Performance and Application of CSPP/IMAPP in East China

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Outline

PART 1 System and Performance

PART 2 Research and Application

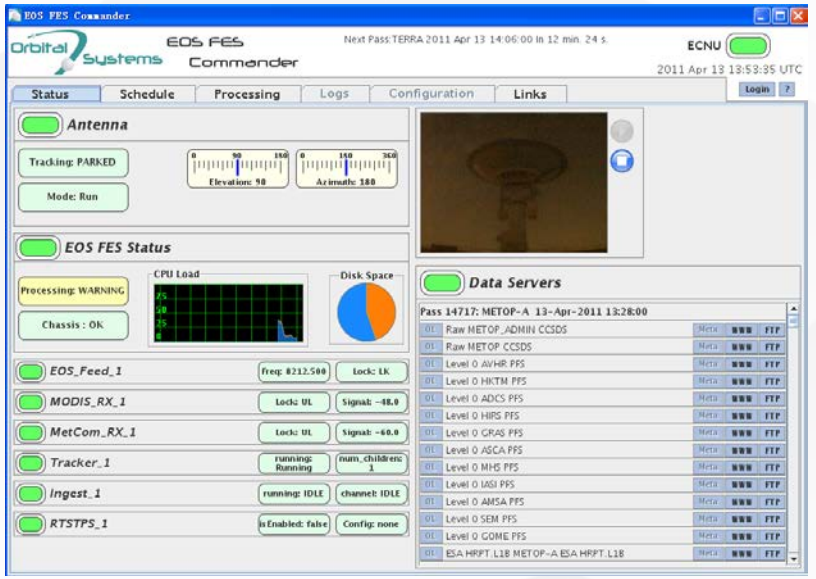
PART 3 Development Plan

PART 1

System and Performance

System and Performance

Installation: Direct Broadcast (DB) Satellite Receiving and Processing System



Located at ECNU Science Bld A

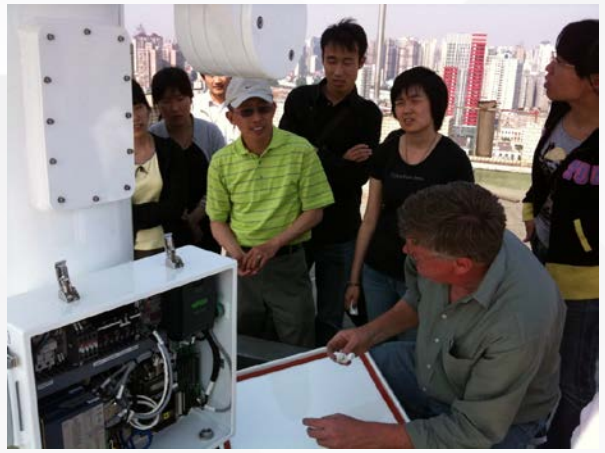
EOS FES Commander Status

DB Receiving System: X & L dual bands for US, EU and China DB satellites

DBPS: real-time retrieval of atmosphere, ocean and land parameters

System and Performance

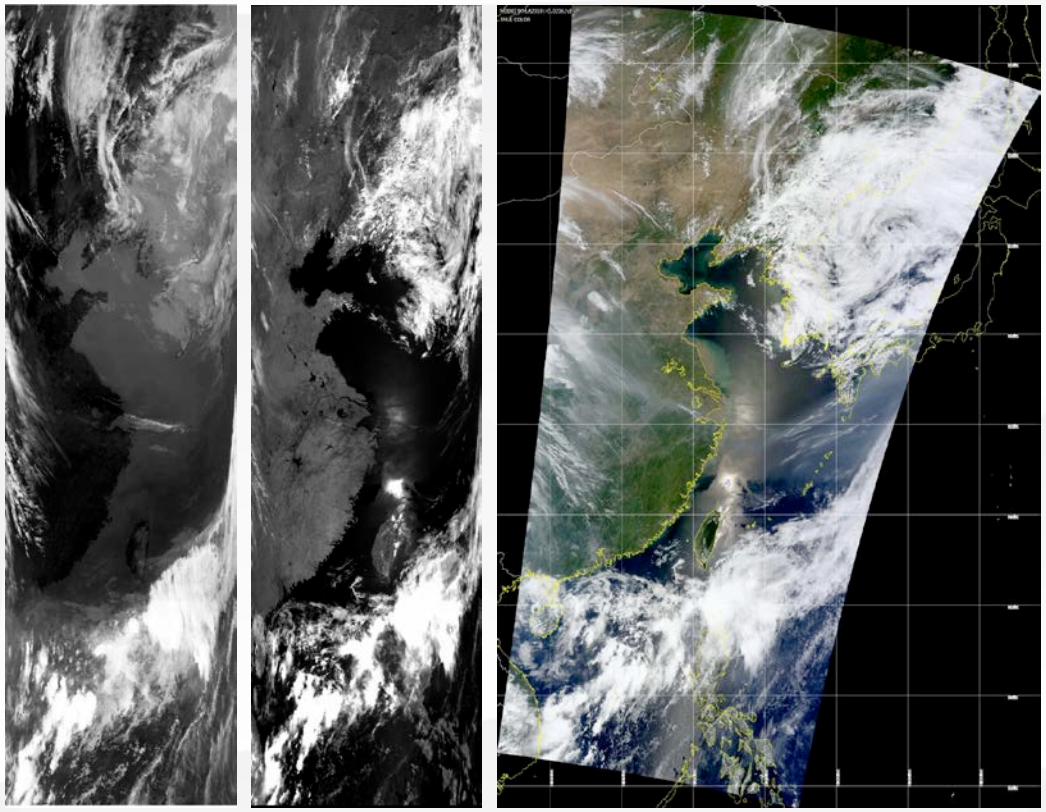
Training: Operation and Theory of IMAPP/CSPP



