

Community Satellite Processing Package (CSPP) – A Level 0 to Level 2 Software System for NPP/JPSS Real Time Processing and Applications

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Community Satellite Processing Package (CSPP) – A Level 0 to Level 2 Software System for NPP/JPSS Real Time Processing and Applications

Outlines/Objectives:

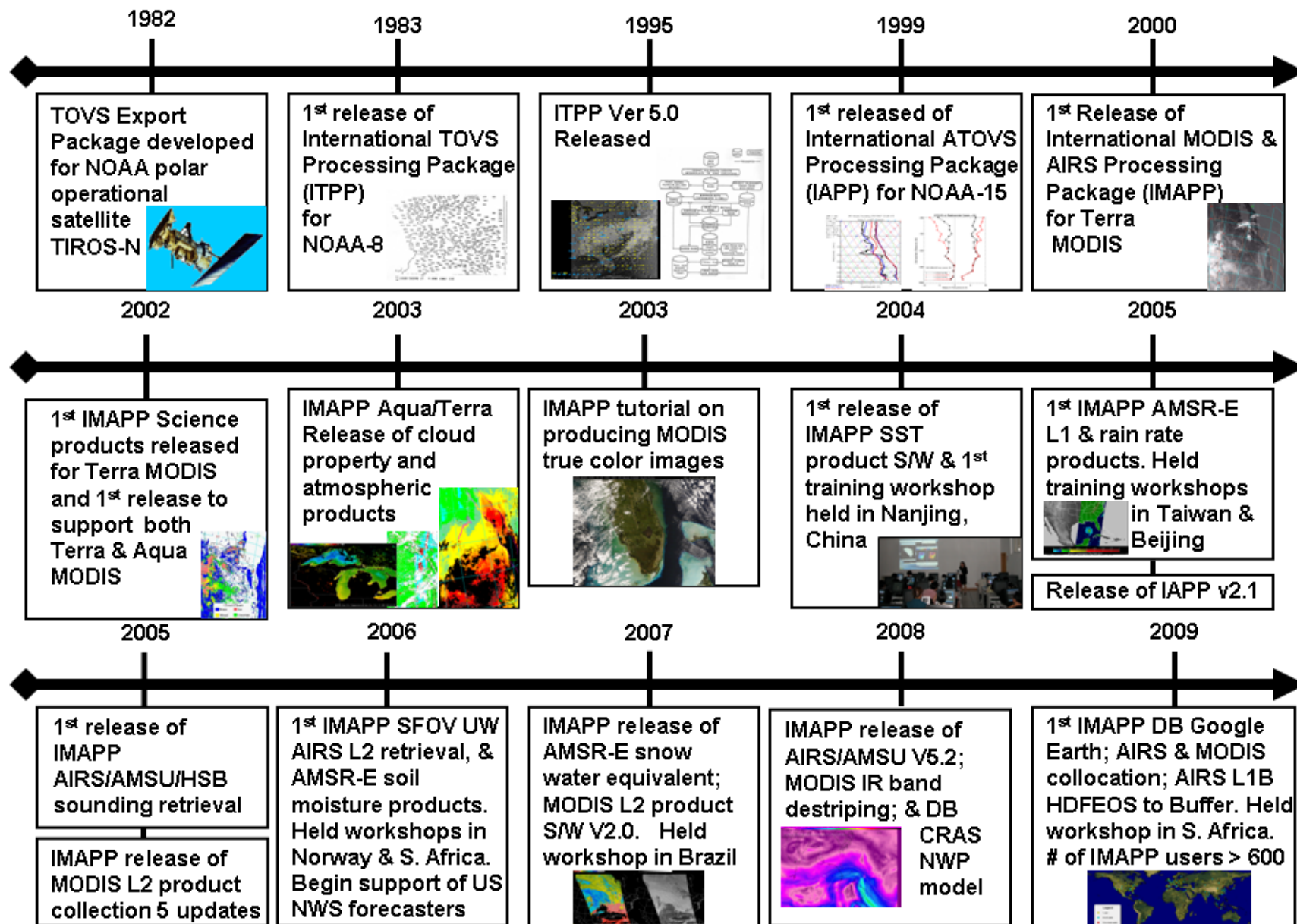
In close partnership with NOAA, NASA, and EUMETSAT through Joint Polar Satellite System (JPSS), the Space Science and Engineering Center (SSEC) of University of Wisconsin-Madison is embarking upon **demonstrating the operational uses of both research and operational weather satellite data to support operational users such as NOAA's National Weather Service, other domestic and international agencies and all direct broadcast users.**

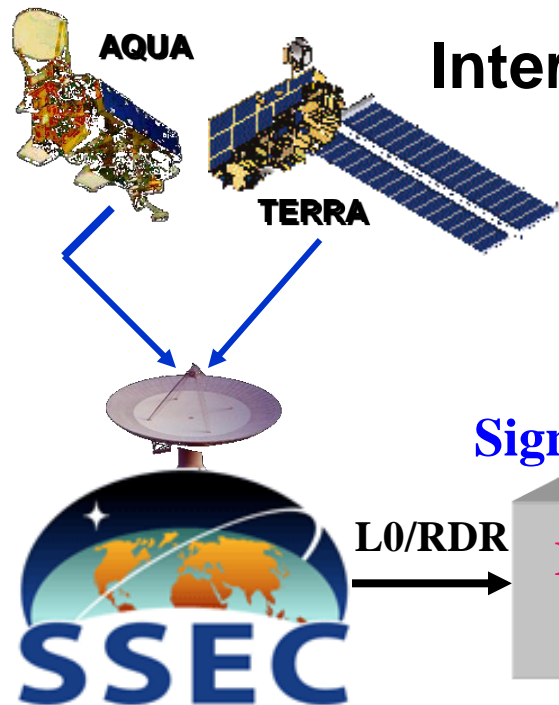
This talk mainly **focuses on the overview of SSEC's activities dedicated to facilitate and demonstrate the use of direct broadcast data collected from the current NASA Terra and Aqua, and NOAA satellites.**

Special attention will be paid to the **providing of user based processing software for VIIRS, CrIS and ATMS** sensors on board NPP, the preparatory program for JPSS,

Above all, the emphasis on the **seamless interface with international DB users** in the optimal and broad use of newly launched (28 October, 2011) NPP operational Polar Orbiting Satellite.

History of NOAA/NASA/CIMSS Partnership in the Development & Maintenance of Polar Orbiting Satellite Direct Broadcast Processing Packages





International MODIS/AIRS Processing Package

Schematic of NASA EOS End-to-End Processing

1. Understanding of instrument design principals
2. Analysis of measurement characteristics
3. Development of processing algorithms

