The Global Impact of 10+ Years of IMAPP Software in Support of Aqua and Terra

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Cooperative Institute For Meteorological Satellite Studies (CIMSS)

Lots of Others

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- UW SSEC
- NOAA/STAR
- Boston University
- NASA Goddard Space Flight Center
- Instituted für Weltraumwissenschaften, Freie Universität, Berlin, Germany
- German Weather Service (DWD)
- NASA Langley
- NASA SPoRT
- UK Met Office
- Taiwan Central Weather Bureau, Taipei
- Australian Bureau of Meteorology
- Eötvös Loránd University, Budapest, Hungary
- East China Normal University, Shanghai, China
- GINA Alaska
- EUMETSAT
- BMKG, Indonesian Agency for Meteorology, Climatology and Geophysics
- CSIR South Africa
- INPE/CPTEC

What is Direct Broadcast?

- Direct Broadcast is the real-time transmission of earth observation data from the spacecraft to the ground
- Data are free and clear with no encryption
- All you need is an antenna and receiver!
- "Terra and Aqua are a great gift to the world" *(Vladimir Gershenzon, ScanEx, Russia)*

History of Direct Broadcast Support

More than 25 years of experience

- IAPP (International TOVS Processing Package) since 1985
- ITPP (International ATOVS Processing Package) since 1998

Acquisition of TeraScan 4.4 m Dish in 2000

- NASA IMAPP (International MODIS/AIRS Processing Package) since 2000
- NOAA CSPP (Community Satellite Processing Package) 2011

The goal is to allow DB users the capability to create their own local products for local applications

Focus on IMAPP

International MODIS/AIRS Processing Package

Funded by NASA since 2000

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

- 48 software packages released in 12 years
- More than 1500 registrants from 70 different countries
- 10 direct broadcast workshops held on 5 continents
- 13 MODIS related software packages
- 6 AIRS related software packages
- 4 AMSR-E software packages

IMAPP Software Suite

MODIS Atmosphere and Polar Products
- Cloud mask
- Cloud top pressure and temperature
- Cloud optical depth and effective radius
- Temperature and moisture profiles
- Total precipitable water
- Stability indices
- Aerosol optical depth
- Ice Surface Temperature
- Snow Mask
- Ice Cover and Ice Concentration
- Inversion Strength and Inversion Depth

MODIS Land Products
- Land Surface Reflectance
- BRDF

MODIS Image Software
- MODIS in Google Earth (true color)

AIRS Level 1B
- Calibrated and geolocated radiances and reflectances (AIRS)
- Calibrated and geolocated antenna temperatures (AMSU)

AIRS Retrievals
- JPL 3x3 FOV
- Dual Regression Single FOV

AIRS Utilities
- Collocating AIRS/MODIS utility
- AIRS HDF to BUFR utility

AMSR-E Level 1B
- Calibrated and Geolocated Antenna Temperatures

AMSR-E Products
- Rain Rate, Soil Moisture, Snow Water Equilvalent

NWP Products
- Globally configurable regional numerical weather prediction model that assimilates MODIS DB products - DBCRAS

Aviation/Severe Weather Products
- Overshooting Tops Identification including turbulence and lightning potential

Air Quality Forecast Product – IDEA-I

Complete DB Processing System
- VA for Mac, Windows and Linux

Metrics of Impact

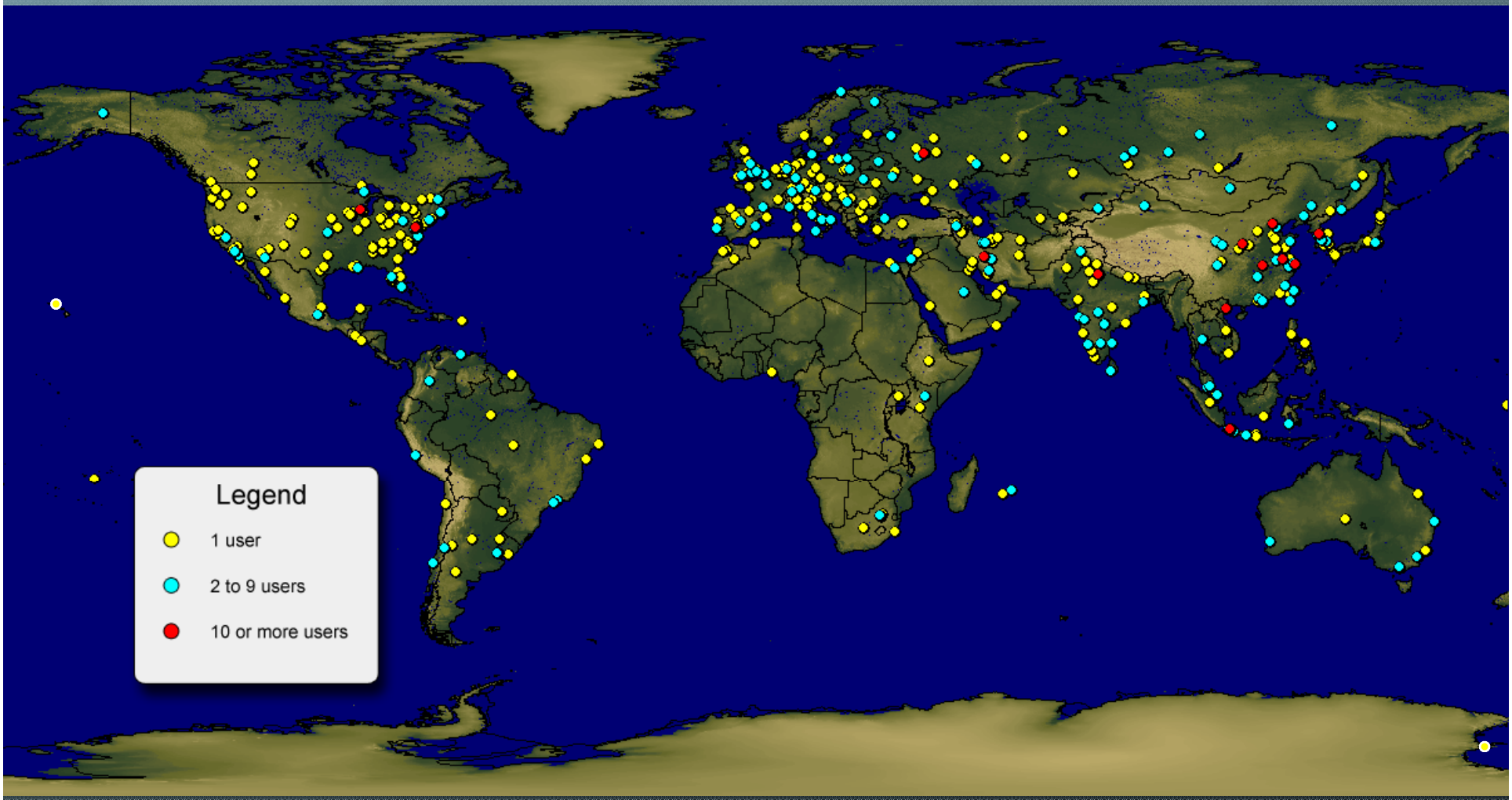
- Relationships
- Global registrant and download statistics
- Applications
- Vendor distributions
- Workshops
- Publications

IMAPP Global Users

70 Different Countries (> 1/3 of the world total)

Italy	Australia	Mexico	Romania
Argentina	Czech Republic	Hungary	Malaysia
Brazil	Canada	Belgium	Algeria
Kazakhstan	Spain	Norway	Reunion
Ukraine	Chile	Venezuela	Austria
Indonesia	Pakistan	Sri Lanka	Finland
China	Nepal	France	Czech Republic
Denmark	Portugal	Russia	New Zealand
South Africa	Poland	Vietnam	Guatemala
Taiwan	Saudi Arabia	Mongolia	Uruguay
Japan	El Salvador	Turkey	Israel
Morocco	Colômbia	South Korea	Azerbaijan
Iran	Serbia	United Arab Emirates	Cuba
Singapore	Kenya	Lithuania	Kuwait
India	Oman	United States	Syria
Germany	Sweden	Thailand	Dominican Republic
United Kingdom	Uzbekistan	Philippines	Belarus
Iceland	Switzerland		

IMAPP Users



More than 1500 people have downloaded some part of the IMAPP suite of products representing 70 different countries and all 7 continents (since 2007)

