



CSPP / IMAPP Users' Group Meeting



Application of IMAPP at East China Normal University

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5/23/2013



Outline

- 1** Installation & Training
- 2** Localization of profile retrieval
- 3** Data fusion of AOD
- 4** Evaluation of DBCRAS



Installation and Training

Site Location



Science Building A at ECNU





Installation and Training

Onsite installation

Lifting of positioner



Lifting of reflector





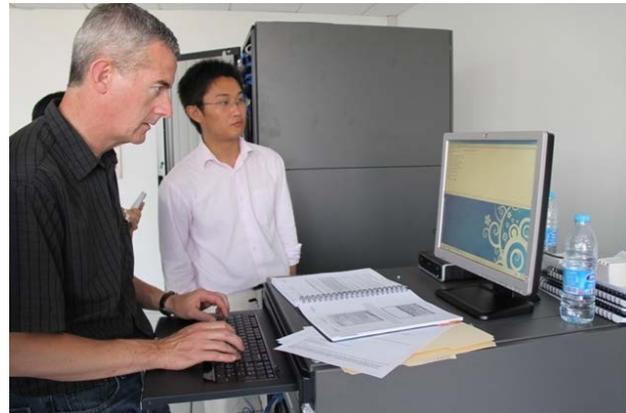
Installation and Training

Onsite installation

Outdoor installation



Indoor installation

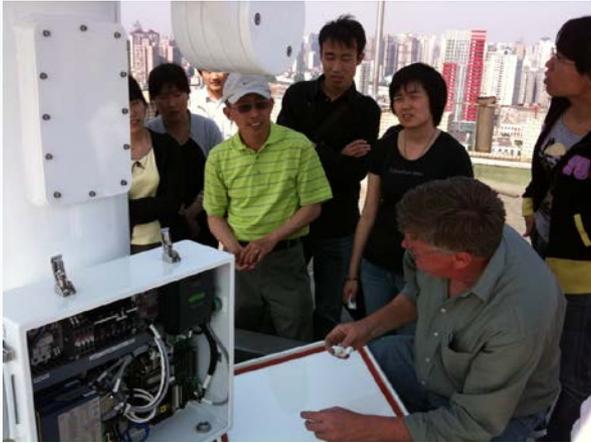


EOF-FES
DBPS
Archive System
Dehydrator



Installation and Training

Hardware onsite training



Software training





Installation and Training

Remote control UI

The screenshot displays the EOS FES Commander interface, which is used for remote control of satellite systems. The interface is divided into several sections:

