Land / cryosphere breakout
Summary on land discussion

Ivan Csiszar
NOAA/NESDIS/STAR

see individual credits on select slides

Principal questions

- Is transition to enterprise processing on track?
  - science, format, dependencies
  - transition to “true” enterprise products
    - GOES-R, non-NOAA / foreign satellites
- Are we ready for reprocessing?
  - product-specific requirements
- Are the products ready to use? Are they used?
  - true operational applications
    - process for implementing operational use
    - demonstrated potential and impacts

Agenda (am)

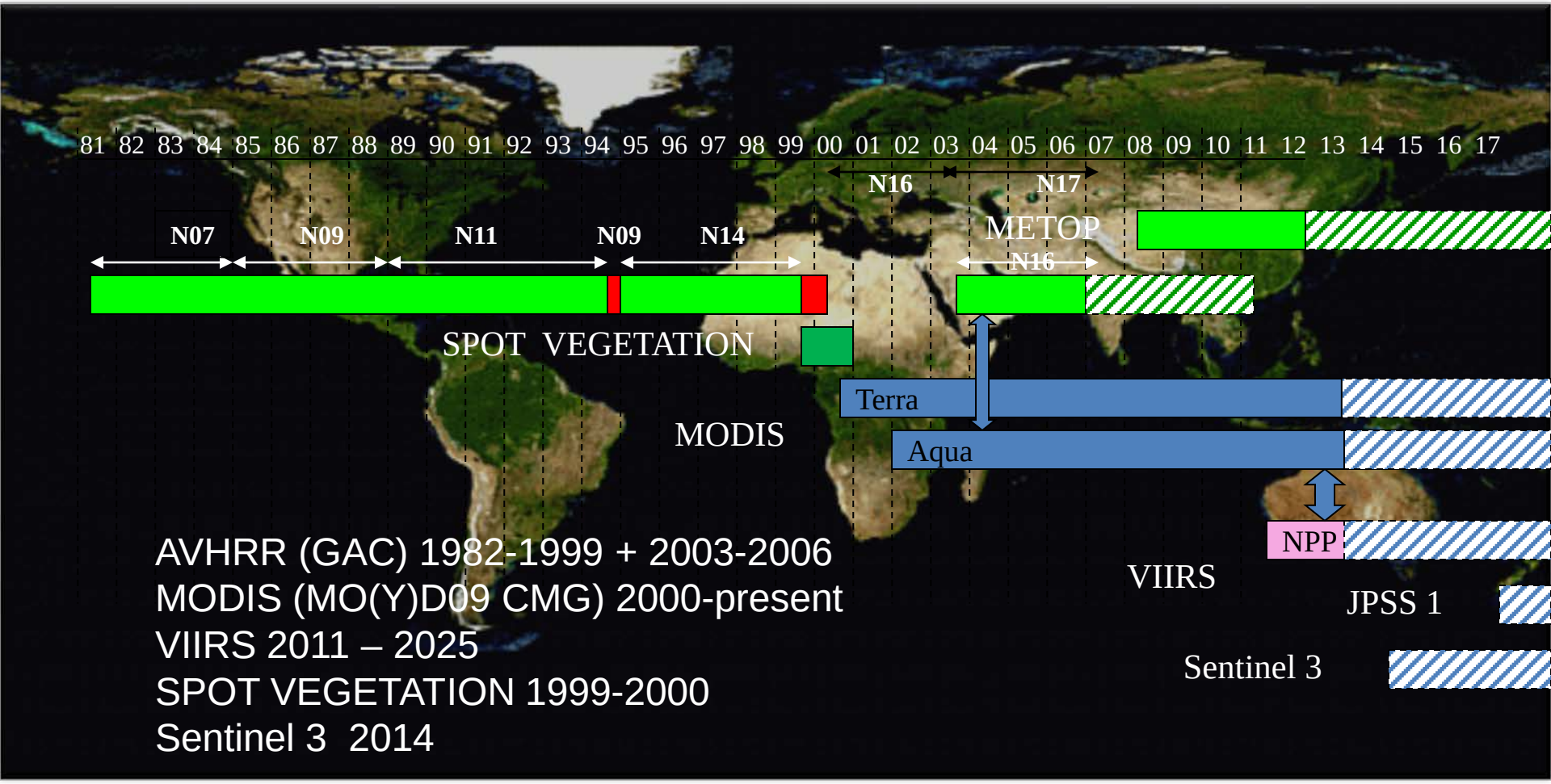
0830 – 0850	***Introduction and welcome***	Ivan Csiszar
0850 – 0910	***Surface reflectance***	Eric Vermote
0910 – 0930	***Terrestrial biophysical product suite***	Marco Vargas
0930 – 0950	***Land surface albedo***	Yunyue (Bob) Yu
0950 – 1010	***Land surface temperature***	Yunyue (Bob) Yu
1010 – 1030	***Break***	
1030 – 1050	***Active fire***	Ivan Csiszar
1050 – 1110	***Surface type***	Xiwu (Jerry) Zhan
1110 – 1130	***Binary snow cover and snow fraction***	Peter Romanov
1130 – 1150	***Sea ice surface temperature***	Mark Tschudi
1150 – 1210	***Sea ice concentration***	Jeff Key
1210 – 1230	***Sea ice characterization and thickness***	Jeff Key

Agenda (pm)

1330 - 1350	***Enterprise system status***	Ivan Csiszar
1350 – 1410	***Suomi NPP reprocessing status***	Jason Choi
1410 – 1430	***NASA Science Team***	Miguel Román
1430 – 1450	***CEOS Land Product Validation***	Miguel Román
1450 – 1510	***Land product characterization system***	Gregory Stensaas
1510 – 1530	***Break / poster session***	
1530 – 1550	***Vegetation Health Applications***	Wei Guo
1550 – 1610	***NCEP Land Applications***	Mike Ek
1610 – 1630	***National Ice Center Applications***	Pablo C. Colón
1630 – 1650	***Open discussion and wrap-up***	

A Land Climate Data Record

Multi instrument/Multi sensor Science Quality Data Records used to quantify trends and changes



Emphasis on data consistency – characterization rather than degrading/smoothing the data

NDE S-NPP VIIRS GVF Validation (1/3)

Home GVF

JPSS VIIRS Green Vegetation Fraction

Data Sources:
- VIIRS
- AVHRR
- VIIRS-AVHRR

Data Sets:
- GVF
- Surface Type
- Climatology

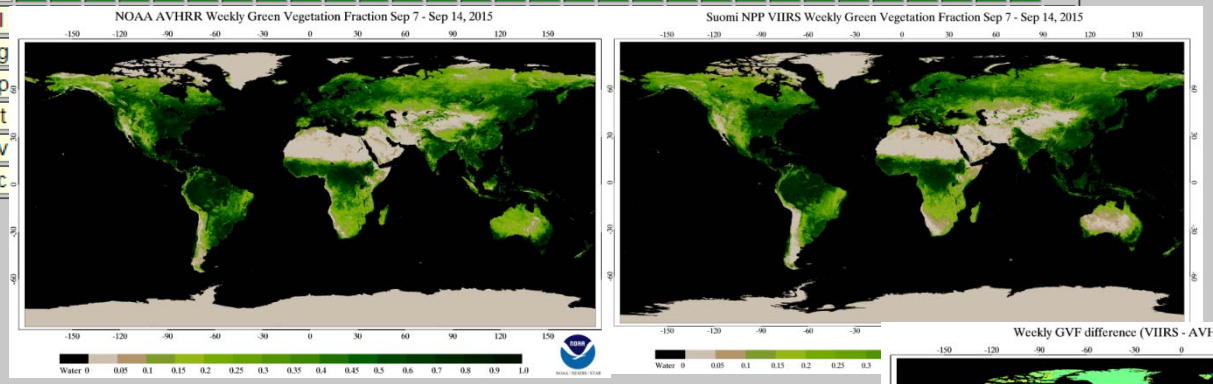
Compositing:
- Daily Rolling Weekly

Analysis:
- Availability Tables
- Maps

Date: dd 08 mm 08 yyyy 2016

VIIRS | Year 2016

M\D	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Jan	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Feb	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Mar	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Apr	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
May	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Jun	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Jul																															
Aug																															
Sep																															
Oct																															
Nov																															
Dec																															