Domestic Applications

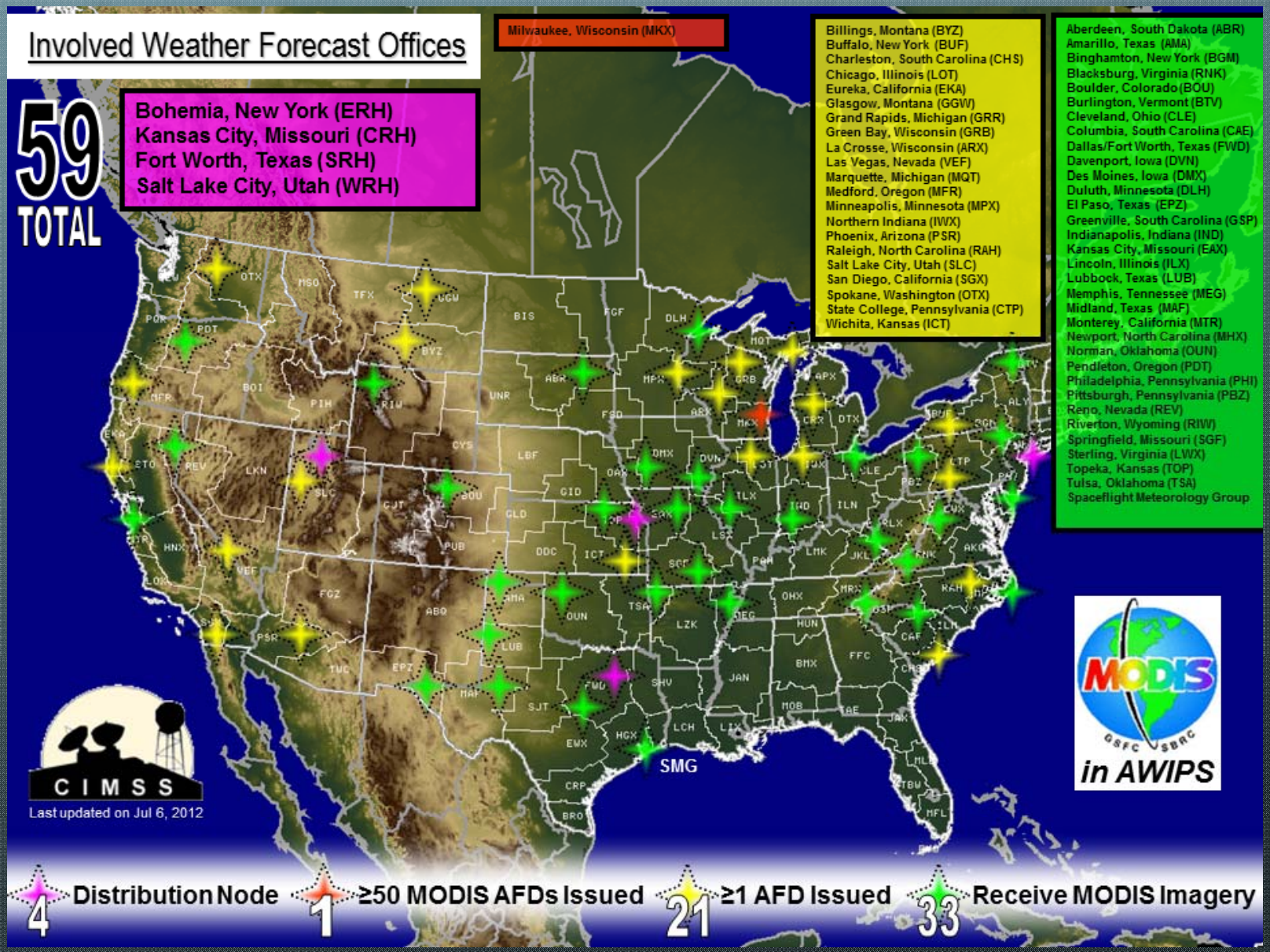
EOS Direct Broadcast Groundstation

TeraScan SX-EOS 4.4 m antenna: First data acquired 2000/08/18

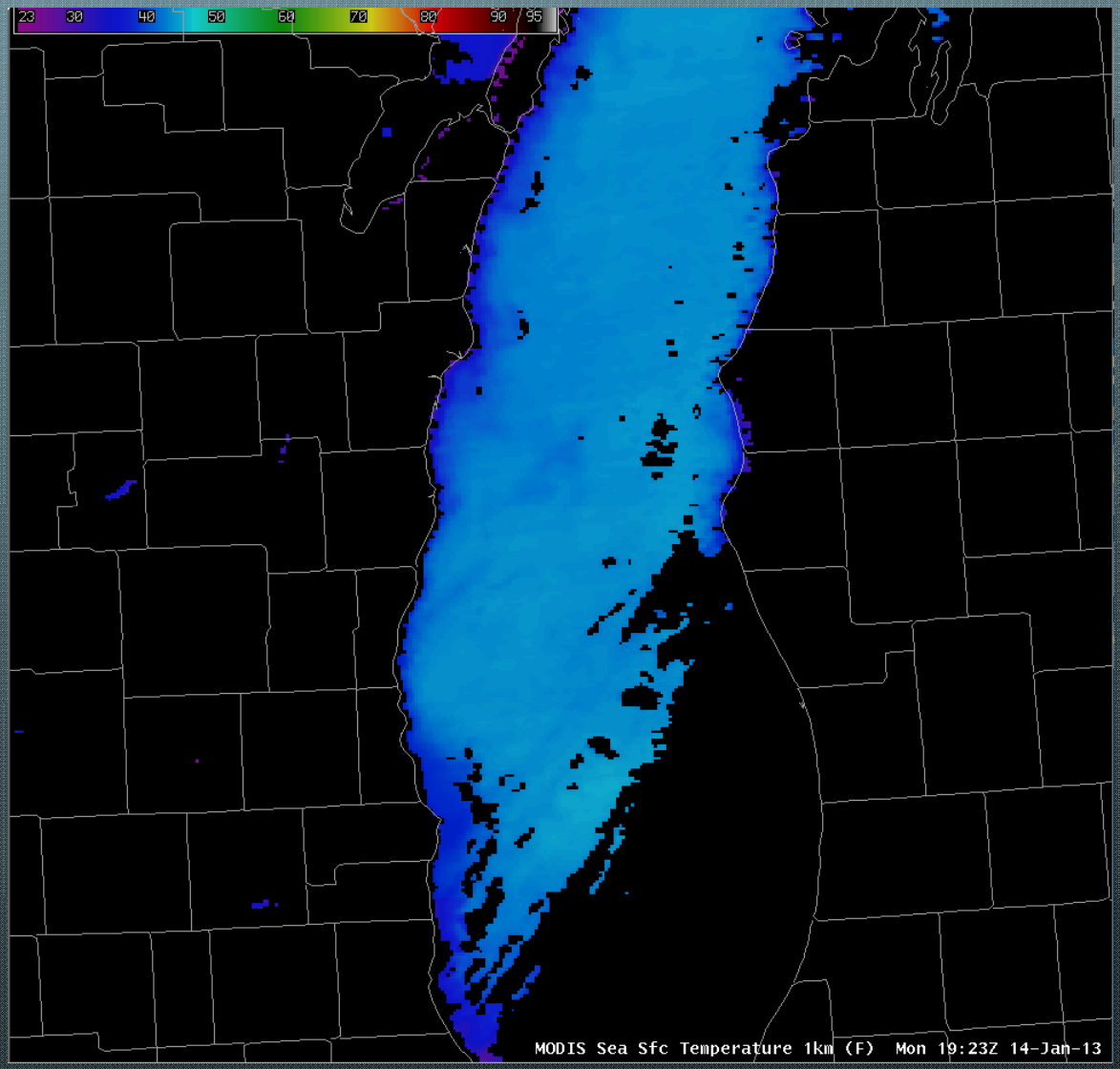
Current Real-time Users

- US National Weather Service
- US Forest Service
- NASA Short-term Prediction Research and Transition Center (SPoRT)
- NOAA Coast Watch
- Canadian Ice Service
- Naval Research Lab
- Bonneville Power Administration (EPS), part of the Department of Energy (DOE)
- Environmental Protection Agency – IDEA – Smog Blog
- Wisconsin View (Part of America View USGS)
- Puget Sound Clean Air Agency
- Idaho Department of Environmental Quality

Support National Weather Service Forecasters



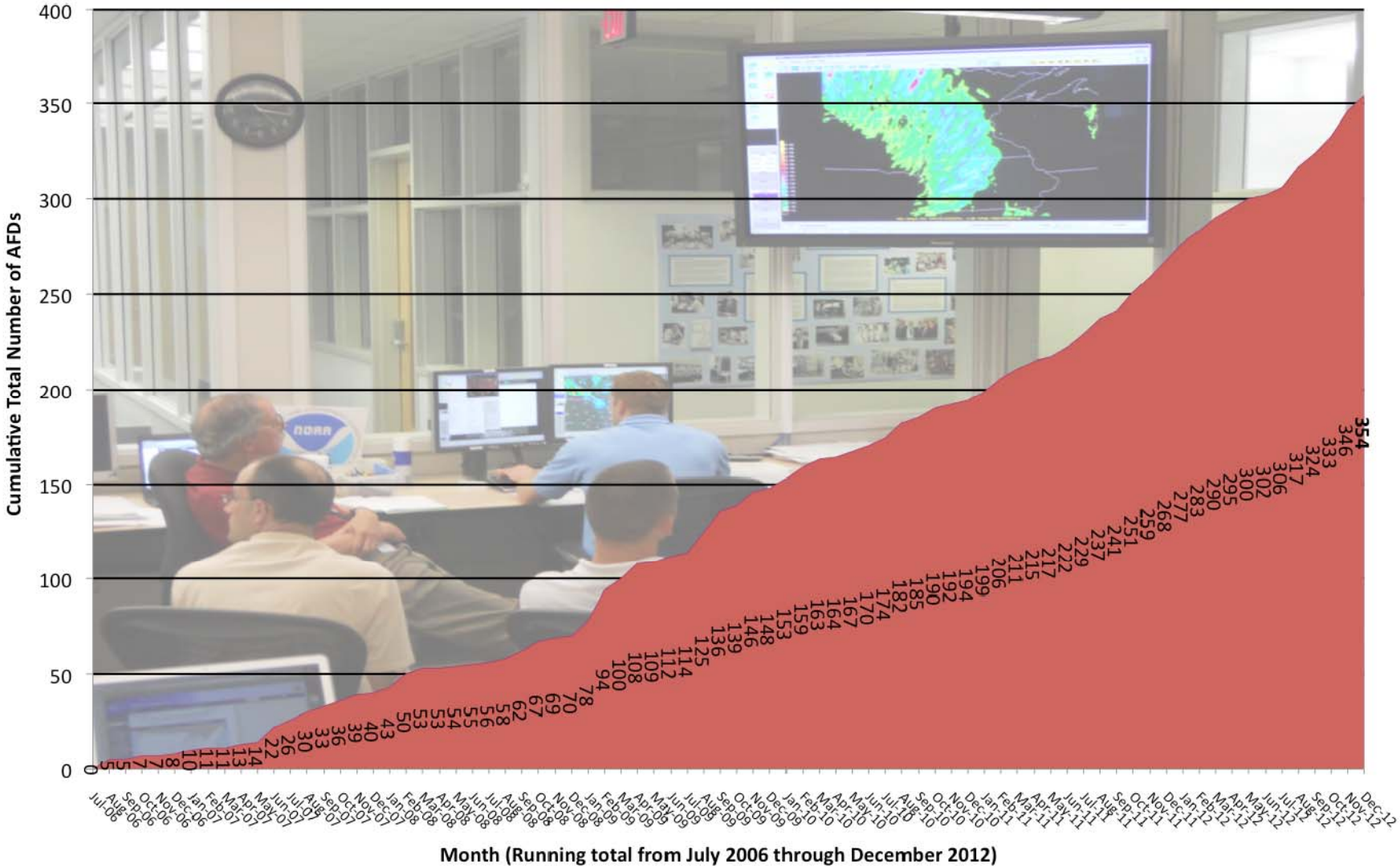
Support for Lake Gale Force Wind Warning



AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE
MILWAUKEE/SULLIVAN WI
324 AM CST TUE JAN 15 2013

.MARINE...RECENT MODIS IMAGERY SHOWS LAKE SURFACE TEMPERATURE GRADIENT RANGING FROM THE MIDDLE 30S BY THE SHORE TO THE LOWER 40S AT THE EDGE OF THE NEAR SHORE WATERS. LOW PRESSURE EXPECTED TO MOVE ACROSS SOUTHERN CANADA TONIGHT AND WEDNESDAY WILL RESULT IN TIGHT PRESSURE GRADIENT ACROSS LAKE MI AND THE WESTERN GTLAKES. BLUSTERY SOUTHWEST WINDS WILL DEVELOP LATER TONIGHT AND CONTINUE THRU WEDNESDAY. RELATIVELY WARMER LAKE MI SFC TEMPS WILL RESULT IN STEEP LOW LEVEL LAPSE RATES WHICH WILL BE ABLE TO TAP INTO STRONGER WINDS JUST OFF THE SURFACE. WIND GUSTS EXCEEDING 33 KTS LOOK MORE LIKELY WED MRNG...SO WL UPGRADE GALE WATCH TO A GALE WARNING AND EXTEND INTO THE MID AFTN. STRONGEST WIND GUSTS WL BE AWAY FROM 2 TO 5 MILES FROM SHORE...AND BEYOND. SMALL CRAFT ADVY CONDITIONS LIKELY TO LINGER INTO WED EVE.

