

JPSS DPA Program Planning Meeting CrIMSS EDR Team

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CrIMSS EDR Lead
Sep. 18, 2012

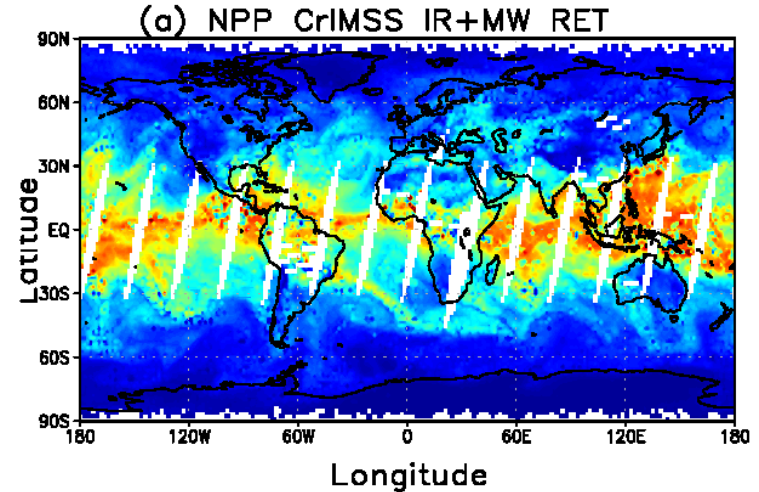


Atmospheric Vertical Moisture Profile (AVMP).

Used for initialization of high-resolution NWP models, atmospheric stability, etc.

Lower tropospheric moisture layers are Key Performance Parameters (KPPs) .

Parameter (KPP in Blue)	IODR-II, JPSS-L1RD
AVMP Partly Cloudy, surface to 600 mb	Greater of 20% or 0.2 g/kg
AVMP Partly Cloudy, 600 to 300 mb	Greater of 35% or 0.1 g/kg
AVMP Partly Cloudy, 300 to 100 mb	Greater of 35% or 0.1 g/kg
AVMP Cloudy, surface to 600 mb	Greater of 20% of 0.2 g/kg
AVMP Cloudy, 600 mb to 300 mb	Greater of 40% or 0.1 g/kg
AVMP Cloudy, 300 mb to 100 mb	Greater of 40% or 0.1 g/kg



Example of AVMP (shown as total precipitable water) on May 15, 2012 from the CrIMSS off-line EDR

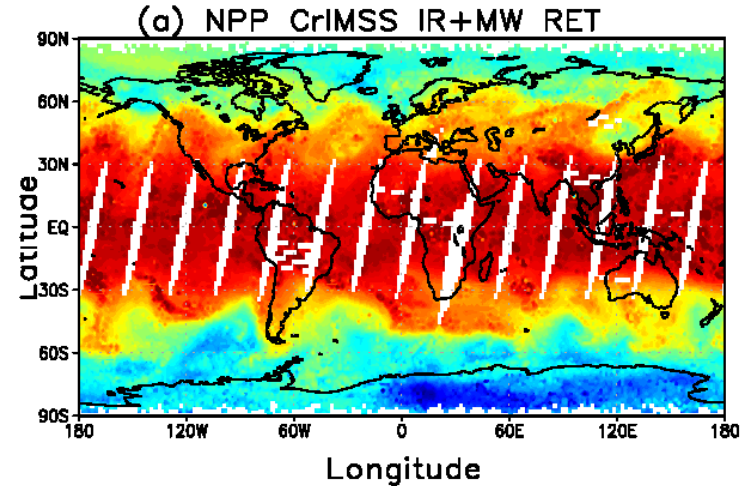
Results are from the coupled algorithm without QC

Atmospheric Vertical Temperature Profile (AVTP).

Used for initialization of high-resolution NWP models, atmospheric stability, etc.

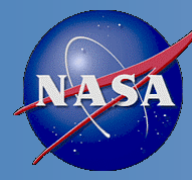
Lower tropospheric temperature are KPPs.