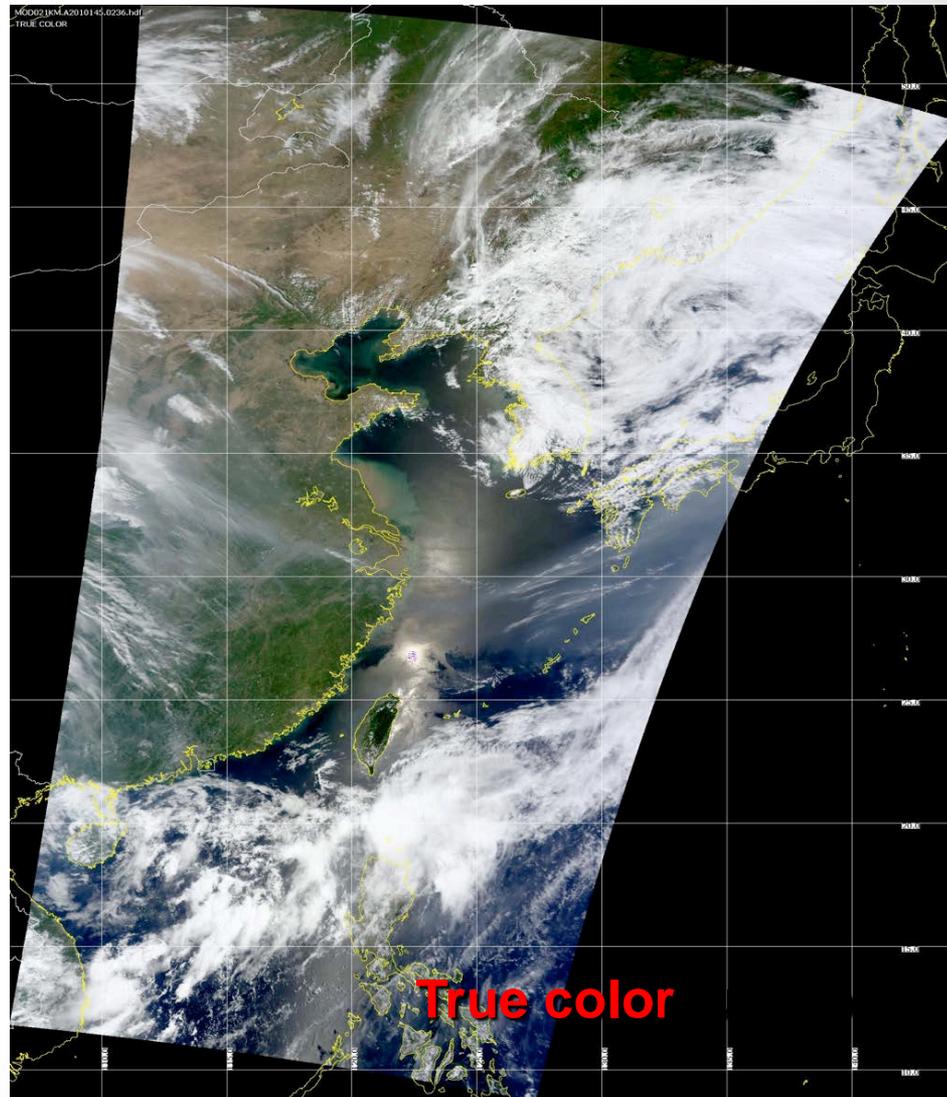
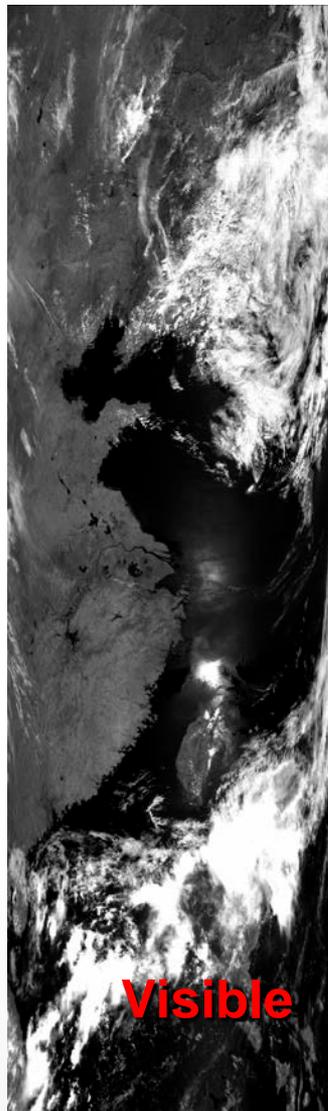
- Antenna Section:** Shows tracking status (PARKED), mode (Run), and antenna orientation (Elevation: 90, Azimuth: 180). A red dashed circle highlights the "Schedule" tab, with an arrow pointing to the "EOS FES Status" section.
- EOS FES Status Section:** Displays system status (Unknown), CPU load, and various subsystems (EOS_Feed_1, MODIS_RX_1, MetCom_RX_1, Tracker_1, Ingest_1, RTSTPS_1).
- Satellite Passes Section:** Shows a map of the satellite's field of view over East Asia, with a list of passes on the right. The selected satellite is TERRA, and the current pass is 2010-07-02 03:37:00 12m TERRA.