MODIS in Area Forecast Discussions at NWS Forecast Offices through 12/31/2012



IDEA-International Air Quality

cimss.ssec.wisc.edu/idea-i/nw/?action=view_animation&params=satellit

Personal | MODIS | DB | Wx | JPSS | Technical | Bookmark

IDEA-I Infusing satellite Data into Environmental Applications – International

CIMSS

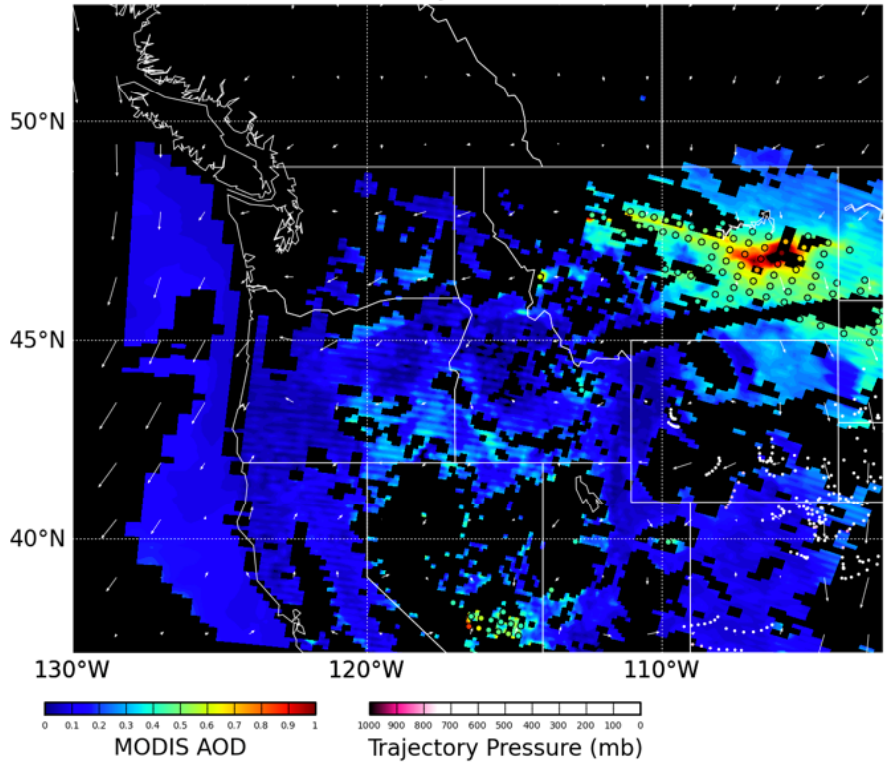
MODIS

Forward Trajectory Forecast

Satellite: Aqua Terra » Date: 02-Oct-2012

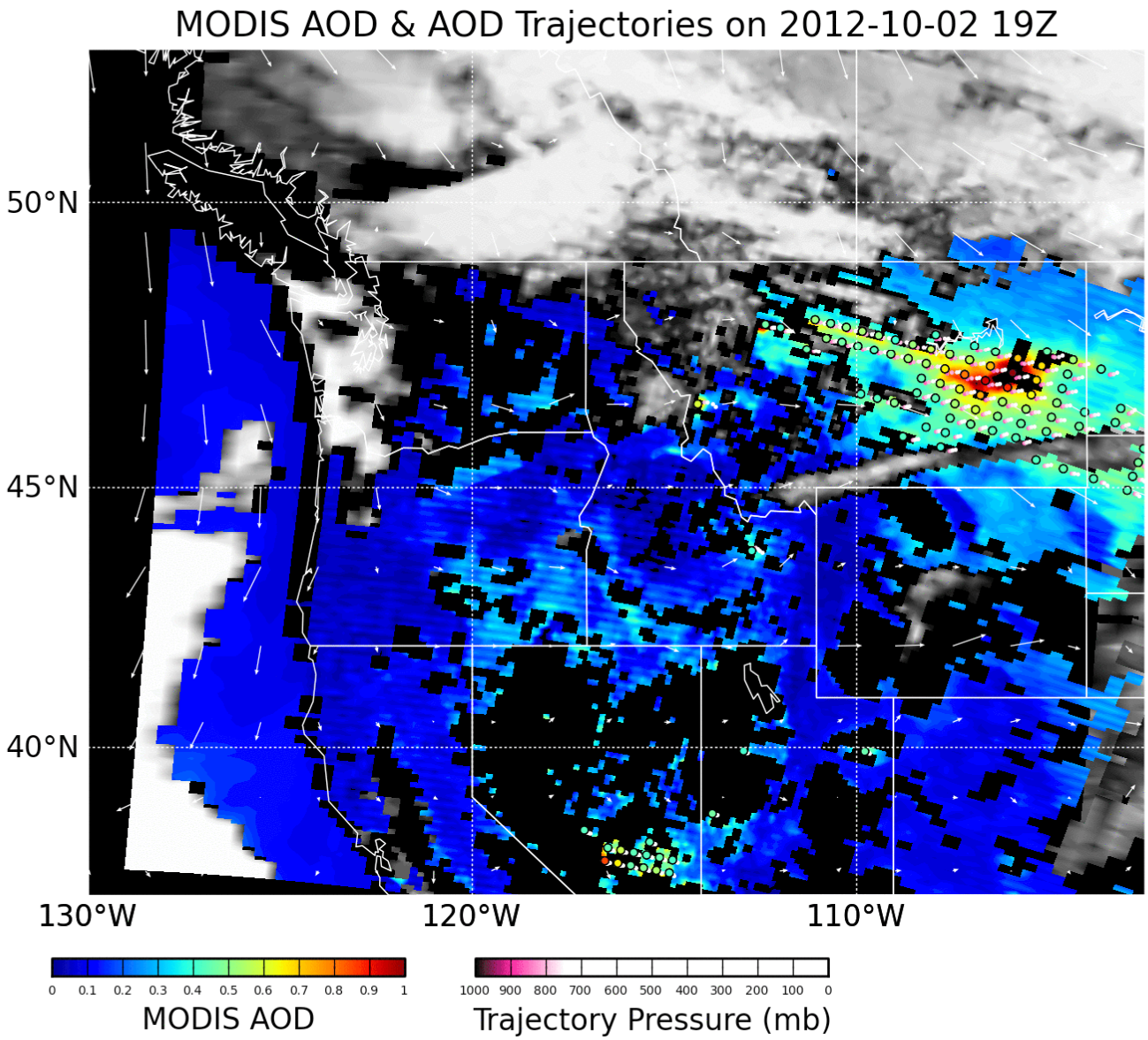
< | play | > | rock | slower | faster

MODIS AOD & AOD Trajectories on 2012-10-04 07Z



Last updated: 3 February 2012

Northwest US IDEA-I Domain



IDEA-I Example

From: Sara.Strachan@deq.idaho.gov
Subject: RE: IDEA-I processing
Date: October 1, 2012 1:29:16 PM CDT
To: Kathy Strabala

This new domain is quite useful. I've just shared this with the NW-AIRQUEST listserv which comprises air quality scientists from state agencies and EPA in Idaho, Washington, Oregon, and British Columbia. I've directed any feedback on the model and web interface to be sent to you. Washington and Oregon will probably latch onto it quickly, since they are the source of the smoke at the moment. Thanks again for your help.

Sara

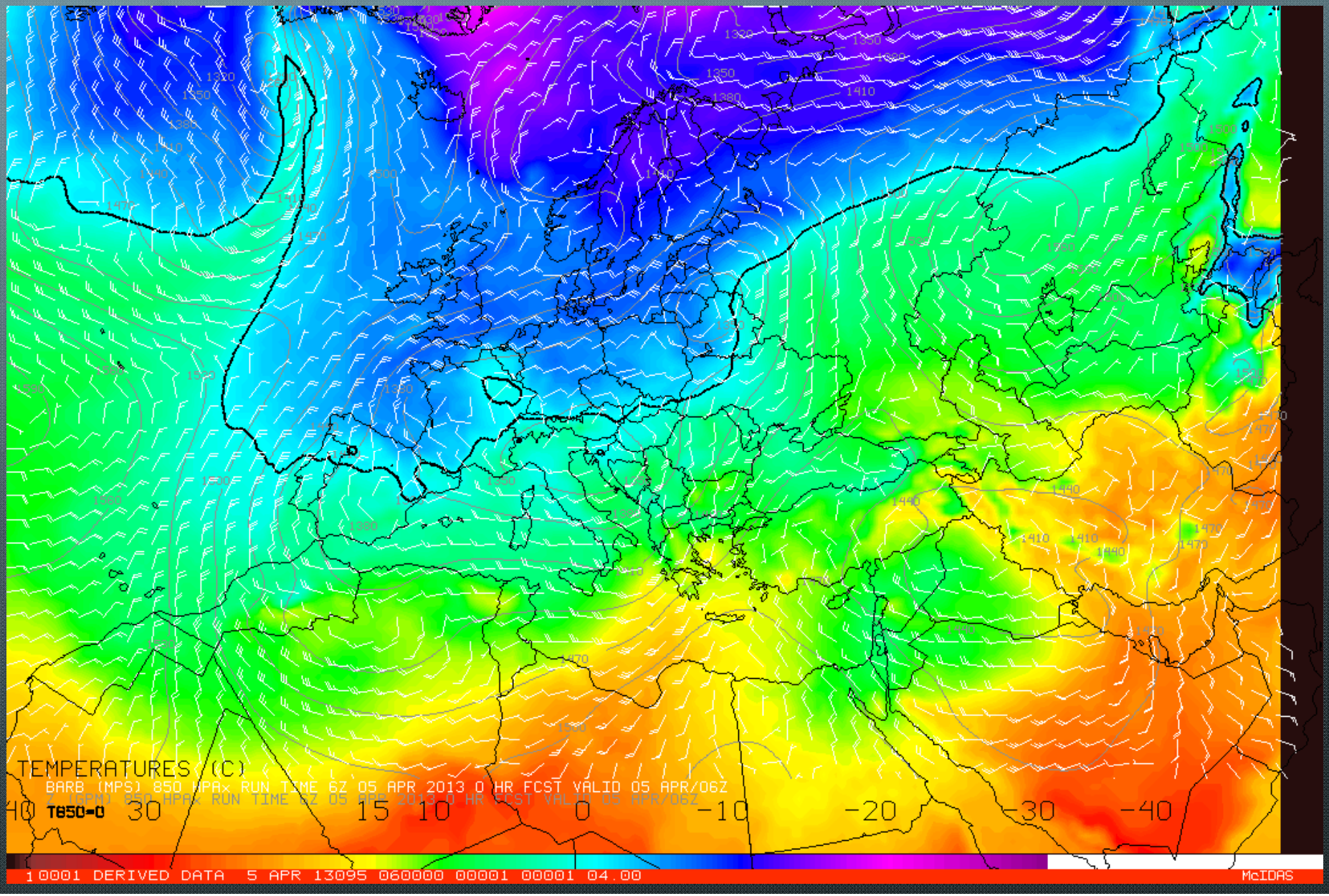
Sara M. Strachan, PhD
Idaho Dept. of Environmental Quality
1410 North Hilton
Boise, ID 83706phone: (208) 373-0567
fax: (208) 373-0340

