

**Land and Atmosphere Near real-time
Capability for EOS (LANCE)
User Working Group (UWG) Meeting**

September 23nd 2014

**Location: Goddard Space Flight Center
(GSFC) Building 32 and WebEx**

Report Date: October 23rd 2014



1. LANCE UWG Members and Attendees

Twelve members of the LANCE User Working Group (UWG), or their designated alternates were in attendance or on the webex. Robert Brakenridge, Nickolay Krotkov, Justin Sherin and Jose Harris did not attend.

Name	Affiliation	Alternate	Email
Arlindo da Silva	NASA/GSFC		arlindo.dasilva@nasa.gov
Brad Quayle	Forest Service		bquayle@fs.fed.us
Chris Justice	University of Maryland		cjustice@umd.edu
Ed Hyer	Naval Research Lab	Louis Giglio, UMD	lgiglio@umd.edu
Gary Jedlovec	NASA/ SPoRT	Andrew Molthan, NASA SPoRT	andrew.molthan@nasa.gov
George Blaisdell	NSF		gblaisde@nsf.gov
James Verdin	USGS	Jim Rowland, USGS EROS	rowland@usgs.gov
Jeff Hawkins	Naval Research Lab		jeff.hawkins@nrlmry.navy.mil
Liam Gumley	University of Wisconsin/ Madison		liam.gumley@ssec.wisc.edu
Mark Trice	Maryland/DNR		mtrice@dnr.state.md.us
Mike Fromm	Naval Research Lab		mike.fromm@nrl.navy.mil
Rama Nemani	NASA/ARC		rama.nemani@nasa.gov

Table 1: UWG Members or affiliates that attended the LANCE UWG

1.1. Other Attendees

There were a number of additional attendees representing other members of the user community, representatives of the individual LANCE elements, NASA Headquarters (HQ) and NASA Earth Science Data and Information System (ESDIS).

Name	Affiliation	Email
Alfreda Hall	GSFC / ESDIS	alfreda.a.hall@nasa.gov
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David Green	NASA HQ	david.s.green@nasa.gov
Dawn Lowe	GSFC / ESDIS	dawn.r.lowe@nasa.gov

Diane Davies	GSFC / LANCE	diane.k.davies@nasa.gov
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Kevin Murphy	GSFC / ESDIS	kevin.j.murphy@nasa.gov
Lalit Wanchoo	GSFC / ESDIS	lalit.wanchoo-1@nasa.gov
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Minnie Wong	GSFC / ESDIS	min.m.wong@nasa.gov
Pamela Rinsland	ASDC	pamela.l.rinsland@nasa.gov
Pat Coronado	GSFC /DRL	patrick.l.coronado@nasa.gov
Phil Durban	GSFC / LANCE OMI	phillip.durbin@nasa.gov
Ryan Boller	GSFC / ESDIS	ryan.a.boller@nasa.gov
Sherry Harrison	UAH	SHarrison@itsc.uah.edu
Terri Wood	GSFC	terri.wood-1@nasa.gov
Zhousen Wang	GSFC	zhuosen.wang@nasa.gov

Table 3: Other attendees

2. Welcome and program perspective

The purpose of the UWG was to review the status of LANCE, progress made on previous UWG recommendations and to identify and discuss potential enhancements and upgrades to the LANCE system as well as to provide recommendations for future efforts.

Kevin Murphy (NASA GSFC, ESDIS) opened the meeting welcoming the attendees and identifying the scope and objectives of the meeting. **Chris Justice (University of Maryland, LANCE UWG Chair)** reminded the group that the UWG role is to provide community feedback and guidance to LANCE and that this could be done verbally at the meeting or by email. He commented that LANCE has a strong applied science component and is an important part of NASA's data systems. He reminded the group that some of the EOS instruments are getting old and that with new instruments coming online, such as the Suomi-National Polar-orbiting Partnership (SNPP) and Soil Moisture Active Passive (SMAP), there are opportunities to broaden the near real-time capability to these instruments and look for new applications and where possible provide continuity for existing products. To date, LANCE products have had a strong science algorithm heritage and associated maturity and are supported by NASA Science Teams. Looking forward, as LANCE transitions to new instruments, he suggested the group should evaluate this approach recognizing that product quality control is important and LANCE needs to find a way to ensure continued support for any product enhancements.

