP SDR reprocessing efforts, highlighting improvements incorporated to create the most matured SDR algorithms for SDR reprocessing, evaluation efforts of the reprocessed SDRs for science integrity, and the availability of S-NPP SDR Version 1.0 reprocessed data sets. The objectives of reprocessing are to provide consistent long-term high quality S-NPP/NOAA-20 data products to users, and to provide S-NPP/NOAA-20 reprocessed SDRs to alleviate some of the artifacts created during real-time SDR generation.

The science teams have done many periodic updates to the real-time SDR processing algorithms for science improvements (e.g. fixing shortfalls through table updates, improvements to quality flags, and performing mitigations to instrument sensor/channel malfunctions) and for moving towards Beta, Provisional, and Validated maturity stages. As a consequence, although the product accuracy and precision have improved, meeting the requirements for various maturity stages, the operational stream of data products exhibit varying characteristics over time, and the science teams recognized the need for science quality reprocessing to remove artifacts and to reduce biases. Based on the recommendations received from the NJO, stakeholders, and user communities through reprocessing and enterprise algorithm workshops, science teams have updated the SDR algorithms and calibration input parameters with the validated maturity algorithm codes and reprocessed the SDR products for the S-NPP mission. The reprocessed SDR products (version 1.0) are currently housed on the STAR and CICS servers (http://jlrdata.umd.edu/opendap/thredds) and have gone through final quality checks and verification. Some of the EDR Teams (VIIRS SST, Ocean Color, OMPS Ozone) have also demonstrated reprocessing and associated improvements through off-line processing efforts and the JSTAR management is currently looking into the computational resources and product dependencies required to set up reprocessing chains for implementation either as individual systems or through framework integration. The JSTAR management is working with CLASS on the Engineering Assessment and other protocols needed for fast access and dissemination of the reprocessed SDRs through CLASS for worldwide users.

The third presentation by Sid Boukabara (Acting Deputy Director, STAR) discussed the pilot project that started ten months ago with a diverse team to explore the use of AI to exploit big satellite data for nowcasting and NWP assimilations. The trends driving this endeavor arise from the significant increase in the volume of data of GEOS and the diversity of trends now seen through the new constellation of satellites (international, commercial, etc.), high resolution sensors, new technologies such as smallsats and cubesats, and other forms of data coming from internet of Things for environmental applications.

In parallel, budget constraints, high performance computing constraints, ever increasing user expectations, the demand for high quality satellite data, and increase in the quantity of data assimilation demands (5% currently assimilated) require the exploration of processing alternatives to achieve quick processing without losing science integrity and quality of data. AI is being used very effectively in many fields such as medical, finance, vehicles, and translation devices , and the algorithms and tools available can be exploited in the field of remote sensing, retrieval algorithms, nowcasting and NWP assimilations to produce similar (if not better) quality results at a much faster pace.

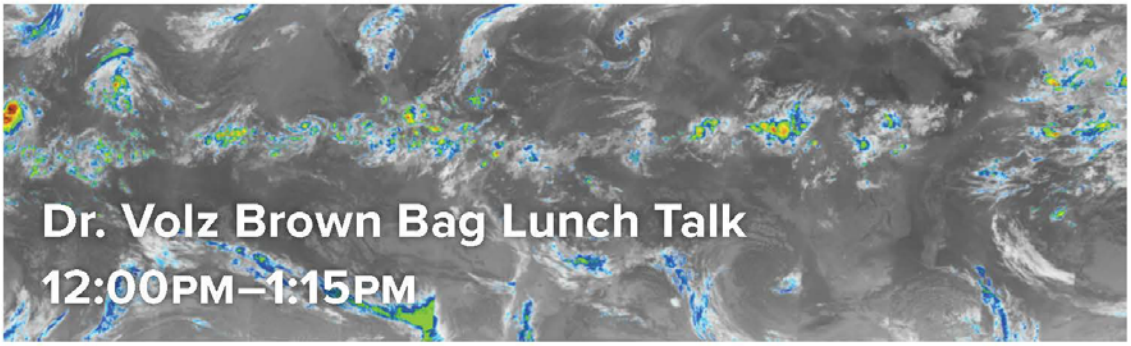
The presentation discussed the end-to-end value chain of observing systems (starting with data ingest to calibration, pre-processing, quality control, radiative transfer, data fusion, now casting, short and long-term NWP forecasting and areas) and used examples to highlight the use of AI through this pilot project for pre-processing & inversion, quality control, radiative transfer, data fusion, and post-forecast applications.

The applicability of AI for inversion algorithms has been demonstrated for the MIDAPS. The MIDAPS algorithm implemented using AI (MIDAPS-AI) produced outputs show high consistency in statistical performance, radiometric convergence, and inter-parameters correlation with reference sources such as ECMWF, and provides comparable results matching (if not better) with the regular MIDAPS outputs but with a very significant processing time advantage (MIDAPS-AI: 5 seconds versus MIDAPS: 2 hours).

AI-based CRTM forward model computations computed for a single ATMS sensor channel showed consistent simulations with the current CRTM model with huge efficiency in processing time advantage (less than a second compared to 1.3 hours of CRTM run). Examples discussed in the presentation included the predictive skills of AI, correcting systematic differences, reducing the standard deviation (example shown in TPW fields reduces the standard deviation), and the AI morphing tool for hurricane movement which may be useful to the forecasters. Overall, the presentation earmarked AI as a natural evolution of opportunity to meet the challenge of processing explosive amounts of data in a wide range of applications. The presenter also announced the upcoming workshop on Leveraging AI in the Exploitation of Satellite Earth Observations & Numerical Weather Prediction (April 23-25, 2019).

The last presentation in the session (Cheng-Zhi Zou) provided a perspective of improved climate data records with stable JPSS observations. The presentation started with requirements on CDRs and a list of ECVs as identified by the GCOS for the atmosphere, ocean, terrestrial, and fundamental climate records. The ECVs currently archived and available through NCEI (https://www.ncdc.noaa.gov/cdr) are relatively small compared to the overall needs and requirements by GCOS. Other important considerations for CDR development are stability and consistency of time series, inter-sensor/satellite calibration/recalibration and bias removal, removal of biases caused by orbital drifts, continuity in instrument design and channel frequency, gap-filling between satellites, and so on.

The CDR development also depends on several satellite systems/sensors to develop one climate record (e.g. atmospheric temperature CDR from 1978-2006 required MSU/SSU and AMSU-A, and is continued through present day through ATMS observations from the S-NPP/NOAA-20 JPSS series). In many instances, calibration drifts and orbit drifts occur at the same time and are difficult to separate causing major complications. The S-NPP/NOAA-20 data from very stable orbits naturally removes diurnal sampling biases and the time series match each other nearly perfectly without applying any diurnal drift corrections, thus allowing calibration drifts estimation quite accurately. These satellite systems have excellent radiometric stability within 0.04 K/decade for S-NPP ATMS and Aqua AMSU-A for all analyzed channels. The same could be true for all other Aqua (AMSR-E, AMSU-A, HSB, AIRS, MODIS, CERES) and S-NPP/NOAA-20 JPSS instruments (ATMS, CrIS, VIIRs, OMPS, CERES), and thus these platforms would be able to provide stable ECVs without diurnal sampling biases. These ECVs could act as references and can help to retroactively correct past time series of CDRs from satellites that suffered orbital drifts. The JPSS series of satellites at 1:30 PM stable orbit, the MetOp series (MetOp-A/B/C) at 9:30 AM stable morning orbits, and the Terra series at stable 10:30 AM morning orbits provide valuable data sets for confident prediction of future, and the stable orbits data could provide good simulations of the past, thus demonstrates a lot of value in correcting the past CDRs and extending the CDRs for future.