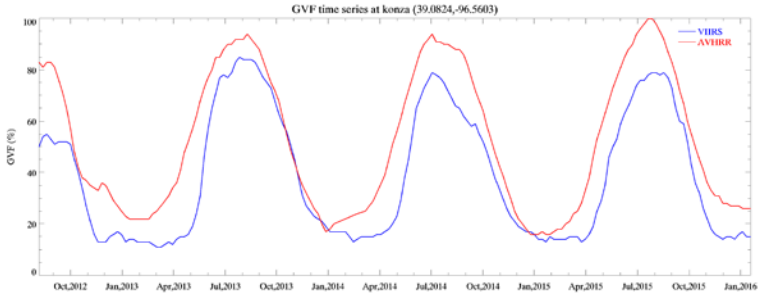
http://www.star.nesdis.noaa.gov/smcd/viirs_vi/gvf/gvf.htm

M. Vargas, STAR

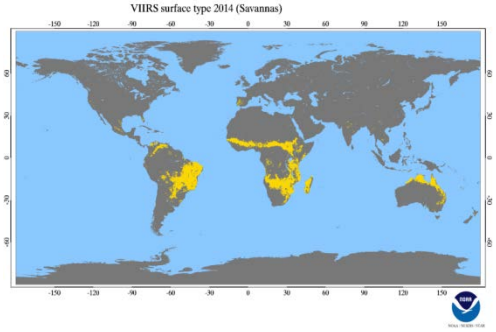
NDE S-NPP VIIRS GVF Validation (2/3)

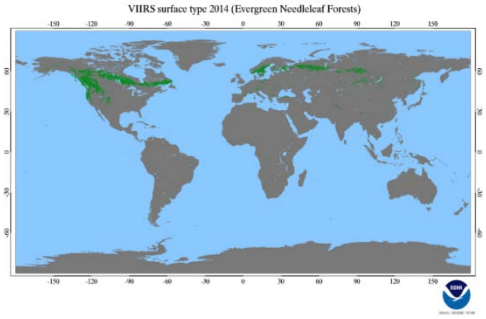
GVF Time Series and Correlative Analysis Between VIIRS and AVHR

GVF Temporal Trajectories VIIRS vs. AVHRR Konza Validation Site

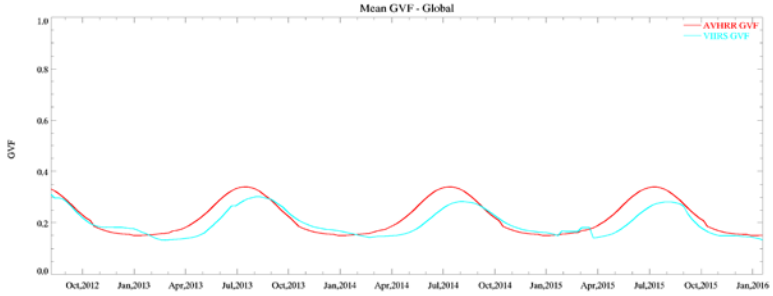


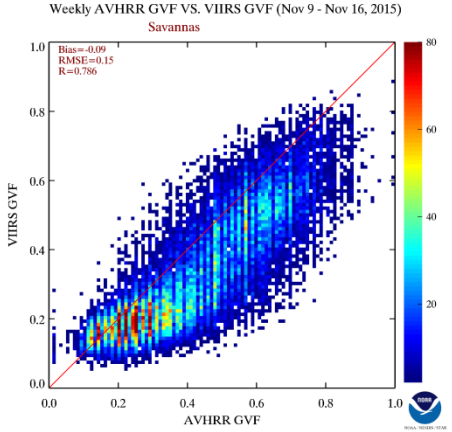
GVF Comparison by Surface Type VIIRS vs. AVHRR

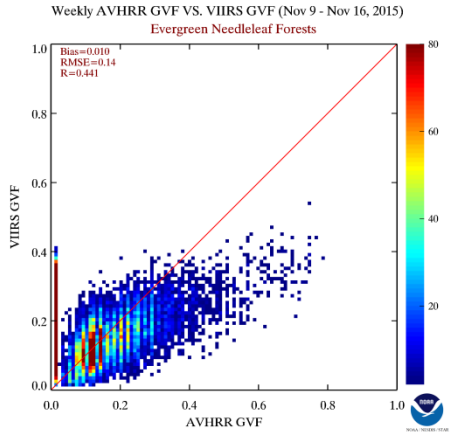




Global GVF Temporal Trajectories VIIRS vs. AVHRR



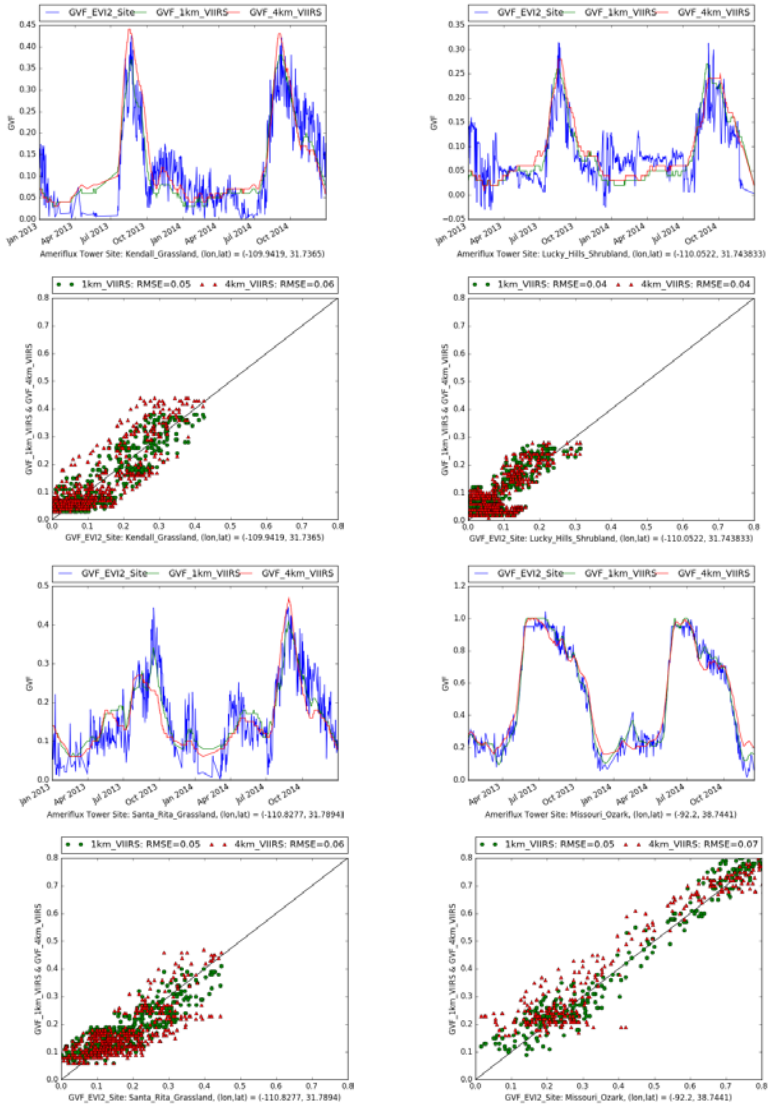




M. Vargas, STAR

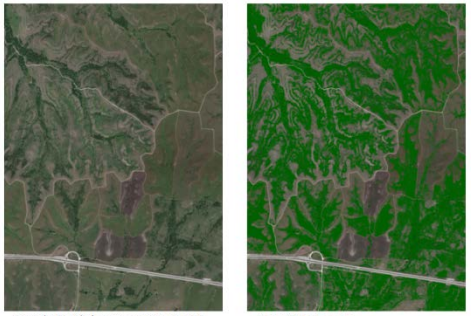
NDE S-NPP VIIRS GVF Validation (3/3)

