Oral Presentations

2019 CSPP in Chengdu, China

Aguilar Sierra, Alejandro (UNAM): *CSPP GEO and LEO use at the National Laboratory for Earth Observation (LANOT), Mexico*

A. Sierra, J. Prado, G. Gómez, U. Mendoza, L. Manzo, P. Cruz, V. Jiménez, and I. Huy

The operation of LANOT has crucial importance for risk prevention in our country. Data and images, that are received and processed in our laboratory, are essential inputs for issuing hurricane alerts, severe storms, wildfires, and volcanic ash emissions, among other phenomena. LANOT has three satellite acquisition systems: a GOES Rebroadcast (GRB) satellite receiving station for GOES-16, GeonetCast, and one more capable to receive imagery and data from polar-orbiting satellites such as SUOMI-NPP, Aqua, Terra and EUMETSAT MetOp. We receive, process, and distribute imagery and data opportunely, in an automatic way to several federal institutions, like the National Center for Disaster Prevention (CENAPRED), the Ministry of Navy (SEMAR), and the National Meteorological Service (SMN). We also provide these images and data, to some research groups as well as to another National Laboratories.

In this work we are introducing the way we process level 1 images, using CSPP GEO and LEO, in combination with other open source programs, as well as some algorithms developed in-house which has allowed us to make a more precise determination of hot spots, and volcanic ash emissions. We were also working in efficient usage of computing power and disk space management, at the same time that costs were reduced incorporating non-commercial hardware.

Braun, Jessica (SSEC/UW-Madison): *CIMSS Global Direct Broadcast Application Workshops - Fostering the Next Generation of Scientists*

Jessica Braun, Liam Gumley, Kathy Strabala

The Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the Space Science and Engineering Center (SSEC) has organized numerous Direct Broadcast Application workshops across the world. These workshops are intended to teach students the basic principles of remote sensing and their use in real-world applications. The workshops use a combination of lectures and interactive labs that build upon each other throughout the duration of the workshop, culminating with students choosing a case study and presenting the results of their investigation.

Students use satellite data from a local direct broadcast antenna that was processed using the NOAA sponsored Community Satellite Processing Package (CSPP) suite of software packages, which supports the creation of science data products from satellites including NOAA-20, Suomi-NPP, Aqua, Terra, NOAA-18/19, Metop-A/B and GCOM. Developed at SSEC, the free software

packages produce products including cloud and land surface retrievals, sea surface temperatures, atmospheric profile retrievals, cloud-cleared radiances, active fires, and flood detection. Labs utilize the CSPP HYDRA2 toolkit to investigate different band characteristics and derived products. HYDRA2 offers tools including basic image displays, transects, scatterplots, band math, and RGB composites. This presentation will describe the approach of these workshops and show examples from past lab exercises.

Burnett, Curtiss (NOAA/NASA/Arctic Slope Regional Corporation): *GOES-R Program Update on Operational Products and GRB*

Curtiss Burnett, Thomas Feroli, Matthew Seybold, Jaime Daniels, James McNitt

The first satellite in the NOAA Geostationary Operational Environmental Satellite R-Series, now GOES-16, launched in November 2016. The second satellite in the GOES-R series, now GOES-17, launched in March 2018. GOES-16 is the NOAA GOES-East operational satellite. GOES-17 recently completed instrument level post launch testing and was declared the NOAA GOES-West operational satellite. Post-launch product validation activities for GOES-17 are underway. The GOES-R Series Product Readiness and Operations (PRO) team is tasked to work with our partners at the National Weather Service and within NESDIS to ensure products (both Level 1 and Level 2) are ready for operations and the user community is ready and are receiving and disseminating the various products to serve their needs and requirements. In this presentation, we will discuss the current operational status of the GOES-16 and GOES-17 ABI L2 products. We will also discuss the unique challenges presented by the GOES-17 thermal control system anomaly. This causes degradation and saturation in some of the infrared bands, so various product algorithm and software updates are being developed and implemented to mitigate the impact of this anomaly. New product quality indicators are being developed and implemented to help users optimize their use of the GOES-17 products. Additionally, we will provide a status update on GRB content and configurations.

Choi, HaYeon (SOLETOP): *Development of Algorithm code standardization/modularization for GK-2A meteorological data processing system*

Ha-Yeon Choi, Sang-Ho Bang, Byoung-Guk Kang, Do-Hyeon Gil, Seong-Seok Yong, Geon-Ho Lee

In order to process the meteorological data (Level 1B) received by the processing system of the geosynchronous orbit satellite GK-2A, a meteorological product (Level 2/3/4) algorithm is required. An algorithm for meteorological data processing / analysis / utilization has been developed, and the basic product algorithm developed independently with ETRI and SOLETOP have standardized and modularized basic product algorithm independently developed to apply standardized form in the GK-2A ground station. We analyzed the meteorological algorithm and derived algorithm precedence relationships, input / output data and common modules, and created algorithm standardized code for module coordination and code management. A verification tool has been developed to ensure the reliability of the generated algorithm code. We also support common test bed (MATE) operation and testing so that the developed

algorithm can be commercialized to the GK-2A ground station processing system. This paper describes algorithm standardization / modularization development and common test bed operation form.

Coppens, Dorothee (EUMETSAT): *Current EARS IASI L1 and L2 processing and preparation of future EUMETSAT hyperspectral missions*

Dorothee Coppens, Thomas August

The EUMETSAT Advanced Retransmission Service (EARS) collects data from a selected set of HRPT stations, processes the data and distributes the data to end users via the EUMETCast satellite broadcast mechanism. EARS aims at providing the Meteorological Community with data sets with timeliness adequate for local and regional numerical weather prediction applications. The EARS services include the IASI Retransmission service since April 2012 for the level 1 products and April 2017 for the level 2 products

We recall here the status of both IASI processing, expose the interactions with user communities to characterise their needs and adapt the service, and also to prepare the future EUMETSAT Polar System-Second Generation (EPS-SG) and Meteosat Third Generation (MTG) programme. We present the plans for the IASI-NG and MTG-IRS L1 and L2 products, and first results of interaction with potential users interested by the IRS L2 products mostly for Nowcasting purposes.

Cureton, Geoff (Cooperative Institute for Meteorological Satellite Studies, UW-Madison): *Near Real Time Active Fires and GAASP Level-2 Products Via Direct Broadcast Using the Community Satellite Processing Package*

The Cooperative Institute for Meteorological Satellite Studies (CIMSS) has a long history of supporting the Direct Broadcast (DB) community for various low-Earth-orbit (LEO) sensors, previously with the International MODIS/AIRS Processing Package (IMAPP) for the NASA EOS polar orbiters Terra and Aqua, and currently with the Community Satellite Processing Package (CSPP) for the NOAA polar orbiters Suomi-NPP and NOAA-20. CSPP has been significant in encouraging the early usage of Suomi-NPP data by US and international weather agencies, and this situation should continue with NOAA-20 and beyond.

CSPP support for NOAA polar orbiters to date has rested upon the Algorithm Development Library (ADL) developed by Raytheon, a refactoring of the science code in the Interface Data Processing Segment (IDPS), the NOAA operational processing system. More recently various science algorithms are being provided for DB in the Delivery Algorithm Package (DAP) format. Examples of both ADL and DAP packages will be presented: the Active Fires package for S/NPP and NOAA-20, and the GCOM-W1 AMSR2 Algorithm Software Package (GAASP), for the retrieval of total precipitable water (TPW) and cloud liquid water (CLW).

