U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service

# 2017 NOAA Satellite Conference
# July 17-20, 2017
## The City College of New York
## NOAA CREST Center, NY

## Conference Summary Report

**July 17 –20, 2017**

**New York, NY**

## Draft Report

# Contents

## Foreword

From NESDIS?

## Executive Summary

The 2017 NOAA Satellite Conference sponsored by NOAA-NESDIS and hosted by the NOAA Center for Earth System Sciences and Remote Sensing Technologies, was held for the first time in the history of the satellite conference at NOAA's Academic Partner and historical campus of the City College of New York.

The 2017 Conference focused on the theme "A New Era of NOAA's Environmental Satellites", to promote meaningful interaction and dialogue between user communities and satellite-based data product developers; ensure user readiness of the next generation satellite data; ensure effective communications among users, program managers and product developers; and identify and address high priority research needs and issues for both GOES-R and JPSS satellite information.

Service, Federal Aviation Administration, Centro de Previsão do Tempo e Estudos Climáticos, Japan Meteorological Agency, National Satellite Meteorological Center China, NBC, World Meteorological Organization, Global Partnership on Space Security Applications for Disaster Risk Reduction, WNBC, and SSAI.

The conference provided students an opportunity via posters and oral presentations to showcase the results of their collaborative research projects. Organizers also held training sessions geared towards students/introductory users on GOES-R and JPSS, two of NOAA's most critical satellite programs.

The program allowed students and young professionals to network with a number of renowned scientists and experts from across the globe and communicate and discuss various scientific topics of interest and their research. The organizers also sponsored a career fair during the conference. Students were matched with NOAA employees to gain one-on-one experience by performing mock interviews. NSC 2017 engaged students from NOAA Cooperative Science Centers and CUNY campuses – a diverse population that includes significance number of students from underrepresented minority communities – who gained an international conference experience. Students also engaged in networking opportunities with a broader international community of scientists and engineers. NSC 2017 shared and showcased new satellite data products and services from the new generation satellite systems – GOES-R and JPSS. This conference provided the students and faculty an out-of-the-classroom educational and professional experience. The presences of Sli do and social media https://twitter.com/NSC_2017 helped the NSC organizers gain valuable insights and feedback from the participants. More details and presentations of the conference can be found at www.nsc2017.org.

# Day 1: July 17, 2017

## SESSION 1 – Opening Session

### Session 1.1: Welcome by President of The City College of New York

Dr. Reza Khanbilvardi, Director, NOAA Cooperative Science Center for Earth Systems Sciences and Remote Sensing Technologies (CREST), Dr. Vincent Boudreau, President, The City College of New York - CCNY

Dr. Reza Khanbilvardi, Director, NOAA Cooperative Science Center for Earth Systems Sciences and Remote Sensing Technologies (CREST) welcomed everyone to the 2017 NOAA Satellite conference and gave a brief description of CREST and its role in the Conference. Dr. Khanbilvardi then introduced Dr. Boudreau, President of The City College of New York (CCNY).

Dr. Boudreau welcomed all to the campus of CCNY and encouraged all to take advantage of the many opportunities that are available on the campus and in New York City. He gave a brief history of CCNY, which was founded in 1847, and was the first free college in the United States. Dr. Boudreau then gave a more detailed description of the Great Hall that the conference was being held in. The building the Great Hall is in was built in 1907 out of the spoils from the tunnels that were then being dug for the New York subway system. The building is in the Collegiate Gothic style and was meant to be a cathedral to learning. The stained glass windows were donated by colleges from around the U.S., with each window having the coat of arms from the institution that donated it. The flags around the Great Hall were donated to CCNY from colleges in Europe for the Great Hall.

Dr. Boudreau hoped the conference participants found the conference informative and hoped they enjoyed their time at CCNY.

### Session 1.2: Highlights: Since the 2015 NOAA Satellite Conference

Vanessa Griffin, Director, Office of Satellite and Product Operations (OSPO)

Ms. Griffin welcomed all to the conference and talked about the importance of the conference to NOAA and its users. She began her presentation with a brief review of the 18 environmental satellites OSPO operates.

- 4 Geostationary (GOES-13/14/15/16) by NOAA
- 3 Polar-Orbiting (NOAA-15/18/19) by NOAA
- 6 Defense Meteorological Satellite program (DMSP) operated by NOAA
- 2 OSTM Jason-2 & Jason-3 (Ocean Surface Topography Mission) - Joint NOAA, NASA, CNES, EUMETSAT effort
- 1 Suomi National Polar - orbiting Partnership (NPP) by NOAA & NASA
- 1 DSCOVR (Deep Space Climate Observatory) by NOAA
- 1 COSMIC-1 (Constellation Observing System for Meteorology, Ionosphere and Climate)

The conference objectives were presented:

- Continue bi-yearly NOAA Satellite Conferences,
- To reach out and interact with our customers, provide them with updates on our current and future systems and receive feedback from them,
- To improve knowledge an d user readiness for products and broadcast services on current and next generation of environmental satellites,
- To discuss and highlight future capabilities.

A quick review of the 2015 NOAA Satellite Conference was then presented. There were 617 attends at the 2015 conference including 73 foreign nationals representing 73 countries.

Ms. Griffin then reviewed the top 12 actions from the 2015 conference that covered GOES-R planning, GEONETCast America, training and frequency matters. See presentation for actions and responses. Probably the most important response to an action was that NOAA will put GOES-16 into the GOES-East position in November of 2017.

Ms. Griffin concluded say that NOAA wants to hear from you! Please actively participate in Q&A and breakout sessions. Attend poster and exhibit session. Follow us on Twitter: @noaasatellites and @NSC_2017 #NSC2017. Participate in Post-Conference Evaluation Survey. And, most important, let's have a great week!

### Session 1.3: NOAA Satellite Conference

Dr. Stephan Volz, Assistant Administrator, NOAA Satellite and Information Service

Dr. Volz welcomed the participants to the conference and gave a brief description of the conference goals and objectives. The then described how the NOAA Satellite and Information Service (NESIDS) supports NOAA's overall mission. One of NESDIS's key missions is a commitment to the continuity of the data and information. He reminded the audience that NESDIS' product is the data and information, not the satellites. Dr. Volz then gave a description and explanation of the NOAA observing system.

The recently launched GOES-16 was highlighted with several examples of the early products that are coming from NOAA's new generation of geostationary satellites. The GOES-R proving ground was also described. Dr. Volz then described the new generation of NOAA polar orbiting satellites, JPSS and its proving ground efforts and showed examples of its data products.

Dr. Volz then moved on to NESDIS' capabilities focusing on architecture and use-inspired science. He described that NOAA's planning for the future that is based on a space-based observing enterprise that is flexible, responsive to evolving technologies, end economically sustainable. A major part of the effort will be in algorithm and product development.

On the research side Dr. Volz, described the research applications development by academic partners for both GOES-R and JPSS and the importance of this relationship to the success of the overall enterprise. Several examples of products developed under this system were shown and described.

Dr. Volz moved on to the importance of the community and the partnerships and people that is critical for the success of earth observing systems. He described how NOAA's satellites fit into the larger global effort and how no one country can do it alone. There needs to be cooperation in both geostationary and polar orbiting satellite in order to get the data that is need to do the monitoring and forecasting that is needed.

Underlying all the effort are the people that make it all possible. Not only the producers of the data, but the users of the data and the products that are made from it. All have to collaborate in order for the system to work.

### Session 1.4: Satellite Observations that Support a Weather-Ready Nation

Joseph Pica, Director, Office of Observations, National Weather Service

Mr. Pica began his presentation with a discussion on the increasing societal vulnerability to environmental hazards, such as severe storms, hurricanes, tornados, and floods. In order to mitigate the consequences of these severs events it is important for us to realize the full value of forecasts and connecting forecasts

to critical decisions. One of the National Weather Service (NWS) strategies to deal with severe weather events is the Weather and Water Ready Nation (WRN).

Mr. Pica then went on to describe the importance of models in forecasting. In today's forecasts everything you read, see or hear about weather, climate and ocean forecasts is based on numerical prediction models. The four essential components of the prediction enterprise are: Global observations, data assimilation and modeling/science, supercomputers, and forecaster skill. He then described the process through which the NWS develops the forecast.

A critical component in developing the forecast is satellite data. At the NWS this is an end-to-end endeavor beginning with the design of a satellite system, to early delivery of the data directly to the forecaster leading to impact-based decision support for decisions makers. NWS engagement with satellite data is much more robust than in the past. Now the NWS is working to be able to take in the new generation data as soon as it is available, where in the past it was one or two years after launch before the NWS was ready to use the new data. The early use of GOES-16 data is an excellent example of the improved readiness focus. Mr. Pica showed several examples of the improved data and how they are being used.

In conclusion, Mr. Pica stated:

- We are building a Weather-Ready Nation to mitigate our growing vulnerability to high-impact weather.
- Satellite data remains critically important to the forecast and warning mission of the NWS and to the global weather enterprise.
- End-to-end user readiness is critical to optimal use of new satellite capabilities.
- There is tremendous enthusiasm with respect to the new satellite capabilities becoming operational.

### Session 1.5 - Opening Keynote Address: Future View of Satellite Meteorology

David Grimes, President, World Meteorological Organization

Mr. Grimes began by looking back at the humble origins of earth observations, starting in 1946 with the a rocket borne camera taking the first image of earth from space and progressing to the first weather satellites in the 1960's and were we have progressed to now. Mr. Grimes showed an example of a weather map from May 20, 1960 that looks remarkably similar to the photographic mosaic taken on the same day by TIROS-1.

Satellite data completely transformed the ability to predict weather. Numerical weather prediction performance can be largely attributed to the assimilation of increased volumes of satellite data.

Environmental satellite information will be increasingly important for WMO's planned Global Data-processing and Forecasting System (GDPFS) architecture. The goal is for seamless weather and climate prediction that is accessible by all WMO members.

For the WMO the drivers that are influencing the future of Global Observing Systems are:

- 2030 Agenda for Disaster Risk Reduction,
- 2016 Paris Climate Agreement,
- 2030 Agenda for Sustainable Development
- Science and Technology
- Commercialization

There are significant trends in science and technology as well as new players. Cube/nano/small sat are all new technologies that are starting to have an impact. Satellite constellations, although not a new idea, are becoming more and more common. Intelligent satellites are also becoming a possibility. Data cubes for integrated analysis another new idea. Although not a new idea, we can now more effectively pursue mobile applications and citizen science. Finally increasing high resolution, spatial, spectral and temporal date, will always be a driver.

The WMO is promoting its 2040 Vision for Global Observing. The emphasis is on:

- respond to user needs
- integration
- expansion
- automation
- consistency

All of the points mentioned are needed in order to promote, develop, and maintain a global constellation of satellites for Earth observation. Satellite monitoring are essential to inform our understanding and actions with respect to reducing losses of life and property, resilience to climate risks and enhancing socioeconomic value from hydro-meteorological and climate services. **In summary, it is a Global Enterprise**.

## SESSION 2 –International Partners: Current and Future Programs and Systems

### Session 2.1

Missing introduction of session notes..

### Session 2.2 – Overview of INPE's Activities and Cooperation with NOAA

Dr. Antonio Divino Moura, Head, CPTEC/INPE

Dr. Moura began his presentation with INPE's area of activities, which include

- space science
- Earth observation
- Space technology
- Earth system science
- weather and climate

INPE has 12 facilities located around Brazil with the Headquarters located in São José dos Campos. INPE's receives images and data from:

- AQUA, TERRA, NOAA 12/16/17
- LANDSAT 5 (US)
- SPOT (França)
- RADARSAT (Canadá)
- ERS (ESA)
- SCD1-2, CBERS 4 (Brasil)

and controls and tracks:

- SCD 1-2
- CBERS 4

INPE's space engineering and technologies (ETE) efforts include:

- Technological development and industrial policy
- Sino-Brazilian Program, CBERS 3&4
- Application Satellites
- Amazonia-1 Satellite
- Brazilian Data Collecting System

The launch date for INPES next satellite, the CBERS-4A satellite, is in 2018. Dr. Moura then described the Amazonia 1 Mission. Its planned launch date is between February of 2018 and June of 2019.

INPE's activities cover a wide area, including space and atmospheric sciences, astrophysics, space geophysics, aeronomy, and space weather. INPE's cooperation with NOAA includes the newly installed CSOMIC-2 station at the INPE facility in Cuiaba. INPE's Earth observation efforts include:

- Remote Sensing Research: Geology, Water Resources, Oceanography, Ecosystems and erritorial Management and Monitoring.
- Technological Development: SPRING, Terralib, etc
- Amazonia Program: Deforestation Monitoring, Forest Fire Monitoring and Prevention

INPES's weather prediction and climate studies are done at CPTEC includes:

- Numerical Weather and Climate Prediction
- Satellite Meteorology
- Research and Development:
- Weather forecasting and climate variability and change;
- Climate and Hydrology of Amazon Ecosystems;
- Climate, Weather, Micro-Meteorology, Ocean-Atmosphere interaction and Marine Meteorology

Models currently running at CPTEC are:

- Brazilian Atmospheric Model – Global 20km
- Regional Eta model –South America – 5km
- Environmental BRAMS model – S. America – 5km: air quality, fire emissions, urban and industrial emissions
- Oceanic global wave model (Wavewatch)
- New global model: 2017...Looking for Cooperation with NOAA and UCAR

Dr. Moura then showed several examples of satellite products produced by INPE's Satellite Division including atmospheric pollution and forest fire detection. INPE's severe Weather Observation System (SOS) monitors and provides near real time weather conditions like rainfall from satellite and radar, lighting ground instruments, fire, fog, severe weather warning, etc. The Information is also available by Web Service or Smartphones.

INPE has developed the SIGMACast software to be used to visualize data and products coming over the GEONETCast Americas system. SIGMACast is an open source and free software program. As for GEONETCast Americas, INPE see it has a bridge between data and society. It is an important dissemination system to get Earth observation data and products to the user. INPE is a strong support of the system and is pleased to be cooperating on it with NOAA.

INPE is part of the network of Regional Centers of Excellence for Training in Satellite Meteorology of WMO. As a Center of Excellence, INPE serves as a source of training for satellite Member countries of WMO to promote the ability of its members to use data satellites broadly and significantly, with particular attention turned to the needs of developing countries.

### Session 2.3 – Status of Himawari Satellite Program

Dr. Yoshishige Shirakawa, Senior Coordinator for Satellite Systems, JMA

Dr. Shirakawa began his presentation by reviewing JMA's geostationary satellite program. He then focused specifically on the Himawari-8/9 program. Himawari-9 is expected to become operational in 2022 taking over for Himawari-8. He showed the first image from Himawari-9 taken on January 24, 2017. A description of the Himawari-8/9 satellites themselves followed. An overview of the overall Himawari ground system was also described.

Dr. Shirakawa gave a detailed overview of the Advanced Himawari Imager (AHI) including its spectrums, observing schedule, and data services. JMA data distribution services were described including HimawariCast and HimawariCloud services including terrestrial redistribution methods. The Himawari User's Guide was previewed including links to the guide.

In summary:

- Himawari-8 and 9 are the new-generation geostationary meteorological satellite. Himawari-8 has been operational since July 2015. Himawari-9 has been standby on orbit since March 2017 and is expected to take over the service in 2022.

- Himawari-8 and 9 carry a new imager, which is a multi-channel passive imaging radiometer similar to the Advanced Baseline Imager (ABI) on the GOES-16.
- JMA distributes the Himawari data in two ways. One is the HimawariCast service via a communication satellite. The other is the HimawariCloud service over the Internet.

## Session 2.4: Monitoring Weather and Climate from Space

Mike Williams, Head of Flight Operations, EUMETSAT

Mr. Williams began is presentation with an overview of EUMETSAT mission planning. Current EUMETSAT satellites include: METOP-A and B, METEOSAT-8, 9, 10, and 11, and JASON-2 and 3. He gave a more detailed description of Meteosat Second Generation, a two satellite operational system and showed some examples of the data products. The EUMETSAT Polar system, part of the Initial Polar System shared with the U.S. was then described. The impact of weather satellite data was then reviewed. Examples of satellite date on modeling were shown focusing on cyclone Sandy.

Altimetry missions – past, present, and future. The contribution of Jason to mean sea level observations was shown as well as Jason=3's contribution to El Niño observations was demonstrated through product and graphic examples.

Mr. Williams then describe the EUMETSAT ground systems across Europe all designed to deliver time-critical data to the three continents, Europe, Asia, and Africa. The ground systems also include online data access. The online data access web links were shown as well as a description of EUMETRSAT's Data Centre.

Next came a description of EUMETSAT's future plans with a description of MTG's full operational configuration. MTG-1 imaging mission was reviewed.

- Imagery mission implemented by two MTG-I satellites
- Full disc imagery every 10 minutes in 16 bands
- Fast imagery of Europe every 2.5 minutes
- New Lightning Imager (LI)
- Start of operations in 2021
- Operational exploitation: 2021-2042

MTG's sounding mission:

- Hyperspectral infrared sounding mission
- 3D weather cube: temperature, water vapour, O3, every 30 minutes over Europe
- Air quality monitoring and atmospheric chemistry in synergy with Copernicus Sentinel-4 instrument
- Start of operations in 2023
- Operational exploitation: 2023-2042

The 4D weather cube with MTG-I and MTG-S will have four layers, lightning, convection, winds and atmosphere. Mr. Williams showed several examples data products from that will be available from MTG.

The next step on the EUMETSAT journey is EPSS-SG. An operational configuration was shown. EPS-SG will be a sounding and imagery mission with:

- IASI-NG Infrared Atmospheric Sounding
- MWS Microwave Sounding
- METImage Visible Infrared Imaging
- RO Radio Occultation

- 3MI Multi-viewing, -channel, -polarization Imaging
- Copernicus Sentinel-5 UN/VIS/NIR/SWIR Sounding

EPS-SG B microwave imagery mission:

- SCA Scatterometer
- RO Radio Occultation
- MWI Microwave Imaging for Precipitation
- ICI Ice Cloud Imager
- ARGOS
- Advanced Data Collection System

Eps-SG mission capabilities

- Major improvements to all EPS observation missions
- Infrared and microwave sounding
- Optical imagery (METImage, developed by DLR)
- Scatterometer
- Radio occultation
- New imagery missions:
- 3MI: first operational imaging polarimeter
- MWI: microwave imagery of precipitation
- ICI: Ice Cloud imagery

Jason – CS instrument locations

- Poseidon-4 Dual Frequency Altimeter
- AMR-C Advanced Microwave Radiometer
- DORIS Doppler Orbitography and Radiopositioning Integrated by Satellite
- GNSS RO GNSS Radio Occultation
- LRA Laser Retroreflector Array
- GNSS POD GNSS Precise Orbit Determination (unseen on top of the satellite)

From weather to environmental forecasting – third party programmes in support of Copernicus. A flyout chart showing all the systems supporting Copernicus was shown.

Sentinel-3 instruments

- OLCI - Ocean and Land Colour Instrument
- SLSTR - Sea and Land Surface Temperature Radiometer
- SRAL - SAR Radar Altimeter
- MWR - Microwave Radiometer

EUM SAT NOAA Cooperation

- Cooperation in satellite meteorology, oceanography and climate monitoring
- Focus on operational data exchange, data redistribution, production of climate-relevant datasets, scientific exchange, user training, coordination through multilateral partnerships (CGMS, CEOS, GEO)
- Joint programmes:
    - Joint Polar System – EPS - SG and JPSS
    - Altimetry -Jason-CS/Sentinel-6

- Data Exchange & Distribution:

- MSG at 0deg & IODC
- GOES-R
- GEONETCast

- Science:
  - Many joint science activities Joint Programs

## Session 3: Lunch Time Speaker

Al Roker, NBC Today Show

Al Roker, the award-winning TV meteorologist and long-time fixture on the NBC Today Show, gave a luncheon talk on the first day of the NOAA Satellite Conference. Roker used his remarks to highlight the ups and downs of a challenging career in broadcast TV and the anticipation of TV meteorologists to use NOAA's GOES-16 data. At the end of his talk, Roker used the time to encourage and answer questions from CUNY students, who were in attendance.

## Session 4: Panel Discussion: Big Data

Session Chair(s)*: Kathryn Mozer

Key Points*:

- NOAA's full and open data are increasingly popular and vulnerable.
- NOAA struggles to keep up with demand.
- Projections of NOAA's archive growth is vast. Data out of archive…moving multiple petabytes and satellite data is important and desired.
- Big Data Project is a business experiment.
  - Industry partners are: Amazon, Open Commons Consortium, IBM, Google, Microsoft
- Industry is bringing infrastructure to the table.
- Had to help industry understand the data, then talk about how users will use the data. Right now these companies are providing data for free, but won't if there's no benefit.
- NOAA doesn't dictate what data goes out, it's driven by the user.
- Example success story: NWS NEXRAD L2 archive was transferred from NCEI to AWS, OCC, Microsoft, and Google. Data usage has increased 2 times and load on NOAA archive has gone down 50%.
- OCC judges success by research papers that cite them.
- Another example: Google taking a subsection of wx data and providing it to other clients who didn't realize they needed it. This is a new kind of flexibility that hasn't existed.
- Different industries have different offerings.
- Industry partners are trying to figure out how to make money off of this. It's of zero cost right now.
- Fisheries data, climate data, etc. is all available. Publishing data outside the gov't.
- Industry partners will monitor quality
- Opportunities:
  - Enhanced distribution of NOAA's open data
  - Reduced level of effort for public data access
  - High level of service to customers

- Pulling data from NOAA through 1 feed at CICS-NC and then splitting the distribution to the industry partners.
- Provisional G16 data is going out. Latency is 30sec to 2-3 min additional latency before it's available through the cloud partners.
- OCC is targeting the research community
- BDP wants feedback from community on how valuable obtaining data in this was is and if this approach makes sense.

