https://doi.org/10.7289/V5XK8CM0

Exploring JPSS Data Application for Earth System Data Assimilation

(Based on Joint JPSS-MAPP Programs Meeting of January 30th, 2017)

Prepared by

Lihang Zhou[1], Murty Divakarla[2], Heather Archambault[3], Annarita Mariotti[3], and Haun Meng[4]

(With inputs from Valerie Mikles[2], Marco Vargas[1], Xingpin Liu[2], Jin Huang[3], and Veronica Lance[5])

[1]Center for Satellite Applications and Research (STAR), College Park, MD
[2]IM Systems Group@STAR, College Park, MD
[3]NOAA Climate Program Office, Silver Spring, MD
[4]Cooperative Research Program, STAR, College Park, MD
[5]Global Science & Technology@STAR, College Park, MD

NOAA Center for Satellite Applications and Research (STAR)
College Park, MD

May 9, 2017

NOAA JPSS-STAR (JSTAR) Website

Table of Contents

1 BACKGROUND 3

2 OVERVIEW OF PROGRAMS, OPERATIONAL AND RESEARCH NEEDS 4

2.1 JPSS Science, Proving Ground Initiative (PGI) and JPSS Products 4
2.2 NCEP Strategic Plans for Earth System Modeling and Data Assimilation 5
2.3 CPO MAPP and OOMD Program Overviews 6
2.3.1 Modeling, Analysis, Predictions, and Projections (MAPP) Program 6
2.3.2 Ocean Observing and Monitoring Division (OOMD) Program Overview 7
2.4 GFDL Forecast Systems and Applications 7
2.4.1 Example 1: The roles of atmosphere and land initial conditions in predicting the western United States precipitation during 2015/16 winter 8
2.4.2 Example 2: Arctic sea ice prediction in the GFDL forecast system 8

3 JPSS DATA FOR EARTH SYSTEM DATA ASSIMILATION 9

3.1 Advancing Ocean Data Assimilation 9
3.2 Advancing Land Surface Data Assimilation for Drought and Other Applications 11
3.2.1 JPSS Land products 11
3.2.2 Hydrology Products 11
3.3 Advancing Data Assimilation for Sea Ice and other Arctic Needs 12
3.4 Data Assimilation for Air Quality 13

4 JPSS REPROCESSED DATA 14

5 MEETING OUTCOMES 15

TABLE 1. S-NPP PRODUCT MATURITY 18

TABLE 2. S-NPP REPROCESSED SDR/EDR DATA SETS 21

APPENDIX 26

Using JPSS Products for Earth System Data Assimilation 26
Meeting Background and Purpose 26
AGENDA 26
Point of Contact(s) 28
Meeting Invitee List 28
List of Acronyms 30

1 Background

One of the objectives of the JPSS Program is to reach out to the user community, to promote the operational utility of high quality JPSS products and to foster scientific collaborations. NOAA/OAR/CPO has a mission to advance the scientific understanding, monitoring and prediction of climate and its impacts to enable effective decisions, which includes utilizing satellite data. The CPO Modeling, Analysis, Predictions and Projections (MAPP) program supports research and transition to advance models, analysis, predictions, and projections of the Earth system. JPSS and CPO held a kick-off meeting on September 12, 2016 to discuss future partnerships and possible collaboration towards using JPSS products for climate applications. Recommendations from this meeting identified three common areas of collaboration between the JPSS and the CPO: (1) Arctic, (2) Atmospheric Composition, and (3) Reanalysis, Modeling, Drought and Hydrology. Following the kick-off meeting, JPSS STAR (JSTAR) initiated Technical Interchange Meetings (TIMs) for in-depth discussions on potential collaboration. The JSTAR team and CPO AC4 program conducted the first TIM for JPSS Atmospheric Composition (JAC) products and the use of these products in the AC4 Program. Meeting reports and presentations from the first TIM are available at: https://www.star.nesdis.noaa.gov/jpss/meetings2016.php).

Following JPSS program objectives for Reanalysis, Modeling, Drought and Hydrology, the JSTAR team and CPO MAPP program jointly conducted the second TIM on the use of JPSS products focusing on Earth System Modeling and Data Assimilation, and avenues for future partnership and collaboration on applications of JPSS products for climate applications.

The JPSS and MAPP TIM was held on January 30, 2017, and was attended by the JSTAR ocean, land and atmospheric teams, as well as representatives from EMC, MAPP, and OOMD, and users from NOAA OAR Laboratories (ESRL and GFDL). The main objectives of the TIM were to: (1) bring together the JPSS Program Management and Products teams, OAR/CPO MAPP team members, and overarching modeling communities for a discussion on the ongoing activities and future plans, and (2) discuss current use of NOAA and non-NOAA satellite data into assimilation schemes, and more importantly, use of the JPSS products in global model assimilation. The following questions framed the workshop organization and discussions:

- What Earth system monitoring and prediction capabilities is NWS/NCEP/EMC planning to develop in the next 5–10 years? Which new or improved services are NWS hoping to provide, and what are the capability gaps that require research and development?
- What is the timeline for integrating various operational JPSS products into the Earth

System Modeling Framework/NUOPC/NOAA Environmental Modeling System (NEMS)?

- What new research or science can be enabled by coupled data assimilation? What is the status of NOAA Earth system research that can enable advanced data assimilation?
- What new climate-quality Earth system data from JPSS is available for data assimilation that could enable new NOAA services?

The meeting was organized into two sessions. The presentations of the first session provided overviews of the programs involved, and the operational and research needs. The second session concentrated on thematic discussions of the JPSS EDR products, applications, reprocessing needs, and ongoing efforts towards data assimilation in various disciplines, viz., ocean, land, cryosphere, and atmosphere. This report provides a summary of the meeting presentations and outcomes.

2 Overview of Programs, Operational and Research Needs

This part of the meeting started with an overview of JPSS program and products' applications by the JPSS Program office and the JPSS STAR (JSTAR) Program Manager. Following the JPSS Program overview, an overview of the NCEP Strategic plans for Earth System Modeling and Data Assimilation, and overviews of CPO MAPP and CPO OOMD activities were presented. The GFDL teams made two presentations and discussed the roles of: 1) the atmosphere and land initial conditions for precipitation forecasts, and 2) Arctic sea ice predictions.

2.1 JPSS Science, Proving Ground Initiative (PGI) and JPSS Products

The JPSS Chief Scientist and the JSTAR Science Program Manager provided an overview of the JPSS science program, instruments and products available for the atmosphere, land, ocean, and cryosphere applications from the current S-NPP satellite launched in 2011, and continuation of the product availability through the upcoming JPSS-1 launch (September 2017) and subsequent series of satellites JPSS-2, 3, etc. The JPSS program also has a long-term agreement with the EUMETSAT for continued support of high quality critical observations through the year 2030. A well-defined science program has been in place since the beginning of the program. The science program functions include: (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, publications, reprocessing and enterprise solutions, and (d) overseeing deliveries of software packages to operations and CSPP DB services. The science program also evaluates operationally produced products from NESDIS and the use of those products for operational applications

across NOAA line offices. To accomplish these science objectives, the JPSS program has established the Proving Ground Initiatives (PGI) to engage users, develop 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. Prioritization of science products and applications is achieved through Executive Boards (PGEB, SDEB). Inception of new science initiatives is channeled through new PG initiatives and starts with: (1) meetings with the users to ensure objectives and actions are well defined, and (2) endorsements by the user advocates from the line offices and service areas in support of the PGI outcomes (e.g. new products, operational applications, core competencies needed by key core applications, etc). The JPSS PGI program coordinates with the overarching scientific community, developers, users and NOAA line offices in achieving the objectives set forth for each PGI. The presentation discussed 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, and identified key PIs associated with each of these initiatives.