Signal to Data

Data to Products

Products to Information

L0/RDR

IMAPP
L0-L1

L1/SDR

IMAPP
L1-L2

L2/EDR

IMAPP
L2-L3

L3/UDR

L1/SDR
MODIS
AIRS
AMSU
AMSR-E

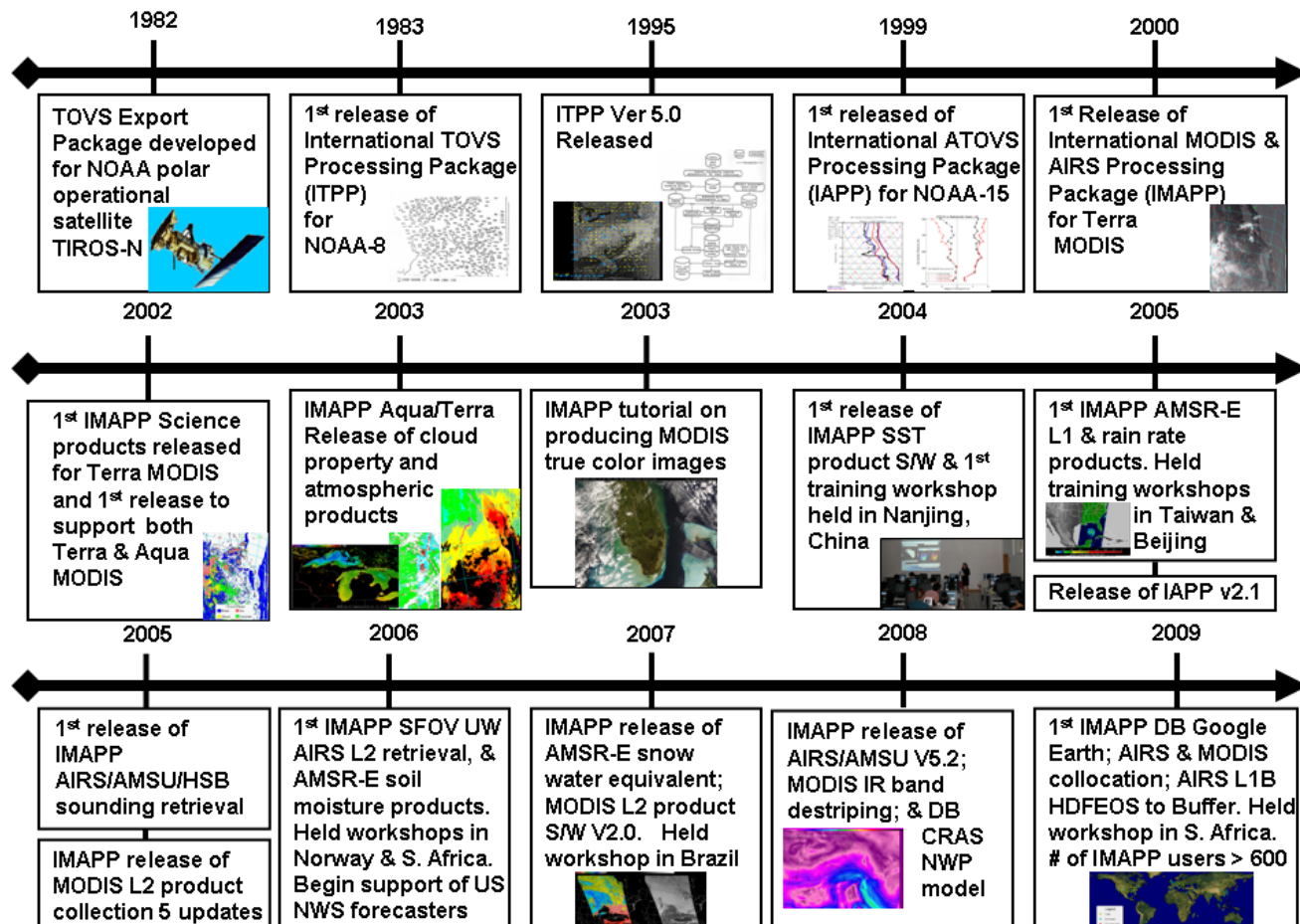
L2/EDR
MODIS
Images
TPW/SST
Clouds
Aerosol
AIRS
C.C. Radiances
T/Q
Clouds
AMSR-E
Soil Moisture
Precipitation

L3/UDR
Air Quality
Natural Resources
Management
Draught Monitoring
Nowcasting
Validation
Data Assimilation
Aviation Safety
Climate Study

Schematic of NASA EOS End-to-End Processing

4. Use of processing S/W System
5. Linkage to meteorological & environmental modeling & applications

NOAA/NASA/CIMSS Partnership in the Development & Maintenance of Polar Orbiting Satellite Direct Broadcast Processing Packages **Continues**



2011

- **IMAPP continuing**
- **“CSPP” for NPP/JPSS Starts**

Community Satellite Processing Package (CSPP) – To extend IMAPP, ITPP and IAPP legacy into Joint Polar Orbiting Satellite System Era

IMAPP BACKGROUND & WAYS FORWARD (1/2):

SSEC/UW-Madison has been developing DB processing S/W to convert lev0 to lev1 & lev1 to lev2 and distributing packages since the early 1980s, i.e. ITPP, IAPP, and in 2000s, the International MODIS and AIRS Processing Package (IMAPP).

So far IMAPP

- 1) supports more than 1000 registered users in 65 countries;
- 2) supports 12 real-time government and institutional users;
- 3) provides more than 50 United States' National Weather Service offices real-time MODIS images and products;
- 4) has conducted 8 DB training workshops at 5 different continents;
- 5) provides MODIS, AIRS, AMSU, AMSR-E level 1 and level 2 processing algorithms,
- 6) provides tools and utilities such as MODIS in Google earth and virtual appliance;
- 7) has provided the first real-time DB data assimilation system and air quality forecast system, and
- 8) has been supported by NASA for more than 10 continuous years of funding, demonstrating NASA's dedication in contributing to global DB users in its long term commitment of data sharing and science assistance.

In December 2010, NASA has awarded SSEC another three-year (2011-2013) of grant to maintain, update, and add new products and applications to support emerging users and growing demands of real-time data access and applications.

Community Satellite Processing Package (CSPP) – To extend IMAPP, ITPP and IAPP legacy into Joint Polar Orbiting Satellite System Era

IMAPP BACKGROUND & WAYS FORWARD (2/2):

For the next three years IMAPP will

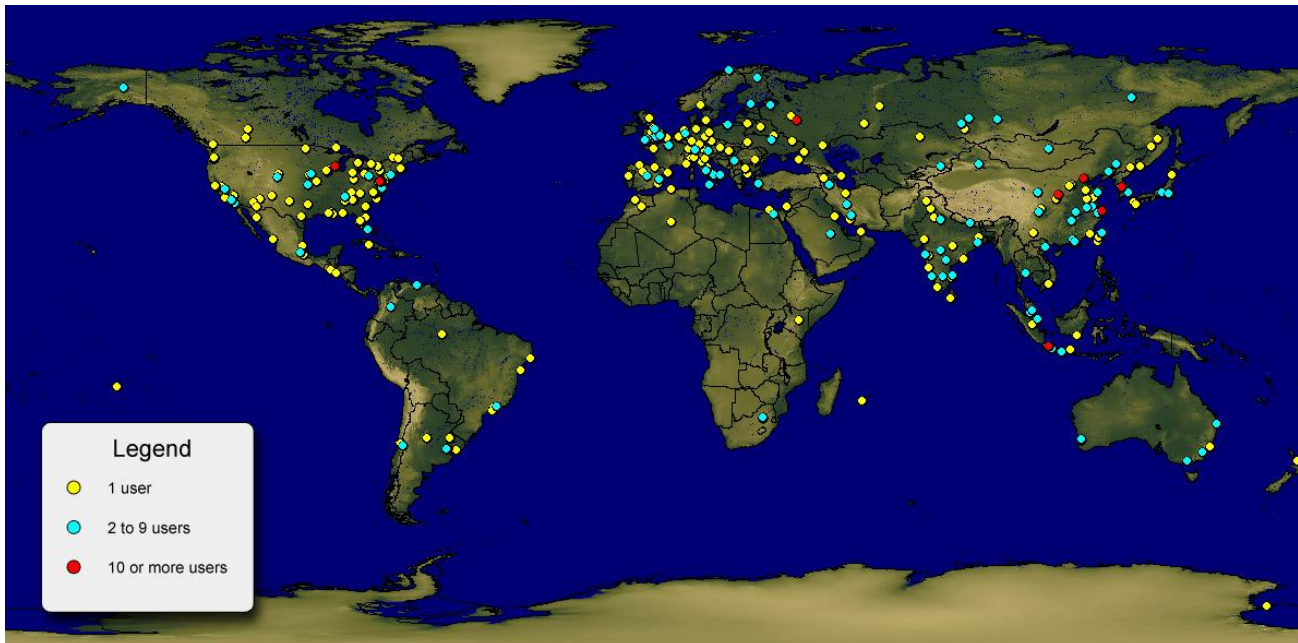
1. Expand the suite of IMAPP products to include new real-time aviation products;
2. Update the existing IMAPP product algorithms to the latest versions released by the MODIS, AIRS, and AMSR-E Science Teams (e.g., Collection 6 for MODIS);
3. Release the first version of a physical retrieval algorithm using collocated AIRS/MODIS;
4. Maintain and improve real-time product generation in support of US agencies (in particular the National Weather Service);
5. Enhance the usability of the IMAPP software by releasing an IMAPP Virtual Appliance for direct broadcast processing;
6. Continue to offer international training workshops to promote the use of Terra and Aqua direct broadcast products and applications and foster the next generation of remote sensing scientists;
7. Collaborate with NASA, NOAA and the EPA to release an international version of Infusing Satellite Data into Environmental Applications (IDEA) to global users;
8. Utilize GPU-based High-Performance Computing (HPC) technology to reduce the latency of IMAPP product generation for time-critical applications.

Since 1999 NASA funded International MODIS/AIRS Processing Package (IMAPP)

Purpose: To allow DB users capability of producing local Aqua and Terra products from direct broadcast data

- Software packages derived from the operational EOS processing
- Modified to be compatible with direct broadcast data.