**Action Items*:**

None

**Questions / Responses*:**

***Question:*** Emphasis on presentation is about changing access. Data isn't information. Not everyone interprets data the same way. Question about certification. How do we identify those data which are to be trusted for what they say?

***Responses:*** BDP has thought about this the entire time. Perils of open data. Can do something about traceability of information to the source. NOAA says they stand behind quality and are providing it openly. At the file level they can do this and they are doing it with G16 right now. Counting checksums. Trouble begins when things are pointed to other interpretative tools. It is a concern and they are working on it.

***Question:*** Moving paradigm that we don't move the data from the customer, move to the data. Is that the direction we need to be going?

***Responses:*** Yes. Customer will need to come to the data in the future. EUMETSAT and JMA, USGS, and NASA are all working on similar things. Datasets will be too large in the future to move around. Having fewer copies of data.

***Question:*** Where do Big Data efforts fit into NESDIS enterprise ground system?

***Responses:*** This experiment will inform each of the line offices. This is an experiment

***Question:*** What's the process for suggesting visualization tools to be added to these services?

***Responses:*** Ed can provide contact info. Willing to host new tools.

***Question:*** Is there a risk that Congress will reduce funding for critical NOAA archives b/c "Google/Amazon is doing that"?

***Responses:*** Gov't plays a key role to provide authoritative voice. Provision of quality of data, only NOAA can do

***Question:*** What's the difference btw getting data from BDP vs PDA

***Responses:*** Get data from PDA which is reproduced

***Question:*** With a reduced load on NCEI/CLASS…would there be a reduction in server/storage or will that keep running?

***Responses:*** No change

***Question:*** Isn't moving Big Data around that involves procedures and protocols. PDA seems better and needs to be multi-threaded.

***Responses:*** Correct, but this experiment is being able to put more taxpayer dollars in the system, work with industry to provide the same amount of accessibility.

***Question:*** What G16 data has been sent to providers and how does instrument data get to providers. What's oneness of providers to understand and listen to scientists if there needs to be an update?

***Responses:*** Anything provisional, Industry will listen to scientists if there's an issue with data that needs to be corrected, and Climate Corp and NOAA got together to check files on some issue

***Question:*** What is the Group on Earth Obs doing to support Big Data

***Responses:*** Interested to find out how experiment works

***Question:*** Quorum could be a useful bridge between cloud and who new end users could be. Thought about a consortium or other IT vendors?

***Responses:*** Yes, thought about setting up a group that would work with these companies. In the

**Suggestions:**

None

## Session 5: Satellite Constellation Evolution (Town Hall)

Session Chair(s): Dr. Karen St. Germain; Director, Office of Systems Architecture and Advanced Planning (OSAAP)

Background: The Satellite Constellation Evolution Town Hall was a highlight of the first day at the NSC. The town hall was broken into two parts; part one being a 30 minute brief by Dr. St. Germain which focused on the need to replenish the overhead NOAA constellation in the 2030 timeframe and NOAA's desire to use commercial weather data in the future. Part two was a 30 minute town hall during which numerous satellite vendors and NESDIS customers (e.g. the National Weather Service (NWS) and foreign mission partners) utilized the SLIDE-O application to ask Dr, St. Germain questions relating to her discussion and to what lies ahead in the future for commercial weather activities.

Key Points as delivered by Dr. St. Germain:

- While the full suite of JPSS and GOES satellites have yet to be launched and deployed, the nation has to start the Satellite acquisition process for the future constellation soonest due to the requirements associated with those activities and the amount of time needed to acquire and build satellites.
- The NOAA Satellite Observing System Architecture (NSOSA) study is not only looking at different types of satellites (then are currently in the Program of Record) but are looking at different orbits, sensors and permutations, in addition to how data will be assimilated in the future.
  - NSOSA is all about the requirements, warnings, watches, weather. "We work with the users to understand how the requirements must work"
- For the Commercial Weather Data Pilot (CWDP), NOAA is going to look to the commercial sector at venues such as AGU and AMS to further discuss the importance of commercial weather data
  - Phase 1 of the CWDP is complete. OSAAP will shortly start round 2 with FY 17 and recovered FY 16 money.
  - In phase-1 OSAAP started with Radio Occultation data because the most mature capability.
- Interacting with the users is paramount from a CWDP and NSOSA perspective.

Questions / Responses*:

Q: Dr. Ucellini (Director NWS) is looking at models in ten years, that we would want to assimilate. Can you see a future where cube-sats could be part of the constellation?

A: Various combinations of high performing payloads in various orbits, wide-range of types, even alternative orbits is what we are exploring. We need to do things more affordably, which is what we are doing in the study.

Q: What progress has NOAA made for enterprise ground system?

A: Don't want misconceptions - there is no NOAA program to build a new ground and plug in, we are taking stuff we have already done and evolving it. We are stepping our way towards enterprise ground, no Big Bang.

Q: How do you take into account future private capabilities that aren't being proposed yet?

A: [We have] Reached out to private industry with RFIs and via Industry days. We had to handle this by discussing observations we need and if we don't see providers let them know what we might need.

Q: What other type of data is NOAA interested in (via commercial) other than RO?

A: We'll discuss after NSOSA as by then we should know what type of data we are most interested in. Ask in 6 months.

Q: JPSS has found that users are using data in totally different ways. How do we bring in new ways of doing things, that don't require new sensors, but adjustments to sensor design and how to bring in data (exploitation)?

A: We'll here more later in conference on Exploitation and how we will address that. The question about making adjustments to the payloads is different - with these large programs, the programmatic risk is coupled together, so as we move to a future architecture we are looking to be more flexible in the future.

Q: Can US Satellite vendors participate in the NSOSA study?

A: We may come up with a great/brilliant solution, so when we come out of the NSOSA study, we will try to tie IGARSS, AMS and other conferences together where we engage the industry to make sure we have the latest thinking from the enterprise that may bear on the enterprise

Q: What about cubists for operational services?

A: Cubesats/smallsats in general have been considered in our analysis. We are tracking these developments closely as we are working closely with NASA

Q: What type of instruments is NOAA looking to add?

A: In order to make it into the mix we had to reasonably assess that it could make it into the constellation. Especially wind-LIDAR, which has moved along quite well, especially since Europe is flying a wind-LIDAR yet, this is not an "inexpensive one".

Q: Can you discuss the vendors and the type of data coming out of CWDP (phase 1)

A: Report coming soon to discuss the data and the data their quality.

Q: Is there a policy from US government preventing NOAA from developing a certain data product?

A: No. We try to tie product development to operational user need.

Q: Is security an issue?

A: For sure. As we move into a future as we draw in data from a variety of sources we have to think about data origins. We are working secure ingest later this year.

## Session 6 – Research to Operations

### Session 6.1 - STAR and Cooperative Institutes in R2O

Session Chair: Satya Kalluri

- Organizational description of NESDIS' 3 STAR CoRPs at CICS, CIMSS, CIRA, & 1 CSC at CREST.
- Contributions:
  - Test bed science products analysis
  - Collaborate with new missions for proving ground and risk reduction activities
  - Innovative data exploitation development
    - Imagery manipulation (e.g. RGB & True Color from GOES-R)
    - Multi-platform interfaces (e.g. Volash)
    - Web displays (e.g. CIRA/RAMMB – Slider)

### Session 6.2a - Satellite Products and Services Review Board: Legacy & Non-NOAA Data Sustainment

Session Chair: Kathryn Shontz

- Provided list of existing legacy and Non-NOAA data products
- Provided list of FY17 sustainment activities which have received support
- Provided list of FY18 sustainment activities currently under review
- Planning efforts include consolidation of scientific approaches for like-data products, which provides benefits
  - Sustainment savings
  - Improves product and verification consistency for users
- Focus going forward is to employ enterprise product generation solutions in product sustainment:
  - Invest in enterprise algorithms for consistency across JPSS & GOES-R missions
  - Consolidate all product generation into enterprise architecture systems
- OSGS is applying funds to product sustainment projects in accordance with NESDIS priorities

### Session 6.2b - Satellite Products and Services Review Board – GOES-R Sustainment –

Session Chair: James Sims

- Provided list of planned GOES-16 future capabilities.
- Presently engaged in process of mapping legacy GOES capabilities against GOES-R product capabilities to highlight continuity of operations as well as product areas where lack of continuity may be reviewed. This activity includes multi line-office prioritization exercises within NOAA.

### Session 6.2c - Satellite Products and Services Review Board – S-NPP & JPSS Sustainment –

Session Chair: Arron Layns

- Briefed S-NPP product portfolio
- Reviewed JPSS-1 product operationalization plan
  - First phase of roll-out (KPPs and SDRs) is complete ~L+90 days
  - Second phase of roll-out (all remaining EDRs) is complete ~L+5-18 months

### Session 6.3 - JPSS Science Research

Session Chair: Mitch Goldberg

- Reviewed JPSS portfolio and network of JPSS stakeholder/services/systems enterprise
- Noted focus on applications and decision support for NOAA service areas and partners
  - One area of JPSS focus includes weather forecasts for 3-7 days
  - Examples shared include fire, smoke, profiles, flood & river ice
- JPSS is part of the foundation for the Proving Ground
  - JPSS is part of enterprise algorithms and cal/val, direct readout CSPP, STAR R&D, User workshops & training, management commitment, and innovation
- Walk-off statement: R2O is more than simply transitioning products to operations. It is more about using ops products in user applications. All satellite programs need to invest in User Readiness (e.g. Proving Ground) in order to reach the ultimate objective of weather-ready decision support.

### Session 6.4 - GOES-R Science Research / Proving Ground –

Session Chair: Steve Goodman

- Highlighted GOES-R role in Proving Ground, which tested product to be used in daily NWS operations
- Provided overview of GOES-16 product quality status
- Signs of successful proving ground activities include the frequent feedback from forecasters about how the enhanced capabilities improve their watch/warn decision making capabilities
- Multiple examples shared of stunning ABI imagery and GLM examples

# Day 2: July 18, 2017

## Session 8: Opening Keynote: WMO Satellite Activities and Strategic Perspective

Dr. Elena Manaenkova, Deputy Secretary-General, WMO

Dr. Manaenkova started her presentation with on overview of WMO Space Programme activity areas. The purposes of these programs are to support weather, water, climate and space weather efforts globally. The primary areas are observations, training and awareness, data dissemination and access, and products. She then described the evolution of the space based Global Observing System (GOS) starting with Tiros and METOER in 1961 to the present. For the future, GOS 2015 to 2022, there is new generation of geostationary satellites coming on-line, including NOAA's GOES-R series.

One of the primary goals of the WMO is to promote user readiness for these new generation satellites. A table of the new satellites and their locations and capabilities was shown. Examples of the new data types that will be available were given. There will be many opportunities for enhancing services and it is important for the WMO members to prepare themselves for these new data and products. Dr. Manaenkova pointed out the NOAA has done a very good job of getting its user ready for the GOES-R series satellites.

The WMO support four areas for user readiness:

- Region-based satellite users groups
- Training events organized by VLab
- Satellite user readiness portal (SATURN)
- Best practices for achieving user readiness

The WMO is fostering coordinated generation of satellite products for nowcasting. The overlapping imaging channels of the geostationary satellites creates overlapping geographic footprints. Overlap in satellite footprint, imaging channels,and derived products offers opportunities for combined use, but poses challenges for users (data reception,data interpretation and potential redundancy). The WMO

SCOPE-Nowcasting initiative addresses some of these challenges for nowcasting applications. Dr. Manaenkova provided a list of WMO SCOPE-Nowcasting pilot projects.

The WMO is deeply involved in assessing the impacts of satellite observations on NWP. One method of doing this is through the WMO's Rolling Review of Requirements (RRR). A key element of the RRR is the WMO Workshops on the impact of various observing systems on NWP. The results from the 6th WMO Impact Workshop in Shanghai in May, 2016 were cited.

The WMO also works hard at maintaining tools for users through the WMO Observing Systems Capability Analysis and Review Tool (OSCAR). The WMO-maintained online resource has 3 components:

- satellite programmes, instruments, and the variables they can observe (OSCAR/Space)
- surface-based stations/platforms under WIGOS (OSCAR/Surface)
- observation requirements for 14 "application areas" and for all relevant variables (OSCAR/Requirements)

The WMO OSCAR/Space had two components:

- factual information on satellites and instruments
- assessments of instruments, and gap analyses

The WMO Vision for WIGOS in 2040. Why do we need such a document?

- To serve as a reference for WMO Members and other observing system operators, providing context and expected boundary conditions relevant for planning their future system developments.
- To act as a (weak) forcing function for satellite agencies
  - Operational meteorological satellite programs tend to have very long life cycles, which means that the existing WMO "Vision for the GOS in 2025" is too near-sighted to be useful
- Sets a frame of reference also development of science algorithms, data processing, dissemination and archiving systems

This is from the 17th World Meteorological Congress (2015): Commission for Basic System to develop a "Vision for WIGOS in 2040", to be submitted to Congress-18 in 2019

A document structured in three components:

- Over-arching "Vision" providing, purpose, context and scope
  - Societal drivers, e.g. increased vulnerability to and awareness of weather and climate risks, population growth, increased urbanization
- Annex I: Vision for the space-based component of WIGOS
  - Long-term satellite programs developed by a relatively small number of space agencies makes this (somewhat) manageable
  - Current draft developed in extensive consultation with user groups, WMO technical commission experts and space agencies.
- Annex II: Vision for the surface-based component of WIGOS
  - Developed with NMHSs, experts, user groups, funding agencies,…
  - This is by far the most difficult component!
  - Rapidly changing role of private sector, lack of central planning, commoditization of sensor, computing and telecommunication technologies makes it very difficult to predict the future.

Vision 2040 WIGOS Space had four components.

Component 1 – Backbone system with specified orbits and approaches

Component 2 – Backbone system with open orbit configuration, flexibility to optimize system

Component 3 – Operational pathfinders, technology and science demonstrators

Component 4 – Additional capacities and capabilities

## Session 9: Introduction to GOES and GOES-R

Session Moderator: Steve Goodman

### Session 9.1: Current GOES Status

Natalia Donoho, NESDIS Office of Satellite and Product Operations (OSPO), Satellite Products and Services Division, spoke on the GOES Mission – the protection and enhancement of the Nation's economy, security, environment, and quality of life. The GOES mission includes: warnings to the public; imagery for weather forecasting; derived products for analysis and forecasting; environmental data collection; space weather monitoring, and search and rescue support. Ms Donoho described the operational status and GOES flyout

schedule, including the GOES-R series. She provided an update of GOES-16 status and current access points for GOES-16 data.

### Session 9.2: GOES-R Overview

Mike Stringer, GOES-R Series Program Acting System program Director began the session by introducing GOES-16. He reported that the GOES-16 handover to OSPO officially took place on June 23, 2017, and that GOES-16 will be moved into operations as GOES East in December of 2017. Mr. Stringer pointed out that during relocation the satellite will not provide any data so it will not be moved until the Hurricane season is over. He said GOES rebroadcast cannot occur simultaneously with GVAR so there is a plan to relay GVAR through GOES-14 during the overlap period. Mr. Stringer reported on upcoming GOES-S milestones, culminating in a planned launch in the Spring of 2018.

### Session 9.3: ABI CMI, First Image Overview

Tim Schmit, NESDIS Office of Satellite Applications and Research (STAR), Advanced Satellite Applications Branch, spoke about the Advanced Baseline Imager (ABI) on GOES-16. He pointed out that the ABI has 3 times the spectral bands, 4 times the spatial resolution, and 5 times the temporal resolution. Mr. Schmit showed many GOES-16 ABI images and products to demonstrate its high quality and fast response.

### Session 9.4: PS-PVR Results Distribution to Users

Matthew Seybold, GOES-R Data Operations Manager and Team Lead for Product Readiness and Operations (PRO), spoke on the GOES-16 Product Quality and Distribution. He first described the current status of both L1b science product validation and L2+ science product validation, indicating that both are on-schedule and going well. He described the validation maturity levels as determined by peer stakeholder product validation reviews. He described current data caveats for both levels and pointed out solutions are in development for all of them. Mr. Seybold also described the HRIT/EMWIN data that is available from GOES-16.

**Questions and Answers**

Q: How long will it take to move GOES-16 into the East position at 75W?

A: We are planning to arrive at the GOES-East position in November. The move will take 14 days.

Q: Can we distribute GOES-16 data nationally?

A: Yes. However, ABI imagery right now is only provisionally, but it is validated and available; GLM and ABI L2 products are beta validated and available via GRB.

Q: Would you still choose cirrus band Ch 4 (1.39 □m vs green spectral band to permit true color RGB?

A: That decision was up to the NWS. NOAA users will determine future requirements for the next imager.

Q: Who sets priority for mesoscale rapid-scan imaging?

A: That is managed by NWS Senior Duty Meteorologist. The priorities that were initially determined are being updated.

Q: How long will GOES-13 be transmitting data through GVAR?

A: That is to be determined with details to be provided once confirmed. Current plan is for two week overlap in the November data collection from GOES-16 and GOES-13, primarily to evaluate the Magnetometer performance.

**Key Points from Session:**

- GOES-R is a game changer, truly a transformational advancement in Geostationary Environmental Satellite capability with 3x greater spectral bands, 4x greater spatial resolution, 5x greater refresh rate and all with more accuracy and reduced latency from today.
- The Geostationary lightning mapper is a wholly new capability to map total lightning activity over much of the western hemisphere.
- All L1B instrument data has reached beta validation maturity and is available to users through the GRB. The ABI cloud and moisture imagery has been provisionally validated and is widely available. The derived ABI L2 products and GLM L2 product will be provisionally validated by the end of the year with some products reaching provisional validation maturity in the first half of 2018.
- GOES-16 will become operational as GOES-E replacing GOES-13 in November.
- GOES-S launch commitment date is 4th Quarter of FY2018, with a current launch date at Cape Canaveral of March 1, 2018. GOES-T launch is planned for 2020.

## Session 10: GOES-R User Testimonial session

Session Chair(s)*: Leroy Spayd and Martin Medina

Key Points*:

- Erica Grow: Trying to educate end users why GOES-16 data is so beneficial. Telling them going from black and white to color resonates well with users. An overarching issue on how broadcasters will utilize the new data, they need better options from their weather graphics software to take full advantage of GOES-16 data.

- Chad Gravelle: Has been working at the Operations Proving Ground to train NWS.

- Dave Radell: Seeing very fine level of detail with GOES-16. Example of data use this morning from the NYC office that mentions G16 RGB imagery. Looking at a layer of dry air that may inhibit thunderstorm activity. This is a learning process for everyone. A benefit to early access to data is learning as we go. An example of how G16 will be used in short term forecasting. Eastern Region just did a Decision Support Service “road show”. One of the forecasters wanted to look at G16 fog difference and visible channel. He wanted to know what was happening now and would they have to content with fog in a Coast Guard rescue scenario. That was from a forecaster who’s been around a long time and the first thing he wanted to see was G16.

- Mike Pavolonis: As a research scientist, first thing he thinks about is data extraction. Need to keep in mind that real-time users can only examine a small subset of that imagery. This has always been a problem. To him, the research community has a mandate to distill all that data into concise information and do it in tandem with other data sets, satellite and non-satellite. Detection of volcanic eruptions has increased since G16. Also severe wx warning operations. Combining with radar, lightning datasets, etc. to determine which storms are most likely to develop severe weather.

- Randy Bass: Weather information is used for many facets of aviation forecasting, particularly satellite information. Example on March 3rd: SFO had fog which caused a ground delay. At 9am, G16 showed stratus already eroding. GOES-W showed that but not until 9:15am. 9:30am, G16 showed stratus almost clear which convinced decision makers to lift the ground delay. They lifted it about an hour earlier (the forecaster predicted) which was a cost savings to airlines of ~$50k since more planes were no longer held. Air traffic monitors tons of offshore airspace. The FAA OPC product merges satellite, radar, and model data into one product. Excited about new G16 data added to this product.

• Tom Cuff: OPC provides forecasts and hazardous weather warnings over a vast amount of ocean. Concerns: sea fog, volcanic ash, among others. Concerned about explosive cyclogenesis and ships getting caught in this. Forecasters are constantly trying to detect this. The airmass RGB product has been very helpful in identifying areas where stratospheric intrusion occurs that is a precursor to rapid storm development. Ships can't get out of the way even with good model predictions. SST that provides better resolution in major ocean current locations, has been very helpful.

• Kathy-Ann Caesar: Having additional information over the ocean is extremely important. Right now, a tropical storm is moving toward the eastern Caribbean. They were using G16 this morning to analyze convection. Have been looking at dust coming across the Atlantic. Feeding G16 data into a dust dispersion model. Downside is access to the data. Once it becomes operational, many of the small island states won't have the funding capacity to access the information. Thank NOAA for making GEONETCAST available which will be a primary way of accessing that information. Grateful and looking forward to what we can learn.

• Gabriella Gomez: Been working with AVHRR since 1996. Use the data in research. New project Mexico is working on.

**Action Items*:**

None

**Questions / Responses*:**

• How will GLM impact terminal operations (FAA)?

  o Will likely help smaller airports and hubs.

• What is going to be the biggest impact to broadcasters?

  o E. Grow: GLM. Lightning jump is important precursor to severe weather. Intra-cloud lightning data is something ground networks don't have that will be huge. Broadcasters don't issue warnings. But on-air and through social media, she can give people a heads-up that there's a strong t-storm that could become severe headed their way.