The JSTAR Science Program Manager provided an overview of the JPSS Cal/Val processes and the S-NPP SDR/EDR product maturity status. Most of the S-NPP SDR/EDR products have reached validated maturity (see Table 1) and the science teams anticipate shorter timelines in reaching JPSS-1 SDR/EDR provisional and validated maturity. The presentation also discussed transition of operations for: (a) the EDRs currently in NDE operations, (b) EDRs migrating to NDE from IDPS (or replacement enterprise algorithms going to NDE), and (c) the EDR algorithms expected to be in NDE operations by 2018. The presentation also highlighted S-NPP SDR/EDR reprocessing plans to generate mission-long high quality science data products, and ended with a set of objectives and expectations from the TIM: (a) summaries of presentations, (b), enhancements of science outreach to ensure products in development are consistent with the users' needs, priorities, and recommendations, (c) future courses of action on collaborations, and (d) identification of high priority JPSS products for data assimilation needs.

2.2 NCEP Strategic Plans for Earth System Modeling and Data Assimilation

The director of NCEP/EMC gave a report on NCEP/EMC Strategic Plans for Earth System Modeling. The presentation focused on the simultaneous long-term and short-term planning approaches to advance EMC modeling. A strategic vision describes where EMC is headed over the next 5–10 years, whereas a strategic implementation plan has been formulated that describes EMC's plans over the next 3 years. Key elements of the strategic vision are unified modeling and unified data assimilation, including approaches for coupled and ensemble-based modeling,

reforecast and reanalysis production, and pre- and post-processing and calibration. The unified global coupled model for the seasonal time scale is expected to be comprised of atmosphere, land, sea ice, land/hydrology, waves, aerosols/chemistry, and ocean components coupled under the Earth System Modeling Framework/NUOPC/NOAA Environmental Modeling System (NEMS). Similarly, as sub-seasonal version is expected to be initially deployed with a sub-set of components using the same framework. Space weather applications will be handled differently and only for the short-range time scale, not on the seasonal scale.

The strategic vision is accompanied by a roadmap to transform a set of complicated models into simple and easier to maintain models at multiple cadences (hourly, weekly, monthly, seasonal, annual, and decadal). This requires solid investment in both new research and operational computing systems. Most importantly, the FV-3-based unified modeling system representing the next generation of weather modeling will constitute a major leap forward in the current Global Forecast System. The presentation also provided insights into community involvement in their weekly Strategic Implementation Plan Working Group as well as an upcoming face-to-face workshop for the developer community on 18-20 April 2017.

2.3 CPO MAPP and OOMD Program Overviews

2.3.1 Modeling, Analysis, Predictions, and Projections (MAPP) Program

The MAPP presentation summarized the MAPP program and highlighted programmatic support for improvements in NOAA models. The MAPP Program is a competitive grants program within the NOAA Office of Oceanic and Atmospheric Research Climate Program Office. The mission of the program is to enhance the Nation's capability to understand and predict natural variability and changes in Earth's climate system. The MAPP program supports applied research projects, research-to-operations (transition) work via the NOAA Climate Test Bed, and engagement activities that focus on the development, integration, and application of Earth system models and analyses. To extend NOAA's research capabilities, MAPP holds annual grant competitions published in the Climate Program Office's annual Federal Funding Opportunity. The five main areas that MAPP funds are: (i) prediction from weeks to decades, (ii) climate reanalysis and data assimilation, (iii) climate and Earth system modeling, (iv) climate projections, and (v) drought and other applications. MAPP-funded investigators participate in the MAPP Task Force that coordinates research funded out of individual grant competitions. The MAPP program partners with programs, labs, and centers across NOAA, as well as with other Federal agencies through such organizations as the US Global Change Research Program (USGCRP), US Climate Variability and Predictability (US-CLIVAR), and the National Earth System Prediction Capability (ESPC) Program.

With regards to programmatic support for improvements in NOAA models, the MAPP priorities include advancing coupled Earth system data assimilation for monitoring and prediction, assessing benefits of high-resolution modeling, testing new physical representations in models via Climate Process Teams, developing process level diagnostics for model improvement, and supporting modeling software infrastructure and CFS data access. The presentation also highlighted MAPP's history of funding data assimilation related work for climate reanalysis, as well as for monitoring and prediction purposes. This support includes four two-year reanalysis-focused projects on waves, ocean, soil moisture and snow cover, and sea ice funded in FY16 via the Climate Test Bed, a jointly run effort between MAPP and NWS/NCEP/Climate Prediction Center.

2.3.2 Ocean Observing and Monitoring Division (OOMD) Program Overview

The director of OOMD presented an overview of the OOMD program. The overarching mission of the OOMD within NOAA's CPO is to develop and provide long-term high-quality global observations, climate information and products for the benefit of researchers, forecasters, assessments and other users of environmental information. Its three foci include the Ocean Observing Program, the Arctic Research Program, and the Monitoring Program. The Ocean Observing Program supports NOAA's contribution to several major ocean observing systems including Argo, surface drifters, RAMA, PIRATA, GO_SHIP, OceanSITES, and several others. They systematically address requirements for numerous essential ocean variables. The Monitoring Program supports development of value-added and authoritative observational-based products.

The presentation also showed how ocean products from nearly 50% of the global ocean observing systems are integrated into climate records, monitoring temperature and salinity of the ocean. The compiled climate information informs and guides policy. At present, satellite data is not being fully utilized, and research funds are needed to determine ways to better integrate all available data. The Tropical Pacific Observing System 2020 (TPOS-2020) was highlighted, as the OOMD team works to improve assimilation systems and utilize data streams. There may be a reconfiguration of the TPOS, but that would depend on input from the ocean monitoring community, and that discussion is ongoing. The Arctic Research Program will be discussed in depth at an upcoming TIM.

2.4 GFDL Forecast Systems and Applications

Two GFDL presentations discussed two example applications of initialized predictions, requiring

data assimilation products. These examples were in the context of the GFDL high-resolution seasonal climate prediction modeling system, and the Arctic Sea-Ice Prediction.

2.4.1 Example 1: The roles of atmosphere and land initial conditions in predicting the western United States precipitation during 2015/16 winter

Improving the model fidelity and improving the utilization of observations have improved GFDL's seasonal climate prediction. The high-resolution model substantially improves regional climate prediction skill and provides statistically skillful seasonal prediction of extreme climate events such as extratropical storms, tropical cyclones and major hurricanes. The stratosphere plays an important role in predicting the extratropical surface climate, so accurately modeling and observing the stratosphere could improve seasonal climate prediction. The coupled data assimilation of atmospheric, land and oceanic observations could substantially improve the seasonal precipitation prediction. The fine-level spatial and temporal climate observations are needed for the high-resolution model development and validation.