<http://cimss.ssec.wisc.edu/imapp>

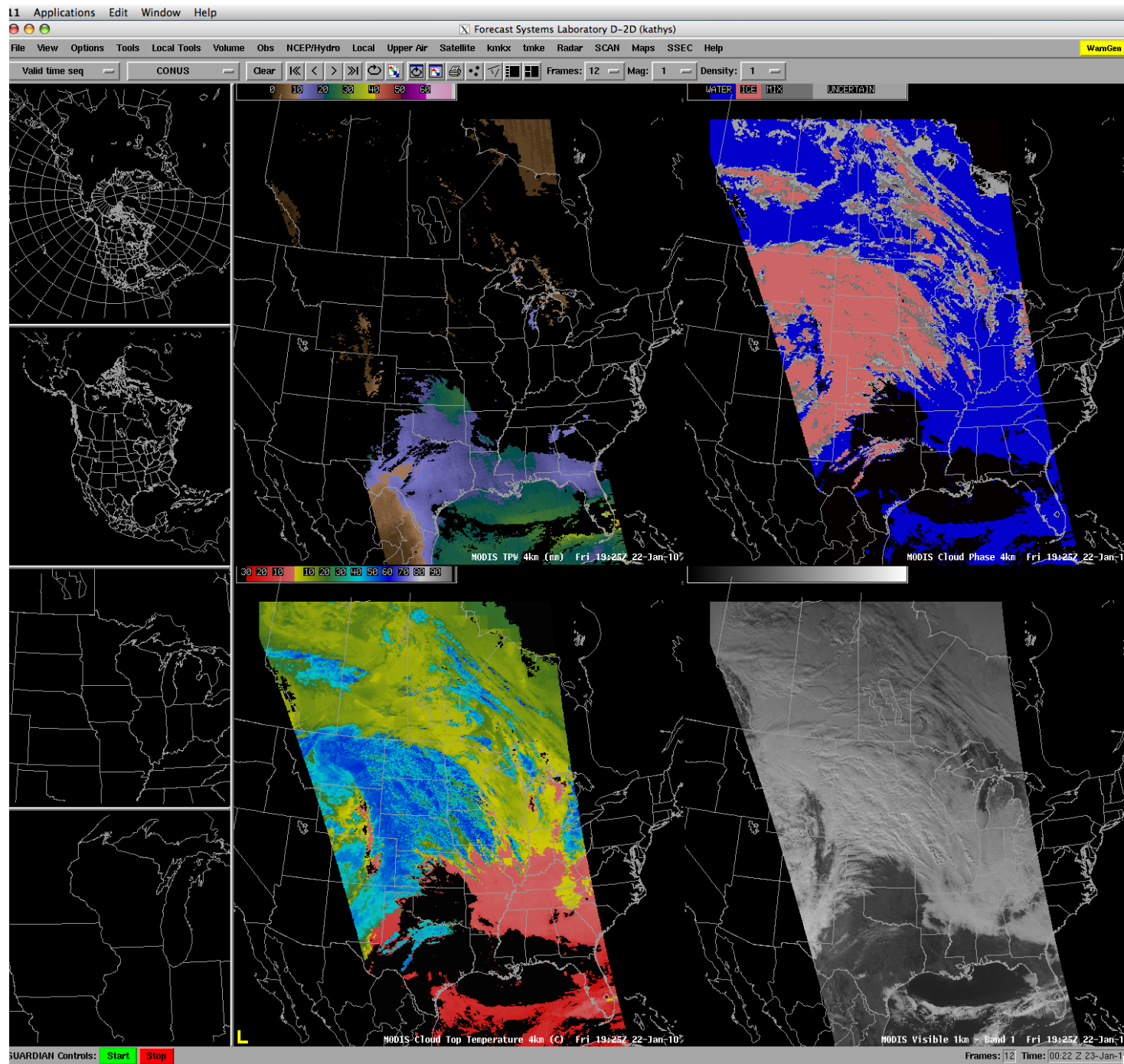


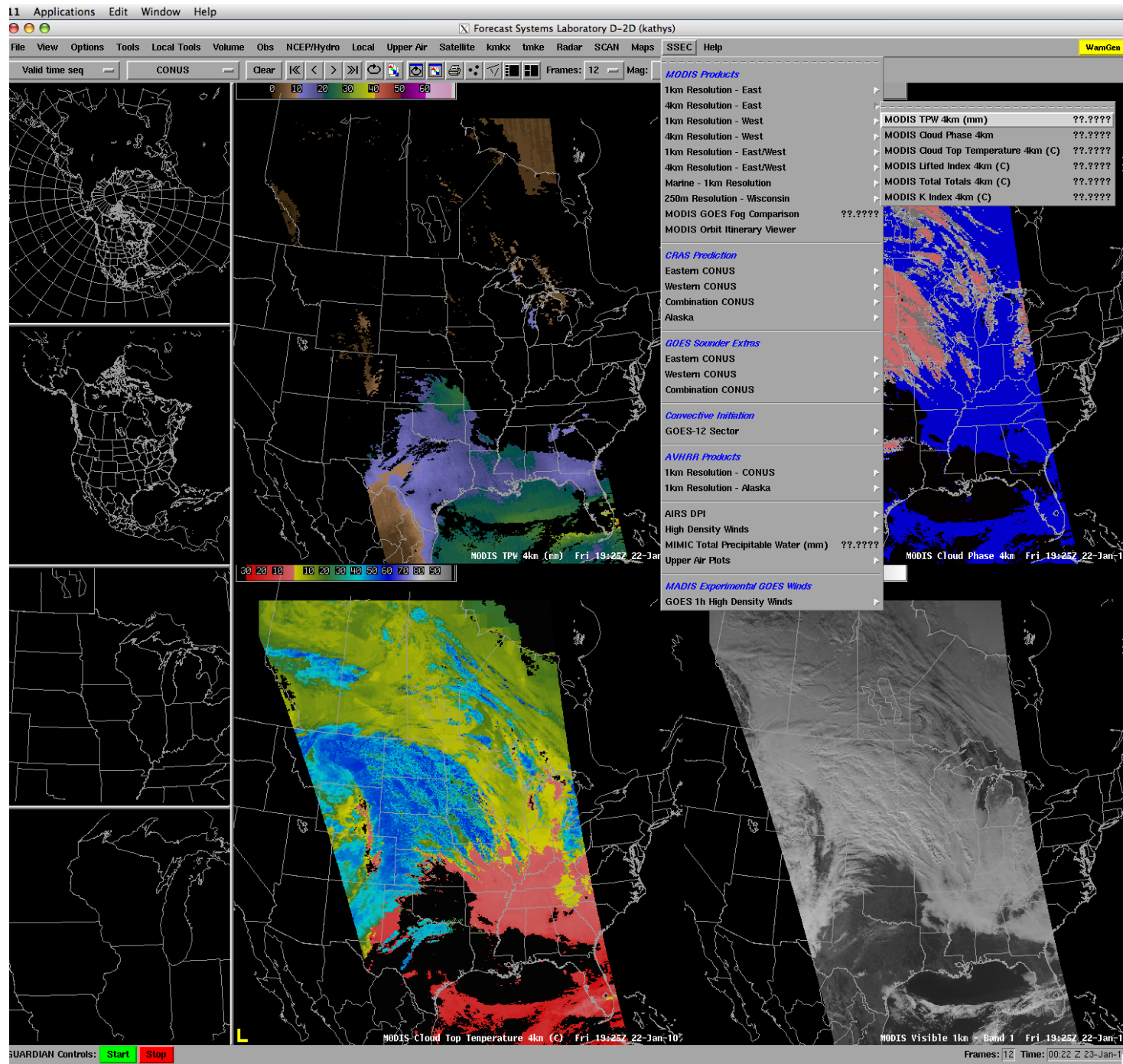
More than 1000 in 65 countries Global IMAPP users

IMAPP Support of US National Weather Service Forecasters – Proving Ground

- University of Wisconsin began providing Direct Broadcast MODIS products NWS in June 2006
- 1km Reflectances and Brightness Temperatures
 - Bands 1 (.68 μm), Band 26 (1.38 μm), Band 7 (2.1 μm)
 - Band 20 (3.7 μm), Band 27 (6.7 μm), Band 31 (11 μm)
- Products
 - 1 km
 - Sea Surface Temperature, NDVI (DB version), Land Surface Temperature, Fog Product
 - 5 km
 - Cloud Top Pressure, Total Precipitable Water, Cloud Phase, Stability Indices
- True Color 250 m Imagery