Parameter (KPP in Blue)	IODR-II, JPSS-L1RD
AVTP Partly Cloudy, surface - 300 mb	1.6 K/1-km layer
AVTP Partly Cloudy, 300 to 30 mb	1.5 K/3-km layer
AVTP Partly Cloudy, 30 mb to 1 mb	1.5 K/5-km layer
AVTP Partly Cloudy, 1 mb to 0.5 mb	3.5 K/5-km layer
AVTP Cloudy, surface to 700 mb	2.5 K/1-km layer
AVTP Cloudy, 700 mb to 300 mb	1.5 K/1-km layer
AVTP Cloudy, 300 mb to 30 mb	1.5 K/3-km layer
AVTP Cloudy, 30 mb to 1 mb	1.5 K/5-km layer
AVTP Cloudy, 1 mb to 0.05 mb	3.5 K/5-km layer



Example of AVTP at 500 hPa on May 15, 2012 from the CrIMSS off-line EDR

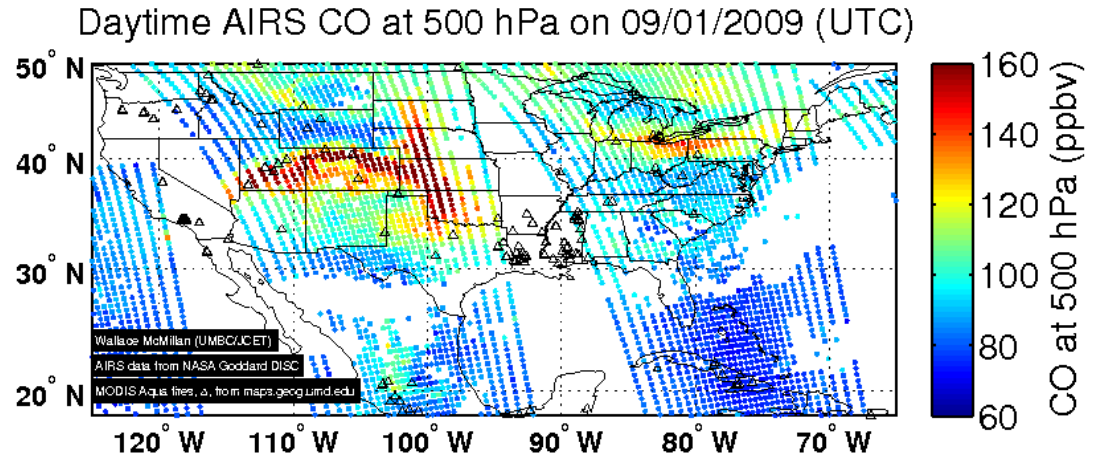
Results are from the coupled algorithm without QC



Overview of CrIMSS EDR Products (3/7)



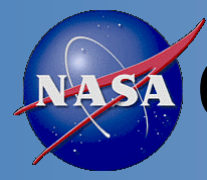
- Pressure product is a EDR derived product that requires validation.
 - Derived from AVTP and AVMP
- Ozone is an intermediate product (IP) used by the OMPS team.
- CO and CH4 are pre-planned product improvements (P³I, Not part of JPSS-funded cal/val program)
 - SOAT has recommended full-resolution RDR's for CrIS SW (and MW) bands to support the science community.



Example of AIRS carbon monoxide product: CO from California fires impacted Denver Colorado on Aug.30 and Oklahoma on Sep. 1, 2009

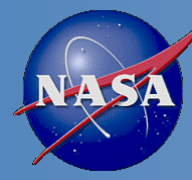
Image courtesy of Wallace McMillan, UMBC

Parameter (P ³ I in Blue)	IORD-II / JPSS-L1RD
Pressure Profile	4 mb threshold, 2 mb goal
Ozone IP	No requirements
CH4 (methane) column	1% ± 5% / 1% ± 4% (precision ± accuracy)
CO (carbon monoxide) column	3% ± 5% / 35% ± 25% (precision ± accuracy)