Time	Altitude	Satellite
2010-07-01 12:21:00	5m	TERRA
2010-07-01 13:54:00	14m	TERRA
2010-07-01 15:36:00	6m	TERRA
2010-07-01 16:36:00	11m	AQUA
2010-07-01 18:13:00	13m	AQUA
2010-07-02 01:59:00	13m	TERRA
2010-07-02 03:37:00	12m	TERRA
2010-07-02 05:13:00	14m	AQUA
2010-07-02 08:07:00	14m	FENGYUN 1D
2010-07-02 10:57:00	10m	NOAA 18
2010-07-02 11:46:00	12m	METOP-A
2010-07-02 12:34:00	14m	NOAA 18
2010-07-02 13:00:00	12m	TERRA
2010-07-02 13:25:00	14m	METOP-A
2010-07-02 14:37:00	13m	TERRA
2010-07-02 16:48:00	13m	NOAA 18
2010-07-02 17:01:00	13m	NOAA 18



First ECNU EOS-FES/DBPS Terra MODIS

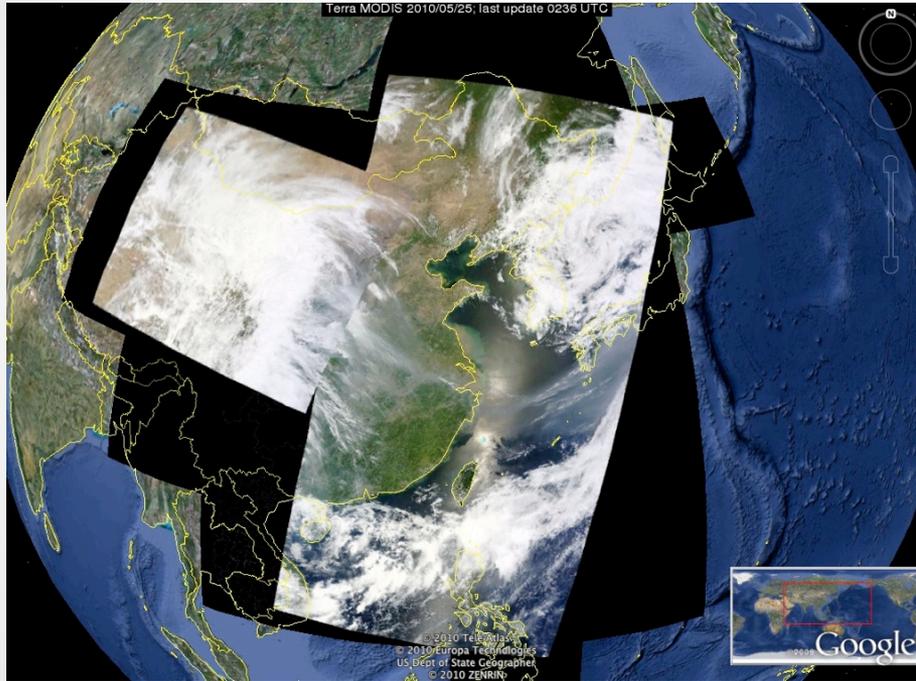
Images(0235 UTC, 25 May, 2010)