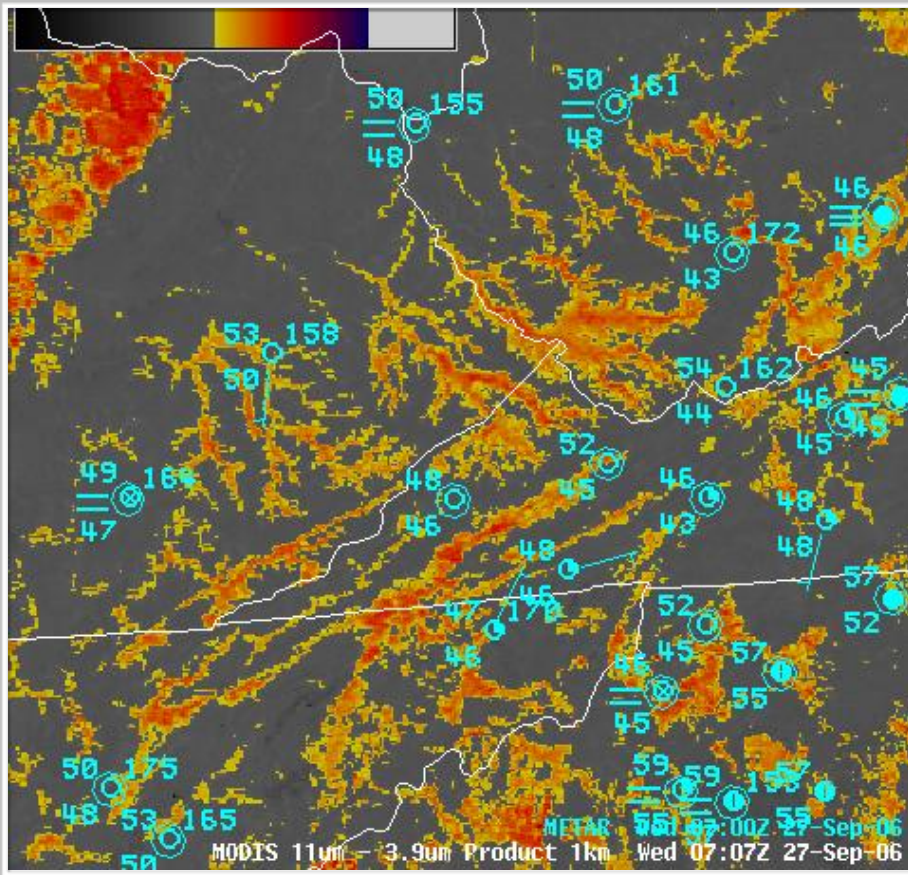




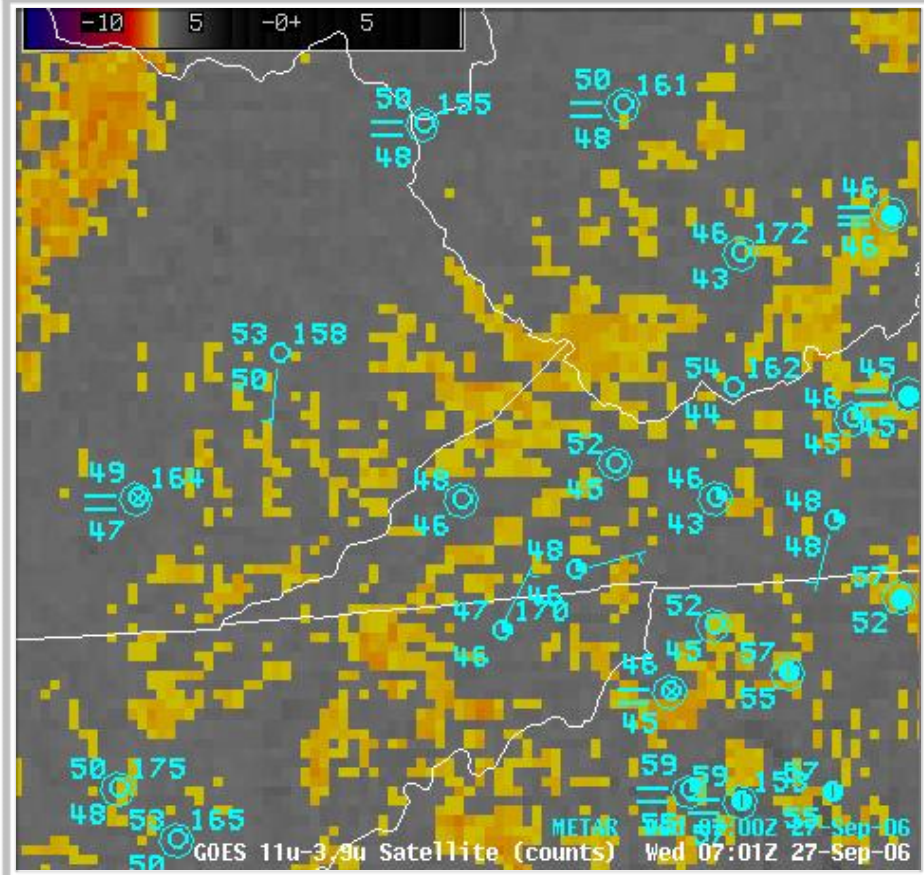


MODIS Imagery in AWIPS

Fog/stratus product ($11.0\mu\text{m} - 3.7\mu\text{m}$)