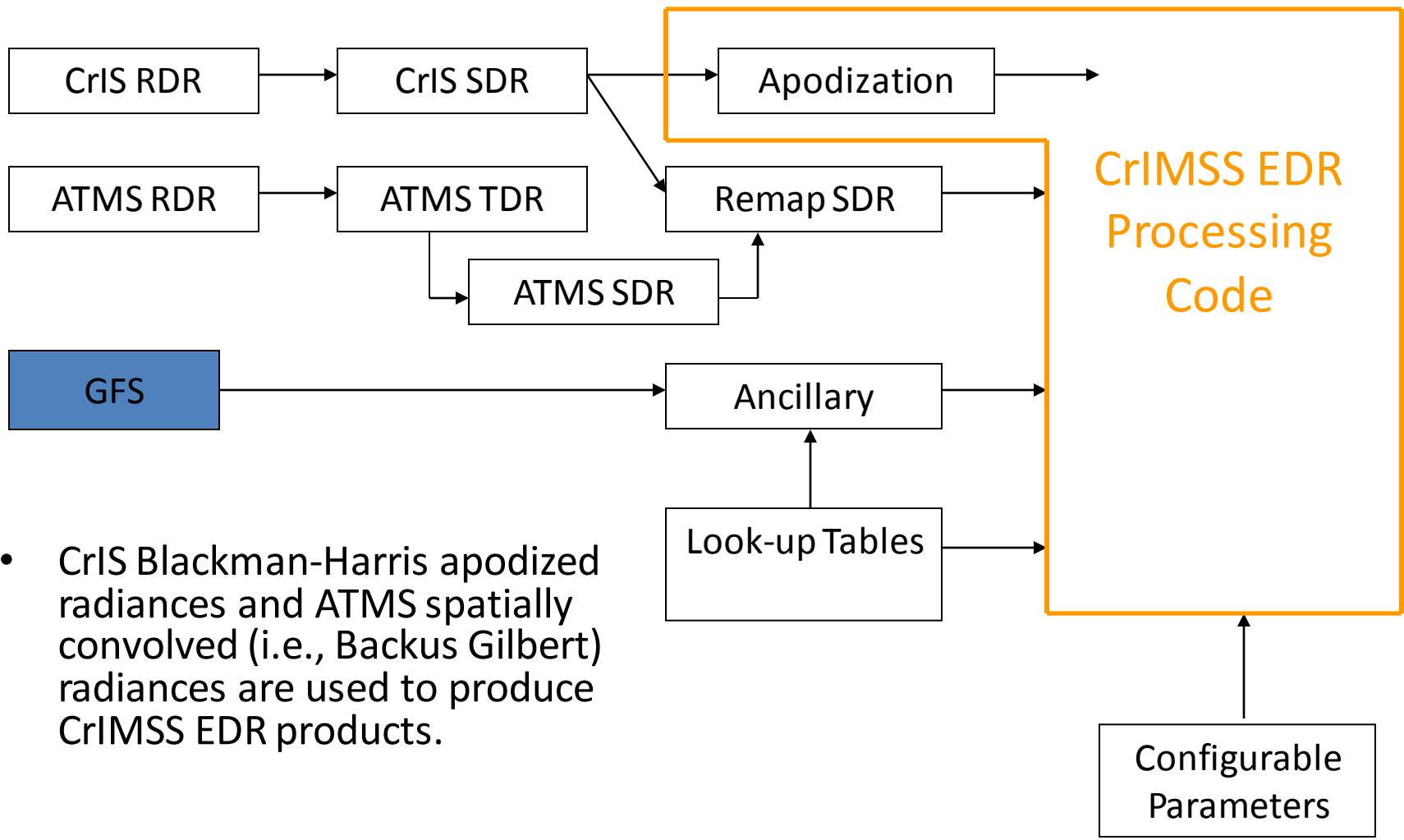


Overview of CrIMSS EDR Products (4/7)

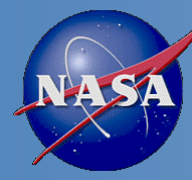
- The CrIMSS EDR algorithm utilizes all of the radiances from CrIS and ATMS within a CrIS field-of-regard (FOR) to produce a single sounding of the AVTP, AVMP
 - Requires agreement between ATMS and CrIS radiances.
- The FOR is derived from ~25 ATMS fields-of-view (FOV) that are optimally averaged along with an optimal spatial combination of the 9 CrIS FOVs (called cloud clearing) within a single interferogram sweep.
- The AVPP product is derived from geopotential height computed from AVTP and AVMP.
- The CrIMSS EDRs are heavily dependent on the upstream SDRs as well as empirically derived bias corrections with respect to the CrIMSS forward model (called the Optimal Spectral Sampling or OSS model).
- As calibration of the CrIS or ATMS SDRs improves, so does the quality of the CrIMSS EDR.
 - We require re-processing of SDRs for our focus days (~4 days/year)