• Forecasters becoming overwhelmed by large volumes. Any ideas on methods and tech that can help?

  o M. Pavolonis: Computers. It's about having them gather information that allows you to make a decision more efficiently. Scientific and mathematical techniques.

o D. Radell: Blended products like Total Precipitable Water is huge. Combining existing datasets into something blended or combined is crucial.

  o C. Gravelle: Forecasters have said it's hard to process all the GLM data on the fly. They want to know when a lightning jump occurred. If an icon came up that said that, it's important to them.

  o T. Cuff: Maritime forecasters need more data.

• Does the research community have ideas on how to best extract data to more manageable subsets?

  o M. Pavolonis: Yes, but how do we work that into our paradigm. How do we integrate with the existing L1 and L2 capabilities that we need and distill that down to more pertinent information. Need to figure out how to bring it all together.

  o G. Gomez: Mexico is trying to get all their groups together.

• GEONETCAST has been mentioned as a way to obtain data. What issues are there to obtain the station?

- K. Caesar: Bandwidth is the biggest issue beyond cost. There is only a subset of channels. They would like more bands available. Trained Personnel is also an issue.

- Is 7 bands enough in GEONETCAST?

  Probably not but we need to determine how to use the bands we will get.

- S. Bojinski (WMO): Is there research planned on added value of 1-min meso-scans on quantitative products and other applications. Not intuitively clear.

  - M. Pavolonis: Quantitatively, there are efforts to try and assess what we can do. Features are moving so fast, a human can't process it that fast and translate that into an event. That's something that will need research.

  - C. Gravelle: Forecasters aren't using just satellite data. With G16, they can visualize and conceptualize physical processes that are happening so they can better understand radar. Fire detection, fog and low stratus…satellite is one of the primary sources of information. For convective operations, it's a difficult question to answer.

  - R. Bass: Biggest issue for us is cessation of an event. We have a lot of problems with that which is one area where G16 can help. You will get wind shifts with t-storms that pass over an airspace.

- What plans do you have for G14 during the change over?

  - V. Griffin: G14 will be used as the storage/backup satellite.

- B. Connell: How many expert forecasters do we have in an average WFO? Combo of using satellite and other tools

  - D. Radell: I'd like to think we have experts in every office. In our region, we have a satellite focal point in every office. All Science Operations Officers went through a 3 day field course on G16. The SOOs are charged with training their forecast staff.

  - B. Connell: Encouraging because we seem to be going back to relying on computers doing the work, but humans program algorithms.

- One of the most exciting part of G16 is the update of satellite with radar. Can you comment on what we expect with rapid update of HRR model and when that might impact forecast office?

  - M. Pavolonis: Not sure what plans are for updating HRR

  - S. Goodman: Met with modeling folks in ESRL last week. They will give Goodman products they want to assimilate into rapid refresh. They are very interested in offshore and assimilating that into the models. It will start ramping up.

  - R. Bass: FAA funds ESRL to do a lot of HRR work.

- D. Lubar: Where do you see the role of the private sector products?

  - R. Bass: had incidents of pilots flying into thunderstorm…not sure what this meant

  - T. Cuff: G16 will be useful in highlighting the hazards.

  - E. Grow: Vendor using proprietary model and using data from smaller aircraft. It created too much noise. WNYC has 2 of their own radars.

- Why not have the computer make the decision? Is there still a place for a human in the loop?

- K. Caesar: 2 weeks ago, one model generated a storm that was going to go over Barbados, but it never happened. They could see something was wrong and it was spinning up too fast. It took human intervention to reduce the panic because some of that information had gone out.

- T. Cuff: Models aren't perfect. Forecasters understand the models are getting better, the key is being able to characterize that uncertainty and apply that skill set to those problems. Decisions aren't coming out of a model

- D. Radell: Communicating effectively and in the context of the user.

- E. Grow: People could interpret model data as a point forecast which is wrong. Consensus and consistency give you confidence in model runs.

- R. Bass: Decision making is will it storm or not? You can't really get that from a computer. Moving toward probabilistic based forecast.

- M. Pavolonis: There is a need to distill large volumes of info to make decision making easier, that does not mean having the computing make the decision.

• Challenges with displaying G16

- E. Grow: Displaying water vapor imagery makes her system crash. Issues are mostly with vendors. She has very specific color schemes and parameters they have to stay within. They can't get too into the weeds when communicating to viewers. It will present a challenge in talking about how great something is.

Comment: B. Connell: Steve G. and Mitch G. said having users look at data and look at products and if something isn't consistent, it needs to get back to the developer.

Suggestions#:

• Users started asking questions on Slido that were out of scope with the panel. Moderators should moderate Slido and ignore questions that are not applicable. Having the questions on the main screen is distracting.

## Session 11: Lunch Time Speakers – Career Stories from the Professionals

The Lunch Time Presentation: Career Stories from the Professional, had professionals and vendors (NESDIS partners) telling their story or journey to fame and fortune. The experience was intended to provide students and conference participant's exposure to careers in the atmospheric sciences and encourage them to consider opportunities in graduate school and the private sector.

Speakers included:

- Erica Grow, Meteorologist for WNBC TV
- Anoop Mehta, President, Science Systems and Applications Inc. (SSAI)
- Melissa Kreller, Science and Operations Officer (SOO) and Acting Meteorologist, NWS, Fairbanks
- Jordan Gerth, Associate Researcher, Cooperative Institute for Meteorological Satellite Studies (CIMSS)
- Kristen Jabanoski, Science Communications and Data Specialist, NOAA Office of Education

## Session 12: Panel Discussion: Training Resources

The Thursday afternoon panel discussion on training resources was moderated by Janel Thomas (STC) and featured 6 panelists: Patrick Dills (UCAR/COMET), Scott Lindstrom (SSEC/CIMSS), Chad Gravelle (UW-CIMSS, NWS/OPG) Bernie Connell (CIRA), Leroy Spayd (NWS/CLO, FDTD), and Jose Galvez (NCEP/WPC International Desk). There are many great training outlets with ample information available for satellites. Each panelist was given 5 minutes to describe their organization, highlight the satellite specific trainings and poll the audience using sli.do about training topics.

Patrick Dills introduced UCAR's COMET Program. COMET specializes in distance learning with over 500,000 registered users and over 600 lessons, some even available in other languages. Specifically, there are 93 satellite meteorology lessons and 8 multi-lesson courses.

Scott Lindstrom introduced the Virtual Institute for Satellite Integration Training (VISIT) Program at CIMSS and CIRA. This is another distance learning program where the trainer and trainees are not in the same room. Scott briefly showed examples of the various delivery methods including unique VISITview software, webinars, blogs, quick guides, and fact sheets.

Chad Gravelle discussed the Satellite Proving Ground which is a collaborative environment with emphasis on the R2O-O2R process utilizing the 6 satellite liaisons that are stationed at the National Centers and Weather Forecast Offices. Satellite products are demonstrated giving forecasters the opportunity to become trained, identify weaknesses and errors, and to identify different utilities. The training has focused on methods for interpretation of satellite data and better understanding of atmospheric sciences and mesoscale meteorology.

Bernie Connell discussed NOAA's contributions to international activities for training in satellite meteorology via the World Meteorological Organization (WMO) virtual laboratory (VLab). It is a worldwide collaborative network connecting training Centres of Excellence (CoEs) and Satellite Operators, with a mission to improve the utilization of data and products from meteorological and environmental satellites. Some of the key points in the current VLab strategy are to provide support to education and training among WMO members through the delivery of Regional Focus Group (RFG) sessions, organization of training event weeks, active support in the introduction of the new generation of satellites and to encourage the translation of training materials.

Leroy Spayd described the National Weather Service (NWS) satellite training timeline and stages, consisting of prerequisites (overall basics), 8-15 hours foundation course (satellite specifics) application (operational setting), exercises (simulations, practice), making it stick (multi-situational, sharing), and continuous learning (evolve and update). He showed the breakdown of the GOES-R Foundational Course as an example and highlighted the completion rate for NWS forecasters. He also noted that the JPSS Foundational course development is underway.

Jose Galvez closed out the panel with a summary of the trainings on weather analysis and forecasting for the Americas via the Weather Prediction Center (WPC) International Desks (Tropical & South American) located at National Centers for Environmental Prediction (NCEP) in College Park, MD. The training program for forecasters is sponsored by the US State Department in partnership with the WMO and Met Services in WMO-RA III and IV. The training focus is on concepts, methods and tools to analyze and forecast the weather with emphasis on Quantitative Precipitation Forecasts (QPF), largely relying and training on interpretation of satellite imagery and derived products. The strategy includes the train-the-trainer concept where experienced fellows assist with the training of their peers and are encouraged to become trainers when returning to their countries. There are also 2-4 international workshops per year as well as

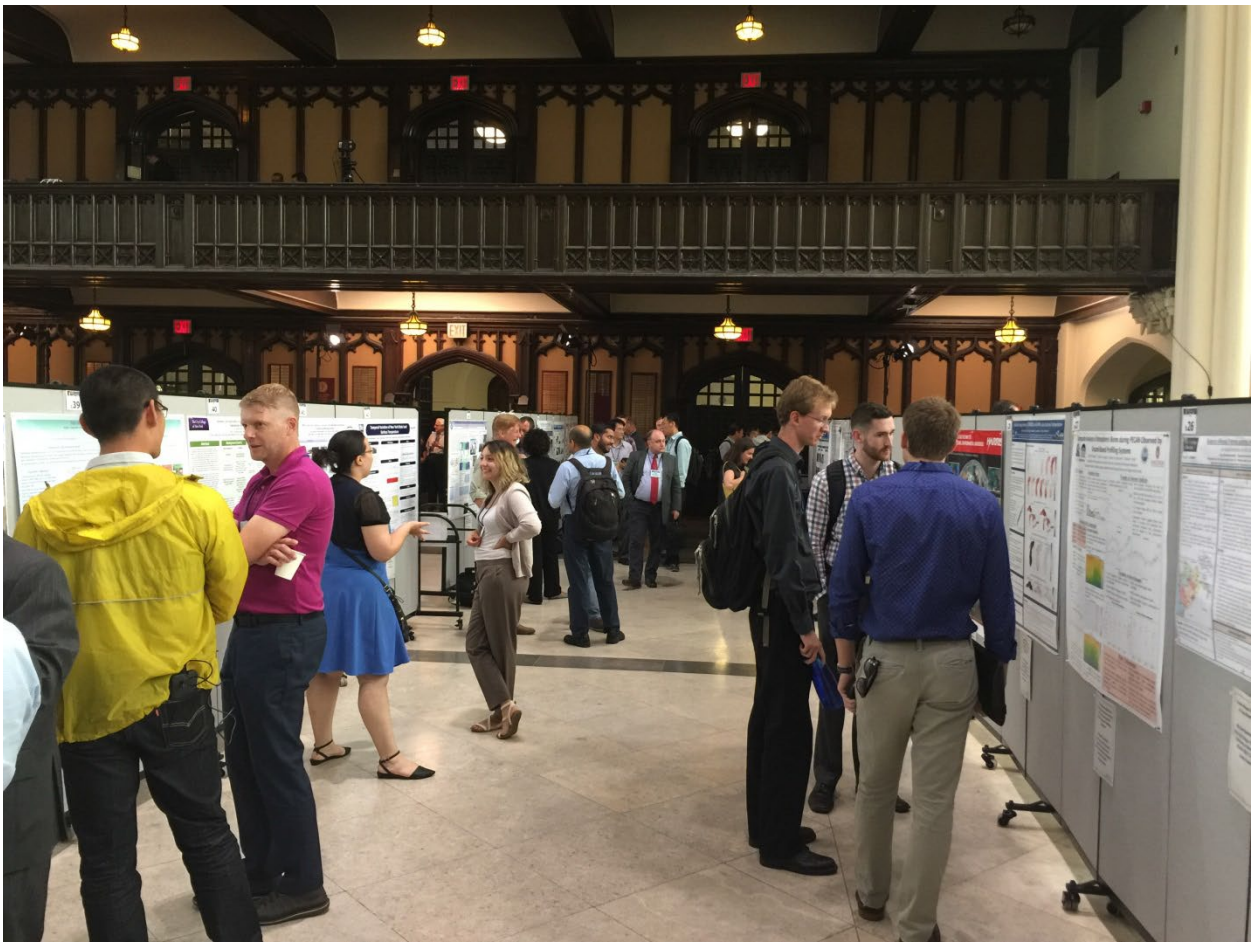
online training through the VLab once per month. As of July 2017 the WPC International Desks have trained over 340 meteorologists.

## Session 13: NSC Poster Summary

There were a total of 138 poster abstracts accepted by the abstract and poster subcommittee. The table in Appendix 2 lists of all the accepted poster abstracts by title and author. The number of posters mounted displayed totaled 119. The poster viewing was available throughout the week including during all the breaks and two official 90-minute poster viewing sessions on Tuesday and Wednesday afternoons. The posters were arranged according to these four subject areas:

1. Reception and readiness for data, technology and applications
2. Application of environmental (atmospheric, ocean, land, cyrosphere and space) satellite data
3. Enhanced interaction and coordination with new environmental satellite programs
4. Education and user training resources for the new era of environmental satellites.

The poster sessions were well attended and the presenters had the opportunity to engage in many in-depth discussions with the participants. There was much positive feedback on the poster session especially that all the posters were up all week. Electronic copies of most of the posters can be viewed at http://www.nsc2017.org/program/poster-downloads/.



## Session 14: GOES-R Operational Applications

Session Chair(s)*: Kathryn Mozer and Matt Seybold

Key Points*:

Drs. Chad Gravelle and Dave Radell lead a 75 minute session on operational applications for GOES-R. They presented five use cases on:

- Aviation
- Fire Weather
- Heavy Precipitation
- Severe Convection
- Dust Detection

Their presentations included lots of GOES-16 cloud and moisture imagery loops. They showed how certain spectral bands are better for detecting one phenomena from another and how they can be combined with radar data or other decision aids in AWIPS. 1-minute and 5-minute imagery was mostly used. Each case study concluded with a quote from a NWS forecaster on the usefulness and utility of the satellite for the case. A 5-minute question and answer session was held after each short, operational application. The audience was very engaged and asked many pertinent questions that were answered by Chad and Dave. The case studies expertly illustrated how beneficial the GOES-R satellite will be to the operational forecaster.

# Day 3: July 19, 2017

## Session 16 - Opening Keynote Address: Preparing for the New Era of NOAA Satellites

Mr. Julián Báez Benítez, President, WMO Regional Association III, Director, Paraguayan Meteorological Service

Mr. Báez kicked off his introduction by outlining the member states in WMO Regional Association III (RA III) South America. He presented regional demographics such as population numbers and topography maps. Mr. Báez gave a background on the Regional Coordination Group on Satellite Data Requirements (SDR), which was established by WMO in 2015. This coordination group was established to discuss how to best utilize existing satellite capabilities and to work on strategies for the users in RA III to receive data from the new generation of NOAA satellites. NOAA experts are working closely with the SDR group and have provided the group lists of GOES-16 and JPSS products and capabilities that could be delivered to users in WMO RA III through the GEONETCast Americas broadcast. Mr Báez presented the current status and future developments in RA III in preparation for GOES-16 products. He moved on to discuss the region's education and training needs, and how their Regional Training Centers (RTCs) can work with NOAA to meet those needs. He closed by thanking the various organizations that have worked to optimize the WMO RA III's use of weather satellites.

## Session 17.0 – Introduction to JPSS

### Session 17.0 –The Current POES & JPSS Status

Jason Taylor, NESDIS/Office of Satellite and Product Operations (OSPO)

Mr Taylor provided a brief introduction on the network of environmental geostationary and polar-orbiting satellites operated by the National Environmental Satellite Data, and Information Service (NESDIS). He mentioned the handover of the recently launched GOES-16 to OSPO, which occurred on June 23, 2017. He also provided schedules for the JPSS-1 and Constellation Observing System for Meteorology Ionosphere and Climate (COSMIC-2A) satellites. He noted OSPO's key role in the deployment of the nation's satellites. These include ground system command & control, ingest, generation, and distribution; pre-launch and post-launch testing, user readiness for broadcast services and product delivery, long-term continuity of products and services, user readiness for broadcast services and product delivery, and long-term continuity of products and services. He introduced OSPO facilities, which house over 500 staff supporting operation of the satellites, receptors, and processing systems. He gave a status update on other satellite missions in the polar constellation as well as Jason and DSCOVR. He continued by highlighting the products that are available for use in operations.

### Session 17.1 – Joint Polar Satellite System

Greg Mandt, Director, NESDIS/JPSS

Greg Mandt kicked off his session with a general description-of the JPSS Program, which included its constellation of polar-orbiting satellites. He noted that polar-orbiting satellites contribute 85 percent of the data used in numerical weather prediction. Data from JPSS for example is critical for 3-7 day forecasts,

and it provides weather and environmental satellite observations for forecasting operations in Alaska and the Polar regions. He added that global coverage twice a day, from JPSS as well as the day night band (DNB) imaging capabilities provided broad environmental monitoring and forecasting. Mr. Mandt discussed the importance of partnerships to the program. He shared how the Program has best leveraged partnerships with universities, cooperative institutes, prime contractors, and the international community. He provided quick overviews of next generation instruments on the JPSS-1 satellite: Advanced Technology Microwave Sounder (ATMS), Cross-track Infrared Sounder (CrS), Visible Infrared Imaging Radiometer Suite (VIIRS), Ozone Mapping and Profiler Suite (OMPS), and Clouds and the Earth's Radiant Energy System (CERES) as well as their derived products which deliver advanced capabilities to support the entire forecast enterprise. In his discussion of the program's future, Mr. Mandt reiterated that JPSS "will continue to provide high quality weather and environmental data and support the needs of the stakeholders and end users." He added that JPSS will continue the exploration of new scientific and societal applications for polar-orbiting data. Before closing, Mr Mandt described the JPSS PGRR program which develops and maintains engagement between JPSS experts and end users about data products and applications. He said that the PGRR initiative projects utilized current data to research and solve various forecast challenges. He closed the session with a brief statement on the upcoming launch of the JPSS-1.

### Session 17.2a – Overview of JPSS Instruments

Mitch Goldberg, Program Scientist, NESDIS/JPSS

Dr. Mitch Goldberg presented an overview of the ATMS instrument. He underlines the importance of polar-orbiting satellites, particularly JPSS by emphasizing the huge impact microwave and infrared sounders have in forecasts. Dr. Goldberg described features on the ATMS and provided examples demonstrating how ATMS data has significantly improved forecasts in the short-and medium-terms, especially in storm tracking. He noted the use of microwave sounders such as ATMS in many applications including hurricane intensity, snow and ice monitoring, and the generation of long-term records of atmospheric temperature and water vapor. Dr Goldberg moved on to discuss the Joint Polar System (JPS) shared with EUMETSAT and included legacy satellites. Dr. Goldberg emphasized that multiple orbits resulted in better coverage. He concluded his presentation with the reinforcement that ATMS products will continue to provide information on long term climate effects.

### Session 17.2b – Use of CrIS Radiances at NOAA

Chris Barnett, Senior Scientist, Science and Technology Corporation

Dr Barnet gave a presentation on the CrIS instrument. He noted that the CrIS sensor has lower noise than IASI and AIRS. He emphasized that the sensor's incredibly low noise made it critical for getting lower tropical soundings. He illustrated how the Cris instrument was used as an interferometer. He noted its use in data assimilation systems, whereby CrIS data was processed over a subset of channels (~60-100 channels or the "Temp" channels). He explained that if a scene is clear i.e., data is unaffected by clouds then all subset channels for that scene are retained. Dr Barnet said that the CrIS full spectral resolution (FSR) mode enabled applications that were challenging in NSR mode. He gave example of air quality applications such as monitoring greenhouse gases and their transport, and a viable carbon monoxide retrieval. The CrIS FSR also resolves weak water vapor spectral lines leading to improvements in upper troposphere water soundings. Dr Barnet concluded his presentation by emphasizing the importance of including soundings in DA models particularly as details of sensor error characteristics, including spectrally correlated noise within the sensor can be accounted for in significantly more detail.

### Session 17.2c – VIIRS EDR imagery, Don Hilger, NESDIS/RAMMB

Dr Hilger began by describing EDR bands, and explaining the difference between SDR and EDR. He also pointed out differences between near constant contrast (NCC) and the DNB, while noting that NCC is derived from DNB. He pointed out some unique features of VIIRS, including finer resolution, for all bands, and at swath edge in particular, he pointed out that it has a wider swath and therefore there were no gaps between adjacent orbits. He provided imagery showing the wider swath and better spatial resolution at swath edge, one depicted detail in cloud contamination, and the other was dust product true color imagery. Dr Hilger then showcased examples of the VIIRS DNB imagery in various applications including the use of: moonlight reflectance to detect snow fields at night; terrestrial light emissions: to indicate power outages in Puerto Rico, and wildfire in Portugal, and the eye of hurricane Mathew to show the DNB view of gravity waves.

### Session 17.3 – Suomi-NPP and JPSS Data Products

Arron Layns, NESDIS/JPSS

Ms Layns began her presentation by explaining what enterprise algorithms were. She discussed the benefits of using enterprise algorithms, and explained the process for transitioning to enterprise algorithm. Ms Layns presented a list of SNPP data products used in operations as of July 2017. She also listed some recent science improvements including a full radiance calibration of ATMS that reduced bias in all channels of up to 0.5 k, a CrIS full spectral SDR, and VI high quality criteria. Ms Layns moved on to discuss the JPSS-1 data product timeline beginning with the data product operationalization plan. She proceeded with a discussion on the various channels available to access data products. These include the Product Distribution and Access (PDA) which is the NESDIS Operational Distribution System, the archive system CLASS, Direct Readout, and the Government Resources for Algorithm Verification, Independent Test & Evaluation (GRAVITE). She also covered methods used to access test and experiment products including NESDIS/STAR websites as well as Cooperative Institutes (CIRA, CIMSS, CICS) and NASA/SPORT. Ms Layns closed with a summary in which she stated that S-NPP data products are meeting performance requirements, and are expected to transition to enterprise algorithms by the end of 2017. She added that product lifecycle and CalVal planning for JPSS-1 is complete and ready for launch. Ms Layns further stated that plans for the future included working with users, STAR, and the JPSS Program Scientist on the addition of new products to the JPSS requirements list, including: ATMS Snowfall Rate, blended Arctic and Antarctic imagery, and global gridded and composited Land Surface Temperature and Land Surface Albedo products.