Global Applications

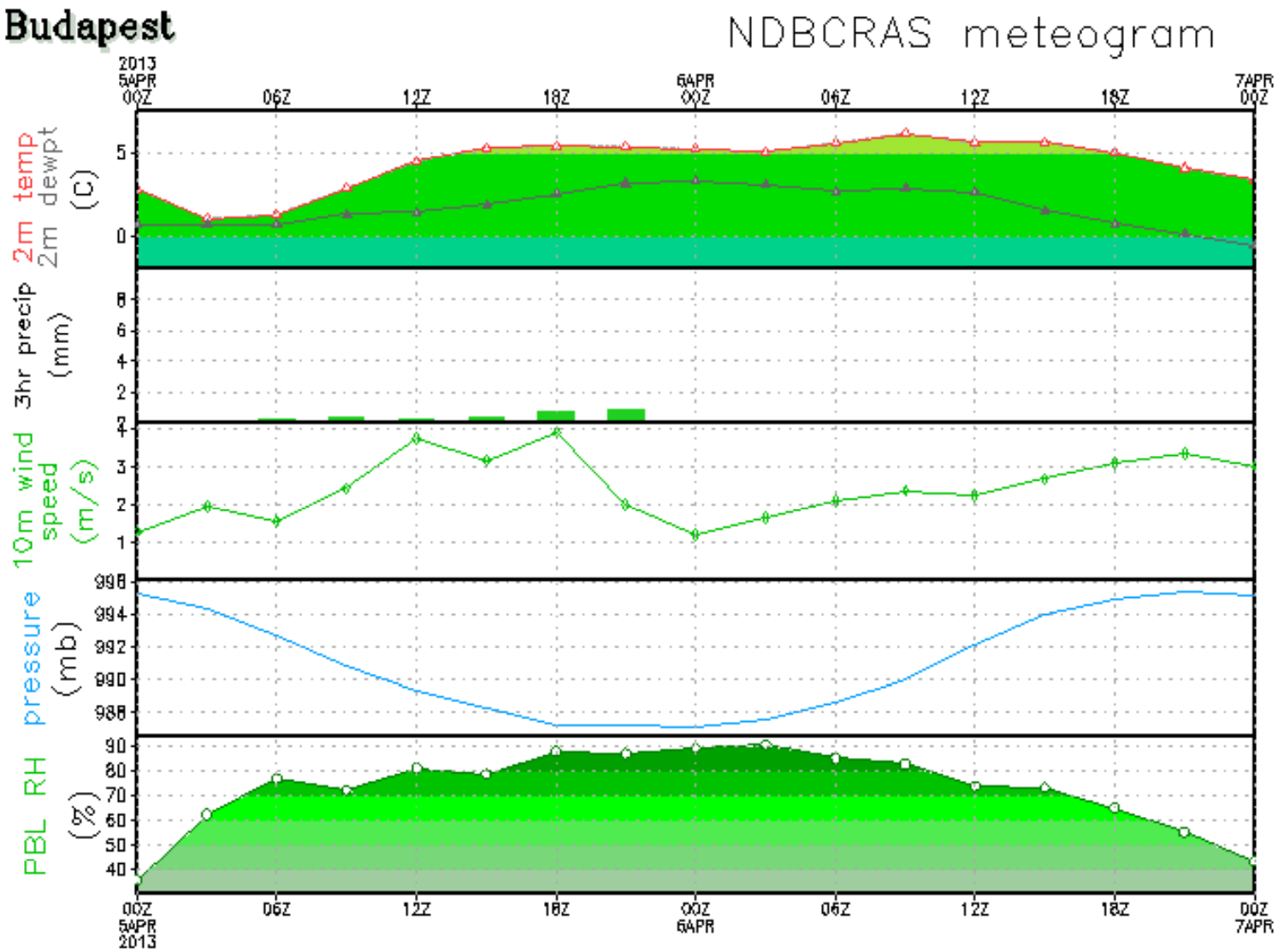
Europe

DBCRAS in Hungary

http://nimbus.elte.hu/kutatas/sat/dbcras-en.html



DBCRAS in Hungary



http://nimbus.elte.hu/kutatas/sat/dbcras-en.html

Global Applications

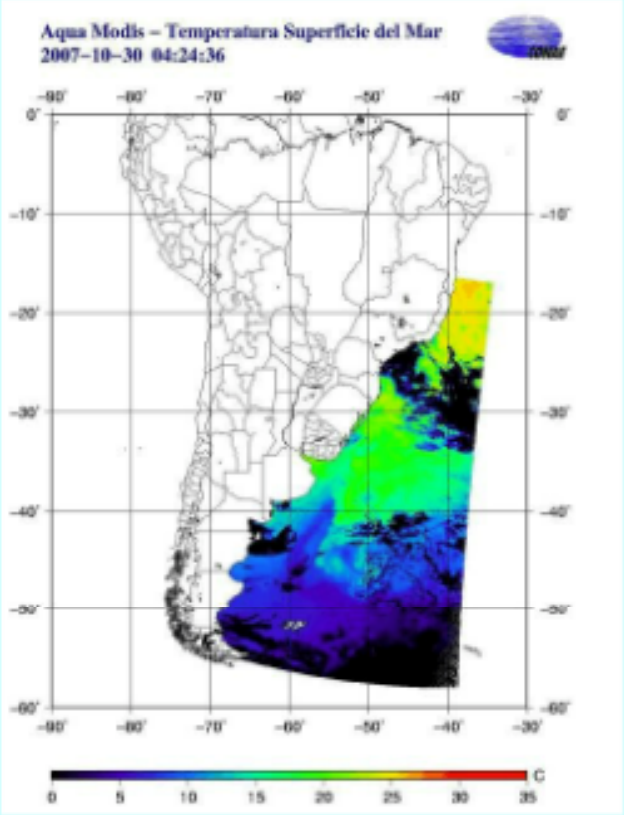
South America

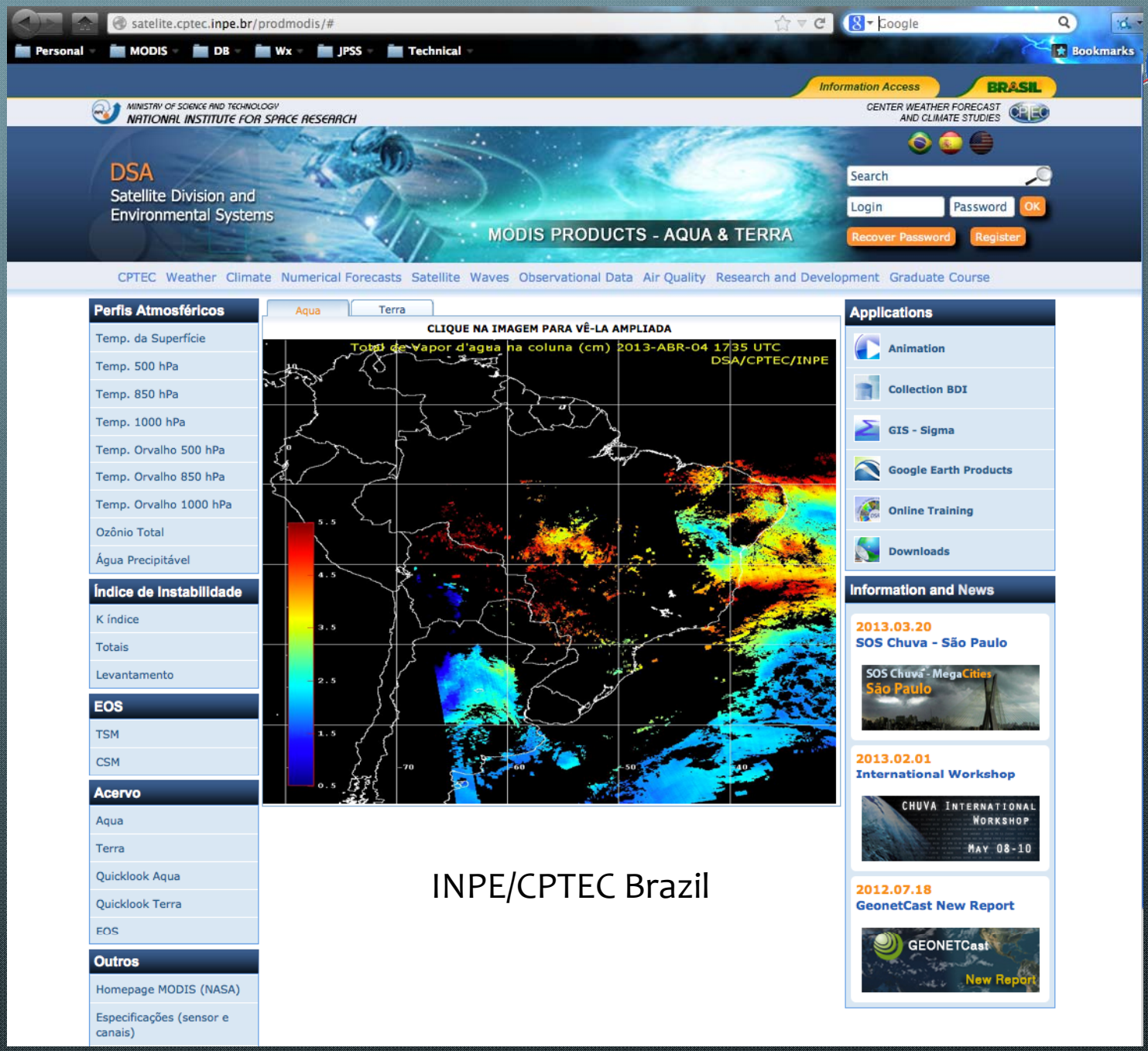
CONAE Argentina

Comisión Nacional de Actividades Espaciales

MODIS Products (IMAPP, SEADAS)

- Hot Spots
- SST, Chlorophyll
- Temperature at 1000,850,700,500,100 Hpa
- Dewpoint Temperature at 1000,850,700,500,100 Hpa
- Total Ozone
- Total, Lifted, K Indexes
- NDVI, EVI
- Cloud top Temperature and Pressure
- Cloud Mask, Phase
- Aerosol Optical Thickness





INPE/CPTEC Brazil

Performance of sounding retrievals from AIRS, GOES10, MODIS and HIRS Radiances during Mini-Barca campaign – June 2008

Simone Sievert da Costa [1]
Jurandir Ventura Rodrigues [1]
Weber Andrade Gonçalves [1]
Rodrigo Augusto Ferreira de Souza [2]

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[2] Universidade do Estado do Amazonas - UEA
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Abstract. This work aims to present some preliminary results on the evaluation of clear sky sounding retrievals operationally processed at DSA-CPTEC/INPE. Radiances are from AIRS, GOES10, MODIS and HIRS sounder sensors. The inverse solution is solved using five different processing packets (i.e. IMAPP, IAPP, GOES, MODIS, NASA-AIRS). The vertical sounding profiles are evaluated through the comparison with radiosonde from the MiniBarca campaign over the Amazon region. The statistical analyses of the temperature profiles are based on bias, root mean square error and correlation coefficient. Biases and RMSE changes are function of the retrieval scheme and sensor spectral resolution. NASA and IMAPP algorithms applied to AIRS sensors tend to represent the temperature inversion observed close to surface, while other retrieval seems to neglect it. AIRS and GOES10 and MODIS (AQUA and TERRA) present high temperature correlation (i.e. $R > 0.8$) with radiosonde data at lower levels (below 900 mbar) while HIRS present lowest correlation of 0.6. The statistical analyses of the humidity for GOES10 and NOAA18 - the only sensors used at present moment to infer moisture at DSA-CPTEC/INPE - shows that the mean error is lower than ±0.5 g/kg for GOES10 and is almost twice as bigger for HIRS-NOAA18. Overall, the retrieved temperature and moisture profiles are in reasonable good agreement with radiosondes. However, the results indicate stronger moisture biases than temperature biases. Further analyses must be carried out on the sources errors, such as initial conditions, radiances biases and cloud mask.

Key-Words: sounding retrieval, temperature and humidity profiles, sondagens, inferência de perfis termodinâmicos.

Anais XIV Simpósio Brasileiro de Sensoriamento Remoto, Natal, Brasil, 25-30 abril 2009, INPE, p. 1647-1652.