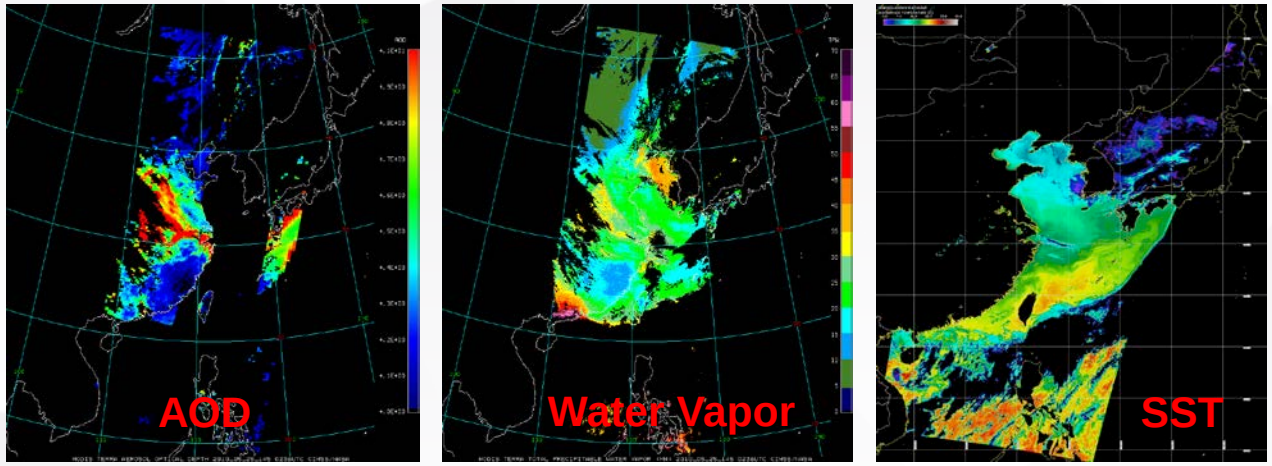
System and Performance

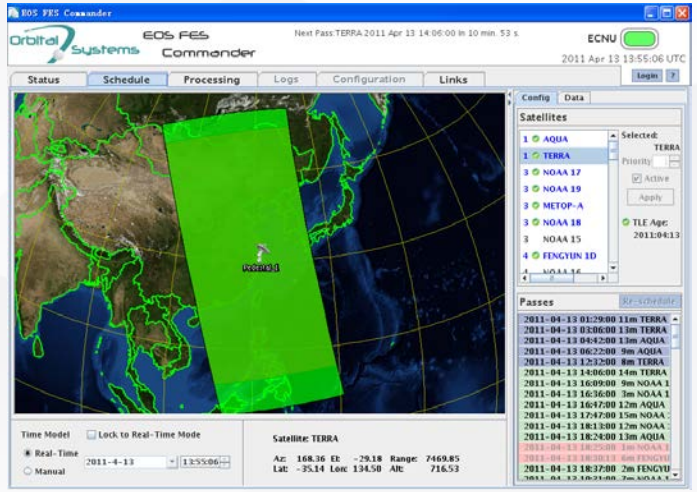
IMAPP/CSPP Real-time Products

First Images Terra MODIS (0235 UTC, 25 May, 2010)



Infrared Visible True color





EOS FES Commander Schedule：

Configure the priority of satellites

System and Performance

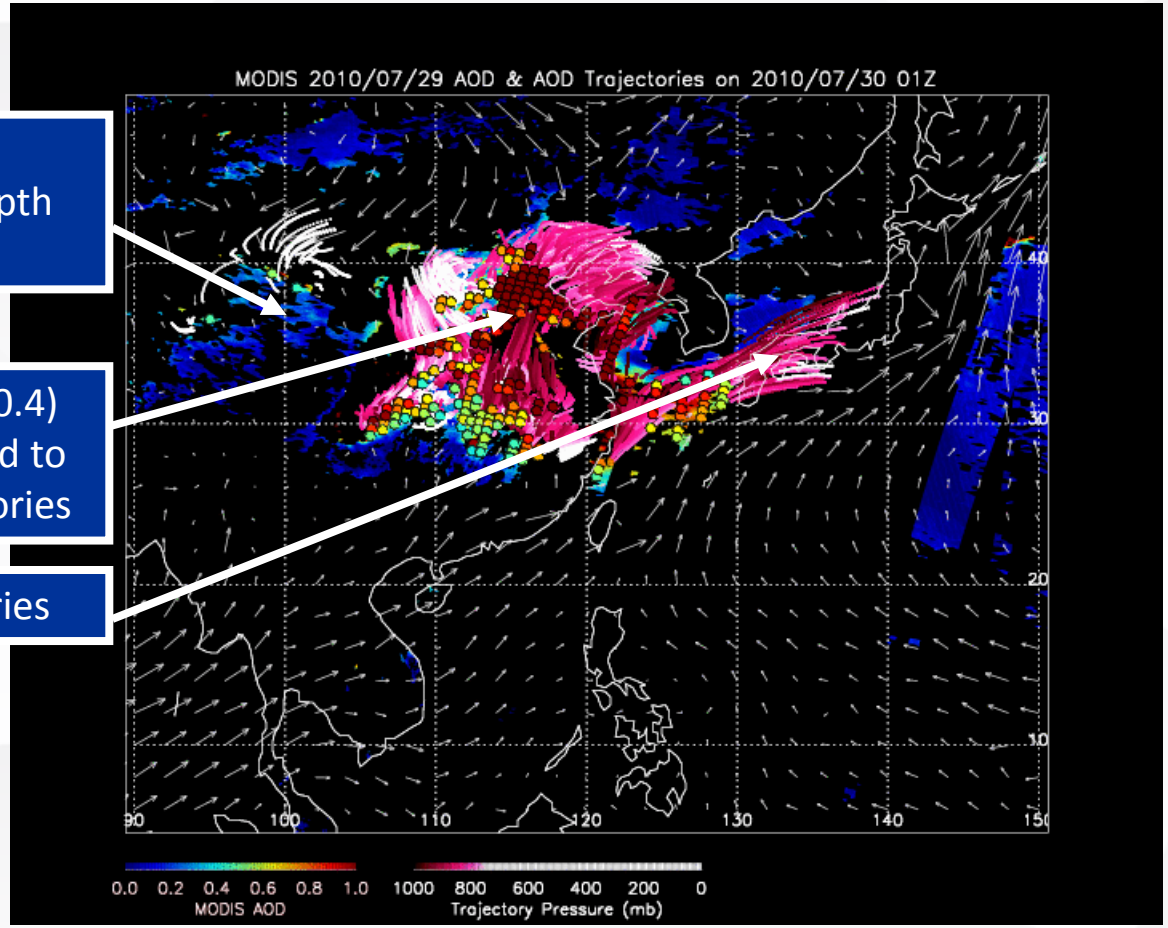
IDEA-I

Infusing satellite Data into Environmental air quality Applications

MODIS
Aerosol Optical Depth
(AOD)

High AOD areas (>0.4) are located and used to initialize the trajectories

Air Parcel Trajectories

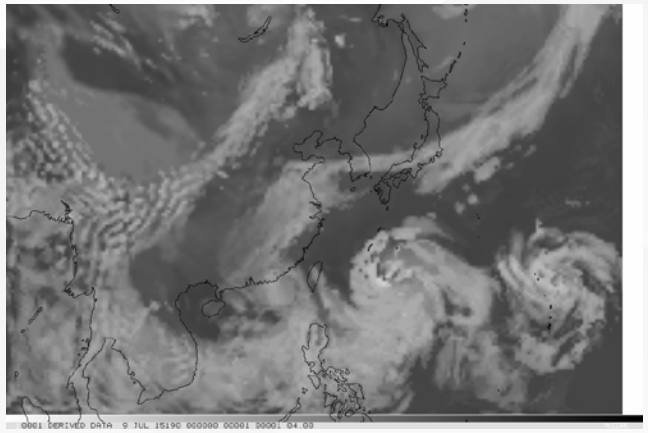


- The air parcel trajectories run using the 12Z NOAA/NCEP GFS forecast data providing a 48hr forecast via trajectories
- The pressure levels of the trajectories are plotted in mb and colored to a magenta-white scale. White indicates that the air parcel no longer affects the surface
- The 850mb wind field vectors are plotted to show wind direction and speed.