Diop, Bouya (Université Gaston BERGER de Saint LOUIS): *Squall lines study on the Sahel by NOAA 18 data.*

Bouya Diop; Adoum Mahamat MOUSSA, Abdoulaye B.DIOP, Mamadou Bamako SEREME

In this work, we used TOVS-ATOVS data from the NOAA-18 satellite to study the horizontal structure of a grain line line (S.L.). We operated the Advanced Microwaves Sounding Unit B channels (AMSUB). The study focuses on the temperature of brightness in the Sahel. We have:

- on the single channel C1 (AMSUB) the influence of the Sea-Earth interface;

- All channels display a minimum heat to the right of the S.L.

a relative maximum at the rear of the S.L., with the channels 4 and 5 more particularly;

- Channels 2 to 5 adjusted around 183 GHz, in the water vapor absorption band, show a difference in light temperature at the front and rear of the SL.

We observe a similarity in the response form of the channels 5,6, 7 and 8. It has the same thermal minima at the passage of the SL. There is a good similarity of the information in the HIRS channels with the AMSUB channel.

Key words: britghness temperature, squall line, AMSUB, TOVS ATOVS, NOAA-18

Flynn, Bruce (SSEC): *Cloud-based Sounder and Microwave Instrument Data Processing Infrastructure for DBNet*

Bruce Flynn, Liam Gumley

Traditional direct broadcast receiving station local processing systems provide several challenges when it comes to producing high quality global datasets. Some of these challenges include keeping processing software up to date, including LUTs and ancillary, processing software version homogeneity, and network policy/throughput issues, as well as monitoring and quality control. A cloud-based solution has potential to solve many of these issues by making use of cloud vendor provided regional data centers, modern software encapsulation technologies such as Docker and Singularity, as well as increased monitoring capability due to a centralized view of overall ingest, processing, and delivery.

This presentation will describe a new DBNet Cloud Service under development at CIMMS/SSEC. This Service will provide an easy and convenient way for DB receiving station operators to contribute to the DBNet project without having to invest their time and resources to install, configure, test and maintain automated processing systems for DB data.

The Service is constructed of several distinct capabilities, including file depots, i.e., data upload, data discovery/metadata, and processing. There can be many file depots running in any number regional data centers. The data discovery/metadata processes keep track of data available amongst all the file depots and is responsible for distributing data to one or more processing systems. The processing systems will communicate back processing status and metrics. Overall

monitoring and status will be provided by metrics generated by the data discovery/metadata processes.

Gershenzon, Olga (LoReTT LLC): *\"Lenticularis\" is the new approach in L-band ground stations for LEO satellites.*

LoReTT LLC is an innovative start-up, engineering company, founded in April 2017 with participation of Internet Initiatives Development Foundation (IIDF - www.iidf.ru). Since 23 March, 2018 \"LoReTT\" LLC is the resident of \"Skolkovo\" Innovation Center (http://sk.ru).

The founders and employees of the Company have 30 years of experience in the field of creating technologies for receiving, processing and using images of the Earth from Space.

Laboratory Complex for Receiving Data from Meteo Satellites \"Lenticularis\" (hereinafter referred to as the \"Complex\") is designed to receive, demodulate, decode, record and process digital information, transmitted from meteorological spacecrafts in low Earth orbits (LEO) via L-band radio channels. It enbles to receive imahs from satellite series Meteor-M #2, NOAA, MetOp, FengYun-3.

\"Lenticularis\" is designed and produced on the base of unique technology without antenna dish positioner and using low cost SDR-receiver. Antenna dish diameter is 1.2 m, wight is about 15 kg. Such innovative approach enabled significantly to decrease size, weight, price of the antenna and to simplify its operation in the whole. The Complex is operated on the standard Windows based notebook.

The Complex provides receiving images from satellites in radius about 400 km from a point of Complex location and automatic data recording on computer disk.

Goldberg, Mitch (NOAA): *Overview of NOAA JPSS Satellite and Science Program*

Gumley, Liam (CIMSS/SSEC/UW-Madison): *CSPP LEO Status Report: New features and enhancements*

The Community Satellite Processing Package (CSPP) for low earth orbit (LEO) satellites has continued to evolve with the addition of support for new satellites and sensors; updates and improvements to existing products; and support for new geophysical products. Support for the new NOAA-20 operational satellite (launched in November 2017) has been added to the CSPP LEO suite to allow creation of geolocated and calibrated sensor data records (SDRs) for ATMS, CrIS, and VIIRS. NOAA-20 support was also added to geophysical product generation software packages including NUCAPS, MIRS, and HSRTV. New geophysical product generation software packages for flood and wildfire detection (both supporting NOAA-20 VIIRS) were added to the CSPP LEO suite, and the Polar2Grid image creation toolkit was updated to fully support NOAA-20 VIIRS and Metop-C AVHRR. A new atmospheric profile retrieval system (IASI-NUCAPS) was introduced for Metop-A and Metop-B IASI. New CSPP LEO releases anticipated before June 2019 include cloud, aerosol, cryosphere, and land surface geophysical products for SNPP and NOAA-

20 VIIRS, and an update for the ACSPO SST product to support NOAA-20 VIIRS and Metop-C AVHRR. This presentation will review the status of the current CSPP LEO software suite and provide examples of new capabilities and products that have been recently added.

Hu, Xiuqing (NSMC/CMA): *Calibration and validation of FY-3D optical sensors MERSI-II/HIRAS*

Xiuqing Hu, Na Xu, Chengli Qi, Chunqiang Wu, Hanlie Xu, Peng Zhang

FY-3D satellite was successfully launched at 2:35UTC am on November 15, 2017, and a new member of Fengyun satellite family was added.FY-3D is the fourth satellite of China's second generation polar orbiting meteorological satellite FY-3 with a design life of 5 years. FY-3D is equipped with 10 sets of remote sensing instruments, among which, Hyperspectral InfRared Atmospheric Sounding instrument (HIRAS), Greenhouse Gases Absorption Spectrometer GAS, Wide-angle Aurora Imager WAI and Ionospheric PhotoMeter IPM are completely new instruments and Medium Resolution Spectral Imager MERSI-II is an significantly upgraded instrument with respect to MERSI-1. The application of these new instruments further improves the spectral resolution and spatial observation accuracy, comprehensively enhances the NWP model satellite data assimilation capability, and improves weather forecasting. The key performance evaluation of FY-3D MERSI-II and HIRAS including the spectral calibration, radiometric calibration and geolocation accuracy was conducted using GSICS platform at CMA GSICS research processing center (GPRC). The GSICS-consensus reference instruments IASI, CrIS, MODIS and VIIRS are used to evaluate the radiometric accuracy of MERSI-II and HIRAS. In addition to this, the accurate collocation and inter-comparison between MERSI-II and HIRAS at the same satellite platform FY-3D gave us several important information of their performance, especially the knowledge of HIRAS subpixel geolocation shift. Based on the above GSICS evaluation, mechanism behind radiometric calibration bias of MERSI-II and HIRAS also were found including the non-linearity, polarization effect and other parameters of the instruments. These calibration parameters were updated timely based on comprehensive assessment and iterative validation after launch.