The presentation also discussed the GFDL high-resolution seasonal climate prediction modeling system. The talk focused primarily on the science and the resolution required to resolve tropical storms and extratropical storms (ETS), specifically whether ETS modeling improves with higher resolution since those models are more computationally expensive. While high-resolution does improve regional climate prediction, stratospheric modeling and appropriate initialization data are also vital. Better data assimilation is essential. The question was posed whether JPSS/ATMS vertical resolution was sufficient to meet the needs of this project.

2.4.2 Example 2: Arctic sea ice prediction in the GFDL forecast system

The second GFDL presentation discussed details on Arctic Sea-Ice prediction in the GFDL forecast system. Recent Arctic sea ice seasonal prediction efforts and forecast skill assessments have primarily focused on pan-Arctic sea-ice extent (SIE). This talk moved towards stakeholder-relevant spatial scales, investigating the regional forecast skill of Arctic sea ice in a GFDL seasonal prediction system. Using a suite of retrospective initialized forecasts spanning 1981-2015, made with a coupled atmosphere-ocean-sea ice-land model, this presentation demonstrated that predictions of detrended regional SIE are skillful at lead times up to 11 months. The presentation also showed that initial conditions provide crucial sources of skill for regional sea ice predictions. In particular, subsurface ocean initialization is critical for winter SIE predictions and sea-ice thickness initialization is critical for summer SIE predictions. These results suggest that satellite sea-ice thickness and better ocean observations could greatly improve seasonal forecasts of Arctic sea ice.

The presentation also discussed cases where initialization parameters play heavily into climate prediction, most specifically, subsurface ocean temperature in winter and satellite-based sea-ice thickness in summer.

3 JPSS Data for Earth System Data Assimilation

The thematic discussion sessions covered in length the JPSS EDR products, applications, and ongoing efforts towards data assimilation in various disciplines, viz., ocean, land, cryosphere, and atmosphere.

3.1 Advancing Ocean Data Assimilation

The Satellite Oceanography and Climatology Division (SOCD) chief presented measurement-based satellite oceanography product development efforts for various NOAA and non-NOAA satellite data in support of NOAA users and ocean applications. The presentation opened with a road map for environmental intelligence. This roadmap begins with transformation of observations into data products; in turn data products may be assimilated into models or used for model validation. Models then provide some mechanistic understanding of environmental processes. Model results may be incorporated into forecasts from which decisions or actions can be taken. In the meantime, satellite data products are actively monitored for quality assurance and periodically re-assessed in a manner consistent with NOAA goals and the needs of end users from NOAA line offices and others. NOAA/NESDIS/STAR/SOCD provides fit-for-purpose satellite data products via an end-to-end value chain from algorithm development, in situ validation and quality monitoring, routine and sustained satellite product production, product discover tools and distribution to users, data stewardship and archiving with active user engagement along the entire process. NOAA users need ocean data products derived from a number of NOAA satellite instrument observations, as well as from non-NOAA satellites. In some cases, these non-NOAA observations are complementary, in other cases they may be the sole source of our satellite observations of a particular environmental parameter. The presentation stressed the need to move away from a mission based approach towards a measurement based approach to help ensure high quality and long term continuity for user applications. Ocean environmental parameters at SOCD include: Altimetry (sea surface height, etc.), sea surface temperature (SST), sea surface salinity, sea surface roughness (from synthetic aperture radar), sea ice, ocean surface vector winds and ocean color (water leaving radiances and chlorophyll, etc.). Data products are distributed through NOAA CoastWatch/OceanWatch. The division has leadership roles and makes contributions to domestic and international science

teams, including decades of development of radar altimetry from Jason 2 and Jason 3. Altimetry data products are used by NOAA and its operational and research partners such as ECMWF, NASA, CNES, etc.

With regards to the development and use of JPSS products, the presentation discussed the enterprise SST ACPSO system as a pathfinder or template for future mission-agnostic or measurement-based product generation. The ACPSO system was used to reprocess 13 years of AVHRR data from seven different NOAA satellites and the products produced are of very high quality and show improved bias characteristics compared to the earlier NOAA Pathfinder SST data sets. Within the JPSS and GOES-R paradigm, the ACPSO SST system produces consistent data products from S-NPP VIIRS and from GOES instruments and will continue to produce products from JPSS-1 as well as GOES-R for real-time applications. For climate applications, the ACPSO system is generating reprocessed SST data using mission-long VIIRS data (see Table 2). In addition to using JPSS and GOES observations, the ACPSO system also brings in non-NOAA satellite SST products. These many sources are used to produce the global 5 km blended SST products.

Another highlighted JPSS product is ocean color (OC) from the NOAA MSL12 system for use in both near real-time and climate applications. The MSL12 system produces NRT products (meeting latency requirements) for many real-time applications. Science quality OC products are produced 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 team is also producing JPSS-VIIRS reprocessed ocean color products for the best quality mission-long S-NPP OC data products to benefit users worldwide (Table 2).

With regards to current emerging efforts, the presentation discussed SOCD efforts on sea surface salinity from the SMOS missions and coordination with many NOAA line offices (STAR, NODC, CICS, NESDIS, NWS, etc.). The applications of sea ice products from passive and active sensors, especially from the Cryosat-II, for climatological ice thickness time series in the Arctic were discussed. The presentation also included: 1) applications of JPSS SST products for Coral Reef Watch anomalies, hotspots, and bleaching area alerts, 2) uses of OC tools for coral reef managers, 3) OC data in conjunction with phytoplankton functional types to support fisheries, and 4) support to ARL in producing Marine Isoprene emissions. Many of these products are distributed through the CoastWatch, OceanWatch, and PolarWatch portals.

3.2 Advancing Land Surface Data Assimilation for Drought and Other Applications

Thematic discussion on land surface data assimilation contained two presentations, one describing JPSS land products and their utility, and one on hydrology products.

3.2.1 JPSS Land products

This presentation provided details and applications of JPSS operational land products (e.g. surface reflectance, VIIRS vegetation products, surface albedo, LST, surface type, active fire, etc.,) and GCOM AMSR-2 soil moisture. Research and experimental data products produced as part of PGIs (e.g. VIIRS Phenology) and the SMOPS project for drought monitoring were discussed. All of the S-NPP land products have been declared validated and a record of error statistics is available. Some of the GCOM products with provisional maturity status will be elevated to validated maturity after a review in April 2017. This presentation discussed operational processing changes (IDPS to NDE) and improvements to the land products through enterprise solutions implemented in NDE/OSPO. In addition, ongoing efforts on reprocessing of mission-long EDR land products, and gridded output product generation plans for consistency among land products for current and future user needs were presented. With regards to applications, the active fire product, in conjunction with aerosol products, has been used to routinely estimate biomass burning emissions (HRRR, GBBEPx) and operational air quality forecasting. These products are provided to many users (e.g. NWS AWIFS) with imagery and integrated air quality analysis tools available through the eIDEA website (http://www.star.nesdis.noaa.gov/smcd/spb/aq/eidea/). NWS is evaluating the usefulness of ingesting VIIRS fire products into the model for smoke forecasts and the feedback has been especially positive from the Western Region. VIIRS AF products are used in the operational HMS operated by the NOAA SAB. Some other land products are at various stages of operational use in weather and climate forecasting systems (e.g. VIIRS green vegetation fraction, GCOM soil moisture etc. in NCEP Land and Coupled Models, HRRR, etc.), as well used in crop forecasts generated by USDA (vegetation health, GCOM soil moisture etc. in the US Drought Monitor). Despite these uses, the presentation noted that the land products are in general still under-utilized, primarily due to the complexity of the ingest / assimilation problem. Efforts are ongoing with the modeling and user communities to maximize the use of improved land information from JPSS.

