6TH GOES USERS' CONFERENCE
POSTER ABSTRACTS

1. Atmosphere *Frank Alsheimer*

Satellite Use in the NWS Eastern Region

Authors: Frank Alsheimer, Dave Radell, and Jon Jelsema

The Eastern Region of the National Weather Service is composed of 23 Weather Forecast Offices, 3 River Forecast Centers, and 4 Central Weather Service Units. All offices use geostationary and polar orbiting satellite data in near real-time, as a crucial component of the forecast processes. Besides routine use in the preparation of daily forecast products, satellite data are also critical in assessing and forecasting aviation weather, marine weather, severe weather, fire weather, and small scale weather that is vital for decision support services. These data provide critical coverage for the forecaster in areas where in-situ data either is not available or is sparsely located, such as over open bodies of water or mountainous regions. Additionally, a large amount of satellite data goes into the operational numerical models, which forecasters at all offices use on a daily basis. This poster shows specific examples of some of these uses in Eastern Region weather forecast offices.

2. Atmosphere *Mark DeMaria*

Applications of the Geostationary Lightning Mapper to Tropical Cyclone Intensity Forecasting

Authors: Mark DeMaria, John A. Knaff, Robert T. DeMaria

The next generation NOAA Geostationary Operational Environmental Satellite (GOES) system starting with GOES-R will include a Geostationary Lighting Mapper (GLM). The GLM will provide near continuing monitoring of the timing and location of total lighting (cloud to ground and intra-cloud) activity. The coverage of GOES-east and –west will include nearly the entire region where tropical cyclones form and move in the Atlantic and eastern North Pacific oceans. Lighting data from the ground-based World-Wide Lightning Location Network (WWLLN) are being used as a proxy for the GLM. The WWLLN data only detects a fraction of the cloud to ground lightning, so a crude correction factor is applied by comparison with annual lightning climatologies from the Optical Transient Detector (OTD) and Lighting Imaging Sensor (LIS) from polar satellites. The OTD and LIS have detection characteristics similar to what will be available from the GLM. The relationships between lightning activity from the corrected WWLLN data and tropical cyclone intensity changes is examined in detail. The relationships with other storm characteristics such as the vertical shear of the environmental wind and the sea surface temperature is also examined. Results show that the relationship between lightning density (strikes per unit area and time) and intensity changes is complicated by the influence of vertical wind shear. Once that factor is taken into account, there is a significant correlation between increased lighting and tropical cyclone intensification. The lightning activity in tropical cyclones in the Atlantic and eastern North Pacific are compared. Atlantic storms tend to have greater lightning activity than those in the eastern North Pacific. Preliminary intensity forecast algorithms that utilize the lighting data are under development. Preliminary real time tests of these algorithms are planned for the GOES-R Proving Ground at the National Hurricane Center during the 2010 hurricane season.

3. Atmosphere *Doris A. Hood*

Satellite Data for Human Spaceflight Operations

Author: Doris A. Hood

The National Weather Service Spaceflight Meteorology Group (SMG) supports NASA's human spaceflight program at Johnson Space Center. Currently, the main operational function is support of the Space Shuttle program by providing landing forecasts for the launch intact abort sites, on-orbit primary landing site selection, and end-of-mission landings. Detailed forecasts are required for cloud cover, winds, visibility and turbulence as well as rain shower and thunderstorm proximity with respect to a specific runway. The main landing sites are located in the United States, Spain and France but the emergency landing sites cover the globe, requiring worldwide data sets.

SMG has local downlink capability for GOES East, GOES West and Meteosat Second Generation (MSG) data. All bands of the GOES and MSG data are ingested, in real time, into SMG's customized version of the Man-computer Interactive Data Access System (McIDAS). The data can be displayed as individual bands, multi-channel differencing imagery or as multi-channel color combinations. Digital imagery from several polar orbiting satellites is also available on McIDAS from various NESDIS and NASA servers.

The high resolution visible, infrared and water vapor MSG channels are put into a netCDF format on McIDAS and then sent via the Local Data Acquisition and Display (LDAD) system for display in the Advanced Weather Information Processing System (AWIPS). SMG also receives Moderate Resolution Imaging Spectroradiometer (MODIS) data from the University of Wisconsin Cooperative Institute for Meteorological Satellite Studies, which is displayed in both AWIPS and McIDAS. Additional imagery and imagery products are also received from NASA's Short-term Prediction Research and Transition Center (SPoRT) for display in AWIPS. Each SMG forecast console provides access to both McIDAS and AWIPS displays.

In the GOES-R era, SMG will be supporting NASA's new Constellation Program where both the abort and nominal end-of-mission landing sites for the crew capsule will be in the ocean. This will require SMG to access and evaluate a new

suite of satellite products applicable to meteorological and oceanographic analysis and forecasting in these data sparse regions.

4. Atmosphere *Deirdre Jones*

Roadmap for Satellite Data in AWIPS

Authors: Deirdre Jones, Brian Gockel

The Advanced Weather Interactive Processing System (AWIPS) is the integrating element of the NOAA's National Weather Service (NWS) IT infrastructure, and is the primary tool in NWS forecast offices for producing forecasts and warnings. The NWS' Office of Science and Technology manages the AWIPS Program, and Raytheon Technical Services is the AWIPS prime contractor. The AWIPS Program is undergoing substantial software rearchitecture to enable NWS to leverage the GOES-R for the warning and forecast mission.

This paper describes the role AWIPS plays in delivery of satellite observations to NWS forecasters, how these data are delivered today, and how AWIPS is evolving to accommodate GOES-R era observations.

5. Atmosphere *Jun Li*

High impact weather study using advanced IR sounding product

Authors: Jun Li, Jinlong Li, Jason Otkin, Hui Liu, and Timothy J. Schmit

A high spectral resolution Infrared (IR) sounder in the geostationary orbit will provide unique high temporal and high spatial resolution 3-dimensional temperature and water vapor profiles. This will help monitor and forecast the severe thunderstorms. In this study, a case from the International H2O Project (IHOP) field experiment was used to demonstrate the benefit of advanced IR geo-sounder in nowcasting severe storms. Atmospheric profiles from the output of high resolution Weather and Research Forecasting (WRF) model were used to simulate the Hyperspectral Environmental Suite (HES) like and Advanced Baseline Imager (ABI) like radiances. Temperature and moisture profiles were further retrieved from these radiances. The derived atmospheric stability parameters (e.g., lifted index) show that the ABI or current GOES sounder only provides limited instability information before the storm development due to the limited spectral information for temperature and water vapor profiling, while the advanced IR sounder (HES like) can provide the critical unstable information well earlier than ABI or current GOES sounder. In the second part of this study, the high spatial resolution of single field of view (SFOV) atmospheric soundings from AIRS, a research product from CIMSS/UW-Madison, have been applied in the hurricane track and intensity assimilation and forecast by using NCAR WRF Data Assimilation Test Bed (DART) system. The results show that the track error for Hurricane Ike (2008) and Typhoon Sinlaku (2008) is greatly reduced when AIRS full spatial resolution soundings are assimilated. The forecast of rapid intensification of Typhoon Sinlaku is also significantly improved if AIRS data are added.

6. Atmosphere *Zhenglong Li*

Improvements and Applications of Atmospheric Soundings from GOES Sounder

Authors: Zhenglong Li, Jun Li and Paul Menzel

A unique feature of the Geostationary Operational Environmental Satellite (GOES) Sounder over the polar orbiting sounders is that it observes the atmosphere and the surface on an hourly basis with a nominal spatial resolution of 10 km. The temporally and spatially dense observations are of great importance for improving short-term weather forecasting or nowcasting. To further demonstrate how the GOES clear-sky sounding products can help nowcasting, an improved clear-sky physical retrieval algorithm for atmospheric temperature and moisture is developed. The use of the GOES Sounder is usually limited to clear skies to avoid cloud contamination of the derived profiles. However, the chance for a GOES Sounder field-of-view (FOV) to be clear is only about 34 %. Until the advent of a microwave sounder in geostationary orbit, the search for viable soundings in cloudy conditions will continue. This study extends the sounding retrievals from clear sky to cloudy regions, by developing a synthetic regression-based cloudy sounding retrieval algorithm. A comparison with the microwave radiometer measured total precipitable water (TPW) at the Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site from June 2003 to May 2005 shows that the clear sky TPW retrievals are improved by 0.4 mm over the legacy GOES Sounder TPW product. Comparisons against radiosondes at SGP CART site from August 2006 to May 2007 and the conventional radiosonde network over the Continental United States (CONUS) from January 2007 to November 2008 both show that the retrievals of moisture under thin cloud conditions perform as well as those with the clear sky conditions. The largest improvement to the Global Forecast System (GFS) first guess is found in the upper level (roughly 300 – 700 hPa) integrated precipitable water vapor (PW) or PW3; the RMS is reduced by 0.4 mm. In the case of low thick clouds, PW3 is significantly improved; the improvement of RMS is about 0.21 mm. The new GOES algorithms are applied to three severe storm cases, demonstrating that the new soundings provide additional information that can lead to better short term severe storm forecasting.

7. Atmosphere *James P. Nelson III*

Monitoring South America and Environs from GOES

Authors: James P. Nelson III, A. J. Scheiner, J. Li, Z.Li, M. M Gunshor, T.J.Schmit, G.S. Wade

For more than two years, NOAA/NESDIS has been operating the Geostationary Operational Environmental Satellite (GOES)-10 at 60 degrees West longitude, and providing data from both the Imager and (until February 8, 2009) Sounder instruments to interested parties, in particular to users in South America. In fact, the GOES-10 Sounder was the first operational geostationary Sounder to routinely provide data over South America. The impetus for providing these GOES data to the South Americans can be traced to the Global Earth Observation System of Systems (GEOSS) project

(http://www.ssd.noaa.gov/PS/SATS/GOES/TEN/), which is a collaborative effort between NOAA and international partners. Within the Space Science and Engineering Center (SSEC) at the University of Wisconsin-Madison, GOES-10 Imager and Sounder data have been archived routinely since 1998, when GOES-10 was used to service North America, and has continued throughout the satellite's service station at 60W. In addition, for most of the period while GOES-10 was at 60W, the Cooperative Institute for Meteorological Satellite Studies (CIMSS) has generated remapped, enhanced imagery from all 5 bands of the Imager, and the Sounder data has been utilized to generate several experimental value-added products (http://cimss.ssec.wisc.edu/goes/rt/goes10.php). The Sounder products available from GOES-10 over South America consist of Derived Product Images (DPI) of Cloud Top Pressure (CTP), Total Precipitable Water (TPW) and Lifted Index (LI). Animations of these DPIs are also available, as well as other displays of single and multiple Sounder bands. At the conference, examples of the imagery and products produced at CIMSS from GOES-10 Imager and Sounder data will be presented.

Due to end-of-life spacecraft fuel issues, the GOES-10 satellite is due to be decommissioned in December 2009 (http://www.oso.noaa.gov/goesstatus/). However, discussions are ongoing concerning perhaps replacing GOES-10 with one of the GOES satellites currently servicing North America. Given their history of successfully ingesting the data and providing meteorological products from GOES-10, SSEC/CIMSS is uniquely positioned to generate and provide the same (and indeed expanded) imagery and meteorological products over South America when the next suitable GOES satellite becomes available.

8. Atmosphere *Ken Sperow*

AWIPS Tracking Point Meteogram Tool

Author: Ken Sperow

With the launch of GOES-R forecasters will have higher temporal and spatial resolution satellite data and exciting new products at their disposal. Forecaster tools to analyze this ever increasing volume of meteorological data are more important today than ever. Simple tools that help the forecasters focus on signals within the data rather than being overwhelmed by the volume of data are crucial. The Meteorological Development Laboratory (MDL) within the National Weather Service (NWS) is developing such a tool for use within AWIPS Migration.

MDL is developing a tool within AWIPS to create "data following" tracking points and subsequently display data values at the points for various time steps. This tool will allow forecasters to assign a "centroid/center point" and motion to any feature of interest displayed within D-2D, and then generate a meteogram of the data underneath the associated centroids. A meteogram is a graphical depiction of trends in meteorological variables, such as temperature, dew point, wind speed and direction, or pressure.

The addition of this tool will allow for "on the fly" plotting of values from gridded model or diagnostics fields, satellite data, or radar data while following a feature in an animation. This tool will have a multitude of operational applications that will benefit NWS forecasters both from a warning and decision making, and forecast and threat assessment standpoint.

The application of this tool to satellite remote sensing is of particular interest. With additional satellite datasets and channels being added to the AWIPS data stream with each upgrade, the forecaster has access to more high resolution satellite data than ever before. To make optimal use of this data, the "tracking point" tool could be utilized to more efficiently query and analyze the satellite fields. For instance, this tool will allow a forecaster to determine cloud top cooling rates for an approaching cluster of convection or analyze total cloud lightning data from the Geostationary Lightning Mapper (GLM) to make assessments of storm strength and growth rates. This tool could also be utilized in conjunction with channel difference fields to analyze a variety of trends including the potential for aircraft icing and fog and stratus development. The tool could also see particular utility in the areas of convective initiation, terminal area forecast (TAF) forecasting, and Aviation Weather Center (AWC) route planning and forecasting. With the NWS developing more user specific products, including graphical and derived applications, this type of cross-cutting concept would have obvious benefits to both the local forecast offices and to national centers.