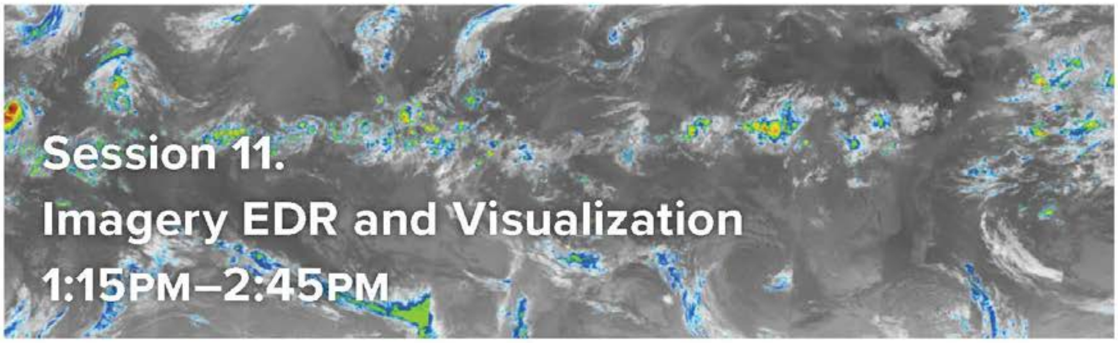
Dr. Volz Brown Bag Lunch Talk 12:00PM–1:15PM

Steve Volz, the NOAA Assistant Administrator for Satellites and Information Services, was the guest speaker at an informal "brownbag" session on 29 August 2018. He focused on the NESDIS Strategic Plan components, the 3 C's: Commitments (Enduring focus on continuity of products & services delivered by NOAA – past, present and future, Dedication to, and expertise in, data and information), Community (People: NESDIS will focus on retaining, creating and developing an agile, expert workforce, through partnerships, maximize both NOAA's and the Nation's value through observations and scientific capabilities) and Capabilities (Importance of considering, analyzing and planning an integrated observing system architecture, delivering ever-increasing value, including new and better information products and services, through science).

He would like NESDIS scientists to focus on users as much as possible (Use-inspired Science) via formal and substantive user engagement processes. He indicated that the current Proving Ground programs have been very successful in engaging NWS and should be expanded across all missions and new service areas. He pushed for more co-location (NWS Ops Centers or equivalent with other users) to develop creative new approaches and to reach out to users at multiple levels (local, state, federal, international). He also outlined goals for data and information (1-4 below) and collaboration (5-10):

1. Develop baseline requirements for FY20 LEO & GEO products/algorithms
2. Increase assimilation of new data sets
3. Lead coupling at the observation level – turn level 1 and 2 data into a common geospatial database
4. Integrate science, engineering, and project management processes
5. Use strategic engagement with commercial and international groups
6. Work more closely with NESDIS Science Organizations (e.g., Science Council)
7. Develop policy and criteria for prioritizing partnership decisions
8. Develop true partnerships with CIs and commercial sector (example: recent CRADA RFI For "Collaborative R&D with one or more private firms or non-government groups . . . [to] enhance the value and enable wider use of data obtained from NOAA's space-based assets")
9. Create Framework agreements
10. Create Partnership/ Collaboration Training courses

He recognized civil servants, Cooperative Institutes, support contractors and industry partners as critical to satellite and information services as well as pipeline programs (undergraduate and graduate programs, fellowships) to keep new ideas flowing into the community. He also discussed potential organization changes to improve coordination across "Design, Develop, and Operate" domains of expertise for end-to-end system design integration, as well as to provide better end-to-end data & product execution.



Session 11. Imagery EDR and Visualization 1:15PM–2:45PM

Summary: The Imagery EDR and Visualization session discussed the status of S-NPP/NOAA Imagery EDRs, as well as data processing, visualization, and product support facilities available to users through various websites.

Don Hillger presented an overview of the VIIRS Imagery EDR products. The presentation covered S-NPP/NOAA-20 product performance, major issues and mitigations, examples of Imagery and DNB products, and downstream RGB products generated using Imagery EDRs for various environmental applications. The Imagery EDR products are comprised of five I-band (375 m) products, six M-band (750 m) products, and NCC Imagery derived at 750 m resolution from the DNB sensor. The VIIRS SDR products are 80-second granules, but contain bowtie effects that lead to redundancy and have artificial pixel spread at the end of the scan. The Imagery EDR algorithm eliminates those overlapping pixels and bowtie effects, and map visible/IR reflectances/radiances to the Ground Track Mercator grid.

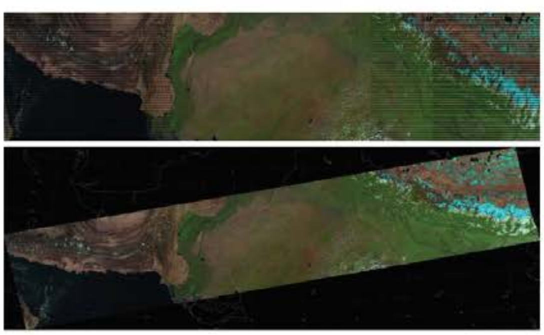
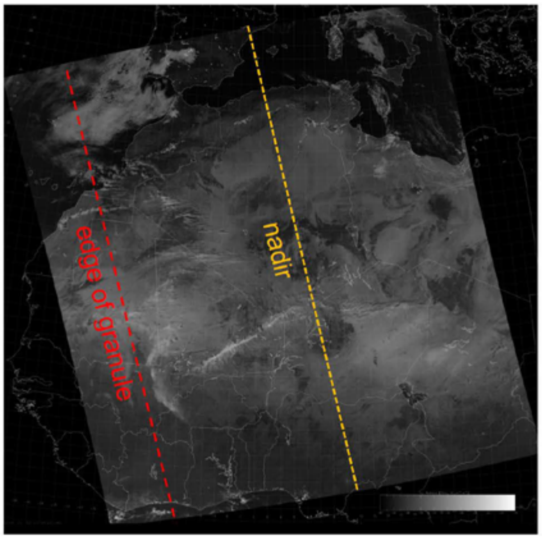


Figure: VIIRS SDR (top) vs. EDR (bottom) showing bowtie deletions and alignment to the GTM grid.

The NCC imagery product is a pseudo-albedo derived product from the DNB. The DNB spans across seven orders of magnitude of brightness and the NCC product removes large contrasts in DNB from day to night across the terminator. The Alaska region and other high-latitude regions benefit from overlapping swaths from adjacent orbits, and eight of the VIIRS Imagery EDRs (bands I1, I3, I4, I5, M14, M15, M16, and the DNB for the Alaskan region (60° N and above) are Key Performance Parameters (KPPs) for many meteorological applications over the Alaskan region.

Figure. DNB (top) vs. NCC (bottom)



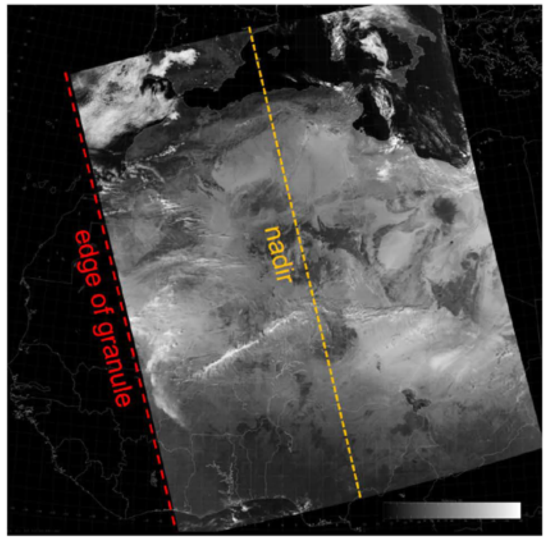


Figure. (Left): DNB (extended granule on left and nadir not at center) (2018-01-22); (Right): NCC (extended granule not included, and nadir at center, and better contrast than DNB) (2018-01-22)

There are no quantitative quality metrics for the imagery products. User acceptance is a key consideration in addressing the quality of the imagery products. The unique features of the VIIRS imagery products as compared with its predecessors are the better spatial and reduced variation over a wider swath (3000 km wide). The DNB/NCC enables visible light imagery under all natural and artificial illumination conditions. With two satellites, the S-NPP and NOAA-20 with a 50-minute spacing, high temporal coverage can be provided in the arctic/polar regions where geostationary satellites have limitations with large view angles and poor spatial resolution.

The presentation also covered a wide range of Imagery examples depicting RGB enhanced tropical cyclones (e.g. Hurricane Lane, Typhoon Soulik), volcanic ash, and dust products (NCC dust off Africa). This imagery showed details of cloud formations and ground structures that other instruments could not provide. The presentation also discussed many DNB applications and examples of moonlight reflectance detecting snowfields at night, distinction of cirrus clouds, low clouds, clear land, and city lights through color enhanced imagery products. Other examples related to the DNB use included the detection of terrestrial light emissions, power outages during hurricane events, wildfires, atmospheric light emissions, and so on. Some of the findings/issues with VIIRS I-bands, extended DNB granule processing, geolocation and stray light corrections identified during maturity review process have been resolved.