First ECNU EOS-FES/DBPS Terra MODIS

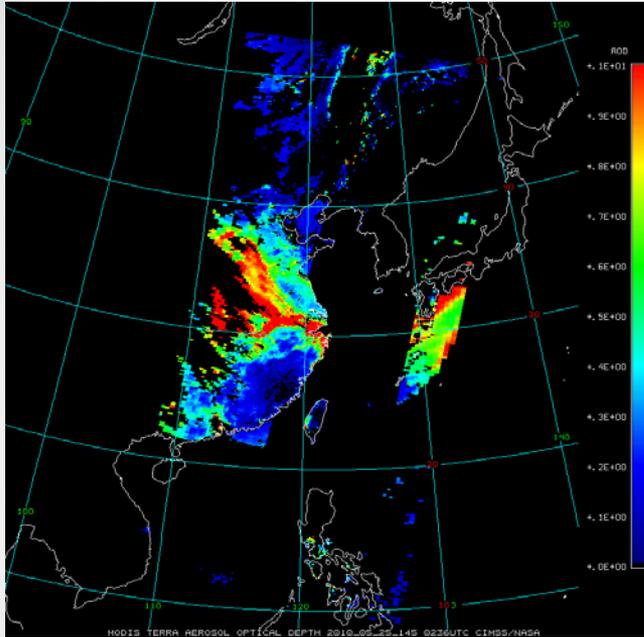
Image in Google Earth



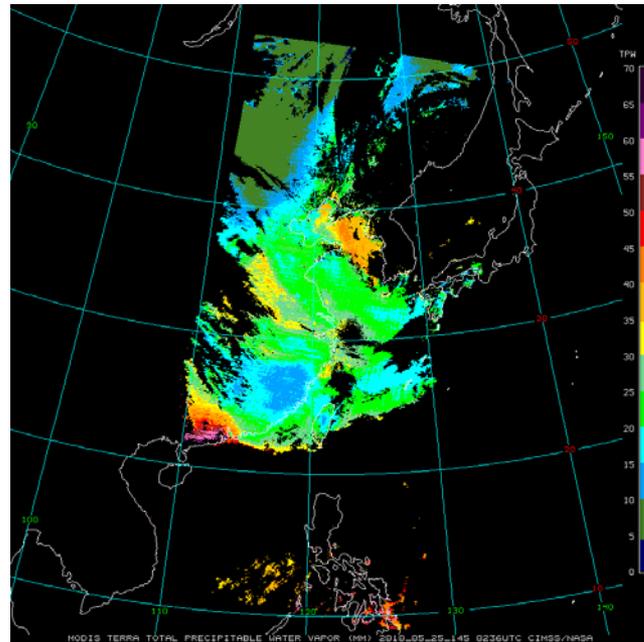


First DB Products Terra/MODIS

Retrieval products

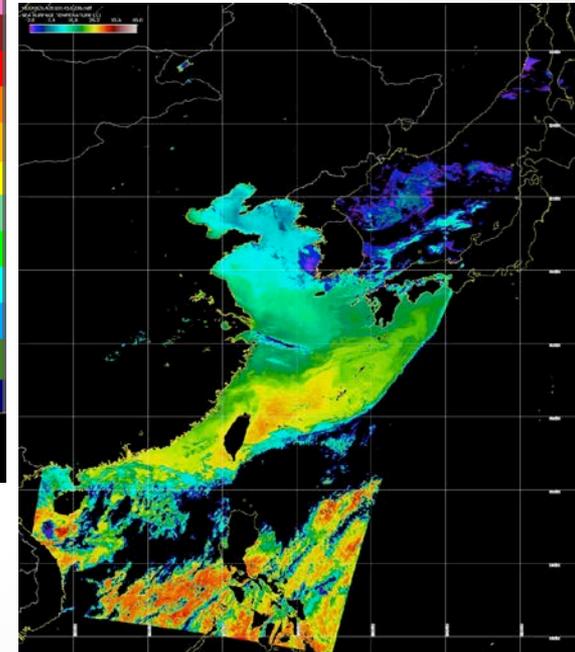


Aerosol Optical Thickness

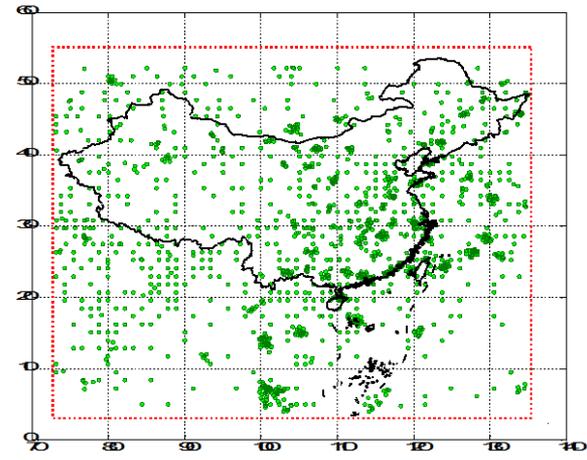
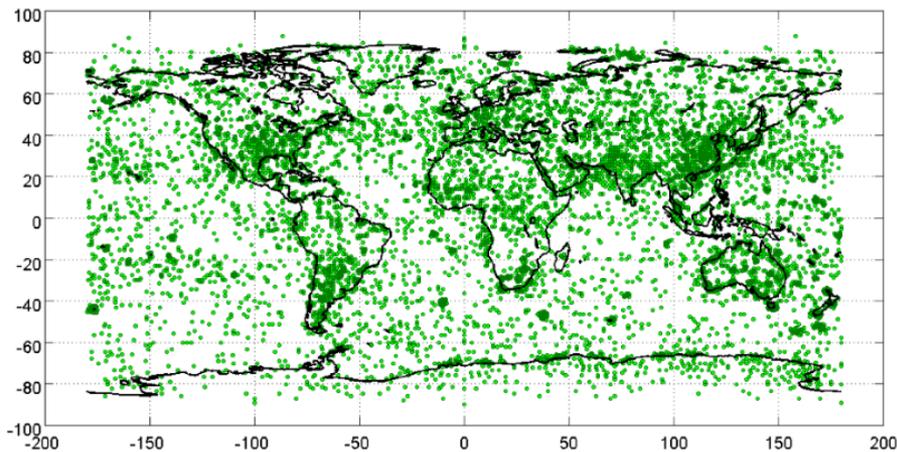


Water Vapor

Sea Surface Temperature



Localization of Temperature Profile Retrieval



Distribution of testing samples in global and China.

Comparison between the two algorithms:

1. **Dual-Regression algorithm** based on global regression coefficients;
2. **AIRS/MODIS retrieval algorithm** that uses both AIRS L1B data and MODIS product.

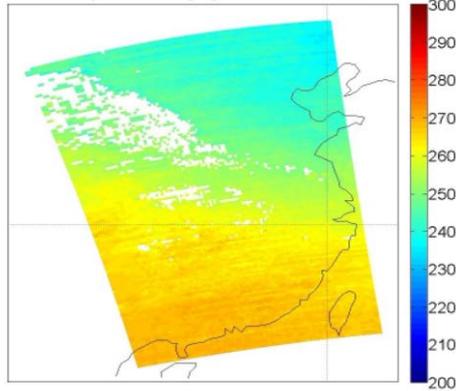
To get a better atmospheric temperature profile, proposed a regional algorithm:

3. Dual-Regression algorithm based on **Chinese regression coefficients**.

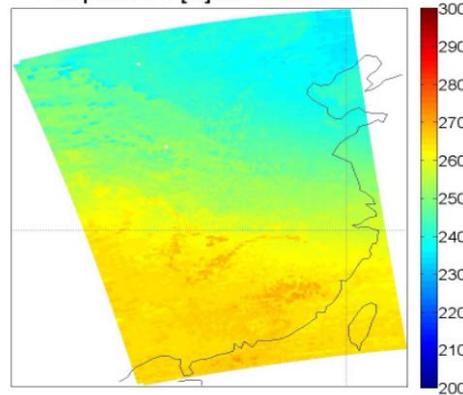


Localization of Temperature Profile Retrieval

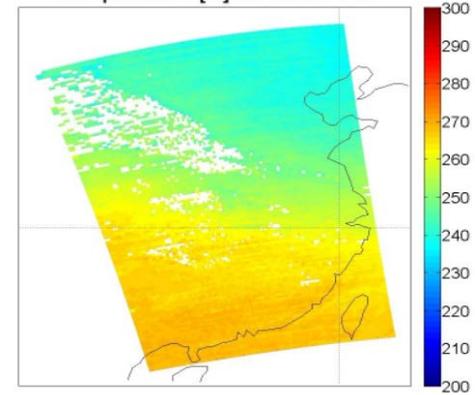
AIRS.2011.01.06.057.atm_prof_rtv.img
Temperature [K] at 496.6 hPa