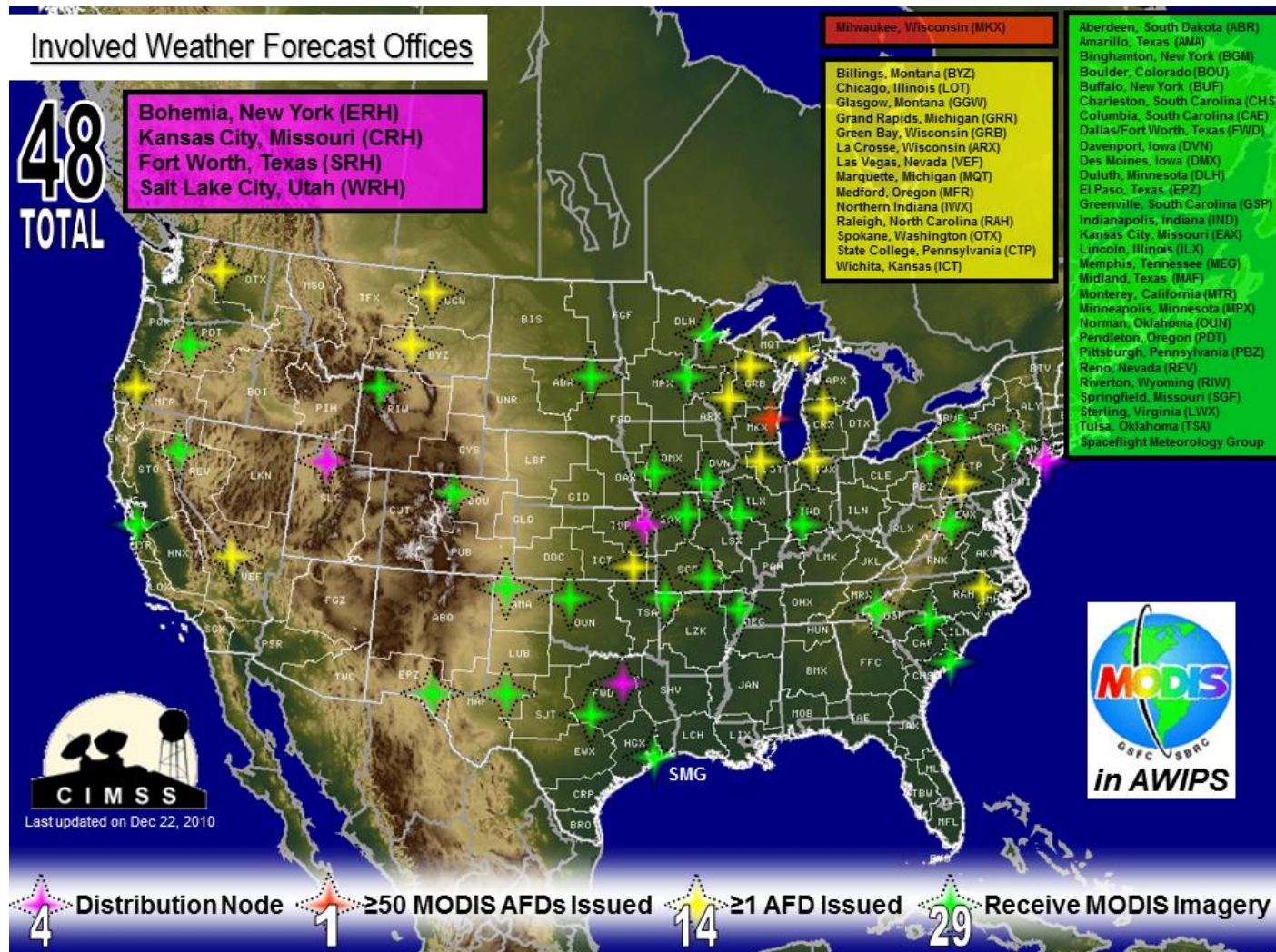
1-km MODIS



4-km GOES

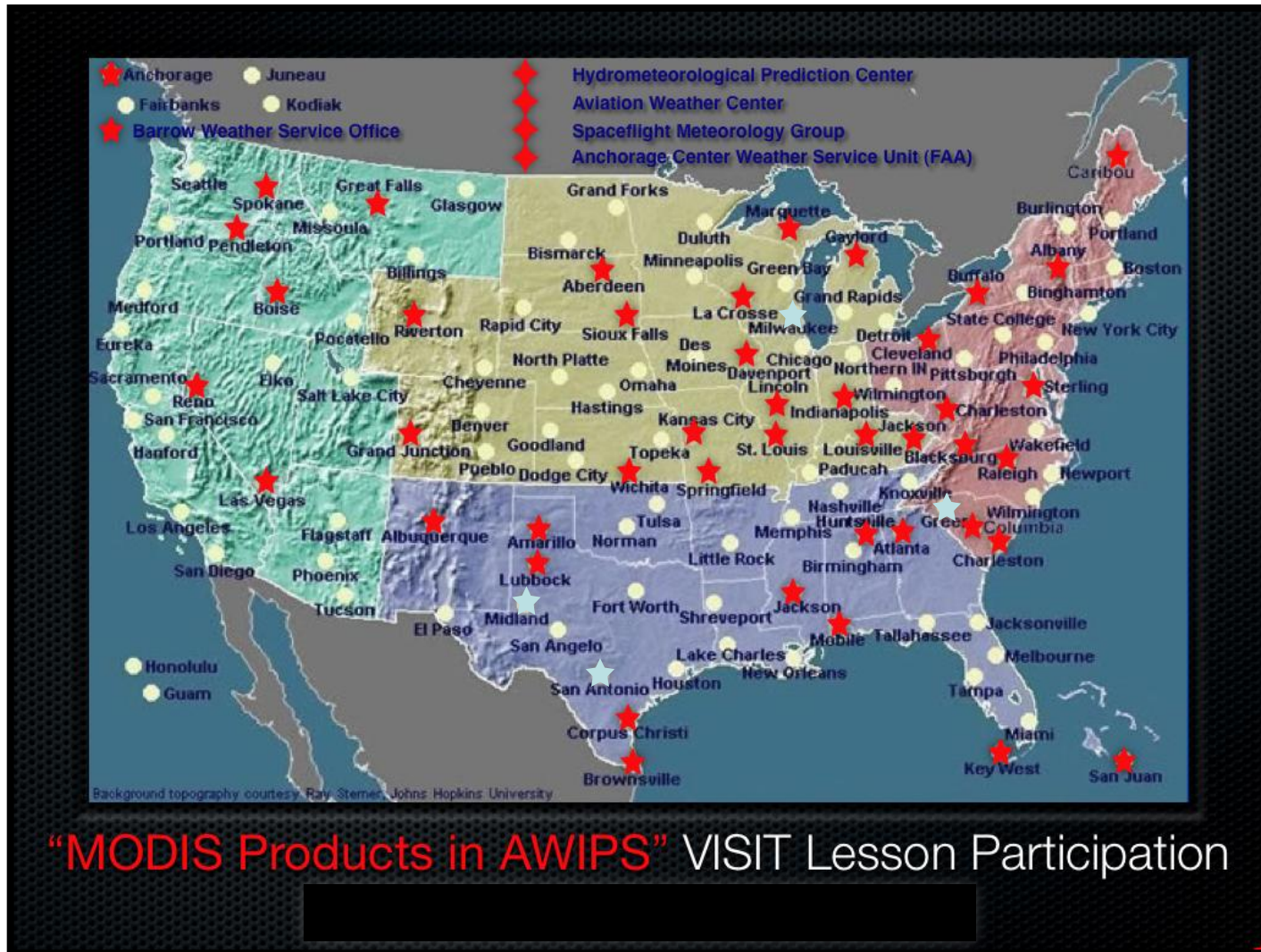
Improved fog/stratus detection capability

SSEC UW Direct Broadcast MODIS and AVHRR Data used by the National Weather Service (NWS)



MODIS and AVHRR products have been mentioned in Area Forecast Discussions 192 times