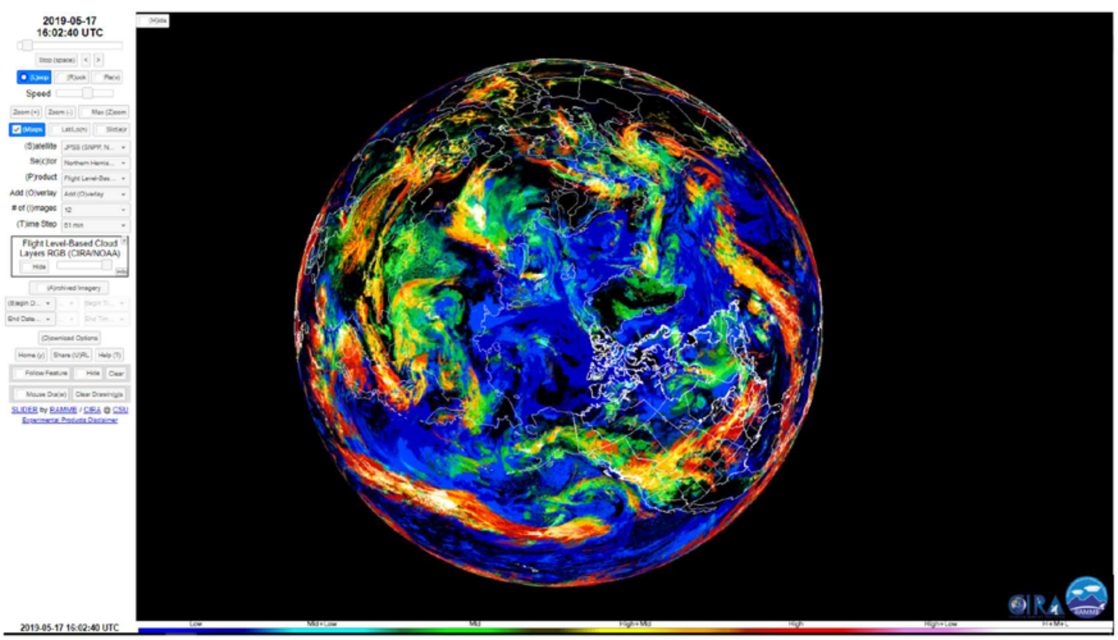
The presentation ended with comparisons between S-NPP and NOAA-20 imagery products, plans on implementing LUT updates for NOAA-20, and Terrain Corrected Imagery EDR code deliveries. Currently, the SDR products are terrain corrected. The Imagery EDRs are not terrain corrected, resulting in displacement of image pixels viewed over high mountain areas (shown through examples of EDR images over Mt. Logan and Mt. St. Elias) from different satellite orbits at different view angles. Many user agencies have requested terrain corrected imagery products and the Imagery Team is working on implementing and operationalizing the terrain correction algorithm for S-NPP/NOAA-20, although the L1RDS requirement for terrain corrected EDR Imagery product is for J2 and beyond JPSS satellites.

The second talk by Curtis Seaman discussed the new project that started at CIRA on global VIIRS imagery and other JPSS product visualizations. The project is an extension of the SLIDER project that was launched a year ago to provide real-time web display (http://rammb-slider.cira.colostate.edu) of GOES-16 and -17, and Himawari-8 images at varying zoom levels ranging from the full view of the full disk (16 km) down to the full resolution of the visible channels (500 m).

Soon after the launch of the geostationary SLIDER website, based on many user requests, the CIRA team developed a parallel system to display polar satellite data, more importantly to visualize S-NPP/NOAA-20 VIIRS imagery bands and other downstream products. The presentation provided an overview of the Polar SLIDER, designed to show polar satellite data in near real-time for the entire globe at six zoom levels ranging from 12 km to 375 m. The Polar SLIDER displays most recent VIIRS data (all 22 bands) for each Earth location at all times with low enough latency to be useful for forecasters. The system provides two views, the Northern Hemisphere composite view and the Southern Hemisphere composite view centered on the poles.

By default, the Polar SLIDER combines both S-NPP and NOAA-20 imagery bands in making the composite and provides high temporal views like a geostationary satellite hovering over each pole. The time-step setting switch accessible on the website (51 minutes vs. 102 minutes) provides for viewing either S-NPP or NOAA-20 as the user desires. All popular features that are currently available on the geostationary SLIDER, such as 'Add Overlay' or "Sandwich Products", will be available on the Polar SLIDER. Examples included are longwave IR imagery with visible imagery to produce enhanced cloud top structure; comparisons between two fire detection bands to know relative performance, and nighttime "Sandwich" products using DNB.

The system also provides other features such as "Flow-Following" for feature tracking, "Mouse Draw" for annotations, and "Share URL" for easy sharing of animated loops or to post on social media. Guide-



[Fig32 http://rammb-slider.cira.colostate.edu/?sat=jpss&z=0&im=12&ts=1&st=0&et=0&speed=130&motion=loop&map=1&lat=0&opacity%5B0%5D=1&hidden%5B0%5D=0&pause=0&slider=-1&hide_controls=0&mouse_draw=0&follow_feature=0&follow_hide=0&s=rammb-slider&sec=northern_hemisphere&p%5B0%5D=flight_level_based_cloud_layers_rgb_cira_clavr-x&x=16000&y=16000]

lines or precautionary tales that users should be aware of in using the Polar SLIDER were part of the presentation. Examples of cautions included in the presentation were illumination and darkness of solar reflective bands in the summer and winter months, and loss of Vis/NIR data over the poles in the winter hemisphere (the DNB and IR band data will be available). Parallax effect for objects near the edge of scan (e.g. Hurricane Lane's view through consecutive satellite passes leading to apparent motion that is not actually occurring) was another caution illustrated in the presentation for user awareness.

The presentation also discussed some example applications of the Polar SLIDER. Applications discussed in the presentation were (1) the use of S-NPP DNB band for the movement of ice off the east coast of Greenland due to a combination of tidal forces and currents, and (2) intensification of fires observed from VIIRS M-13 over northern British Columbia through six consecutive overpasses of S-NPP/NOAA-20. The VIIRS GeoColor composite (true-color imagery during the day with a low cloud detection algorithm at night) with the overlaid DNB band shows auroras, movement of ship lights and even fires at night.

The Polar SLIDER is currently working on a private server for 11 of 16 M-bands and the DNB, and the team is planning on a quick transformation to a public server (http://rammb-slider.cira.colostate.edu) once adapted to run all of the VIIRS bands. The team is also planning to improve the low cloud detection algorithm and to extend the Polar SLIDER to include many RGBs (Natural Color/Day Land Cloud RGB, Fire Temperature and Natural Fire Color, Day/Night Snow/Cloud discriminator, etc.) and additional JPSS products such as Cold Air Aloft, Clouds and other EDR products, and blended microwave products.

The third presentation by William Straka provided an overview of the McIDAS-V capabilities and CIMSS support for Imagery EDR Team and other JPSS activities. McIDAS-V is an open source data analysis and 3D visualization tool that incorporates the functionality of VisAD, IDV, HYDRA and McIDAS-X for viewing data, developing algorithms and validating results. The system accesses data from multi- and hyperspectral sensors on many current satellites, including S-NPP/NOAA-20, GOES/GOES-16, POES, MSG, Himawari-8, MODIS, and MetOp, and is used by domestic as well as international users worldwide.

Pertaining to JPSS data, currently the McIDAS-V system can ingest S-NPP/NOAA-20 data from three of the five JPSS instruments, namely, VIIRS, CrIS, and ATMS. The system has all of the built-in data readers to unpack, process, display bit level data, analyze and display IDPS SDR products as well as many of the NDE enterprise EDR products. The presentation covered S-NPP/NOAA-20 specific McIDAS-V1.7 updates and included many examples highlighting the McIDAS-V display capabilities for many SDR and EDR products, scatter analysis, visualizations related to 2018 lower Puna lava outbreaks, Hurricane Lane, and mesospheric gravity wave monitoring from the DNB band.

Chris Elvidge's presentation discussed fires, flares, boats and lights products exploiting nighttime VIIRS low-light imaging bands and the DNB. The VIIRS instrument provides low-light imaging data from five spectral bands. The DNB band detects faint radiant emission in the visible and near infrared, and four daytime channels (M7, M8, M10, and M11) detect radiant emissions from IR emitters at night. Exploiting the DNB detection capabilities for electric lighting, fires and flares, and utilizing M7, M8, M10, and M11 bands to detect combustion sources, the team at the NCEI Earth Observation Group has developed three global products.