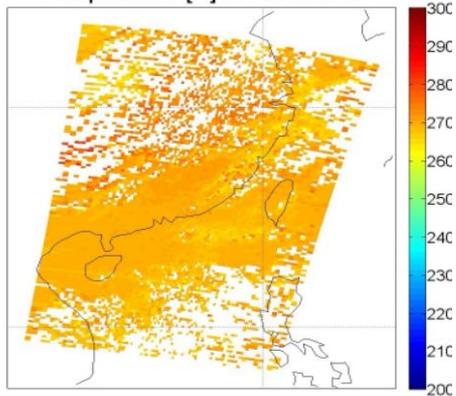
AIRS.2011.01.06.057.atm_prof_rtv.img
Temperature [K] at 496.63 mbar



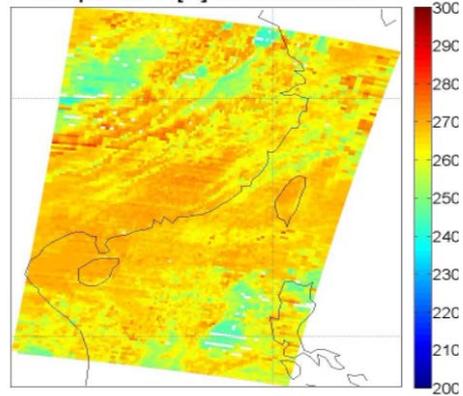
AIRS.2011.01.06.057.atm_prof_rtv.img
Temperature [K] at 496.6 hPa



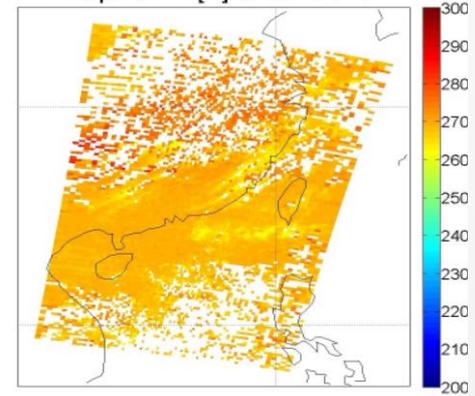
AIRS.2011.07.06.181.atm_prof_rtv.img
Temperature [K] at 496.6 hPa