GVF Time Series Inter-Comparison Using In Situ Networks



Comparison Between VIIRS GVF and Google Earth GVF

Konza

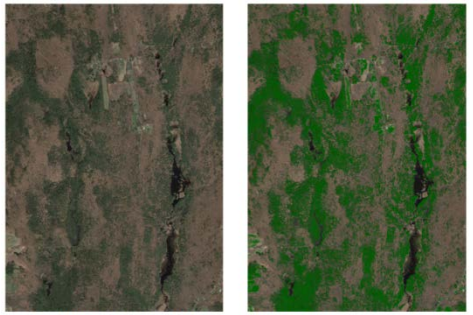


Google Earth image over a 0.036-degree VIIRS GVF pixel (8/13/2014)

Classified image (green vegetation: green)

Google Earth GVF= 0.44
VIIRS GVF= 0.55

Harvard Forest

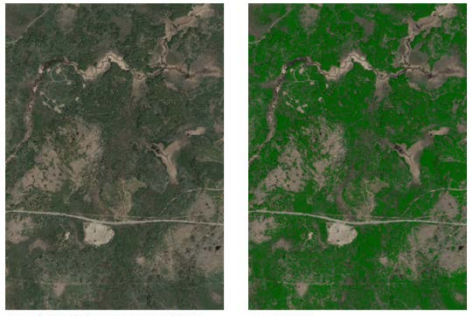


Google Earth image over a 0.036-degree VIIRS GVF pixel (4/27/2016)

Classified image (green vegetation: green)

Google Earth GVF= 0.26
VIIRS GVF= 0.34

Park Falls

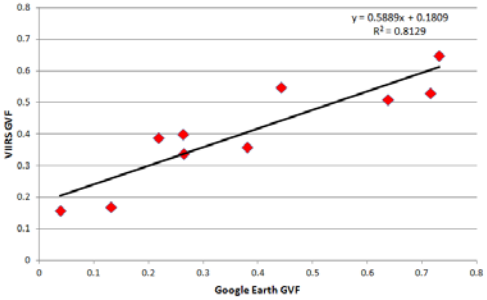


Google Earth image over a 0.036-degree VIIRS GVF pixel (5/10/2013)

Classified image (green vegetation: green)

Google Earth GVF= 0.38
VIIRS GVF= 0.36

Scatter Plot
VIIRS GVF vs. Google Earth GVF



M. Vargas, STAR

Land surface albedo summary

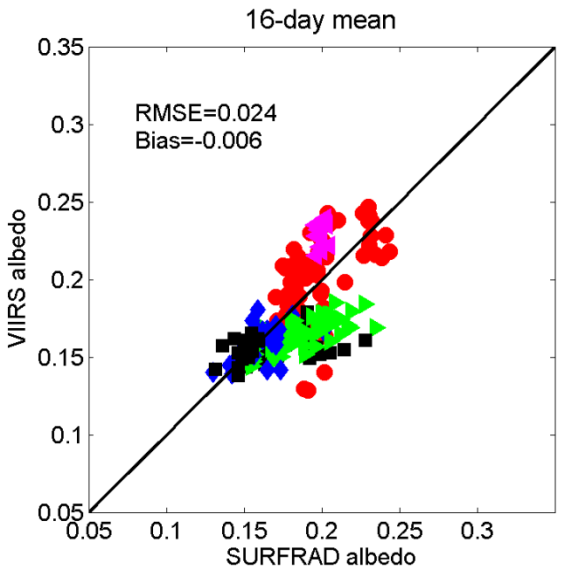
- Land surface albedo is the ratio between outgoing and incoming shortwave radiation at the Earth surface. It is an essential component of the Earth's surface radiation budget. LSA is part of VIIRS Surface Albedo Environmental Data Record (EDR).
- After three updates of LUTs of regression coefficients since launch, **quality of LSA retrievals have been significantly improved**.
- Accuracy of the current non-snow LSA retrievals are smaller than the L1RD threshold. The performance of snow LSA is also comparable (slightly better) than the existing albedo product, although RMSE of current snow retrievals are greater than the precision requirement.
- Current IDPS product contains data gaps/missing values due to cloud coverage. Meanwhile, the albedo retrieved from a single observation may contain some levels of random noises. Daily noise-reduced, no-gap albedo product is required by user.
- **An improved enterprise albedo algorithm is currently under development** to address these issues.

Albedo product performance

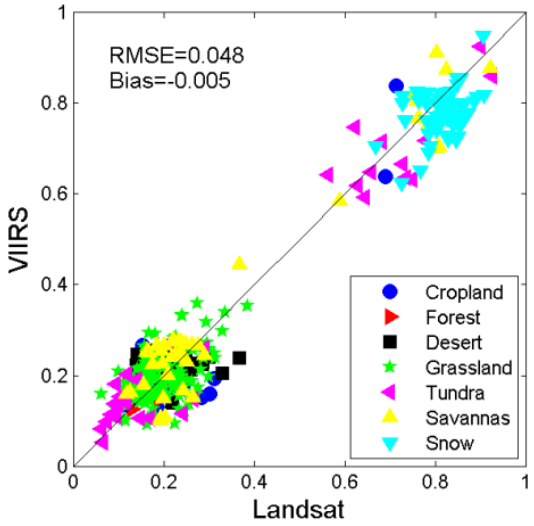
VIIRS Surface albedo EDR is a full resolution granule instantaneous product. LSA is only generated for clear-sky land pixels.

Product	L1RDS APU Thresholds	Performance
VIIRS LSA	Precision: 0.05	RMSE: 0.05
VIIRS LSA	Accuracy: 0.08	Bias: 0.01

- Comprehensive evaluation was conducted using field measurements and high-resolution LSA reference maps
- The current LSA data can well meet the requirements for snow-free cases.