Lawrence Friedl (Director of the Applied Sciences Program, NASA HQ) introduced David Green, as the new Disasters Program Manager in NASA Applied Sciences Program (ASP). David will be the new LANCE Program Scientist. Friedl commented on the importance of LANCE to NASA's Applied Sciences Program; echoing the perspective of the Applied Sciences Advisory Committee (ASAC), which released a report in May 2014 commenting that "a constant and over-riding theme throughout our meetings was the growing importance of applications to NASA's core mission – a natural outcome of NASA's multi-decade commitment to understanding Earth from space".

Looking forward, Friedl said preparations are underway for the second Earth Science Decadal Survey. He estimated the publication release would be scheduled for 2017; meaning community input would be required in 2015. As part of the preparations for the decadal survey, an ad-hoc committee will review the needs for [Continuity of NASA-Sustained Remote Sensing Observations if the Earth from Space](#). He suggested the UWG

should review the findings of this committee and make the case for continued near real-time (NRT) access from new missions as appropriate.

Friedl emphasized the need for early input on mission design to enable NRT access. He commented that the NRT latency survey, commissioned by the ASP, while useful, did not address the criteria that should be considered on the flight side if NRT data are to be a priority. He suggested that this is something that the LANCE UWG could pursue or contribute to. As NASA has recently signed an agreement to distribute some data from the European Commission/European Space Agency Sentinel series of satellites, Friedl also suggested that the UWG might consider what NRT products they would like to see from the future Sentinel satellites.

Reflecting on these comments, the UWG acknowledged that LANCE is on track to expand beyond NASA's Earth Observing System (EOS) satellites and beyond Land and Atmosphere data and that a phased interest approach needs to be adopted for upcoming missions. The composition of the UWG will need to be revisited, or augmented, to provide guidance for new NASA systems coming online. Jeanne Behnke (NASA ESDIS) suggested that the UWG might re-visit the definition of NRT; as new applications and datasets become available this could be expanded based on user needs for data prior to science data availability, rather than just 'three hours after acquisition'.

3. Progress and Action Item Review

Diane Davies (GSFC/ESDIS, LANCE Operations Manager) gave an overview of LANCE's status, actions and accomplishments.

- An overview of key metrics showed that LANCE is operating well within its three-hour latency requirement and that the number of users and the amount of NRT data and imagery downloaded continues to rise. Since October 2013, there has been a three-fold increase in the NRT product downloads from the Global Imagery Browse Services (GIBS).
- In July 2014, LANCE started generating new Vegetation Indices (VI) and Surface Reflectance products (SR) following requests from the dust modeling and agricultural monitoring communities. The new Moderate Resolution Imaging Spectroradiometer (MODIS) products

- are: a daily 8-day rolling vegetation indices product, which includes both Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI), and an 8-day rolling surface reflectance product. As there is no equivalent science product for the new vegetation indices, Jim Rowland (U.S. Geological Survey, Famine Early Warning System (USGS, FEWSNet)) asked about if there was a historical time series being archived that they could access. No archive is stored; Justice suggested that if users want to compare the last 8 days with historical years or the mean of last 8 days VI, they could create an archive from the 8-day surface reflectance products which are available. Alternatively the MODIS Adaptive Processing System (MODAPS), in the framework of Collection 6, could consider adding an 8-day rolling NDVI, if there is sufficient user demand.
- LANCE is continuing to prototype Hypertext Transfer Protocol Secure (HTTPS) data distribution for LANCE.
 - The LANCE Core Requirements are being revised in COMET (Configuration Management EOSDIS Tool). The intention is to make the core document more generic with separate appendices to manage information specific to each element. This modular approach will enable new sensors to be added to LANCE more easily.
 - In 2013 Earth Observing System Data and Information System (EOSDIS) initiated an American Customer Satisfaction Index (ACSI) Survey to assess customer satisfaction with NASA LANCE. Overall the satisfaction rate among LANCE users was high, with a baseline score of 78. A second ACSI survey will be conducted in the Fall of 2014.