The VIIRS Boat Detections (WBD, https://ngdc.noaa.gov/eog/viirs/download_boat.html) algorithm runs through the image data in near real-time, and the product (reports of boat-locations) is disseminated with a four-hour temporal latency to many fishery agencies. The VIIRS Night Fire (VNF) product (https://ngdc.noaa.gov/eog/viirs/download_viirs_fire.html) uses multispectral observations and Planck curve fitting to calculate temperatures of radiance sources such as fires, flares and other IR emitters. The VNF is a near real-time product available to users with a four-hour temporal latency. The VIIRS Nighttime Lights (VNL) product (https://ngdc.noaa.gov/eog/viirs/download_dnb_composites.html), available to users as monthly to annual summary increments, is a widely-used product in the sciences, social sciences and development-tracking communities. The presentation discussed in detail the product algorithm and various stages of filtering applied to make the final product. The team also produces monthly and annual summary grids for boat detection and night fire products.

In addition to the product overviews, the presentation discussed gas flare summary estimates for an array of countries for the years 2012-2016. The team is also working on producing a power stability index (derived from the night lights) to assess the reliability of the electric power generation. Examples of the power stability illustrated as RGB products in the presentation were based on using data from three different months, and the accompanied charts provided depictions of reliable power, outages below threshold, and seasonal power loading.

The presentation also discussed a comparison of the fire detections by the DNB band and by the longer-wavelength channels that indicates that some of the DNB detected fires are unseen by the longer-wavelength M-bands channels. Future plans of the team include continuous generation of VNL, VNF, and VBD products, R&D activities through JPSS proving ground initiatives, augmenting the DNB fire product with other fire products, DNB road/street lighting detections to rate infrastructure connectivity between urban centers, developing annual power stability index with monthly near real time updates, and developing alert systems for power outages.

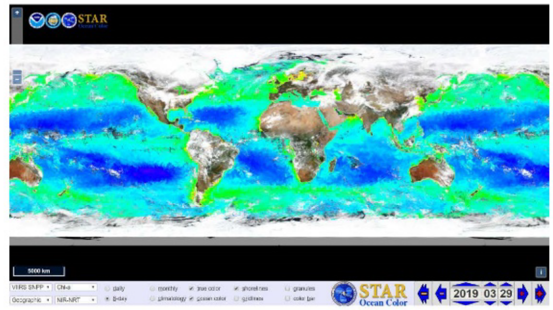
Jay Cable from GINA on behalf of Carl Dierking, made a remote presentation on GINA activities, and on GINA-DB downstream CSPP implementation to derive and disseminate Arctic products from S-NPP/NOAA-20 VIIRS and ATMS, Terra/Aqua MODIS, and AVHRR/AMSU of NOAA-19, 18, 15 and MetOp-B series of satellites. Products produced at GINA are in use by NWS WFO through the AWIPS interface. The ASIP and Alaska Fire Service also use the GeoTIFF single bands and RGB products produced at GINA. Many of the SDR products generated for this region (Alaska/Arctic) through GINA DB/CSPP are also in use by many centers such as the Alaska Volcano Observatory, CIMSS, CIRA, and SPoRT for weather related applications and proving ground initiatives.

The GINA team is now equipped to receive and process data from both S-NPP and NOAA-20 to produce two-satellite combined image coverage utilizing 18 passes/day over the Alaska/Arctic region at I-band resolution with minimum parallax displacement. Recently, the GINA team started producing products in Sectorized Cloud and Moisture Imagery (SCMI) Polar2Grid tile format (NetCDF files) that offers full resolution products replacing the earlier Regionalsat (1 km) products. The team is currently mitigating the challenges associated with this SCMI tile format change, such as higher data volume, higher bandwidth requirements for file transfers meeting latency requirements, and somewhat longer processing, delivery and display times.

The presentation provided examples of comparisons of SCMI DayLandCloudFire RGB SCMI data with Regionalsat (1 km) products (e.g. VIIRS on Ice, DNB imageries tracking sea ice movement, etc.) to reveal the advantages gained through SCMI products. The NWS WFOs are currently evaluating these products for near real-time use. The GINA team is also collaborating with CIMSS, SPoRT, and CIRA on many initiatives through providing River Flood and River Ice Products, Volcanic Ash product, MiRS and Gridded NUCAPS products, and many RGB products such as Limb and Bias corrected RGBs, FireTemperature RGB, DayLandCloudFire RGB, etc. The team is also supporting the Arctic and the Aviation initiatives through providing product evaluations of sea ice products and CLAVR-x cloud products, respectively.

Banghua Yan presented the status and upgrades to the ICVS system (https://www.star.nesdis.noaa.gov/icvs/) currently operating at STAR. The presentation reiterated the excellent teamwork over the years in developing and upgrading the ICVS as a unified portal to produce, organize, and view satellite instrument and spacecraft monitoring metrics. The system has been in use since 2012 to monitor both spacecraft and sensor health parameters using instrument housekeeping and telemetry parameters for all NOAA geostationary and polar orbiting satellites. Concerning JPSS, the ICVS team has augmented S-NPP spacecraft/sensor health and satellite products display/monitoring capabilities to support NOAA-20 in-orbit verifications, post-launch cal/val tasks, and has developed new modules to support NOAA-20 SDR provisional/validated maturity reviews. The JSTAR science teams as well as the Common Ground System and flight teams have used ICVS for many corrective actions and long-term sustainment of S-NPP/NOAA-20 products. The ICVS team has also added S-NPP and NOAA-20 on-orbit events and anomaly tables for customer/user-oriented support.

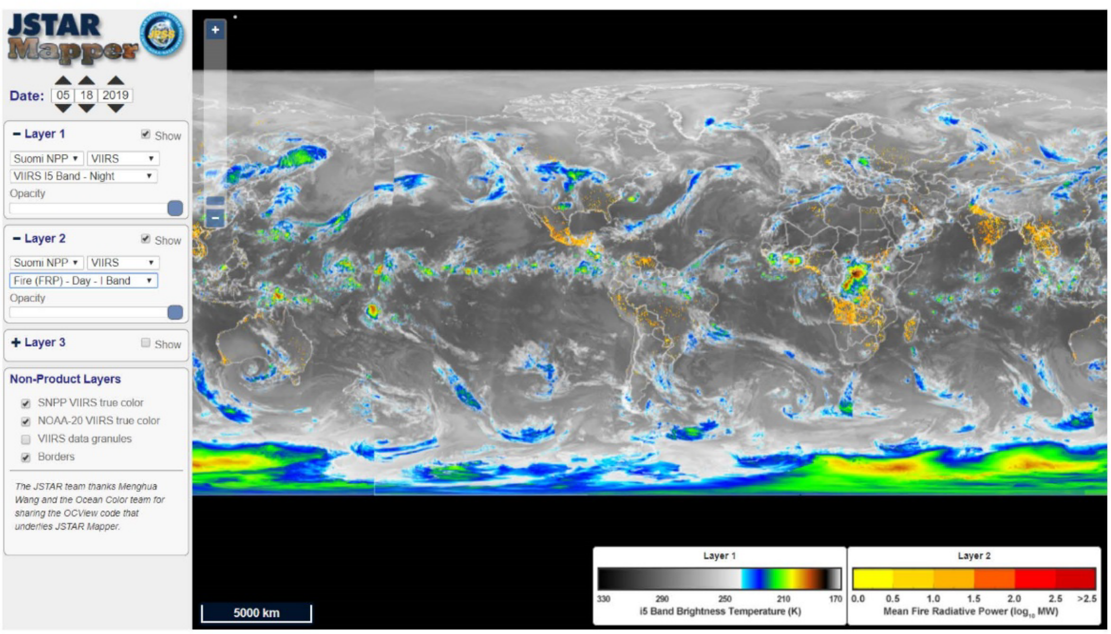
Recently, the ICVS team has made significant upgrades to its monitoring capabilities such as SNO inter-comparisons, double difference monitoring for quantitative assessment, and verifying inter-satellite consistency (e.g. S-NPP vs. NOAA-20) of SDR products to suggest necessary algorithm upgrades and to maintain consistent long-term SDR time series. The ICVS team has also developed and implemented Machine-Learning Clear Sky Mask algorithm for VIIRS. The algorithm is useful to generate clear sky radiances when other cloud mask algorithms are not available or optimized for immediate post-launch in-orbit SDR product cal/val and inter-satellite product verifications. The iSEW system implemented recently has been extremely useful for monitoring and for animations of severe weather systems and other event-based applications (fires, hurricane, snowstorms, etc.). The presentation covered many examples demonstrating the use of ICVS tools in gap-filling ATMS observations and 3D animations of hurricane warm



core structures. As a path forward, the team continues to advance the quality, technology, and science of the ICVS system to support SDR/EDR Teams, the JPSS program and NOAA user needs, and towards pre-launch and pre-operational testing events as part of J2 preparations.