Left: Comparison of snow free albedo with SURFRAD measurements.
Right: Validating snow-free and snow albedo using Landsat albedo maps



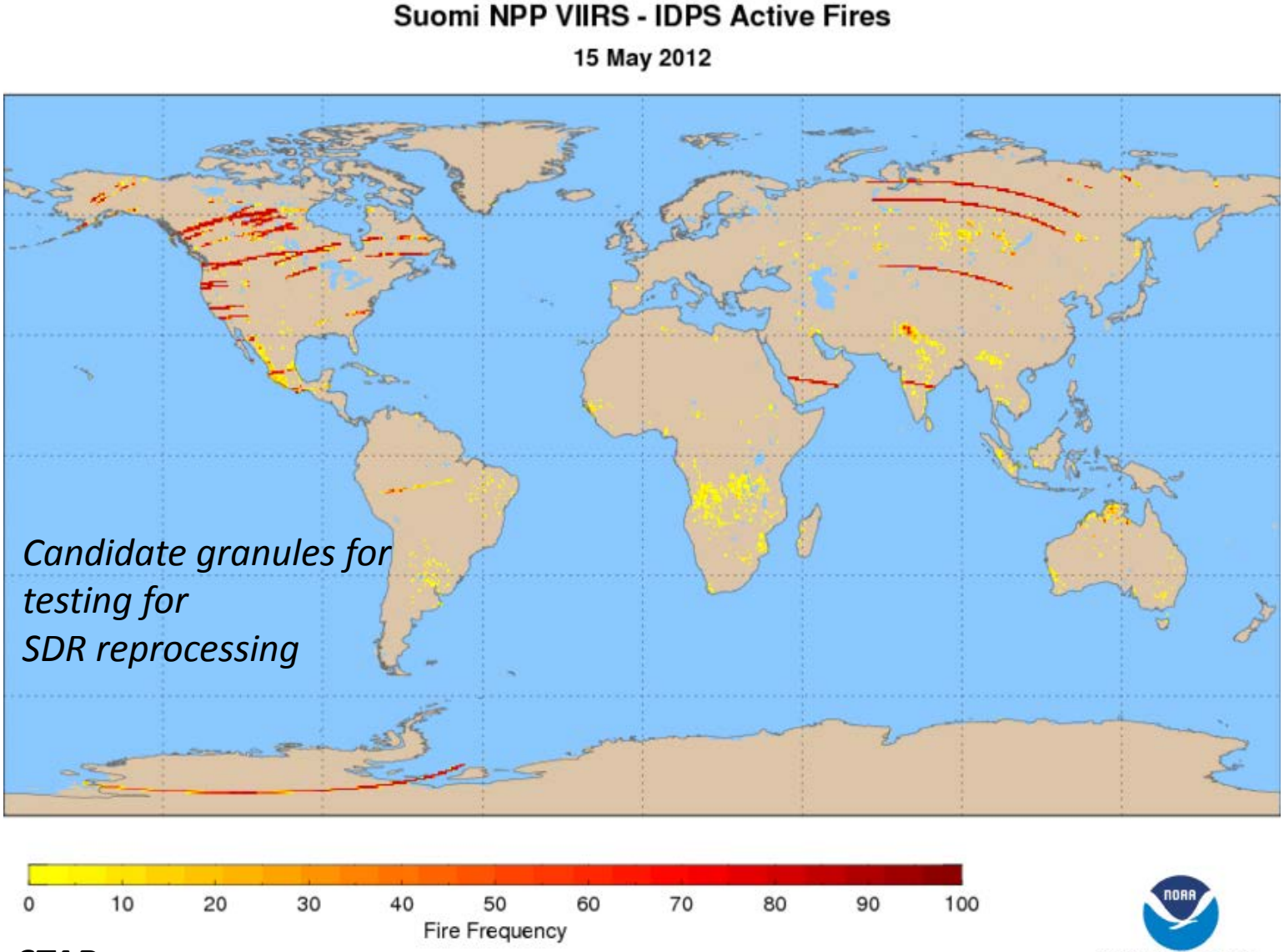
Y. Yu, STAR

Land surface temperature summary

- SNPP LST performance
  - The SNPP LST marginally meets the mission requirements based on the validation result s obtained from
    - Ground based validations(CONUS, Europe, Greenland, Australia, China)
    - Radiance based validations over global and four seasons
    - Cross satellite comparisons with MODIS, AATSR, SEVIRI etc.
  - Validation tools are run regularly for routing monitoring and web info update
  - Working with EMC/NCEP for the model verification
  - Suspicious High LSTs observed in Australia in Summer time; lack of in-situ data available for deep-dive validation
  - Cloud contamination is still the issue for accurate validation .
- Enterprise LST algorithm progress
  - Emissivity explicit algorithm developed and tested
  - Emissivity estimation algorithm is developed and tested
  - NDE LST production system is in development
- Reprocessing status
  - A reprocessing plan is proposed
  - Enterprise algorithm will be used for the reprocessing for LST consistency
- JPSS-1 readiness
  - All the validation tools and simulation tools/database are ready for the J-1 mission
  - J-1 LST production in NDE will be based on the Enterprise Algorithm
  - The J-1 Cal/Val plan has been submitted, with the schedule and milestones consistent to the mission's plan

Y. Yu, STAR

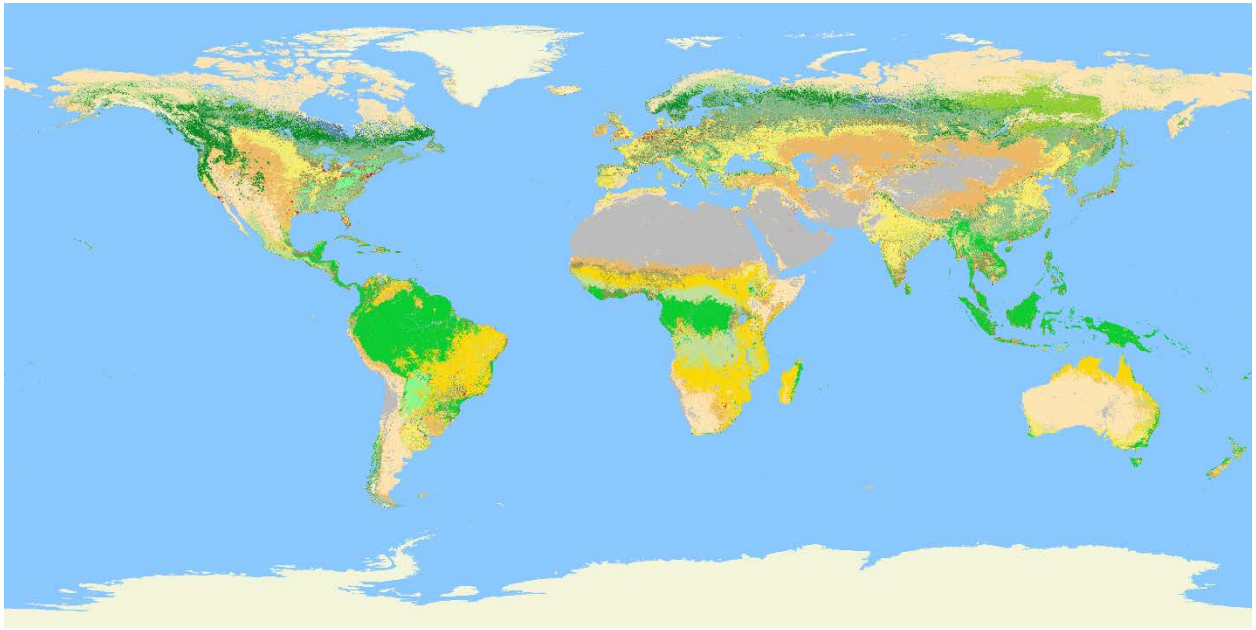
Active fire data anomalies during the early period of the Suomi NPP data record



I. Csiszar, STAR

Surface Type Products Overview

- New global surface type map using 2014 VIIRS data was generated.