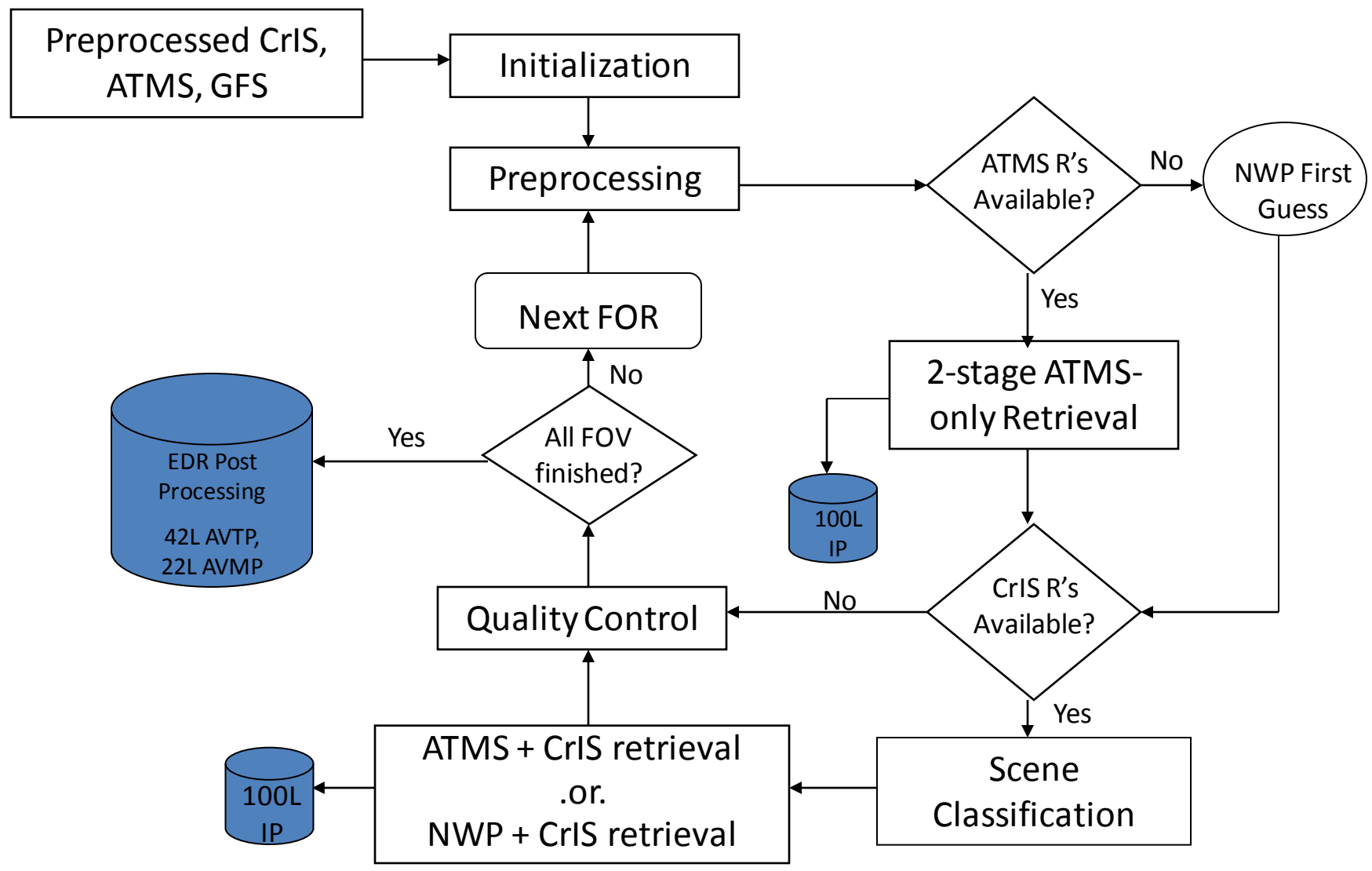
Overview of CrIMSS EDR Products (5/7)

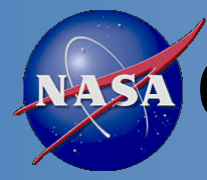


- CrIS Blackman-Harris apodized radiances and ATMS spatially convolved (i.e., Backus Gilbert) radiances are used to produce CrIMSS EDR products.



Overview of CrIMSS EDR Products (6/7)

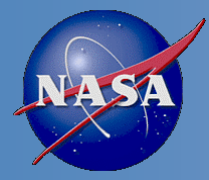




Overview of CrIMSS EDR Products (7/7)



- The CrIMSS EDR derives AVTP, AVMP, AVPP, O3-IP, surface temperature, surface emissivity simultaneously.
 - AVTP reconstructed from 20 EOF's, AVMP from 10 EOF's
 - Also 1 surface temperature, 5 MW EOF's, 12 IR emissivity and reflectivity hinge points, MW cloud top pressure and cloud liquid water path
 - These products are not currently supported as IP products
 - There is an inter-dependence within products
 - Therefore, entire atmospheric state needs to be assessed in order to validate these products.
- Assumption for EDR validation is that CrIS and ATMS SDRs are calibrated.
 - Beta versions of SDR were to assess the CrIMSS EDR algorithm.
 - Assessment is “hierarchical”
 - Use NWP model(s) and operational RAOBs for global assessment
 - Use dedicated radiosondes for detailed performance characterization at selected sites
 - Characterization improves as more *in-situ* data is acquired.
 - NJO funded ARM CART radiosondes are being acquired under FY12 funds.
 - Collaborative activities to acquire other radiosondes (Aerospace collaborators)