[Fig33 https://www.star.nesdis.noaa.gov/sod/mecb/color/ocview/ocview.html#date=20190329/zoom=2/lat=0/lon=0/tc=true/l2=true/sens=VIIRS/proj=4326/algo=noaa_msl12_nrt/prod=chl/ave=8_day/cbar=false/gran=false/coast=true/grid=false screencap]

Karlis Mikelsons presented the OCView website to display and monitor OC product imageries used for fisheries and many other ocean applications. The presentation started with an illustration of the OC science team website (www.star.nesdis.noaa.gov/socd/mecb/color/index.html) and component webpages of the OCview accessible through the website. The OCview provides an interactive environment to visualize true-color imageries and OC data products utilizing JavaScript functionalities in the front end with the data products accessed at the backend. OCview provides a large set of functionalities to users in selecting the required geographic extent, zoom-in and zoom-out controls, projection choices, and time averages (daily, 8-day, monthly, climatology) for various ocean color products from a wide variety of satellite instruments such as S-NPP, NOAA-20, etc. The true color (at VIIRS imagery band resolution 375m) and the ocean color data layers (sampled at 2 km) have the ability to independently switch them on/off, which helps to identify various features such as sun glint, land, dust, clouds, etc., that are sometimes difficult to identify from the ocean color product itself. Availability of these true color/OC product layers in a continuous fashion through the international date line, ability to know approximate value of the product through tool-tip feature (when true color is switched off), added shorelines, gridlines, and color bar provide ease to study/analyze data products over global oceans. The ability to identify various land features (vegetation, dust, etc.) also provides useful information for scientists beyond the ocean community. The website also supports true color and OC products with high latency near real-time products as well as the best quality mission long science quality delayed latency products at the highest possible spatial resolution. The time averaged data sets (daily, 8-day, monthly, and climatological data) provide data products with minimal gaps. The granule overlay feature also helps identify exact overpass time to select granules in preparing OC product composites as well as to download individual granule data products. The Arctic and the Antarctic cloud-free true color and OC products produced by the OC team utilize polar projections in the OCview display. The zoom-in/zoom-out, time averages, and other commonly available options facilitate users with many display options for analysis. In addition to NOAA-20, the OC team also produces and archives true color and OC products from the Sentinel-3A OLCI instrument, geostationary satellite instruments, and the GOCI aboard COMS . The Sentinel-3B (launched 2018), currently in similar orbit as like S3A, is expected to have a shifted orbit to a later time to complement Sentinel-3A products with gap fillings. With regards to JPSS, the OCview provides both S-NPP and NOAA-20 true color and OC products, and also produces merged S-NPP/NOAA-20 data products reducing data gaps (due to clouds, sun glint etc.) present on individual satellite products. The presentation covered a wide range of examples of OC products derived from all of these satellites and viewable through the website. The team thanked the institutional IT support for web-server services and welcomed users to visit the website and provide feedback/comments to help them improve the product suite.

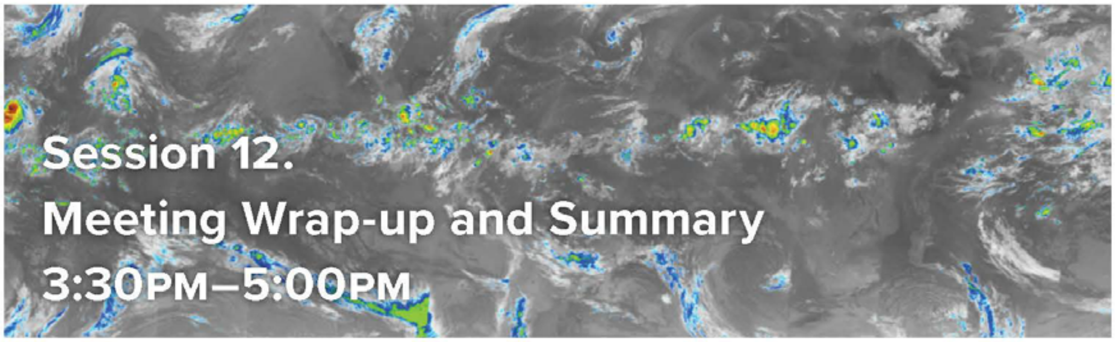


[Fig 34 https://www.star.nesdis.noaa.gov/jpss/mapper/#date=20190518/zoom=2/lat=-15.75/lon=-63.42186212539673/tc=true/sat=SNPP/l2=true/sens=VIIRS/prod=i5_d/ave=daily/gran=false screen cap]

Tom Atkins, the last presenter of the session, introduced the EDR Long Term Monitor (https://www.star.nesdis.noaa.gov/jpss/EDRs/) and the JSTAR Mapper web utilities (https://star.nesdis.noaa.gov/jpss/mapper). The success of ICVS and the need for consistent monitoring of the EDR products led the direction to construct a centralized location to host images of the EDR products in a consistent manner. The JPSS EDR LTM website, developed following the example of ICVS, monitors S-NPP/NOAA-20 EDR products produced daily and accumulated over the lifetime of the satellites. The system currently accesses data via SCDR or offline production streams, and allows users to visualize satellite EDR products from the S-NPP/NOAA-20 and GCOM to easily access data, products and plots by date, type, and other sorting parameters. Regarding JPSS, the JSTAR LTM produces about 950+ global EDR images for S-NPP. Currently, selected EDR products from NOAA-20 are accessible, and the LTM team is prepared to ingest new EDR products into the system as each product reaches its maturity.

The high volume of requests for images of specific events (e.g. hurricanes, fires, intense snow events, etc.), the need for area specific images with zoom-in/out control, product overlay, and other options led to the development of the JSTAR Mapper. The JSTAR mapper, built upon the code and interface already established and used by STAR OC team (See OCview presentation by Karlis Mikelsons), allows the display of an array of JPSS EDR products with multiple zoom levels, lat/lon and measurement tool tips hovering, overlay options, and infinite scrolling abilities to view global data over time. EDR data products that come at different resolutions are mapped into 512 x 512 pixel "tiles" in a pyramid format and products are produced from the lowest resolution (1024 x 512 global map) to the highest possible for the product. A free software tool, "OpenLayers" is used to display and zoom-in/out of the tiles on the JSTAR Mapper website.

As of now, the EDR products are made daily, and the team is beginning to ingest products in near real-time. The presentation demonstrated the utility of the JSTAR Mapper through a variety of EDR product examples, overlays, and animations (Hurricane Lane, Kilauea Volcano, Western wildfires, etc.). Currently the STAR Mapper has aerosol, fires, and products from MiRS and NUCAPS. As a path forward, the team intends to add many other EDR products such as volcanic ash, land surface products, and cryosphere products, and additional capabilities such as polar stereographic projections, mouse hover functions to obtain data values from the map, and granule maps for the entire JPSS suite of instruments.



Session 12. Meeting Wrap-up and Summary 3:30PM–5:00PM

The meeting ended with a warm applause appreciating the tremendous efforts by meeting organizers, and scientific contributions from JSTAR cal/val teams, JPSS Program office, NOAA stakeholders, user agencies, academia, and industry partners for a successful on-going JPSS mission with two satellites providing excellent data, and many more JPSS satellite as part of the JPSS Follow on mission. The poster session and the icebreaker reception was another highlight that allowed lot of discussions, social gathering, and on-hands training/demonstrations. The wrap-up session provided a platform with a question/answer session and moving forward views by the JPSS Program. The JPSS program management team, leaders from NOAA provided a quick summary echoing the current state of the JPSS program, cal/val accomplishments, and congratulated all the key players for a successful on-going JPSS mission with two satellites providing excellent data, and many more JPSS satellite as part of the JPSS Follow on mission. The major points highlighted during the wrap-up session are:

The S-NPP satellite has been extremely successful in operations for the last seven years and has produced an array of very high quality atmospheric, land, ocean, and cryosphere data products. The recently launched NOAA-20 is producing high quality data products currently provided through S-NPP, along with additional products as a direct result of the instrument upgrades and science improvements. All of the S-NPP data products have passed through the Cal/Val validation maturity stage and the products are now at the long-term monitoring and reactive maintenance phase. The NOAA-20 KPP products have all reached validated maturity status as of October 2018. The NOAA-20 EDR products are currently at the Beta/Provisional maturity stages and most of EDRs reached provisional maturity stage by the end of 2018. All of the SDR and Imagery EDR product generation will continue using the IDPS processing system, and most of the S-NPP EDRs are currently under operations at NDE/OSPO/ESPC. Operationalization of NOAA-20 EDR products at NDE/OSPO/ESPC is going at high pace. The AMP expects at least 6 months of transition time for users to switch from IDPS to NDE enterprise products after which IDPS products subscriptions to CLASS will cease, but only after a realization of NDE products archival by NCEI.