Eastern Africa

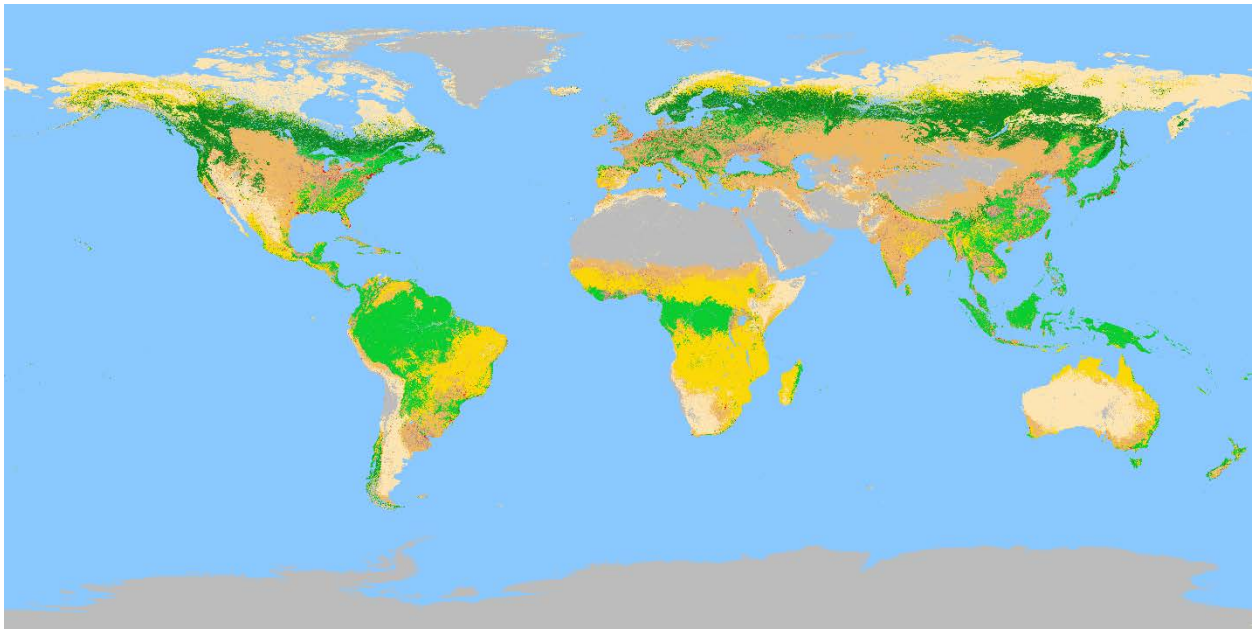
Canada

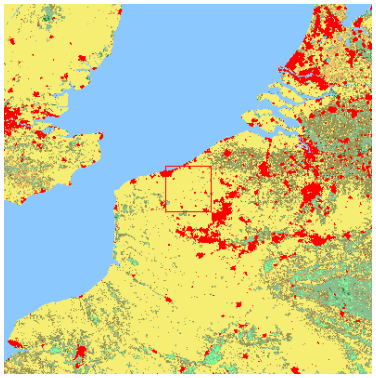
While the overall classification accuracy (~78%) of the new map is similar to 2012 delivery, some accuracy improvements are observed, such as croplands. The images shown left demonstrate two examples of the improved cropland mapping results, where the old version presented wrong type labels. Google images verified the mapping results.

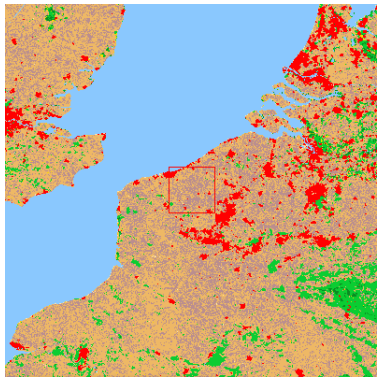
X. Zhan, STAR; C. Huang, UMD

Surface Type Products Overview

New global surface type map in biome classification types to support LAI/FPAR and other studies







Europe

The biome scheme surface type map was generated using a IGBP-biome LUT plus a second SVM classification to further separate cereal crops and broadleaf crops. Validation in progress. The two images shown left is an example of crop mapping result in IGBP and biome legends. Cereal and broadleaf croplands are further separated in biome ST map.

X. Zhan, STAR; C. Huang, UMD

Daily Surface Type Product

- Rapid surface changes can be caused by many events:
  - Flooding, severe drought, snow storm, fire, large scale deforestation
- These changes cannot be captured by the annual GST product
- A suite of daily products or change indicator products are needed to capture such rapid changes
  - Can build on the original ST-EDR concept
  - Where available, use existing VIIRS products (e.g., Snow, Fire, vegetation cover)
    - Better temporal consistency needed to allow change detection
    - For fire, post fire surface type information needs to be derived
  - Some changes require new products, e.g.:
    - Daily surface inundation needed to capture surface changes due to flooding and flood receding
    - Sub-annual tree cover data needed to capture deforestation