Huang, Allen (SSEC/CIMSS UW-Madison): *What CSPP can do for you and what you can do for CSPP*

Allen Huang, Mitch Goldberg, Liam Gumley, Kathy Strabala and Graeme Martin

Community Satellite Processing Package (CSPP) is intended to support, primarily, the near-real-time LEO/GEO meteorological satellite global user community. These are people who collect direct broadcast (DB), or direct readout (DR), downlink raw data, available to them when satellites are within the range of their receiving antennas and during which time each satellite is broadcasting measurement data currently within its view.

CSPP is designed to use NOAA official level 0 to level 1 calibration and navigation algorithms and level 1 to level 2 retrieval algorithms with a single processing framework. CSPP is capable of processing multispectral and hyperspectral measurements over a wide spectral range, from visible, near infrared, shortwave, mid-wave, long-wave infrared, and microwave measurements.

The data products generated include atmospheric and oceanic products, such as temperature, water vapor, clouds, aerosol, sea/land surface temperature, minor or trace gas column amounts and/or profiles, such as for O3, CO, CO2, and CH4, and finally, environmental products such as fire, flood, volcanic ash and SO2.

To date, the versatility of CSPP has attracted over 2,000 registered users in more than 97 countries, including government operational agencies, research institutes, university academics, and commercial industry. CSPP boasts over 14 independent level 1 and level 2 and visualization/projection packages that combine to process measurements from more than 12 separate space-borne sensor suites.

In this presentation, we overview CSPP's current capabilities and future goals along with a call for users to contribute back to their own user community. We envisage that the CSPP user community may benefit further through user feedback and recommendations, value-added usage, and by the development of unique and innovative applications that may become companion software to CSPP or even an integrated part of future CSPP releases.

Lacava, Teodosio (CNR-IMAA): *25 Years of operation and applications of the IMAA-CNR direct readout satellite receiving station*

Lacava Teodosio, Ciancia Emanuele, Falconieri Alfredo, Faruolo Mariapia, Filizzola Carolina, Genzano Nicola, Lisi Mariano, Marchese Francesco, Mazzeo Giuseppe, Pergola Nicola, Satriano Valeria, Tramutoli Valerio

The direct readout satellite receiving and archiving system of the Institute of Methodologies for Environmental Analysis (IMAA) has been working since 1994. Located in Tito Scalo (Basilicata Region, Southern Italy; 40.601N, 15.724E, 782 m amsl), it started collecting TIROS-N/NOAA 9 data by a 2.1 m diameter antenna; after that, thanks also to a constant updating program, the system has been operational up to now almost without any interruption. The whole NOAA constellation satellites series as well as data acquired by the EOS-NASA, Met-Op, and the Suomi NPP/JPSS-1 satellite/s have been directly acquired. Furthermore, the installation of a EUMETCast reception station in 2005 has also allowed acquiring and analyzing Meteosat First and Second generation data.

All the acquired data are archived in a dedicated storage system, which has fostered the development of the Robust Satellite Techniques (RST) approach, a general methodology for multi-temporal satellite data series analysis. RST has been applied to the analysis of different natural hazards, such as flooding, volcanic eruptions, forest fires, sand storms, etc. Different anthropic risks, such as gas flaring, pipeline monitoring, oil spill, have been also investigated. Thanks to the availability of direct broadcast data, several near-real time services have been also implemented. The RST approach, as well as a few examples of its applications will be shown in this work.

Li, Jun (University of Wisconsin-Madison): *The application of low latency direct broadcast data in regional NWP*

Jun Li, Pei Wang, Timothy J. Schmit, Jinlong Li, Chris Velden, Zhenglong Li, and Agnes Lim

The forecast of local severe storms (LSS) highly depends on how well the pre-convection environment is characterized in the numerical weather prediction (NWP) model analysis. The usefulness of the forecast highly depends on how soon the forecast is updated. Therefore, the data latency is critical for assimilation in regional NWP models, to be able to assimilate more data within the data cut-off window. Such low latency data can be obtained through satellite data direct receiving system. The current polar orbit (LEO satellites (i.e. FY3 series, JPSS, Metop series) have the capability for atmospheric sounding in the pre-convection environment and low latency can be obtained through Direct Broadcast (DB) sites, the geostationary satellites (FY4 series, GOES-R series, Himarari-8/-9) have the capability for monitoring moisture changes in pre-convection with high spatial and temporal resolutions, and low latency can be obtained through receiving the geostationary rebroadcast (GRB) L1B data. Those low latency data from LEO and GEO are very useful for improving the rapid changing weather forecasts through assimilating into high resolution regional NWP.

Impact studies have been conducted on the assimilation of radiances, derived layered precipitable water (LPW) and rapid scan AMVs from ABI, positive impact and added value are found from the assimilation of new information from GEO satellites, indicating the potential real-time or near-real time (NRT) application of GRB data. For LEO latency impact, in general, there is a trade-off between the number of observations and latency. Low latency ensures observations closer to model analysis time, which is beneficial to NWP, but may result in fewer observations available for the model. The observing system experiments (OSE) is performed to study the impact of data latency on LSS forecasts. The experiments assimilate all existing observations, including conventional data (from the GTS) and satellite data (AMSU-A, ATMS, CrIS and IASI), they are carried out in a nested domain with horizontal resolution of 9 km and 3 km, respectively with WRF model. The ETS/FAR/POD scores of the LSS precipitation forecasts are calculated and compared with different data cut-off widows to evaluate the data latency impact. Results show that low latency can lead to improved positive impact on precipitation and other forecasts, which indicates the potential application of LEO DB data in high regional NWP for LSS forecasts.

Li, Sanmei (George Mason University): *Contributions of GEO-LEO Satellite Imagery in Flood Mapping for Flood Forecasting and Monitoring*

Sanmei Li, Donglian Sun, Mitchell Goldberg, and William Sjoberg

Globally impacting human lives and properties, floods are the most frequent natural disasters. Accurate and timely flood mapping plays a significant role in flood forecasting and investigation for river forecasters and decision-makers.

With the high spatial resolution and global data coverage, imagery from the polar-orbit satellites such as Suomi-NPP/VIIRS and NOAA-20/VIIRS remains critical for flood mapping, but flood

detection with LEO satellite imagery are easily affected by clouds and cloud shadows due to the data availability once a day in mid to low latitudes. In comparison to LEO satellite imagery, imagery from the new-generation geostationary satellites such as the GOES-16/ABI and Himawari-8/AHI are available every 5 to 15 minutes. The high temporal resolution allows more clear-sky views for flood mapping, although the spatial resolution is as relatively low as 1km. Combining utilization of the LEO and GEO satellite imagery shows great advantages in flood mapping. Under clear-sky coverage, the floodwater detected in LEO satellite imagery shows rich inundation detail; while under non-clear-sky conditions, composition from multiple GEO satellite images provides more clear-sky coverage for flood detection and the clear-sky information can be used to fill the gaps of clouds and cloud shadows in LEO imagery.

With the support from NOAA/NASA JPSS Program, efforts have been made to apply LEO and GEO satellite imagery in global flood mapping. VNG Flood Ver1.0 has been released and distributed through CSPP for global flood mapping using Suomi-NPP/VIIRS and NOAA-20/VIIRS imagery. Later, GOES-16/ABI imagery has been integrated into the software and shows substantially improved flood-mapping capability in the CONUS. Demonstration of the data from Himawari-8/AHI, FY-3D/MERSI and FY-4A/AGRI in flood detection has also proved of significant improvements on flood mapping in local regions, which encourages extensive collaboration among satellite agencies for a more robust global GEO-LEO flood mapping system.