9. Atmosphere *Hai Zhang*

Estimating PM2.5 using MODIS and GOES aerosol optical depth retrievals in IDEA

Authors: Hai Zhang, Raymond M. Hoff, Shobha Kondragunta

Aerosol optical depth (AOD) acquired from satellite measurements demonstrates good correlation with particulate matter with diameters less than 2.5 um (PM2.5) in the eastern United States so that it can be used to estimate PM2.5 in areas where in situ measurements are not available. We investigated the relationship between AOD and PM2.5 over ten regions defined by Environmental Protection Agency (EPA) in different seasons and developed a look-up-table based on the seasonal and regional varied linear regression relationship for estimating PM2.5 from AOD. We applied this LUT in the IDEA (Infusing satellite Data into Environmental Applications) product currently running at NOAA (http://www.star.nesdis.noaa.gov/smcd/spb/aq/), and combined the AOD retrievals from MODIS Terra and Aqua and from GOES east imager to generate daily PM2.5 estimations. The PM2.5 estimations from AOD using this LUT were found to be more accurate than those using a fixed ratio between AOD and PM2.5.^^

10. Atmosphere *Hai Zhang*

A Multi-angle Aerosol Optical Depth Retrieval Algorithm for GOES

Authors: Hai Zhang, Alexei Lyapustin, Yujie Wang, Shobha Kondragunta and Istvan Laszlo

Aerosol retrieval from a geostationary satellite has high temporal resolution compared to a polar orbiting satellite, which enables us to monitor aerosol motion. However, the current GOES imager has only one visible channel for retrieving aerosol, and hence its accuracy is low compared to polar-orbiting satellites which carry the Moderate Resolution Imaging Spectroradiometer (MODIS). The operational GOES aerosol optical depth (AOD) retrieval algorithm (GOES Aerosol/Smoke Product, GASP) uses 28-day composite images from the visible channel to derive surface reflectance. In this work, we investigate a new AOD retrieval algorithm from the GOES imager. The algorithm assumes the surface Bidirectional Reflectance Distribution Function (BRDF) at channel 1 of GOES is proportional to the BRDF at 2.1 μm from MODIS. The ratios between them are derived through timeseries analysis of visible channel images. The results of the AOD and surface reflectance retrievals are compared against Aerosol Robotic Network (AERONET), GASP, and MODIS retrievals. The benefit of the new algorithm is that the time period for the surface reflectance retrieval is much shorter than GASP algorithm so that it can capture the rapid change in the surface reflectance. Compared to GASP algorithm, the new algorithm has significantly better retrievals during early spring at some of the AERONET sites, and similar retrievals during summer and fall.

11. Atmosphere *William C. Straka III*

Version 2 of the GOES Surface and Insolation Products: An improved solar radiation and cloud resource for coral bleaching and NWP modeling

Authors: William C. Straka III, Istvan Laszlo, Andrew Heidinger

Measured radiative fluxes are important inputs into hydrological models that evaluate water budgets. This is due to their direct influence on the climate. In addition, radiative fluxes combined with other cloud properties and surface temperature, can be used in a variety of other operational products. Several examples of these include, the NOAA Coral Reef Watch (CRW) program, which combines photosynthetically active radiation (PAR) with operational thermal stress products to help determine coral bleaching. The Woods Hole Oceanographic Institute (WHOI), which uses radiation data in estimating heat flux components over the coastal ocean to drive ocean circulation models and the PAR data to drive coupled ocean biophysical models. Finally, radiative fluxes, land surface temperature as well as cloud properties are used to validate and as model initializations for numerical weather prediction (NWP) models.. The second version of the GOES Surface & Insolation Products (GSIP) processing system is a near real-time operational system for generating several different radiative properties from the shortwave, longwave, and visible portions of the electromagnetic spectrum, as well as cloud properties and surface temperature, using data from the GOES satellite system. This study will discuss the products as well as the usage of of the products in an operational capacity.

12. Hazards *Corey G. Calvert*

An Object-Based Nighttime Fog/Low Cloud Detection Algorithm

Authors: Corey G. Calvert and Michael J. Pavolonis

The current GOES operational nighttime fog detection algorithm relies on the pixel brightness temperature difference (BTD) between the 3.9 and 11 micron channels. While large areas of distinct fog and low cloud are usually detected using this method, local fog events (e.g., valley fog) are harder to discern without dramatically raising the false alarm rate. Here we introduce an object-based fog/low cloud detection algorithm that uses the 3.9-11 micron BTD as well as a 3.9 micron pseudo emissivity to categorize connecting pixels with similar radiometric properties into objects. Once the objects are formed, the probability that the object is fog or low cloud can be assigned through predetermined look-up tables established using surface observations.

13. Hazards *Wayne Feltz*

GOES Convective and Turbulence Aviation Applications

Authors: Wayne Feltz, Kristopher Bedka, Justin Seiglaff, Lee Cronce, and Jordan Gerth

As satellite infrared imager/sounder sensor spectral, spatial, and temporal resolutions become higher, satellite data will be a primary driver for aviation decision support, especially for over-ocean route turbulence, atmospheric stability, convective initiation, and volcanic ash decision support. A decade ago the perspective of using satellite infrared and microwave data to help the aviation community was primarily dismissed due to lack of instrument temporal and spatial resolution on the 0-6 hour nowcasting time frame. This has changed dramatically, and with the United States government agencies behind the Joint Program Development Office NextGen endeavor (http://www.jpdo.gov/nextgen.asp), satellite data will be used extensively to drive air traffic control routes, general flight planning, and weather hazard avoidance. New imager and sounder technology planned for the next ten years will be a fruitful area of research and has direct cost-benefit metrics. Current and Future GOES convective and turbulence decision support applications will be presented.

14. Hazards *Jay P. Hoffman*

Recent Wild Fire Automated Biomass Burning Algorithm activities at CIMSS

Authors: Jay P. Hoffman, Christopher C. Schmidt, Elaine M. Prins, Jason C. Brunner, Joleen M. Feltz, Scott S. Lindstrom

Efforts are underway at the Cooperative Institute for Meteorological Satellite Studies (CIMSS) to enhance the Wild

Fire Automated Biomass Burning Algorithm (WF_ABBA) and expand its coverage to the entire globe. Active fire detection and characterization from geostationary satellites provides the hazard mapping user community, emissions and air quality modeling and applications, and land use / land change applications with hotspot detection and characterization in near real-time, as well as over a decade of archival fire detections. With a legacy dating back to the GOES VAS instrument, continuous development has led to the current operational version of the WF_ABBA that processes data from all GOES from GOES-8 through GOES-14, with plans to continue support for future GOES. The WF_ABBA has been adapted to the Met-8/-9 SEVIRI and MTSAT JAMI instruments, allowing for near-global fire product coverage from a suite of geostationary platforms. Development work for GOES-R ABI has also been underway. Fire product development at CIMSS focuses on active fire detection and sub pixel characterization, including analysis of fire radiative power (FRP) and the calculation of instantaneous fire size and temperature. Product improvement efforts involve inter-comparison of the WF_ABBA fire product with other satellite fire products such as MODIS, case study analysis of fire detection and characterization from scenes of MODIS data projected to ABI resolution, and collaboration with CIRA (Cooperative Institute for Research in the Atmosphere) on the development and application of modeled ABI proxy data containing fires. Additional research efforts have focused on understanding the impact of the satellite navigation variations, surface emissivity determination, atmospheric attenuation correction, diffraction considerations, and correction for solar radiance contamination in the 4 micron band.

15. Hazards *Justin Sieglaff and Lee Cronce*

Introducing a GOES Convective Initiation Nowcasting Decision Support Tool

Authors: Justin Sieglaff, Lee Cronce, Wayne Feltz, Kristospher Bedka

A newly developed satellite-based convective initiation nowcasting decision support tool has been developed at the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin. The decision support tool known as UWCI (University of Wisconsin Convective Initiation) uses GOES infrared window cloud-top cooling rate combined with the GOES-R ABI/GOES cloud mask/type algorithms to make convective initiation nowcasts. The UWCI algorithm has shown lead-times ahead of radar-based convective initiation (35dBZ echo or greater) by as much as 45 minutes.

As part of the GOES-R Proving Ground, the UWCI algorithms are being provided to NOAA operational centers for evaluation and feedback. The Storm Prediction Center (SPC) began receiving and evaluating the products for the Spring 2009 Hazardous Weather Testbed Experiment. In addition to the SPC, NOAA's Satellite Analysis Branch (SAB) and the National Weather Service Milwaukee/Sullivan Forecast Office have been evaluating the product since Spring 2009. The feedback from operations is crucial to making UWCI algorithm product improvements.

Ongoing work includes algorithm improvement based upon operational feedback. In addition algorithm validation work is underway to determine the UWCI probability of detection (POD) of convective initiation and probability of false alarm (POF).

The poster presentation will provide a high-level algorithm description and examples of the UWCI algorithm over the Central Plains from the Spring/Summer 2009.

16. Hazards *Yinghui Liu*

Sea and Lake Ice Concentration, Extent, and Motion with GOES-R ABI

Authors: Yinghui Liu, Jeffrey R. Key, and Xuanji Wang

The cryosphere exists at all latitudes and in about one hundred countries. It has profound socio-economic value due to its role in water resources and its impact on transportation, fisheries, hunting, herding, and agriculture. Not only does the cryosphere play a significant role in climate, but also its characterization and distribution are critical for accurate weather forecasts. A number of ice characterization algorithms have been improved and/or developed for the next generation Geostationary Operational Environmental Satellite (GOES-R) Advanced Baseline Imager (ABI), including ice identification and concentration, ice extent, ice thickness and age, and ice motion. An overview of the ice concentration, extent, and motion algorithms will be provided and their preliminary results will be shown here with applications to SEVIRI, and MODIS data.

Mature algorithms exist for ice identification and ice surface temperature, but others such as ice concentration, ice thickness and age, and ice motion are experimental or under development. Errors in existing algorithms must be determined by inter-comparing products from other sensors and comparing those products to numerical model simulation, submarine sonar measurements, and surface-based observations. Potential solutions to problems have been sought and new algorithms for estimating ice concentration, ice thickness/age, and ice motion have been developed and validated against a variety of realistic data sources. This work will serve as a testbed of the current and developing algorithms for sea and lake ice products.

17. Hazards *Michael Pavolonis*

Quantitative Volcanic Ash Monitoring from GOES and GOES-R

Authors: Michael Pavolonis, Justin Sieglaff, and Andrew Parker

Suspended volcanic ash poses significant threats to the aviation community. These threats include loss of life and severe damage to aircraft. Current operational volcanic ash detection techniques used at the various Volcanic Ash Advisory Centers (VAACs) are generally qualitative and require manual analysis. Reliable satellite-based automated ash detection techniques are few and far between due to the

difficult nature of separating volcanic clouds from meteorological clouds and other non-volcanic features using reflectance or brightness temperature measurements alone. In addition, to forecast the dispersion of volcanic ash clouds, an estimate of the cloud height, effective particle size, and mass loading is needed. We will present results from automated algorithms designed to reliably detect volcanic ash clouds and retrieve their macro and micro-physical properties using the current GOES Imagers and the future GOES Imager (GOES-R).

18. Hazards *Ralph Petersen and Robert Aune*

Optimizing the Impact of Geostationary Satellite Products in very-short-range forecasts – Recent Results and Future Plans

Authors: Ralph Petersen and Robert Aune

Instruments aboard the future GOES-R satellite series will resolve atmospheric features at extremely high resolution both in time and space. Although one measure of the utility of these data will be their impact on NWP guidance at 12 hours and beyond, a greater benefit from these detailed and frequently refreshed data may come through objective tools that assist forecasters in identifying rapidly developing, extreme weather events 1-6 hours into the future. These "NearCasting" systems must be able to detect and retain extreme variations in the atmosphere, incorporate large volumes of high-resolution asynoptic data, and provide guidance products within minutes of when updated satellite observations become available. Because of the detail and perishable nature of these very-short-range forecast products, numerical approaches are needed that are notably different from those used in numerical weather prediction, where the forecast objectives cover longer time periods and take substantially longer to run using many more computer resources.

At previous meetings, a new Lagrangian approach was introduced that optimizes the impact and retention of information provided by satellites, specifically detecting and preserving intense vertical and horizontal variations observed in the various data fields observed over time. To test the system, full resolution (10 km) moisture products from current GOES sounders have been used to update and enhance longer-range guidance from very-short-range NWP forecasts. Results show that the Lagrangian system captures and retains details (maxima, minima and extreme gradients) important to the development of vertical moisture structures critical to the development of convection 3-6 hours in advance, even after IR observations are no longer available due to obscuration by the developing convection itself. Early results also point to the need to control the growth of convergence in the show-range wind forecasts. To accomplish this, both components of the deformation as well as the convergence itself must be minimized in the initial wind fields.

Although previous tests provided prototype examples of NearCast products that can be available at higher resolution using existing GOES or SEVIRI data, additional experiments have been conducted to further expand the utility of both existing and future Geostationary observations. Key to these NearCasting experiments is choosing parameters whose forecasts are both 1) critical in identify the pre-convective environment and 2) observed well by GOES. To accomplish this, 2 or 3 layers of moisture data and 6 to 8 layers of temperature data can be projected forward in time and then combined to determine areas where a variety of stability indices are undergoing substantial changes. Candidate indices include the Lifted Index, Totals Index, CAPE, CIN, and Convective Instability, as well as scaled ensembles of these individual indicators. Because of the desire to reduce false alarms and increase probability of detection, both destabilization and stabilization must be studied.