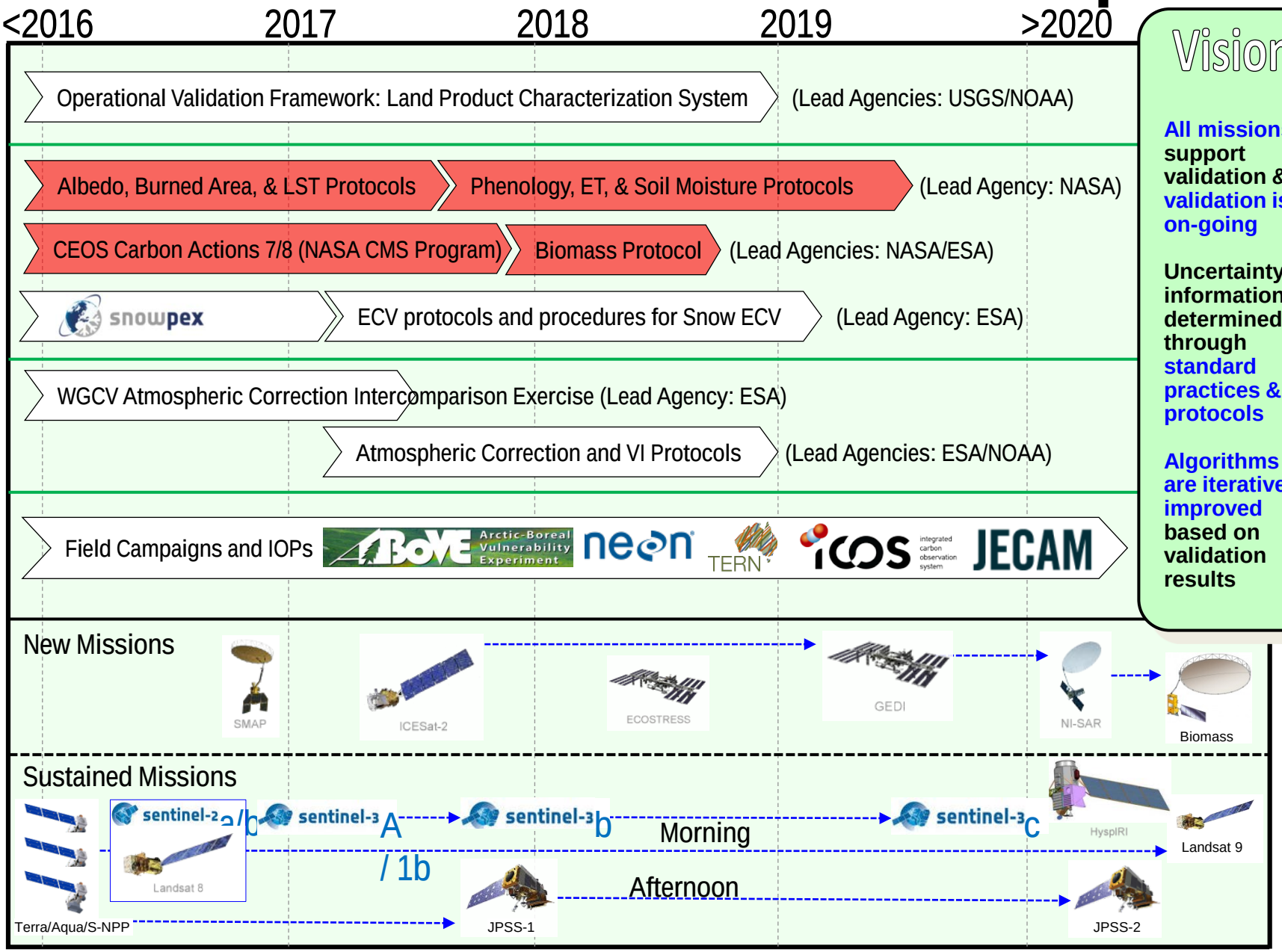
X. Zhan, STAR; C. Huang, UMD

NASA Land SIPS: Code Delivery and Integration Status

Land SIPS Products	Algorithms Delivered to Land SIPS	Product Integration and Testing	Draft ATBD Delivery	Delivery of User's Guide	Products Delivered to assigned DAAC
Surface Reflectance	✓	✓	✓	✓	Summer, 2016
LAI/FPAR	Underway	Underway	Summer, 2016	Summer, 2016	Fall, 2016
Snow Products	Underway	Underway	✓	Fall, 2016	Fall, 2016
MAIAC	Summer, 2016	Pending	Fall, 2016	Fall, 2016	Fall, 2016
BRDF/Albedo	Underway	Underway	✓	Summer, 2016	Fall, 2016
Burned Area	Fall, 2016	Pending	Spring, 2017	Spring, 2017	Spring, 2017
Active Fires	Underway	Underway	Spring, 2016	Fall, 2016	Fall, 2016
Vegetation Index	✓	Pending	Summer, 2016	Summer, 2016	Fall, 2016
LST&E	Underway	Pending	✓	Fall, 2016	Fall, 2016
Ice Products	Fall, 2016	Pending	✓	Fall, 2016	Fall, 2016
Phenology	Fall, 2016	Pending	Fall, 2016	Fall, 2016	Spring, 2017
Day/Night Band	✓	Underway	Fall, 2016	Fall, 2016	Spring, 2017

M. Román, NASA

CEOS-LPV 5-Year Roadmap



Vision

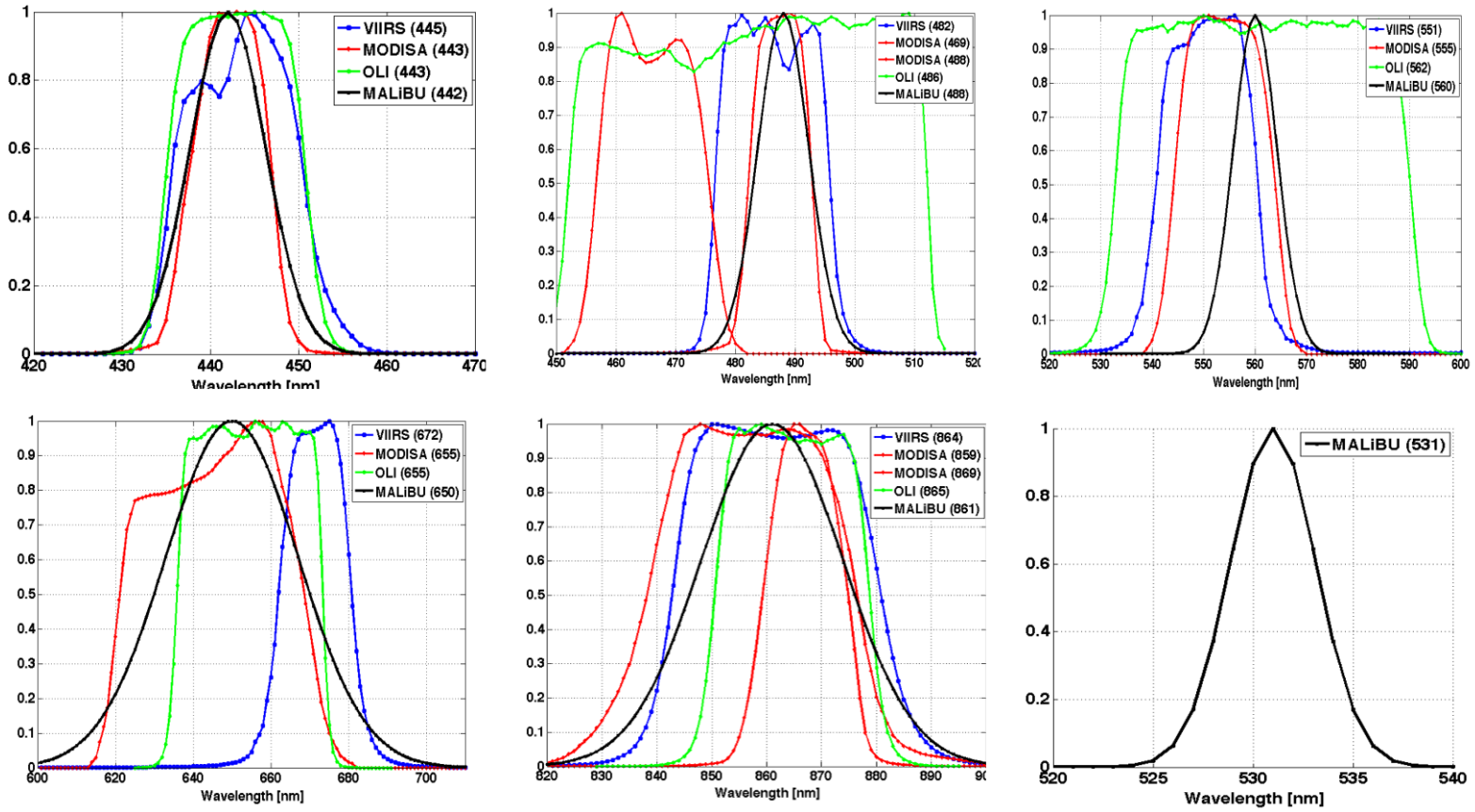
All missions support validation & validation is on-going

Uncertainty information determined through standard practices & protocols

Algorithms are iteratively improved based on validation results

M. Román, NASA

MALIBU Spectral Response



The MALIBU instrument design includes two Tetracam optical units matching the optical Land channels of key Land sensors such as Landsat-8 OLI, Sentinel-2 MSI, Sentinel 3-OLCI, Terra/Aqua MODIS, Terra MISR, and Suomi-NPP/JPSS VIIRS.

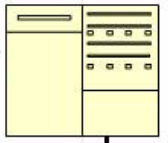
M. Román, NASA

What is LPCS

A web-based system designed for comparative analysis of global satellite higher-level land products.

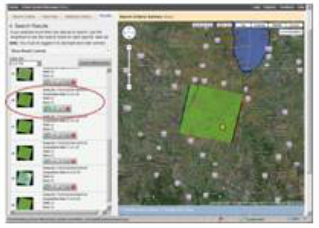
- Inventory & order data
- Advanced processing
- Basic analysis
- Output charts , images, & tables

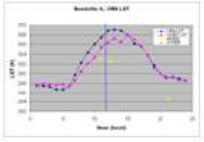
SNPP & JPSS VIIRS
GOES-R ABI
Landsat-7 & -8
MODIS
Sentinel-2 & 3
others..
& In Situ

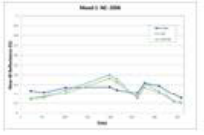


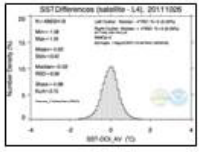
On demand data acquisition
Automated data acquisitions

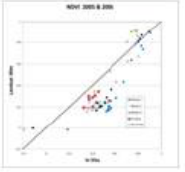
Data and Inventory information stored at EROS.