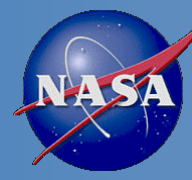
CrIMSS EDR Team Members' Roles and Responsibilities (part of CrIMSS EDR budget)



Lead for Activity	Organization	Task
Chris Barnet	NOAA/NESDIS/STAR	CrIS/ATMS EDR algorithm lead (Wilson) and validation (Nallii, Xiong)
Mitch Goldberg (C. Barnet)	NOAA/NESDIS/STAR	NGAS-code analysis (Divakarla, Tan)
Anthony Reale	NOAA/NESDIS/STAR	NPROVS RAOB comparisons
Ralph Ferraro	NOAA/NESDIS/STAR	Precipitation Flag

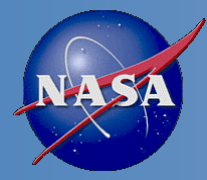
Lead for Activity	Organization	Task
Allan Larar	NASA/LaRC	Comparisons to NAST-I EDRs
Xu Liu	NASA/LaRC	IASI proxy, Algorithm, Validation (Kizer)
Hank Revercomb	SSEC	AVMP/AVTP validation (Knuteson), AVTP/AVMP validation (Li)
Dave Tobin	SSEC	ARM-RAOBS at NWP, SGP, NSA
Larrabee Strow	UMBC	OSS validation and comparisons to SARTA

Brown=funding reduced in FY13, RED = not funded in FY13,
GREEN = FY13 funding removed from CrIMSS-EDR team



External CrIMSS EDR members of validation team (not funded by CrIMSS EDR budget)

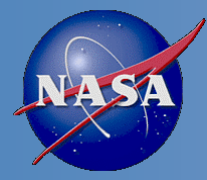
SDR/EDR	Lead for Activity	Organization	Task
ATMS SDR, CrIS SDR, CrIMSS EDR	Degui Gu / Denise Hagan / Xia-Lin Ma	NGAS	EDR /SDR Validation, code integration
ATMS TDR/SDR	Sid Boukabara	NOAA/STAR	MiRSEDR
CrIMSS EDR	Lars Peter Riishojgaard	JCSDA	NCEP analysis
CrIMSS SDR	Steven Beck	Aerospace Corp.	RAOB,LIDAR
CrIMSS SDR	Steven English	UKMET	UKMET analysis
CrIMSS SDR	William Bell	ECMWF	ECMWF analysis
AVTP/AVMP	Steve Freidman	NASA/JPL	Sounder PEATE
CrIMSS SDR	Ben Rustin	NRL	NOGAPS/NAVDAS analysis



FY-12 Accomplishments (1/4)



- Launch validation activities
 - Communication with NWP centers on data formats, proxy data, channel subset selection, etc.
 - 1st focus day, Nov. 11, 2012 (ATMS-only)
 - Derived ATMS tuning, check out ATMS-only parts of code
 - 2nd focus day, Feb. 24, 2012
 - 1st look at full retrieval system
 - 3rd focus day, May 5, 2012
 - Characterization and optimization of algorithm
 - 4th focus day to be acquired Sep. 20, 2012
 - Coordinated with Aerospace Corp. to utilize sonde launches from Hawaii (20 in May 2012, more planned for Sep 2012)
 - Coordination with DOE/ARM to begin dedicated sonde launches at NSA, SGP, TWP (90x3 overpasses will be acquired in Fall 2012)
- Met milestone for beta maturity
 - Justification package delivered mid-July
 - AERB approach on Aug. 9, 2012

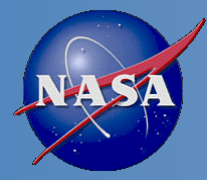


FY-12 Accomplishments (2/4)