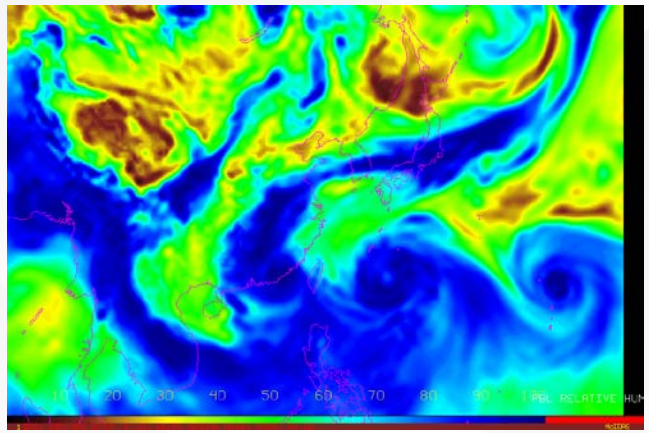
The trajectory forecast animation displays the most important components of an aerosol forecasts

System and Performance

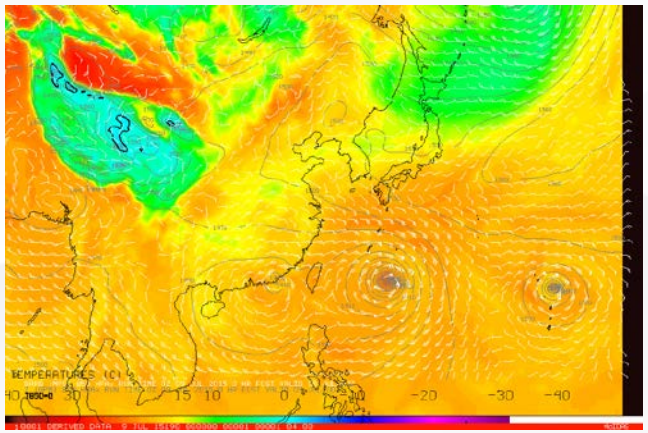
DBCRAS
Direct Broadcast CIMSS Regional Assimilation System



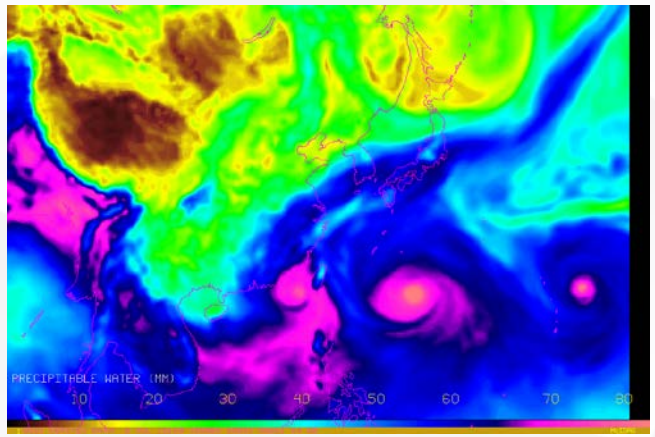
11μm Bright Temperature Image



Relative Humidity



850mb Temperature Fields



Precipitable Water

- DBCRAS can assimilate direct broadcast products from MODIS, including Total Precipitable Water and Cloud Top Pressure
- DBCRAS configuration: 48km resolution with 38 sigma levels; 12hr spin-up with 5-7 MODIS inserts and 72hr forecast length
- DBCRAS includes 16km nest for high-resolution 48hr forecast
- The system can generate forecast images and animations of different meteorological fields for real-time application

PART 2

Research and Application

Research and Application

Shanghai (East China): Economic center, Densely populated, and Coastal city

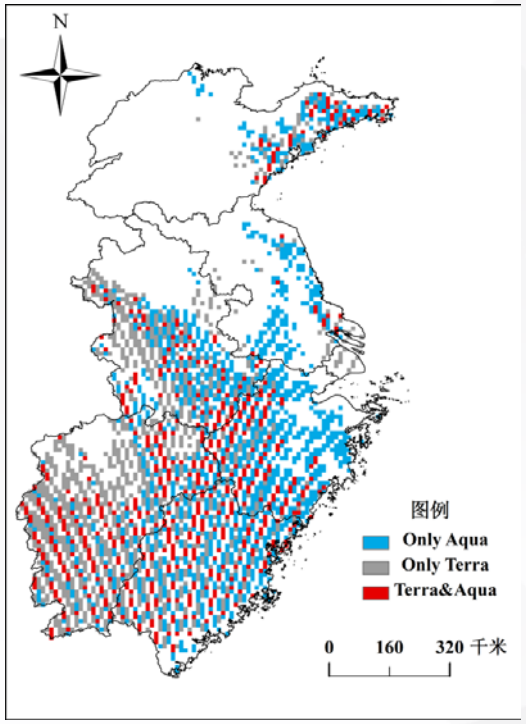
CSPP/IMAPP → **Product** → **Model** → **Applications**

❖ **Air quality monitoring and forecasting with direct broadcast RS data**

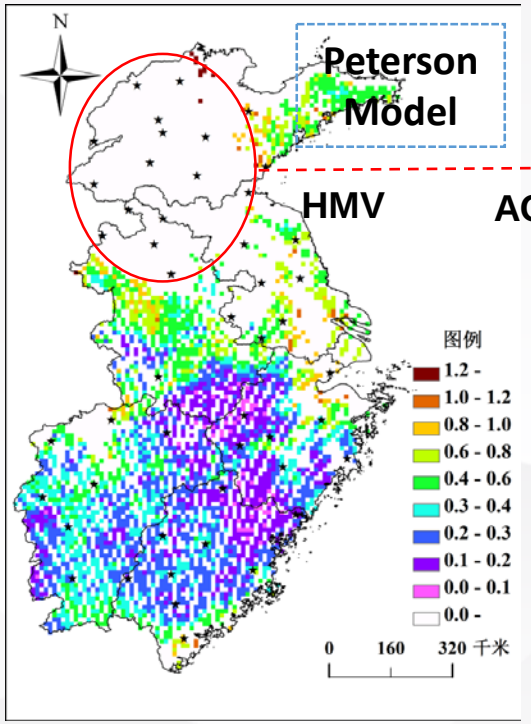
❖ **Typhoon forecasting with Direct Broadcast CIMSS Regional Assimilation System**