Land Product Characterization System

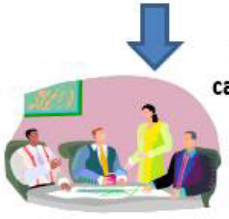
Inventory and ordering of data

Co-register satellite and in situ data

Analysis of satellite and in situ data

Generate statistics, charts and reports

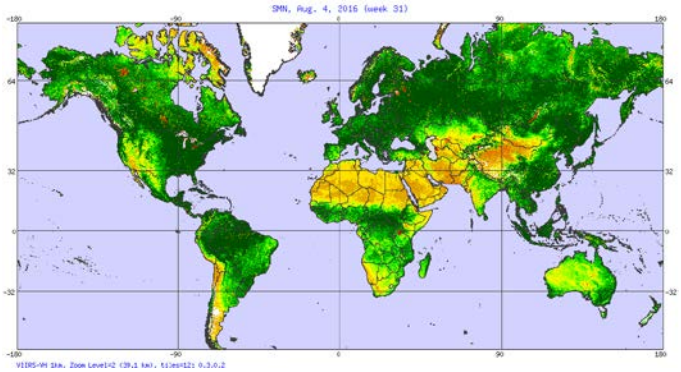
Feedback / Additional Analysis

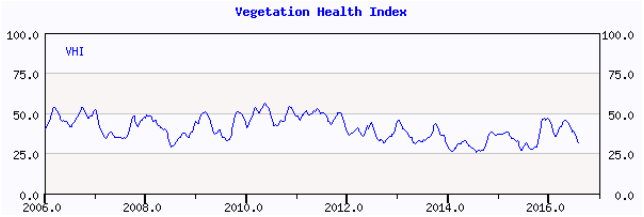


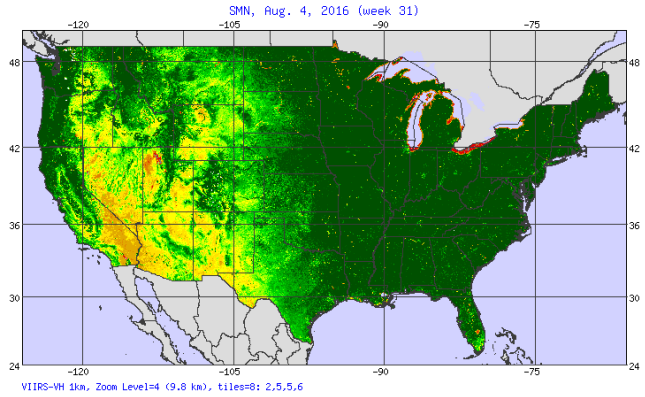
Review by cal/val teams. Product algorithm updates.

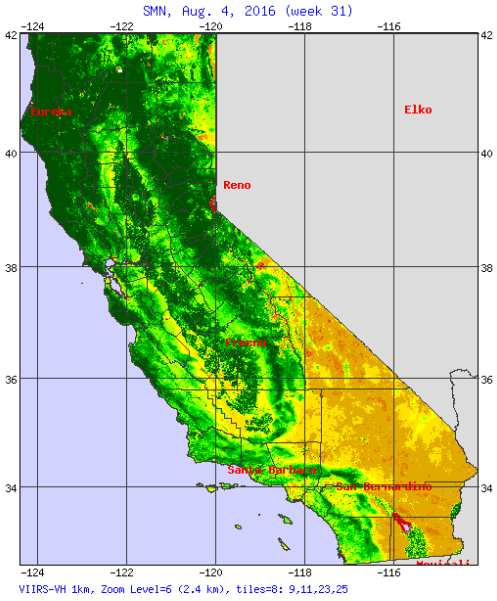
K. Gallo, STAR; G. Stensaas, USGS

Using map tiles technology to present 1km VH data through web pages





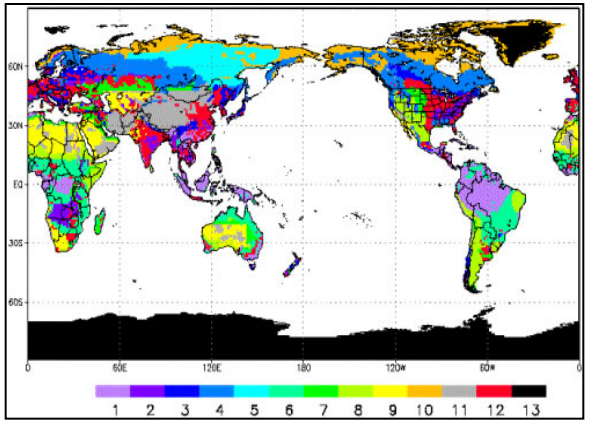




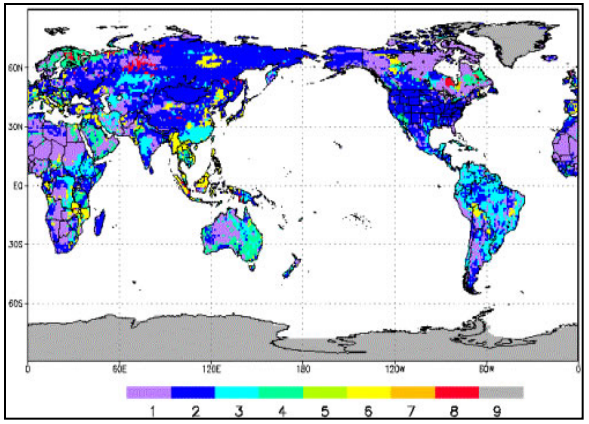
Users access the country and province maps by clicking the web page.

F. Kogan, STAR; W. Guo, IMSG

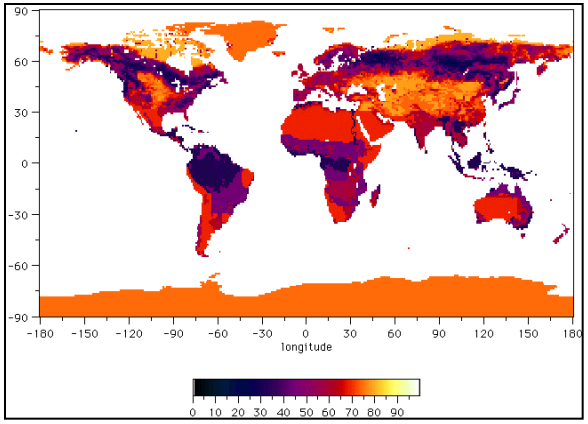
Land Data Sets *(GFS and CFS, GLDAS)*



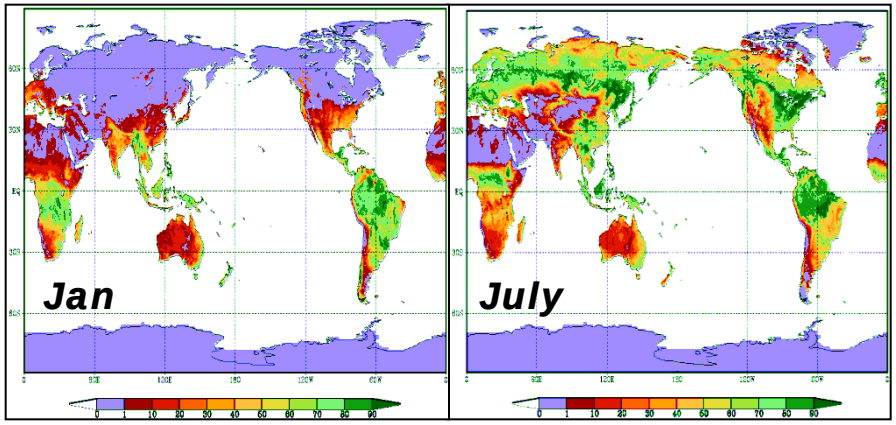
Vegetation Type
(1-deg, UMD)