3.2.2 Hydrology Products

The Hydrology products presentation discussed the availability of three classes of products: (a)

baseline products, (b) blended products, and (c) developmental products. The baseline suite is composed of a diverse group of products primarily retrieved from ATMS, AMSR-2, and VIIRS, such as cloud properties, rain rate, soil moisture, moisture profile, and snow and ice products. It also includes products from legacy NOAA polar satellites currently operating and are derived mainly from the microwave instruments such as AMSU/MHS and also non-NOAA satellites like NASA GPM. Some of the blended products, such as the total precipitable water and rain rate, are produced by fusing the baseline products derived from a multitude of sensors. The developmental products such as the snowfall rate and layered water vapor relate to the enhancements to the baseline products and are supported by the JPSS PGRR program. Other PGRR sponsored projects focus on the hydrological applications of JPSS products such as the utilization of snow products in seasonal streamflow forecasting, etc. The processing systems of MIRS, NOGAPS, IMS, and SMOPS produce these hydrological products and use enterprise solutions to derive products from JPSS ATMS, GCOM-AMSR, and other instrument complements. Some of the JPSS hydrological products have been utilized in Earth system modeling and data assimilation such as snow cover and soil moisture. The team is currently interacting with the NWS/Office of Water Prediction/National Water Center (NWC) on some data sets and plans to formalize these initiatives through the JPSS Program. The current research focuses on establishing a common footprint between data sources, to reduce issues with resolution inconsistency between instruments and achieve consistency of product accuracies.

3.3 Advancing Data Assimilation for Sea Ice and other Arctic Needs

The presentation provided a glimpse of the JPSS snow and ice products derived from the VIIRS instrument that are available operationally, as well as experimental products currently being developed. Products derived using passive microwave observations (AMSR2) and experimental products such as the ice-motion product currently running at the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin-Madison were also discussed. The discussion also included AMSR2 products using heritage algorithms (snow cover, snow depth, and snow water equivalent), recent improvements to these algorithms, and future plans on producing these products from AMSR-E. Examples of IST (ice/snow surface temperature over frozen ocean), ice concentration, and ice thickness products from the JPSS VIIRS instrument, product coverage constraints due to cloud-cover over orbital data, daily and weekly composite animations, and use of these products by various centers were discussed.

Another product of direct relevance to the climate is the AVHRR Polar Pathfinder-Extended (APP-x). The APP-x is a 25 km resolution, twice-daily gridded data product with coverage since 1982 over the Arctic and Antarctic. The product is updated daily with a 3-day delay and is

produced for two local solar times to infer diurnal cycle changes. Some of the algorithms used in the APP-x products are the same as the algorithms implemented for JPSS-VIIRS, thus providing continuity of the time series. The presentation ended with ice thickness and ice volume trends and quoted some of the recent presentations on important sea-ice variables for modeling purposes.

The presentation also focused a lot of attention on the ice thickness algorithm, finding it to be both dynamically and thermodynamically important, as ice thickness is a major influence over the surface energy budget and also is important to navigation. The team has used both ground and space-based data to calibrate and validate their ice thickness algorithm and tweak energy balance equations. While they would love to produce snow depth over ice, that information has proven elusive with current technology.

3.4 Data Assimilation for Air Quality

This presentation introduced S-NPP VIIRS aerosol products and discussed mainly the AOD product. The discussion included reprocessing efforts, AOD assimilation experiments carried out at NRL, initial assimilation results from the NCEP/NGAC model, and future courses of action. The AOD product from VIIRS is a pixel level product at a very high resolution. Models at coarser resolution perform either data averaging (at NRL) or data thinning (at NCEP) to accommodate pixel level products into the assimilation process. The IDPS operational algorithm, inherited from Northrop Grumman, was implemented at the beginning of the S-NPP launch. The NDE enterprise algorithm product developed at STAR works on both GOES-R and JPSS. Both of these algorithms meet the accuracy and precision requirements, with the enterprise algorithm (EPS) showing improved bias characteristics and expanded spatial coverage with respect to the AOD measurements. The EPS also has fixes that reduce some anomalies found with the IDPS algorithm over melting snow contamination. The major benefits from the EPS algorithm are the retrieval of the AOT product over an expanded measurement range, including bright surfaces in desert and semi-arid dry regions, and over inland water bodies. The algorithm is ready for operational implementation in the NDE (planned for the year 2017). The team has already performed one year of AOD product reprocessing using the enterprise algorithm and is continuing reprocessing of S-NPP mission-long data. The team has provided the EPS AOT product to many user agencies including ESRL, JCSDA, NCEP-EMC, NRL, and the State University of New York, and the product is being tested in assimilation experiments.

The presentation also covered the assimilation experiments conducted at NRL and NCEP and adapted data assimilation procedures (averaging process in NAAPS versus data thinning process

in NGAC). Results of VIIRS AOD assimilation into NRL/NAAPS indicated that the quality of the forecast has improved by using both VIIRS and MODIS and concluded that assimilation of the VIIRS AOD product is adding value. The team is moving forward with further assimilation experiments using the re-processed AOD product. The aerosol team also coordinated with NCEP/NGAC on the assimilation of the VIIRS AOD product and initial results show positive impact. Between the assimilation experiments conducted by the NRL/NAAPS and the NCEP/NGAC, the team plans to evaluate the 'averaging *vs*. thinning' processes and its impact in moving forward. The AOD team requested CPO projects and plans on the reanalysis schemes, and stressed the need for mission-long reprocessing of the AOD product.

4 JPSS Reprocessed Data

This presentation provided an overview and status of reprocessing efforts, accomplishments, and computing needs for mission-long reprocessing of S-NPP SDRs. Based on the recommendations received from NOAA, NASA, and other user agencies during the reprocessing workshop, the STAR SDR teams have updated the SDR algorithms for reprocessing the four S-NPP instrument SDR products, namely for ATMS, CrIS, VIIRS, and OMPS. Citing the land and ocean team's presentations and their reprocessing efforts, this presentation concentrated mainly on the S-NPP SDR and atmospheric products reprocessing efforts using the most matured algorithms. Improvements in SDR product quality achieved through upgraded reprocessing algorithms for the ATMS and CrIS SDR products were highlighted with examples showing reprocessed SDR product improvements to the real time operational SDR product. The upgraded algorithms used for reprocessing will be in operations in IDPS Block 2.0 or in the future version to realize improvements achieved through reprocessing SDR algorithms. These improved SDR products through operational data streams, when assimilated into global and regional models, are expected to provide improved forecasts.