Details of recent NearCasting enhancement results, as well as assessments the products within NWS WFOs and NCEP Service Centers, will be presented. Examples will include cases of severe convection over the US using sounder products from the current GOES satellites and over Europe using SEVIRI temperature and moisture data as a surrogate for future GOES-R ABI data. Efforts to limit the growth of convergence and deformation within the NearCasting model will also be discussed.

19. Hazards *Jason Brunner*

Objective Day/Night Overshooting Top and Enhanced-V Detections Using MODIS, AVHRR, and MSG SEVIRI Imagery in Preparation for GOES-R ABI

Authors: Kristopher Bedka, Jason Brunner, Wayne Feltz, Rich Dworak, and Lee Cronce

An overshooting convective cloud top is defined by the American Meteorological Society as "a domelike protrusion above a cumulonimbus anvil, representing the intrusion of an updraft through its equilibrium level". A single overshooting top (OT) exists for less than 30 mins and has a maximum diameter of ~15 km. Despite their relatively small size and short duration, storms with OTs often produce hazardous weather conditions such as aviation turbulence, frequent lightning, heavy rainfall, large hail, damaging wind, and tornadoes. Though it is commonly understood that a small cluster of very cold IRW brightness temperatures from satellite data relates well with the presence of an OT, this characteristic has yet to be exploited in any operational objective OT detection technique. Spatial IRW BT gradients (IRW-texture technique) can be combined with NWP-based tropopause temperature information and knowledge of the characteristic size of an OT to objectively identify them at their proper scale. OTs found in combination with a U or V shaped region of cold infrared window brightness temperatures (BTs) are often indicative of an especially severe thunderstorm. Once OTs have been identified by the IRW-texture technique, the focus can be directed toward the objective detection of the enhanced-V signature. While the enhanced-V is often highly variable in infrared imagery, one aspect of the enhanced-V remains fairly constant in that the "arms" of the V signature enclose a warm region downwind of the overshooting top to form an "anvil thermal couplet". UW-CIMSS and Kristopher Bedka (SSAI/NASA LaRC) have developed a pattern recognition technique with IRW imagery

to objectively detect anvil thermal couplets associated with the enhanced-V signature.

These IRW-texture OT and enhanced-V/anvil thermal couplet detection algorithms are currently being developed for future operations with the Geostationary Operational Environmental Satellite Advanced Baseline Imager (GOES-R ABI) within the GOES-R Aviation Algorithm Working Group. As GOES-R ABI will offer 2 km spatial resolution in the infrared channels, we can use current satellite instruments to emulate the imagery that will be available in the future with GOES-R ABI. This work provides some examples of algorithm output and validation using MODIS, AVHRR, MSG SEVIRI, CloudSat, and CALIPSO data.

20. Hazards *Jason Brunner*

An overview of the improvements with the version 6.5 WF_ABBA and trend analyses of fires from 1995 to present over the

Authors: Jason C. Brunner, Christopher C. Schmidt, Elaine M. Prins, Joleen M. Feltz, Jay P. Hoffman, and Scott S. Lindstrom

The UW-Madison Cooperative Institute for Meteorological Satellite Studies (CIMSS) is reprocessing the GOES-East archive with an updated version 6.5 of the WildFire Automated Biomass Burning Algorithm (WF_ABBA) to generate fire summary statistics and locations of fires throughout the western Hemisphere from 1995 to present. Trend analyses of fires have been generated for this time period. The 14-year diurnal fire climatology will have applications in emissions and air quality modeling, climate change studies, land-use/land-cover change, fire dynamics modeling, fire weather analyses, and socio-economic studies. The WF_ABBA is a dynamic, multispectral, thresholding, contextual algorithm that uses the visible (when available), 3.9 μm, and 10.7 μm infrared bands to locate and characterize hot spot pixels. The algorithm is based on the sensitivity of the 3.9 μm band to high temperature subpixel anomalies and is derived from a technique originally developed by Matson and Dozier (1981). It incorporates statistical techniques to automatically identify hot spot pixels in the GOES imagery. Once the WF_ABBA locates a hot spot pixel, it incorporates ancillary data in the process of screening for false alarms and correcting for water vapor attenuation, surface emissivity, solar reflectivity, and semi-transparent clouds. Version 6.5 of the WF_ABBA provides additional parameters and metadata as requested by the international user community. Improvements include an opaque cloud product to indicate regions where fire detection is not possible; a fire radiative power (FRP) product in addition to Dozier output of instantaneous estimates of fire size and temperature; metadata on processing region and block-out zones due to solar reflectance, clouds, extreme view angles, saturation, and biome type; and fire metadata mask imagery.

21. Hazards *Jamie Kibler*

Operational Hazard Detection and Monitoring in the Satellite Analysis Branch

Authors: Jamie Kibler and Brian Hughes

The National Environmental Satellite Data and Information Service (NESDIS) is a line office within the National Oceanic and Atmospheric Administration (NOAA) charged with the development and operation of the Nations' environmental satellites and the creation of associated data and products. These satellite derived products support all of NOAA's core missions, including ensuring safe and efficient commerce and transportation, monitoring of weather and water, ecosystem management, and climate services. As such, NOAA's satellites enjoy a unique perspective of the Earth to allow scientists to detect and monitor significant environmental and man made hazards that pose a threat to life and property.

This presentation will focus on the hazard and disaster detection, product generation and product distribution of the Satellite Analysis Branch (SAB) of NESDIS. The SAB is staffed 24x7 to monitor and distribute products related to volcanic eruptions, ash extent and movement, global tropical cyclone analysis, wildfire detection and smoke emissions monitoring, and heavy precipitation nowcasting and analysis. SAB also participates as an operation test-bed for new satellite product algorithms, before products are placed into routine operations. An overview of SAB operations, satellite data used, how these data and derived products are used in operations, and linkage to users will be presented.

22. Hazards *Jamie Kibler*

The Satellite Analysis Branch Hazard Mitigation Programs

Author: Jamie Kibler

The Satellite Analysis Branch (SAB) provides and distributes a wide variety of operational hazard mitigation products to the user community for use in operations, research, validation and verification. The programs associated with these products are many; including a precipitation analysis and estimation, tropical position and intensity classification, volcanic ash tracking and a smoke and fire detection.

This presentation will focus on hazard and disaster detection and product generation. Hazard mitigation analysts of SAB have an expertise in satellite meteorology. They use a variety of satellite data including NOAA's Geostationary Operational Environmental Satellites (GOES), Polar Orbiting Environmental Satellites (POES), also, NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) and other satellite constellations to provide hazard mitigation products on a 24/7 daily basis. These products are time sensitive and our users depend on the information provided to be of highest quality. SAB continues to improve each program and associated product with the help of user input and new satellite technology.

23. Imagery *Hyre Bysal*

GOES Stray Light Intrusion and Remedies

Author: Hyre Bysal

There is no longer a health and safety risk of imaging close to sun with the improvements incorporated into GOES N-P imagers and sounders. However, NOAA has discovered significant product degradation due to sun intrusion when scanning within 10 degrees of the sun. The sun intrusion is more detectable on lower wavelength IR channels (especially Channel 2) of the imager with the effect increasing as the scan angle gets closer to the sun. NOAA and ITT are still characterizing the effect of the sun intrusion and working on two potential remedies to maximize scanning around satellite midnight during the eclipse season. The easier and more immediate one of these remedies is the replacement of regular frames with same size frames shifted away from the sun when sun is near the edge of the frame. The longer-term remedy is to remove the stray light effect from the effected areas of the image through an algorithm in the Sensor Processing System (SPS) and send the corrected image through GVAR.

24. Imagery *Xin Jin*

The legacy products from GOES-R atmospheric sounding

Authors: Xin Jin, Jun Li, Timothy J. Schmit, Graeme Martin, Jinlong Li, and Mitchell D. Goldberg

The legacy products from GOES-R atmospheric profile sounding are compared with the ECMWF forecast and reanalysis products using the SEVIRI onboard the Meteosat Second Generation (MSG) as proxy. It is found that the quality of these legacy products is solidly improved over cold area and in warm area, the improvement is less significant.

25. Imagery *Eileen Maturi*

NOAA'S Geostationary Operational Sea Surface Temperature Product suite

Authors: Eileen Maturi, John Sapper, Andy Harris, Jon Mittaz, Wen Meng, Robert Potash, Meizhu Fan

NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) have generated Sea Surface Temperature (SST) products from Geostationary (GOES) East (E) and West (W) satellites on an operational basis since December of 2000. Since that time, a process of continual development has produced steady improvements in product accuracy. Recent improvements extended the capability to permit generation of operational SST retrievals from the Japanese Multi-function Transport Satellite (MTSAT-1R) and the European Meteosat Second Generation (MSG-2) satellite, thereby extending spatial coverage. The four geostationary satellites (longitudes 75ºW, 135ºW, 140ºE, and 0º, respectively) provide high temporal SST retrievals for most of the tropics and mid-latitudes, with the exception of a region between ~60ºE and ~80ºE. Due to ongoing development, the quality of these retrievals now approaches that of SST products from the polar orbiting Advanced Very High Resolution Radiometer (AVHRR). The suite of products consists of gridded, NetCDF imagery and HDF blended SST analysis. Gridded products generated from the four geostationary satellites provide hourly regional imagery, 3-hourly hemispheric imagery, 24 hour merged composites, along with a buoy matchup data set. NetCDF Level 2 preprocessed products are generated for every satellite image. This consists of a pixel level SST and additional parameters which are generated for GOES-E/W every 30 minutes for each N and S hemispheric sectors; MTSAT-1R every 60 minutes for each full disk sector; and MSG-2 every 15 minutes for each full disk sector. The blended SST is daily 11KM analysis generated from blending geostationary and polar-orbiting satellite SST retrievals. These products provide to the user community a reliable source of SST observations, with improved accuracy and increased coverage in important oceanographic, meteorological, and climatic regions.

26. Imagery *Tim Olander*

Status of the Advanced Dvorak Technique (ADT)

Authors: Tim Olander and Chris Velden

The Advanced Dvorak Technique, an objective algorithm developed at UW-CIMSS designed to estimate tropical cyclone intensity from geostationary IR imagery, has undergone several important recent upgrades and modifications. These upgrades range from functionality changes to accommodate operational ADT user requirements, to coding modifications to adapt and adhere the algorithm to GOES-R guidelines and objectives. In addition, new innovations continue to improve the performance and accuracy of the ADT in estimating tropical cyclone intensity. These modifications and upgrades will be summarized in the poster to brief current and future ADT users on the algorithm's status.

27. Imagery *Anthony J. Schreiner*

Diurnal Frequencies of the GOES Derived Cloud Product

Authors: Anthony J. Schreiner and James P. Nelson III

One of the primary strengths for the Geostationary Operational Environmental Satellite (GOES) series of Imager- and Sounder-derived products is the opportunity to examine and compare the diurnal cycle for specific atmospheric components (e.g. frequency of cloudiness) for varying time lengths. Comparisons of this type may show changes in seasonal trends with respect to the diurnal cycle within a given year, or comparisons from year to year. In addition to examining diurnal characteristics at a particular location, one can also investigate diurnal differences due to land/sea conditions or orographic differences, for example.
Routine processing of the GOES Sounder and Imager Cloud Product at the University of Wisconsin–Madison Cooperative Institute for Meteorological Satellite Studies (UW-CIMSS) has been ongoing for the past fourteen and eight years, respectively. These data are available in near-real time on the CIMSS Real-time web page

(http://cimss.ssec.wisc.edu/goes/rt/). A technique for generating monthly frequencies of all-cloud, high-level, mid-level, and low-level cloud at hourly intervals has been developed using the GOES Sounder Cloud Product. To date this technique has only been applied for the months July through September 2009 and is limited to the CONtinental United States (CONUS) plus the immediate surrounding waters of the Atlantic and Pacific Oceans and the Gulf of Mexico.
A demonstration of this product will be presented. Future plans include the reprocessing of historical Sounder derived Cloud Product data and expanding this technique to include the derived Cloud Product from the GOES-12 Imager.

28. Readiness / Training *Thomas Achtor*

McIDAS-V Support for the GOES-R Program

Authors: Thomas Achtor, Thomas Rink, Thomas Whittaker

The fifth generation of the Man computer Interactive Data Access System (McIDAS-V) is a java-based, open-source, freely available software package. It provides powerful new capabilities to analyze and visualize data from the next generation of remote sensing instruments under development for the GOES-R and NPOESS programs. Working through the GOES-R AWG Imagery team, McIDAS-V will provide visualization and analysis capabilities for the GOES-R algorithm development teams. We are developing data analysis and visualization tools for ABI simulated imagery and AWG development products. SEVIRI data can also be displayed and manipulated. We will provide an intuitive user interface to the GOES-R routine processing framework to bring AWG products into the McIDAS-V data model. This will allow GOES-R scientists and algorithm developers to analyze and visualize their products, enable algorithm evaluation, monitoring and support iterative development.