This session concluded with a designated question and answer period summarized below:

Question/Answer

Q: Enterprise algorithm: Will JPSS use GOES-R algorithm?

A: The JPSS algorithm is much better than GOES-R

Q: What is the status of JPSS ATMS sensor issues?

A: There are a couple of noise issues: First there was a minor leak, which is now fixed. Secondly, there is noise from spacecraft heaters- still working on it to find the root cause.

## Session 18.0 – User Testimonials /JPSS - Panel Discussions

This panel featured testimonials from diverse users including the NMFS, the Alaska Fairbanks WFO, INPE, Brazil, SMN, Argentina, and Meteorological Services Canada. The session provided NOAA and international users the opportunity to discuss the operational application of JPSS capabilities. Users

briefed on ways in which JPSS data and products supported their missions, data access and provided feedback from their user communities regarding the JPSS Program. The panel was moderated by Melissa Kreller (Science Operations Officer and Acting Meteorologist in Charge National Weather Service Fairbanks Weather Forecast Office).

### Session 18.0 – Ocean and Coastal Ecosystems

Cara Wilson (Environmental Research Division, NOAA/NMFS/SWFSC) began the session by underlining the importance of VIIRS in oceanographic applications as it is the only instrument that makes remote oceanographic measurements, i.e., surface chlorophyll and sea-surface temperature, which are useful to NMFS and NOS. Dr Wilson gave a few examples from NOAA satellite course participants which featured VIIRS usage within the NOS and NMFS. She concluded with a few take home points on the value and usefulness of VIIRS ocean color data in many applications within the NMFS and NOS. She noted that the biggest value of VIIRS is that it is part of a longer time-series of satellite chlorophyll measurements that extends back to 1997.

### Session 18.1 – Alaska/Polar Region

Melissa Kreller talked about the importance of collaborative partners in Alaska's forecast operations. She talked about LEO satellite operations pertaining to river flooding, fire weather and sea ice in the Alaska Region NWS. She concluded with plans for future collaborations to include the JPSS Arctic Initiative.

### Session 18.2 – Active Fires

Mr Bill Sjoberg, Global Science & Technology, followed with a presentation on the JPSS PGRR Fire and Smoke Initiative. Mr Sjoberg provided a background of the PGRR as well as one for the Fire and Smoke Initiative. He gave a list of key organizations supporting the initiative. He gave examples of general and specific questions that were considered in fire events, and how satellites were utilized to help answer these questions. He moved on to present recent scenarios of fire events in which satellite capabilities had been utilized extensively and in varied ways. This included examples of the VIIRS DNB showing fire perimeter lines as well as active fires in the Fort McMurray fire, and fire temperature and natural fire color images of fires in Alaska in July 2017. He presented summaries of smoke applications such as the Real-Time HRRR-Smoke Web-Site (rapidrefresh.noaa.gov/HRRRsmoke) and the VIIRS AOT and RGB that helped forecast smoke trajectories.

### Session 18.3 – International Users

Additional user testimonials were given by Dr Estela Angela Collini on behalf of Argentina's Naval Hydrographic Service/National Meteorological Service, Dr Luiz Machado, on behalf of the Brazilian Institute of Space Research (INPE), and David Bradley, on behalf of the Meteorological Service of Canada.

## Session 19.0 - Lunch Presentations – The Future of Our Career Field

Representatives from six conference exhibitors gave presentations. Each representative was asked to provide background on how they entered the workforce, discuss their company's environmental focus and identify how their company would bring on new employees and foster their professional development.

## Session 20.0 - NSC Poster Summary

There were a total of 138 poster abstracts accepted by the abstract and poster subcommittee. The table in Appendix 2 lists of all the accepted poster abstracts by title and author. The number of posters mounted and displayed totaled 119. The poster viewing was available throughout the week including during all the breaks and two official 90-minute poster viewing sessions on Tuesday and Wednesday afternoons. The posters were arranged according to these four subject areas:

1. Reception and readiness for data, technology and applications
2. Application of environmental (atmospheric, ocean, land, cyrosphere and space) satellite data
3. Enhanced interaction and coordination with new environmental satellite programs
4. Education and user training resources for the new era of environmental satellites.

The poster sessions were well attended and the presenters had the opportunity to engage in many in-depth discussions with the participants. There was much positive feedback on the poster session especially that all the posters were up all week. Electronic copies of most of the posters can be viewed at http://www.nsc2017.org/program/poster-downloads/.


## Session 21.0 – JPSS Breakout Sessions

The breakout sessions explored in more depth key program initiatives and activities. Each breakout session had a central focus and questions to stimulate discussion among its participants.

### Session 21.0 - Proving Ground Initiatives

Bill Sjoberg, JPSS Program led this breakout session. Mr. Sjoberg provided details of the JPSS Proving Ground and Risk Reduction (PGRR) Program and the Initiatives that are part of the Program. He provided details for several of the initiatives including their objectives, participants, and activities. He also provided examples of some key products from the Initiatives. Mr. Sjoberg described how the JPSS Program provided oversite of the initiatives and how the Initiatives' research activities were communicated to those interested in the PGRR Program. He suggested some discussion topics for breakout participants and facilitated the discussion.

### Session 21.1 - Cal/Val and Product Performance

Lihang Zhou, STAR JPSS program manager chaired the session. Participants considered ways to incorporate a science reprocessing capability as part of Cal/Val. They discussed an enterprise algorithm approach as a viable way to assure a common cal/val process for all products. Dr Zhou noted that most Suomi NPP products are validated, and asked participants to consider the current status and path forward for NUCAPS trace gas products. Following is a synopsis of questions and answers presented during this session.

Q: In the trace gas retrievals, have you had the opportunity to cross-validate against other sensors like OMI and GOME? - Jim Carr

A: Yes, some of them are compared for OMI and GOME. Also compared with AQUA/AIRS and IASI. Definitely have more work to do. Longer wavelengths (carbon gases) are unique CrIS products. The NUCAPS algorithm is more or less the same as AIRS, but there's more.

- Instrument called TEMPO is coming out soon.

- Jianguo is working on the blended product working on bringing the OMI and GOME together for blended ozone product.

- Want to get trace gas folks involved in the TEMPO science development. TEMPO is UV/Vis/NIR. Airmass is biggest uncertainty in retrievals. Complementary geometries could be useful.

Note: James Carr continued questions on trace gases including SO2 and NO2 which were answered by Jianguo, Murty and Lihang. The answers included products from CrIS and OMPS.

Q: When do you think the NO2 product is going to be available?

A: We have an experimental product, but right now it's not in the requirement. So we need to go through the user request process. We leverage a lot of NASA products. (This is a future OMPS capability.)

Q: Could you say a little bit more about how the future capability – how do you distinguish tropospheric NO2 from total column NO2, which includes atmospheric?

A: We're not sure. We need to refer you to someone else.

Q: For algorithm, are errors global, or are they quantified per pixel

A: We have multiple statistics on our validation reviews to understand data quality and error/performance.

Q: For Aerosol, you have total AOT. Do you have fine vs coarse mode fractions or more detailed particle size? NRL is ready to ingest AOT into aerosol forecast. Currently using MODIS for initial condition but by

using MODIS combined w/ VIIRS, given VIIRS has more coverage, we get better results. For future, can we have a dust product?

A: This is an excellent suggestion for future development. Consider the APSP product which is currently operationally available. Is this something you want?

Note: Peng Xian from Naval Research Lab asked many questions on Aerosol products. She is a modeler and they use SNPP Aerosol data on their models. She asked questions on error flags, uncertainty errors and asked if all the information about the data products can be available with the data as metadata so that the users are aware of exactly what type of data they are receiving and accordingly can make their judgements in using the product.

Land Products

Q: What regions are available?

A: Conus regions

Note: Questions on Land products were mainly asked by Barry Baker. His questions include Land Surface Type and also on whether SNPP Land Products are being used by EMC currently or not.

Q: Is the Surface Type being used by EMC for the operational models over the MODIS?

A: Not yet. We're trying to sell it, but it takes time.

- Would be interested in trying out on the Air Quality

Lihang put a question to Barry: What do you use now?

Barry: MODIS

Q: How often is Surface Type done?

A: Annual.

Ocean Products

Q: Quality control/calibration has been frustrating for users.

A: We can provide flags, but don't have funding to do additional quality control.

A: We discuss a lot on clear and easy to use quality flags, but since this hinges on the user, we can't please everyone.

Q: What is the driver for the bias in SST?

A: There are many drivers, but pixel and sub-pixel cloud, aerosol, user-dependent biases.

- This may be an opportunity for GOES-R look angles to help out.
- Already looking into this, as Sasha rules it all

Q: Are there any reprocessed products available as of today for SNPP? Can you discuss the reprocessing plan?

A: This depends on the maturity of the algorithm. The SDRs are pretty much mature, but reprocessing is occurring. EDR depends on the maturity. Ocean teams are advanced on the reprocessing. We are putting on an overall status of the reprocessing status, and will present at the August meeting. If you have questions regarding a specific product, just ask.

Q: How is quality control incorporated into reprocessing?

- Uncertainty is a need in modeling. Can we have AOT uncertainty from a measurement point of view? EUMETSAT product PMAP AD (Metop retrieval for aerosol) produces this uncertainty at pixel level which helps with modeling and data assimilation (Peng)

- This may be nice for next generation of products.

### Session 21.2 - Training Needed for Data Product Applications

Jorel Torres, the JPSS Satellite Liaison from the Cooperative Institute in the Atmosphere (CIRA) in Fort Collins, Co, moderated the breakout session on 'Training needed for Data Product Applications'. Discussions from the participants ranged from a variety of topics: the different ways that non-AWIPS users can display polar-orbiting data via software packages, such as, Hydra-II and McIDAS-V, and the JPSS product applications for aviation and tropical cyclone forecasting for the Caribbean countries. Discussions also touched upon the utility of NUCAPS and its functionality for users and the upcoming training that will be produced in the near-future, that is, the Satellite Foundational Course for JPSS (SatFc-J) which is governed by the Satellite Training Advisory Team (STAT). The training will consist of training modules, quick briefs (short 3-5 minute videos), and quick guides for users.

### Session 21.3 - JPSS Operational Applications

Christie Best, Senior Systems Engineer, served as moderator for this session which focused on the types of training needed and those available for JPSS Applications. Participants reviewed the basics of the current baseline fire algorithm. They learned that depending on a specific application one needed to understand the specifics scenarios and measurements they wished to observe given that pixel size is what drives the minimum size one is looking at.

Next participants compared the VIIRS I Band versus the M Band. The I-Band is not designed for fire detection; and the I-Band algorithm is more complex. For this reason a hybrid approach using data from both the I-Band and M-Band is used (for fire radiative power).

Dr. Csiszar presented a case study on the wildfires that struck Chile January 2017. Participants explored possible theories for the explosive growth in the Chilean fire between 24-26 January, 2017. Using the NOAA Products Validation System (NPROV) radiosondes participants observed very dry conditions in the days leading up to (and feeding) the fire.

A Q&A session was conducted responding to questions about why NOAA looked at orbital projection instead of geo projections; noting also that scientists often go back to the SDR because the fire product is dependent on the quality of the SDR.

Q: When will we be using GOES-R and S-NPP and JPSS?

A: Over the next year NOAA wants to compare the GOES-R observations with the VIIRS fire detection. J1 gets the first detection, then GOES-R, then check what is in between. GOES-R fire product is fantastic to provide temporal dynamics, but it is a bigger pixel and thus can detect only somewhat larger fires.

### Session 21.4 - GEONETCast JPSS Requirements

Dr. Mitch Goldberg, the JPSS program scientist, served as the moderator for this session that discussed identifying and prioritizing the JPSS data products that would be of greatest benefit to the users of GEONETCast-Americas (GEO-A). The session was attended by 22 representatives from US, Caribbean, and South American government agencies; academia; and private industry. Dr. Goldberg told the participants

starting in FY 2018 JPSS is being allocated 20% of the current GEO-A 12 Mb/sec bandwidth to transmit data products to GEO-A customers and he is currently preparing a list of JPSS data product to provide GEO-A users in WMO Regions III and IV. This occasion was an opportunity for him to inform the participants on his recommendations and asking for their feedback. Earlier in the conference he had briefed the WMO Coordination Group on Satellite User Requirements in Regions III and IV.

As a prelude to his recommendations, Dr. Goldberg asked Mr. Diego Souza from the National Institute for Space Research Center for Weather Forecast and Climate Studies to give a briefing on GEO-A use in Brazil. Mr. Souza said that GEO-A is expanding rapidly and now has 64 operational stations while two years ago there were only 11. The primary purpose of GEONETCast is to disseminate GEOSS data products which now total over 300. There are 4 systems providing GEONETCast global coverage: GEO-A, EUMETCast, EUMETCast-Africa, and CMACast (China Meteorological Administration). He went on to describe the system architecture and said that a low cost GEO-A ground station could be purchased for about $5000. Local products that are generated in Brazil are transmitted by internet to a facility in the US state of Georgia where they are uploaded and rebroadcast over GEO-A. Currently his organization uses 15% of the available GEO-A products.

Dr. Goldberg next briefed the JPSS products he is recommending for dissemination over GEO-A and how they could be used operationally to benefit society. Several of his recommended products included current POES products available over GEO-A that that would be significantly improved with the addition of JPSS and GCOM/AMSR2 data. His recommendations for using the JPSS microwave and infrared sounder products (CrIS, ATMS and GCOM/AMSR2) are:

1. MiRS (Microwave Integrated Retrieval System ) products
2. Blended microwave products (animated GIFS)
3. All GCOM-W/AMSR2 products
4. NUCAPS (NOAA Combined Atmospheric Processing System) products (JPSS and MetOp)

His recommendations for the JPSS VIIRS products are:

1. DNB
2. VIIRS Fire location and Fire Radiative Power
3. VIIRS Vegetation Products
4. VIIRS selected bands (9 out of 22)
5. Ocean color products

Dr. Goldberg mentioned that OMPS ozone and volcanic SO2 products could be made available as well. JPSS is planning to support training on the new enhanced products made available over GEO-A and to support augmenting the GEO-A broadcast with Direct Readout (L-X band).

The breakout participants were very supportive of Dr. Goldberg's recommendations. Dr. Goldberg asked the participants to contact him during the next few months if they have any suggestions on how his recommendations could be improved.

## Session 22: Student and Early Professional Speed Networking Event

The session held Wednesday evening was a great opportunity for students and young professionals to interact with senior people in the weather career field. Teams of professionals from governments, academia, and industry engaged with the students and young professionals during this "speed networking" event to share their career stories, provide advice on how to enter into the weather work force and answer questions. The weather professionals moved from table-to-table ensuring that all the

students and young professionals had a chance to talk with them. The lively discussions during and after the event was a clear sign of the success of the session. Planners can anticipate that this type of session will become a tradition for all future NOAA Satellite Conferences.

# Day 4: July 20, 2017

## Session 23: Opening Keynote: Satellite Data Matters Affecting Developing Countries and Small Island States in RA IV

Glendell De Souz, Science and Technology Officer, Caribbean Meteorological Organization

Mr. De Souza was speaking on behalf of the President of WMO RA IV, Mr. Juan Carlos Fallas, who was unable to attend. Mr. De Souza began his presentation with an overview of the Caribbean region of WMO RA IV and some of the obstacles that met services there face. He defined a Trinidadian phrase, Titivay, as "to waste time," and how that phrase is applicable to some of the issues facing the countries in that area. Real action started in the Caribbean on the preparation on the reception of GOES-R data with the first meeting of the RA III and IV Coordination Group on Satellite Data Requirements (SDR) during the 2015 NOAA Satellite Conference.

The SDR helped to develop a roadmap forward for both regions for access to the new generation of NOAA satellite data and imagery. The group also developed a Regional Training Plan. Mr. De Souza then presented a slide showing how the countries in the Caribbean are currently receiving NOAA data.

Training is a major issue for the region and the SDR's training plan was endorsed by the WMO. The SDR group also developed a proposed Satellite Skills and Knowledge for Operational Meteorologist as part of the Guide on Competency that is under development by the WMO. Mr. De Souza described the Regional Training Center at the Caribbean Institute for Meteorology and Hydrology (CIMH) and the types of courses provided there.

The data acquisition strategies in the region can be broken down into two categories, data and images. For data, the strategy is to receive the data via GRB, Data as a Service, GEONETCast Americas, CLASS or PDA. For images the strategy is to receive them via HRIT/EMWIN and through the internet. Mr. De Souza presented a slide showing how most countries in the region are planning to receive their data and imagery.

In closing Mr. De Souza noted to avoid Titivay the following lessons are good to know.

- Have a Focus Group
- Empower the Focus Group to do the ground work (anti-procrastination methodology)
- Develop the necessary training plans.
- Meteorological Services to act on the outputs of the Focus Group.

## Session 24: Data Distribution and Access – Panel Session

Session Chair(s)*: Jim McNitt and Jing Han

Panelists:

Mr. Greg Mandt – GOES-R and JPSS Direct Broadcast Capabilities

Ms. Kathy-Ann Caesar – The Training Perspective

Mr. Graeme Martin – The DB User Perspective

Mr. Alan Hall – Overview of CLASS

The first panelist to speak was Mr. Greg Mandt, Director, Joint Polar Satellite System (JPSS). The tile of his talk was: JPSS and GOES-R Direct Broadcast Capabilities. Mr. Mandt described the direct broadcast and direct readout services on the GOES-R and JPSS series of satellites and made the following points:

- The JPSS Direct Broadcast (DB) provides real-time access to regional users and includes: the Field Terminal Support (FTS) web portal; Community Satellite Processing Package (CSPP), an open source software to produce SDRs and EDRs; and NOAA Direct Broadcast Real-Time Network (DBRTN). The DBRTN demonstrates the benefits of low latency infrared and microwave sounder data to NOAA's NWS NWP computer models.
- The GOES-R series GOES Rebroadcast (GRB) downlink is standards-based and includes data from all six instruments including the Advanced Baseline Imager (ABI). The ABI provides three times more spectral information, four times the spatial resolution, and more than five times faster temporal coverage than the current system.
- The Emergency Managers Weather Information Network (EMWIN) service that provides users with weather forecasts, warnings, graphics, and other NWS data on the High Rate Information Transmission (HRIT).

The second panelist to speak was Ms. Kathy-Ann Caesar, Chief Meteorologist at the Caribbean Institute for Meteorologist and Hydrology to present the training perspective and the title of her talk was: Direct Readout: GOES/POES, and GOES-R/JPSS. Ms. Caesar noted that the launch of the GOES -16 satellite ushered a new era of exciting weather observations over the Americas. She described the impacts of the advanced monitoring capabilities of GOES-16 and the improvements in monitoring relatively small convective systems which can produce devastating rainfall and in lightning detection. There are addition benefits of the tracking of tropical waves and African dust plumes across the Atlantic. Ms. Caesar described the challenges in data access, data acquisition and training, in the region.

- Few of the operational forecast offices are in the position to install GOES
- Rebroadcast (GRB) receive stations.
- The limiting factors are the hardware cost, and the high-speed connectivity that maybe required for the Product Distribution and Access (PDA).
- Training of the many operational forecasters will now take on more urgency as well.
- WMO Satellite Data Requirement RA III/RA IV – reviewing regional training
- NOAA/CIRA has devised the CIRA Satellite Foundational Course for GOES-R/16
- (SatFC-G) to equip forecasters with the appropriate knowledge.
- Further training opportunities are forthcoming with a Train the Trainer events at NSC
- 2017, and Virtual training via COMET modules and WMO VLAb training events.

The third panelist to speak was Mr. Graeme Martin, University of Wisconsin-Madison, Space Science and Engineering Center to present the Direct Broadcast (DB) user's perspective. Mr. Martin noted that DB allows users to generate products locally from data received directly from satellites and that:

- Products are generated with low latency, data coverage is specific to the users' local region
- Data is used in real-time decision making
- US missions with a direct broadcast stream: Aqua, Terra, Suomi NPP, GOES 13, 14, 15 and 16
- DB has opened up data access to a wide audience of users and apps, especially for real-time decision-making, that wouldn't have happened otherwise
- DB is generally a robust and reliable method of distribution

- Some users can get data via terrestrial distribution, but some do not have access to a reliable Internet connection with sufficient bandwidth

Users have come to expect that they can receive data using stations that they have built or bought, and there will be freely available software. The availability of free software lowers the cost for end users, allows vendors to focus on hardware and lowers the total cost of ownership, and enables users to start working with the data sooner. Often the software has already been developed by the government. The software that is freely available to process data from U.S. weather satellites includes IMAPP, CSPP LEO, and CSPP Geo. The software supports the creation of calibrated observational data, geophysical derived products, and mapped images from visible, infrared, and microwave sensors. Mr. Martin offered the following recommendations:

- Keep direct broadcast on future spacecraft
- Keep funding development and distribution of freely available software for direct broadcast users
- Preserve spectrum for direct broadcast
- Consider cost of entry for direct broadcast users
- Add Level 2 products for GOES-16
- DB community should advocate for continued direct broadcast
- Consider DB in all phases of mission (pre- and post-launch)
- Communication with DB users is key (e.g. through groups like GRB Working Group)

The fourth and final panelist to speak was Mr. Alan Hall, CLASS Operations Manager Office of Satellite Product and Operations (OSPO), NOAA NESDIS and the title of his talk was: Comprehensive Large Array-data Stewardship System (CLASS). CLASS provides long-term, secure storage of NOAA-approved data, information, and metadata to enable access to these holdings through both human and machine-to-machine interfaces. CLASS is not intended to support near-real-time nor mission-critical product delivery. CLASS Maintains 3 Operational Nodes: two Full Service Nodes (FSN), one at Asheville, NC, and the other at Boulder, CO; and one Ingest Node (IN) at Suitland, MD.