With regards to mission-long reprocessing of S-NPP SDR products, the team has already reprocessed ATMS, CrIS normal spectral resolution (NSR), and OMPS-NM/NP SDRs. Four weeks of VIIRS SDRs were reprocessed to date (storage limitations precluded further processing), and the team is currently installing 750TB of storage to reprocess two years of VIIRS SDR products by the end of this month (February 2017). By the end of April 2017, the team expects to produce mission-long S-NPP reprocessed SDRs for all four instruments. The team expects to have CrIS full-spectral resolution (FSR) reprocessed SDR products around April/May and the user communities will have an access to the CrIS-FS SDRs after a review on the quality of the CrIS-FSR data products. The CrIS-FSR SDRs provide necessary high resolution spectral channels for improved CO, CH4, and CO2 retrieval products. The EDR

teams are currently evaluating EDR product improvements using reprocessed SDRs. Table 2 provides a summary of S-NPP SDR/EDR reprocessed products currently available to the user community.

The presentation also emphasized the importance of the reprocessed SDR products in the reanalysis/forecast efforts. STAR teams, in partnership with NCEP/NASA/GMAO, JCSDA, University of Maryland, and many other NOAA line offices, are working on a data assimilation project to improve forecasts of hurricanes and precipitation.

In conclusion, the presentation reiterated the importance of reprocessing and the readiness for reprocessing with a very good reprocessing system, using the most matured SDR algorithms, to achieve long-term consistency of data product quality and enable users to utilize the high-quality products retrospectively to evaluate impacts on user applications. The reprocessed SDRs (radiance level) are very well calibrated and are of very high quality with necessary quality flags.

5 Meeting Outcomes

Meeting participants from JSTAR, CPO and other NOAA institutions representatives discussed at length the common areas of interest to include: collaborative projects, data products, user needs for new data products derivable from the JPSS instruments suite, all in the context of Earth system data assimilation applications. The discussion emphasized what JPSS program can provide that is of relevance to the MAPP program Earth system data assimilation research areas, and how MAPP program research can enhance the JPSS product application to NOAA's mission goals as part of future collaboration.

The meeting presentations highlighted the following:

- NOAA NCEP operational suite is moving towards a more unified suite for weather to climate applications for monitoring and prediction, which will be based on a coupled model including at least six Earth system components - these will all require initialization via the use of Earth system data.
- On the research side of NOAA, GFDL has advanced Earth system models and is experimenting with prediction systems for seasonal prediction that require initialization of its various components including land and sea ice, at increasingly higher resolutions.

Outcome A: NOAA modeling systems, for both research and operations, will require increasing capabilities to assimilate Earth system data into models in support of NOAA's mission.

- The JPSS Program has been developing a rich suite of products to characterize the Earth system, including its ocean, land hydrology, sea ice and atmospheric composition. Many JPSS products are already applied by the NWS for weather forecasting.
- The JPSS program includes the goal to explore new JPSS data applications, and has a dedicated Proving Ground Program and Initiatives. Earth data assimilation for climate purposes is within its scope and it is looking at a prioritization of JPSS data needs.

Outcome B: The application of JPSS Earth system data for climate applications is conditional on data reprocessing and planned duration of the products. Reprocessing is ongoing for several products. A prioritization of products for data assimilation needs will inform future work in this area.

- As part of the Climate Program Office, the MAPP program scope includes research and transition to improve Earth system data assimilation in NOAA modeling systems, including exploring new methodologies and the use of newly available climate quality Earth system data.
- The OOMD focuses on ocean observing and monitoring, including the Arctic. The in situ ocean observation network supported by OOMD can provide ground validation for JPSS ocean products. Vice versa, OOMD is interested in increasing the integration of satellite data, for example as part of TPOS, via data assimilation.

Outcome C: The MAPP program and OOMD see the new JPSS Earth data as an emerging research opportunity to advance NOAA's Earth system data assimilation capabilities, once it is of climate quality.

Overall, the meeting highlighted the opportunities for STAR, JPSS and CPO representatives to continue to discuss specific actions items of relevance to the findings above with the involvement of relevant key NOAA laboratories, centers and stakeholders.

Table 1. S-NPP Product Maturity

Most of the S-NPP SDR/EDR products have reached validated maturity[#] and the science teams anticipate shorter timelines in reaching JPSS-1 SDR/EDR provisional and validated maturity.

Sensor	Algorithm	Priority	Beta	Provisional	Validated
ATMS	SDR	1	Jan-12	Oct-12	Dec-13
ATMS	Land Surface Emissivity (LSE)	2	Apr-12	Aug-14	*
ATMS	Total Precipitable Water (TPW)	3	Apr-12	Aug-14	Oct-16
ATMS	Rainfall Rate	3	Apr-12	Aug-14	Oct-16
ATMS	Cloud Liquid Water (CLW)	3	Apr-12	Aug-14	*
ATMS	Sea Ice Characterization (SIC)	3	Apr-12	Aug-14	*
ATMS	Snow Cover/Depth	3	Apr-12	Aug-14	*
ATMS	Snow-Water Equivalent (SWE)	3	Apr-12	Aug-14	*
ATMS	Moisture Profile	4	Apr-12	Aug-14	Oct-16
ATMS	Temperature Profile	4	Apr-12	Aug-14	Oct-16
ATMS	Land Surface Temperature (LST)	4	Apr-12	Aug-14	*
VIIRS	SDR	1	Apr-12	Oct-12	Dec-13
VIIRS	Imagery (Not Near-Constant Contrast)	1	May-12	Jan-13	Jan-14
VIIRS	Imagery (Near-Constant Contrast)	1	Oct-12	Aug-13	Jan-14
VIIRS	Ocean Color (OCC)	2	Jan-13	Jan-14	Mar-15
VIIRS	Sea Surface Temperature (SST)	2	Feb-13	Jan-14	Sep-14
VIIRS	VIIRS Polar Winds	2	---	Mar-14	Oct-16
VIIRS	Aerosols - Suspended Matter (SM)[1]	3	Jun-13		
VIIRS	Aerosol Optical Thickness (AOT)	4	Sep-12	Apr-13	Aug-14
VIIRS	Aerosol Particle Size (APSP)	4	Sep-12	Apr-13	Aug-14
VIIRS	Cloud Mask (VCM)	3	Jun-12	Jan-13	Jan-14
VIIRS	Cloud Optical Properties (daytime)	3	Jun-13	Jan-14	Sep-14
VIIRS	Cloud Optical Properties (nighttime)	3	Jun-13	Jan-14	Sep-14[&]
VIIRS	Cloud Cover Layer (CC/L)	3	Jun-13	Jan-14	Sep-14[&]
VIIRS	Cloud Top Height (CTH)	3	Jun-13	Jan-14	Sep-14
VIIRS	Cloud Top Temperature (CTP)	4	Jun-13	Jan-14	Sep-14
VIIRS	Cloud Top Pressure (CTP)	4	Jun-13	Jan-14	Sep-14
VIIRS	Cloud Base Height (CBH)	4	Jun-13	Jan-14	Sep-14[&]