4. Updates from the elements

4.1. Kathryn Regner (University of Alabama in Huntsville, AMSR-SIPS) provided an update on the Advanced Microwave Scanning Radiometer 2 (AMSR2). Good progress has been made in setting up the LANCE core requirements for AMSR2. The approach has been to leverage as fully as possible the LANCE Advanced Microwave Scanning Radiometer for EOS (AMSR-E) hardware and software architecture. Level 1R data are ingested from the Japan Aerospace Exploration Agency (JAXA) and the US AMSR2 Science Team are providing preliminary algorithms. So far two algorithms are ready for testing: a Snow Water Equivalent (SWE) algorithm and a GPROF2010 (GSFC Profiling) retrieval code for a NRT AMSR2 precipitation

and non-raining parameters. More information will be available following the AMSR2 science meeting (23 -24 September 2014). It is expected that the first NRT AMSR2 products will be made available in early 2015 subject to products being approved by the science team.

4.2. Feng Ding (GSFC, LANCE AIRS and MLS) provided an update on Aqua's Atmospheric Infrared Sounder (AIRS) and Aura's Microwave Limb Sounder (MLS). Both instruments are stable with the exception of a single event upset that caused a loss of AIRS data for about one week from March 22, 2014. Ding highlighted a study by McNally et al (2014) demonstrating the contribution of NRT AIRS data in successfully predicting Hurricane Sandy via numerical models.

4.3. Phil Durbin (GSFC, LANCE OMI) said that Aura's Ozone Monitoring Instrument (OMI) experienced a row anomaly around August 13, 2014 effectively blocking another 6 (out of 60) pixels in the northern part of the orbit, greater than 50 degrees North. This unfortunately means OMI cannot be used to monitor volcanic eruptions such as the Bardabunga volcano, currently active in Iceland. Durbin also mentioned that an improved product measuring Sulfur Dioxide (SO₂) loads in the planetary boundary layer (PBL) is expected to be available by the end of September 2014.

4.4. Ed Masuoka (GSFC, LANCE MODIS) provided an update on MODIS Collection 6 (C6) reprocessing. Atmosphere testing and reprocessing are complete for Aqua and almost complete for Terra. For land products, C6 Program Executables (PGEs) are currently being prepared for NRT and expected to be operational within 6 months after start of C6 reprocessing at MODAPS. C6 PGEs will be run in parallel with Collection 5 (C5) version for 1 year to allow applications users time to transition – additional resources are being added to meet the latency requirement and the needed redundancy (nrt1 and nrt2 servers). The UWG questioned whether all products should be produced in parallel for a year. It was agreed that if the Principal Investigator for a product advised that the new product was substantially better than the old product (say due to degradation of the sensor) this rule would not be implemented.

Masuoka said overall, MODIS NRT products are being generated within 2 hours of data acquisition for most Level 2 (L2) products. Latency varies for

Level 3 (L3) products. He also added a note on procedure for the induction of new products in LANCE:

- LANCE gets recommendations from the UWG to implement new LANCE products – could be a standard product running at MODAPS or sometimes a new product.
- The LANCE team works with MODAPS to implement the product in the LANCE framework.
- For an existing product, the Science Team (ST) member is contacted by LANCE and/or MODAPS and they work together on any needed modifications needed to make them LANCE/NRT compatible.
- ST member participation (algorithm update and quality assurance (QA)) is voluntary, i.e. unpaid.
- Products are checked for quality (QA'd) after the product is running at NRT (e.g. comparing against the standard product).

5. Product Enhancements

5.1. Crystal Schaaf (University of Massachusetts, Boston) and Zhuosen Wang (GFSC) provided an update on the rolling NRT Bidirectional Reflectance Distribution Function (BRDF) product that was requested at the May 2013 LANCE UWG to support worldwide air quality and atmospheric modeling communities. The NRT Bidirectional Reflectance Distribution Function (BRDF) /Nadir BRDF-Adjusted Reflectance (NBAR) /Albedo algorithm is derived from the (V006) MODIS MCD43 algorithm and will be made available after the MODIS C6 NRT forward processing begins. There will be small differences between the NRT and the standard product due to the temporal weights applied to the algorithm; the NRT version emphasizes the last most recent day of the 8-day period, whereas the standard product will emphasize the middle day.