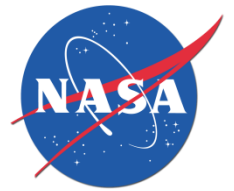
MODIS Products Training for Forecasters



54 NWS forecast offices participating



CIMSS Routinely Supports Real-Time Direct Broadcast Users

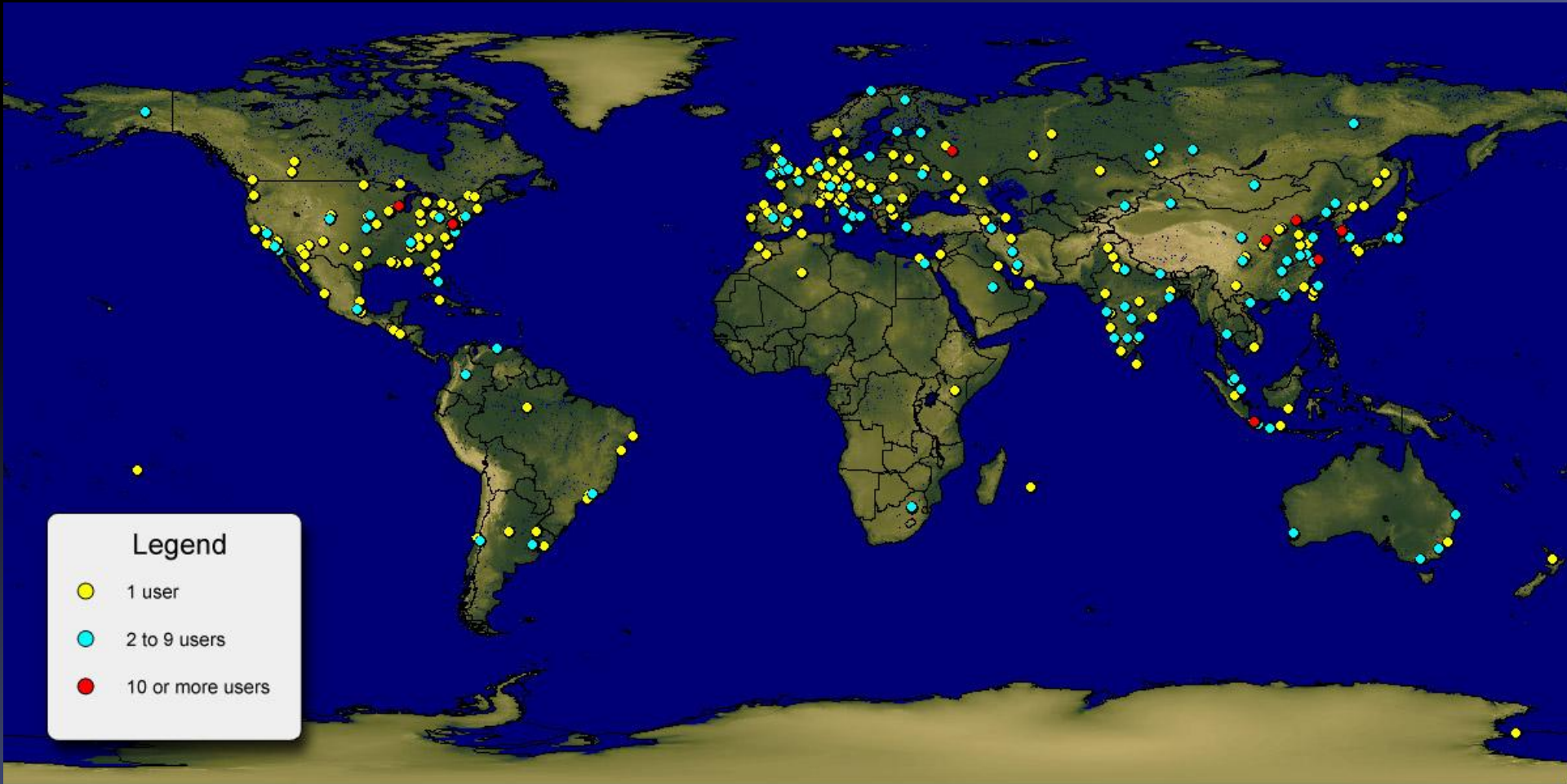


1. **US National Weather Service (NWS):**
 - ☐ Central,
 - ☐ Western,
 - ☐ Eastern and
 - ☐ Southern Regions
2. **NWS Space Flight Meteorology Group** <http://www.srh.noaa.gov/smg>
3. **Naval Research Laboratory Monterey**
http://www.nrlmry.navy.mil/nexsat_pages/nexsat_home.html
4. **NASA/MSFC Short-term Prediction Research and Transition Center**
<http://weather.msfc.nasa.gov/sport/>
5. **NOAA CoastWatch Great Lakes Node**
http://coastwatch.glerl.noaa.gov/modis/region_map.html
6. **WisconsinView** <http://www.wisconsinview.org/>
7. **UMBC US Air Quality Blog** <http://alg.umbc.edu/usaq/>
8. **Canadian Ice Service** <http://ice-glaces.ec.gc.ca/>
9. **Real-Time Images for PDAs** <http://www.ssec.wisc.edu/data/paw/>
10. **MODIS Today website** <http://ge.ssec.wisc.edu/modis-today/>
11. **Weather Underground** <http://www.wunderground.com/blog/Rainman32>
12. **United States Forest Service** <http://activefiremaps.fs.fed.us/imagery.php>

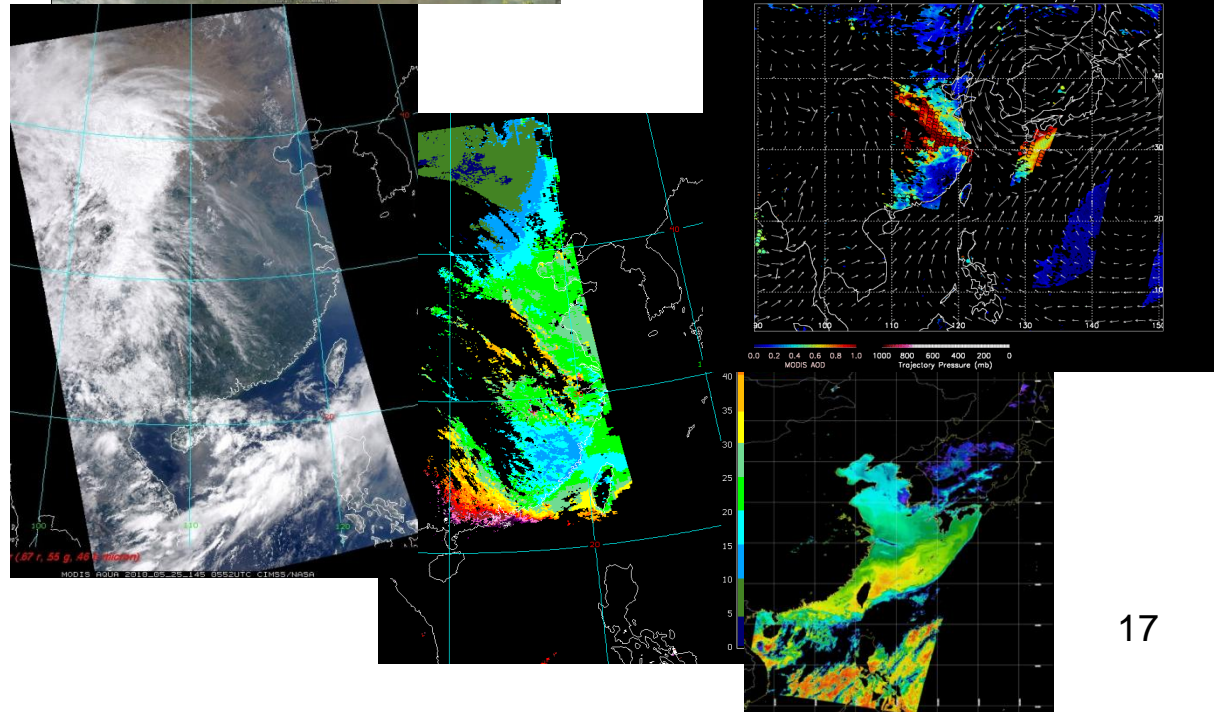
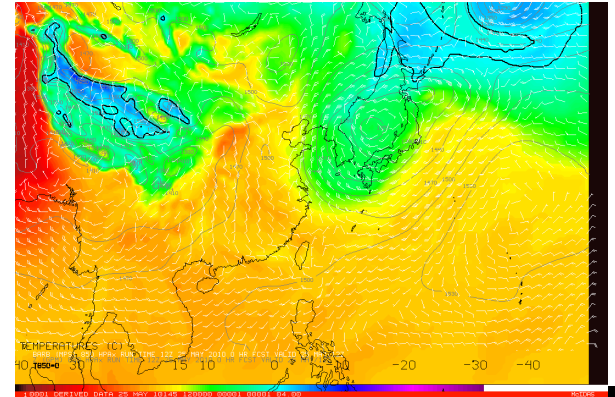
CIMSS/SSEC, UW-Madison IMAPP Global Registrations



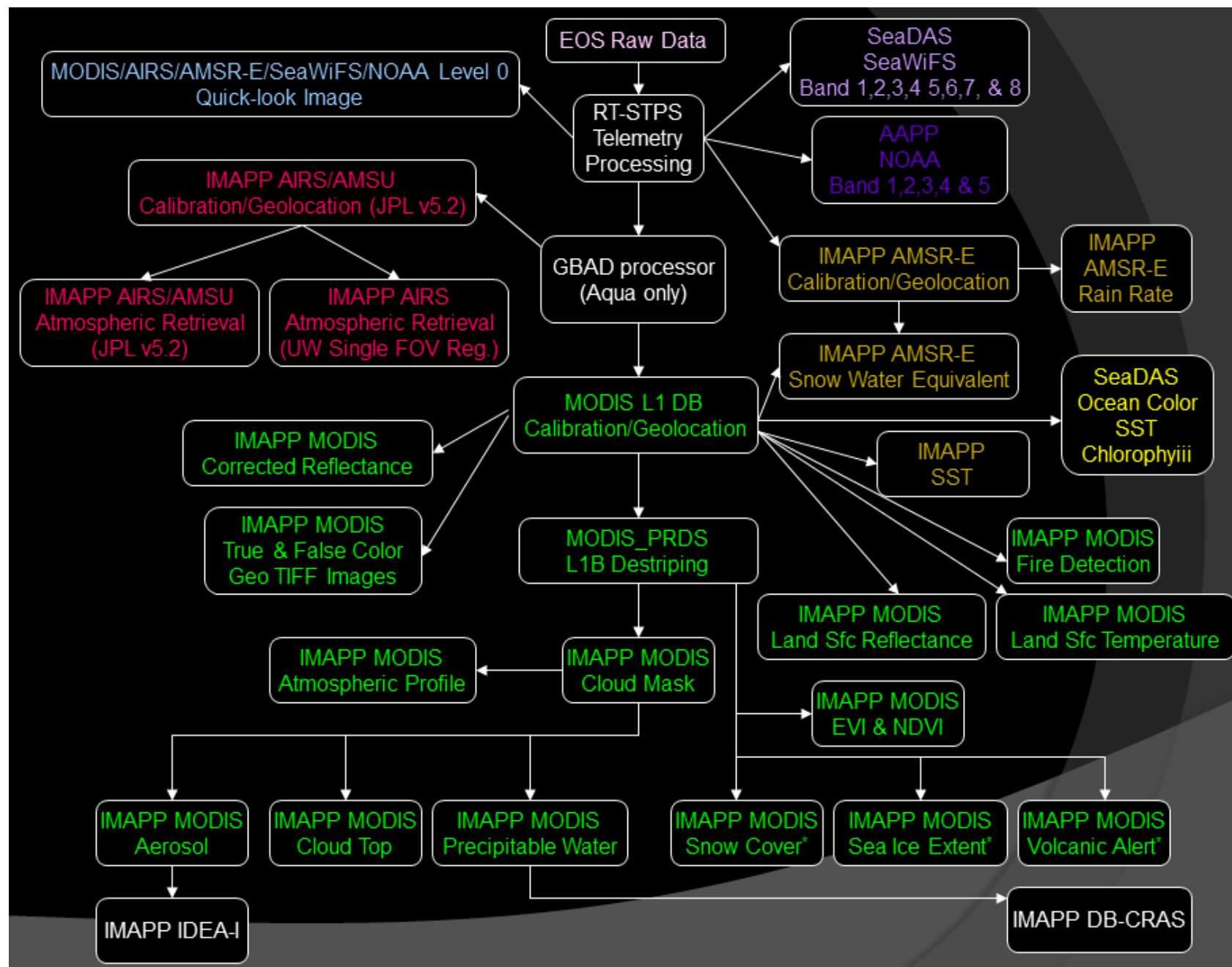
**IMAPP SITES: 65 Countries with > 1000 Users
(Since 2007)**