VIIRS	Binary Snow Cover	3	May-13	Nov-13	Jan-14
VIIRS	Snow Cover Fraction	3	May-13	Nov-13	Sep-14[&]
VIIRS	Sea Ice Concentration IP[2]		May-13	Nov-13	---
VIIRS	Sea Ice Characterization (SIC)	3	May-13	Nov-13	Sep-14[&]
VIIRS	Ice Surface Temperature (IST)	4	May-13	Aug-13	Jan-14
VIIRS	Active Fires (AF)	3	Oct-12	Aug-13	Sep-14
VIIRS	Land Surface Temperature (LST)	4	Dec-12	Apr-13	Dec-14
VIIRS	Land Surface Albedo (LSA)	4	Jun-13	Apr-14	Dec-14
VIIRS	Surface Type (ST)	4	Feb-13	Jan-14	Dec-14
VIIRS	Land Surface Reflectance (SR)	4	Feb-13	Aug-13	Sep-14
VIIRS	Vegetation Index (VI)	4	Feb-13	Aug-13	Sep-14
VIIRS	Green Vegetation Fraction (GVF)	2	Jan-13	Aug-13	Oct-16
VIIRS	Vegetation Health Index Suite	4	Jun-14	Jun-15	Oct-16[&]
CrIS	SDR	1	Apr-12	Oct-12	Dec-13
CrIS/ATMS	Atm. Vertical Moisture Profile (AVMP)	3	Aug-12	Jan-13	Sep-14
CrIS/ATMS	Atm. Vertical Temperature Profile (AVTP)	3	Aug-12	Jan-13	Sep-14
CrIS	Ozone Profile EDR	3	---	Jan-13	Oct-16
CrIS/ATMS	Carbon Monoxide	4	---	Jan-13	**
CrIS/ATMS	Carbon Dioxide	4	---	Jan-13	**
CrIS/ATMS	Methane	4	---	Jan-13	**
CrIS	Outgoing Longwave Radiation EDR	3	Dec-13	Sep-15	Oct-16
OMPS	Total Column SDR	3	Feb-12	Oct-12	Aug-15
OMPS	Nadir Profiler SDR	3	Feb-12	Oct-12	Aug-15
OMPS	Total Column Ozone EDR	3	Jul-12	Jan-13	Aug-15
OMPS	Nadir Profiler Ozone EDR	3	Aug-12	Jan-13	Aug-15
AMSR	Sea Surface Temperature (SST)	2	May-13	Apr-14	Oct-16
AMSR	Microwave Imagery	3	May-13	Apr-14	Oct-16
AMSR	Cloud Liquid Water (CLW)	3	May-13	Apr-14	Oct-16
AMSR	Precipitation (Type/Rate)	3	May-13	Apr-14	Oct-16
AMSR	Total Precipitable Water (TPW)	3	May-13	Apr-14	Oct-16
AMSR	Sea Surface Wind Speed	3	May-13	Apr-14	Oct-16
AMSR	Sea Ice Characterization	3	May-13	May-16	*
AMSR	Snow Cover/Depth	3	May-13	May-16	*

AMSR	Snow-Water Equivalent (SWE)	3	May-13	May-16	*
AMSR	Soil Moisture	3	May-13	May-16	*

[#] https://www.star.nesdis.noaa.gov/jpss/documents/Status/DataProductMaturityLevelDefinitions.pdf

[*] Validate Maturity Review planned in April 2017

[**] Validate Maturity Review planned in June 2017

[&] Review Panel recommended more validation efforts.

Table 2. S-NPP Reprocessed SDR/EDR Data Sets

Some of the reprocessed data sets may not be accessible publicly. Interested users are requested to contact the POC.

Team	Algorithm/ Product	S-NPP Reprocessed Data Availability				
		Reprocessing Efforts/Future Plans	Reprocessing System/Alg. Version	POC	Start Date	End Date
SDR	ATMS	Attempts to complete S-NPP Mission-long SDR reprocessing are ongoing. Reprocessed SDRs have been validated and EDR teams are evaluating EDR product improvements using reprocessed SDRs.	ATMS/V1.0	Mark Liu Ninghai Sun	11/08/11	08/31/16
SDR	VIIRS		VIIRS/V1.0	Chanyong Cao	05/20/12	05/28/12
					12/15/12	12/21/12
					07/06/15	07/12/15
					10/18/15	10/24/15
SDR	CrIS		CrIS-TSR/V1.0	Yong Han	02/20/12	08/31/16
			CrIS-FSR/V1.0		TBD	TBD
SDR	OMPS-TC		OMPS-TC/V1.0	Trevor Beck Chunhui Pan	01/26/12	09/09/15
SDR	OMPS-NM		OMPS-NM/V1.0		01/26/12	09/09/15
Data Location		Reprocessed: /data/data263/gregk/VIIRS_SDR/ IDPS equivalent: /data/data263/gregk/VIIRS_SDR_Ops/				
Imagery	VIIRS Imagery	Currently investigating off-line processing system for reprocessing	TBD	Don Hillger	TBD	TBD
Clouds	VCM, CCL, DCOMP, NCOMP, CTP, CBH	SSEC/CIMSS processes the entire VIIRS record daily and generate the entire suite of NOAA Enterprise cloud products (including those with the DNB). Data is stored only for a week. The Cloud team also does		Andy Heidinger	01/01/12	Current

		selective reprocessing for sample cloud regimes by choosing 20 x 20 deg domains for MODIS, AVHHR, and VIIRS. With regards to VIIRS, the team has these data sets available from January 2012 for three locations, (1) Off the cost of California, (2) over Brazil, and (3) over the Central USA.				
Data Location		On local disks at SSEC that are not open to public. Users interested may contact the POC.				
Aerosol	AOT	The team has the ability to reprocess multiple versions of algorithms. Currently the team has used Enterprise AOT algorithm and reprocessed one year of Aerosol products. The team envisions continuation of these efforts.	AOT-V5.0	Shobha Kondragunta	01/01/15	12/01/15
	ADP		ADP-V1.1	Istvan Laszlo	01/01/15	Current
Data Location		Reprocessed AOD: /data/data314/hliu/DATA/REPROCESS_NDE_FORMAT/) Reprocessed ADP: /data/smcd4/SM/EPS)				
Cryosphere	IST, Sea Ice, Snow Cover, Snow Fraction,	The Cryosphere team currently generates The APP_X-25 km resolution gridded data product with coverage since 1982 over the Arctic/Antarctic. The product gets updated daily with a 3-day delay and is produced for two local solar times to infer diurnal cycle changes. Algorithms used in the APP_X products are the same as the algorithms implemented for JPSS-VIIRS products thus providing continuity of the time series. Plans on	TBD	Jeff Key	TBD	TBD

		reprocessing of Cryosphere products are ongoing.				
Data Location		TBD				
Land	AF, SR, LST, SA, ST, VI	The team is currently working on the transition of land products to enterprise solutions and gridded product generation. The team is also evaluating the VIIRS SDR reprocessed data sets and planning on upstream data product reprocessing using enterprise solutions to prepare for reprocessing of all land products. Individual land products teams have off-line versions running with the latest algorithm upgrades and will be used to generate consistent reprocessed land products. Many of the improved land products will be ingested into the Land Product Characterization System (LPCS) to facilitate data analysis.	TBD	Ivan Csiszar	TBD	TBD
Data Location		TBD				