29. Readiness / Training *Kaba Bah*

Operational Uses of Bands on the GOES-R Advanced Baseline Imager (ABI)

Authors: Kaba Bah, T. J. Schmit, T. Achtor, T. Rink, W. Wolf, J. Otkin, J. Sieglaff, and J. Feltz

The capabilities of the Advanced Baseline Imager (ABI) that will be on board the GOES-R satellite are being demonstrated by using McIDAS-V as a tool to visualize and analyze simulated GOES-R ABI data. These simulated images were created by the GOES-R Algorithm Working Group (AWG) who used super computers to run high resolution numerical models, which were then input into the Cooperative Institute for Meteorological Satellite Studies(CIMSS) advance radiative transfer models. The simulated datasets include 2km sampling full disk images showing GOES-R ABI in the "west" projection, 2km resolution Continental United States(CONUS) images, and higher resolution meso-scale images for the convective outbreak on June 4-5 2005 at 1-minute time intervals. McIDAS-V is a free java based open source software package designed for easy visualization and analysis of different satellite datasets. By ingesting these simulated ABI datasets into McIDAS-V for visualization, we were also able to analyze multiple bands in many different ways, which includes Normalized Difference Vegetation Index (NDVI), simple band differences, scatter analysis and data transacts.

30. Readiness / Training *Eric C. Bruning*

Interpretation of total lightning density patterns in the GOES-R Proving Ground

Author: Eric C. Bruning

Described is a framework for explaining total lightning density patterns using charge conservation and simple electrostatic criteria for lightning initiation and propagation. It is proposed that cellular maxima in lightning density maps are tied to frequent, local flash initiation driven by local updraft conditions supportive of non-inductive charging, while extensive regions of lower-density activity are tied to lower-frequency propagation of lightning channels through regions of charge carried to those regions by advection. Lightning imagery possibilities from the GOES-R Geostationary Lightning Mapper will be shown, focusing on different combinations of event, group, and flash centroids, extents, and radiances, and the different physical processes implied by each.

31. Readiness / Training *Patrick Dills*

Education Resources: GOES Satellite-related Web Modules and the Environmental Satellite Resource Center (ESRC)

Authors: Patrick Dills and Wendy Schreiber-Abshire

The COMET® Program (www.comet.ucar.edu) receives funding from NESDIS and the NPOESS Integrated Program Office (IPO), with additional contributions from the GOES-R Program Office and EUMETSAT, to directly support education and training efforts in the area of satellite meteorology. This partnership enables COMET to create educational materials of global interest on the products and operational applications from geostationary and polar-orbiting remote sensing platforms.

Since the mid 1990s, COMET's satellite education programs have focused on the capabilities and applications of operational GOES and POES systems and their relevance to operational forecasters and other user communities. Several years ago, COMET introduced educational materials on the upcoming NPP/NPOESS system, and then in 2008 expanded its activities to include training on the future GOES-R satellites. By partnering with experts from various scientific and user communities, and applying cutting edge Web-based learning and teaching technologies, COMET is able to stimulate greater utilization of both current and future satellite data observations and products. COMET has also recently broadened the scope of its online training to include materials on the EUMETSAT Polar-orbiting System (EPS) and Meteosat geostationary satellites. EPS represents an important contribution to the Initial Joint Polar System (IJPS) between NOAA and EUMETSAT, while Meteosat imaging capabilities provide an important proving ground for the next generation GOES-R imager.

This presentation provides an overview of COMET's recent satellite education efforts and publications, highlighting new materials relevant to the GOES satellite series. In addition to being available via the MetEd Web site (www.meted.ucar.edu/topics_satellite.php), COMET's satellite modules can also be found amongst a growing body of satellite information and training resources within the Environmental Satellite Resource Center (ESRC) Web site (www.meted.ucar.edu/esrc). The ESRC, developed and supported by COMET, provides search capabilities and free access to both geostationary and low Earth orbiting satellite information and education from multiple trusted sources. The ESRC site is a community-driven resource and is sponsored by the NPOESS IPO, NOAA, and NESDIS.

32. Readiness / Training *B. Connell*

New Course: Satellite Hydrology and Meteorology for Forecasters

Authors: B. Connell, J. Braun, D. Bikos, R. Van Til, S. Lindstrom, S. Bachmeier, T. Mostek, and M. DeMaria

The Forecaster track of the Satellite Hydrology and Meteorology (SHyMet) Course will cover satellite imagery interpretation, including feature identification, water vapor channels and what to expect on GOES-R. There is a session on remote sensing applications for hydrometeorology that includes uses of remote sensing data for operational hydrology and there is also a session on aviation hazards. Other topics include an understanding of the Dvorak method in tropical cyclone analysis and the utility of cloud composites in forecasting. This course will be administered through web-based instruction and will be the equivalent of 16 hours of training. The course will be available this Fall 2009.

33. Readiness / Training *B. Connell*

New Training: GOES-R 101

Authors: B. Connell, T. Schmit, J. Gurka, S. Goodman, D. Hillger, and S. Hill

What information would you select to present to forecasters to introduce them to GOES-R – and do it in under 2 hours? We address 3 W's: Why, when, and what sensors and provide examples and information links. Come find out what is in the module.

34. GOES-R/S trans *S. Bedka*

Validation of nighttime cloud optical and microphysical properties for GOES-R

Authors: S. Bedka, P. Minnis, P. W. Heck, Y. Yi, M. M. Khaiyer, D. A. Spngenberg, and S. J. Abel

The determination of nighttime cloud microphysical properties from satellite-based radiometers remains a relatively unexplored area, particularly in comparison to daytime methods. While nighttime multi-spectral algorithms are routinely used for cloud masking, cloud typing and determining cloud height, techniques for deriving optical properties and microphysics are less prevalent due to the lack of shortwave information from which scattering and absorption properties of hydrometeors can be inferred. The GOES-R Cloud Algorithm Working Group (AWG) is employing a modified version of NASA Langley's Solar infrared-Infrared-Split window Technique (SIST) to retrieve cloud optical depth, particle size and liquid/ice water path. This modified technique, the Nighttime Optical and Microphysical Properties (NCOMP) algorithm, currently utilizes 3.9, 10.8 and 12 -μm channels and has been applied to Advanced Baseline Imager (ABI) proxy datasets, Spinning Enhanced Visible InfraRed Imager (SEVIRI) imagery. NCOMP is a streamlined version of SIST in that it uses both cloud phase and cloud temperature that are pre-determined by upstream GOES-R algorithms rather than deriving those quantities as part of its retrieval technique. This paper will present validation and comparisons of NCOMP results from a 10-week period during which other Cloud AWG products are also being validated. Performance and accuracy will be assessed with respect to the GOES-R Function and Performance Specifications (F&PS). Particular emphasis will be placed on Cloud Liquid Water Path (LWP) and Ice Water Path (IWP) comparisons as these quantities are readily available from Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO), Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) and surface-based retrievals. Consistencies between SIST and NCOMP results will also be shown in order to expand validation opportunities given the relative lack of well-tested nighttime optical and microphysical property retrievals from other instruments. SIST is used in near-real time over a variety of domains using imagery from additional geostationary and polar-orbiting orbiting satellites, so validation results from non-SEVIRI field programs such as the Tropical Composition, Cloud and Climate Coupling (TC4) mission will be shown.

35. GOES-R/S trans *Francis G. Eparvier*

GOES-R EXIS: Providing Solar EUV and X-Ray Irradiances for Space Weather

Author: Francis G. Eparvier

The variable solar EUV and soft X-ray radiation is a primary energy source for the upper atmosphere, heating the thermosphere, creating the ionosphere, changing the evironment in which low earth orbit satellites fly, and affecting telecommunications and navigation systems. Part of the GOES-R solar instrumentation will be the EUV and X-Ray Irradiance Sensors (EXIS). The EXIS consists of two instruments, the EUV Sensor (EUVS) and the X-Ray Sensor (XRS), both designed to measure the solar spectral irradiance in different geo-effective wavelength ranges. An XRS has been included in the GOES manifest since the beginning of the program and has become the standard, real-time monitor of solar flares. The new XRS design will continue that long history, measuring the solar irradiance in the 0.05-0.4 nm and 0.1-0.8 nm bands, but will have a larger dynamic range, capturing both the lowest solar minimum and brightest flaring irradiances. An EUVS was first added to the program with the launch of GOES-13 in 2006. Completely redesigned for GOES-R, the new EUVS will use a combination of measurements of specific solar emissions and empirical modeling to produce a realtime solar irradiance product

spanning the entire 5-127 nm wavelength range. This paper will introduce the concept designs for the GOES-R EXIS and the utility of the EXIS data products for space weather monitoring and modeling.

36. GOES-R/S trans *M. Green*

An Air Quality Proving Ground (AQPG) for GOES-R

Authors: M. Green, R. Hoff, S. Christopher, F. Moshary, S. Kondragunta, R. Pierce

A consortium of Universities have been awarded an Air Quality Proving Ground for the GOES-R ABI instrument. Led by UMBC and University of Alabama Huntsville, the Proving Ground will provide the first steps to building a user community who will be prepared to use the ABI data in near-real time for air quality forecasting and analysis needs. Based on the currently successful, IDEA product, the AQPG will evolve a product delivery system so that regional air quality forecasters have access to measurements from GOES-R, from ground based sites, and from models to better predict particulate air quality in the US. The Year 1 activities of the Proving Ground will be to gather user driven ("pull") guidance on the understanding of the ABI product and how it would be used in such a forecast system. To that end, an AQPG User Group will be formed that will advise the project in the future. Evolving from the current Three-Dimensional Air Quality System User Group and adding members from the NWS Forecast Guidance User community, these advisers will assess ABI proxy data which has been and will be processed in the future. Using known data sets from existing satellite, ground based remote sensing, ground based air quality and models, at least ten case studies will be created which exercise the ABI algorithm and allow the User Group to comment on how those data would be used in their forecast tasks.

37. GOES-R/S trans *Wayne M. MacKenzie*

Convective Initiation Algorithm for GOES-R

Authors: Wayne M. MacKenzie, John R. Walker, John R. Mecikalski

This algorithm, first developed for the current GOES satellite series (Mecikalski and Bedka 2006), is being evolved to take advantage of the improvements in spectral, spatial and temporal resolution. A recent study by Mecikalski et al. (2009) and Siewert et al. (2009) outlines the uses of additional spectral bands on convective initiation events using Meteosat Second Generation (MSG). Since MSG contains similar spectral bands as GOES-R will contain, these results are applies to the GOES-R Convective initiation (CI) algorithm. The results from that study have been used tested in a framework to include within the (CI) algorithm.

The components of the algorithm include an object tracking component, and spectral channel tests to determine a high probability for which cloud objects will CI. The validation has been performed on the algorithm itself (independent of an objective tracking system), and current work includes object-tracking validation. This will allow for an analysis of which components contribute to the algorithm error.

38. GOES-R/S trans *R. Bradley Pierce*

Development of a visibility retrieval for the GOES-R Advance Baseline Imager

Authors: R. Bradley Pierce and Allen Lenzen

This poster presents a comparison between GOES-R Advanced Baseline Imager (ABI) visibility retrievals, under development within the GOES-R Aviation Algorithm Working Group, with model based estimates from the NCEP North American Model (NAM) and observations Automated Surface Observing Systems (ASOS) visibility reports for the period from May-July, 2008. Visibility is proportional to extinction-1 which is a measure of attenuation of the light passing through the atmosphere due to the scattering and absorption by aerosol particles. The integrated extinction coefficient over a vertical column is called aerosol optical depth (AOD). Conversion from AOD and Low Cloud/Fog optical depth (COT) to extinction requires knowledge of the depth of the aerosol/cloud layer, which is assumed to be determined by the depth of the planetary boundary layer (PBL) in the ABI visibility algorithm. The ABI visibility retrieval combines ABI clear sky Aerosol Optical Depth (AOD) retrievals (using MODIS L1 radiances as ABI proxy data) with ABI Cloud Optical Depth (COT) retrievals (using GOES-12 L1 radiances as ABI Proxy data) and meteorological analyses from the NCEP Global Forecasting System (GFS). Assessment of visibility product measurement accuracy is presented. The results of this feasibility study show systematic biases in classification for Low and Moderate visibility that point to the need to perform seasonal and/or regionally dependent bias corrections to meet ABI design specifications.

39. GOES-R/S trans *Timothy J. Schmit*

The History and Evolution of the ABI (Advanced Baseline Imager) on the GOES-R series

Author: Timothy J. Schmit

The evolution of the next generation GOES-R Advanced Baseline Imager (ABI) will be covered. As with any instrument, the ABI leverages heritage instruments and the input from many. The ABI began as a proposed eight-channel imager, all with fairly wide instrument spectral responses. Over time, eight more bands were added to better meet the stated requirements. In general, the bands were made more narrow spectrally. The next generation geostationary satellite series will offer a continuation of current products and services and enable improved and new capabilities. The ABI on the GOES-R series has been designed to meet user requirements covering a wide range of phenomena. This includes applications related to weather, oceans, climate, and the environment. The ABI will improve upon the current GOES Imager with more spectral bands, faster imaging, higher spatial resolution, improved navigation and registration, and more accurate calibration. The ABI expands from five spectral bands on the current GOES imagers to a total of 16 spectral bands in the visible, near-infrared and infrared spectral regions. The ABI will also offer an increase of the coverage rate leading to full disk scans at least every 15

minutes. ABI spatial resolution at the satellite sub-point will be 2 km for the infrared bands and 0.5 km for the 0.64 um visible band.

40. GOES-R/S trans *Christopher Siewert*

The GOES-R Proving Ground at NOAA's Storm Prediction Center and Hazardous Weather Testbed

Authors: Christopher Siewert, Eric Bruning, Russell Schneider, Steve Goodman, Jim Gurka, Robert Rabin

The GOES-R Proving Ground's activities at NOAA's Hazardous Weather Testbed (HWT) in the Storm Prediction Center (SPC) in Norman, OK provide a unique opportunity to interact with and study new products available on the next generation GOES-R satellite in an operational framework. The overall goal of the proving ground is to provide forecasters with the knowledge and experience needed to effectively use the products in day to day operations once they become available. This past year, the GOES-R Proving Ground's Spring Experiment at the SPC this goal was met through constant interaction with the products in real-time forecasting situations by both forecasters and product developers. Constructive feedback given by forecasters during the Spring Experiment and throughout the year is provided to product developers in order to facilitate required improvements to the products.