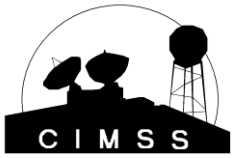


A Direct Broadcast Processing & Application System (DBPAS)



CIMSS End-to-End DBPAS





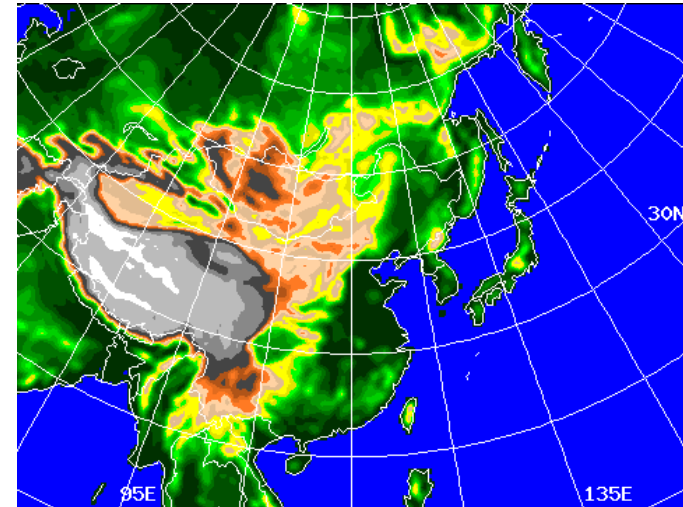
CIMSS Regional Assimilation System

Developed by a NOAA Scientist



Direct Broadcast CRAS Configuration Re-locatable anywhere on the globe

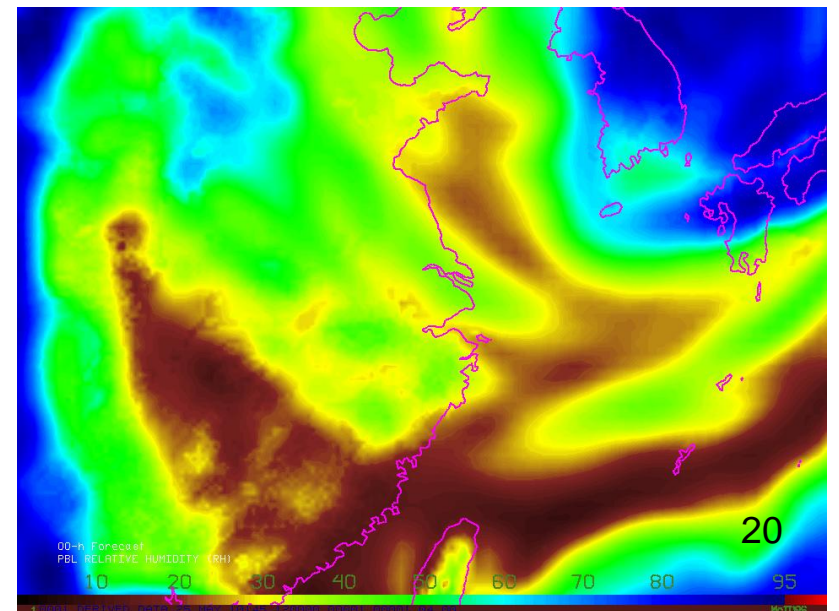
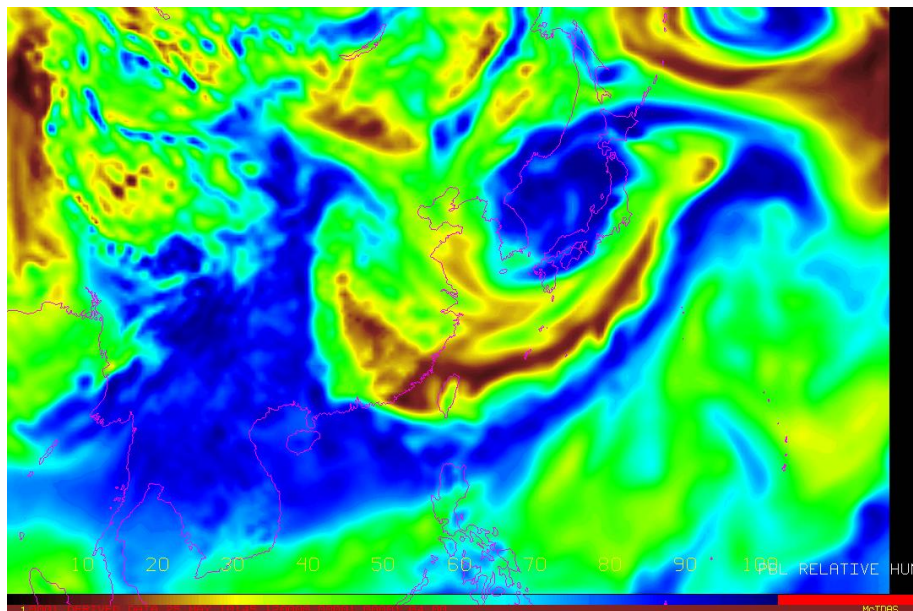
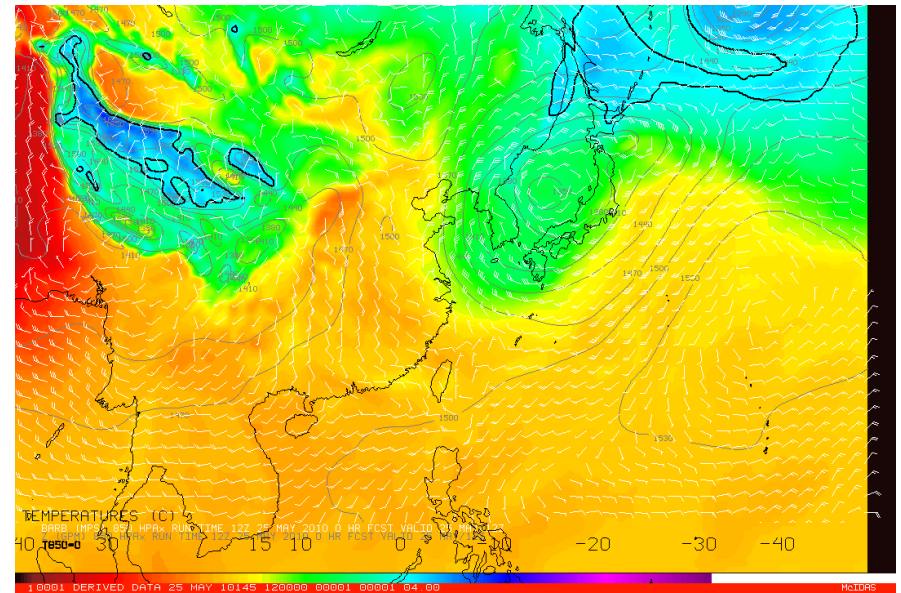
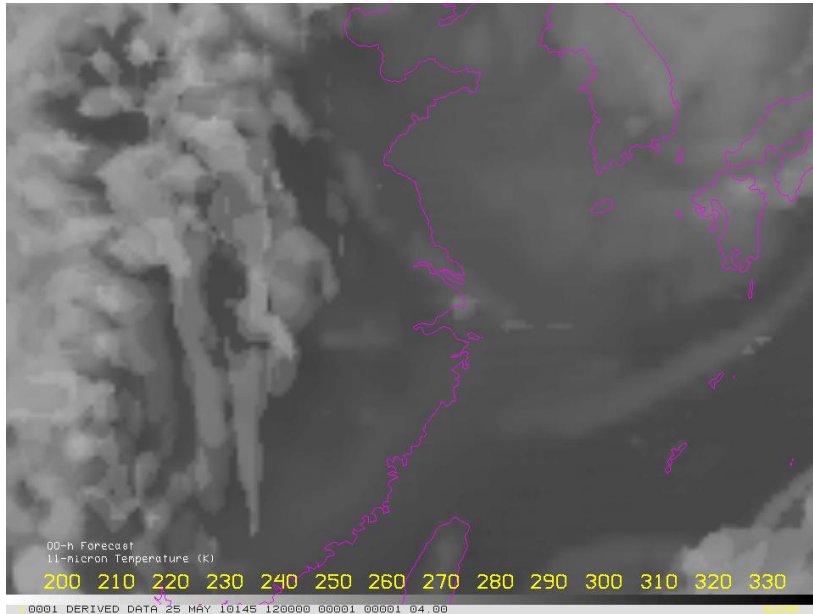
Resolution:	48 km
Sigma levels:	38
Grid Size	201x151
Time-step:	240 seconds
Forecast length:	72 hours
Initialization:	12-hr spin-up with 5-7 MODIS inserts
Output:	3 hourly, grib2 format
Initial times (UTC):	00/12 UTC
Start times (UTC):	00:25/12:25 UTC
Initial conditions:	1/2 degree GFS, 6 hr Forecast
Boundaries:	6 hourly, one degree GFS Forecasts
Inputs:	Surface, RAOBs MODIS: Total precipitable water, cloud-top pressure
Verification:	RAOBs, Surface, MODIS