The S-NPP/NOAA-20 satellite data products are disseminated through the PDA and NOAA's CLASS system for NOAA stakeholders and user agencies worldwide. Progress on using S-NPP products in NWP assimilations worldwide, in support of observing and predicting key weather phenomena (e.g. hurricanes, blizzards), and for event based applications (e.g. flash floods, volcanic ash, wildfires etc.) have shown remarkable success.

One of the major strengths of polar orbiting satellites is the collection of global observations needed for NWP assimilations worldwide. CrIS and ATMS observations are assimilated into NWP models worldwide on a routine basis and have been found to improve 5-7 day forecasts and hurricane track predictions. The availability of two down-link play-back stations

(Svalbard and McMurdo) for JPSS-1 coupled with the implementation of CSPP, (http://cimss.ssec.wisc.edu/cspp/) implemented at the DB network of stations allows assimilation of JPSS-1 observations into regional rapid refresh models with improved latency for many real-time applications. The S-NPP/JPSS-1 satellite data products have been proven to be invaluable over the data-sparse polar regions . The ability to derive JPSS products (regional) at a much higher latency through DB networks and using CSPP has been found to be extremely fruitful for many regional real-time applications.

The JPSS-2 and follow-on satellites (JPSS-3, 4) with similar instruments, and consistent science products produced from the JPSS constellation, provide users with the opportunity to move out from the aging legacy NOAA POES, and EOS Aqua and Terra satellites products and keep up with continuity and connectivity for coordinated science experiments. Commitments and collaborative agreements between the JPSS Program, EUMETSAT, and JAXA are leading to a wide variety of enterprise algorithm solution for consistent data product generation, demonstration of blended product generation and application, and operationalization towards mission-agnostic data products leading to measurement based approach.

On the algorithm reallocations and operationalization between the IDPS and the NDE, the AMP laid out a transition plan consistent with the Program directives and in conformity to the SPSRB process. All of the SDR and imagery EDR product generation will continue using the IDPS processing system, while the other JPSS EDR products are transitioned to operations through NDE/OSPO. Operationalization of these products in NDE/ESPC will follow after an evaluation of the current NDE processing loads and performance, and after an assessment of the current/future NDE operational processing capability needs. The AMP expects at least 6 months of transition time for users to switch from IDPS to NDE enterprise products after which IDPS products subscriptions to CLASS will cease, but only after a realization of NDE products archival by the NCEI. Interdependencies associated with IDPS product generation may preclude decommissioning of the IDPS products generation, but may happen eventually. Back filling IDPS products with the NDE products for the entire Suomi NPP mission will be realized once NDE products are operationalized and funding appropriations are in place for retrospective processing. For a smooth transition and adaptation of NDE products in user applications, users will be provided with NDE test data products through an FTP site. Any fixes or suggested modifications to the NDE products from user agencies will be evaluated and accommodated in finalizing the NDE product generation for an eventual dissemination and archival of NDE products.

The JSTAR Program will continue the development/improvement of algorithms for both S-NPP and NOAA-20, as well as future JPSS missions. The team is also actively engaged in implementing the enterprise algorithms, and in reprocessing of the S-NPP SDR/EDR algorithms with the most matured validation codes towards the generation and archival of science quality data products to advance satellite research and applications. Finally, through the ICVS, EDR-LTM, and JPSS Mapper websites, JSTAR provides much needed real-time product display and evaluations, along with numerous documents and webpage links on S-NPP/NOAA-20 products, ATBDs, maturity reviews, meeting minutes of JSTAR Annual Science Team Meetings and coordinated efforts with NOAA stakeholders and user communities.

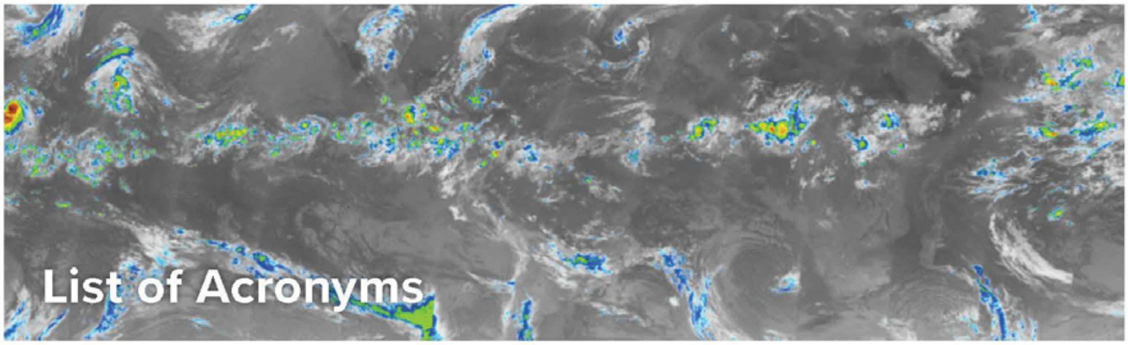
The PGRR science program initiated at the beginning of the JPSS program has been providing vital program functions on (a) addressing data needs across NOAA line offices (e.g. NWS, NMFS, OAR, etc.) and other agencies, (b) identification of requirements and prioritization via the LORWG, (c) fostering algorithm development for high-quality data products, cal/val, reprocessing and enterprise solutions, and (d) overseeing deliveries of software packages to operations and CSPP DB services. The program is playing an active role in evaluating the use of operationally produced products for operational applications across NOAA line offices and transformation to information critically needed by decision makers. The ongoing PGIs in Atmospheric Chemistry, River Ice and Flooding, Fire and Smoke, Soundings, Data Assimilation, Imagery/Now casting, Ocean/Coastal applications, and Hydrology, Arctic, and Land data assimilation, have engaged users as well as developers in identifying a vast numbers of innovative products based on users' requirements and NOAA line offices, and provide pathways to improve transitions from research to operations, and streamline improvements to operational products.

Follow-on in-depth discussions through side meetings with the STAR SDR teams, experts from ECMWF and EUMETSAT, and other user agencies resulted in multiple data exchange requests and collaborative experiment proposals.

Thursday (August 30, 2018)
Blended Product Workshop
8:30am–3:00PM

The fourth day of the JPSS Annual Science Team Meeting was devoted to the JPSS Blended Product Workshop. The workshop was held on August 30th 2018, at ESSIC in College Park, Maryland. The workshop was attended by the experts across agencies of satellite research and applications including NOAA/NESDIS, NOAA/NWS, NRL, Cooperative Institutes, NOAA industry partners, and ECMWF.