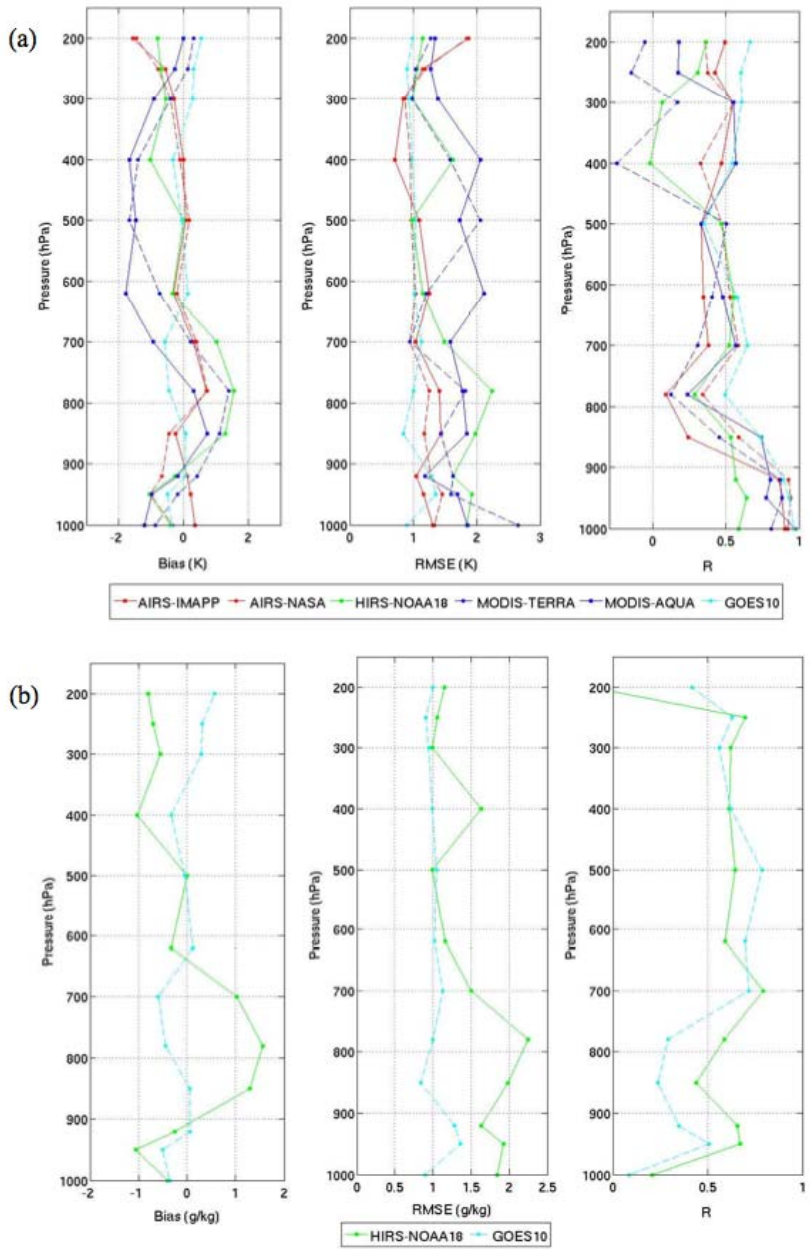
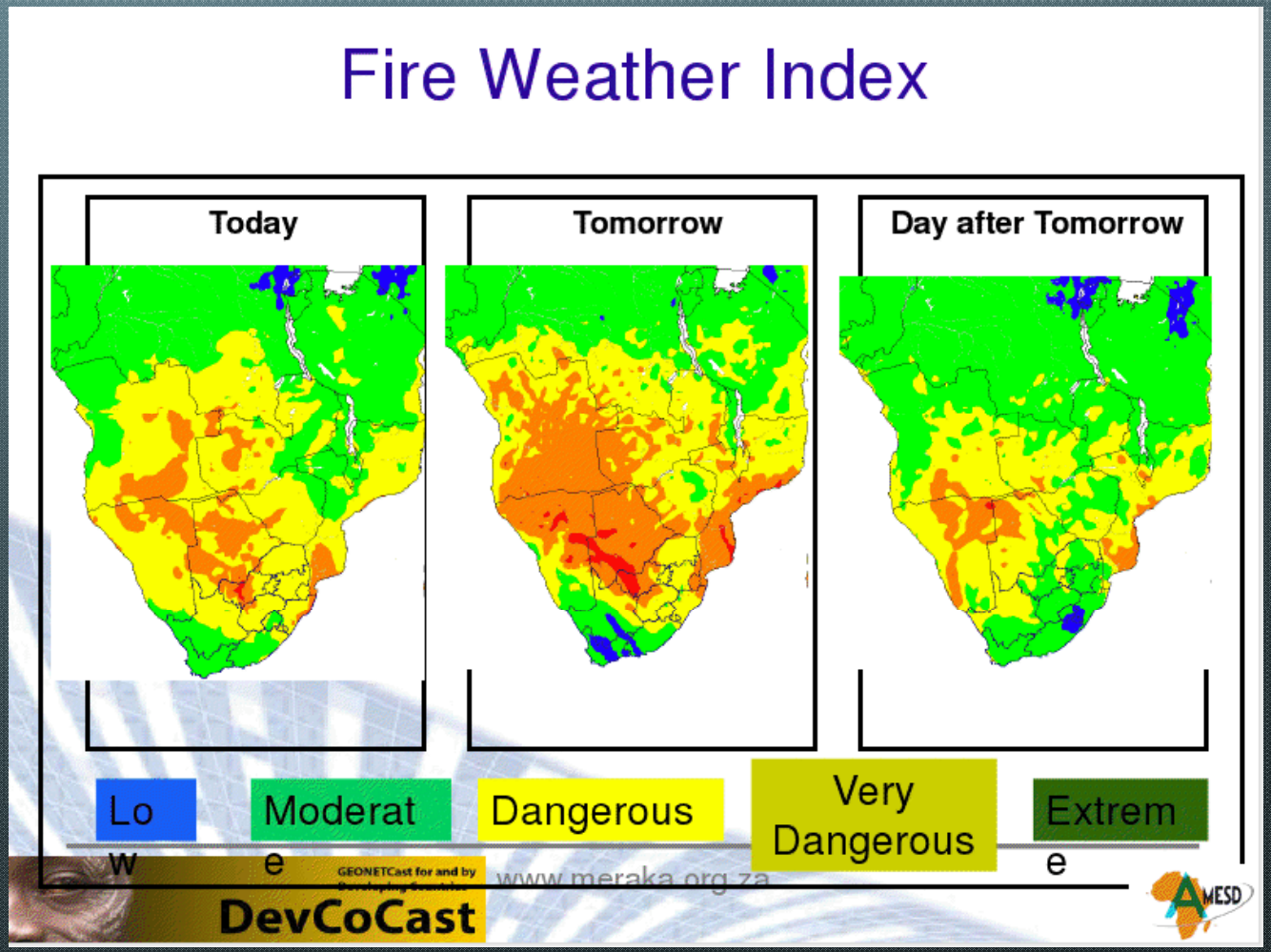


Figure 3 – Comparison of statistical analyses (Bias, RMSE and Correlation coefficient) for the retrieved (a) temperature (K) and (b) mixing ratio (g/kg) as function of pressure.

Global Applications

Africa

CSIR AFIS Advanced Fire Information System



Global Applications

Asia

Committee on Earth Observation Satellites

AQUA/TERR MODIS L1B in the S...

idn.ceos.org/portals/Metadata.do?Portal=idn_ceos&KeywordPath=DataCenters|GOVERNMENT+A

Personal | MODIS | DB | Wx | JPSS | Technical

CEOS International Directory Network Portals

Record Search Query: Data Providers>GOVERNMENT AGENCIES-NON-US>JAPAN>JP/CC/AFFR

AQUA/TERR MODIS L1B in the SIDaB Data Base

Entry ID: MAFFIN_SIDaB_0027

[Update this Record]

Summary

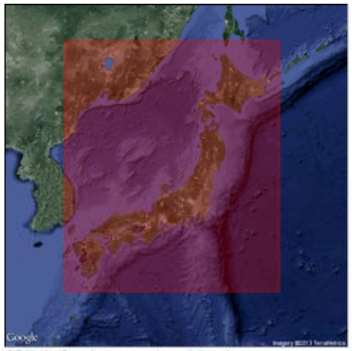
Abstract: The AQUA/TERRA MODIS Level 1B data set are distributed from SIDaB database system.The data was generated by using IMAPP software from MODIS-DB and was archived by TeraScan software into SIDaB.The data was used for quick imaging by TeraScan for natural disaster monitoring.

Related URL

Link: VIEW PROJECT HOME PAGE

Description: Satellite data base system for Agriculture Forestry and Fisheries research

Geographic Coverage



(Click for Interactive Map)