OCC	OCC	The NOAA MSL12 system produces OC products for use in both near real-time and climate applications.	MSL12/V1.0	Menghua Wang	01/01/12	Current
Data Location		http://coastwatch.noaa.gov/cw_html/OceanColor_Science_Quality_VIIRS_SNPP.html				
SST	SST	The SST team in coordination with UW team runs ACSPO SST products in real-time (RT) and also reprocessing mode using Reanalysis 1 (RAN1). In addition to SST processing system, the team also maintains SST monitoring SQUAM. The team intends to use RAN2 version in future reprocessing efforts.	ACSPO 2.40/RAN1 ACSPO 2.41/RAN2	Sasha Ignatov	03/01/12 TBD	12/06/15 TBD
Data Location		ftp://ftp.star.nesdis.noaa.gov/pub/socd2/coastwatch/sst/ran/viirs/snpp				
Sounding	NUCAPS	The NUCAPS team has off-line processing capability to produce NUCAPS products using the latest version and is working on the reprocessing plans.	NUCAPS Phase IV/ V2.X	Lihang Zhou	TBD	TBD

	MIRS	Starting mid-June 2015, MIRS version 11.1 has been running on ATMS data that has significant improvements to the earlier version v9.2 (operational until mid-June 2015). The team is planning to use another updated version v11.3 for mission-long reprocessing efforts.	MIRS/V11.3	Mark Liu	TBD	TBD
Data Location		TBD				
OMPS EDR	NP & TC	The OMPS EDR team regularly produces offline versions of the V8TOz EDRs and V8Pro EDRs at STAR and save copies of them on the LINUX cluster. The team plans to use reprocessed OMPS TC/NP SDRs to produce improved reprocessed V8TOz and V8Pro EDRs	V8TOz V8Pro	Larry Flynn	TBD	TBD

Appendix

Using JPSS Products for Earth System Data Assimilation

(JPSS–CPO Technical Interchange Meeting 2)

Jan 30 2017, 9:00 AM – 12:30 PM EST
NCWCP Room 2554-2555

Meeting Background and Purpose

NOAA/NESDIS/JPSS (Joint Polar Satellite System) and NOAA/OAR/CPO (Climate Program Office) had a kick-off JPSS-CPO meeting on September 12, 2016. The goal of the meeting was to enhance future partnership and collaborations on applications of JPSS products for climate applications. Several common interest areas for JPSS–CPO collaborations were identified in the kick-off meeting. Both JPSS and CPO programs (Arctic, MAPP, and AC4) expressed interest in follow-on Technical Interchange Meetings (TIMs) to:

- Communicate info about JPSS products (e.g., data variables, length, resolution, quality)
- Communicate info about corresponding CPO programs
- Understand users' needs - for this meeting, to understand the needs for data assimilation and earth system modeling for research and operational prediction
- Learn the current state of services/applications, what improvements are still needed, and how satellite data can help
- Explore potential applications and products
- Discuss collaboration mechanisms and costs

AGENDA

Part 1: Overview of programs, operational and research needs

9:00	Mitch Goldberg (JPSS Program Scientist): JPSS Overview (10 min)
9:10	Lihang Zhou (JPSS STAR Program Manager): JSTAR Overview (10 min)
9:20	Mike Farrar (EMC Director): NCEP Strategic Plans for Earth System Modeling and Data Assimilation (20 min)

9:40 Heather Archambault (CPO MAPP Program Manager): MAPP Program Overview (10 min)

9:50 David Legler (CPO OOMD Chief): CPO OOMD Overview (10 min)

10:00 Xiasong Yang (GFDL - via telecon): The roles of atmosphere and land initial conditions in predicting the western United States precipitation during 2015/16 winter (15 min)

10:15 Mitch Bushuk (GFDL - via telecon): Arctic sea ice prediction in the GFDL seasonal forecast system (15 min)

10:30 Break (10 min)

Part 2: Thematic discussions

10:40 **Theme 1. Advancing ocean data assimilation** (inclusive of sea-level, salinity, and carbon/color data)

- JPSS Ocean Products (5 min) (Paul DiGiacomo)
- Discussion (20 min)

11:05 **Theme 2. Advancing land-surface data assimilation for drought and other applications**

- JPSS Land Products (5 min) (Ivan Csiszar)
- JPSS Hydrology Products (5 min) (Ralph Ferraro)
- Discussion (20 min)

11:35 **Theme 3. Advancing data assimilation for sea ice and other Arctic needs**

- JPSS Cryosphere (Snow and Ice) Products (5 min) (Jeff Key)
- Discussion (20 min)

12:00 **Theme 4. Data assimilation for air quality**

- JPSS Atmospheric Products/Reprocessed Data (5 min) (Fuzhong Weng)
- JPSS Aerosol Products (5 min) (Shobha Kondragunta)
- Discussion (20 min)

12:30 Adjourn

Point of Contact(s)

1. NOAA/STAR: Lihang Zhou
2. JPSS Program: Mitch Goldberg
3. CPO/MAAP: Annarita Mariotti
4. Cc: Lihang.Zhou@noaa.gov, mitch.goldberg@noaa.gov

Meeting Invitee List

Alex Ignatov, NESDIS/STAR
Andrew Heidinger, NESDIS/STAR
Annarita Mariotti, OAR/CPO
Arron Layns, JPSS/AMP
Brad Pierce, NESDIS/STAR
Brian Cosgrove, NWS/NWC
Changyong Cao, NESDIS/STAR
Cheng-Zhi Zou, NESDIS/STAR
Christie Best, JPSS Program Office
Christopher W. Brown, NESDIS/STAR
Chunhui Pan, NESDIS/STAR
Craig Long, NWS/NCEP
Daniel Barrie, OAR/CPO
David Legler, OAR/CPO
Don Hillger, NESDIS/STAR
Felix Kogan, NESDIS/STAR
Fuzhong Weng, NESDIS/STAR
Gregory J Frost, OAR/ESRL
Harry Cikanek, NESDIS/STAR
Heather Archambault, OAR/CPO
Huan Meng, NESDIS/STAR
Istvan Laszlo, NESDIS/STAR
Ivan Csiszar, NESDIS/STAR
James G Yoe, NWS/NCEP
James Todd, OAR/CPO
Jeff Key, NESDIS/STAR
Jin Huang, OAR/CPO
Kenneth Mooney, OAR/CPO