Response to DR's



Date	Update/DR#	Reason	Completed
Nov. 2010	4068 & 4079	Precip flag is out of date	In-work
Dec. 2010	4090 (same as 4045)	Derivatives w.r.t. emissivity	Cancelled
Feb. 2011	4207 & 4208	Interpolation of AVTP/AVMP is incorrect, bottom layer missing	Have not confirmed that this is a real problem
Mar. 2011	4233	Surface pressure has Gaussian Noise (for simulation)	Completed and closed
Mar. 2011	4234	State.2 (increased spatial resol.)	Deferred to J1
Aug. 2011	4325	ATMS bias correction	Proposed for Mx6.3
Aug. 2011	4334	CrIS bias correction	Code complete (Mx5.0), LUT update proposed for Mx6.3
Aug. 2011	4335	Updates of post-launch LUTs	OSS (both IR and MW) completed in Mx5.3, emissivity covariance LUT proposed for Mx6.3
Sep. 2011	4346	Pressure inconsistencies at TOA	Closed
Sep. 2012	(to be submitted)	Code bug: non-LTE indexing	Causes rejection in daytime

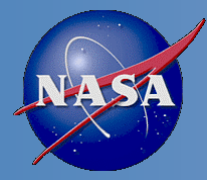


FY12 Accomplishments (3/4)

External communications (1/2)



- Periodic telecon's with team
 - Now moving towards bi-weekly “validation” telecon with entire team
 - Also have internal STAR/LaRC/NGAS bi-weekly “algorithm” telecon
- Monthly/Quarterly STAR reports
 - Full team reports are now provided quarterly.
- STAR Weekly
 - Many intermediate analyses were summarized.
- NASA Souder Science Meeting (Nov. 2011)
 - Chaired session on Weather Forecasting (Barnet, Boukabara)
 - Participated in NPP session (Barnet, Divakarla, Gambacorta)
- AMS Annual Meeting (Jan. 2012)
 - Nalli (2-oral, 1-poster), Divakarla (1-oral), Jun Li (1-oral), Knuteson (2-poster)
- 18th International TOVS Study Conf. (Mar. 2012)
 - Reale (1-oral), Gambacorta (1-oral), Li (1-oral), Collard (1-oral)
- 4th GCOS Reference Upper Air Network (GRUAN) International Coordination Meeting (ICM-4) in Tokyo (Mar. 2012)
 - Reale (1-oral) – included discussions to utilize GRUAN sites for NPP validation

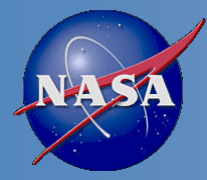


FY12 Accomplishments (4/4)

External communications (2/2)



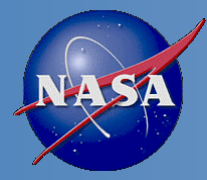
- Algorithm tutorial successfully held April 17-19 2012, at Aimen's Building, Camp Springs
 - STAR, LaRC, NGAS team members
 - PEATE, GSFC, DPA participation
- Participated in NPP science workshop (May 10-11, 2012)
- IGARSS (July 22-27, 2012) presentations
 - From STAR: Nalli, Divakarla
 - NOTE: Divakarla's travel funds pulled at last minute, presented by Nalli)
 - Also Xu Liu (LaRC)
- Supported JCSDA summer colloquium in Santa Fe, New Mexico, Jan. 31-Aug. 1 (2 lectures on theory)
- Held TIM with AWIPS-II staff (Aug. 14, 2012)



Scientific Advancements (1/2)



- Supported discussions and decisions for full spectral resolution with CrIS
 - Worked with Jim Jung (JCSDA) to build NWP justification of CrIS MW channels for upper troposphere/ lower stratospheric moisture sounding
- Supported discussions and pending decisions for requirements for CrIMSS EDR horizontal cell size requirements
- Analysis of maximum separation of ATMS/CrIS
 - Ran a AIRS + ATMS retrieval within NUCAPS system with 0 to 45 minutes delay between Aqua and NPP – no sensitivity was noted in global statistic
 - NOTE: demonstrates flexibility and robustness of NUCAPS
 - 2nd analysis used ECMWF analysis (separated by 6h) to determine when changes should begin to impact performance
 - Determine that a small number of scenes are impacted at 12 minutes for AVTP and 2 minutes for AVMP
 - Given that most useful retrievals are in evolving meteorology this result suggests synchronization is important for ATMS+CrIS
 - Also demonstrates that use of ECMWF (or radiosondes) for validation must be done with care in evolving meteorology.
 - Full discussion in July 3, 2012 weekly

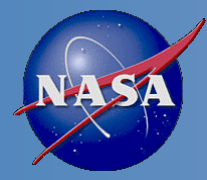


Scientific Advancements (2/2)

(Published papers related to CrIMSS EDR)