Li, Yue (University of Wisconsin/SSEC): *Retrieval of cloud properties from FY-3 observations in the CLAVR-x system*

Yue Li, Andrew Heidinger, Steve Wanzong, Denis Botambekov, Andi Walther, William Straka

The CLouds from AVHRR Extended (CLAVR-x) system is NOAA's operational cloud processing system for the AVHRR sensors on the NOAA Polar Operational Environmental Satellites and EUMETSAT-METOP series. CLAVR-x also provides the development platform for the GOES-16/17 ABI and Suomi-NPP/NOAA-20 VIIRS cloud retrieval algorithms. CLAVR-x is part of the Community Satellite Processing Package-LEO (CSPP-LEO) and provides key cloud parameters available for the meteorological society to use. Current supported sensors in CLAVR-x CSPP-LEO include NOAA-18, NOAA-19, MetOP-A an MetOP-B AVHRR, Aqua and Terra MODIS, and Suomi-NPP. In this study, we will present the retrieval of cloud properties from FY3 observations – the second generation Chinese polar-orbiting meteorological satellite systems in CLAVR-x. A comparison between CLAVR-x retrievals and level-2 products obtained from China Meteorological Administration/National Satellite Meteorological Center (CMA/NSMC) will be demonstrated.

Lin, Dan (weather modification office of sichuan province): *ANALYSIS ON AN AIRBORNE PRECIPITATION ENHANCEMENT EXPERIMENT IN NORTHEASTERN SICHUAN*

LIN Dan, LIU Ping, LIU Guihua, WANG Weijia, FAN Sirui

This paper is addressed on a field airborne precipitation enhancement experiment which was carried out on November, 11, 2018 in Sichuan Basin, Southwest China. Based on the

precipitation enhancement techniques by glaciogenic seeding, silver iodide flares were utilized to affect the ice phase processes in the cold clouds where the supercooled water was sufficient while the ice crystals were insufficient. To analyze the macro and micro characteristics variation produced by the glaciogenic seeding, some microphysical parameters from FY-4A geostationary satellite and AQUA polar orbiting satellite are utilized as well as the raingauge data from the ground meteorological stations and the sounding data. Before the seeding, the skies over Sichuan Basin are mainly covered by medium and low level clouds that are moving eastward. The height of the cloud base is around 1000 meters, the cloud thickness is 3000-4000 meters, and the cloud top temperature is around -10°C. Satellite inversion shows that the medium and low level clouds are rich in supercooled water with small cloud particle effective radius which is about 10 microns. The particles in the cloud are mainly liquid state, and the clouds lack of ice crystals. It is therefore unable to effectively initiate physical processes of cold cloud growth. From Beijing Time 12:00 to 13:00, airborne seeding was carried out in the northeastern area of the Sichuan Basin. The \"S\" route was used to seed with burning silver iodide catalyst. The seeding height is 5000 meters; the seeding layer temperature is -8°C; the upper wind direction is west; and the wind speed is about 15m/s. Following the selection principle of the comparison area, the precipitation in the affected area and the comparison area are compared. FY-4A geostationary satellite observations show that there is no high cloud configuration before the seeding, and after seeding, the cloud particle effective radius increases, and the cloud top temperature decreases. The FY-4A geostationary satellite has wide range, high time and spatial resolution, and easy access to data. By using multichannel synthesis technology to generate cloud micro-physical composite maps and cloud phase composite maps, combining with cloud top brightness, the supercooled water area could be effectively identified and tracked, and cloud microscopic characteristics and variation could be obtained, which have important practical significance for scientific design of artificial precipitation enhancement experiments.

Liu, Shay (Indiana University Bloomington): *Southern Hemisphere Cloud-climate Variability Detection by Legacy Satellites*

Shay (Xuechang) Liu, Paul Staten, Brian Kahn, and Mathias Schreier

The imager-sounder combination of AVHRR and HIRS has been flown aboard a series of satellite missions since late 1970s, and thus has the potential to provide satellite data for climate study over three decades. This study employs a novel method that “stitches” imager and sounder data together to create a cloud type-specified brightness temperature dataset with a 4x4 km spatial resolution at 19 spectral channels. This dataset has been used to detect the signatures of cloudiness with modes of climate variability in southern hemisphere on interannual timescale, namely, multivariate ENSO index (MEI) and southern annular mode (SAM). Current findings have confirmed various regional cloud-climate patterns in other studies, such as the poleward and upward shift of midlatitude high clouds, and have shed light on the capability of higher statistical moments of our dataset.

Majewski, Leon (Australian Bureau of Meteorology): *Use of directly-received space-based observations for improved user outcomes*

Leon Majewski, Ian Grant, Fiona Smith, David Howard

The Australian Bureau of Meteorology operates a network of satellite reception stations with both tracking and fixed antennas for the reception of meteorological satellites in low-Earth and geostationary orbits, respectively. The satellite observations and derived quantities provided from these sites are vital to routine and severe weather operations. Operational meteorologists rely upon accurate model fields, which are overwhelmingly driven by satellite observations of the atmosphere from polar satellites. These model fields are used in conjunction with frequently updated satellite imagery to build a conceptual model of the atmosphere to provide guidance to the public and industry.

There is an increasing use of quantitative products by industry partners. Many of these products are derived using algorithms and utilities provided by the Community Satellite Processing Package. For example, vegetation indices are provided to the Epidemic Thunderstorm Asthma Project as an input to the modelling of thunderstorm asthma risk which is then communicated to the public by the Victorian State Government.

Similarly, there is an increase in the use of observations from multiple platforms to provide improved, consistent guidance. In the case of fire hotspot detections, Himawari-8/9 observations are able to provide frequent updates of fire activity. These detections are combined with the small footprint and high sensitivity of the VIIRS active fires products to provide emergency services with a greater understanding of the active fire front and associated meteorological conditions.

The Bureau's updated network of satellite reception stations and use of CSPP will be discussed.

Martin, Graeme (UW-Madison SSEC/CIMSS): *CSPP Geo Status and Plans*

The CSPP Geo project is funded by the NOAA GOES-R Program to create and distribute software allowing users to process direct broadcast data received from geostationary weather satellites. Supported satellites include the US GOES-R and GVAR series, as well as the Japanese Himawari-8 satellite. Capabilities include real-time generation of base products from the Advanced Baseline Imager (ABI), Geostationary Lightning Mapper (GLM) and space weather instruments on the GOES-R series, as well as Level 2 geophysical products from the Advanced Himawari Imager (AHI) on Himawari-8. This presentation will provide an overview of the available software packages, including the GOES Rebroadcast (GRB) package, AIT Framework and GEOCAT Level 2 packages, and the newly released Geo2Grid package to create high quality RGB imagery and animations. Project status, recent developments and ongoing work will be discussed, including a look at AIT Framework Version 1.0. Future plans will be covered, including added Level 2 capabilities and GOES-17 thermal anomaly mitigation.

Pujiastuti, Tyas (BMKG): *Himawari-8 Observation of Significant Krakatau Eruption on December 2018*

Tyas Tri Pujiastuti; Bony Septian Pandjaitan; Asri Susilawati; Sugeng Indarto

This paper discussed Himawari-8 observation of Krakatau eruption on December 2018, the event related to significant impact including landslide, massive wave, and tsunami in Pangandaran coast. Not only cloud obscuration due to Asian monsoon during the eruption, the volcano itself was creating a mount of volcanic Cb. Various RGB schemes were used to acquire informations about volcanic ash dispersion, SO2, and volcanic Cb.