The CLASS dissemination requirement is: The System shall be capable of disseminating, on a daily basis, 600% of the daily ingested data volume. The order fulfillment requirement is:

- Subscriptions: 72 hours
- Ad-Hoc: 5 days
- Current Ingest Volume Requirement: ~14TB/day
- Dissemination Volume Requirement: ~84TB/day
- The CLASS capacities are:
- Nominal Ingest:
  - Satellite and Legacy data:6TB/Day
  - Common Submission (NCEI): 8 TB/Day
  - Total: 14 TB/Day
- Archive Tape Storage:
  - CLASS-AVL:20 PB
  - CLASS-BOU:19 PB
  - Total:39 PB
- Dissemination Disk Cache:
  - CLASS-AVL:2.0 PB
  - CLASS-BOU:2.0 PB
  - Total:4.0 PB

The CLASS data sets include: Suomi National Polar-orbiting Partnership (S-NPP), Geostationary Operational Environmental Satellite (GOES), Climate Forecast System – Reanalysis (CFS-R), Advanced Very High Resolution Radiometer (AVHRR), Infrared Atmospheric Sounding Interferometer (IASI), and Advanced Clear-Sky Products over Oceans (ACSPO). CLASS provides a rolling window (~60 days) Anonymous FTP access to aggregated S-NPP data. Mr. Hall described the CLASS access services, including the GOES-16 access service, and asked the audience if CLASS should make GOES-16 data available in a rolling window similar to the S-NPP access service.

**Action Items*:**

None.

**Questions / Responses*:**

None.

There was no time available for Q&A in plenary. After the last speaker completed his talk the attendees broke into two breakout groups: one at the Great Hall and the other in NAC 1/203.

**Suggestions#:**

Allocate more time for the Data Distribution and Access Session. Only 90 minutes was allocated for the Data Distribution and Access Session which was comprised of 3 parts: the panel session, two concurrent breakout sessions, and a report at plenary (to report the results of the breakout groups). Instead of 30 minutes for the panel session at least 45 minutes should be allocated so that a Q&A period can be added. If the breakout rooms are in the same building then it will be easier to move from plenary to breakout (with 10 minutes allocated). 45 minutes should be allocated for the breakouts and 30 minutes for the report at plenary so that the entire group can discuss the results from each breakout group. Recommend we schedule a break between the breakout sessions and the final plenary as that worked well. The break provided time for the moderators to provide the final briefing slides to A/V for display on the screen. Also, move the Data Distribution and Access Session up a day in the schedule so that action items can be included in the review of action items on the last day. The Data Distribution and Access Session resulted in 8 action items that were not reviewed because there wasn't time to add them to the briefing slide.

## Session 24.1: Data Distribution and Access – Direct Broadcast Breakout Session

Session Chair(s)*: Jim McNitt

Key Points*:

The following items were discussed by the participants during the breakout session:

- Consistent algorithms – CM between ground algorithms and direct readout algorithms.
  - Improve the timeframe.
- GRB rebroadcast through terrestrial distribution. Hub based processing – one location to ingest and process the data and provide it via FTP to help distribute costs.
  - Consideration: FTP server may get hit hard because of the large data volumes and bandwidth considerations make it difficult.
- What is an acceptable latency for each user's needs, and can people live with the limitations.
  - GRB is fastest.
  - GNC-A and HRIT are dependent on PDA and any PDA issues will impact GNC-A and HRIT.
  - SBN has CMI that's not dependent on PDA and is redundant however L2 products on SBN is dependent on PDA.

- CSPP-GEO long-term funding needs to be figured out.
- LRIT users transitioning to HRIT.
  - Technical demodulation is the same. Only difference is frequency change, slight demodulation change and higher data rate
- Transition issue plan between GVAR in the west and GRB in the east.
  - How long does it take to transition a receiving station from GVAR to GRB?
- A commercial weather service provider said it takes several months.
- Funding is available from World Bank for international users and funding includes maintenance and sustainment.
- Move towards one universal broadcast.

The group agreed that the following are top priorities

- Facilitate transition planning by sharing information when available and ensuring vendor/user readiness
- Users with GRB/HRD funding issues could consider terrestrial data sharing from a DB hub. There are a number of considerations:
  - Users need to identify their acceptable latency requirements.
  - Associated costs.
  - Bandwidth considerations.
- Consistent algorithms between ground and direct readout while reducing implementation time.
- CSPP-Geo long-term support desired.
- Examine advantages of commercial broadcast capability including one universal broadcast.

**Action Items*:**

1. Countries that plan to receive the GOES-R Series GOES Rebroadcast (GRB) are working with other countries in their region to provide them products. Action: Participating counties should consider joining the GRB User Group that is chaired by NESDIS OSPO to communicate their plans.
2. Long-term support for Community Satellite Processing Package for Geostationary Data (CSPP Geo) is desired as the community grows. Action: CSPP Geo program communicate resource needs.
3. A commercial broadcast capability such as GEONETCast, provides a universal broadcast to users and users need only one receive station to receive products from multiple satellites. Action: NESDIS investigate expanding GEONETCast of Americas (GNC-A).
4. The time required to implement new science algorithms in satellite ground systems is greater than the time required to implement baseline algorithms in DB user software. Action: NESDIS and partners investigate alternatives that would decrease the time required to implement new algorithms in DB user systems and satellite ground systems.

**Questions / Responses*:**

Question: How much does a GRB receive station cost?

Response: A GRB users responded that their system cost about $150,000 (initial investment cost).

**Suggestions#:**

Allocate more time for the Data Distribution and Access Session. Only 90 minutes was allocated for the Data Distribution and Access Session which was comprised of 3 parts: the panel session, two concurrent breakout sessions, and a report at plenary (to report the results of the breakout groups). Instead of 30

minutes for the panel session at least 45 minutes should be allocated so that a Q&A period can be added. If the breakout rooms are in the same building then it will be easier to move from plenary to breakout (with 10 minutes allocated). 45 minutes should be allocated for the breakouts and 30 minutes for the report at plenary so that the entire group can discuss the results from each breakout group. Recommend we schedule a break between the breakout sessions and the final plenary as that worked well. The break provided time for the moderators to provide the final briefing slides to A/V for display on the screen. Also, move the Data Distribution and Access Session up a day in the schedule so that action items can be included in the review of action items on the last day. The Data Distribution and Access Session resulted in 8 action items that were not reviewed because there wasn't time to add them to the briefing slide.

Session 24.2: Data Distribution and Access – Terrestrial Breakout Session

Session Chair(s)*: Jing Han

Key Points*:

- What top challenges does your organization face in terms of obtaining/providing environmental data?
  - evolving IT security threats
  - network speeds/limitations (affecting data transfer capability)
  - system limitations
  - data volume sizes (are growing exponentially)
  - regulation/laws and acquisition rule limitationso
- Given constraints on existing distribution services, what strategies do you recommend for making data more widely available?
  - one to many data transfer approach (i.e. multi-cast services)
  - cloud based distribution services
  - leverage available archives (like CLASS for non-time critical data needs)
  - re-distribution strategy (one organization routes data to another)
- What is your vision of distribution services for the future?

**Priorities and Action Items:**

1. Show and share results from Big Data Project
2. Make more data available via BDP
3. Explore capability for users to run their code on the data provider side, including data aggregation prior to download
4. Provide secondary access points in addition to PDA (ex. Universities with LDM, McIDAS, Unidata, STAR CoRPs)
5. Revisit requirements for JPSS data latency to CLASS
6. Compress large data sets, such as GOES-16, to make it more available to users - explore additional methods

Suggestions#:

1. Allocate more time for the Data Distribution and Access Session.
2. Put two breakout sessions in the same building.

## Session 25: Spectrum Allocation and NOAA Satellite Downlinks

The radio spectrum panel at the NOAA 2017 Satellite Conference consisted of the following speakers:

Ms. Renee Leduc Clarke, Principal at Narayan Strategy; Mr. Jonathan Porter, Vice President of AccuWeather; Mr. Brett Betsill, President of Microcom Design, Inc; Mr. David G. Lubar, spectrum management specialist for the GOES-R Program Office, NASA Goddard Space Flight Center, and Mr. Beau Backus of the NOAA / NESDIS Office of Spectrum Management.

Ms. Leduc Clarke outlined the nature of the issue for the weather and water communities, where sharing of Federal radio spectrum can impact all users of the broadcasts and data relayed via GOES and GOES-R satellites.

Mr. Porter described the widespread use of NOAA satellite data by the private sector meteorological community and his concern over potential impacts from spectrum sharing. He discussed how the private sector uses GRB received via the GOES-R downlink to create products.

Mr. Betsill's company, Microcom Design, is a manufacturer of GOES receiving systems, and he indicated that demodulators need to be either updated for DCS/HRIT or replaced for GRB data reception. Testing performed by Microcom Design was the basis for discussion on radio frequency interference to GOES/ GOES-R receivers in support of work for future spectrum sharing scenarios.

Some mitigation of existing radio frequency interference was described. However concern was raised about interference mitigations to coming commercial use of 1695-1710 MHz or proposed use of 1675 – 1680 MHz. Interference can impact reception of science data used for meteorology and hydrology. Mitigation of in-band interference (that could result from the grant of the 1675 -1680 MHz proposal) is impractical or impossible.

Mr. Lubar provided an overview of services and spectrum use in the GOES-R satellite downlinks. The fastest access with the highest availability for GOES-R data is by receiving the direct broadcast in 675-1695 MHz.

Many federal and non-federal users depend upon the data as received from GOES or GOES-R in the 1675 – 1695 MHz band or portions thereof.

The worldwide growth of small duration satellites (generally known as small satellites) may impact spectrum demand for the UHF band, where meteorological services currently reside.

Mr. Backus provided a description of spectrum associated with the following topics: small satellites, sharing of passive remote sensing bands and for space weather applications, including GPS radio occultation. (GPSRO).

Frequency bands discussed included 1695-1710 MHz, 1675-1680 MHz, 400.15 – 420 MHz, 150..05 – 174 MHz, 5150 – 5925 MHz, 24.5 – 27.5 GHz and above 24 GHz.

These bands include planned or proposed sharing with advanced wireless services, combined satellite and terrestrial services, UHF frequencies to be sharing with commercial small satellites, radars, and active remote sensing.

Many international studies are necessary to evaluate proposals under the processes of the International Telecommunications Union (ITU), which develops worldwide radio regulations for the use of the frequency spectrum.

Audience Questions from SliDO:

● Ligado, a terrestrial wireless provider, has proposed to share the same spectrum with NOAA's DCS data distribution system and operate close to GRB and EMWIN. How will this impact the weather and water enterprises?

o The current technical assessments are based upon the information provided by Ligado in their submitted proposals, as a petition, to the FCC. NOAA has been funded by Congress to study the possibility of sharing spectrum between the space meteorological service and an advanced wireless service. The study will begin soon and will take two years to complete. Based on some initial analysis, the signals are considerably different in strength between the proposed terrestrial signals and the relatively weak signals originating from the GOES/GOES-R spacecraft. The potential for radio frequency interference to unprotected sites appears, at this point, to be likely.

● What can concerned users of real time GOES data do to avoid potential interference from Ligado? What can these users do to oppose Ligado moving forward with its proposal?

o While Ligado is a significant advocate for petitioning the FCC to make the band available for shared use, the organization to communicate with regarding this matter is the FCC. Users have the opportunity to participate in the current FCC proceeding, RM-11681, by ex parte briefings and letters and by submissions in any future public comment and reply periods. For users, in the same spectrum as proposed (1675 – 1680 MHz) there are few mitigation techniques to avoid in-band interference. Physical separation, adequately distant, under all atmospheric conditions, should help to reduce the potential for interference. However, no amount of filtering would help to resolve this in-band issue, as the desired signals would be reduced along with the undesired signals. The requested commercial terrestrial coverage, throughout the United States and possessions, would place multiple transmission sources throughout the country-all which become an interference source for one or more user GOES/GOES-R antennas.

● Jonathan (Porter's) talk on AccuWeather's use of GRB for their clients / users was very compelling. Given that their site is not in a federally protected area for these frequencies, what is their "plan B" should they lose access to the GRB and what would be the impact to their business and clients?

o NOAA would not presume to answer for AccuWeather. We do not know how to specifically answer for the case posed in the question. However, private sector users generate value-added products and warnings derived from Federal satellite data. Low latency and high availability requirements drive the need for many users to receive the GOES-R direct broadcasts via ground station antennas. GOES-R functional specifications on GRB allow for 5 minutes of outage within a 30 day period (availability of 99.988%). This kind of availability is not possible via commercial dissemination services (e.g., cloud services) that only guarantee 45 minutes of outage within a 30 day period. The plan "B" may be to resort to terrestrial access via NOAA's Product Dissemination and Access (PDA) system – however it has higher latency than GRB and has no backup location for GOES-R data and may not have full capacity available to provide a given user the full component of GOES-R data. Clients who depend upon "always there" data products, under all conditions, may find the service unavailable due to outages. Terrestrial "last mile" connectivity to a user's premises detracts from the availability of the data when compared to a direct satellite broadcast.

● Who will have protection zones to avoid interference from Ligado if their proposal is approved by the FCC? Will the government? Are the protection zones going to be enough to protect critical information from interference?

o How such existing ground receiving systems are protected would be contained in a future FCC Notice of Proposed Rulemaking, which would include the criteria or potentially list specific federal sites for which protection zones would be proposed. It is expected that the FCC will be utilizing the results of the NOAA spectrum pipeline study as a basis for implementing mitigation and/or protection zones. While NTIA can

establish protection zones around federal sites, the FCC would have to do so for nonfederal sites. Without specifics, it is difficult to answer the second question.

- How far away can a tower interfere? For example, under certain ducting situations?

o Atmospheric effects creating anomalous propagation (e.g. ducting) can create interference from distant towers, who normally would not have such signals present at a particular receive location. Interference effects could occur from hundreds of kilometers away in these situations.

- Microcom shows one LTE device in their test at their facility. What is the impact of aggregated power of LTE mobile devices in the AWS-3 band?

o Aggregate effects of multiple mobile devices would be more problematic than a single device, however, probabilistic techniques were used by regulators to estimate the number of mobile devices in proximity to satellite earth stations, and that aggregate is a larger signal level than that caused by a single device.

- Regarding the spectrum that has already been designated for commercial use, how has NOAA used the period since the auction to prepare for potential interference?

o NOAA has requested funding from the Office of Management and Budget via a Technical Panel, to evaluate the potential for interference caused by adjacent band AWS-3 operation. NOAA has been preparing for coordinating with the legally mandated users. NOAA is developing and installing Radio Interference Monitoring Equipment at specific locations (NOAA protection zones), and has initiated a competitive procurement process to obtain such capabilities at those designated locations.

## Session 26: Review of 2017 NOAA Satellite Conference Action Items

Vanessa Griffin, Director, Office of Satellite Product Operations

Ms. Griffin began her presentation with a review of the actions that had been collected so far from the conference. She noted that there were several more that will be added as the Conference organizers complete the report for the conference. Ms. Griffin also noted that there were 156 question submitted via SLI.do during the conference. These too will be reviewed for any actions. The final Actions list will be posted to the conference website and their progress will be reported on at the next NOAA Satellite Conference.

The main actions that had been collect so far were:

- NOAA Detailed Schedule for GOES-16 transition to GOES-East
  - NOAA Detailed Schedule for GVAR to GRB
  - NOAA Detailed Schedule for DCS transition from GOES-13 to GOES-16
- NOAA Data Distribution Policy for satellite data (PDA)
- NOAA Schedule for GOES-13, 14, 15 after new GEOS-R series come on line

In conclusion, Ms. Griffin thanked all the attendees for their active participation in the conference. NOAA wanted to hear from our users during this conference and we did. She then reminded everyone to please take the post-conference evaluation survey. This information is extremely valuable and we do look at it closely as we prepare for the next conference.

Thank you for participating in this year's NOAA Satellite Conference!

## Session 27: Concluding Remarks for the 2017 NOAA Satellite Conference

Mark Paese, Deputy Assistant Administrator, NOAA Satellite and Information Service

Mr. Paese thanked all the attendees for participating in the 2017 NOAA Satellite Conference. He noted the number of interactive sessions and the use of the SLI.do software to facilitate audience participation during the conference. He reiterated the goal of the conference to bring people together to discuss the current and future NOAA satellite systems. NOAA's primary goals were to inform our users and to receive feedback from them. He proclaimed these goals fulfilled.

Mr. Paese then reviewed the accomplishments of NOAA's newest satellite, GOES-16. Even though it has not been made operational yet, it is already having an impact. The same for S-NPP and soon to be launched JPAA-1. These NOAA satellites are part of a larger Global Observing System that is providing the necessary information, data and products that is needed by decision makers. NOAA is proud to be a part of this Global effort.

NOAA will be launching JPSS-1 in late 2017 with JPSS-2, -3, and -4 following in 2021, 2026 and 2031. GOES-S will be launched in 2018 with GOES-T in 2019 and GOES-U in2025. These new generation satellites will insure the continuity of the Global Observing System from many years to come.

Mr. Paese concluded by inviting everyone to the next NOAA Satellite Conference.

## Appendix 1: Conference Agenda

# Agenda

**Location**: All Plenary Session will be held in **Great Hall** (Shepard Hall)
Exhibits and Coffee Breaks will be held in **Exhibit area** in **NAC Ballroom**
Lunches will be served in **Lincoln Corridor** (Shepard Hall)

**Day 1: Monday, July 17, 2017**

| | |
|---|---|
| 8:30 am - 10:05 am | Plenary Session (NOAA, NESDIS, NWS)<br>Stephen Volz, Vincent Boudreau, Vanessa Griffin, Eric Madsen, Joseph Pica,<br>Key note address: David Grimes |
| 10:05 am - 10:35 am | Breaks/Exhibits |
| 10:35 am - 11:55 am | Plenary Session: International Partners<br>Eric Madsen, Mark S. Paese, Hoon Park, Yang Jun, Antonio Divino Moura,<br>Yoshishige Shirakawa, Michael Williams |
| 11:55 am - 12:55 pm | Lunch – Guest Speaker: Al Roker, Anchor, NBC's Today Show<br>Moderator: John Leslie |
| 12:55 pm - 1:40 pm | Panel Discussion: Big Data<br>Kathryn Mozer, Ed Kearns |
| 1:40 pm - 2:40 pm | Town Hall Meeting: Satellite Constellation Evolution<br>Michael Roth, Karen M. St. Germain |
| 2:40 pm - 3:10 pm | Breaks/Exhibits |
| 3:10 pm - 4:40 pm | Panel Discussion: Research to Operations<br>Thomas Renkevens, Satya Kalluri, Kathryn Shontz, Jamese Sims, Arron Layns,<br>Mitch Goldberg, Steve Goodman |
| 5:00 pm - 6:00 pm | Exhibit Opening |

**Day 2: Tuesday, July 18, 2017**

| | |
|---|---|
| 8:30 am - 9:00 am | Opening Keynote Address by WMO<br>Speaker: Elena Manaenkova |
| 9:00 am - 10:00 am | Plenary Session: GOES-R and Instruments<br>Steve Goodman, Tim Schmit, Natalia Donoho, Michael Stringer, Matt Seybold |
| 10:00 am - 10:30 am | Breaks/Exhibits |

| | |
|---|---|
| 10:30 am - 11:45 am | Panel Discussion: GOES-R User Testimonials<br>Erica Grow, Martin Medina, Julio Castillo, Kathy-Ann Caesar, Dave Radell, Chad Gravelle, Randy Bass, Thomas Cuff, Mike Pavolonis, Nick Keener |
| 11:45 am - 12:45 pm | Lunch: Career Stories from the Professionals<br>Eli Salahuddin, Erica Grow, Anoop Mehta, Jordan Gerth, Kristen Jabanoski |
| 12:45 pm - 1:15 pm | Panel Discussion: Training Resources<br>Janel Thomas, Leroy Spayd, Chad Gravelle, Bernadette Connell, Patrick Dills, Scott Lindstorm, Jose Galvez |
| 1:15 pm - 3:00 pm | Poster Session: NOAA-Sponsored Science GOES-R<br>Gary McWilliams, Tim Schmit, Tarendra Lakhankar |
| 3:00 pm - 3:30 pm | Breaks/Exhibits |
| 3:30 pm - 4:45 pm | GOES-R Operational Applications: Conversations with the Users<br>Kathryn Mozer, Matt Seybold, Chad Gravelle, Dave Radell |
| 5:30 pm - 8:00 pm | GOES-R Advanced Training<br>Steve Goodman, Janel Thomas |