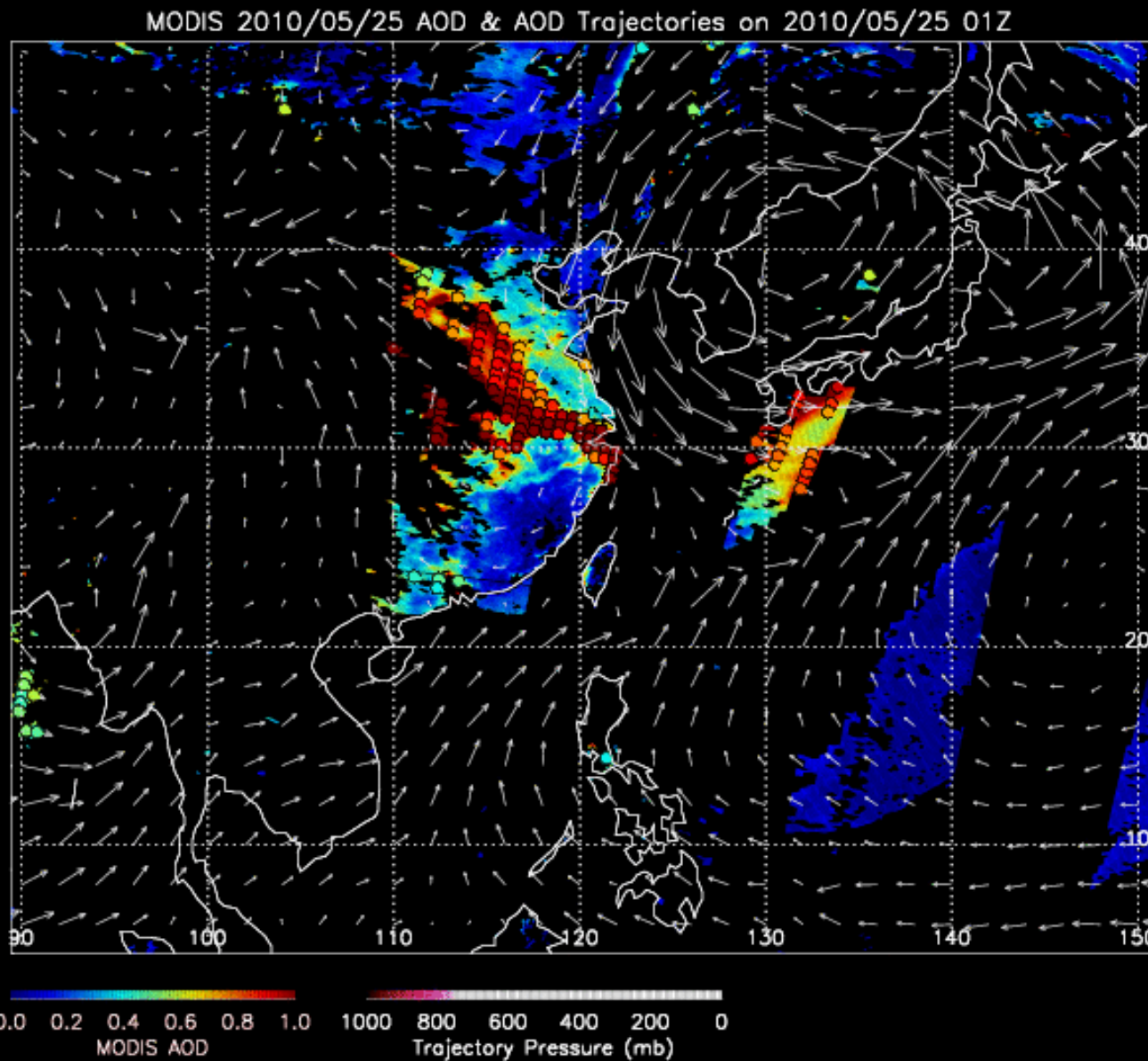
Example DBCRAS Domain

Note: Multiple high-resolution nests can be placed anywhere in the 48 km grid.

ECNU DBPAS: Data Assimilation & Forecast System



ECNU DBPAS: Air Quality Forecast System



Community Satellite Processing Package (CSPP) – A Level 0 to Level 2 Software System for NPP/JPSS Real Time Processing and Applications

13 Features of Community Satellite Processing Package (CSPP) (1-7):

- 1) Ingest CCSDS packet files from VIIRS, CrIS, ATMS and NPP spacecraft diary;
- 2) Create SDR and EDR products for VIIRS, CrIS, and ATMS using the current operational versions of the IDPS PRO algorithms and lookup tables;
- 3) Produce all output files in the HDF5 formats defined by the JPSS Common Data Format Control Books;
- 4) Retrieve all required dynamic non-spacecraft ancillary data automatically;
- 5) Run natively on 64-bit Intel Linux host platforms;
- 6) Run on Microsoft Windows 78/Vista/XP and Apple OS X platforms via a Virtual Appliance;
- 7) Allow the end user to customize which EDR products are created;

Community Satellite Processing Package (CSPP) – A Level 0 to Level 2 Software System for NPP/JPSS Real Time Processing and Applications

13 Features of Community Satellite Processing Package (CSPP) (8-13):

- 8) Provide a simple algorithm chaining capability to run algorithms in sequence;
- 9) Provide detailed logs of all processing operations and give clear indications of where and when failures occur;
- 10) Allow the end user to add customer user-developed algorithms;
- 11) Provide products optimized for NWS which are AWIPS and/or NOAA NextGen compatible;
- 12) Provide value-added products for end users that are not part of the JPSS operational suite, such as images in KML format for Google Earth; Night Fog Detection; Volcanic Ash; and Aviation Safety products;
- 13) Utilize GPU-based High-Performance Computing (HPC) technology to reduce the latency of CSPP-NPP/JPSS product generation for time-critical regional applications.

Community Satellite Processing Package (CSPP)

SUMMARY

With strong support from NASA & NOAA support, SSEC/UW **is committed to fully support NASA & NOAA Direct Readout/Broadcast activities to:**

- Maintain existing DB Processing Packages (i.e. **IMAPP**) for MODIS and AIRS and to develop new capabilities/applications and **packages for NPP/JPSS (CSPP, see next two slides), & METOP (L1-L2 PP) systems.**
- Upgrade DB real-time processing system efficiency, functions, and effort in enhancing Numerical Weather Prediction (DBCRAS) and air quality model (IDEA-I) and other applications to directly assimilate real time products (i.e. clouds, water vapor, and aerosol) to optimize broad use of DB products.
- Provide DB users a turn-key, end-to-end, real-time data acquisition, processing and distribution system
- Support NOAA NNWS offices & Real-Time DB users in the efficient and broad use of the current and future polar orbiting satellite data/information.
- Offer DB users training workshops in processing algorithms, S/W package operations and real-time applications

Community Satellite Processing Package (CSPP)

Timeline

With strong support from JPSS program scientist, Dr. Mitch Goldberg support, SSEC/UW **is committed to the public release of CSPP:**

- By the end of December 2011 (with the approval of Dr. Goldberg) Public release of 1st ver. CSPP to any registered user which include
 - ☐ ATMS RDR to SDR
 - ☐ VIIRS RDR to SDR
 - ☐ CrIS RDR to SDR
- After official release of science data
 - ☐ Selected VIIRS SDR to EDR
 - ☐ CrIS official and single-FOV SDR to EDR

Thank you for your Patience, any question is welcomed!