GOES-R proxy products focusing on detecting and forecasting convection, lightning and severe weather were studied this year in a broad range of forecasting strategies, from short term convective outlooks to real-time nowcasting exercises. The products available currently at the SPC include a 15-minute cloud-top cooling and 0-1 hour convective nowcast product from the University of Wisconsin – Cooperative Institute for Meteorological Satellite Studies (UW-CIMSS), a 10-km total lightning GLM proxy from NASA's Short-term Prediction Research Transition (SPoRT) and the National Severe Storms Laboratory (NSSL), and a 0-1 hour severe hail probability forecast from the Cooperative Institute for Research in the Atmosphere (CIRA).

The presentation will focus on the GOES-R Proving Ground's activities at the SPC, preliminary findings from this past year's experiment, product improvements and case examples, forecaster interactions, and goals for the GOES-R Proving Ground's activities in years to come including additional experiment activities throughout the year.

41. GOES-R/S trans *Xuanji Wang*

Sea and Lake Ice Thickness and Age for Use with GOES-R ABI

Authors: Xuanji Wang, Jeffrey R. Key, Yinghui Liu

Sea and lake ice concentration and thickness affect the exchange of heat, energy, mass, and momentum between the atmosphere and the underlying water body. Ice and snow, commonly called the cryosphere, exist at all latitudes and in about one hundred countries. Not only does the cryosphere and its characterization and distribution play a significant role in weather forecast and climate, it also has profound socio-economic value due to its role in water resources and its impact on transportation, hazards, recreation, fisheries, hunting, herding, and agriculture. Current remote sensing techniques provide an unprecedented opportunity to estimate and monitor the cryosphere routinely with relatively high spatial and temporal resolutions. In this study, a thermodynamic model, called One-dimensional Thermodynamic Ice Model (OTIM), is developed and introduced here to estimate sea and lake ice thickness and age with optical (visible, near-infrared, and infrared) satellite data for the next generation Geostationary Operational Environmental Satellite (GOES-R) Advanced Baseline Imager (ABI).

The comparison in ice thickness between the OTIM retrievals and submarine upward-looking sonar measurements during the 1999 Scientific Ice Expedition (SCICEX) shows that the OTIM is capable of retrieving ice thickness up to 3 meters. The mean absolute error is 0.31 m for the samples with a mean ice thickness of 1.80 m, i.e., a 17% mean absolute bias. Sensitivity studies indicate that the largest errors in the model ice thickness estimates come from uncertainties in surface albedo and downward solar radiation flux estimates from satellites, followed by uncertainties in snow depth and cloud fractional coverage. Based on the ice thickness, eight categories of ice “age” are defined: new, nilas (0.00~0.10 m), grey (0.10~0.15 m), grey-white (0.15~0.30 m), first-year thin (0.30~0.70 m), first-year medium (0.70~1.20 m), first-year thick (1.20~1.80 m), and old ice including second-year and multi-year ice (> 1.80 m). The thicker categories are for sea ice only. The current version of the OTIM was also compared with the ice thickness data measured by Canadian meteorological stations over 2002~2004, and the simulated ice thickness data from Pan-Arctic Ice-Ocean Modeling and Assimilation System (PIOMAS). Due to the uncertainties in current satellite retrievals of surface albedo and surface downward shortwave radiation flux, the model is not recommended for use with daytime data. Preliminary testing results with the proxy data from AVHRR, MODIS, and SEVIRI are promising.

42. GOES-R/S trans *Steve Wanzong*

Exploring the behavior of atmospheric motion vector (AMV) errors through simulation studies

Authors: Steve Wanzong, Chris Velden, Jaime Daniels and Wayne Bresky

The Cooperative Institute for Meteorological Satellite Studies (CIMSS), in cooperation with NOAA's GOES-R Algorithm Working Group (AWG), has been using simulated Advanced Baseline Imager (ABI) radiances to evaluate potential instrument effects on atmospheric motion vector (AMV) errors.

Simulated GOES-R ABI Top of Atmosphere (TOA) radiances derived from the Weather Research and Forecasting (WRF) model, and the CIMSS fast solar/infrared forward model are used within a new framework to produce AMVs. The use of this framework is a departure from the current operationally derived GOES AMVs, but is employed in this study since this framework will mimic what will be in place for the GOES-R ground system data processing. Adaptive changes to the operational feature-tracking algorithms were necessitated for inclusion into this system. For example, pixel-level cloud heights derived from the AWG cloud team algorithms are used in the AMV height assignment routine.

As a first step, unaltered TOA radiances (no noise) are used to derive a baseline set of AMVs. The TOA radiances are then altered at 1- and 3-times the ABI threshold specifications with several different induced noise effects: calibration offsets, navigation shifts, degraded sensor signal-to-noise, image striping, and all the effects combined.

AMV datasets are derived with the above instrument effects for a selected case study time period. They are then compared to the WRF model U and V wind fields ("truth") to assess which effects are most sensitive to the AMV processing software within the framework. The results will provide important tolerance guidance to the GOES-R Program Office in the selection of instrument specification thresholds.

43. GOES-R/S trans *Walter Wolf*

GOES-R AWG Product Processing System Framework

Authors: Walter Wolf, S. Sampson, Z. Cheng, P. Keehn, Q. Guo, S. Qiu, and M. Goldberg

NOAA/NESDIS/STAR has designed, developed, and implemented the GOES-R Algorithm Working Group (AWG) Product Processing System Framework. The framework enabled the development and testing of the Level 2 Advance Baseline Imager (ABI) and the GOES-R Lightning Mapper products within a single system. The development of one program was possible because most main programs for operational level 2 satellite product processing systems perform similar functions. Although the concept of a unified framework seems simple, many issues had to be taken into consideration to accomplish this task due to the intricacies inherent in each algorithm. One concern involved maintaining algorithm compatibility with outside research systems. To address this, algorithms were integrated into the framework using a plug and play interface allowing for backwards compatibility with other systems. To prevent redundant code, commonalities between different algorithms were identified, consolidated into a single place, and the duplicate code removed. Other considerations addressed in developing this system include: the coordination of the input data for the multiple algorithms, unified data structures, common data formats for all the products, common software libraries, input file configurations, interface between the main program framework and the algorithms, product precedence, hardware, programming languages, and the software used to both check and compile the code. The framework also has the ability to process both polar and geostationary data. These design features and the current algorithms integrated into the framework will be discussed.

44. GOES-R/S trans *Shu Yang and Mike Jamieson*

Emulated GVAR from GOES-R ABI Data

Authors: Shu Yang and Mike Jamieson

Advanced Baseline Imager (ABI) is a next-generation imaging instrument onboard of GOES R-series. Its design has no backward compatibility consideration for the current GOES I-P Imager, and its operation is significantly different from the current Imager in scenario, scan pattern, number of spectral bands, image shape, size and resolution, and pixel bit-widths. Therefore an emulated GVAR product (eGVAR) is to be created to facilitate the current GOES Imager users to continue utilization of their heritage downloading hardware, ingesting software, as well as various GVAR data application software modules they have developed over years.

The eGVAR will contain ABI's L1b image data (i.e., images after radiometric and geometric calibrations) but formatted to the same GOES VARiable (GVAR) format as the current GOES payload data. Since there is no counterpart of the current GOES Sounder onboard GOES-R, there are no corresponding sounding data to be generated in the eGVAR. Five of ABI's 16 spectral bands, whose central wavelengths are 0.64, 3.90, 6.19, 11.2, and 13.3 μm respectively, are chosen to be the eGVAR spectral bands. These wavelengths are very close to those of GOES I-P Imager's spectral bands. For example, GOES-P Imager's five spectral bands have central wavelengths of 0.625, 3.885, 6.517, 10.70 and 13.28 μm.

The resolution of Imager's one IR band has been changed from 8 km in GOES I-M to 4 km in GOES O-P; hence the eGVAR product is going to be compliant with the GVAR format of GOES O-P, i.e., 1-km resolution for the visible band and 4-km for all four IR bands.

The scenario of the eGVAR will be scheduled to create one full-disk image frame in every half hour.

In order to create a backward compatible eGVAR product, the following three emulations have to be achieved:

1. Fit the ABI's range of albedo in the specified visible band and the ranges of brightness temperature in the specified IR bands into the corresponding ranges of the current GOES Imager. Then re-digitize the radiometric values of the ABI image pixels in all specified bands to match the bit widths to that of the GOES O-P Imager by using linear interpolation, and extrapolation if necessary.

2. Transform the elevation and azimuth angles from ABI scanner to that of the current Imager scanner if their scan angle definitions are different. Then transform the image resolution from ABI to the current Imager. Both transformations will be carried out by resampling, sub-sampling and/or binning of image pixels.
3. Design and implement a virtual yet sophisticated GOES O-P Imager simulator to correctly create the scenario, scanner, pixel calibration and image frame related metadata in GVAR block 0 and 11's as well as the document portion of GVAR block 1 to block 10 so that GVAR users can process the eGVAR imagery pixel data in block 1 to 10 in the same fashion as they did for a GOES O-P GVAR downlink stream. The created eGVAR data will be sent via a modulated IF signal from GOES R Ground Segment (GRGS) to the current GOES Satellite Support Ground System (SSGS).

45. GOES-R/S trans *Jason Otkin*

High-resolution simulated ABI datasets used for GOES-R research and demonstration activities

Authors: Jason Otkin, Tom Greenwald, Justin Sieglaff, Mat Gunshor, Kaba Bah, Tim Schmit, Allen Huang, and Steve Wanzong

The next generation of Geostationary Operational Environmental Satellites (GOES), beginning with GOES-R in a few years, will contain improved spacecraft and instrument technologies capable of observing the earth's atmosphere with greater accuracy and at higher resolutions than current GOES satellites. The Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin-Madison is heavily involved in GOES-R satellite algorithm development, risk reduction, data processing, and measurement capability demonstration activities. To support this work, an end-to-end processing system that utilizes proxy top of atmosphere radiance datasets has been developed. High-resolution numerical model simulations are used to generate simulated atmospheric profile datasets that are subsequently passed through a sophisticated forward radiative transfer model to generate proxy top of atmosphere radiances for the GOES-R Advanced Baseline Imager (ABI) spectral bands.

In this paper, results from several large-scale, high-resolution Weather Research and Forecasting (WRF) model simulations will be presented. Proxy ABI radiances generated from the model-simulated data are a critical component of the GOES-R Proving Ground and GRAFIIR projects that are used to demonstrate future ABI-derived cloud and stability products for the operational community and to test the sensitivity of various retrieval algorithms to potential errors in the ABI radiances. Representative examples of how these projects use the proxy radiance data will be shown.

46. GOES-R/S trans *Jason Otkin*

New large-scale model-derived proxy ABI datasets available for GOES-R research and demonstration activities

Authors: Jason Otkin, Justin Sieglaff, Tom Greenwald, and Allen Huang

The Cooperative Institute for Meteorological Satellite Studies at the University of Wisconsin-Madison is heavily involved in GOES-R satellite algorithm development, risk reduction, data processing, and measurement capability demonstration activities. In support of this work, an end-to-end processing system that utilizes proxy top of atmosphere radiance datasets derived from numerical model output has been developed. The first step in the end-to-end system is to use the Weather Research and Forecasting (WRF) model to perform a high-resolution simulation covering a large geographic domain with high spatial and temporal resolution. Model-simulated temperature, moisture, and cloud data are subsequently passed through a forward radiative transfer model to produce proxy ABI radiances.

In this paper, we will describe our recent simulation activities, which includes performing two large-scale, high-resolution model simulations at the Pittsburgh Supercomputing Center during 2009. The first simulation contained a single 3950 x 3420 grid point domain with 5-km horizontal resolution centered at -137º W while the second simulation contained two nested domains with the inner domain covering a 1000 x 1000 km area with 500-m resolution. These two simulations were configured to represent the potential western viewing area of GOES-R and a representative special mesoscale viewing area, respectively. Proxy radiance datasets generated from these simulations provide an important opportunity to realistically demonstrate ABI measurement capabilities.

47. GOES-R/S trans *William Callicot*

Processed Sensor Data Rebroadcast for the GOES-R Weather Satellite System

Author: William Callicott

GOES Rebroadcast (GRB) will provide ground-processed sensor data from the GOES-R System to weather operations, research, and Earth sciences communities on a free and open basis. In addition, GRB will deliver processed instrument data to the NOAA product generation facility, enabling creation of higher-level weather products at low latency. The GOES-R satellite instruments will collect about 50 times more data than the current NOAA geostationary operational satellites with advanced temporal, spatial and spectral performance. Compared with previous generation of GOES satellites, broadcast rates for processed data from GOES-R series will increase from 2.6 Mbps to 31 Mbps. The Poster describes the GOES R data flow and content of GRB to direct readout users. A dual circular polarization approach will be used to accommodate the 31 Mbps data rate within a band frequency of 12MHz using a standard modulation at 1690 MHz (L-band). The GRB processed instrument data will be packetized using CCSDS Space Packet standards and will include lossless data compression to fit within bandwidth constraints. Data blocking and accompanying header metadata will be used to

minimize risk of loss due to link errors and allow for user verification of data integrity.