The objective of the workshop was to determine the status of various algorithms used to blend operational products, including emerging and new techniques being tested through developing products from the PGRR initiatives, and to identify common tools and their potential use in NESDIS enterprise systems. The workshop was organized into several sessions starting with the NESDIS operational blended products, blending methods and approaches, and presentations on a variety of blended products currently available and user applications. Discussion topics included methods/tools commonly adaptable in deriving baseline and emerging products, future improvements to meet end users' needs in terms of data formats, metadata, latency, resolution, and so on. A special lunch time brown bag seminar was presented featuring data fusion through synergy of data assimilation and remote sensing techniques. The workshop concluded with the discussions about the future improvements to meet end users' needs (data formats, metadata, latency, resolution, etc.). For more information please see the full workshop report at https://www.star.nesdis.noaa.gov/jpss/documents/meetings/2018/SJAS-TM/Blended_Workshop_Report.pdf



List of Acronyms

3MI	Multi-Viewing Multi-Channel Multi-Polarisation Imaging
4DEnsVar	Four-Dimensional Ensemble Variational
ABI	Advanced Baseline Imager
AC	Atmospheric Composition
ACAPEX	ARM Cloud Aerosol Precipitation Experiment
ACSPO	Advanced Clear-Sky Processing for Oceans
ACT-America	Atmospheric Carbon and Transport-America
ADA	Algorithm Development Area
ADL	Algorithm Development Library
ADP	Aerosol Detection Product
AEROSE	Aerosols and Ocean Science Expedition
AHI	Advanced Himawari Imager
AI	artificial intelligence
AIRS	Atmospheric Infrared Sounder
AMP	Algorithm Management Project
AMS	American Meteorological Society
AMSR(-E)	Advanced Microwave Scanning Radiometer (for EOS)
AMSU	Advanced Microwave Sounding Unit
AOD	Aerosol Optical Depth
API	application programming interface
APRFC	Alaska Pacific River Forecast Center
APS	Aerosol Particle Size
APU	accuracy/precision/uncertainty
AQI	Air Quality Index
ARL	Air Resources Laboratory
ARM	Atmospheric Radiation Measurement
ARMS	ACSPO Regional Monitor for SST
ASCAT	Advanced Scatterometer
ASIP	Alaska Sea Ice Program
ASSISTT	Algorithm Scientific Software Integration and System Transition Team
ATMS	Advanced Technology Microwave Sounder
ATom	Atmospheric Tomography Mission
ATOVS	Advanced TIROS Operational Vertical Sounder
AVHRR	Advanced Very-High Resolution Radiometer
AVMP	Atmospheric Vertical Moisture Profile
AVTP	Atmospheric Vertical Temperature Profile
AWEX-G	AIRS Water Vapor Experiment-Ground
AWIPS	Advanced Weather Interactive Processing System

BAER	Burned Area Emergency Response
BARC	Burned Area Reflectance Classification
BCCSO	Beltsville Center for Climate System Observation
BRDF	bidirectional radiance distribution function
BRIDGE	Burn Intensity Delta Greenness Estimation
BSRN	Baseline Surface Radiation Network
BUFR	Binary Universal Form for the Representation of meteorological data
CAA	cold air aloft
cal/val	calibration/validation
CCAR	Colorado Center for Astrodynamics Research
CCR	code change request
CDR	climate data record
CEOS	Committee on Earth Observation Satellites
CERES	Clouds and Earth's Radiant Energy System
CGMS	Coordination Group for Meteorological Satellites
CICS	Cooperative Institute for Climate and Satellites
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CIRA	Cooperative Institute for Research in the Atmosphere
CLASS	Comprehensive Large Array-data Stewardship System
CLAVR-x	Clouds from AVHRR Extended
CLW	cloud liquid water
CM	Climate Monitoring
CMORPH	CPC MORPHing technique
COMS	Communication, Ocean and Meteorological Satellites
CONUS	contiguous United States
COSMIC	Constellation Observing System for Meteorology, Ionosphere, and Climate
CPC	Climate Prediction Center
CRADA	cooperative research and development agreement
CrIS	Crosstrack Infrared Sounder
CRTM	Community Radiative Transfer Model
CSEM	community surface emissivity mode
CSPP	Community Satellite Processing Package
CUNY	City University of New York
CWSU	Central Weather Service Unit
DA	data assimilation
DAP	delivered algorithm package
DB	direct broadcast
DCC	deep convective clouds
DMSP	Defense Meteorological Satellite Program
DNB	Day/Night Band
DPE	Data Processing and Engineering
DR	discrepancy report
DRAT	DR Action Team
EAQUATE	European Aqua Thermodynamic Experiment
ECMWF	European Centre for Medium-range Weather Forecasting
ECV	Essential Climate Variable
EDR	Environmental Data Record
EMC	Environmental Modeling Center
EOS	Earth Observation System
EPA	Environmental Protection Agency

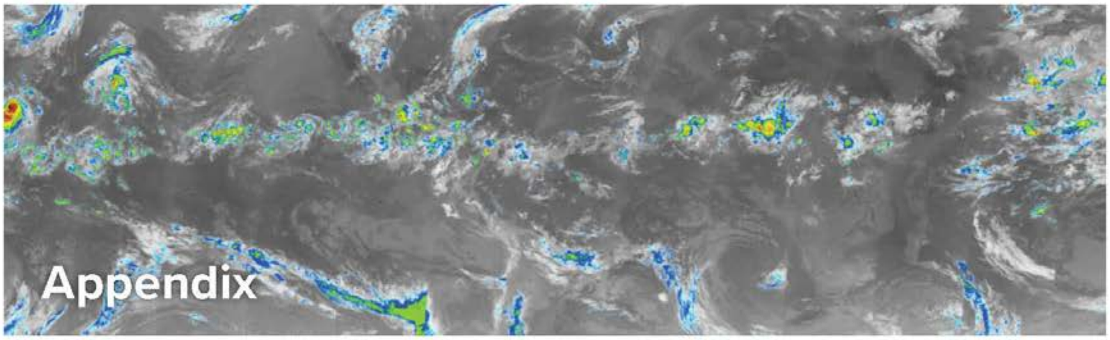
EPS	Enterprise Product System
EPS-SG	EUMETSAT Polar Satellite System
ESPC	Environmental Satellite Processing Center
ESPDS	Environmental Satellite Processing and Distribution System
ESRL	Earth System Research Laboratory
ESSIC	Earth Systems Science Interdisciplinary Center
EUMETSAT	European Centre for the Exploitation of Meteorological Satellites
EVI	Enhanced Vegetation Index
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FIREX	Fire Influence on Regional and Global Environments Experiment
FL	flight level
FOV	field-of-view
FRP	Fire Radiative Power
FSW	flight software
FTP	file transfer protocol
FV3	Finite-Volume Cubed-Sphere Dynamical Core
FY	fiscal year
GAASP	GCOM-W1 AMSR2 Algorithm Software Processor
GCOM-C/w	Global Change Observation Mission-Climate/Water
GCOS	Global Climate Observing System
GDAS	Global Data Assimilation System
GeoTIFF	Geographic Tagged Image File Format
GFS	Global Forecast System
GINA	Geographic Information Network of Alaska
GIS	Geographic Information System
GLM	Geostationary Lightning Mapper
GMASI	Global Multisensor Automated satellite-based Snow and Ice Mapping System
GMI	GPM Microwave Imager
GMU	George Mason University
GOES	Geostationary Operational Environmental Satellite R series
GOME	Global Ozone Monitoring Experiment
GPM	Global Precipitation Measurement
GPROF	Goddard Profiling Algorithm
GRAVITE	Government Resource for Algorithm Verification, Independent Test, and Evaluation
GSI	Gridded Statistical Interpolation
GVF	Green Vegetation Fraction
HEAP	Hyperspectral Enterprise Algorithm Package
HFR	high frequency radio
HG	high gain
HMS	Hazard Mapping System
HRRR	High-Resolution Rapid Refresh
HWT	Hazardous Weather Testbed
HYDRA	HYperspectral-viewer for Development of Research Applications
HYSPLIT	Hybrid Single Particle Lagrangian Integrated Trajectory
I&T	Integration and Testing
IASI-NG	Infrared Atmospheric Sounding Interferometer
I-band	imagery band
ICF	Investigator Computing Facility

ICI	Ice Cloud Imaging
ICT	internal calibration target
ICVS	Integrated Cal/Val System
IDEA-I	Infusing satellite Data into Environmental air quality Applications
IDL	Interface Data Language
IDPS	Interface Data Processing Segment
IDV	Integrated Data Viewer
IMS	Interactive Multisensor Snow and Ice Mapping System
IMSG	IM Systems Group
IOOS	Integrated Ocean Observing System
IPT	Integrated Product Team
iQUAM	in situ Quality Monitoring
IR	infrared
iSEW	ICVS Severe Event Watch
IST	Ice Surface Temperature
IT	information technology
J1-4	JPSS-1/2/3/4
JAIVEx	Joint Airborne IASI Validation Experiment
JAXA	Japanse Aerospace Exploration Agency
JCT	JPSS Compatibility Tests
JPSS	Joint Polar Satellite System
JSTAR	STAR JPSS
Kd()	diffuse attenuation coefficient
KPP	key performance parameter
L+	launch plus
L1/2/3/4/C/S/U	Level 1/2/3/4 Collated/Super-collated/Uncollated
L1RD	Level 1 Requirements Document
LFSO2	linear fit SO2
LG	low gain
LGEM	Logistic Growth Equation Model
LORWG	Low-Earth Orbiting Requirements Working Group
LSA	Land Surface Albedo
LSE	Land Surface Emissivity
LSM	land surface model
LST	Land Surface Temperature
LTM	Long-Term Monitoring
LUT	look-up tablehillg
LWIR	longwave infrared
M2M	machine to machine
M-band	moderate-resolution band
McIDAS	Man computer Interactive Data Access System
MiRS	Microwave Integrated Retrieval System
MOBY	Marine Optical Buoy
MODIS	Moderate-resolution Imaging Spectroradiometer
MPE	Multisensor Precipitation Estimator
MSG	Meteosat Second Generation
MSL12	Multi-sensor Level-1 to Level-2
MSN	Mission Science Network
MSU	Microwave Sounding Unit
MTG	Meteosat Third Generation
MWI	Microwave Imager
MWIR	midwave infrared
MWS	Microwave Sounder
NAAQS	National Ambient Air Quality Standards