Research and Application

Air Quality: Data Fusion of Aerosol Optical Depth

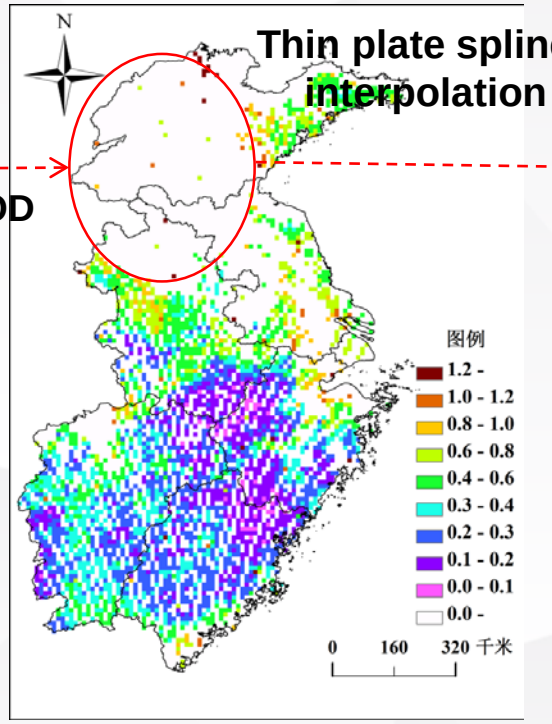


Distribution of Aqua and Terra AOD

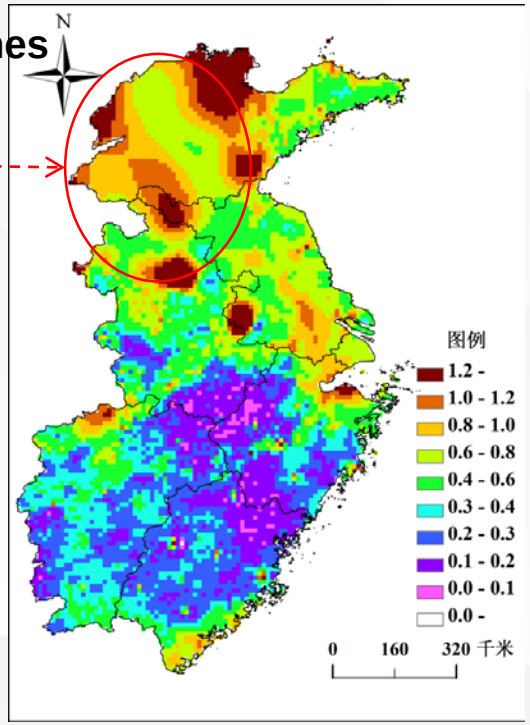


Distribution of HMV* data from observation sites (stars)

AOD



Model conversion fusion

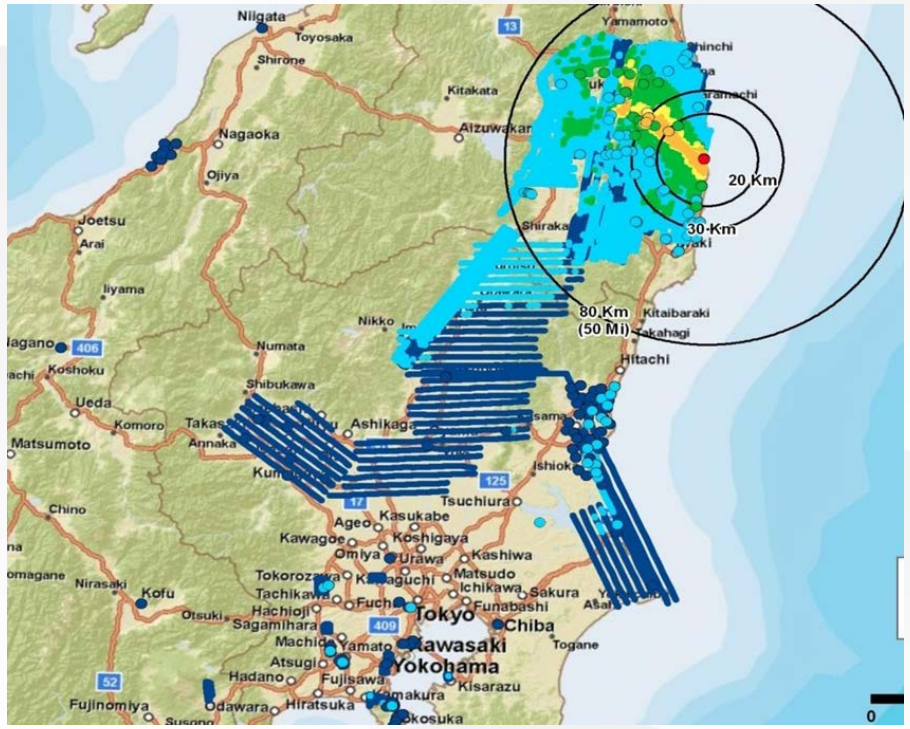


Fusion data

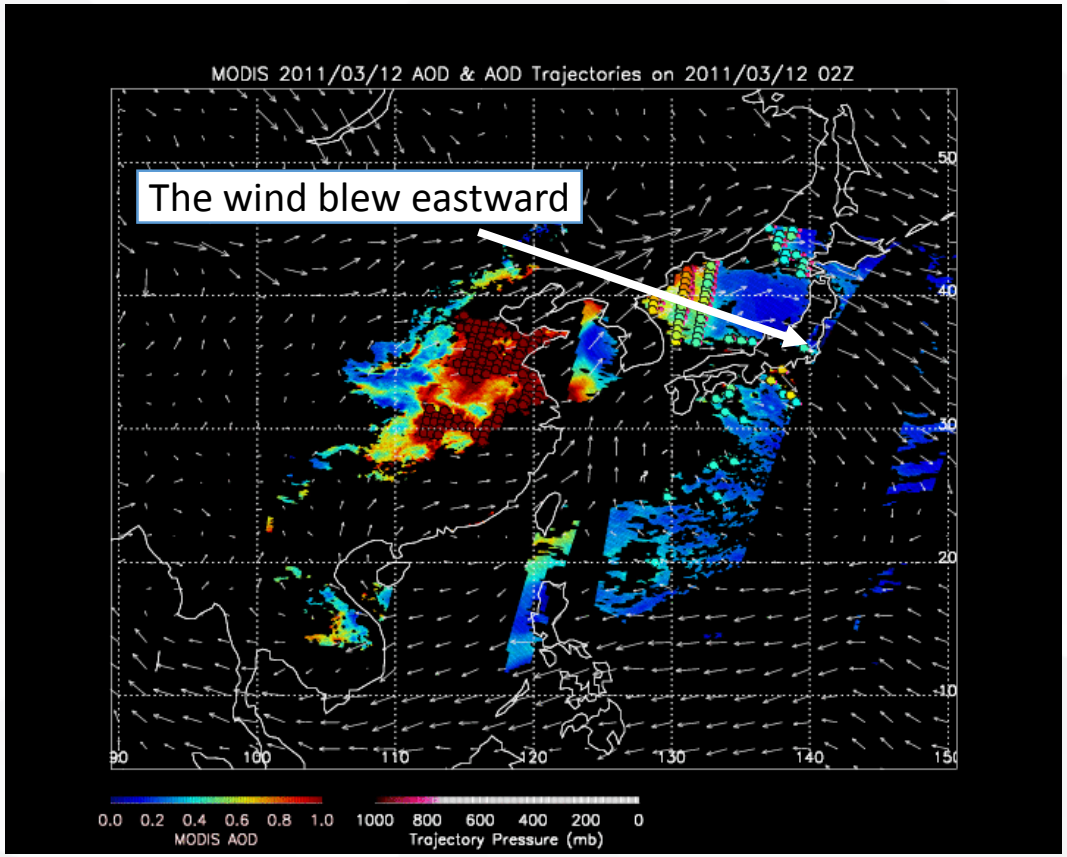
*HMV: Horizontal Meteorological Visibility