**Day 3: Wednesday, July 19, 2017**

| | |
|---|---|
| 8:40 am - 9:00 am | Opening Keynote Address by WMO Regional Association III<br>Speaker: Julian Baez Benitez |
| 9:00 am - 10:15 am | Plenary Session: JPSS and Instruments<br>Mitch Goldberg, Gregory Mandt, Jason Taylor, Don Hillger, Chris Barnet, Arron Layns |
| 10:45 am - 12:00 pm | Panel Discussion: JPSS User Testimonials<br>Melissa Kreller, Estela Collini, Luiz Machado, Bill Sjoberg, Cara Wilson, David Bradley |
| 12:00 pm - 12:10 pm | JPSS Breakout Introduction<br>Bill Sjoberg |
| 12:10 pm - 1:20 pm | Lunch: The Future of our Career Field<br>Shakila Merchant, Bill Sjoberg |
| 1:20 pm - 2:50 pm | Poster Session: NOAA-Sponsored Science JPSS<br>Tim Schmit, Gary Mcwilliams, Tarendra Lakhankar |
| 2:50 pm - 3:20 pm | Breaks/Exhibits |

| | |
|---|---|
| 3:20 pm - 5:15 pm | JPSS Breakout Sessions<br>Christie Best, Lihang Zhou, Mitch Goldberg, Bill Sjoberg, Jorel Torres |
| 6:00 pm - 6:30 pm | Employment Opportunities in the Federal Government<br>Nicole Scarborough |
| 6:30 pm - 8:00 pm | Student and Early Professional Networking Session<br>Bill Sjoberg, Joseph Pica |

**Day 4: Thursday, July 20, 2017**

| | |
|---|---|
| 8:40 am - 9:00 am | Opening Keynote<br>Glendell De Souza, Eric Madsen |
| 9:00 am - 9:30 am | Panel Discussion: Data Distribution and Access<br>Jim McNitt, Jing Han, Kathy-Ann Caesar, Graeme Martin, Gregory Mandt, Alan Hall |
| 9:30 am - 10:15 am | Data Distribution and Access – Breakout Session<br>Jing Han, Jim McNitt |
| 10:15 am - 10:45 am | Breaks/Exhibits |
| 10:45 am - 11:00 am | Data Distribution Plenary Reconvene<br>Jing Han, Jim McNitt |
| 11:00 am - 12:00 pm | Town Hall Meeting: Spectrum allocation and NOAA Satellite Downlinks<br>Renee Leduc Clarke, Jonathan Porter, David Lubar, Beau Backus, Brett Betsill |
| 12:00 pm - 12:15 pm | Review of Conference Action Items<br>Vanessa Griffin |
| 12:15 pm - 12:30 pm | Concluding Remarks<br>Mark S. Paese |
| 12:30 pm - Adjourn | |

## Appendix 2: List of Posters

| Title | Author(s) |
|---|---|
| **A Blended High Resolution Snow Depth Analysis for NOAA's Next Generation Global Prediction System (NGGPS)** | Cezar Kongoli, Peter Romanov, Jiarui Dong, Sean Helfrich, Michael Ek, Thomas Smith, Ivan Csiszar |
| **Applications of Suomi-NPP VIIRS Flood Products in Operational Forecasting at the North Central River Forecast Center** | Mike DeWeese, Brian Connelly, Sanmei Li, Jay Hoffman |
| **Applications using Nighttime VIIRS Imagery** | Feng Chi Hsu, Christopher Elvidge, Kimberly Baugh, Mikhail Zhizhin, Tilottama Ghosh |
| **April 2008 Saharan Dust Event: Its contribution to PM10 Concentrations over the Anatolian Peninsula and Relation with Synoptic Conditions** | Burcu Kabatas, Brad Pierce, Alper Unal, Marek Rogal, Todd Schaack, Allen Lenzen |
| **Assessing the effectiveness of assimilating satellite soil moisture to improve dust forecasting with the NOAA National Air Quality Forecast Capability (NAQFC) experimental modeling system** | Barry Baker, Daniel Tong, Xiwu Zhan, Li Pan, Pius Lee, Youhua Tang, Mitch Schull |
| **Automatic Near-Real-Time Flood Detection using Suomi-NPP/VIIRS Data** | Donglian Sun, Sanmei Li, Mitch Goldberg, Bill Sjoberg |
| **Automation of VIIRS and MODIS big data processing at the Canada Centre for Remote Sensing over Canada** | Calin Ungureanu, Alexander Trishchenko |
| **Climate Warming and Satellite-based Land Cover Changes during 1980-2017** | Felix Kogan |
| **Comparison of aerosol characteristics between AERONET-Ocean Color and VIIRS sensor and impact assessment on the retrieval of ocean reflectance spectra** | Eder Herrera, Alexander Gilerson, Yaron Klein |
| **Composite Analysis of Atmospheric Bores during PECAN Observed by Ground-Based Profiling Systems** | David Loveless, Timothy Wagner, Steven Ackerman, Wayne Feltz |
| **Continuous measurements of fluorescent dissolved organic matter at the brackish tidal marsh-estuary interface** | Alana Menendez, Maria Tzortziou, Patrick Neale |
| **CREST-SAFE Field Experiment: Continuous In Situ Observations of Snow Physical Properties and Microwave Emission** | Tarendra Lakhankar, Carlos Perez Diaz, Peter Romanov, Reza Khanbilvardi |
| **Data assimilation and inverse modeling with HYSPLIT Lagrangian dispersion model and satellite data – Applications to volcanic ash and wildfire smoke predictions** | Tianfeng Chai, Hyuncheol Kim, Ariel Stein |

| Title | Author(s) |
|---|---|
| **Design for operating linear fit SO2 algorithm using irregular data flow and monitor the near real time global volcanic activities** | Jianguo Niu, C. Trevor Beck, Lawrence Flynn |
| **Detection of Freeze and Thaw States from Satellite Passive Microwave Global Land Emissivity Estimates** | Satya Prakash, Hamid Norouzi, Marzi Azarderakhsh, Reginald Blake, Reza Khanbilvardi |
| **Detection of mineral dust aerosol at Comodoro Rivadavia Airport on February 2016** | Leonardo Mingari, Maria Salles, Estela Collini, Diana Rodriguez, Lidia Otero |
| **Distributing NOAA's Climate Data Records (CDR) into Product Areas at NCEI's Center for Weather and Climate (CWC)** | Daniel Wunder, Jeffrey Privette, Gary Ellingson, Candace Hutchins |
| **Diurnal Variation Analysis of Land Surface Temperature Using Satellite Observations over New York State** | Zahra Sharifnezhadazizi, Shirin Estahbanati, Hamid Norouzi, Satya Prakash, Reza Khanbilvardi, Naresh Devineni |
| **Estimation of outgoing longwave radiation from Cross-track Infrared Sounder (CrIS) radiance measurements** | Kexin Zhang |
| **Fusion of LEO and GEO Satellite Data for the Demonstration of Enhanced Unified Products** | Allen Huang |
| **Global, 500 m Droughts Prediction from Space – New VIIRS Technology** | Felix Kogan |
| **GOES-16 Applications over South America: post-launch validation activities** | Daniel Vila,, Luiz Machado, Renato Galante, Alberto Setzer, Diego Souza |
| **GOES-R Satellite ABI Sensor Enables Improved Fire Detection and Monitoring** | J. Harlan Yates, Thomas Jordan |
| **Hyperspectral Imaging of the Ocean and Atmosphere for satellite calibration/validation** | Carlos Carrizo, Robert Foster, Andrii Golovin, Alexander Gilerson |
| **Importance of time series of satellite images to monitor agricultural fields in a tropical region** | Jurandir Zullo Junior, Renata Gonçalves, Luciana Romani, Agma Traina |
| **In-orbit and Vicarious Calibration of FY-3B/TOU since Launch** | Yuan Li, Weihe Wang, Huanhuan Yan |
| **Integration of New Satellite Observations into the National Ice Center's Snow and Ice Mapping System** | Katherine Nohe, David McCormick, Sofia Montalvo, Kelly Neugent |
| **Intercomparison Between Polarimetric Radar and Satellite Indicators of Storm Severity in Supercells** | Michael French, Jeffrey Snyder |
| **Introducing Atmospheric Motion Vectors Derived from the GOES-16 Advanced Baseline Imager (ABI)** | Jaime Daniels, Wayne Bresky, Andrew Bailey, Americo Allegrino, Steve Wanzong, Chris Velden |
| **JPSS Products and Training for NWS forecasters leading up to JPSS-1 Launch** | Jorel Torres, Bernie Connell, Steven Miller |

| Title | Author(s) |
|---|---|
| **Mapping wetland vegetation and inundation with optical and microwave remote sensing** | Brian Lamb, Maria Tzortziou, Kyle McDonald |
| **Near-real time CAPE Combining Hyperspectral IR Satellite Sounding and Surface Met Stations** | Callyn Bloch, Robert Knuteson, Jessica Gartzke |
| **Near-Real-Time Sea Ice Motion Products using AMSR2 and VIIRS** | Aaron Letterly, Jeffrey Key, Yinghui Liu |
| **Observations Lead the Way to Persistent Global Environmental Awareness** | J. Harlan Yates, Thomas Jordan, Prasad Kota |
| **Open R2O Architecture - Reducing the Cost of Entry for Science Applications** | Patrick Barnes, Stephen Marley, Laura Ellen Dafoe |
| **Polar Warming Revealed by Cryosphere Changes** | Xuanji Wang, Jeffrey Key, Aaron Letterly |
| **Polar2Grid: Reprojecting Satellite Data Made Easy** | David Hoese, Kathy Strabala |
| **Primary Modes of Global Major Crop Yield Variations and Teleconnections with Climatic Patterns** | EHSAN NAJAFI, Naresh Devineni, Reza Khanbilvardi |
| **Remote Sensing of Gas Flares** | Ted Kennelly, David Hogan, Tom Connor |
| **Remote sensing retrievals of DOC dynamics in eutrophic estuaries** | Fang Cao, Maria Tzortziou |
| **Retrieval of Precipitable Water Vapor over Land from GCOM-W/AMSR2** | Masahiro Kazumori |
| **Satellite aerosol products for long-term atmospheric reanalysis and improved aerosol forecasting** | Peng Xian, Edward Hyer, Jianglong Zhang, Douglas Westphal, Jeffrey Reid |
| **Satellite Data and Visualization Activities at the Space Science and Engineering Center** | David Santek, Jerrold Robaidek |
| **Satellite radiance assimilation upgrades for RAP version 4** | Haidao Lin, Yuanfu Xie, Ming Hu, Stephen Weygandt, Stan Benjamin |
| **Season-Ahead Forecasting of Crop Water Stress** | Arun Ravindranath, Naresh Devineni, Upmanu Lall, Paulina Concha Larrauri |
| **Solar resource assessment and forecasting in Uruguay using GOES-East satellite images** | Rodrigo Alonso Suárez, Daniel Aicardi, Pablo Musé, Gonzalo Abal, Matías Roubaud |
| **Spatial Analysis of Leptospirosis in the Province of Santa Fe, Argentina, using NOAA and MODIS satellite images. Year 2014** | Laura Balparda, Carlos Cotlier, Lucrecia Corallo, Gabriela Müller, Diego López, Andrea Fretes Chavez |
| **Spatial and temporal variability of global marine isoprene emissions observed by Suomi-NPP VIIRS** | Daniel Tong, Binyu Wang, Menghua Wang |
| **Spatial and Temporal Variation of PATMOS-x AVHRR Lake Surface Temperatures** | Charles White, Andrew Heidinger, Steve Ackerman, Peter Mcintyre |

| Title | Author(s) |
|---|---|
| **Synergistic satellite and ground-based observations for evaluating aerosol plume transport and impact on air quality in NYC area** | Yonghua Wu, Anjeza Arapi, Adrian Diaz, Barry Gross, Fred Moshary |
| **The GOES-R Rainfall Rate Product: Status and Plans** | Robert Kuligowski, Yaping Li, Yan Hao |
| **The VIIRS active fire product suite and its key operational applications** | Ivan Csiszar, Shobha Kondragunta, Scott Rudlosky, Marina Tsidulko, Evan Ellicott, Wilfrid Schroeder, Louis Giglio, Ravan Ahmadov |
| **Use of Satellite Data for Disaster Risk Reduction** | Sheldon Drobot, Jack Hayes, Marie Colton |
| **Validation and Application of JPSS/GCOM-W Soil Moisture Data Product for Operational Flood Monitoring in Puerto Rico** | Cassandra Calderella, Tarendra Lakhankar, Jonathan Munoz-Barreto, Reza Khanbilvardi |
| **Validation of SNPP VIIRS green vegetation fraction phenology using PhenoCam data** | Zhangyan Jiang, Marco Vargas, Ivan Csiszar |
| **Validation of SNPP Water Vapor Retrieval Profiles and towards defining a site atmospheric state best estimate and the creation of a mid-Atlantic GRUAN team** | Belay Demoz |
| **COMET's MetEd Education and Training Resources for GOES-R and JPSS User Readiness** | Patrick Dills |
| **Galvanizing Awareness around the GOES-R Satellite Series working with Science Teachers, Science Centers and NOAA Science On a Sphere (SOS)** | Margaret Mooney, Tim Schmit |
| **A first look at GOES-16 cloud top height product** | Yue Li, Andrew Heidinger, Steve Wanzong |
| **An Assessment of Microwave Products Generated from Direct Broadcast Data in Support of the NWS Alaska Sea Ice Program** | Eric Stevens, Carl Dierking, Tom Heinrichs, Dayne Broderson, Jay Cable, Will Fisher, Jiang Zhu |
| **Attribution of Climate Change and Climate Variability to Extreme Rainfall Frequency in Contagious United States** | Saman Armal, Naresh Devineni, Reza Khanbilvardi |
| **AWG Imagery Team: GOES-16 ABI Post Launch Test** | Tim Schmit, Mat Gunshor, Kaba Bah, Joleen Feltz, James Nelson, Hong Zhang |
| **Common Ground Through Open Interfaces** | Shawn Miller, Kerry Grant |
| **Development of an Urban Thermal Product Using Goes-R Satellite Data and High-Resolution Land cover** | Joshua Hrisko, Prathap Ramamurthy, Jorge Gonzalez |
| **Enhanced VIIRS snow cover products in the NPOESS Data Exploitation (NDE) system** | Peter Romanov |
| **Enhancing Snow Water Equivalent Capabilities with Multifrequency, Multi-polarization, Very High-Resolution SAR Information** | Sheldon Drobot, Robert Taylor, Tim Durham, Kerry Speed |

| Title | Author(s) |
|---|---|
| **Estimation and Evaluation of GOES-16 Land Surface Temperature Measurement** | Yunyue Yu, Peng Yu, Yuhan Rao |
| **EUMETSAT's collaboration with NOAA onthe redistribution of global and regional data** | Simon Elliott |
| **Evaluation of JPSS-1 Science Algorithms and Data Products: Pre-Operational Verification to Post-Launch Cal/Val Readiness.** | Murty Divakarla, Lihang Zhou, Xingpin Liu, Jeffrey Weinrich, Arron Layns |
| **GOES-16 Cloud Products and the Impact of the Presence of 1.38 micron channel.** | Andrew Heidinger, Yue Li, Steven Wanzong, Denis Botambekov, Andi Walther |
| **GOES-16 Post-Launch Product Testing for ABI Level 2 Algorithms** | Paul Van Rompay, Ted Kennelly, Jaime Daniels, Robert Kaiser |
| **GOES-R ABI Land Surface Albedo: Algorithm, Validation, and Intercomparison** | Tao He, Yi Zhang, Shunlin Liang, Dongdong Wang, Yunyue Yu |
| **Himawari Support In The CSPP-GEO Direct Broadcast Package** | Geoffrey Cureton |
| **Ice Products with VIIRS** | Yinghui Liu, Jeffrey Key, Xuanji Wang, Richard Dworak, Aaron Letterly |
| **Identifying and Characterizing Volcanic Ash Clouds in the GOES-R Era** | Michael Pavolonis, Justin Sieglaff, John Cintineo |
| **Imagery Highlights from the First Six Months of the ABI** | Don Hillger, Dan Lindsey, Debra Molenar, Steven Miller, Kevin Micke |
| **Introduction to the GOES-R Science Instruments** | Steven Goodman |
| **Joint Polar Satellite System (JPSS) Common Ground System (CGS) Block 3.0 Communications Strategies** | Kerry Grant, Shawn Miller, Kyle Ottinger |
| **Joint Polar Satellite System (JPSS) Common Ground System (CGS) Use of Space Link Extension Protocol** | Kerry Grant, Guy Cordier, Lindsay Johnson, Shawn Miller |
| **JPSS and GOES-R Land Surface Emissivity Product Evaluation** | Heshun Wang, Yunyue Yu, Peng Yu, Yuling Liu |
| **Leveraging Container Virtualization to Improve Weather Processing Portability** | James Gundy, Brad Brown-bergtold, Daniel Thompson |
| **Mapping Land Surface Albedo from VIIRS Data** | Dongdong Wang, Shunlin Liang, Yuan Zhou, Yunyue Yu |
| **MetNet– Development of a Network of Small Weather Satellite Constellations** | John Fisher, Larry Gordley, David Fritts, Marian Klein, Richard Lachance, Daniel Guerin, Zachary Burns, Jeffrey Julian |
| **Modeling Additional Missions in the Joint Polar Satellite System (JPSS) Common Ground System (CGS)** | Shawn Miller, Kerry Grant |

| Title | Author(s) |
|---|---|
| **Monitoring GOES-R ABI Radiometric Performances with a Machine Learning System** | Zhenping Li, J. P. Douglas, Kenneth Mitchell, Dave Pogorzala, Biruh Tesfaye |
| **Multi-Mission Satellite Management** | Kerry Grant, Brenda Dougherty, Marcus Teter, Shawn Miller |
| **NOAA/NESDIS ESPDS – Enterprise Multi-Mission Operational Product Generation and Distribution for NESDIS** | Rich Baker, Mike Brogan, George Wilkinson, Dan Beall, Ron Niemann |
| **NOAA's Joint Polar Satellite System's (JPSS) Proving Ground and Risk Reduction (PGRR) Program – Successful PGRR Program Moves into the Future with the Launch of JPSS-1** | Bill Sjoberg |
| **On the use of remote sensing to enhance environmental monitoring at local, regional, and global scales** | Marouane Temimi |
| **Open Software Standards for Next-Generation Enterprise Algorithm Development, Testing and Deployment** | T Scott Zaccheo, Alexander Werbos, Erik Steinfelt, David Hogan |
| **Overview of the GOES Rebroadcast (GRB)** | James McNitt, Jeff Smeby |
| **Overview of the Joint Polar Satellite System (JPSS), NOAA's Proving Ground Initiative on Critical Weather Applications, Numerical Weather Prediction (NWP) Impact Studies and Data Assimilation** | Chowdhury Nazmi, Laura Dunlap, Mitch Goldberg |
| **Preliminary Results of the GOES-R Post-Launch Airborne Science Field Campaign** | Francis Padula, Steven Goodman, Aaron Pearlman |
| **Results of a Cloud Based Enterprise Ground System** | Justin Sanchez |
| **River Ice and Flood Detection Products Derived from SNPP VIIRS Satellite Data to Support NWS Operations in Alaska** | Melissa Kreller |
| **SigmaCast Preparation for GNC-A and the Satellite Data Requirements** | Luiz Machado, Mario Figueiredo, Diego Souza, Sergio Pereira, Daniel Vila, |
| **Snow and Ice Products with GOES-R ABI** | Yinghui Liu, Jeffrey Key, Xuanji Wang, Yong-Keun Lee, Richard Dworak, Thomas Painter |
| **Soft Calibration of OMPS Ozone Products** | Lawrence Flynn, Zhihua Zhang, C. Trevor Beck, Jianguo Niu, Chunhui Pan, Irina Petropavlovskikh, Eric Beach |
| **Space Weather Monitoring with GOES-16: Instruments and Data Products** | Paul Lotoaniu, Juan Rodriguez, Robert Redmon, Janet Machol, Brian Kress, Daniel Seaton, Jonathan Darnel, William Rowland |

| Title | Author(s) |
|---|---|
| **Streamlining full and effective NWS access to JPSS data** | John Evans |
| **The Satellite Product and Services Review Board (SPSRB) Process** | Laura Dunlap |
| **The validation of snow products from the Global Change Observation Mission (GCOM) AMSR2 instrument** | Yong-Keun Lee, Cezar Kongoli, Jeffrey Key |
| **Using PCA Method for Downscaling Passive Microwave Temperature to MODIS Resolution** | Niloufar Nouri, Hamid Norouzi, Navid Haji Allahverdi Pur, Reza Khanbilvardi, Satya Prakash |
| **Using the Smithsonian Coral Collection Specimen Data to examine the Daily 5-km Coral Bleaching Thermal Stress Product Suite** | Edward Keller |
| **VIIRS LST Quality Assessment and Product Development** | Yuling Liu, Yunyue Yu, Zhen Song, Peng Yu, Heshun Wang |
| **Visualizing the degradation of the Long Island South Shore Estuary Reserve using NVDI Time-Series Analysis** | Asif Zaman |
| **A new approach to sustain legacy satellite ground system** | Ye Men |
| **Applications of Remote Sensing and In-Situ Measurements for Studying Lateral Carbon Fluxes Between Tidal Marshes and Connected Estuarine Waters** | Usaama Van, Brian Lamb |
| **Challenges and progresses in the intercalibration of microwave humidity sounders** | Isaac Moradi, James Buechamp, Ralph Ferraro |
| **Change detection: how has urban expansion in Buenos Aires metropolitan region affected croplands** | Sike Li |
| **Combining Imager and Lightning For Enhanced GOES-R Rain Estimates in the NWS Pacific Region** | Nai-Yu Wang, Yalei You |
| **Comparison of Different Methods for Soil Moisture Estimation in Puerto Rico Soils** | Jonathan Nunez-Olivieri, Jonathan Munoz-Barreto, Tarendra Lakhankar, Rebecca Tirado-corbala |
| **CSPP Geo GRB: GOES-R Rebroadcast Reconstruction for Everyone** | Nick Bearson |
| **Development of collated hourly SST product for ABI onboard GOES-R series using Himawari-8 AHI as prototype** | Andrew Fitzgerald, Irina Gladkova, Alexander Ignatov, Yury Kihai, Maxim Kramar |
| **Enhanced Support for the Operational Forecasters Alaska in Alaska Thanks to Direct Broadcast** | Eric Stevens, Tom Heinrichs, Dayne Broderson, Jay Cable, Jiang Zhu, Will Fisher, Carl Dierking |