Qin, Luyao (Nanjing University of Information Science & Technology): *Preliminary test and analysis of dynamic cloud detection scheme for microwave temperature sounding channels*

Luyao Qin, Gang Ma and Yaodeng Chen

As one of the most important observation for numerical weather prediction (NWP), microwave radiances at 50-60GHz can provide vertical information of atmospheric temperature under non-precipitation conditions. The removal of radiance affected by cloud and precipitation is one of the most important factors in satellite data assimilation. In the traditional methods of microwave temperature sounder radiance cloud detection, the radiances in channels which have weighting functions peaks under 100hPa are removed when the cloud water content of a certain pixel exceeds the threshold. As a result, a large number of effective observations could be wasted. In fact, there are geometric heights in the clouds. When the cloud top height is lower than the height of the channel observation, it can be considered that the observation of this channel is not affected by cloud and precipitation.

In order to fully use microwave radiances, this study evaluates the influence of cloud parameters on simulating radiances at 50-60GHz in detail. First of all, the effects of the vertical distribution of cloud liquid water (CLW) on simulating microwave brightness temperature at different channels are analyzed. It indicates that the accuracy of calculating transmittance and simulating brightness temperature at 54.4GHz, 54.94GHz and 55.5GHz are affected by changing the height of CLW. Furthermore, a lookup table is established according to the relationship between pixel cloud height, cloud fraction and simulation accuracy, and then a dynamic cloud detection (DCD) scheme is developed based on the table. One-week experiment is carried out using FY-3D MWTS-II radiances to evaluate the DCD scheme. By using real-time cloud top height and cloud fraction data matched to MWTS-II pixels, the result shows that the DCD scheme can choose channels which are free of clouds affection. Then the number of upper level microwave data is increased. Meanwhile, by screening the cloud-contaminated satellite measurements, the mean, standard deviation, and root mean square of O-B (the difference between observed and the simulated brightness temperature) at 54.4GHz, 54.94GHz and 55.5GHz are smaller. This shows that the quality of the cloud-screened microwave radiances is improved, which laid a foundation for the application of MWTS-II radiances in the NWP data assimilation system.

Reed, Bonnie (JPSS/STC): *NOAA Level 2 Geophysical Products from VIIRS, CrIS, and ATMS: Overview and status of releases via CSPP*

Bonnie Reed, Mitch Goldberg, Arron Layns

The Joint Polar Satellite System (JPSS) Suomi National Polar-orbiting Partnership (S-NPP) and NOAA-20 satellites provide global coverage of level-2 geophysical products from the Visible Infrared Imaging Radiometer Suite, (VIIRS), Cross-track Infrared Sounder (CrIS), and the Advanced Technology Microwave Sounder (ATMS) instruments. These imagery, cloud, aerosol, land, ocean and atmospheric products are available to users via the NOAA Product Distribution and Access (PDA) and the Comprehensive Large Array-data Stewardship System (CLASS). In addition to these dissemination systems, the JPSS program has been working with the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin (UW) to migrate the JPSS algorithms to the Community Satellite Processing Package (CSPP) which supports the Direct Broadcast (DB) meteorological and environmental satellite community through the packaging and distribution of free open source science software. This talk will describe the algorithms that are currently available within CSPP and provide the migration plan for the remaining algorithms included in the CSPP software suite.

Smith, William (UW-SSEC): *Use of Direct Broadcast Leo and Geo Soundings for Numerical Weather Prediction*

W. Smith Sr.,R. Knuteson, H. Revercomb, D. Tobin, E. Weisz, M. Shao, Q. Zhang,

Direct broadcast polar satellite 15-km resolution CrIS and IASI hyper-spectral radiances are combined with Himawari satellite AHI multi-spectral radiances to produce synthetic geo-hyper-spectral radiances from the AHI data over China at a 1-hour/2-km resolution. For the same region and time period, FY4-A geostationary satellite 1-hour/16-km resolution GIIRS hyper-spectral resolution radiance data are combined with Himawari AHI multi-spectral radiances to also produce synthetic geo-hyper-spectral radiances at the 1-hour/2-km resolution. Information content differences between these two sounding data sets are due to the time resolution of the hyper-spectral data, the polar orbiting data being 12-hours per satellite and the Geostationary orbiting data being 1-hour or less, dependent on the total area coverage being provided by the GIIRS sensor. These data sets are assimilated into a regional high-resolution numerical forecast model to demonstrate the importance of the time resolution of the hyper-spectral resolution data for the diagnosis of atmospheric wind profiles as well as for the prediction of severe convective storms. These results support the development of a high spatial resolution geostationary satellite-sounding instrument by the USA. The high temporal resolution hyper-spectral sounding data over the western hemisphere is needed to provide a global coverage through their combination with the Asian and European geo-stationary hyper-spectral sounding coverage planned for the next decade.

Strabala, Kathleen (UW-Madison/SSEC/CIMSS): *Polar2Grid and Geo2Grid: Open source image creation software*

Kathleen Strabala and David Hoese

Meteorological instruments such as those on the JPSS and GOES satellites pose substantial challenges for providing scientists, forecasters, and the general public with useful high quality images. To make high quality imagery, remote sensing satellite data must be carefully processed and how that is done depends on a couple of key factors. Factors like the type of instrument that observed the data (Imager, Sounder, etc.), what software generated the data files, how the data is stored (HDF4, HDF5, NetCDF, etc.), and what tool will be visualizing or using the data can completely change and complicate how data is processed. To simplify these operations, NOAA has funded the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin to create a pair of open source command line tools called Polar2Grid and Geo2Grid. These easy to install tools provide an interface for converting satellite data file formats to widely used formats and structures required by various visualization tools, including GeoTIFFs, US National Weather Service (NWS) AWIPS compatible NetCDF files, and NinJo forecasting workstation compatible TIFF images. These tools handle all of the complexity involved in this conversion including resampling to custom uniform grids or regions of interest, perceptual enhancements, atmospheric corrections, and RGB, including true color, image creation. While the tools provide simple interfaces, they do not sacrifice performance and can complete the conversions in seconds on large swaths of data. Polar2Grid is currently providing VIIRS imagery over the Continental United States, as well as Alaska, Hawaii, Puerto Rico, and Guam from various Direct-Broadcast antennas to operational forecasters at the NOAA NWS offices in their AWIPS terminals, within minutes of an overpass of the Suomi NPP and NOAA-20 satellites. Six years after Polar2Grid development started, the Polar2Grid team is getting ready to release version 3.0 of the software. Geo2Grid version 1.0 software, which supports GOES-16 and GOES-17 ABI and Himawari-8 AHI was released on 1 March 2019.

Xi, Shuang (National Satellite Meteorological Center): *Ways to Improve the Quantity of Polar-Orbit Satellite Data in Regional Weather Forecasting Model——Preliminary Analysis of DBNet Data and Its Characteristics*

In the investigation of the national and local models of regional numerical prediction in China, it was found that the polar-orbit meteorological satellite radiance data is not widely used in regional numerical prediction, and the long delay in data receiving may be one of the reasons. Meanwhile, DBNet (Direct Broadcast Network for Near Real-Time Relay of Low Earth Orbit Satellite Data) data, is little known by nationwide numerical prediction users.

At present in our country, numerical forecasting operation have been established in almost all the regional NWP centers. It is well proved that data of microwave thermometer in ATOVS series polar orbit meteorological satellite, can provide vertical atmospheric temperature sounding information, and is benefit for the global numerical forecast business. But in regional numerical prediction operations in China, there is seldom assimilation of polar orbit satellite data, because of little data available in the assimilating time window.