Research and Application

Air Quality: Real-time Application of IDEA-I



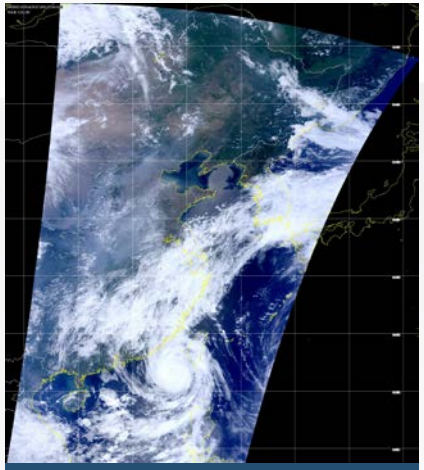
Fukushima nuclear disaster in March 2011



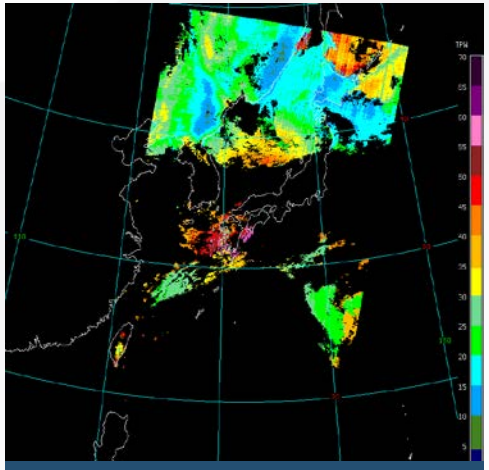
IDEA-I forecast was provided to Shanghai government to make decision for eliminating the panic of people