NAM	North American Mesoscale Forecast System
NAQFC	National Air Quality Forecast Center
NASA	National Aeronautics and Space Administration
NCC	Near-Constant Contrast
NCEI	National Centers for Environmental Information
NCEP	National Centers for Environmental Prediction
NCWCP	NOAA Center for Weather and Climate Prediction
NDBC	National Data Buoy Center
NDE	NPP Data Exploitation
NDSI	Normalized Difference Snow Index
NEdN	noise equivalent differential radiance
NEdT	noise equivalent differential temperature
NESDIS	National Environmental Satellite data and Information Service
netCDF	Network Common Data Format
NEXRAD	Next Generation Weather Radar
NG	Northop Grumman
NIR	near infrared
NIST	National Institute of Standards and Technology
NJO	NOAA JPSS Office
nLw	normalized water leaving radiances
NM	Nadir Mapper
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NP	nadir profiler
NRL	Naval Research Laboratory
NRT	near real time
NSR	Nominal Spectral Resolution
NUCAPS	NOAA Unique CrIS/ATMS Processing System
NVAP-M	NASA Water Vapor Project reanalysis and extension
NVPS	NDE Vegetation Products Suite
NWC	National Water Center
NWM	National Water Model
NWP	numerical weather prediction
NWS	National Weather Service
OAR	Oceanic and Atmospheric Research
OC	Ocean Color
OCView	Ocean Color Viewer
OLCI	Ocean Land Colour Instrument
OLR	Outgoing Longwave Radiation
OMAO	Office of Marine and Aviation Operations
OMI	Ozone Monitoring Instrument
OMPS	Ozone Mapping Profiler Suite
OSAAP	Office of Systems Architecture and Advanced Planning
OSPO	Office of Satellite and Product Operations
OSU	Oregon State University
PAL	Product Area Lead
PAR	photosynthetically active radiation
PDA	Product Distribution and Access
PGE	Product Generation Executable
PGI	Proving Ground Initiative
PGRR	Proving Ground/Risk Reduction
PM	particulate matter

PMR	Procurement Management Review
PMRF	Pacific Missile Range Facility
POES	Polar Operational Environmental Satellite
PTU	pressure-temperature-humidity
QC	quality control
QPE	quantitative precipitation estimation
R&D	research and development
RAN1	Reanalysis version 1
RAP	Rapid Refresh Model
RDR	Raw Data Record
READY	Real-time Environmental Applications and Display System
RGB	red/green/blue
RII	Rapid Intensification Index
RIVAL	Radiosonde Intercomparison and Validation
RO	radio occultation
ROFS	Regional Ocean Forecast System
ROMS	Regional Ocean Modeling System
ROSES	Research Opportunities in Earth and Space Science
RR	rain rate
RSB	reflective solar bands
RTA	radiative transfer algorithm
SAL	Saharan Air Layer
SAR	synthetic aperture radar
SBUV	Solar Backscatter Ultraviolet Instrument
SCA	Scatterometer
SCMI	Sectorized Cloud and Moisture Imagery
SDR	Sensor Data Record
SeaWIFS	Sea-viewing Wide Field-of-View Sensor
SFR	snowfall rate
SGLI	Second-generation Global Imager
SHIPS	Statistical Hurricane Intensity Prediction Scheme
SIC	Sea Ice Concentration
SLIDER	Satellite Loop Interactive Data Explorer in Real-time
SMAP	Soil Moisture Active Passive
SMCD	Satellite Meteorology and Climatology Division
SMOPS	Soil Moisture Operational Products System
SNO	simultaneous nadir overpass
SNR	signal to noise ratio
SOCD	Satellite Oceanography and Climatology Division
SPoRT	Short-term Prediction Research and Transition Center
SPSRB	Satellite Products and Services Review Board
SQUAM	SST Quality Monitoring
SRF	spectral response functions
SSMIS	Special Sensor Microwave Imager/Sounder
SST	Sea Surface Temperature
SSU	Stratosphere Sounder Unit
ST	Surface Type
STAR	Center for Satellite Applications and Research
STC	Science and Technology Corporation
Suomi NPP	Suomi National Polar-orbiting Partnership
SURFRAD	Surface Radiation Network

SWE	snow water equivalent
SWIR	shortwave infrared
TC	total column
TC	tropical cyclone
TCCON	Total Carbon Column Observing Network
TDR	Temperature Data Record
TEB	thermal emissive bands
TELSEM	Tool to Estimate Land Surface Emissivities at Microwave frequencies
TEMPO	Tropospheric Emissions: Monitoring of Pollution
TIROS	Television Infrared Observation Satellite
TOA	top-of-atmosphere
TOC	top-of-canopy
TPW	total precipitable water
TR	technical report
TTO	transition to operations
TVAC	thermal vacuum
UMD	University of Maryland
USDA	United States Department of Agriculture
UV	ultraviolet
UW	University of Wisconsin
V8Pro	Version 8 Ozone Profile
V8Toz	Version 8 Total Ozone
VA	Volcanic Ash
VAAC	Volcanic Ash Advisory Centers
VBD	VIIRS Boat Detections
VCST	VIIRS Calibration Support Team
VI	Vegetation Index
VIIRS	Visible Infrared Imaging Radiometer Suite
VIS	visible
VisAD	Visualization for Algorithm Development
VNF	VIIRS Night Fires
VNL	VIIRS Nighttime Lights
VOLCAT	Volcanic Cloud Analysis Toolkit
WCOFS	West Coast Operational Forecast System
WE-CAN	Western Wildfire Experiment for Cloud Chemistry, Aerosol Absorption, and Nitrogen
WFO	Weather Forecast Office
WRF	Weather Research and Forecasting Model
WUCD	warm-up/cool down



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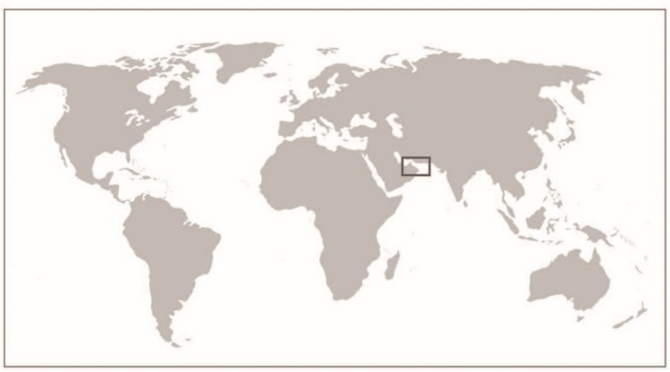
GCOM-W /AMSR-2	Paul Chang (Lead) Ralph Ferraro (Project Scientist)	

[Detailed agenda - https://www.star.nesdis.noaa.gov/star/meeting_2018JPSSAnnual_agenda.php#tab1]



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Sand blown from southern Iran and Pakistan over the Arabian Sea on 4 December 2017, observed by the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi National Polar-orbiting Partnership (SNPP) satellite. The true color image was generated using the NOAA Ocean Color Viewer (OCView) online viewing tool.

Image produced by Karlis Mikelsons (NOAA/NESDIS/STAR and GST, Inc.) and Menghua Wang (NOAA/NESDIS/STAR) along with the NOAA Ocean Color Team

Web address:
https://www.star.nesdis.noaa.gov/socd/mecb/coor/ocview/ocview.html

Inset (above): Global map highlighting the location of the cover photo centered over the Gulf of Oman and the Arabian Sea.

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