| Title | Author(s) |
|---|---|
| **From Moon to Earth: Build The Moon as an calibration reference for microwave instruments** | Hu (Tiger) Yang |
| **GOES-16 Post-Launch Testing Status** | Elizabeth Kline, Matthew Seybold, Jon Fulbright, Wayne MacKenzie, Randall Race, Jeffrey Kronenwetter |
| **GOES-R Product Readiness: Post-Launch Product Testing Status of the L2+ Algorithms** | Wayne MacKenzie, Matthew Seybold, Elizabeth Kline, Kathryn Mozer, Jon Fulbright |
| **GOES-R Satellite Series: Mesoscale Domain Sector Request Process and Early Results** | Kathryn Mozer, Daniel Nietfeld, Matthew Seybold, Elizabeth Kline, Jon Fulbright, Dave Pogorzala, Wayne MacKenzie, Chad Gravelle |
| **Hampton University Direct Broadcast Satellite Thunderstorm Forecast Products** | William Smith, Elisabeth Weisz, John Mcnabb, Michael Dutter |
| **How IDPS Algorithms are Changed for S-NPP & JPSS** | Rosalie Marley |
| **IMPROVING AEROSOL RETRIEVALS BY USING MULTI-MODAL REPRESENTATIONS OF THE LAND SURFACE REFLECTANCE TIME SERIES** | Nathaniel Levitan, Barry Gross, Fred Moshary |
| **In-Orbit-Test results of Himawari-9/AHI** | Ryuichiro Nakayama |
| **Integrated multi-missions remote operational management system** | Ye Men |
| **J1 Planning from a Cal/Val Perspective** | Jeffrey Weinrich |
| **JPSS Field Terminal Support (FTS)** | Bob Lutz |
| **NESDIS Enterprise Near Real-Time Environmental Satellite Data Distribution System - PDA** | Chris Sisko, Jing Han, Katie Feiner |
| **NOAA Satellite Oceanographic Data Archive, Distribution and Value-Added Service at NOAA National Centers for Environmental Information (NCEI)** | Yongsheng Zhang, Viva Banzon, Kenneth Casey, Korak Saha, Dexin Zhang, Huai-min Zhang, Xuepeng Zhao |
| **NOAA's Jason Products** | David Donahue, Donald Richardson, Alejandro Egido, Yongsheng Zhang |
| **NOAA's National Centers for Environmental Information** | William Denig |
| **On Empirical Bias Corrections of NUCAPS CrIS Full-Resolution RTA** | Changyi Tan, Quanhua Liu, Lihang Zhou, antonia gambacorta, Xiaozhen Xiong, Kexin Zhang, Flavio Iturbide-sanchez, Nicholas Nalli |
| **SLIDER: Satellite Loop Interactive Data Explorer in Real-time** | Kevin Micke, Steven Miller, Don Hillger, Renate Brummer, Steve Finley, Natalie Tourville, Debra Molenar, Dan Lindsey |

| Title | Author(s) |
|---|---|
| **Suomi-NPP Cross-track InfraRed Sounder (CrIS) Spectral Ringing Correction and Validation** | Robert Knuteson, Lori Borg, Michelle Feltz, Yong Han, Graeme Martin, Henry Revercomb, Joseph Taylor, David Tobin |
| **The impact of temporal changes on satellite retrievals of harmful algal blooms in the West Florida Shelf** | Ahmed El-Habashi, Claudia Duran, Vincent Lovko, Sam Ahmed |
| **The NOAA Weather and Climate Toolkit (WCT) as a tool for the analysis of intense rainfall in Peru** | Jorge Chira |
| **The NPP and J1 NOAA Unique Combined Atmospheric Processing System (NUCAPS): current status and recent algorithm enhancements tailored to near real time users applications.** | Antonia Gambacorta |
| **Uncertainty Analysis of Urban Sewer System under Extreme Rainfall Events (NYC Case Study)** | Ali Hamidi |
| **WMO Supporting User Readiness for New-Generation Satellites** | Stephan Bojinski |

## Appendix 3: Preconference Workshop: COMET Online Training Resources for GOES and JPSS

In conjunction with the National Satellite Conference, COMET provided a three-hour workshop on "Online Training Resources for GOES and JPSS" prior to the 2017 NOAA Satellite Conference for students and other attendees from City College of New York. Patrick Dills and Amy Stevermer from UCAR/COMET introduced the COMET MetEd website and the suite of training resources available for GOES, JPSS, and other environmental satellites. Learners had a chance to practice accessing satellite training materials and work through portions of select online lessons. The workshop also included brief information on sources for viewing and obtaining environmental satellite data. The final slides were made available to the workshop attendees:

https://docs.google.com/a/ucar.edu/presentation/d/1iVuOYAecqbmyPgXUd87KoxfGfd9DKFpU5MkowjAJe5I/edit?usp=sharing

## Appendix 4: Preconference Workshop: WMO/NOAA VLab Train the Trainer Workshop on Satellite Data Usage: Access through GEONETCast Americas, Display, Interpretation, and usage in Training

**15-16 July 2017**
**CREST at the City College of New York**
**New York City, New York, USA**

The National Oceanic and Atmospheric Administration (NOAA), the Cooperative Institute for Research in the Atmosphere (CIRA), the Caribbean Institute for Meteorology and Hydrology (CIMH), and (CPTEC) organised and conducted the "VLab Train the Trainer Workshop on Satellite Data Usage: Access through GEONETCast Americas, Display, Interpretation, and usage in Training" under the auspices of the World Meteorological Organization (WMO)/ Coordination Group for Meteorological Satellites (CGMS) Virtual Laboratory (VLab) and the WMO Space Programme. The 1.5-day workshop preceded the meeting of the Coordination Group on Satellite data Requirements for Regions III and IV and the 2017 NOAA Satellite Conference (NSC), 17-20 July, and was hosted by NOAA CREST at the City College of New York (CCNY). Participants came from 19 countries and was also attended locally by 4 CCNY students.

The following topics were covered:

a) A brief introduction and update on the GEONETCast - Americas (GNC-A) Data Dissemination System, which included timelines for image and product flow over GNC-A for both GOES-16 and JPSS imagery and products;
b) Aspects of image display for 3 distinct levels of users/viewers and interfaces to view them: quick look, analysis, and in-depth probing.
c) Hands-on exercises using McIDAS-V free software to demonstrate the capability to load and probe GOES-16 Level 2 Cloud and Moisture Imagery, and JPSS VIIRS Level 1 Imagery. User accomplishments and contributions;
d) Gather feedback from the participants on potential to incorporate hands-on activities into a virtual course;
e) The workshop agenda (Appendix I) and list of participants (Appendix II) are provided at the end of the document. The hands-on exercise and presentation materials will be available at http://rammb.cira.colostate.edu/training/rmtc/mcv_exercises.asp

### 1. Introduction (B. Connell, D. Souza, and H. Qi)

Bernie Connell, Diego Souza, and Hongming Qi introduced motivation for the training event as a positive response to the input from users to have access to affordable software and training on how to use the software to view satellite imagery and products that are on or will be on the GNC-A broadcast. These user requests were made at the 2015 NSC and continue to emerge in collaborative efforts between the WMO Coordination Group on Satellite Data Requirements (SDR), NOAA's GNC-A Coordination Group, and the WMO-CGMS VLab training efforts. One of the recent successes highlighted was NOAA's release of provisional GOES-16 Cloud Moisture Imagery (Level 2 imagery) with 7 channels being made available on GNC-A on July 10, 2017. The user community is grateful to NOAA for making this imagery available. Progress has also been recently made through discussions with the JPSS program office on recommended imagery and products on the GNC-A broadcast. The agenda of the workshop has started to address the questions that have been brought forward by the SDR and the User community on data display and training. They include:

- What free or low cost software are available to view the imagery being broadcast over GNC-A?"
- Is there training on how to use the software?
- How can we prepare for the next generation of geostationary and polar-orbiting satellites? More specifically: what training is available and how can we best adapt it for different user audiences?

All these questions relate to activities that help build capacity for users in RA III and IV.

## 2. Objectives and Approach

To understand the users and what types of display are important for their user needs, we reviewed the aspects of image display for 3 different levels of users:

- Level 1 users includes academic institutions and large organizations who want the digital data (in either Level 1 and Level 2 data format) to generate imagery and products and to use as input to models and algorithms. We refer to them as ***in-depth users***.
- Level 2 users includes academia, smaller organizations, and forecast offices who want digital data (mostly Level 2 data format) to generate imagery and products for other users. We refer to them as ***analysis users***.
- Level 3 includes small groups and individuals who are satisfied with gif and jpeg type images. We refer to them as the ***quick-look users***.

The initial intent of the hand-on exercises was to serve as the demonstration of the "flipped" approach to training. The "traditional" approach utilizes instructor led learning: the instructor presents materials, the students/participants take notes, the instructor assigns homework. Under the "flipped" approach, the instructor assigns reading materials and/or exercises and the students/participants come to class to discuss exercises. This approach utilizes self-guided and peer to peer learning and the instructor has presence as a guide and mentor. This method of learning supports the concept, "Make it Stick" and the following are a few of the ways this is accomplished.

- *Learning is deeper and more durable when it requires effort.*
- *Learning requires a foundation of knowledge*
- *Hands-on applications strengthen knowledge retention.*

The exercises utilized the free software McIDAS-V (https://www.ssec.wisc.edu/mcidas/) because it is relatively easy to install, reads in and displays multiple types of data and imagery, allows the user to readily query the data, view in different projections and area coverage, view "layers" of imagery and data, perform calculations, manipulate and combine imagery, and output values and views to files.
Since McIDAS-V does have a learning curve to use, the Labs were designed for the Level 2 and Level 3 users:

a) Level 3 user: demonstrate what can be viewed and what extra information can be gained from digital imagery. Use the McIDAS-V command bundle to load Fulldisk GOES-16 Cloud Moisture Imagery in NetCDF format and JPSS VIIRS imagery in NetCDF format (slightly different) and add the features that make it more readily interpretable.
b) Level 2 and 1 users: provide step by step instructions on how to load the imagery, where to find color tables, labels, and other features in the menus.

It is noted that McIDAS Version 1.6 was used for the exercises. This was the version available on the McIDAS-V website and was made available in July 2016. We anticipate another version to be released soon in 2017. Based on the previous trainer use of McIDAS-V, there were certain

features of the software that were currently not available but would be very useful in the future. We anticipate that these features will be part of the next McIDAS-V release.

The initial intent of the "flipped" training approach was to make the materials available for the GOES-16 and JPSS imagery in 2 phases a few weeks before the workshop. The complicating factor was that we did not have access to the list of registrants until the week prior to the workshop and could not reach the registered participants readily. A survey by show of hands at the beginning of the workshop on Saturday revealed that 6 out of 34 persons had done the exercises. The trainers then chose to modify the agenda and work through the exercises, both short and long versions. There was not enough time to develop case examples or blogs.

3. **SIGMA, SIGMACast, and SLIDER (D. Souza and B. Connell)**

For the quick look and analysis users mentioned above, Diego Souza demonstrated the existing SIGMA (Sistema de Informacoes Geograficas Aplicadas ao Meio Ambiente) web page (http://sigma.cptec.inpe.br/sigma/) which allows the user to view various imagery and image products and overlay many layers of information. Diego also gave an overview of the SIGMACast software under development to view imagery and products from the GNC-A broadcast on a local system. The Linux version of SIGMACast will be available at the end of August, and the Windows beta version will be available at the end of September 2017.
For the quick look audience, Bernie Connell demonstrated the new CIRA Satellite Loop Interactive Data Explorer in Real-time (SLIDER) (http://rammb-slider.cira.colostate.edu). This site offers viewing of all 16 channels and a few RGB image composites derived from the ABI provisional data from GOES-16. The SLIDER is currently only accessible through the web. In the future, we hope that JPSS imagery and products will be viewable in SLIDER.

4. **Hands-on exercises using McIDAS-V free software to demonstrate the capability to load and probe GOES-16 Level 2 Cloud and Moisture Imagery. (E. Dagg and B. Connell)**

This first tutorial uses McIDAS-V data bundle files to quickly display the GOES-16 Cloud and Moisture Imagery (CMI) (19 April 2017 at 18:45 UTC) in netCDF format with predefined settings. The objectives of this exercise were to demonstrate that McIDAS-V can load a sub-sector of full disk images in the given netCDF file format, and to be able to view, probe, and compare the Level 2 CMI data in two groups: 6 visible and near infrared (IR) channels and 10 infrared channels. The main reason this tutorial focused on a sub-sector of the data is that it takes more time and more memory for McIDAS-V to load the full resolution, full disk imagery that will be available through the GEONETCast Americas (GNC-A) broadcast. Another purpose of this exercise was to point out to users the significantly increased volume of ABI data that is available from GOES-16 and that the users may want to consider upgrading their hardware to accommodate the increased imagery and products. This exercise also provided the user with many examples of environmental, meteorological, and hydrological features that were highlighted in the first six modules of the Satellite Foundation Course for GOES-R:
http://rammb.cira.colostate.edu/training/visit/training_sessions/satfc-g.asp

3. **Hands-on exercises using McIDAS-V free software to demonstrate the capability to load and probe JPSS VIIRS Level 1 Imagery. (E. Dagg and B. Connell)**

In this tutorial McIDAS-V instruction bundle files were again used to quickly display the Suomi-NPP VIIRS data (19 April 2017 at 18:47 UTC) with predefined settings. The objectives of this exercise were to demonstrate that McIDAS-V can load a swath in the given HDF5 file format and was able to view, probe, and compare the 16 "Moderate" resolution ("M", 750 m) data in three groups: 5 visible bands, 6 near infrared bands, and 5 infrared bands. This tutorial focused on a selected swath of VIIRS data obtained through NOAA's Comprehensive Large Array-data Stewardship System (CLASS) (https://www.class.ncdc.noaa.gov). The date and time closely matched the GOES-16 example noted in section 3 above and provided the opportunity for the participant to compare the two data sets. The participants immediately recognized the higher resolution imagery and many asked how frequently the data were available.

4. **McIDAS-V scripting capabilities using the Jython Shell – enhancing processing capabilities. (D. Souza)**

After users get through the initial viewing and interpretation of imagery in McIDAS-V, the discussion often moves to "How can this be done more quickly and automatically and can we create the Red/Green/Blue (RGB) image composites?" The first presentation on Sunday morning focused on McIDAS-V scripting capabilities and was given by Diego Souza. Diego utilized Jython to call a function with a formula to read in a subsector of the data and create RGB combinations. One of the reasons to focus on a sub-sector of the data is that it takes more time and more memory for McIDAS-V to load the full resolution, full disk imagery that will be available through the GEONETCast Americas (GNC-A) broadcast. Creating and interpreting RGB composites will be an important component of training to improve the utilization of GEO and LEO imagery and products.

After working on the examples, many participants expressed interest in having these training efforts improved upon and continued both virtually and through face to face training. This will be taken forward as an action item.

5. **Hands-on "fire" case to explore the 16 channels and view 5-minute time step animation of imagery over 2 hours– GOES-16 CMI data from 6 March 2017. (E. Dagg and B. Connell)**

Users were given the opportunity to use the "quick load" McIDAS-V command bundles to load all 16 GOES-16 channels for a single time when the fire was very intense as well as a 2-hour timeframe with a 5-minute time step to explore the strengths and limitations of the GOES-16 imagery. The audience consisted of both English and Spanish speakers. The tutorials are currently in English. Going through the tutorials step by step ensured the Spanish speakers were aware of the intent and content of the tutorials. Bilingual instructors and participants were on hand to help with translation of instructions and questions. If there is interest, we will consider translating the modules.
Relevant to the user community outside the continental US, the default GOES-16 scan mode will take a full disk image every 15 minutes; the uninterrupted 5-minute full disk scanning strategy is possible under an alternative scanning strategy.

6. **User Input, Accomplishments, and Recommendations**

One of the valuable aspects of the workshop was the feedback from the participants. The following are some of the questions and suggestions with responses.

*Questions from Jorge Chira:*
1) *What system memory is recommended to effectively use McIDAS-V to read in and manipulate GOES-16 and JPSS imagery and products?*
Ans: This is a good question and one that we will have to look in to further. The laptop and the computers in the lab had 16 GB of RAM. This is the minimum we recommend having. We have not done tests to see what an optimal amount of memory would be. We await the new version of McIDAS-V to see if some of the issues with reading in imagery are corrected. As noted from Diego's presentation, there is the potential to use the SIGMACast software to view imagery. Marcial Garbanzo and Diego Souza and others also initiated discussions to collaborate on using jython scripting capabilities alone or in McIDAS-V to speed up display, perform calculations, and create RGB combinations.

2) *It seems like the CIRA fire RGB works well for large fires. How well does it identify smaller fires?*
Ans: This is a good observation as this fire RGB uses simple single channels as input. The question will be passed on to the algorithm developer to obtain the strengths and limitations of the products and to produce a quick guide.

Other question:
3*) Is there a way to obtain the GOES-16 CMI data before July 10th, 2017 (before it became provisional)?*
Ans: The GOES-16 CMI data after June 1st, 2017 is available on NCEI/CLASS https://www.class.ncdc.noaa.gov . The GOES-16 CMI data before June 1st hasn't been released to the public yet and GOES-R program is working with NCEI/CLASS now.

Comments:

1. Marcial Garbanzo, professor at the University of Costa Rica, member of the WMO Coordination Group on Satellite Data Requirements, and representative to the WMO VLab recommends that we strive for access to all channels of GOES-16 imagery, particularly to use for training activities. For his graduate students, he lectured more extensively on radiation concepts and then directed the students to take the SatFC-G to get an idea of the application aspects.

2. Update on training activities in Argentina: Estela Collini and Manuela Marino gave an overview of the Moodle course which is under development and focuses on GOES-16 training for forecasters in their country. They used the SatFC-G as guidance and developed 3 modules focused on 1) Physics, 2) the ABI sensor, and 3) the GLM sensor. The virtual course will run between August and October, and will be complemented by a 1-week long in-person course in November, to be conducted by Jose Galvez (SRG/NOAA). After this initial course is delivered, they will consider opening it up for participation from other Spanish speaking countries.

3. Simon Craig requested that the presentations be made available via drop box.

4. José Galvez offered to create a shareable Google document to collect feedback on the tutorials and potential use of the materials in a virtual course environment. When the details of this have been worked out, we will share the information with the attendees.

5. Steve Goodman, the NOAA GOES-R Program Scientist, was on hand to observe participants reacting to hands–on access to imagery and products and to answer questions on GOES-16. The 'GOES-16 satellite is currently at 89.5 degrees west longitude and NOAA plans to move it to the operational location of 75 degrees during the late fall. Details will be released when they are finalized.

Recommendations identified during the Event:

- Continue training, both virtual and in-person events, on the use of satellite data and associated visualization, processing and analysis tools. McIDAS-V is a potential platform, Jython was identified as another means to automate image processing and viewing.
- Identify ways to gain access to all image channels from both GOES-16 and VIIRS. If there is available bandwidth currently on GEONETCast, can all the GOES-16 channels be broadcast? This would provide a low cost alternative to many users to be able to explore the capability of all the new channels. There are a number of outcomes: the user may decide they like the imagery and upgrade to a GOES Rebroadcast (GRB) receive station; the user may decide they like the imagery and look for alternative means (for example via Local Data Manager (LDM)) to get the channels when the GNC broadcast becomes limited.
- Continue to work with the JPSS Program Office to identify imagery and products for the GNC-A broadcast that are of importance to the user community.

## 7. CONCLUSION

The WMO/NOAA VLab Train the Trainer Workshop on Satellite Data Usage was the third of such events to take place in association with the NSC and again it was successful. This was an important international forum for training and enables the exchange of ideas focused on satellite training. It should be noted that some of the questions and concerns mentioned in the workshop were brought forward into the NSC. Users and trainers are excited about the capabilities of both the GOES and LEO new generation of satellites and expressed interest in setting up groups continue to explore access to satellite data, particularly GOES-16 and JPSS-1 imagery and products. They also recognize the value of training materials, particularly providing examples for their area of interest and in their native language and look forward to virtual and in-person opportunities to collaborate on and share training materials.