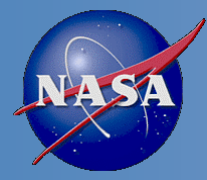
- Gambacorta, A. and C. Barnet 2012. Methodology and information content of the NOAA NESDIS operational channel selection for the Cross-Track Infrared Sounder (CrIS). IEEE TGARS, In-Press, June 2012
 - Discusses methodology of selection of CrIS channels sent to NWP centers
 - More details in published NOAA Technical Report v.133
- Maddy, E.S., S. DeSouza-Machado, N.R. Nalli, C.D. Barnet, L.L. Strow, W.W. Wolf, H. Xie, A. Gambacorta, T.S. King, E. Joseph, V. Morris, S.E. Hannon and P. Schou 2012. On the effect of dust aerosols on AIRS and IASI operational level 2 products. Geophys. Res. Lett. v.39 L10809 doi:10.1029/2012GL052070, 5 pgs.
 - Direct result of analysis of AEROSE data
- Nalli, N.R., C.D. Barnet, E.S. Maddy and A. Gambacorta 2012. On the angular effect of residual clouds and aerosols in clear-sky infrared window radiance observations: Sensitivity analyses. J. Geophys. Res. v.117 D12208 doi:10.1029/2012JD017667, 19 pgs.
 - Direct result of analysis of AEROSE data
- Reale, T., B. Sun, F.H. Tilley and M. Pettey 2012. The NOAA Products Validation System (NPROVS). J. Atmos. Oceanic Tech. v.29 p.629-645.
 - Demonstration of the NOAA CrIMSS EDR validation system
- Nalli, N., Joseph, E., Morris, V.R., Barnet, C.D., Wolf, W.W., Wolfe, D., Minnett, P.J., Szczodrak, M., Izaquirre, M.A., Lumpkin, R., Xie, H, Smirnov, A., King, T.S., Wei, J. 2011. Multi-year observations of the tropical Atlantic atmosphere: Multidisciplinary applications of the NOAA Aerosols and Ocean Science Expeditions (AEROSE). Bull. Amer. Meteor. Soc. v.92, p.765-789 doi:10.1175/2011BAMS52997.1 (June 2011 and was cover of that issue)



Issues, Challenges, Setbacks (1/3)



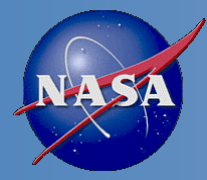
- Activation of CrIS was delayed by 42 days
 - Focused on ATMS preparations and validation, no schedule slip.
- Lack of viable contract vehicle for FY12 funds required “stretching” 9 month FY11 budget 4 extra months
 - Did not hire algorithm support staff.
 - Bridge contract vehicle was more expensive.
- FY12 funds were reduced (9 month PoP, 5% cut) and FY13 funds were reduced by 20%
 - 20% reduction of funds for STAR for FY13 w.r.t. baseline (18.4% w.r.t. full-year FY12)
 - Had to remove 2 team members for FY13 (Larar, Li)
 - Held other external members at 100%
 - Continued critical reliance on NGAS for algorithm “ownership”
- Good news: validation is going better than anticipated
 - Overall, no impact to maturity schedule
- Bad news: there is zero margin in CrIMSS EDR budget.



Issues, Challenges, Setbacks (2/3)



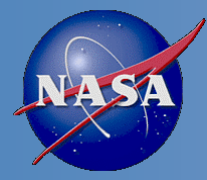
- Constraints on making changes to IDPS makes meeting maturity milestones difficult
 - Raytheon TPI test (45 day dry-run July 30-Sep.12, 90-day from mid-Oct to mid-Jan)
 - Mx6.3 active on Oct 10, 2012 (CCR's in late July)
 - Mx6.4/7.0 active NET Feb. 2013 (CCR's due in mid.Nov)
 - Windows for IDPS changes do not dovetail with maturity schedule
 - Provisional maturity scheduled for Dec. 2012
 - IDPS will be running Mx6.3, a post-beta configuration
 - Most changes for provisional justification will only be functional in the offline code and will be operation in IDPS with Mx6.4/7.0.
 - Stage.1 maturity scheduled for June 2013, will most likely be based on provisional configuration
 - Again, we expect IDPS to lag the off-line system.
 - Does not allow a step-wise approach of implementation and testing
 - many changes have to be made simultaneously without ability to test the interaction
 - Complicates the interaction and validation of changes to upstream SDRs



Issues, Challenges, Setbacks (3/3)