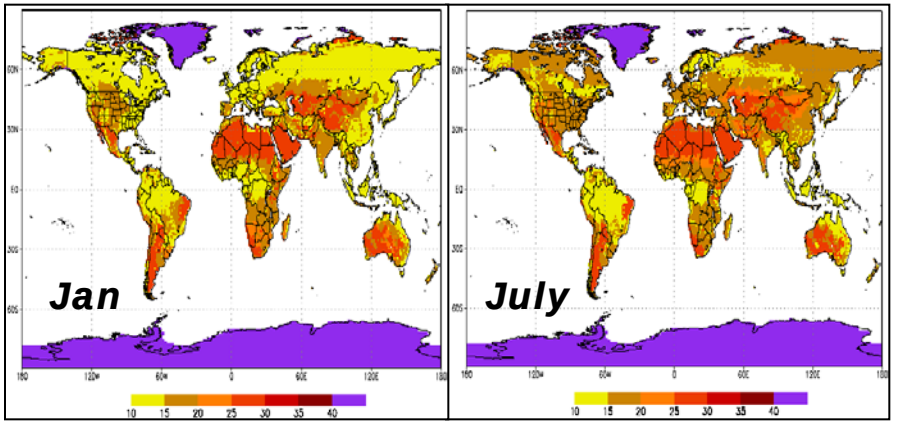
Soil Type
(1-deg, Zobler)



Max.-Snow Albedo
(1-deg, Robinson)



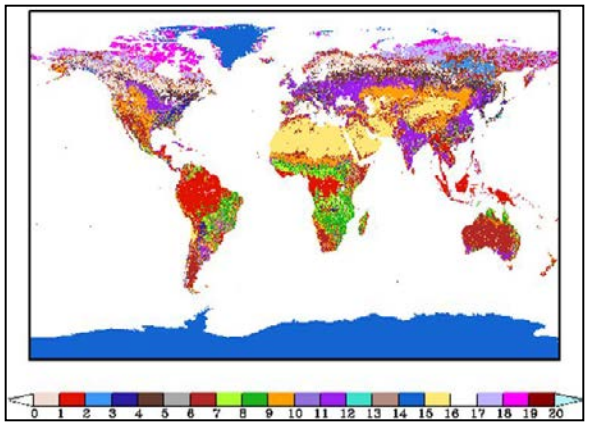
Green Vegetation Fraction
(monthly, 1/8-deg,
NESDIS/AVHRR)



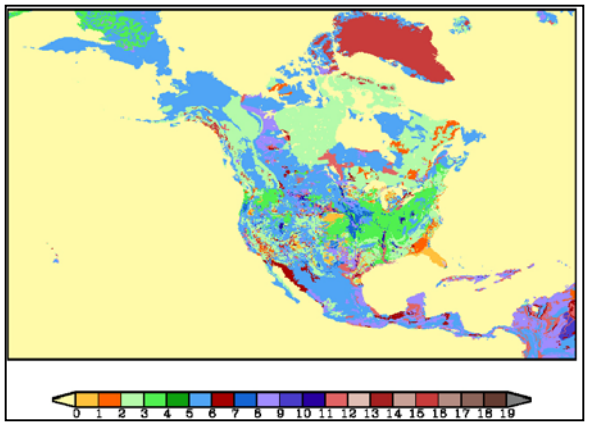
Snow-Free Albedo
(seasonal, 1-deg,
Matthews)

M. Ek, EMC; Y. Wu, IMSG

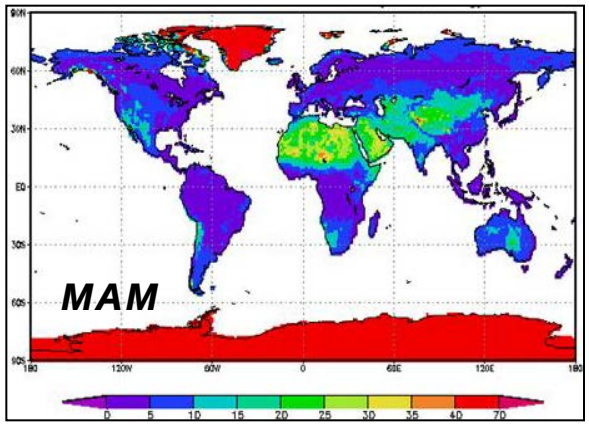
Land Data Sets *(NAM, NLDAS)*



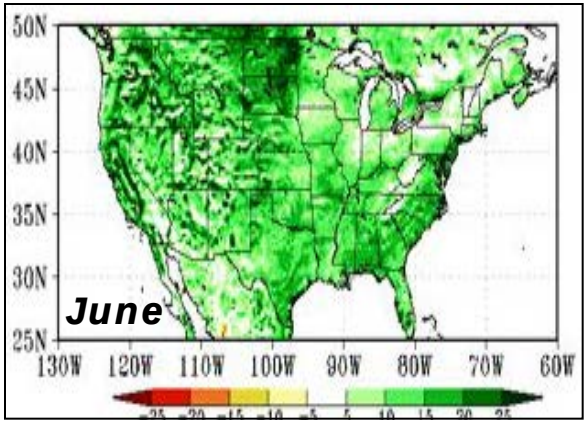
Vegetation Type
(1-km, MODIS)



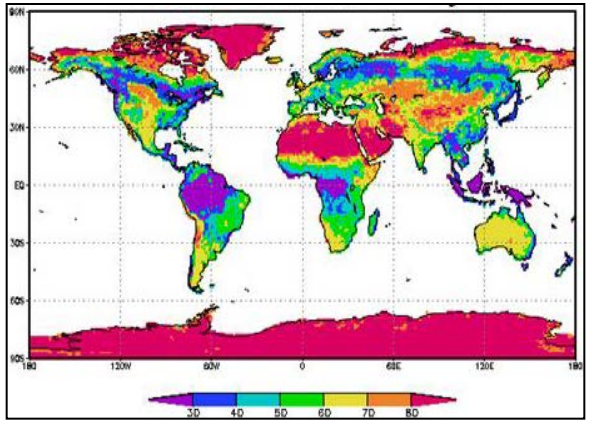
Soil Type
(1-km, STATSGO/FAO)



Snow-Free Albedo
(1-km, MODIS)



Green Vegetation Fraction
(1/8-deg, new NESDIS/AVHRR)



Max.-Snow Albedo
(5-km, MODIS)

M. Ek, EMC; Y. Wu, IMSG

Overarching issues (2/1)

- Enterprise product suite
  - Evolving science and evolving user needs -> requirements
    - I-band / hybrid VIIRS fire product
    - CCR on global gridded products to meet user needs
  - ensure seamless transition to NDE, including dependencies
  - Enterprise Cloud Mask testing
    - science
    - code interface
  - “soft” vs. “strict” definition of Enterprise
    - VIIRS-only in NDE vs. true common algorithm base for multiple sensors
- Reprocessing
  - ensure testing and evaluation
    - define needs and requirements
      - beyond calibration LUTs
    - explicitly test “problem” granules
  - broad interaction to meet all teams’ needs

Overarching issues (2/2)

- Validation
  - further coordination on field campaigns
    - GOES-R, MALIBU
  - increasing involvement of NOAA JPSS (and GOES-R) Science Team members in CEOS LPV
    - product teams
    - Land Product Characterization System (with USGS)
- Interagency / international coordination and collaboration
  - science algorithms / products
  - validation
  - multi-satellite observing systems
    - Mid-morning measurements from polar platforms

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Science Team members

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SPARKS interns

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