48. GOES-R/S trans *David Crain*

Commercial Sounder Options in the GOES-R Era

Author: David Crain

Advanced Geostationary Sounding remains an unmet requirement since the HES cancellation on GOES-R. Recent NOAA solicitations for commercial options have resulted in several alternatives for making Hyperspectral Sounding Observations during the GOES-R Era. These options do not require any accommodation within the GOES-R mission, but can be accomplished using existing commercial architectures and leveraging existing sensor development programs. The proposed options do not require upfront investment, but rather rely on a fee-for-service procurement model to make timely hyperspectral sounding data available for weather forecast and climate observations. Details of these options and timelines are presented.

49. GOES-R/S trans *Loren Woody*

Commercial Ocean Color Options in the GOES-R Era

Authors: David Crain and Loren Woody

The original ocean color mission requirement for GOES-R was lost with the cancellation of HES. Recent NOAA solicitations for commercial options have resulted in several mission concepts to achieve a US Ocean color observation capability including LEO (Low Earth Orbit) and GEO options. Details for some of these options are presented.

50. GOES-R/S trans *Don Hillger*

GOES-R ABI True-Color Capability

Authors: Don Hillger, Louie Grasso, Renate Brummer and Robert DeMaria

The 16-band GOES-R Advanced Baseline Imager (ABI) does not contain a "Green" (0.55 μm) band; however the Green band is needed to generate RGB (true-color) imagery from ABI. The CIRA-RAMMB Team in Fort Collins is developing forward model simulations of ABI reflective band imagery in order to test the production of ABI Green band and RGB products. Using 16-day albedos from MODIS for the land background, forward model simulations of the Red (0.64 μm), Near-IR (0.86 μm), and Blue (0.47 μm) images are made. Those three bands are used as input into a look-up-table (LUT) generation of the Green band, which we refer to as "synthetic Green" band. The LUT, created by Steve Miller, was trained on MODIS imagery which contains all three: Red, Near-IR, and Blue images, as well as a Green band.

The ABI Green band can also be simulated directly using the same forward model calculations used to produce the other ABI bands. This allows for the "simulated Green band" to be used as ground truth for the "synthetic Green band". In addition, the direct simulation of the Green band allows the possibility of Green band generation through regression on the other (Red, near-IR, and Blue) ABI bands. Results of both methods of Green band generation will be presented and compared. The synthetic-Green and synthetic-RGB ABI products have application for use in detection and retrieval of smoke plumes, volcanic ash, and other aerosols. Example of synthetic-RGB imagery with added smoke will be presented. Such simulations, with known aerosol properties, may be useful as proxy datasets for testing of algorithms for detection of such aerosols.^^

51. GOES-R/S trans *Don Hillger*

GOES Science Testing

Authors: Don Hillger and Tim Schmit

Two out of three of the Geostationary Operational Environmental Satellites (GOES) in the current series (GOES-13/14) have been launched. Only GOES-P remains to launch before the GOES-R series. An important aspect of the Post Launch Testing (PLT) of each satellite is the NOAA Science Test. That Science Test occurs at the end of the 5-month PLT, and allows scientists a chance to check out the satellite capabilities, especially the new and improved capabilities as the satellites evolve. Also unique of the Science Test in the focus on products, as well as the imagery. Science Testing will be especially important when GOES-R is launched. The entirely new series of spacecraft will provide many new capabilities and challenges. Improvements are expected in the following four areas: spectrally (increased number of bands), radiometrically (lower noise), spatially (better spatial resolution), and temporally (increased temporal resolution).

As an example of the types of tests that may take place, examples will be given of the NOAA Science Testing that was completed for GOES-13 and that is currently taking place for GOES-14 and to be completed in December 2009. Details of the current Science Test are being gathered on the GOES-14 Science Test page at http://rammb.cira.colostate.edu/projects/goes-o/ and will appear in a NOAA Technical Report to appear in 2010.

For all GOES check-outs, the goals of the Science Tests include the following: 1) To assess the quality of the GOES radiance data. This was accomplished by comparison to other satellite measurements or by calculating the signal-to-noise ratio compared to specifications, as well as assess the striping in the imagery due to multiple detectors. 2) To generate products from the GOES data stream and compare to those produced from other satellites. These included several Imager and Sounder products currently used in operations. In addition, rapid-scan imagery of interesting weather cases are collected with temporal resolutions as fine as every 30 seconds, a capability of rapid-scan imagery from GOES-R that is not implemented operationally on current GOES.

52. GOES-R Space *Uwe Arp*

SURF/NIST Calibration Capabilities for Solar Extreme Ultraviolet Missions

Authors: Uwe Arp, Alex Farrell, Mitch Furst, Steven Grantham, Edward Hagley, Ping-Shine Shaw, Charles Tarrio, Robert Vest

The Synchrotron Ultraviolet Radiation Facility SURF III maintains several experimental stations, which are used to support solar observations in the ultraviolet, extreme ultraviolet, and even soft x-ray range.

Recently several instruments for the Extreme Ultraviolet Variability Experiment (EVE) on the Solar Dynamics Observatory (SDO) were calibrated at SURF III. In addition, the twin instruments used for rocket underflight experiments that ensure the stability of the EVE instruments are also calibrated at SURF before and after each sounding rocket experiment.

Several, very different, experimental stations can be used to perform calibrations at SURF. For many solar observations the calculability of synchrotron radiation is used to calibrate instruments on beamline 2. SURF can be operated at electron energies between 100 MeV and 420 MeV, which allows us to custom-tailor the output spectrum. The storage ring can also be operated with electron ring currents from a few micro-amperes to about one 1 ampere, which allows us to change the output intensity over several decades, to match the expected intensity in space.

On beamlines 4, 7, and 9 we have the capability to calibrate photodectors in the extreme ultraviolet and ultraviolet spectral ranges by comparing them against absolute cryogenic radiometers. Beamline 7 is equipped with a grazing incidence monochromator and a large sample chamber that allows us to measure optical properties in the extreme ultraviolet spectral range, like multilayer reflectivities. Beamline 7 can also be used to calibrate CCD cameras. Recently we have calibrated vacuum ultraviolet sources as transfer standards on beamline 3, again using the calculability of synchrotron radiation. Overall, SURF III is available to the heliophysics and astrophysics communities to perform a multitude of calibration tasks for future solar and earth observing missions.

53. GOES-R Space *Joe Kunches*

GOES-R Solar and Space Environment Data Products: Benefiting Users

Author: Joe Kunches

Space weather data from GOES are the cornerstone of valuable products and services to the user community. The data are the basis of the widely-used NOAA Space Weather Scales, as well as the premier input to another class of users, the duty forecasters at the Space Weather Prediction Center. The growing user base, both external and internal, is the focus for planned product improvement activities at SWPC. These activities include better products derived directly from GOES data, i.e., the D-Region Absorption Model, used by commercial airlines as they plan and fly polar routes, to the envisioned ENLIL/Cone interplanetary coronal mass ejection model that will enable better predictions of the most threatening geomagnetic storms. The external user segment is varied and broad; examples of the key role of the GOES data, now and in the future, will be the focus of the presentation.

54. GOES-R Space *Kevin P. Ray*

Space Environment In-Situ Suite (SEISS)

Authors: Kevin P. Ray, E. Gary Mullen, Gary E. Galica, Bronek K. Dichter

The Space Environment In-Situ Suite (SEISS) is a suite of five instruments and a Data Processing Unit (DPU) that will provide real-time measurements of electrons, protons, and heavy ions in geosynchronous orbit while operating on-board the GOES-R series spacecraft. The SEISS suite is comprised of the following instruments: Magnetospheric Particle Sensor – Low (MPS-LO) which measures both electrons and ions from 30 eV to 30 keV; Magnetospheric Particle Sensor – High (MPS-HI) which measures electrons from 50 keV to 4 MeV and protons from 80 keV to 12 MeV; Two Solar and Galactic Proton Sensors (SGPS) which measure protons from 1 to greater than 500 MeV and alpha particles from 4 to 500 MeV; Energetic Heavy Ion Sensor (EHIS) which measures solar and galactic heavy ions in five mass groups (H, He, CNO, Ne-S, Fe-group). All five instruments are controlled by the DPU which serves as the main power and telemetry interface with the spacecraft. The paper will present an overview of the instruments, initial modeling results and preliminary results from testing in particle beam accelerators showing the expected on-orbit performance of the SEISS instruments.

55. Synergy *Toshiro Inoue*

Life stage of deep convection defined by split window and rainfall rate observed by TRMM/PR

Author: Toshiro Inoue

The life stage of deep convective system over the eastern tropical Pacific (30N-30S, 180-90W) was studied in terms of cloud type classified by the split window (11 micron and 12 micron). Hourly split window image data of Geostationary Operational Environmental Satellite (GOES-W) from January 2001 to December 2002 was used in this study. Deep convection mostly consists of optically thick cumulus type cloud in the earlier stage and cirrus type cloud area increasing with time in the later stage. In this analysis period and over the analysis area, life stage of deep convection, to a large extent, identified by computing the percentage of cirrus type cloud within deep convection from the single snap shot of split window image. Coincident Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR) observation was used to study the relationship between the percentage of cirrus type cloud within deep convection (life stage) and rainfall rate from TRMM PR. It is found that the rainfall rate tends to be larger at the earlier stage of the lifecycle when smaller percentage of cirrus type cloud is present within deep convection.

Calibration is essential to classify cold cloud type by split window. We desperately need the best quality of calibration for 11 micron and 12 micron data, especially for colder brightness temperature in GOES-R system.

56. Synergy *Bob Lutz*

CLASS Presentation

Author: Bob Lutz

GOES-R data will be permanently archived at two NOAA data centers - the National Climatic Data Center (NCDC) and the National Geophysical Data Center (NGDC). The Comprehensive Large Array-Data Center (CLASS) is the informational technology (IT) component of the data centers and provides the archive and access services for this data. Enhancements of CLASS are planned for the GOES-R era.

57. Synergy *Jay Al-Saadi*

The NASA Geostationary Coastal and Air Pollution Events (GEO-CAPE) Mission

Authors: Jay Al-Saadi, Paula Bontempi, Ernest Hilsenrath, and Lawrence Friedl

The Geostationary Coastal and Air Pollution Events (GEO-CAPE) mission was recommended for launch in the second tier of missions by the 2007 U.S. National Research Council Earth Science Decadal Survey, "Earth Science and Applications from Space." The mission's purpose is to identify human versus natural sources of aerosols and ozone precursors, track air pollution transport, and understand the short-term dynamics of coastal ecosystems. Instrument concepts covering the wavelength range from UV through thermal IR are being considered to meet these objectives. We will summarize the current status of GEO-CAPE including mission study activities and instrument technology investments. The potential role of GEO-CAPE within integrated US and global observing strategies will be discussed, focusing on synergies with the GOES-R Series.

58. Synergy *Matthew A. Lazzara*

Satellite Composites in the Polar Regions: Development, Evolution and Applications

Authors: Matthew Lazzara, Linda Keller, Shelley Knuth, Rick Kohrs, Rich Dworak, and Jerry Robaidek

Research investigations and operational needs in the data sparse polar-regions and adjacent high latitudes have called for satellite observations to complement limited in situ observation systems. For over 17 years, the combination of geostationary and polar orbiting satellite imagery into a single composite view over the Antarctic and Southern Ocean have been captured in three hourly mosaics. A review of the history of satellite composites in the Antarctic and their evolution will be followed by a report on applications and extended uses. Some examples include storm tracking, atmospheric motion vectors, and cloud mass transport. Recent improvements in temporal resolution will be introduced, as well as changes in the processing methodology. Multi-spectral compositing and recent development of Arctic composites will also be presented. Future efforts with polar satellite composites will be outlined.

59. Synergy *B. Motta*

The Blended Total Precipitable Water (BTPW) Product

Authors: B. Motta, R. VanTil

The National Weather Service (NWS), NOAA Oceanic and Atmospheric Research (OAR), and National Environmental Satellite Data and Information Service (NESDIS) have deployed an operational version of the Blended Total Precipitable Water product for operational use on the Advanced Weather Interactive Processing System (AWIPS). The data are flowing to National Weather Service (NWS) field offices and are available for display in the operational AWIPS systems used by weather forecasters to issue warnings and forecast products. A number of issues have arisen with the operational implementation of this
blended product and the poster will identify and explain them.

60. Synergy *Mathew Gunshor*

Intercalibration of the world's geostationary imagers with high spectral resolution data^^

Authors: Mathew Gunshor, Tim Schmit, W. Paul Menzel and Dave Tobin

High spectral resolution polar-orbiting satellite instruments, such as AIRS and IASI, can be used to intercalibrate the global system of operational geostationary imagers. The international community of satellite operators, through the WMO, has recognized a need for an improved quantitative assessment of satellite calibration for applications such as climate monitoring and has formed an international committee to coordinate a Global Satellite-Based Intercalibration System (GSICS). In addition to climate monitoring, intercalibration provides satellite operators with near real time feedback on instrument operation and response to changes implemented from the ground. Comparisons between geostationary imagers and the high spectral-resolution Atmospheric InfraRed Sounder (AIRS), polar-orbiting on Aqua, have provided an accurate estimate of calibration performance of the world's geostationary imagers. AIRS has been proven to have absolute calibration accuracies of 0.1K in most bands. However, AIRS does not have complete spectral coverage. The channels on geostationary imagers where AIRS has spectral gaps, such as the water-vapor absorption region, are difficult to compare accurately. IASI, which does not have spectral gaps, offers another opportunity for geostationary satellite intercalibration as well as validation of spectral interpolation techniques being used for AIRS where necessary. Both AIRS and IASI are being used to intercalibrate the world's geostationary imagers.