Research and Application

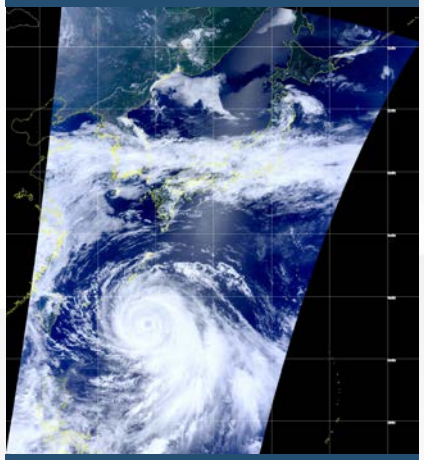
DBCRAS: Triple typhoon forecast case



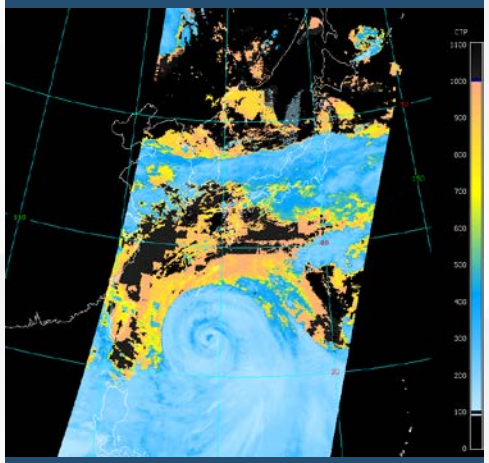
Typhoon Linfa



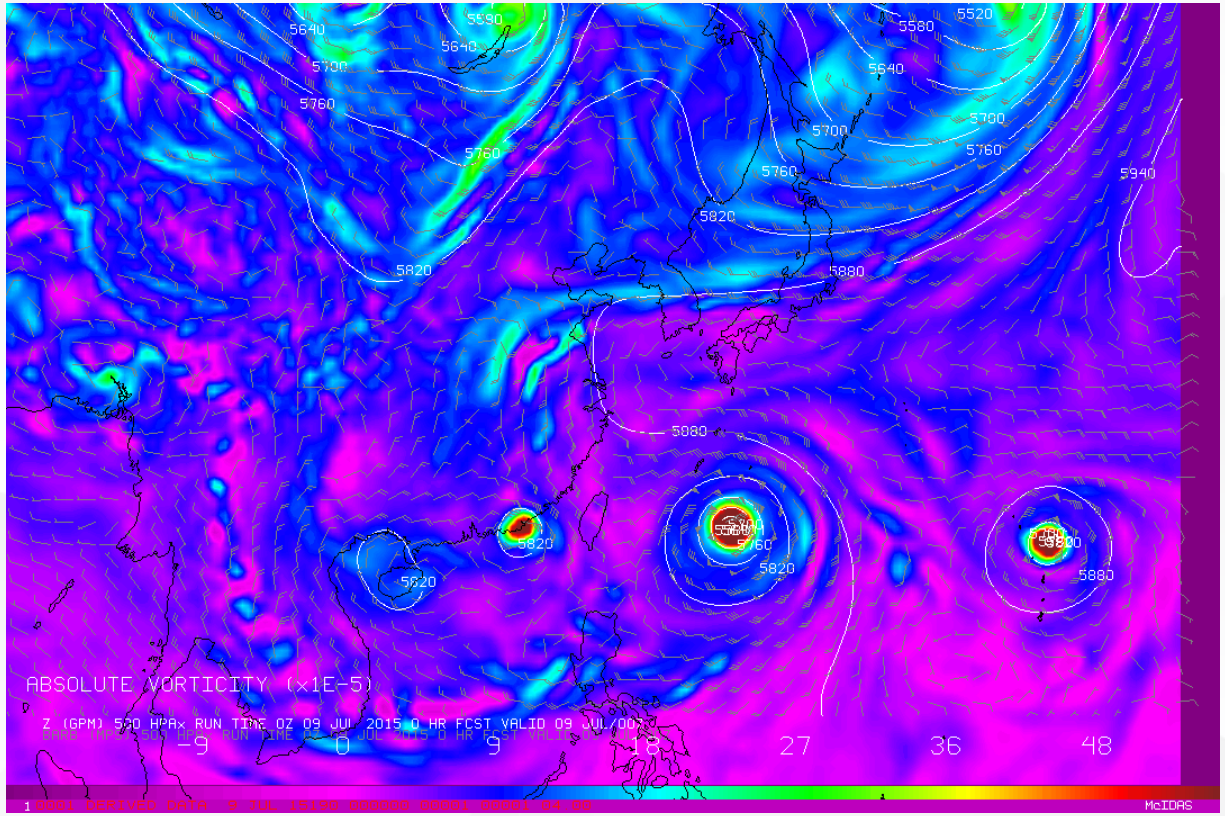
Total Precipitation



Typhoon Chan-hom



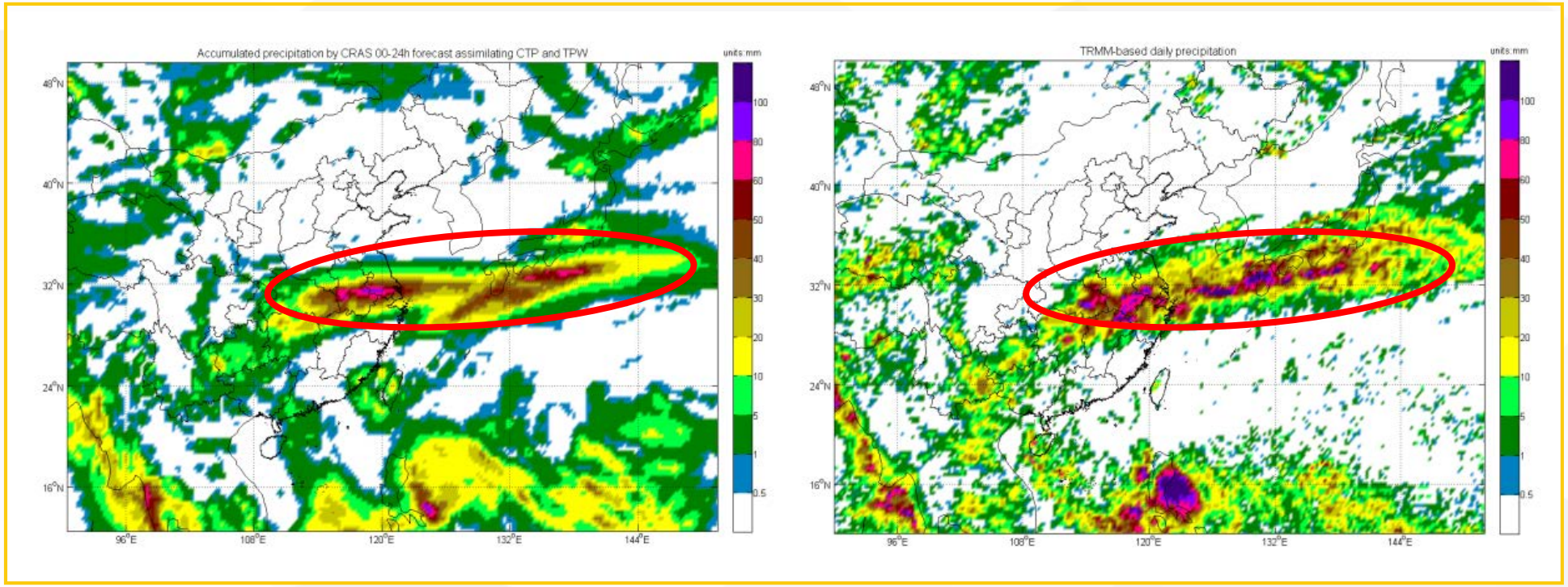
Cloud Top Pressure



DBCRAS 72hr forecast (every 3h) of triple typhoon vorticity, wind, and geopotential height at 500mb; accurately simulate the typhoon Linfa, Chan-hom, and Nangka in real-time

Research and Application

DBCRAS: Precipitation Validation



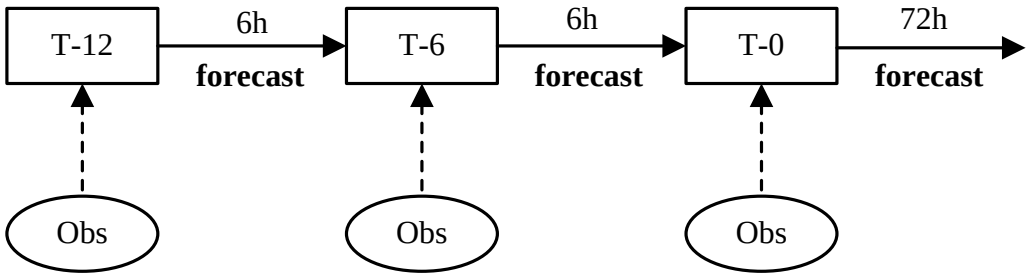
Forecast of 24h accumulated precipitation compared with TRMM precipitation
Showing location and intensity are consistent

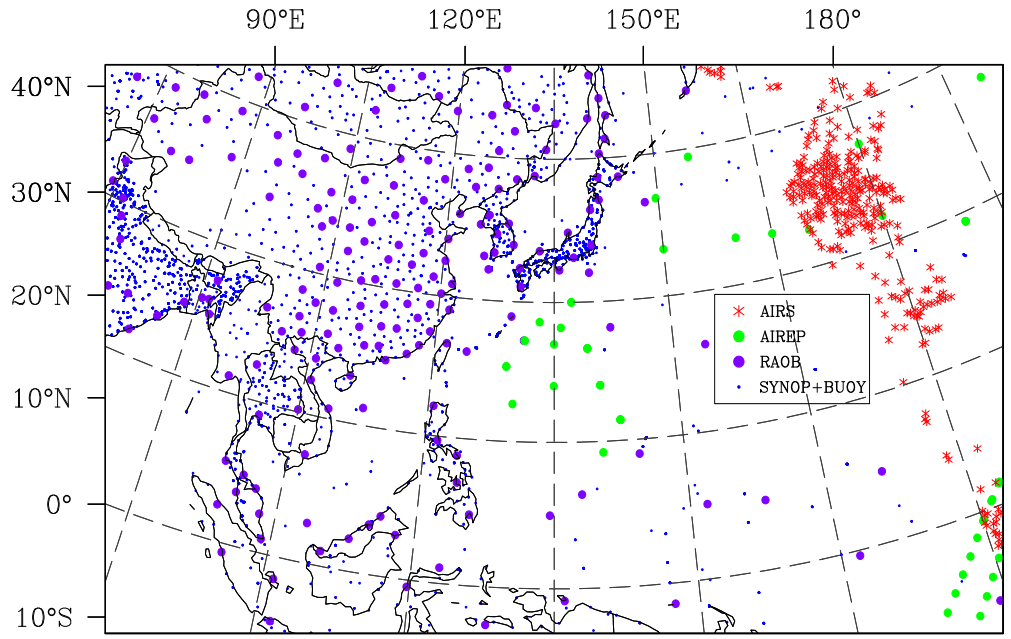
Research and Application

AIRS Radiances Assimilation: Model and Domain

Using contemporary data assimilation technique to improve DBCRAS performance

- ✓ Weather Research Forecast (WRF) Model
- ✓ Gridpoint Statistical Interpolation (GSI)
- ✓ Community Radiative Transfer Model (CRTM)