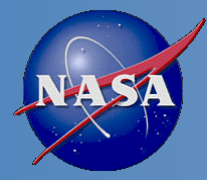
- AEROSE Campaign was underway ... but
 - While in dry dock earlier this year the Ronald H. Brown had one of its two propulsion systems replaced
 - Inspector showed up in Bermuda, and upon inspecting the propulsion systems, issued a formal assessment that the original one was at risk for failure within the next 30 days
 - Unfortunately the entire scientific party and their equipment were already in Bermuda
 - Mission was scrubbed.
- PNE cruise (and AEROSE campaign) is tentatively rescheduled for the January 2013 time frame



Changes in Strategy (due to funding constraints)



- Original BOE requested +4 FTE to handle algorithm lead activities
 - With budget cuts and POP stretching we effectively have had zero algorithm lead support to date
 - Expect to hire +1.5 FTE soon and do not expect future growth.
 - Delay working with ADL (continue to use off-line code)
 - Rely on Northrop Grumman staff for algorithm experience
 - Rely on LaRC staff for off-line code support
 - As cal/val activity rolls down in FY13/14 will move staff from cal/val to algorithm lead activities to maintain “flat” budget.
 - Mostly “treading water”
 - Will not be able to fully become “owners” of LUTs
- FY13 cuts means the loss of some CrIMSS EDR validation activities.
 - Now there is no direct connection between aircraft campaigns (when/if they exist) and CrIMSS EDR (Larar funding)
 - Investigation of CrIMSS EDR performance as a function of cloud type and scene classifications is terminated (Li funding)
 - Comparison of CrIMSS EDR cloud cleared radiances w.r.t. VIIRS is terminated (Li funding)

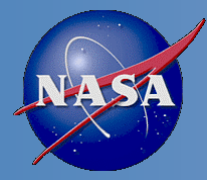


FY-12/13 Schedule and Milestones

(NOTE: FY12 funds start Oct.1, 2012 and go through June 2013)



- October to December, 2012
 - Get exact match between off-line code and on-line IDPS code
 - Submit CCRs for changes required for provisional maturity
 - Preliminary comparison to ARM radiosondes
 - Dec. 2012 milestone: submit justification for *provisional* maturity.
- January to June 2013
 - Support AEROSE field campaign (rescheduled from Aug. 2012)
 - Feb. 2013 Milestone – have stage.1 validated NUCAPS running operationally within NDE
 - Detailed comparison to all dedicated radiosondes (ARM + Aerospace + GRUAN)
 - Code changes for stage.1 system running in off-line code
 - June 2013 Milestone – submit justification for *validated stage 1* CrIMSS EDR
- Summer 2013
 - Support AEROSE (tentatively late-Aug) campaign to obtain RAOB's
 - Dec 2013 Milestone: submit justification for *validated stage 2* CrIMSS EDR

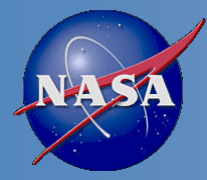


Path Forward (FY-13 thru FY-17)

(assume "FYxx" runs from Apr 1, 20xx to Mar. 31, 20xx+1)



	NPP	JPSS J1
FY12	L+14m (12/2012) deliver EDR matrix evaluation report based on provisional SDR (provisional EDR) Support ICV	
FY13	L+19m (6/2013) deliver EDR matrix evaluation based on validated SDR (stage 1 validated EDR) Support ICV (through 5/2013) L+26m (12/2013) deliver EDR matrix evaluation based on multi-year analysis (stage 2 validated EDR)	Recommendations for algorithm modifications for J1
FY14	L+38m (12/2014) deliver EDR matrix evaluation based on multi-year analysis (stage 3 validated EDR) Support LTM	
FY15	Support scientific evaluation <ol style="list-style-type: none"> Higher spatial resolution retrievals modifications for trace gases and long-term stability of AVTP and AVMP 	Launch readiness - begin simulation of J1 instrument using proxy and/or NPP products (i.e., test instrument calibration changes).
FY16		≥ 1/2017 assumed launch of J1 L+55 days support intensive campaign Use NPP products to support J1 SDR valid
FY17	Detail study overlap timeframes of NPP-J1	Detail study overlap timeframes of NPP-J1



Summary



- Entire team has worked to make operational EDR functional and improve performance
 - Empirical bias corrections added (Mx6.3)
 - Many modifications were implemented and tested
 - Emissivity constraint modified (Mx6.3)
 - Number of other changes proposed for provisional maturity
- AEROSE campaign has been postponed to Jan. 2013
- FY13 focus is on detailed characterization of CrIMSS EDR products using primary *in-situ* datasets (dedicated RAOBs from ARM and Aerospace for provisional and stage.1 validated maturity.
 - Many algorithm bug fixes and enhancements have already been tested in off-line codes.