61. Synergy *Mathew Gunshor*

GRAFIIR – An Efficient End-to-End Semi Automated GOES-R ABI Algorithm Performance Analysis and Implementation Verification System

Authors: Allen Huang, Hong Zhang, William Straka and Mathew Gunshor

The NOAA GOES-R mission is the first of the next generation of national geostationary operational environmental satellites. The Advanced Baseline Imager (ABI) on GOES-R represents a technological leap in the nation's satellite sensing capabilities. In support of this mission CIMSS at the University of Wisconsin-Madison is contributing to the critical role of performing tasks for risk reduction, data processing system framework, proving ground, sensor tradeoff, sensor impacts on algorithm performance, and calibration/validation for the ABI. This work is being done in concert with other major ongoing efforts, such as the GOES-R Algorithm Working Group (AWG).

This presentation will overview the updated capability of GOES-R Analysis Facility for Instrument Impacts on Requirements (GRAFIIR). GRAFIIR is a system facility established to leverage a host of projects including AWG proxy, AWG algorithms, AWG McIDAS visualization, GOES-R Risk Reduction, sensor tradeoff and calibration/validation. GRAFIIR is to support GOES-R analysis of instrument impacts on meeting user and product requirements. GRAFIIR is for "connecting the dots", the components that have been built and/or are under development, to provide a flexible frame work to effectively adopt component algorithms toward analyzing the sensor measurements with different elements of sensor characteristics (i.e. noise, navigation, band to band co-registration, diffraction, etc.) and their impact on products.

One of the newly developed components called GLANCE is a comparison tool built to assess and evaluate many of the GOES-R data and products (i.e. imagery, clouds, derived products, soundings, winds, etc.) in a consistent and semi-automated way. This tool can be used to help characterize the effects of changes in sensor characteristics on product performance. It can also be used to quickly test proper product algorithm implementation as various product algorithms are transferred from developers to operators. Furthermore, the concept and build details of GLANCE will also be highlighted to demonstrate a truly functional and effective end-to-end system is being built to support NOAA's GOES-R ABI project.

62. Synergy *Andrew Heidinger*

Blended POES and GOES Real-time and Climate Cloud Products

Authors: Andrew Heidinger, Corey Calvert and William Straka III

NOAA/NESDIS and CIMSS are pursuing several concepts to blend the cloud products from the VIS/IR imagers on the current POES and GOES platforms. One of these efforts is a blended POES/GOES cloud height analysis for Alaska and the other is a blended POES/GOES cloud climatology over the GOES/West domain. This poster will provide examples and discuss the benefits and challenges of these efforts.

63. Processing *Brian Hughes*

Overview of NOAA's Satellite Operations including Data, Products, and Services

Authors: Brian Hughes, Thomas Renkevens

The mission of the National Oceanic and Atmospheric Administration (NOAA) National Environmental Data Information Service (NESDIS) is to provide timely access to global environmental data from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment, and quality of life. To fulfill its responsibilities, NESDIS

- acquires and manages the Nation's operational environmental satellites,
- operates the NOAA National Data Centers,
- provides data and information services including Earth system monitoring,
- performs official assessments of the environment, and
- conducts related research

This presentation will provide an overview of NESDIS satellite operations, data processing and product generation, data and product distribution, unique satellite services, and customer services. A schedule of current and future satellite activities will be presented. Satellite data and product access will be covered including distribution through the Man-computer Data Analysis System (McIDAS) and the Advanced Weather Interactive Processing System (AWIPS). Several examples of how satellite data and products are used for weather analysis and forecasting will be shown. Finally, we will discuss how NESDIS manages these many streams of satellite data and processing systems, and the management of user services.

64. Processing *Chian-Yi Liu*

The UTLS Signatures from Advanced Infrared Sounder Retrievals

Authors: Chian-Yi Liu, Jun Li, Timothy J. Schmit and Steven A. Ackerman

The atmospheric sounding retrieval methods from satellite infrared (IR) radiance measurements have been developed over decades. The sounding retrieval accuracy is much improved with the hyperspectral IR radiances compared with to those from the broadband IR radiances, and to be indispensable in achieving the 1K/1km and 10%/1km requirements for tropospheric temperature and humidity, respectively. The retrieval accuracy is better in the upper troposphere lower stratosphere (UTLS) than the atmospheric boundary layer, which provides an opportunity to explore the UTLS structure. We employ both clear and cloudy skies sounding retrievals from satellite-based hypersprctral IR radiance measurements to investigate the UTLS stability in associated with storm-scale weather phenomenon. The case study shows the atmospheric thermodynamic stability (e.g., Lifted Index) may be flawed in certain circumstance, while a

relative low UTLS stability in terms of the buoyancy frequency is found in the storm vicinity. The paper demonstrates the advantage of using the clear and cloudy hyperspectral IR sounding retrievals for supporting the short-term forecasting or nowcasting.

65. Processing *Robert Woodward*

Exception Handling for GOES-R Ancillary Data

Authors: Robert Woodward, Laurie Rokke, Donald Gray, August Ryberg

The GOES-R Advanced Baseline Imager (ABI) algorithms require ancillary data to generate the suite of proposed output data products. For a variety of reasons, these ancillary inputs may not always be available in a timely manner requiring the use of exception handling techniques. These techniques generally employ programming language constructs designed to manage the occurrence of special conditions, known as exceptions, which change the normal flow or execution of a program. With regard to ancillary data, exception handling techniques involve substituting alternate ancillary or climatological data when the primary sources are unavailable. As a means of gauging requirements for GOES-R, this poster presents a compilation of ancillary data exception handling techniques for algorithms from the Moderate Resolution Imaging Spectroradiometer (MODIS), the Sea-Wide Field-of-view Sensor (SeaWiFS), the NPOESS Preparatory Project (NPP), and GOES-R.

66. Processing *Chris Wheeler*

GOES Constellation Status Update

Author: Chris Wheeler

Significant changes to the GOES constellation have occurred since the last GOES Users' Conference including the launch of GOES-14 and an emergency operational period for GOES-13. Additionally, the upcoming year will see a de-commission of GOES-10, a transition of GOES-13 as the operational GOES-East, and a transition of GOES-12 to provide operational support for South America. This presentation will cover the status of the on-orbit GOES spacecraft and instruments as well as present the timeline and schedule for the upcoming operational transitions. Also presented will be status of the GOES-14 post-launch testing, GOES Imager stray light performance, and changes to the GVAR format for GOES-14 and GOES-15.

67. Processing *Mary M. Hopkins*

Improved Observations of Earth and Space Weather From GOES-R

Authors: Mary M. Hopkins, Dr. Satyanarayan Kalluri

The National Oceanic and Atmospheric Administration (NOAA) has been operating a system of Geostationary Operational Environmental Satellites (GOES) since 1975 to provide nearly continuous monitoring of the earth's environment, including ocean, land, atmosphere and the solar/space environment to protect life and property across the United States and the Western Hemisphere. GOES satellites series from 1994 through 2010, share the same generation primary instrument payload. The next generation GOES-R series represents a generational change in both spacecraft and instrument capability. Upon launch in 2015, the GOES-R series will carry into orbit a new suite of instruments that will provide improved observations of earth and space weather:

- the Advanced Baseline Imager (ABI) will collect imagery in 16 spectral bands within 0.45 μm to 13.6 μm., The spatial resolution varies from 0.5km to 2 km with the 0.59-0.69 μm band having the highest spatial resolution.
- the Extreme ultraviolet and X-ray Irradiance Sensor (EXIS) will measure the magnitude of solar X-ray irradiance and determine the solar EUV irradiance from 5 to 127 nm
- Solar Ultraviolet Imager (SUVI) will image the full disk in the following six wavelengths every five minutes: 93.9 Å, 132.8 Å, 171.1 Å, 195.1 Å, 284.3 Å, and 303.8 Å at high cadence around the clock;
- Space Environment In-Situ Suite (SEISS) has a set of particle sensors that measure the proton, electron, and heavy ion fluxes,
- Magnetometer (MAG) will provide information on geomagnetic activity in Earth's magnetosphere such as monitoring of magnetopause crossings and shock that permit the detection of space plasma storms and substorms
- Geostationary Lightning Mapper (GLM) will capture at least 70% of the global lightning flashes with a false alarm rate less than 5%..

Additionally, GOES-R will provide a set of communications services (Unique Payload Services) in support of the Data Collection System (DCS), Low-Rate Information Transmission (LRIT), Search-and-Rescue Satellite Aided Tracking (SARSAT), and Emergency Managers Weather Information Network (EMWIN).

The new instrument suite covers a wider spectral range, with increased frequency, and with observations in areas not covered by heritage instruments. This combination produces dramatically more data than any previous GOES series, along with significantly enhanced nowcasting and forecasting capability

68. Processing *Gary S. Wade*

Insuring incorporation of improvements to the GOES Sounder vertical profile retrieval algorithm into NOAA/NESDIS operations.

Authors: Wade, Gary S., Zhenglong Li, James P. Nelson III, Jun Li, and Timothy J. Schmit

Recently, Li et al. (2008) reported on improvements to the Geostationary Operational Environmental Satellite (GOES) Sounder vertical profile retrieval algorithm. These changes in the retrieval methodology marked the first successful attempts to significantly improve upon the established GOES physical retrieval algorithm currently in use (Ma et al. 1999). The Ma approach has been employed for several years by the NOAA/NESDIS Office of Satellite Data Production and Distribution (OSDPD) to provide GOES Sounder products to the National Weather Service (NWS).

A moist and unstable bias near cloud edges has historically plagued the Ma et al. (1999) retrievals. The Li et al. (2008)

algorithm has made improvements with respect to this deficiency, and is currently being moved through the research-to-operations process. Both retrieval algorithms are implemented as Man-computer Interactive Data Access System (McIDAS) applications on hardware at the University of Wisconsin (UW)-Madison Space Science and Engineering Center (SSEC). The current goal is to port the Li et al. (2008) algorithm to the NOAA/NESDIS/Center for Satellite Applications and Research (StAR)/Satellite Meteorology and Climatology Division (SMC)/Operational Products Development Branch (OPDB), who in turn will provide operationally ready, locally run code to NOAA/NESDIS/OSDPD.

As this transfer of technology is progressing, scientists at the Cooperative Institute for Meteorological Satellite Studies (CIMSS), housed within SSEC, continue (1) to assess how successfully the McIDAS implementation of Li et al. (2008) is being completed, and (2) to evaluate how much the Li et al. (2008) algorithm routinely improves upon the Ma et al. (1999) algorithm. The current status and methods used to compare the retrieval products from both algorithms will be described. This work is relevant to future GOES-R data processing, as these current GOES Sounder products are to be approximated as the required GOES-R "GOES Sounder legacy" products (for profiles, stability, and moisture), which are to be derived with the non-sounder, but multi-spectral GOES-R Advanced Baseline Imager (ABI).

69. Processing *Michael Guberek*

A Single-Antenna Field Deployable Polar/Geostationary Direct Readout System

Author: Michael Guberek

Global Imaging's new Mark X portable, tactical earth station is capable of receiving, processing, and displaying digital LRIT data from the latest GOES, MSG and MTSAT-1R next-generation geostationary satellites and NOAA HRPT and DMSP polar imagery using a single antenna and workstation. The Mark X system contains all the electronics, computers and software necessary for an autonomous field meteorological operation.

70. Processing *Wayne Bresky*

A New Nested Tracking Approach For Reducing The Slow Speed Bias Associated With Atmospheric Motion Vectors (AMVS)

Authors: Wayne Bresky and Jaime Daniels

The GOES-R Algorithm Working Group (AWG) Winds team is working on the development and validation of algorithms for the generation of Atmospheric Motion Vectors (AMVs) from the future GOES-R Advanced Baseline Imager (ABI). Meteosat SEVIRI imagery is currently serving as an important GOES-R ABI proxy data source for the development, testing, and validation of the GOES-R AMV algorithms.

Statistics comparing satellite-derived motion estimates to collocated radiosonde observations often show a pronounced slow speed bias at mid and upper levels of the atmosphere. One possible explanation for this slow bias is a poorly assigned height (too high). Recent work by Sohn and Borde (2008), however, suggested a link between the size of the target box used and the magnitude of the slow bias. Specifically, they found that a smaller target box leads to both a faster wind estimate and a lower height assignment. Both of these factors will contribute to a smaller slow bias. Independent tests performed by the authors of this poster, that involved varying target size (5 to 21 pixels) and temporal intervals (5 to 30 minutes), have confirmed these earlier findings. This testing, as well as subsequent analysis of individual case studies, have led the authors to develop a new approach to tracking that relies on a smaller target box "nested" within a larger one to derive a field of vectors for each pixel location in the larger window. Statistical comparisons of AMVs derived via this new approach show a significant improvement in the overall quality of the derived AMVs characterized by significant reductions in the slow speed bias without a corresponding increase in spatial variability. In addition, results from case studies involving use of Meteosat-8 rapid-scan SEVIRI imagery will be shown.