Horizontal Grid resolution: 12km

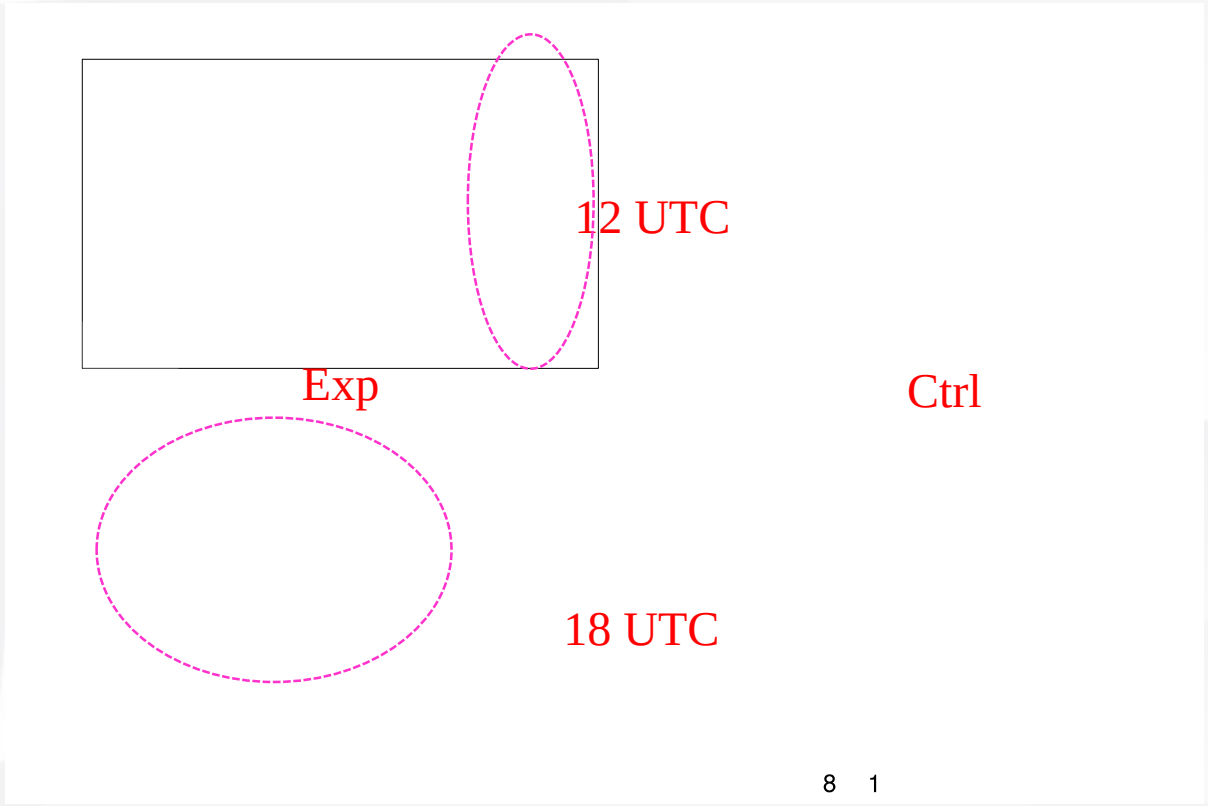
Domain size: 917 by 550 by 50; Model top: 10hPa

Data: all conventional data and AIRS

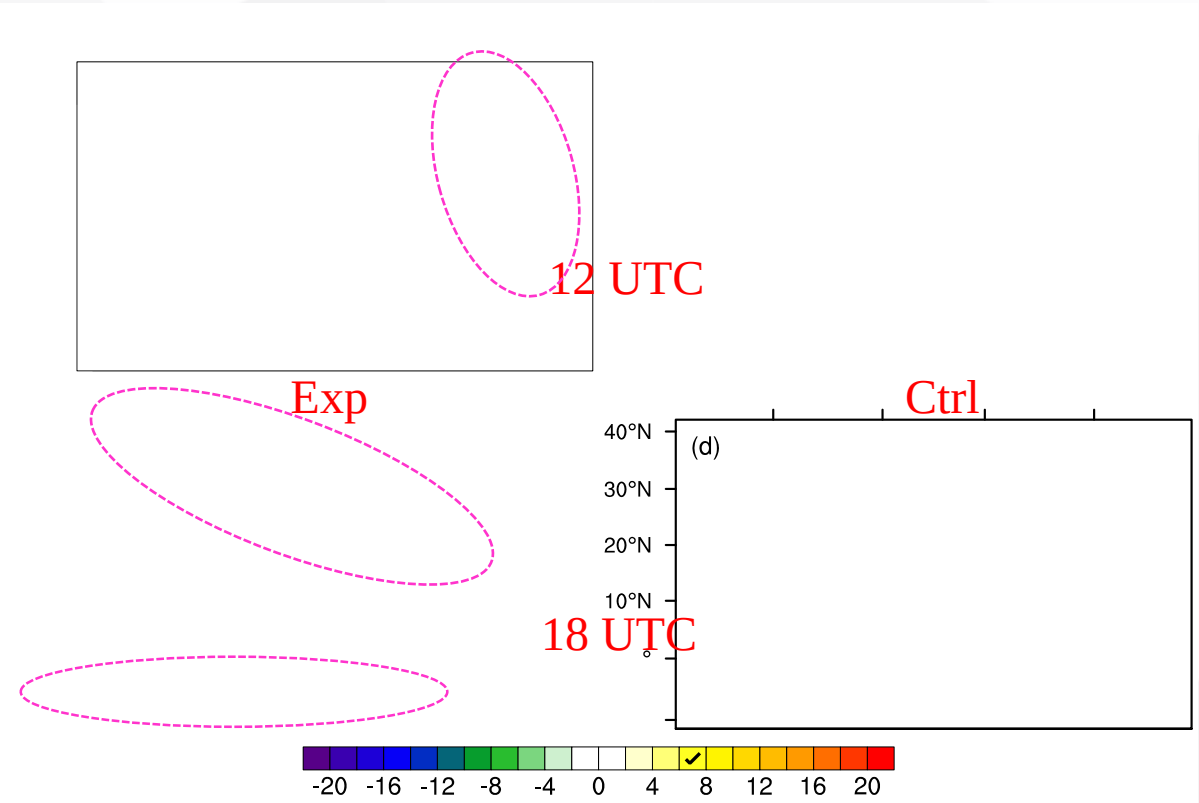
Research and Application

AIRS Radiances Assimilation: Analysis Increment

Control Run (Ctrl): all conventional observations Experiment Run (Exp): Control Run + AIRS