Appendix I: Workshop Agenda

| **15 July 2017** | **Saturday** |
|---|---|
| 08:30-9:00 | Registration |
| 09:00-10:00 | Welcome, Introductions, and General Information – Bernie Connell, Kathy-Ann Caesar and all. Overview of the objectives of the Train the Trainer Workshop. B. Connell (10 min.) Brief introduction and update on GEONETCast –Americas Data Dissemination System. Diego Souza (10 min.) Timelines and data volumes for image and product data flow over GNC-A (both GOES-16, JPSS) Hongming Qi (10 min.) |
| 10:00-10:30 | Image display for different audiences (Bernie 5 min.) Demonstration of Display Software: Sigmacast (Diego 5 min.), SLIDER (Bernie 5 min.) |
| 10:30-11:00 | Break |
| 11:00-12:00 | Trainer Perspectives on usage of SatFC-G and the McIDAS-V pre course exercise. http://rammb.cira.colostate.edu/training/rmtc/mcv_exercises.asp Participants are asked to contribute focused feedback on a chosen aspect of modules 1 – 7 of the Satellite Foundation Course for GOES-R/16 and complimentary usage of the hands-on exercise. This can also include feedback from any of the other modules in SatFC-G and user provided case example. Moderators: B. Connell and K-A Caesar |
| 12:00-13:00 | Lunch |
| 13:00-15:00 | Groups work together to build content for 5-20 minute hands-on training exercise, a Blog, or a web page on GOES-16 on a preferred topic using tools introduced in the pre-workshop activities. Topics will include the following: distinguishing water/ice cloud, fire, or ash/dust and will encourage translation. Moderators: E. Dagg and B. Connell |
| 15:00-15:30 | Break |
| 15:30-17:00 | Participants present case highlights – this is an opportunity to present GOES-16 imagery strengths and limitations, offer suggestions based on experience with the data or request help on a confusing aspect of image interpretation or data display. Questions to consider from the training perspective: If you were charged to update an aspect of SatFC-G by providing a regional example or translating text, what would you propose? Moderators: K.-A. Caesar, R. Alfaro, and B. Connell |
| **16 July 2017** | **Sunday** |
| 08:30-10:00 | Groups work together to build content for 5-20 minute hands-on training exercise, a Blog, or a web page on JPSS imagery on a preferred topic using tools introduced in the pre-workshop activities. http://rammb.cira.colostate.edu/training/rmtc/mcv_exercises.asp Topics will likely include of the following: distinguishing water/ice cloud, fire, or ash/dust. Moderators: E. Dagg and B. Connell |
| 10:00-10:30 | Break |
| 10:30-11:15 | Participants present case highlights – strengths/limitations/offer suggestions/request help. As a trainer, what aspects of SatFC-G would you like to see incorporated into a Satellite Foundation Course for JPSS or other low earth orbiting satellite? Moderators: K.-A. Caesar, R. Alfaro, and B. Connell |
| 11:15-12:00 | Focused feedback – can we effectively utilize tools like McIDAS-V, Sigmacast, and SLIDER in an online training environment? Explore ways to collaborate with the Regional Focus Group or other online sessions, and how to engage and utilize students. Example from D. Souza on McIDAS-V scripting capabilities. Moderators: B. Connell, J. Galvez, and K.-A. Caesar |
| 12:00-13:00 | Lunch |
| 13:00-14:00 | Reflect on and Summarize the Workshop: How did we do? Were the following questions answered: Did the content of the first 6 modules of SatFC-G adequately address all the levels of learner needs? If not, how can the information be adapted to address wider ranges of learner needs and for "our region of interest"? How easy was it to download and run the McIDAS-V hands-on examples? Did the hand-on examples help to reinforce module concepts? Do you have imagery or products to recommend to add to the GNC-A broadcast? Similarly, are there imagery and products that are not used and should be removed from the broadcast? As a training community, what can we collaborate on? Moderators: B. Connell and K.-A. Caesar |
| 14:00-15:00 | Start of meeting WMO Coordination Group on Satellite Data Requirements (SDR) for Regions III and IV |
| 15:00-15:30 | Break |
| 15:30-17:30 | WMO Coordination Group on SDR for Regions III and IV |

**List of Participants for workshop (41 total)**

| Name | Country | Organization | Email |
|---|---|---|---|
| Manuela Sanchez | Argentina | SMN | msanchez@smn.gob.ar |
| Estela Collini | Argentina | SMN | estela.collini@gmail.com |
| Gregory Gibson | Bahamas | Met. Service | gregorygibson1969@gmail.com |
| Gregory Thompson | Bahamas | Met. Service | gregorydthompson@gmail.com |
| Kathy-Ann Caesar | Barbados | CIMH | kacaesar@cimh.edu.bb |
| Lawrence Pologne | Barbados | CIMH | lpologne@cimh.edu.bb |
| Dwayne Scott | Belize | Met. Service | dscott@hydromet.gov.bz |
| Diego Souza | Brazil | CPTEC | diego.souza@cptec.inpe.br |
| Expedito Rebello | Brazil | INMET | expedito.rebello@inmet.gov.br |
| Jose Murilo | Brazil | SDC SC | murilo@sdc.sc.gov.br |
| Diego Campos | Chile | DGAC | diego.campos@dgac.gob.cl |
| Gustavo Munoz | Colombia | EPM | Gustavo.Munoz@epm.com.co |
| Marcial Garbanzo | Costa Rica | Univ. of Costa Rica | mgarbanzopcm@gmail.com |
| Rodolfo Sanchez | Costa Rica | IMN | rodolfos@imn.ac.cr |
| Edison Cruz | Ecuador | INAMHI | ecruz@inamhi.gob.ec |
| William Abarca | El Salvador | MARN | Wabarca@marn.gob.sv |
| Carlos Rabanales | Guatemala | INSIVUMEH | cmaldonado@insivumeh.gob.gt |
| Gabriela Rodriguez | Mexico | UNAM | gabyg@igg.unam.mx |
| Olivia Salmeron | Mexico | UNAM | osg@igg.unam.mx |
| Roberto Luevano | Mexico | CILAMEX | rluevano@cila.gob.mx |
| Jorge Chira | Peru | SENAMHI | jchira@senamhi.gob.pe |
| Elmo Burke | Saint Kitts | Met. Service | eccb22@hotmail.com |
| Andre Joyeux | Saint Lucia | Met. Service | andre.joyeux@govt.lc |
| Glendell De Souza | British Caribbean Territories | CMO | GDe_Souza@cmo.org.tt |
| Simon Craig | Trinidad & Tobago | Met. Service | simongcraig@gmail.com |
| Bryan Thomas | Trinidad & Tobago | Met. Service | bry46an@yahoo.com |
| Earle Williams | USA | MIT | earlerw@mit.edu |
| Rosario Alfaro | USA | UCAR | arosario@ucar.edu |
| Robert Sames | USA | NASA | robert.sames@nasa.gov |
| Bernie Connell | USA | CIRA | bernie.connell@colostate.edu |
| Erin Dagg | USA | CIRA | erin.dagg@colostate.edu |
| Steve Goodman | USA | NOAA | steven.j.goodman@noaa.gov |
| Hongming Qi | USA | NOAA | hongming.Qi@noaa.gov |
| Jose Galvez | USA | NOAA | jose.galvez@noaa.gov |
| Moses Angeles | USA | NOAA-CREST | mangeles@ccny.cuny.edu |
| Adrian Diaz | USA | NOAA-CREST | adiaz001@citymail.cuny.edu |
| Cassandra Calderella | USA | NOAA-CREST | ccalder001@citymail.cuny.edu |
| Joshua Hrisko | USA | NOAA-CREST | joshhrisko@gmail.com |
| Tarendra Lakhankar | USA | NOAA-CREST | tlakhankar@ccny.cuny.edu |
| Daniel Aicardi | Uruguay | LES – Univ. de la Rep. Uruguay | daicav@gmail.com |
| Ana Marotti | | | marotti.ime@gmail.com |

## Appendix 5: Preconference Workshop: GOES-16 Training Session for Introductory Users

Sunday, 16 July 2017

The half-day GOES-16 training session introduced the users to the new capabilities made possible by NOAA's next generation Geostationary Operational Environmental Satellite (GOES) R Series Advanced Baseline Imager (ABI), Geostationary Lightning Mapper (GLM), and derived products for improved environmental intelligence, forecasts, and warnings. Twenty-five participants had the opportunity to participate in guided hands-on experience with GOES-16 data that showcased the opportunity to improve forecasts and warnings of high impact weather and environmental phenomena.

The session kicked off with an introduction and overview of the GOES-R Program given by the GOES-R System Program Director (Acting) Michael Stringer (NESDIS/GOESPO). He introduced attendees to the GOES-R Series Program, reported on the current program, instrument, and product status including early on-orbit results. He explained that the GOES-R Series will provide significant improvements in the detection and observance of meteorological phenomena that directly impact public safety, protection of property, and the nation's economic health and prosperity. He showed diagrams and breakdowns of the system architecture, the space craft and its instruments. Mr. Stringer highlighted the GOES-R launch, field campaign, and first looks from the various instruments. The presentation concluded with a brief explanation of the current GOES-16/13 East transition planning and the status of GOES-S, T & U with plans to launch GOES-S in spring 2018!

The session continued with a detailed ABI introduction by Tim Schmit (NESDIS/STAR). He broke down the improvements on GOES-R's ABI by comparing them to the current GOES Imager. In short, the ABI has 5 times faster coverage (5-minute full disk vs. 25-minute), 4 times improved spatial resolution (2 km IR vs 4 km), and 3 times more spectral bands (16 vs. 5). Mr. Schmit showed various graphics depicting the various views of the different sectors and scanning modes, including views of the default meso locations. He discussed the differences and benefits for each of the 16 bands, and included side by side comparisons of the GOES-16 ABI channel vs. the GOES-13 comparable channel. The ABI presentation concluded with a look at one of the GOES-R Education Proving Ground WebApps. Students were directed to the Hurricane Sandy activity to try out and then encouraged to check out the Cooperative Institute of Meteorological Satellite Studies (CIMSS) short course link to find additional training exercises.

The final portion of the GOES-16 Training Session for Introductory Users was provided by Chief Program Scientist Steven Goodman (NESDIS/GOESPO) on the GLM. He presented an overview of the GLM and its capabilities and introduced actual observations to the attendees. The GLM detects total lightning activity across the Western Hemisphere: in cloud-to-cloud and cloud-to-ground. It provides coverage both over land and ocean at a spatial resolution of ~8 km across the entire field of view with less than 20 seconds latency. Mr. Goodman showed some early pre-operational GLM use cases obtained by the GLM Post-Launch Validation Campaign as well as an example of an offshore convection example from March of 2017 and severe weather over the southeast in April 2017 that impacted Delta Airlines operations for multiple days. He concluded with an interactive discussion on various GLM uses highlighting aviation, storm monitoring for development and rapid lightning activity changes, storm monitoring in data sparse regions and overall lightning safety.

Attendees were presented with course completion certificates and encouraged to take part in the GOES-16 Advanced Users Training (Use Case Workshop) on Tuesday 18 July 2017.

## Appendix 6: Preconference Workshop: JPSS 101 Satellite Training Session

Sunday July 16, 2017, 1:00 PM – 5:00 PM

This half-day workshop focused on JPSS related Satellite training on applications extending from the capabilities of the planned new generation of JPSS satellite products to a variety of operational forecasting scenarios. Participants took part in hands-on experiences using Suomi National Polar-orbiting Partnership (Suomi NPP) data, Direct Broadcast (DB) data and operational applications. Training included information on JPSS instruments and their improved observational capabilities, new JPSS data product applications, and on-line resources available for training. The workshop format was a balanced mix of presentations and hands-on exercises.

Christie Best, moderator, introduced the agenda and session logistics to participates.

Dr. Mitch Goldberg began with an introduction of the JPSS program, and the instruments. He explained why polar-orbiting satellites are important as well as the necessity of JPSS satellite. He described ATMS rainfall and MIIRS rainfall. He introduced CrIS and NUCAPS products. He noted that VIIRS has more pixels than MODIS for fire events. Dr. Goldberg concluded his presentation with a summary on JPSS proving ground activities, science seminars and the annual science digest.

Dr. Lihang Zhou introduced JPSS EDR products. She gave an overview of the Cal/Val process – an essential aspect of the pre-launch phase. She provided a status update and explained how products were monitored. Dr. Zhou moved on to describe atmospheric products and gave NUCAPS as an example of a product that's being used in reprocessing to produce long-term data records. Dr Zhou also noted that NUCAPS is an enterprise algorithm retrieved from multiple satellites. She talked about new capabilities in various applications including land, ocean, snow and ice and imagery. Among the examples she gave were OMPS products, SNPP/JPSS Aerosol EDRs, city lights, and NOAA Coastwatch/Oceanwatch products.

Following the introductions, the rest of the workshop was dedicated to hands-on exercises which included the use of Suomi NPP data to analyze and forecast Hurricane Otto which impacted Central America in November 2016, and to observe the wildfires which occurred near Santiago, Chile in January 2017. In each of the scenarios the workshop participants applied these products to simulate making the operational decisions that were necessary during each of the events.

Each of the scenarios began with a description of the JPSS products that were most useful for that particular event.

In the Hurricane Otto scenario, Michael Folmer, the instructor, gave an overview of applications of JPSS products to TC analyses and forecasts.

In the Chilean Fire scenario, Ivan Csiszar, the instructor, gave an overview of applications of JPSS products in fire events. Dr Csiszar discussed key US missions for fire monitoring. He provided information on how the VIIRS Active Fire product could be accessed. Using images, web links, and other materials, students were directed to look at FRP, and see what they get out of VIIRS data: temporal and also spatial. FRP is important also in smoke models, particularly for initialization. Profiles generated over multiple days were used to observe development over time. They also looked at DNB imagery for night time views of the fires. While the Chilean scientists did not use FRP for model initialization, they looked at it qualitatively.

The training concluded with a Q&A session summarized below.

Q. Why do we use SDR spaces instead of geo projections?

A: Scientists always go back to the SDR because the fire product is dependent on the quality of the SDR.

Q: When will we be using both GOES-R and S-NPP and JPSS?

A: Over the next year we want to compare the GOES-R observations with the VIIRs fire detection. J1 gets the first detection, then GOES-R, then check what is in between. GOES-R fire product is fantastic it is just a bigger pixel.

Following the scenarios, Jorel Torres provided information on JPSS training modules, satellite CHAT, NASA SPORT and CIRA McIDAS.

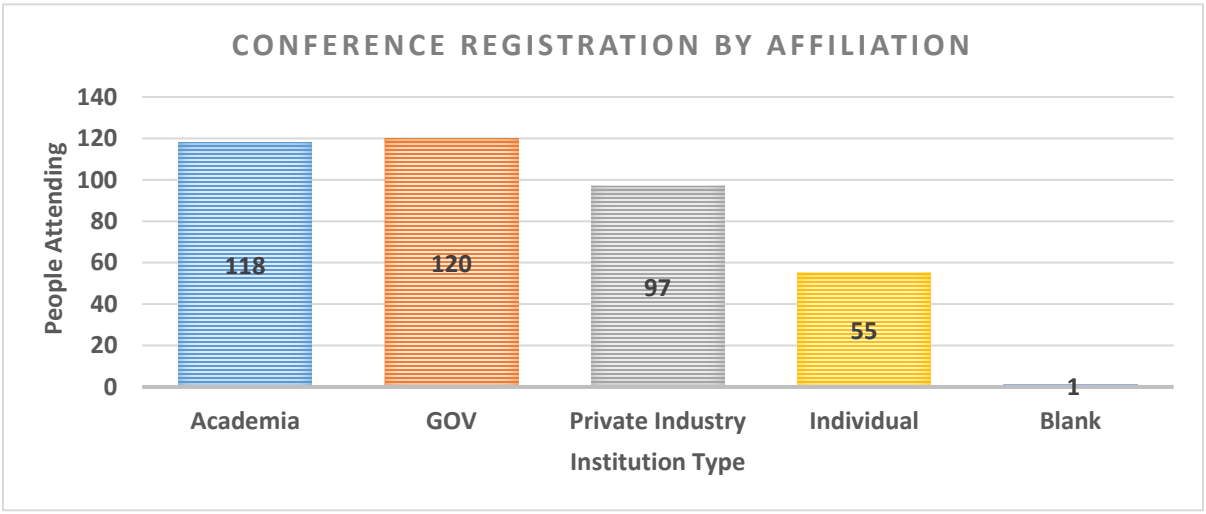
The fire alarm in the building was pulled and the participants were asked to evacuate just before completion of the training session. A post course evaluation survey was given to the participants, most of whom provided feedback on course-specific themes including organization, clarity of expectations, balance/appropriateness, application, skill development, and content knowledge.

# Conference Evaluation/Feedback:

Wordcloud poll

**What one word would you use to describe what you liked best about the conference?**

0 1 2

Multiple-choice poll

**Which satellite series provides the most applications for you?**

0 3 0

GOES-R

37 %

JPSS

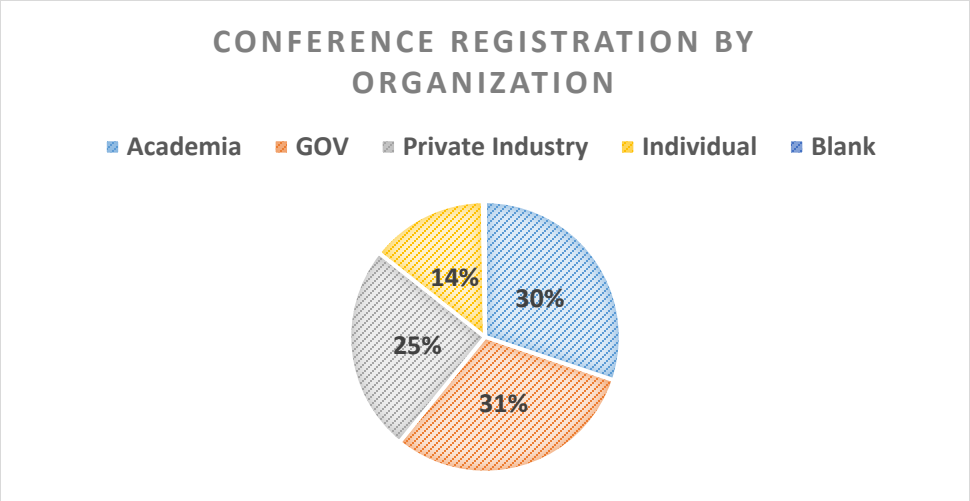
17 %

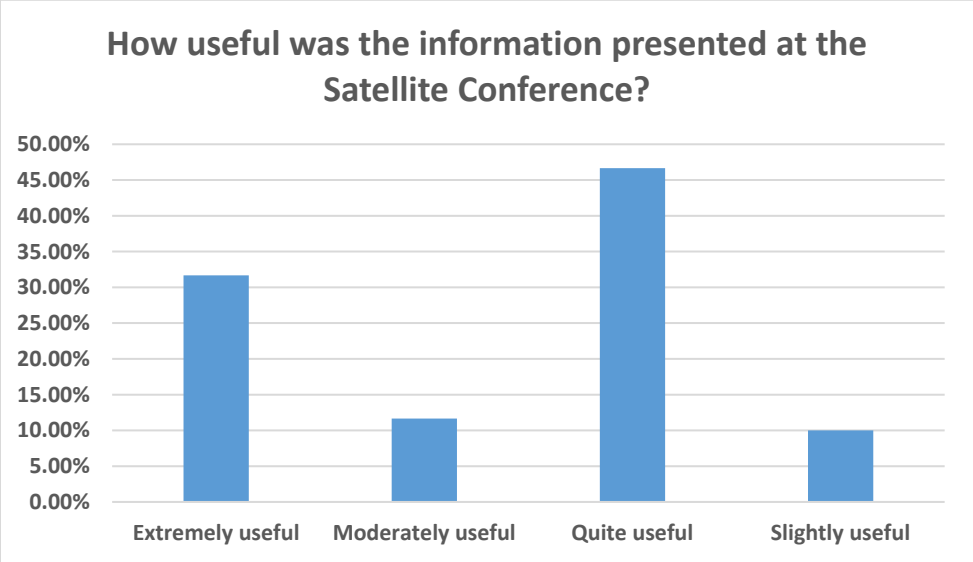
Both

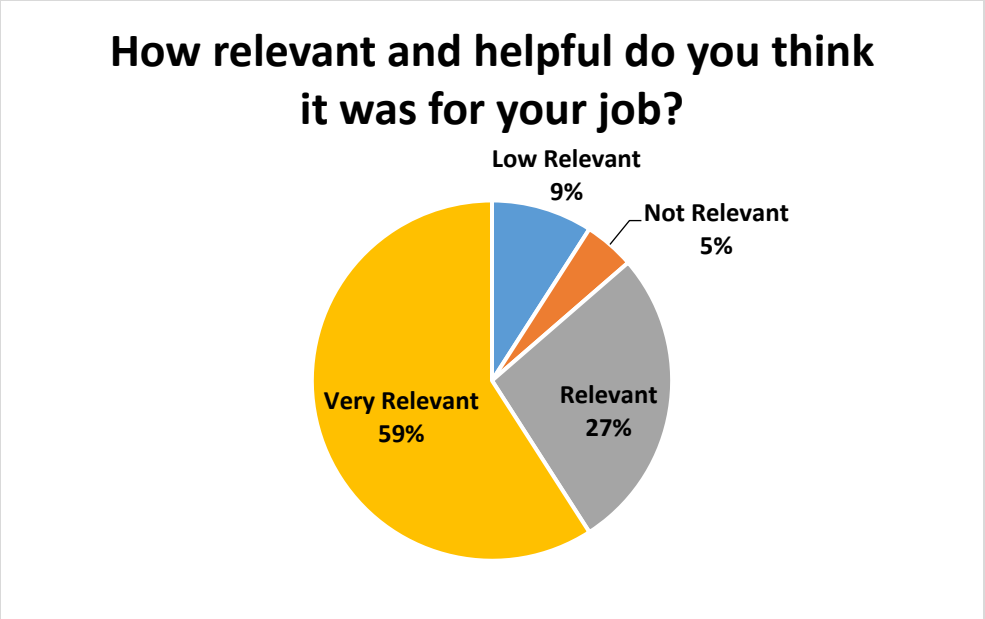
43 %

Other

3 %


CONFERENCE REGISTRATION BY ORGANIZATION
Academia
GOV
Private Industry
Individual
Blank
14%
30%
25%
31%


How useful was the information presented at the Satellite Conference?
50.00%
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Extremely useful
Moderately useful
Quite useful
Slightly useful


How relevant and helpful do you think it was for your job?
Low Relevant 9%
Not Relevant 5%
Relevant 27%
Very Relevant 59%