71. Processing *James L. Carr*

GOES-R Image Navigation and Registration (INR)

Authors: James L. Carr and Houria Madani

The GOES-R series offers enhanced imagery with better spatial, spectral, and temporal resolution and introduces a new instrument, the GOES Lightning Mapper (GLM), for detection and monitoring of lightning. Processing and monitoring the data generated by a GOES-R satellite are challenging in terms of product quality and latency. The subject of this paper is image navigation and registration (INR) of GOES-R earth viewing instruments with a special focus on the Advanced Baseline Imager (ABI).

Image navigation provides the relationship between image coordinates and earth coordinates (latitude and longitude). Image registration ensures that the pixel earth locations remain aligned to a predetermined fixed grid. INR on the GOES I-M and NOP series is achieved through application of Image Motion Compensation (IMC) to the instrument's servo mechanism to control its scanning. The GOES-R Advanced Baseline Imager (ABI) will use a mechanism akin to IMC to ensure the geographical coverage but the geometric correction and registration to a fixed grid are achieved by resampling. The GOES-R INR concept and its main differences with the current GOES INR process will be presented.

Another important activity performed in the GOES ground system is product monitoring, which consists of inspecting the data quality, such as INR performance, as it is distributed to the user community. Monitoring the INR performance is provided by the Replacement Product Monitor (RPM) for the current GOES series. Information about the RPM can be obtained from the RPM User's Manual or the RPM Software Maintenance Manual . Although some re-use of the RPM algorithms is expected, the GOES-R PM capability is expected to be more complex than the RPM. The main features of the GOES-R PM will be presented with a special focus on monitoring the GOES-R INR performance.

72. Processing *Denny Hansen*

Overview of the GOES-R ground system architecture

Authors: Denny Hansen

The next generation GOES, designated the GOES-R Series, provides continuity of the GOES mission and improvement of its remotely-sensed environmental data. The GOES-R system consists of the Space and Ground Segments. The Space Segment comprises the spacecraft bus, and its remote-sensing instruments and communications payloads. The Ground Segment, comprising all Earth-based functions, provides satellite operations and instrument product generation and distribution. The GOES-R Ground Segment operates from three sites. The NOAA Satellite Operations Facility (NSOF) in Suitland, MD houses the primary Mission Management (MM), and selected Enterprise Management (EM), Product Generation (PG), and Product Distribution (PD) functions. The Wallops Command and Data Acquisition Station (WCDAS), located in Wallops, VA, provides the primary space communications services, EM and MM functions, and selected PG and PD functions. The third site is a geographically diverse remote backup facility (RBU), located at Fairmont, WV. It functions as a completely independent backup for the MM and selected PG and PD functions for the production of Key Performance Parameters (KPPs) and GOES Rebroadcast (GRB) data, and is capable of concurrent and remote operations from the NSOF and the WCDAS. The RBU has visibility to all operational and on-orbit spare satellites.

73. Processing *Allan Weiner*

Process for Transitioning Algorithms from Research to Operations

Author: Allan Weiner

The GOES-R Algorithm Transition to Operations Process is a low risk methodology to translate algorithm definitions into operational code that aligns with the iterative delivery of Algorithm Packages. This process encompasses the full algorithm software development lifecycle (SDLC) from requirements analysis through qualification testing for science and operational code development. It is comprised of the following process flows: First, the Ground Segment Project Office (GSP) Algorithm Package is delivered with subsequent Systems Engineering Audit/Analysis/Examination of GSP Material; next, the Science Implementation is performed by the Algorithm Engineering Team which develops and tests the implemented algorithm; and finally the Algorithm Code Operationalization is performed by the Product Generation (PG) Algorithm Software Team. The entire process is completed by independent PG IPT Integration and Test.

74. Processing *T. Scott Zaccheo*

Development of GOES-R Algorithms using Common Framework and Data Model Design Approach

Authors: T. Scott Zaccheo, Craig Richard, David B. Hogan and Edward Kennelly

The development of a common/robust algorithm framework and data model(s) are two key elements of Harris GOES-R Team ground system infrastructure design. These modern software design elements will facilitate the transition of Government provided algorithms packages to operational Level 1 and 2+ software. The Harris Team GOES-R GS algorithm framework provide general design principles and standardized methods for initializing general algorithm services, interfacing to external data, generating intermediate and L1b and L2 products and implementing common algorithm features such as meta-data generation and error handling. The data model interface is an essential part of this framework, and provides abstract classes/methods for reading external data and writing output products and meta-data. The data model design provides a seamless mechanism for transition core algorithm software between algorithm engineering and operational environment. Algorithm developed and tested in an engineering environment will need not significant if any interface re-work as they are transitioned to the production facility, since data model classes and methods employed in the development environment will mimic those in the operation system. This modular design approach not only enables a smooth transition from development to operations, but also enables "buy-back" from the production to the development environment. This work described the basis Harris GOES-R GS team's algorithm architecture and engineering approach, and demonstrates how the algorithm framework and data model are an integral part of this process. It also provides a preliminary implementation road map for the development of the GOES-R GS software infrastructure, and view into how the framework and data model will be integrated into the final design.

75. Processing *Mike Blanton*

GOES-R GS Product Generation Infrastructure Operations

Author: Mike Blanton

GOES-R GS Product Generation Infrastructure Operations: The GOES-R Ground System (GS) will produce a much larger set of products with higher data density than previous GOES systems. This requires considerably greater compute and memory resources to achieve the necessary latency and availability for these products. Over time, new algorithms could be added and existing ones removed or updated, but the GOES-R GS cannot go down during this time. To meet these GOES-R GS processing needs, the Harris Corporation will implement a Product Generation (PG) infrastructure that is scalable, extensible, extendable, modular and reliable. The primary parts of the PG infrastructure are the Service Based Architecture (SBA) and the Distributed Data Fabric (DDF). The SBA is the middleware that encapsulates and manages science algorithms that generate products. The SBA is divided into three parts, the Executive, which manages and

configures the algorithm as a service, the Dispatcher, which provides data to the algorithm, and the Strategy, which determines when the algorithm can execute with the available data. The SBA is a distributed architecture, with services connected to each other over a compute grid and is highly scalable. This plug-and-play architecture allows algorithms to be added, removed, or updated without affecting any other services or software currently running and producing data. Algorithms require product data from other algorithms, so a scalable and reliable messaging is necessary. The SBA uses the DDF to provide this data communication layer between algorithms. The DDF provides an abstract interface over a distributed and persistent multi-layered storage system (memory based caching above disk-based storage) and an event system that allows algorithm services to know when data is available and to get the data that they need to begin processing when they need it. Together, the SBA and the DDF provide a flexible, high performance architecture that can meet the needs of product processing now and as they grow in the future.

76. Processing *Mike Blanton*

Integrated Requirements and Design Model for GOES-R

Author: Mike Blanton

Integrated Requirements and Design Model for GOES-R: The Harris Team is using an advanced set of integrated requirements and design tools to ensure that the GOES-R Ground Segment meets the Government's requirements. Our toolset maintains a single baseline of requirements and design that is accessible by all Contractor and Government personnel regardless of where they are geographically located. All Government requirements are linked to Contractor requirements and then to the design and implementation of the Ground Segment. This allows the implementation of each Government requirement to be followed to its implementation in the Ground Segment. Our approach provides a very high level of visibility in to how Government requirements are met and how the Ground Segment is designed and tested, while minimizing manual efforts.

77. Processing *Les Spain*

How GOES-R Will Limit Outages and Breaks In Continuity

Author: Les Spain

The GOES-R Series with new spacecraft and a new ground system contains a number of features designed to limit outages and breaks in continuity. The GOES-R spacecraft will make use of GPS based navigation to maintain position and operate for up to 14 days without command contact with the ground and lower outage time during and following maneuvers. The use of Consultative Committee for Space Data Systems (CCSDS) standards and Low Density Parity Check (LDPC) code permits improved communications packet handling and error detection and correction. The ground system contains a geographically isolated back-up facility that mimics the ability of the primary site to command the spacecraft, produce and uplink GRB and generate KPPs. The spacecraft and ground system both contain features designed to meet stringent availability requirements. The spacecraft contain autonomous fault detection and correction capabilities that contribute to successful recovery from component failures. The ground system uses an Enterprise Management capability to enable operators to supervise their local site and distributed GS components, infrastructure, and interfaces. The Ground Product Processing Infrastructure uses mainstream, standards-based hardware technology based on mature, vendor-neutral, commodity hardware components, reducing risk during upgrades. Hardware processing capacity can be increased by adding commodity blade servers to a high-performance computing grid. The Product Processing Software allows changes to algorithm complements and precedence dependencies and the addition of new sensors, without adversely affecting the generation of other executing algorithms.

78. Processing *Les Spain*

GOES-R Command and Control

Author: Les Spain

The GOES-R Command and Control System ensures continuity of services by incorporating centralized management of space and ground assets, a backup site, redundant equipment, automated recovery, and workflow-enabled contingency procedures. Mission Management and Enterprise Management functions are integrated to ensure that operations and maintenance activities align with mission priorities. Scheduling of satellite and ground segment activities is consolidated to prevent operational errors that could result in a loss of operations continuity or interruption in service. The capability to monitor the satellite and GS assets together is provided to minimize staff and enhance well-informed coordinated responses when anomalies occur. An integrated approach to automation provides an efficient system that can be operated with minimal staff, while maintaining high availability. Centralized control and monitoring of the satellites, GS equipment and processing across three sites, and lights-out operations at the RBU minimize staff and expedite problem resolution.

79. GOES-R/S trans *Bobby Braswell (Rob)*

GOES-R Algorithm Architecture: Ensuring Product Quality and System Performance

Authors: Bobby Braswell, Peter Finocchio, Richard Lynch, William Gallery and Edward Kennelly

The Harris GOES-R Ground Segment team will provide the algorithm and engineering infrastructure for production and distribution of next-generation GOES-R data products. The team will implement, verify, and test software corresponding to government-supplied algorithms which will yield a variety of products that describe the state of the atmosphere, land, oceans, and solar/ space environment. The GOES-R end-product performance parameters (EPPs) (i.e., the characteristics and quality of the data products) are unprecedented in terms of spatial resolution, temporal frequency, precision, and thematic focus. This poster presents

the suite of GOES-R products, their properties and the process by the related requirements are maintained during the design/development life-cycle. It also describes the means by which the system will maintain the integrity of the EPPs, and monitor the quality and accuracy of the products.

80. Distribution *Tom Renkevens*

Current GOES Variable (GVAR) Data and Examples

Authors: Tom Renkevens, Brian Hughes, Paul Seymour

The GOES Variable (GVAR) data stream is a service from the current series of Geostationary Operational Environmental Satellites (GOES) that broadcast 10-bit scaled radiances to a broad community of users. This poster will display the capabilities of the current GOES I-M and N-P series, by showing imager and sounder examples that can be generated in real time from the GVAR data stream. Changes to the GVAR format beginning with GOES-O (GOES-14) will be highlighted as well.

81. Distribution *Paul Seymour*

Current GOES Direct Readout Overview

Authors: Paul Seymour, Marlin O. Perkins, Kay Metcalf, Rob Wagner, Santos Rodriguez

NOAA provides data and information through several GOES direct readout and broadcast services. They include imagery in the GOES VARiable (GVAR) format, the Data Collection Service (DCS), the Low Rate Information Transmission (LRIT) broadcast and the Emergency Managers Weather Information Network (EMWIN) broadcast. This presentation will discuss the current status of these services and changes due in the near future including changes required for reception from the new GOES-14 broadcasts.

82. Distribution *Paul Seymour*

Low Rate Information Transmission (LRIT)

Author: Paul Seymour

NOAA's GOES Low Rate Information Transmission (LRIT) broadcasts transmit reduced resolution GOES Imagery from both the East and West GOES along with a copy of the GOES Data Collection System (DCS) and Emergency Managers Weather Information Network (EMWIN) data streams, environmental data and administrative information. The service is broadcast at 1691.0 MHz and at 128 Kilobits per Second.

83. Distribution *Santos Rodriguez*

HRIT/EMWIN

Authors: Robert Wagner and Santos Rodriguez

EMWIN and LRIT are NOAA data broadcast services from the GOES satellites that provide users a variety of weather forecasts, warnings, and imagery. The transition to the GOES N-P satellites and later to the GOES R-T satellites will affect these services and their users. This presentation will describe the EMWIN and LRIT services and the changes that will occur with each transition, culminating in a merged 400 kbps broadcast in the GOES R era. It will also discuss the proof of concept system that was developed to be backward compatible and transition ready. This design takes advantage of software defined radio techniques for greater flexibility and reduced user cost.

84. Distribution *Santos Rodriguez*

EMWIN Poster & Demonstration

Authors: Robert Wagner and Santos Rodriguez

EMWIN is a low cost service that allows users to obtain weather forecasts, warnings, watches, graphics, imagery and other information directly from the National Weather Service (NWS) in near real time and broadcast from the GOES satellites. EMWIN is intended to be used primarily by emergency managers and public safety officials who need timely weather information to make critical decisions. The demonstration will highlight the HRIT/EMWIN proof of concept receiver developed by the GOES R Program, Aerospace Corporation, NESDIS and the NWS.

85. GOES Trans *Ted Habermann*

The GOES-R Metadata Model

A group of metadata experts from NOAA, NASA, and other groups associated with the GOES-R Program worked together during the early part of 2009 to create a Strawman Metadata Model for GOES-R based on the ISO 19115-2 Metadata Standard for Geographic Data. I will describe the model and use it as a starting point for discussion of capabilities that might be developed using metadata provided with the GOES-R products.