Spatial coordinates

N: 46.26 **S:** 30.1 **E:** 146.46 **W:** 128.74

Temporal Coverage

Start Date: 2002-11-06

Location Keywords

CONTINENT > ASIA > EASTERN ASIA > JAPAN

CONTINENT > ASIA > EASTERN ASIA

Science Keywords

SPECTRAL/ENGINEERING > INFRARED WAVELENGTHS > INFRARED IMAGERY

SPECTRAL/ENGINEERING > VISIBLE WAVELENGTHS > VISIBLE IMAGERY

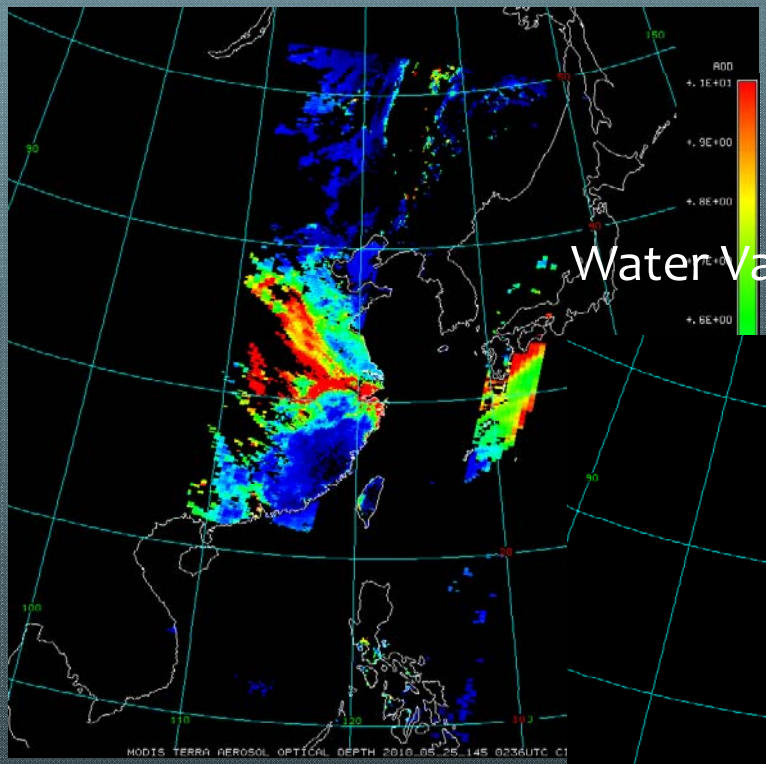
ISO Topic Category

IMAGERY/BASE MAPS/EARTH COVER

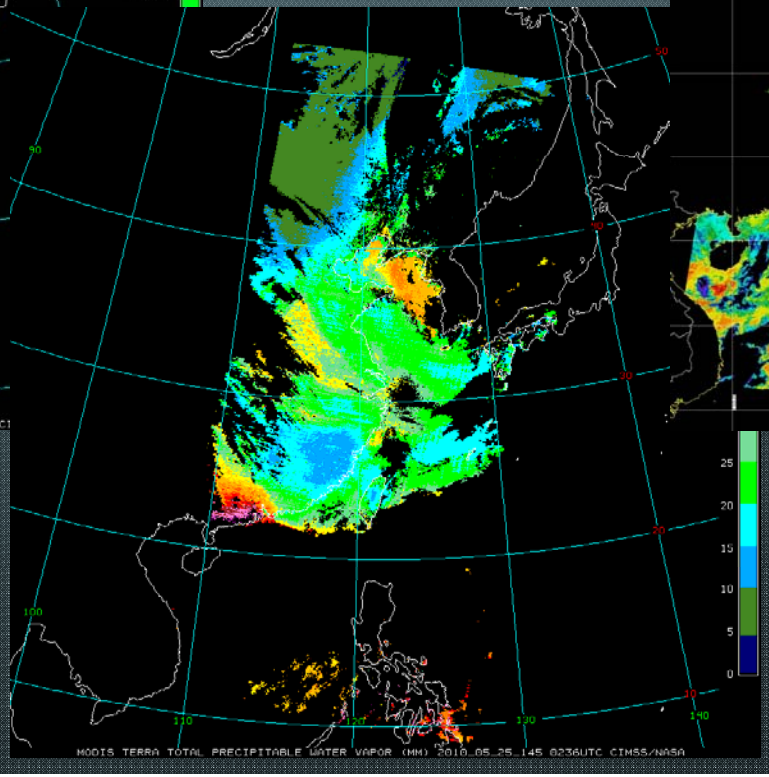
First ECNU DB MODIS Products

0552 UTC, May 25, 2010

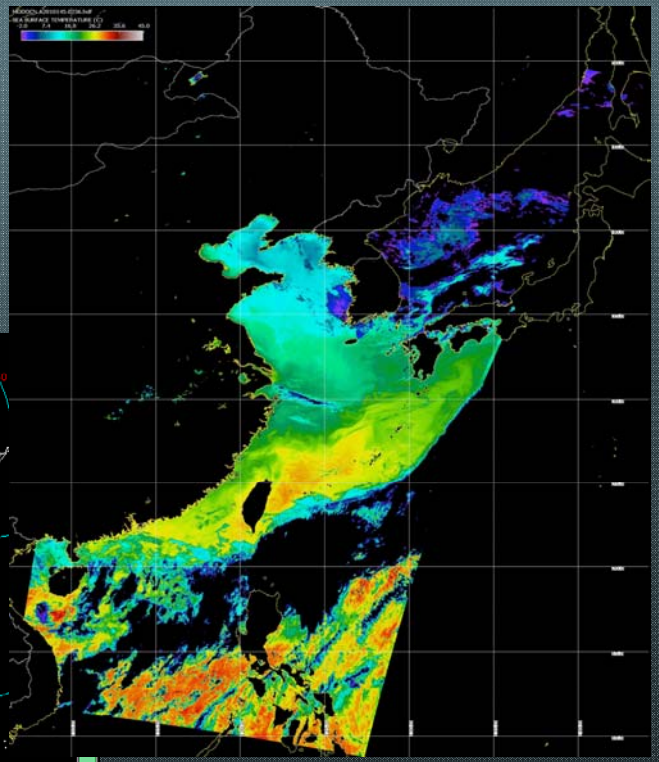
Aerosol Optical Thickness



Water Vapor



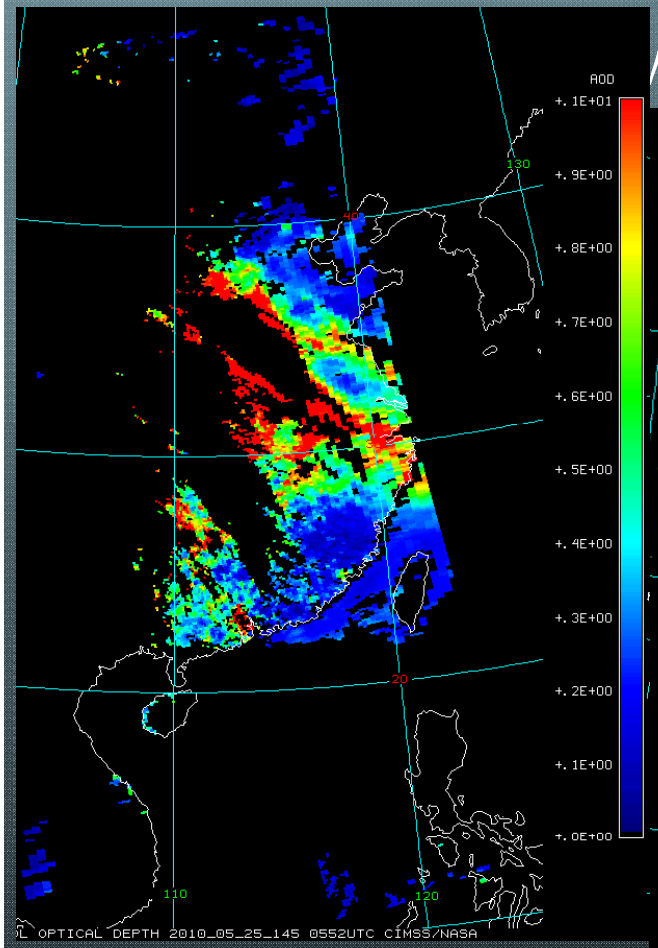
Sea Surface Temperature



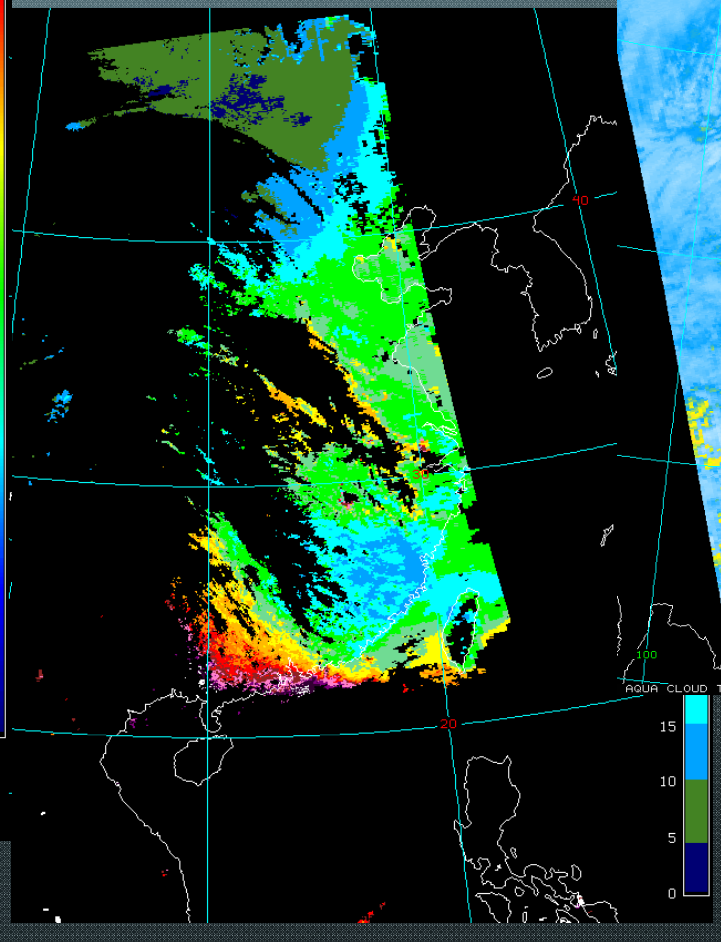
First ECNU DB MODIS Products

0236 UTC, May 25, 2010

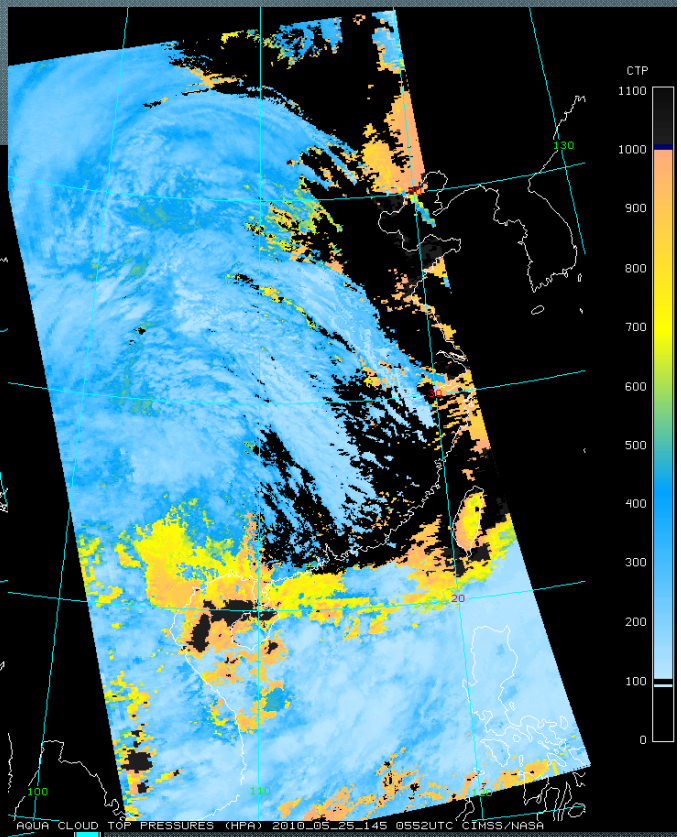
Aerosol Optical Thickness



Water Vapor

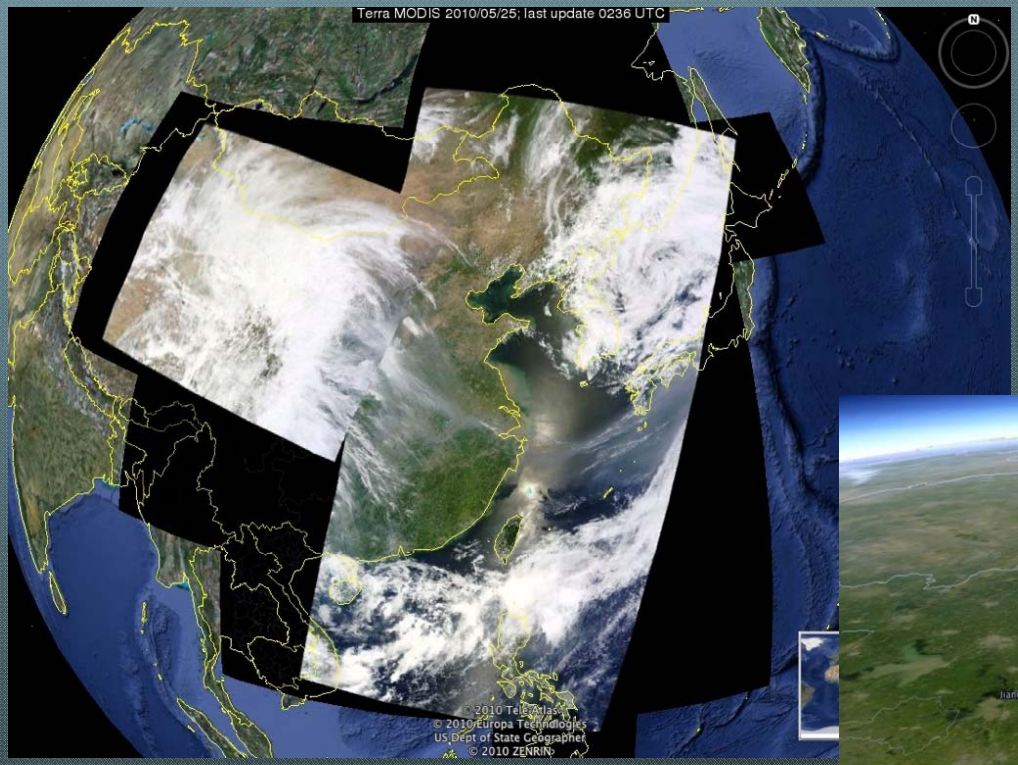


Cloud Top Temperature



First ECNU DB MODIS image in Google Earth

0236 UTC, May 25, 2010

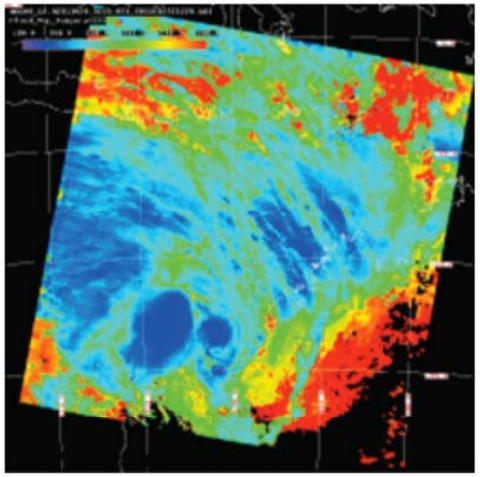


Global Applications

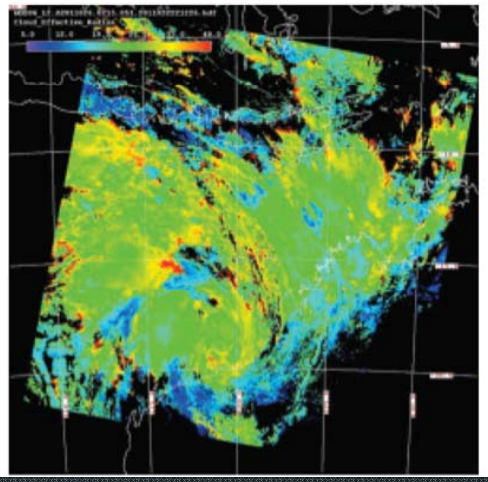
Australia

WESTERN AUSTRALIAN SATELLITE TECHNOLOGY AND APPLICATIONS CONSORTIUM

APPLICATIONS CONSORTIUM

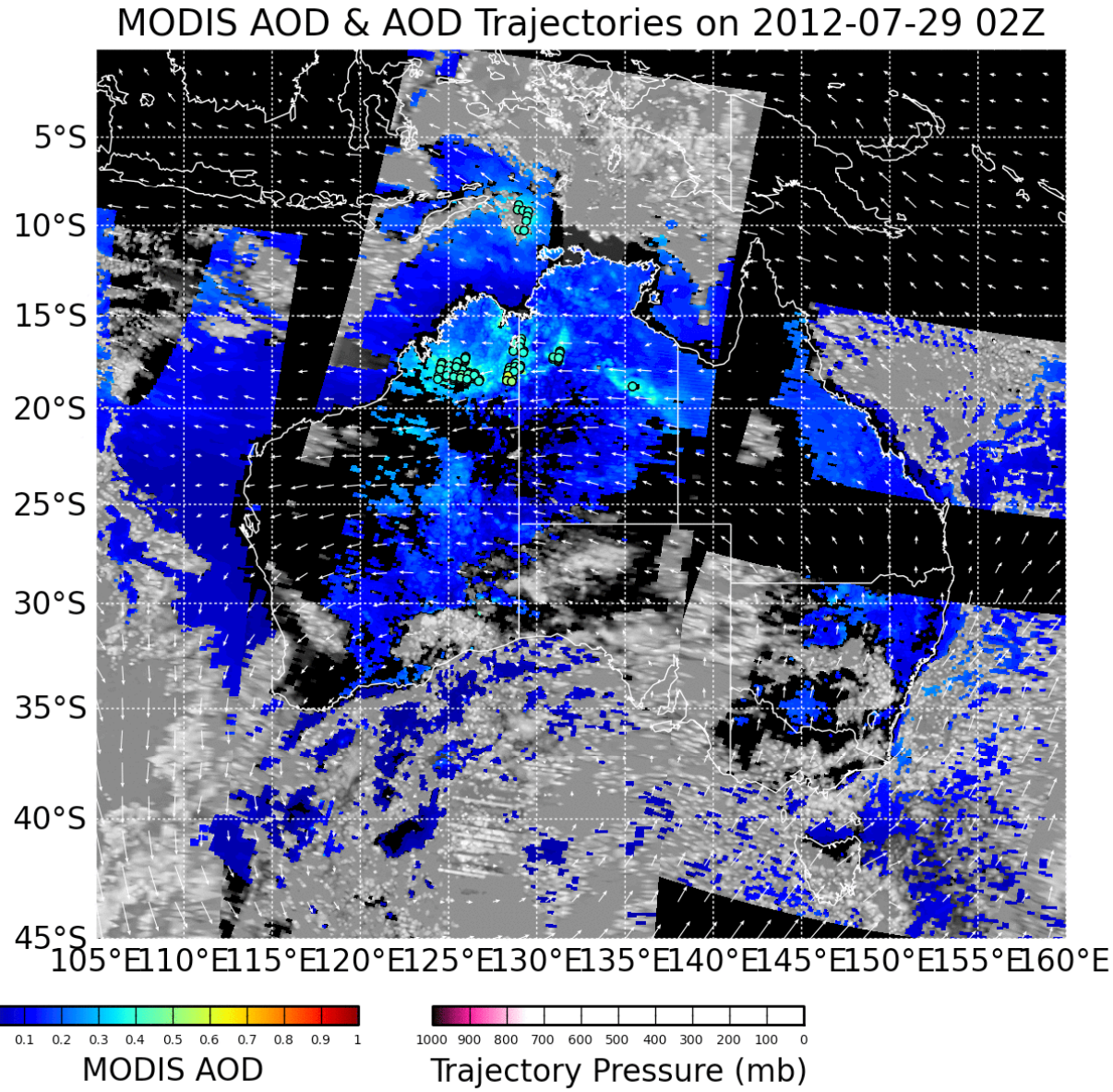


The Aqua satellite also carries the Atmospheric Infrared Sounder (AIRS), which provides atmospheric profile data at high spectral resolution. Image products describing the temperature and moisture structure of the atmosphere are also produced by IMAPP software for delivery to forecasters. AIRS data have shown major positive NWP impact overseas, and are being assimilated on a trial basis into the Bureau's new NWP system, 'ACCESS' which is a local implementation of the United Kingdom Met Office Unified Model.



2010 Report From the Western Australia Satellite Technology and Applications Consortium

WESTAC IDEA-I Implementation



Global Applications

Polar Regions

http://stratus.ssec.wisc.edu/cgi-bin/db_main?site=mcmurdo

Getting Started | Apple | Personal | MODIS | DB | Wx | Technical

NESDIS/STAR/ASPT | Home | Products | Projects | Scenes | Links | CIMSS

McMurdo Home
Tromsø Home
Sodankylä Home
Fairbanks Home
Barrow Home
Real-Time Home

Atmosphere Products:

MODIS winds
Cloud mask
Cloud pressure
Cloud phase
TPW
Inversions:
Strength
Depth

Surface Products:

Surface Temperature
Surface Albedo
Snow Index
Vegetation Index

Image Products:

RGB Day
RGB Night
True Color

Misc:

Data Access
Credits
Cautions
Processing times
Model winds:
Surface
400 hPa

Real-Time MODIS Products from McMurdo

A number of MODIS products are generated on-site at McMurdo, Antarctica, using data from the National Science Foundation's direct broadcast system. Here are the most recent images for each product. **Click on the product links at left for more images of a specific product.** The purpose of this direct broadcast real-time system is two-fold: (1) to generate polar wind and other information more quickly than is done with our current system, so that numerical weather prediction centers can assimilate more polar data in their model runs, and (2) to provide an additional source of information, primarily winds, for weather forecasters in Antarctica.

TERRA:

Winds — Day 120, 16:46 UTC
Cloud Mask — Day 120, 16:46 UTC
Cloud Pressure — Day 120, 16:46 UTC
Cloud Phase — Day 120, 16:46 UTC
Inversion Strength — Day 120, 16:46 UTC
Inversion Depth — Day 120, 16:46 UTC
Precipitable Water — Day 120, 16:46 UTC
Surface Temperature — Day 120, 16:46 UTC
Surface Albedo — Day 120, 16:46 UTC
Snow Index — Day 120, 16:46 UTC
Vegetation Index — Day 120, 16:46 UTC
RGB Day — Day 120, 16:46 UTC
RGB Night — Day 120, 16:46 UTC
True Color — Day 120, 16:46 UTC