Firstly, the five sources of ATOVS data in China Meteorological Adminstration (CMA) was sorted out in this paper, including 3 kinds of DBNet data and 2 kinds of global data. The five sources contain different polar-orbit satellites, as well as observation coverages. Regional information can fill gaps in global information. Previously, DBNet data had not been used in numerical prediction in China.

Secondly, in regional model and assimilation under a quasi-real-time environment, DBNet data and global data were both put into a real-time regional assimilation system. And the data quantities, and coverages of ATOVS microwave thermometer data from various sources were studied and analyzed, within the regional scope and assimilating time window.

Then the results show that the combined using of multiple satellites from multiple sources can improve the receiving time and extend the data coverage, and thus increasing the amount of polar-orbit meteorological satellite data in regional assimilation operations. The data analysis from June to December 2018 shows that the application of DBNet data increases the total data quantities by more than 100% and the coverages of the regional area by more than 50%.

Therefore, it is necessary to popularize the application of DBNet data in numerical prediction in China. Through analysis, it is also pointed out in this paper that the problems that need to be paid attention to, when using DBNet data, such as the differences in bright temperature and positioning between RARS regional station receiving data and global NESDIS data. These efforts have provided examples and advices for operational assimilation applications of multi-source satellite data.

Keywords: satellite data assimilation, regional numerical prediction, DBNet

Xian, Di (NSMC): *Introduction to Fengyun satellites data dissimilation and broadcasting systems*

XIAN Di, XU Zhe, YANG Lei, ZHANG Peng, YANG Zhongdong, LI Xue, JIA Xu, LIU Chang

With the new generation Fengyun GEO satellite FY-4A and new LEO Fengyun satellites FY-3D are operational running, the need to these new Fengyun satellites data are huge. NSMC has released the preprocessing packages for FY-3D to the community. Because of the huge data amount of FY-4A, FY-4A direct broadcasting systems and CMACast broadcasting systems complement each other. Besides, NSMC has built a data dissimilation system based internet and public cloud to increase the timeliness of Fengyun satellite data. To support CSPP users community, NSMC will fasten data transfer ability and strengthen users application systems based ‘cloud + client’ architecture.

Xie, Hua (IMSG @ NOAA/NESDIS/STAR/ASSISTT): *NOAA Algorithm Scientific Software Integration and System Transition Team (ASSISTT) Collaboration with CSPP Geo on Level 2 Product Software*

Hua Xie, Shanna Sampson, Thomas S. King, Yunhui Zhao, Claire McCaskill, Rickey Rollins, Aiwu Li, Brian Helgans, Walter W. Wolf

The Algorithm Scientific Software Integration and System Transition Team (ASSISTT) at NOAA/NESDIS/STAR leverages its effective model for transitioning algorithms from research to operations in support of doing the same for CSPP. This collaboration with CSPP provides the project with algorithms that are either identical or closely comparable with those currently running in operations.

ASSISTT handles much of the routine transition to operations work at STAR using the STAR Algorithm Processing Framework (SAPF). This framework offers an organized way of transferring algorithms to CSPP, and these algorithms have already been verified and validated through the transition to operations lifecycle process.

After the algorithms have been successfully implemented into CSPP, ASSISTT locally runs CSPP stand-alone on a regular machine as well as in a Docker container on the ASSISTT cluster. ASSISTT further conducts in depth comparison to ensure that the algorithms run in direct broadcast are comparable to the ones running in operations. Examples of comparison for baseline Cloud Mask on GOES-16 shall be provided.

Yang, Lei (National Satellite Meteorological Center CMA): *Evolution of Fengyun-3 Direct Broadcasting Software Package*

Lei Yang, Peng Zhang, Zhongdong Yang, Aijun Zhu, Xiuqing Hu, Di Xian and Maonong Ran

The Fengyun-3 polar program now has four on-orbit satellites since 2008, which consistently provides the earth observation data for the imagery and soundings. All Fengyun-3 polar satellites have the direct broadcasting ability by which any ground station within the view of the satellite with appropriate hardware can receive and process the satellite data. The Fengyun-3 direct broadcasting data includes both the imagery and sounding data. NSMC has released the DB software freely via the website since 2008. The software can process the Fengyun-3 data from L0 to L1 data with geolocation and calibration. In this paper, we will provide an overview of the DB software, including the software capabilities for the current and future satellites, Fengyun-3 DB service for the users who are both from the Chinese domestic and the international regions, and recommended hardware configuration. With those efforts, NSMC try to help advancing the NWP, climate and environmental communities.

Zhang, Peng (National Satellite Meteorological Center CMA): *Overview of the CMA Fengyun Meteorological Satellite Program*

Peng Zhang

Overview of the CMA Fengyun Meteorological Satellite Program

Zhou, Lihang (NOAA): *NOAA-20 Data Product Performance Updates for CSPP Users*

Lihang Zhou, Murty Divakarla, Xingpin Liu, Changyong Cao, Ivan Csiszar, Tom Atkins, Satya Kalluri, Arron Layns, and Mitch Goldberg

The JPSS program at the center for SaTellite Applications and Research (JSTAR) led the development and calibration/validation (Cal/Val) of JPSS science algorithms to generate a vast number of products which are operationally available to NOAA stakeholders and users. By far the S-NPP data products have passed through the Cal/Val validated maturity stage, and at the long-term monitoring and reactive maintenance phase. The NOAA-20 Key Performance Parameters (KPPs) products have all reached validated maturity and met the users' requirements. The other NOAA-20 EDR products are currently going through the Cal/Val process as planned. The S-NPP/NOAA-20 satellite data products are disseminated operationally to the NOAA and user agencies worldwide. Progress on using S-NPP and NOAA-20 products in Numerical Weather Prediction (NWP) assimilations, in support of predicting key weather phenomena (e.g. hurricanes, blizzards), and for nowcasting and event-based applications (e.g. flash floods, volcanic ash, wildfires etc.), have shown remarkable success. The ability to derive JPSS products regionally at a much higher latency through Direct Broadcast (DB) networks using Community Satellite Processing Packages (CSPP) has been extremely fruitful for many real-time applications. This paper presents the details of the NOAA-20/S-NPP product performance evaluations and highlights some of the science applications of these products for the CSPP users.

Poster Presentations

2019 CSPP in Chengdu, China

Bearson, Nick (SSEC): *CSPP CLAVR-x*

Nick Bearson, Andrew Heidinger, Denis Botambekov, Kathy Strabala, Liam Gumley

The Clouds from AVHRR Extended System (CLAVR-x) is a processing system developed at NOAA/NESDIS and UW/CIMSS for generating quantitative cloud products in real-time from AVHRR, MODIS, VIIRS, and other sensors. CLAVR-x was first packaged and released for the direct broadcast community as part of the CSPP suite in May 2014 and receives ongoing support. We report on the capabilities of CSPP CLAVR-x and improvements users can find in the latest version, including NOAA-20 and MetOp-C support, improved output configuration, and algorithm updates.

Botambekov, Denis (SSEC/University of Wisconsin-Madison): *Cloud Properties from FY-4 in CLAVR-x Processing System.*

Denis Botambekov, Andrew Heidinger, Steve Wanzong, Yue Li, Andi Walther, William Straka

The first version of the CSPP CLAVR-x (The Clouds from AVHRR Extended) was released in 2013. The CLAVR-x processing system with CSPP wrapper provides users official NOAA Enterprise cloud algorithms, some surface and other products for polar-orbiting AVHRR, MODIS, VIIRS, and Geostationary Imagers ABI, AHI, SEVIRI, COMS. Since then many users all over the world are using the CSPP CLAVR-x.