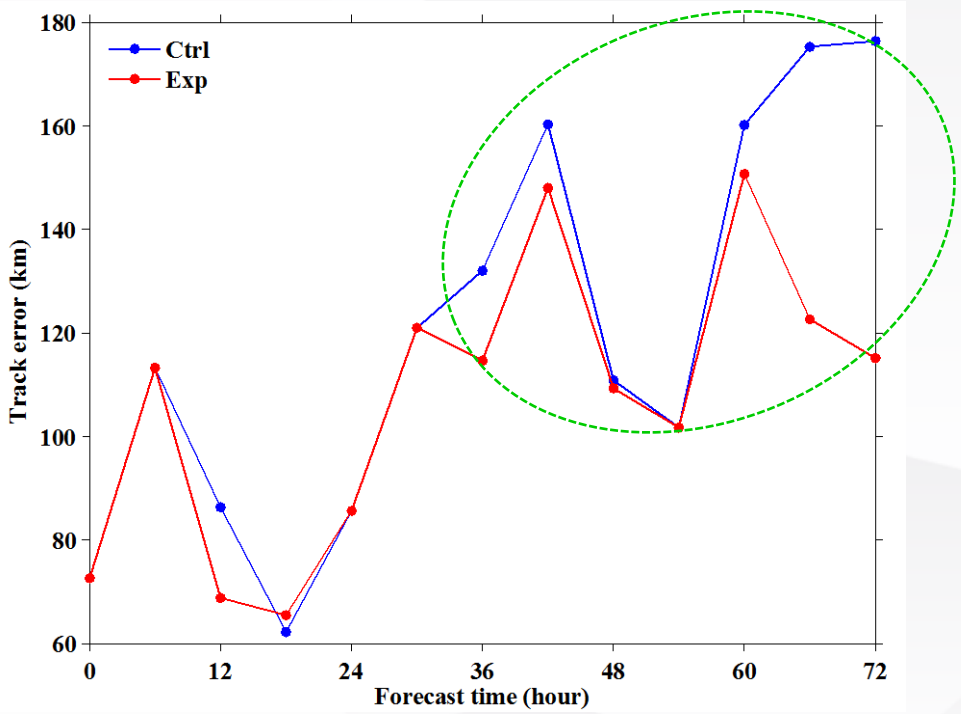
500hPa Temperature

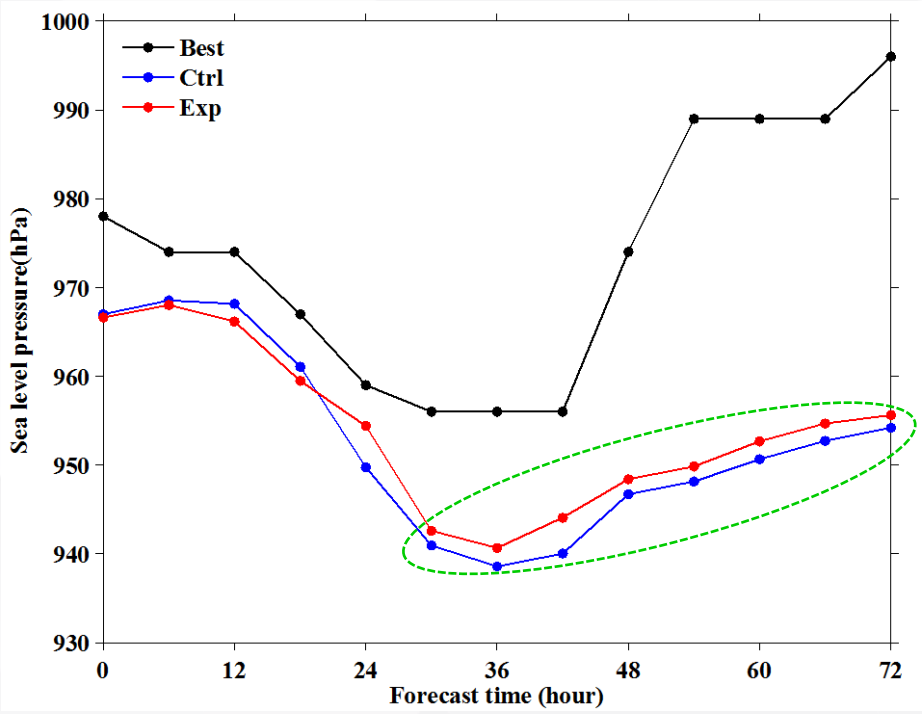


850hPa Relative humidity

Research and Application

AIRS Radiances Assimilation: Impact on typhoon forecast





Comparisons of 72h track and intensity forecast for Ctrl and Exp experiment with the best observations from JTWC

Improved track and intensity forecasts assimilating AIRS radiances

PART3

Development Plan

Development Plan

Integrated Data Acquisition Platform

Operational Observation	Tower	Ground-based Radiance Instruments
Atmospheric Observation field	Gradient Tower	UV sensor-Interferometer-Microwave sounder

To Establish Top-down and Bottom-up Observation Network

Development Plan

Cooperation Platforms

Mar. 2015

ECNU signed strategic agreement with CMA：Priority to support the development of Atmospheric Science

Nov. 2015

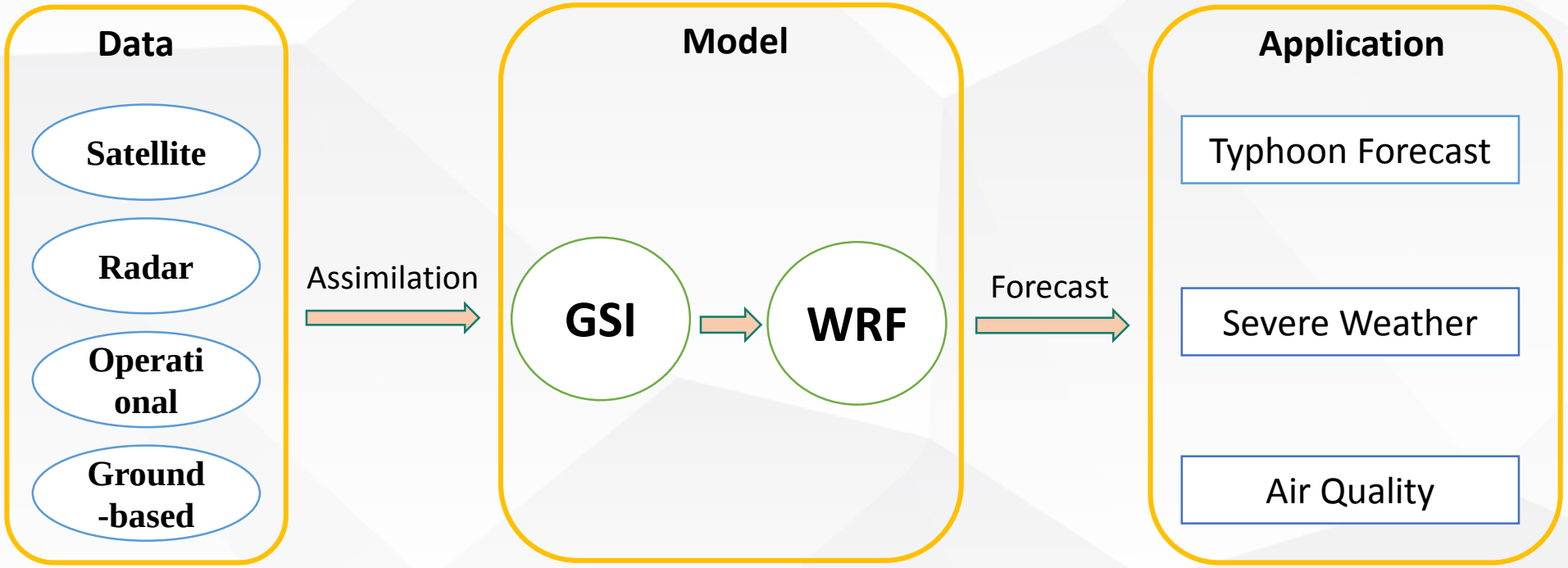
ECNU signed strategic agreement with SMA：Promote the conversion of research and operational application, and data sharing

Apr. 2017

ECNU founded Institute of Atmospheric and Earth System Science：Atmospheric RS as core research direction

Development Plan

Integrated Application Platform



Real-time
Fusion
Special subject
Daily, Monthly, Seasonally

High Resolution Regional Assimilation System: Horizontal, vertical, and time resolution

Typhoon track and intensity, and rainstorm forecast; predict urban flood disaster with Digital Elevation Model; IDEA-I with various air quality indexes; SMA, SOA, SWA, EPA and so on

Thanks for your attention!

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