5.2. Louis Giglio (University of Maryland) on behalf of Ed Hyer (Naval Research Laboratory), presented a request to include per pixel geolocation coordinates in the NRT MOD14 (Thermal Anomalies and Fire Algorithm). He explained that the Level 2 (swath-based) MODIS active fire product does not include per-pixel geolocation and this would be useful for a range of NRT application users. The C6 MODIS fire code can optionally append geolocation layers (latitude and longitude) to swath products via command-line switch. File sizes would be larger but as the NRT archive is a rolling

archive this would not have any significant impacts on production or hardware. This was agreed by the UWG.

5.3. MISR Update

Pamela Rinsland (Atmospheric Science Data Center, NASA Langley Research Center) presented an update on progress to make NRT Multi-angle Imaging SpectroRadiometer (MISR) data available. MISR NRT L2 Winds products are available as Hierarchical Data Format (HDF) and Binary Universal Form for the Representation of meteorological data (BUFR) through the protocol called Open-source Project for a Network Data Access Protocol (OPeNDAP), within 2.3 hours of satellite overpass. Steps are underway to make the data available through LANCE.

6. Digital Object Identifiers (DOIs) for NRT data

Lalit Wanchoo (NASA GSFC, ESDIS) presented an overview of the EOSDIS Digital Object Identifier (DOI) process. This was followed by a discussion in which the UWG was asked to consider whether they would recommend DOIs be adopted for NRT data. DOIs are generally assigned to data products that are to be archived for a long time to ensure data users can get to the data using the DOIs cited in literature. Short-lived data products do not usually get DOIs as the exact data product will not be available after data has been deleted. However, the UWG agreed that DOIs promote discoverability, accessibility and reproducibility and would help users distinguish between NRT and Standard Science Quality datasets. The UWG agreed there is no intention of archiving NRT data. The UWG recommended DOI's be assigned to NRT datasets.

7. EOSDIS Updates

LANCE leverages a number of existing EOSDIS components including the Earthdata website (earthdata.nasa.gov), the User Support Tool and the User Registration System. **Kevin Murphy** highlighted a number of updates from EOSDIS that are relevant to LANCE. These include:

- Earthdata website is currently being re-designed to make it more up to date and easier for users to search.

- Continued development of the Global Imagery Browse Service (GIBS) is ongoing to make the system more robust and easier for users to access. Worldview is the EOSDIS (reference) client for GIBS (<https://earthdata.nasa.gov/labs/worldview>)
- User Registration System (URS) (<https://urs.eosdis.nasa.gov>). The latest version, 4.0, provides single sign-on for EOSDIS applications and websites.
- Common Metadata Repository (CMR): The CMR will be the authoritative management system for all EOSDIS metadata for all EOSDIS data holdings. CMR is a common middleware replacement for the EOS ClearingHouse (ECHO) back-end and the Global Change Master Directory (GCMD) back-end. The GCMD front-end, however, will *not* change and users of GCMD should see no impact.
- Earthdata Search Client: This is a new client that provides users with cross-DAAC search, discovery, and access for all EOSDIS data. It showcases the advanced features of the Common Metadata Repository, the Global Imagery Browse Service and OPeNDAP. The benefits of the Earthdata Search Client will be:
 - Improved user experience for search, discovery, and access.
 - Provides granule visualization.
 - Allows for cross dataset comparisons.
 - Provides services for format conversion and subsetting.
 - Supports saving and sharing of data projects.
 - Has Streamlined data access workflows

Andrew Molthan commented that finding data using LANCE is very easy and user-friendly, however finding tools to process the data is more complicated. Kevin Murphy said the Earthdata Code Collaborative (ECC) should make this easier, but there are some legal issues that have to be considered for tools not developed by NASA. He added that the provenance of science products, is recorded through the Algorithm Theoretical Basis Documents (ATBDs) and a similar approach should be sought to capture provenance for tools and non-science products such true color images.