The new FY-4a - second-generation geostationary satellite, positioned at the 105E longitude, is added to the CLAVR-x. The results of performance of cloud detection and cloud properties algorithms will be presented with comparisons to Himawari-8/AHI and collocated CALIPSO/CALIOP data.

Costa, Ozeas (The Ohio State University): *Using satellite based AOD to estimate particulate matter in Qatar*

We used a combination of daily aerosol optical depth (AOD) data from the Moderate Resolution Imaging Spectro-radiometer (MODIS) and ground measurements using a Dylos air quality monitor (a laser particle counter) to estimate particle matter air quality over a number of locations throughout the country of Qatar, in the Middle East. An empirical relationship between AOD and PM air quality was obtained from these datasets (linear correlation coefficient of 0.78) and was used to evaluate annual and seasonal trends in air pollution in Qatar since 2012.

Haibo, Xu (National University of Defense Technology): *New Method for Determining Cloud-Top Height from Stereoscopic Observation based on FY-4A and Himawari-8 satellites*

Xu Haibo, Du Huadong

High temporal and spatial resolution of new generation geostationary satellite such as FY-4A and Himawari-8 contributes to the improvement of geometric method for determining cloud top height(CTH). A new method based on Convolutional Neural Network(CNN) has been used to accurately match images from FY-4A and Himawari-8 respectively, and CTHs are determined through spherical and plane triangular relationships of satellites, earth core, projected-cloud and true-cloud. The new method has been applied to retrieve CTHs in South China Sea between August to September 2018. A comparison between the results and CloudSat data is conducted for validation.

Huang, Allen (SSEC/CIMSS UW-Madison): *The Quest for the Most Effective CSPP Training*

Allen Huang and Mitch Goldberg

Over the years, the CSPP development team has offered many forms of training courses, workshops, scientific lectures, operation instructions and the use of a basic form of user's menu for package installation and software operation.

In this poster we are not only to illustrate the past forms and approaches of CSPP training and public outreach related activities and events but also to interactively inform users about our planned training formats, contents, and targeted trainees and furthermore, to solicit inputs and ideas about how users envisage the optimal training courses that they like to receive.

This first dynamic and interactive 2019 CSPP training subject poster will have ample opportunity for viewers to voice their desire of which areas of training and reeducation that they wish to have along with subject details such as fundamental remote sensing theory, algorithm theoretical based principle, products performance uncertainties, limitations, and others related to processing technique, and timeliness and available tools for projection, mapping, visualization, and information integration are also included for deliberation.

Jin, Sha (HUAYUN ShineTek, Beijing China): *3.5m Vehicle-mounted Antenna System for Satellite Telemetry and Data Receiving*

Jia Shubo, Liang Yonglou, Sha Jin

With the opening of the satellite telemetry market, China's domestic satellite telemetry systems are springing up all over the world. However, for the mobile and portable needs of some sites, many systems are still unable to meet. In addition, on the basis of satellite telemetry, there are few multi-functional systems that can verify the load data broadcast by satellites. So few, the key technical point is the mobile and portable transformation of antenna system.

Based on the investigation of various types of mobile and portable antennas, the design scheme of 3.5m vehicle antenna system for satellite telemetry and data reception is given. In the second chapter, the system requirements are elaborated in detail, and functional analysis is carried out. In the third chapter, the overall design scheme of the 3.5m vehicle antenna system is given. Chapter IV and Chapter V will respectively elaborate the electrical design and structural design of the antenna system. In Chapter 6, the tracking mode of the antenna system is explained, and the corresponding indicators are given. Chapter 7 describes the servo control part of the antenna system and its specific interface.

Finally, this paper realizes the design of 3.5 meters vehicle antenna system, and provides technical basis for its subsequent production and processing.

Liu, Xingpin (NOAA/STAR IMSG): *Applications of JPSS/NOAA-20 Limb Corrected ATMS Observations for Severe Weather Monitoring*

Xingpin Liu, Lihang Zhou, Quanhua Liu, and Mitch Goldberg

The Suomi National Polar-orbiting Partnership (S-NPP) satellite, launched in October 2011, initiated a series of the next generation weather satellites for the National Oceanic and Atmospheric Administration (NOAA) Joint Polar Satellite System (JPSS) program. The Advanced Technology Microwave Sounders (ATMS), carried onboard the S-NPP and the recently launched JPSS-1 (renamed as NOAA-20) satellites, is a follow-on instrument to the Advanced Microwave Sounding Unit (AMSU). A feature of a cross-track sounder is that the measurements vary with scan angle because of changes in the optical pathlength through the Earth's atmosphere between the Earth and the satellite. This feature is called the limb effect. By performing the limb correction we transform the data into the values they would have been observed in a nadir view and remove the scan angle effects. The limb corrected ATMS are generated as ATMS imagery products and have been made available on the JPSS STAR web server. It is also going to be integrated as part of the Microwave Integrated Retrieval System (MiRS) system and will be made available to the direct broadcast users.

A preliminary set of NOAA-20 ATMS limb correction coefficient was calculated using the December 1-29, 2017 training data set. With the ATMS algorithm reached the validated maturity on July 5th, 2018, it is necessary to update the limb correction coefficients with more maturated training data set. This paper will present the detail of the updated NOAA-20 ATMS limb correction coefficient set and the corresponding results. Comparisons with the NOAA-20 limb corrected ATMS from previous coefficient set, and with the SNPP limb corrected ATMS, will also be briefed. This paper will also present some applications of limb corrected ATMS towards monitoring the severe weather events, such as Hurricanes.

Mindock, Scott (SSEC /CIMSS): *CSPP SDR and CSPP VIIRS ASCI, Level 1 and 2 Products at your fingertips*

Scott Mindock, Ray Garcia, Graeme Martin, Kathy Strabala, Nick Bearson, Liam Gumley, Allen Huang

The CSPP (Community Science Processing Package) Team at SSEC/CIMSS has created the CSPP VIIRS ASCI 1.0 software to support SNPP and JPSS-1 Level 2 product creation. The CSPP VIIRS ASCI package creates Enterprise Level, Cloud, Ice, Snow, Ash and Aerosol products using NOAA/NESDIS Enterprise Level algorithms. The CSPP SDR package creates Level 1 (SDRs) from SNPP and J01 RDRs acquired from Direct Broadcast. CSPP VIIRS ASCI allows the user control over the creation of Cloud, Ice, Snow, Volcanic Ash and Aerosol products. CSPP SDR and CSPP VIIRS ASCI work beautifully together. SDRs created with CSPP SDR are used as input to CSPP VIIRS ASCI providing a complete set of Cloud products from your antenna. The packages also provide quick-look capabilities for a wide variety of products.

Mindock, Scott (SSEC /CIMSS): *CSPP User Group 2019 Deploying CSPP applications with virtualization*

Scott Mindock, Ray Garcia, Graeme Martin, Kathy Strabala, Nick Bearson, Liam Gumley, Allen Huang

CSPP software packages are developed and tested on the Centos 6 platform. CSPP Users may choose or be required to run on other platforms, in addition CSPP Users may not have control the versions of the CSPP packages they are using. This can create problems for users desiring to use the latest CSPP packages. The CSPP team has been exploring package deployment using virtualization technology. Virtualized deployment will be examined. Different deployment scenarios will be defined and examined, Comparisons of virtual machines, to containers and other technologies will be made. Potential downfalls and solutions will be explored and shared, so that recommendations and guidelines can be established for CSPP users.