Find: Wang | Next | Previous | Highlight all | Match case

Done

http://stratus.ssec.wisc.edu/cgi-bin/db_main?site=tromso

Getting Started | Apple | Personal | MODIS | DB | Wx | Technical

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Real-Time Home

Atmosphere Products:

MODIS winds
Cloud mask
Cloud pressure
Cloud phase
TPW
Inversions:
Strength
Depth

Surface Products:

Surface Temperature
Surface Albedo
Snow Index
Vegetation Index

Image Products:

RGB Day
RGB Night
True Color

Misc:

Data Access
Credits
Cautions
Processing times
Model winds:
Surface
400 hPa

Real-Time MODIS Products from Tromsø, Norway

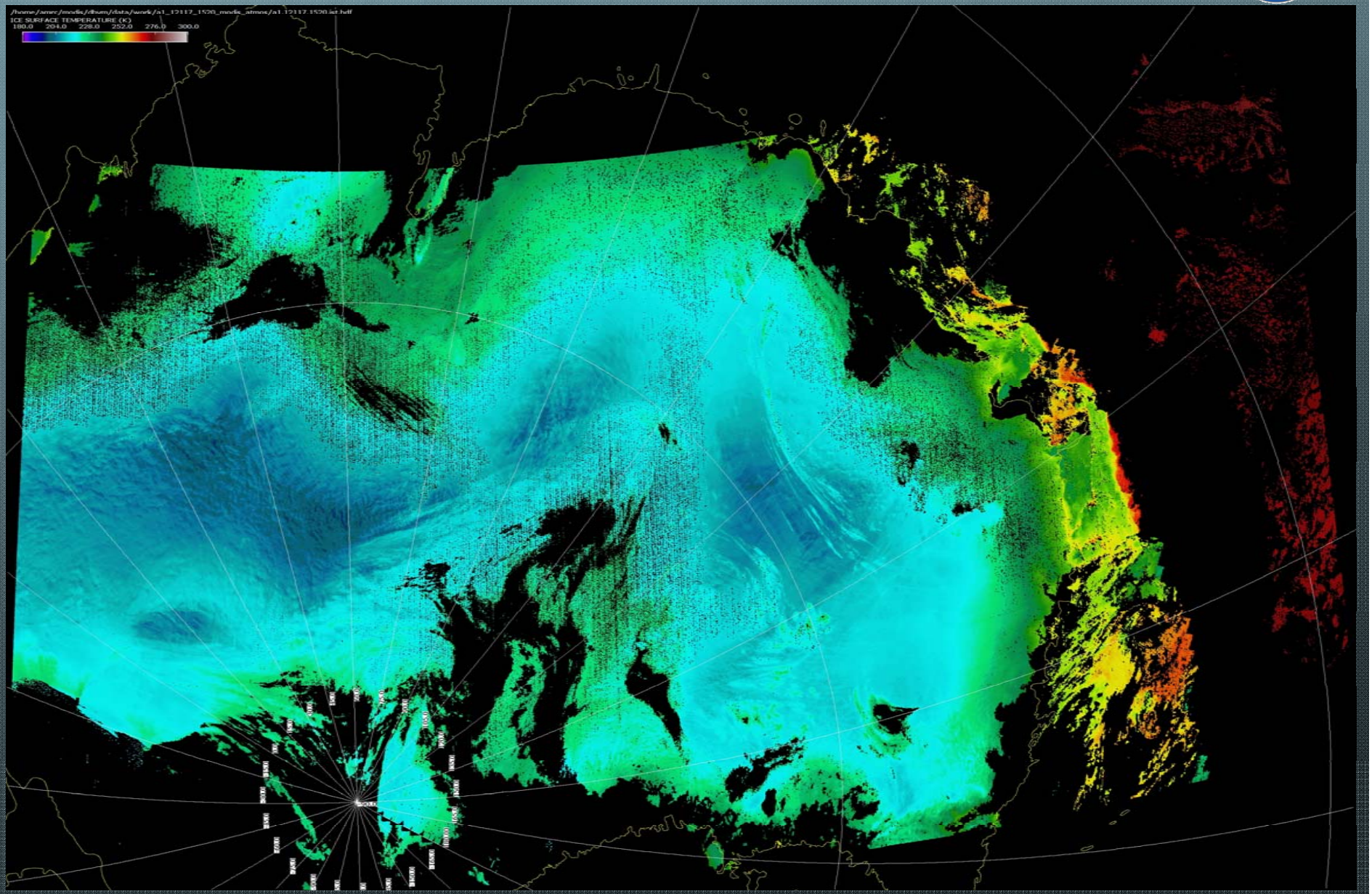
A number of MODIS products are generated on-site at Tromsø, Norway, using data from the Integrated Program Office's direct broadcast system. That system is operated by Ksat. Here are the most recent images for each product. **Click on the product links at left for more images of a specific product.** The purpose of this direct broadcast real-time system is two-fold: (1) to generate polar wind and other information more quickly than is done with our current system, so that numerical weather prediction centers can assimilate more polar data in their model runs, and (2) to provide an additional source of information, primarily winds, for local weather forecasters. NOTE: Because of Aqua playback scheduling, only Terra data are used for these products.

TERRA:

Winds — Day 120, 15:56 UTC
Cloud Mask — Day 120, 17:33 UTC
Cloud Pressure — Day 120, 17:33 UTC
Cloud Phase — Day 120, 17:33 UTC
Inversion Strength — Day 120, 17:33 UTC
Inversion Depth — Day 120, 17:33 UTC
Precipitable Water — Day 120, 17:33 UTC
Surface Temperature — Day 120, 17:33 UTC
Surface Albedo — Day 120, 17:33 UTC
Snow Index — Day 112, 16:45 UTC
Vegetation Index — Day 112, 16:45 UTC
RGB Day — Day 120, 17:33 UTC
RGB Night
True Color

Find: | Next | Previous | Highlight all

Done


/home/amrc/modis/dhum/data/work/a1_12117_1520_modis_atmos/a1.12117.1520.ist.hdf
ICE SURFACE TEMPERATURE (K)
180.0 204.0 228.0 252.0 276.0 300.0

Global IMAPP Workshops

Web site: http://cimss.ssec.wisc.edu/dbs/

2004 – Nanjing, China
2004 – Perth, Australia
2005 – Taipei, Taiwan
2005 – Beijing, China
2006 – Andenes, Norway
2006 – Pretoria, South Africa
2007 - Cachoeira Paulista, Brazil as part of GEOSS
2009 – Stellenbosch University, South Africa

IGARSS Short Course 4: MODIS direct broadcast data for enhanced forecasting and real-time environmental decision making

2011 June – Shanghai, China

East China Normal University (ECNU): Satellite direct broadcast data for real-time environmental applications

2011 September – Jakarta, Indonesia

WMO Region V Training workshop on satellite applications for meteorology and climatology

Indonesia 2011

Working with World Meteorological Organization (WMO) And BMKG Indonesia

Publications

18 Refereed Journal Articles: related to IMAPP in 2012, here are a set of examples:

- **Weisz, E., W. P. Menzel, N. Smith, R. Frey, E. E. Borbas, and B. A. Baum (2012), An approach for improving cirrus cloud top pressure/height estimation by merging high spatial resolution infrared window data with high spectral resolution sounder data.. J. Appl. Meteor. Climatol., 51, 1477-1488.**

- **Mitra, A. K., A. K. Sharma, V. K. Soni, and P. K. Kundu. "Characteristics of recent dust storms over the Indian region using real time multi-satellite observations from the direct broadcast receiving system at IMD." Advances in Space Research (2012).**

- Seyed Rashid Fallah Shamsi, Sanaz Zare and Seyed Ali Abtahi. "Soil salinity characteristics using moderate resolution imaging spectroradiometer (MODIS) images and statistical analysis." *Archives of Agronomy and Soil Science* (2012), Vol. 59, Iss. 4, 2013.