Lawrence E Flynn, NESDIS/STAR
Lihang Zhou, NESDIS/STAR/JPSS
Marco Vargas, NESDIS/STAR
Menghua Wang, NESDIS/STAR
Michael Ek, NWS/NCEP
Michael Farrar, NWS/NCEP
Mitch Goldberg, JPSS Program Office
Mitchell Bushuk, OAR/GFDL
Monika Kopacz, OAR/CPO
Murty Divakarla, NESDIS/STAR
Nai-Yu Wang, NESDIS/STAR
Ninghai Sun, NESDIS/STAR
Paul DiGiacomo, NESDIS/STAR
Quanhua Liu, NESDIS/STAR
Ralph R Ferraro, NESDIS/STAR
Sandy Starkweather, OAR/ESRL
Sarah Lu, NWS/NCEP
Satya Kalluri, NESDIS/STAR
Shobha Kondragunta, NESDIS/STAR
Sreela Nandi, JPSS Program Office
Steven Miller, NESDIS/STAR
Tess Valenzuela, NESDIS/STAR
Thomas Atkins, NESDIS/STAR
Thomas Auligne, JCSDA
Tony Reale, NESDIS/STAR
V Ramaswamy, OAR/GFDL
Valerie Mikles, NESDIS/STAR
Veva Deheza, National Integrated Drought Information System
Walter Wolf, NESDIS/STAR
William Straka III, CIMSS
Xiaosong Yang, OAR/GFDL
Xingpin Liu, NESDIS/STAR
Xiwu Zhan, NESDIS/STAR
Yong Han, NESDIS/STAR
Yunyue Yu, NESDIS/STAR

List of Acronyms

AC4	CPO Atmospheric Chemistry, Carbon Cycle, and Climate
ACPSO	Advanced Clear-Sky Processor for Oceans
ADP	Aerosol Detection Product
AERONET	AErosol RObotic NETwork
AF	Active Fire Product
AIRS	Atmospheric InfraRed Sounder
AMSR	Advanced Microwave Scanning Radiometer
AMSU	Advanced Microwave Sounding Unit
AOD/AOT	Aerosol Optical Depth/Aerosol Optical Thickness
APP-x	AVHRR Polar Pathfinder-Extended Data Set
ARL	Air Resources Laboratory
ATMS	Advanced Technology Microwave Sounder
AVHRR	Advanced Very High Resolution Radiometer
AWIFS	Advanced Wide Field Sensor
CBH	Cloud Base Height
CCL	Cloud Cover Layer
CCR	Configuration Change Request
CFS	Climate Forecast System
CICS	Cooperative Institute for Climate and Satellites
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CLASS	Comprehensive Large Array-data Stewardship System
CPO	Climate Program Office
CrIS	Cross-track Infrared Sounder
CSD	ESRL Chemical Sciences Division
CSPP	Community Satellite Processing Package
CTP	Cloud Top Pressure
CTT	Cloud Top Temperature
DB	Direct Broadcast
DCOMP	Daytime Cloud Optical and Microphysical Properties Algorithm
EDR	Environmental Data Record
EMC	Environmental Modeling Center
EPA	Environmental Protection Agency
EPS	Enterprise Processing System
ESPC	National Earth System Prediction Capability
ESRL	Earth System Research Laboratory
ESSM	CPO Earth System Science and Modeling
ETS	Extratropical Storms
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
FIREX	Fire Influence on Regional and Global Environments Experiment
FRP	Fire Radiative Power Product

FSR	CrIS Full Spectral Resolution
FV-3	Finite-Volume Cubed-Sphere Dynamical Core
GBBEPx	The Blended Global Biomass Burning Emissions Product
GCOM	Global Change Observation Mission
GFDL	Geophysical Fluid Dynamics Laboratory
GMD	ESRL Global Monitoring Division
GO_SHIP	the Global Ocean Ship-Based Hydrographic Investigations Program
GOES	Geostationary Operational Environmental Satellite
GOME	Global Ozone Monitoring Experiment
GPM	Global Precipitation Measurement
HMS	Hazard Mapping System
HRRR	High Resolution Rapid Refresh
IASI	Infrared Atmospheric Sounding Interferometer
QC	Quality Check
IDPS	Interface Data Processing Segment
IST	Ice Surface Temperature
JAC	JPSS Atmospheric Composition
JCSDA	Joint Center for Satellite Data Assimilation
JPSS	Joint Polar Satellite System
JSTAR	JPSS STAR
LORWG	Low earth-Orbiting Requirements Working Group
LP	S-NPP Limb Profiler
LST	Land Surface Temperature
MAPP	CPO Modeling, Analysis, Predictions and Projections
Meteosat	Geostationary Meteorological Satellites operated by EUMETSAT
MetOp	Meteorological Operational satellite programme
MHS	Microwave Humidity Sounder
MISR	Multi-angle Imaging SpectroRadiometer
MODIS	Moderate-resolution Imaging Spectroradiometer
MOPITT	Measurements of Pollution in the Troposphere
MSU	Microwave Sounding Unit
NAAPS	Navy Aerosol Analysis and Prediction System
NASA	National Aeronautics and Space Administration
NCEP	NWS National Centers for Environmental Prediction
NCOMP	Nighttime Cloud Optical and Microphysical Properties Algorithm
NDE	S-NPP Data Exploitation (NDE)
NEMS	NOAA Environmental Modeling System
NESDIS	National Environmental Satellite Data and Information Service
NFS	National Forest Service
NGAC	NOAA Environmental Modeling System (NEMS) Global Forecast System (GFS) Aerosol Component

NJO	NOAA JPSS Office
NM	OMPS Nadir Mapper
NMFS	National Marine Fisheries Service (NMFS)
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center
NP	OMPS Nadir Profiler
NRL	Navy Research Laboratory
NSR	CrIS Normal Spectral Resolution
NUCAPS	NOAA Unique CrIS/ATMS Processing System
NUOPC	National Unified Operational Prediction Capability
NWC	National Water Center
NWS	National Weather Service
OAR	Office of Oceanic and Atmospheric Research
OC	Ocean Color
OceanSITES	A worldwide system of deepwater reference stations
OMI	Ozone Mapping Instrument
OMPS	Ozone Mapping and Profiler Suite
OOM	Ocean Observing and Monitoring
OOMD	CPO Ocean Observing and Monitoring Division
OSPO	Office of Satellite and Product Operations
OWP	Office of Water Prediction
PGEB	Proving Ground Executive Board
PGI	Proving Ground Initiative
PGRR	Proving Ground & Risk Reduction
PIRATA	Prediction and Research Moored Array in the Atlantic prediction
RAMA	Research Moored Array for African-Asian-Australian Monsoon Analysis and
RTOFS	Real-Time Ocean Forecast System
SA	Surface Albedo Product
SAB	NESDIS Satellite Analysis Branch
SDEB	Satellite Development Executive Board
SDR	Sensor Data Record
SIE	Sea-Ice Extent
SMOS	European Space Agency Soil Moisture - Ocean Salinity Mission data
S-NPP	Suomi-National Polar Orbiting Partnership
SOCD	Satellite Oceanography and Climatology Division
SR	Surface Reflectance Product
ST	Surface Type Product
STAR	Center for Satellite Applications and Research
TC	Total Column Ozone

TEMPO	Tropospheric Emissions: Monitoring Pollution
TES	Tropospheric Emission Spectrometer
TIM	Technical Interchange Meeting
TPOS	Tropical Pacific Observing System
TROPOMI	TROPOspheric Monitoring Instrument
TSR	CrIS Truncated Spectral Resolution
US-CLIVAR	US Climate Variability and Predictability
USDA	US Department of Agriculture
USGCRP	US Global Change Research Program
UVAI	UV Absorbing Aerosol Index
VCM	VIIRS Cloud Mask (IDPS implementation)
VI	Vegetation Index
VIIRS	Visible Infrared Imaging Radiometer Suite