Shao, Min (Hampton University): *Impact of Atmospheric Retrievals on Hurricane Florence/Michael Forecasts in a Regional NWP Model*

Min Shao, William L. Smith

Adding atmospheric information to the initial conditions of a numerical forecast model is critical for improving regional nowcasting and forecasting severe weather events such as convection storms and hurricanes. The hyperspectral instruments onboard the polar orbiting satellites provide high temporal and spatial resolution atmospheric temperature and water vapor information. Atmospheric temperature and water vapor profiles with acceptable qualities under clear condition and above clouds are derived using the Dual-Regression (DR) algorithm based on the Principle Component based Radiative Transfer Model (PCRTM). The application of the derived atmospheric retrievals with high temporal and spatial resolutions in a regional weather model is studied for two hurricane cases by assimilating the retrievals in an hourly update cycle. Improvements on hurricane forecast are obtained by assimilating satellite retrievals as compared to both conventional operational data and radiance assimilation. Position of the

predicted hurricane center which is especially critical for landfall position is corrected with a maximum improvement of 45 km compared to conventional assimilation. Predictions of heavy precipitation produced by hurricanes are improved with smaller bias and Standard Deviation (STD). Precipitation scores used for the validation of predictions also show great improvements in heavy precipitation forecast against conventional data and radiance assimilation. Potential applications of such approaches can be applied to assimilating the retrieved information from the geostationary satellite instruments by adding higher temporal and horizontal resolutions to the polar satellite hyperspectral sounding data.

Wang, Mingshi (Space Star Technology Co.,Ltd.): *FY-3D satellite product generation system design and implementation*

Product generation system is the core mainline operation system of fy-3d satellite ground application system. The main objective is to generate a variety of geophysical parameter products that can reflect the characteristics of atmosphere, cloud, land surface, sea surface and space environment from the data of multiple spectral data through the comprehensive use of multiple information quantitative extraction methods based on L1 data observed by satellite instruments and auxiliary data. The overall design principle of the system is stability, extensibility and maintainability, standardization and normalization. Meanwhile, the efficiency, usability and robustness are improved to meet the requirements of the operation system.

Wang, Yanting (HUAYUN ShineTek): *Cloud Shadow Detection and Elimination Technology Based on FY-3D MERSI-II Vegetation underlying surface data*

FY-3D was launched in November 2017.The Medium Resolution Spectral Imager-2 (MERSI-II) onboard Fengyun-3D, which data play an important role in many fields, such as ocean, land and so on. But, the data of almost four months in summer , there are many clouds and cloud shadows, coverd on different underlying surfaces. And due to the difference of their radiation characteristics from other surfaces,it limits the application of MERSI-II global data, especially for product inversion and application. At present, cloud detection technology is basically mature, but cloud shadow, especially the shadows of fragmented clouds, which is dense and extremely difficult to detect and remove. Therefore, after studying the characteristics of a large number of MERSI-II data in different seasons and different underlying surfaces, this paper innovatively proposes to use the correlation of multi-day data to identify cloud shadow for vegetation underlying surface, and using technology of synthesizing multi-day data to eliminate cloud shadow based on the principle of Gemma.And it has achieved good results. At present, some images have been included in the production of Fengyun 3 Atlas of the NSMC, and the subsequent economic product application has been considered.

Keywords: cloud shadow, radiation characteristics, Gemma, Fengyun 3 Atlas

Wang, Yanting (HUAYUN ShineTek): *Inter-Orbital Data Fusion Technology of FY-3D MERSI-II Instrument*

Junjie YAN, Yanting WANG

The Medium Resolution Spectral Imager-2 (MERSI-II) onboard Fengyun-3D (FY-3D) satellite, which was launched in November 2017. MERSI-II joins all the spectral bands with Visible and Infrared Radiometer and has the capability to observe virtually the entire Earth every day via a set of 25 spectral bands at nadir geometric instantaneous fields of view (FOVs) of 250 and 1000 m. The FY3D orbits around Earth for a period of 102 minutes. Due to the time delay of two adjacent orbits, the difference of solar zenith angle, solar azimuth angle and calibration between adjacent orbits near the mosaic area in the global image. Therefore, there are usually obvious gaps or color difference in the global mosaic. These gaps limit the application of MERSI-II global data, especially for vegetation monitoring and urban heat island monitoring. Based on a certain optimization algorithm which use satellite zenith angle to correct the orbit differential, this paper proposes a progressive data fusion technology for polar satellite and develops corresponding engineering modules to eliminate the data difference between orbits. The application of this technology in the FY-3D satellite service system has achieved significant results and improved the performance of series remote sensing retrieval products of MERSI-II.
Key words: FOVs, satellite zenith angle, Solar azimuth angle, data fusion

Zhang, Fangfang (HUAYUN ShineTek): *An improved fire detection algorithm for Himawari-8 /AHI*

QU Jianhua, ZHANG Fangfang, WANG Ding

Abstract: This paper describes an improved fire detection algorithm based the continuous phase change on the two channels of Himawari-8 3.9 μm and 11.2 μm. Continuous phase change studies were performed on two channels of Himawari-8 3.9 μm and 11.2 μm. According to the results on the brightness temperature change of different latitude under clear sky conditions in one day, it is concluded that the brightness temperature change is stable and obvious. When the fire happens, the brightness temperature of 3.9 μm channel changes rapider than 11.2 μm channel between two continuous ten minutes. An improved fire detection algorithm is proposed based on this change studies, and considers the visible spectra effect on the 3.9 μm channel during the day time. Experiments with this algorithm have been carried out in several places, such as the serious explosive fire near a chemical plant in Qiaodong District, Zhangjiakou City, Hebei Province, at 16:40 (UTC) on November 27, 2018, a fire incident near the northeast border of China and Australia, and the improved fire detection algorithm was used to quickly and effectively extract the fire points. The results show that the algorithm can perform fire detection well, and can solve the fire detection on snow , during twilight ,and so on.

Keywords：Himawari-8；AHI；fire detection；high-frequency observation; phase change; brightness temperature;

Zhonghui, Tan (National University of Defense Technology): *Estimation of Cloud Base Height for FY-4A Satellite based on Random Forest Algorithm*

Tan Zhonghui, Yan Wei, Yu Zhuofu, Hu Xiong, Gao Ding

Knowledge of cloud-base height (CBH) is of practical relevance to the aviation and military. Whereas cloud-top height (CTH) and cloud water path (CWP) has been traditionally provided as an operational product, retrieval of CBH for satellite remote sensing with passive radiometers heavily depends on the assumptions on cloud water content (CWC; g m-3) in terms of priori cloud type. This paper presents a new methodology based on Random Forest for retrieving CBH of the uppermost cloud layer, introducing more factors such as geography position and solar declination into the input and eliminating assumptions on CWC. Upstream products of FY-4A and A-Train satellites data (August to November 2017) are used to train the RF model, and then CBH can be estimated utilizing upstream products of FY-4A and trained RF model. Compared with cloud profile of CloudSat, CBH estimations from FY-4A have good coherence with bias less than 2km. Best results are expected for single-layer liquid-phase clouds while optically thin cirrus and deep convection generally perform worse.