- Zuo, Min, Hongwu Chen, Hailei Wang, and Zhimin Feng. "Monitoring and Analyzing for Overflowing Status of Hotan River in Summer Season Based on EOS/MODIS Data." Future Control and Automation, Volume 172, (2012): 1-8.

- Recondo, Carmen, Enrique Pendás, Sofía Moreno, de Vicuña, Alfonso García-Martínez, Adán Abajo, and Eva Zapico. "A simple empirical method for estimating surface water vapour pressure using MODIS near-infrared channels: applications to northern Spain's Asturias region." International Journal of Remote Sensing ahead-of-print (2013): 1-26.

Summarizing the First Ten Years of NASA's Aqua Mission

Claire L. Parkinson

***Abstract*—The Aqua spacecraft was launched on May 4, 2002 with six Earth-observing instruments on board to collect data on a wide variety of Earth system variables. After ten years of on-orbit operations, Aqua has provided data that have contributed to over 2 000 scientific publications, with new results on the Earth's energy budget, trace gases and particulate matter in the atmosphere, vegetation on land and in the oceans, and many aspects of the water cycle, including evaporation and transpiration, water vapor, cloud cover, precipitation, the oceans, sea ice and land ice, snow cover, and soil moisture. Additionally, Aqua data have been used to assist in practical applications ranging from weather forecasting to the deployment of firefighters and the routing of aircraft. Although the six-year design life of the satellite has been successfully completed and exceeded, enough fuel remains on Aqua for approximately another ten years of operations.**

***Index Terms*—Satellite Earth observations, Aqua, global energy budget, water cycle.**

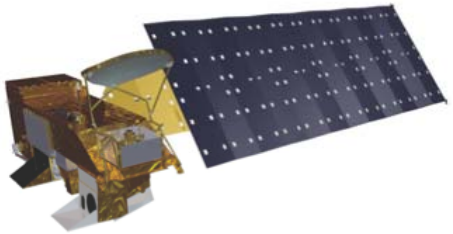


Fig. 1. Artist's rendition of the Aqua spacecraft in orbit. (Rendering by Marit Jentoft-Nilsen, based on an earlier version by TRW/Northrop Grumman.)

I. Introduction

NASA's Earth-orbiting Aqua spacecraft (Fig. 1) was launched at 2:55 a.m. on May 4, 2002, from Vandenberg Air Force Base in California. It soon was maneuvered to its desired near-polar, sun-synchronous orbit at an altitude of 705 km, crossing the equator going north at 1:30 in the afternoon and south at 1:30 in the morning, local time [32]. At 705 km, Aqua orbits the Earth every 98.8 minutes. Aqua has now exceeded ten years of on-orbit operations, with a wealth of scientific output resulting at least in part from the use of Aqua data.

Aqua was specifically named for the significant amount of information that it collects regarding water in the Earth system, 'Aqua' being Latin for 'water'. Aqua measurements include water in the atmosphere, on land, and in the oceans, and water in each of its three states: gaseous, liquid, and solid. The Aqua measurements, however, include other aspects of the Earth system as well, and this paper highlights a selection of the key results obtained from the extensive Aqua datasets, doing so in sections on: the global energy budget; water vapor, clouds, and precipitation; other atmospheric trace gases; particulate matter in the atmosphere; ice and snow; vegetation and other life forms; and temperature. The science results are followed by a section on practical applications. First, though, comes a section describing the complement of Aqua's Earth-observing instruments.

Manuscript received September 26, 2012; revised December 04, 2012 and January 08, 2013; accepted January 09, 2013. This work was funded by the Earth Science Division at NASA Headquarters.

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Color versions of one or more of the figures in this paper are available online at http://ieeexplore.ieee.org.

Digital Object Identifier 10.1109/JSTARS.2013.2239608

II. Aqua's Earth-Observing Instruments

Aqua has on board six Earth-observing instruments: the Atmospheric Infrared Sounder (AIRS), the Advanced Microwave Sounding Unit (AMSU), the Humidity Sounder for Brazil (HSB), the Advanced Microwave Scanning Radiometer for the Earth Observing System (AMSR-E), the Moderate Resolution Imaging Spectroradiometer (MODIS), and the Clouds and the Earth's Radiant Energy System (CERES). HSB was provided by the Brazilian Institute for Space Research, AMSR-E was provided by the Japan Aerospace Exploration Agency (JAXA), and the remaining instruments and the spacecraft were provided by the United States National Aeronautics and Space Administration (NASA).

AIRS, AMSU, and HSB together constitute a sophisticated sounding system centered on AIRS. AIRS makes measurements at 2378 infrared and 4 visible/near-infrared channels and is unique to the Aqua platform. The 2378 infrared channels on AIRS far exceed the number of channels on previous satellite sounders and enable the determination of atmospheric temperature, moisture, and key trace gases in the atmosphere as well as cloud and surface parameters.

In contrast to the uniqueness of AIRS, both AMSU and HSB are near-identical copies of instruments flown also on satellites of the National Oceanic and Atmospheric Administration (NOAA). AMSU is a 15-channel microwave sounder used in the Aqua sounder system to facilitate cloud clearing of the AIRS observations and to provide, for instance, cloud liquid water and vertical temperature profiles in the presence of clouds. HSB is a four-channel microwave sounder that

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IV. Practical Applications

Although the Aqua mission was developed largely for its scientific value, the Aqua data have proven to be of immense practical value as well. This section discusses several of the practical applications of the Aqua data, beginning with one that affects hundreds of millions of people, namely, weather forecasting.

A. Weather Forecasting

When the AIRS instrument was conceived and developed, one of the primary goals for it was to facilitate improved weather forecasts. As anticipated well before launch, the high accuracies of the AIRS/AMSU temperature and water vapor products (Sections III-B and III-G) have led to measurable improvements in forecast skill when these data are incorporated in weather forecast models [4]. As a result, NOAA and other weather forecasting agencies in North America and in Europe, Asia, Africa, Australia, and South America routinely use at least some of the AIRS data in their forecast models. Some of these agencies, however, use only clear-sky radiances; studies have shown that some forecasts could be improved even further with assimilation of more of the AIRS data [36].

Although less anticipated, MODIS and AMSR-E data have also proven valuable for forecasts. Specifically, incorporation of MODIS-derived polar winds in weather forecast models has resulted in improved forecasts for the polar regions and beyond [24], [37], and AMSR-E sea surface temperature, water vapor, and precipitation data have all been used by hurricane prediction centers. The Japan Meteorological Agency (JMA) has found that assimilation of AMSR-E data has improved the skill of the JMA forecasts of hurricane tracks. Further, the Joint Center for Satellite Data Assimilation has reported that assimilation of AMSR-E radiances over the oceans improves medium-range forecasts in the Southern Hemisphere, although shows neutral impacts for the Northern Hemisphere [30].

Fig. 10. Aqua MODIS image of forest fires in Oregon, in the northwest United States, on August 12, 2002. Such images assist forest services in monitoring forest fires and determining the appropriate deployment of fire fighters.

The usage of Aqua data in weather forecasts is greatly facilitated by two important services. One is NOAA's National Environmental Satellite, Data, and Information Service (NESDIS), which distributes the AIRS radiance data in near real time. The other is a software package—the International MODIS/AIRS Processing Package (IMAPP)—made available by the University of Wisconsin's Cooperative Institute for Meteorological Satellite Studies (CIMSS). IMAPP converts direct broadcast data from Aqua and Terra into a suite of geophysical data products from the MODIS, AIRS, AMSU, and AMSR-E instruments. This IMAPP software is used not only by weather agencies to support weather forecasting but also for the fog detection and snow/ice/cloud discrimination provided by the MODIS products.

Conclusions

- The free distribution of NASA Aqua and Terra data and software have resulted in their wide use
- IMAPP software is being used for a wide variety of applications globally
- We believe it has had a positive impact in the area of satellite remote sensing applications
- We believe future packages such as CSPP will do the same for current and future satellites

What are we working on?

- Collection 6 updates to MODIS level 2 product package
- AIRS version 6 software package
  - JPL direct broadcast version
- AIRS ozone and trace gas trajectory forecasts
  - Addition to IDEA-I
  - Input is dual-regression retrievals meaning cross –platform (CrIS and IASI)
- MODIS Polar2grid software extension
  - Reprojected GeoTIFFs of L1B reflectances, brightness temperatures and True color images

The goal of the meeting is to bring together the worldwide community of CSPP and IMAPP users to discuss issues relevant to reception, processing and applications of data acquired by direct broadcast from Suomi NPP, Terra and Aqua.

Abstract Submission Deadline: 1 May 2013

CSPP/IMAPP Users' Group Meeting

Madison, Wisconsin

21-23 May 2013

http://www.ssec.wisc.edu/meetings/cspp/

Master's Degree Thesis

UNIVERSITAS INDONESIA

PENENTUAN KANDUNGAN UAP AIR MAMPU CURAH
MENGGUNAKAN DATA TERRA/AQUA MODIS

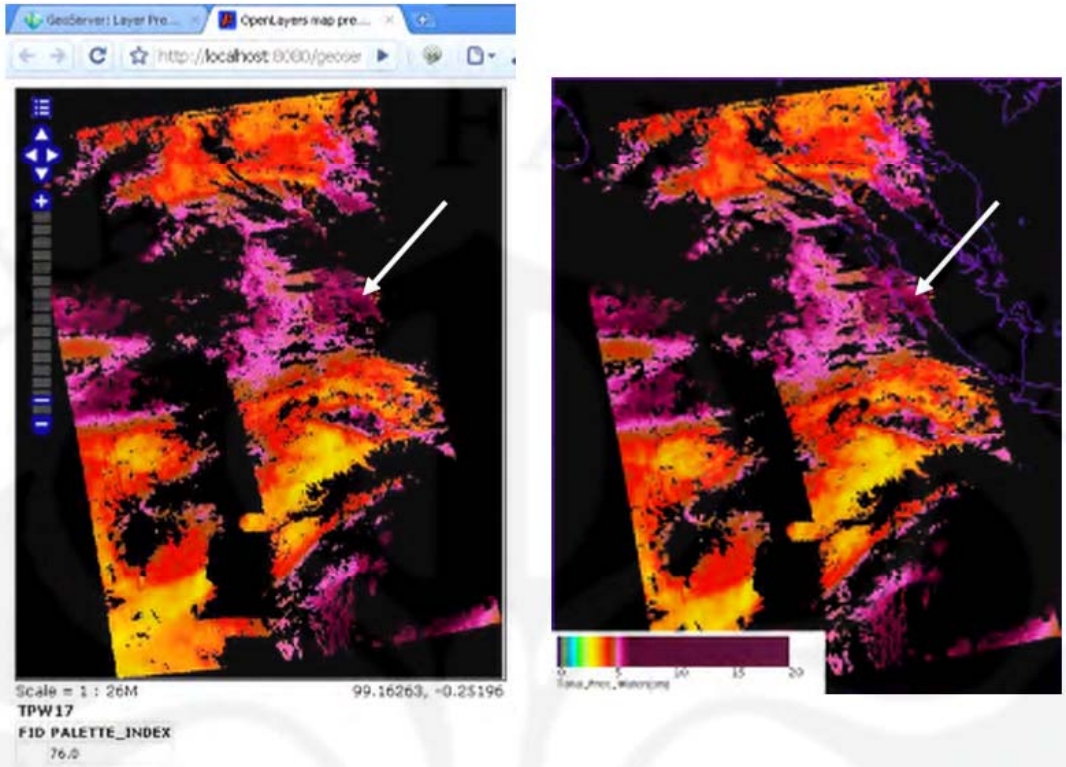
SKRIPSI

ABDULLAH MANSYUR
0606078254

FAKULTAS TEKNIK
PROGRAM STUDI TEKNIK ELEKTRO
DEPOK
JUNI 2010

Master's Degree Thesis

IMAPP MODIS TPW Study over Java



(a) (b)

Gambar 4.6 Penyesuaian data Air Mampu Curah (AMC) (a) format geoTIFF pada geoserver dengan (b) format JPEG berindeks