8. Applications using LANCE Data:

8.1. Global Flood Mapping

Dan Slayback (NASA GSFC) provided an update on how LANCE NRT data are being used for global flood mapping. The product is proving to be very useful to a wide range of organizations but there are some improvements that still need to be implemented before the product is considered to be robust enough for transition to an operational partner. These include: a seasonal water layer to better identify flood, better identification of terrain and shadow as they can be misclassified as flooded land. More information can be found on the NASA OAS website: <http://oas.gsfc.nasa.gov/floodmap>

8.2. LANCE products for weather, climate and disaster applications

Andrew Molthan (NASA Marshall Space Flight Center, Short-term Prediction Research and Transition (SPoRT)) said that SPoRT makes extensive use of LANCE products for weather, climate and disaster applications. Recently SPoRT was able to utilize short-term NDVI change data following severe weather to identify hail or tornado damage scars, when corroborated with other storm information. This information is provided to the NOAA/NWS Damage Assessment Toolkit via Web Map Service (WMS) for use in the field. Molthan commented that at SPoRT they highly value the streamlined Application Programming Interfaces (APIs) that allow for global search and acquisition of MODIS products and that they would like to see these capabilities extended to S-NPP data sets and other NASA missions such as the Global Precipitation Measurement mission (GPM). He said SPoRT applications continue to grow in S-NPP, GPM, and upcoming SMAP areas, and LANCE-like data access would be beneficial. SPoRT is highly interested in developing closer, collaborative partnerships to test and evaluate new LANCE capabilities for S-NPP, GPM, and other instruments. Reflecting on the presentation, the UWG considered the challenges of managing products with varying levels of maturity; this is something LANCE has not dealt with in the past but may need to consider moving forward.

9. S-NPP Update

Alfreda Hall (NASA GSFC, ESDIS S-NPP Manager) gave an update on the NASA Suomi National Polar-orbiting Partnership (S-NPP). It is too early to know what NASA NRT products will be produced from S-NPP; it is anticipated more will be known in mid-November. It was estimated that global S-NPP products would not be available before late 2015 but that the

Direct Readout Laboratory (DRL) would provide an interim source for non-global products. It was agreed that LANCE should consider ways to fast track products to LANCE when they are ready.

10. Sentinel Data Gateway

Kevin Murphy informed the group that NASA ESDIS would become a distribution hub for Sentinel 1 (Synthetic Aperture Radar) data. NASA will develop a Sentinel Data Gateway, which will pull Level 1 data from the Copernicus Data Hub. Sentinel 1 data will not be distributed in NRT.

11. Wrap up

Chris Justice wrapped up the meeting by saying that overall LANCE is doing well and has good visibility. LANCE seems to be coming to a turning point where it will move beyond EOS data; in the short term this will be data from SNPP and SMAP. He recommended that at the next UWG group we should ask the Science Team lead for SMAP to talk about possible SMAP NRT products. He also recommended that Green look across the Applications program to see who can use / benefit from LANCE and bring them in to discussion. Justice summed up the action items from meeting; these are listed below.

12. Action Items

1. In the lead up to the Earth Science Decadal Survey there will be a report from the NRC Continuity Committee. The UWG should get an update from continuity committee with a view to providing comments to the decadal survey on NRT data continuity.
2. The UWG should consider what NRT products they would like to see from the ESA Sentinel series of satellites (suggestion from Friedl – action for next UWG).
3. Recommendation from UWG to add coordinates to NRT MOD14.
4. Recommendation from UWG to move ahead with DOI for NRT data.
5. Recommendation that MISR continue working to meet the core LANCE Requirements.
6. Ensure LANCE Core Requirements are given to the SIPS (for NRT SNPP) in the early stages of planning NRT datasets.

7. In mid-November, provide a summary of where we are in terms of NRT SNPP data and LANCE. This should follow the SNPP SIPS meeting on October 23rd.
8. Revisit UWG composition to include guidance on new instrument data coming in to LANCE.
9. The UWG should consider a streamlined process to determine when NASA NRT Applications Products could be disseminated through LANCE, while ensuring data quality.
10. Revisit the definition of NRT data in context of data needs.
11. Not all C5 and C6 should be produced in parallel for a year. If a PI advises otherwise.

Reference:

McNally, T., M. Bonavita, and J.-N., Thepaut, 2014: The Role of Satellite Data in the Forecasting of Hurricane Sandy. *Mon. Wea. Rev.*, **142**, 634-646, doi: [10.1175/MWR-D-13-00170.1](https://doi.org/10.1175/MWR-D-13-00170.1)