AIRS.2011.07.06.181.atm_prof_rtv.img
Temperature [K] at 496.63 mbar



AIRS.2011.07.06.181.atm_prof_rtv.img
Temperature [K] at 496.6 hPa



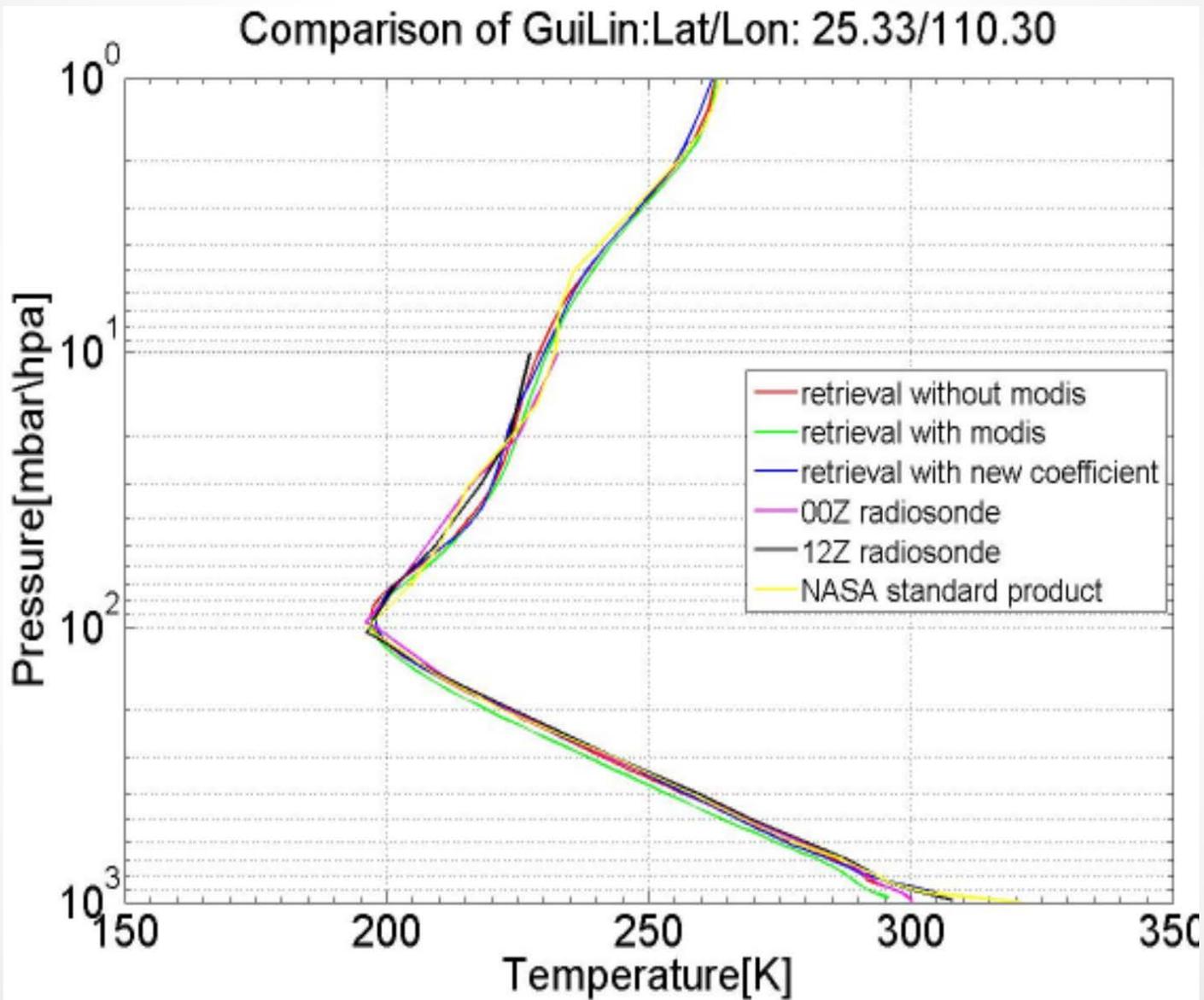
Dual-regression

AIRS/MODIS retrieval

Chinese coefficient

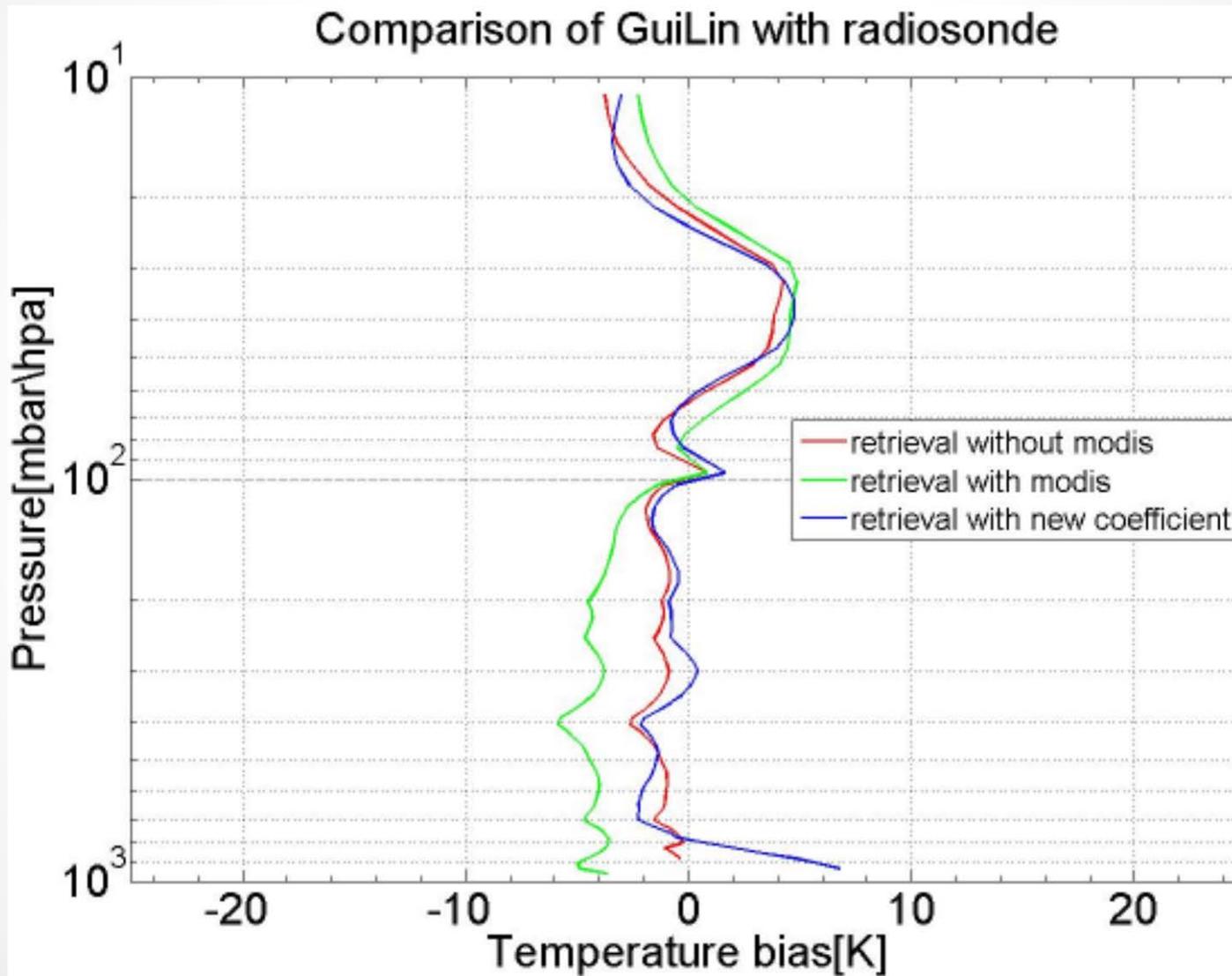


Localization of Temperature Profile Retrieval





Localization of Temperature Profile Retrieval





Localization of Temperature Profile Retrieval

Averaged absolute error and relative error compared with radiosonde observations:

1. Dual-regression algorithm: 1.71K, 0.84%

2. AIRS/MODIS Retrieval algorithm: 2.68K, 1.32%

3. Chinese coefficients: 1.59K, 0.78%



Data Fusion of Aerosol Optical Depth

Satellite retrieved aerosol product has **the low spatial coverage** because of the limitation of cloud coverage and dark target algorithm.

Horizontal meteorological visibility (HMV) is another very important parameter in describing aerosol optical characteristics. It is observed fixed times and published per day by widely distributed meteorological sites. It can be a good supplement of satellite retrieved AOD.

Thus, a **fast fusion algorithm** was developed. **Terra and Aqua** satellite MODIS AOD and **ground-based HMV** data were fused in order to obtain AOD product with **high spatial resolution and complete spatial coverage in real time.**

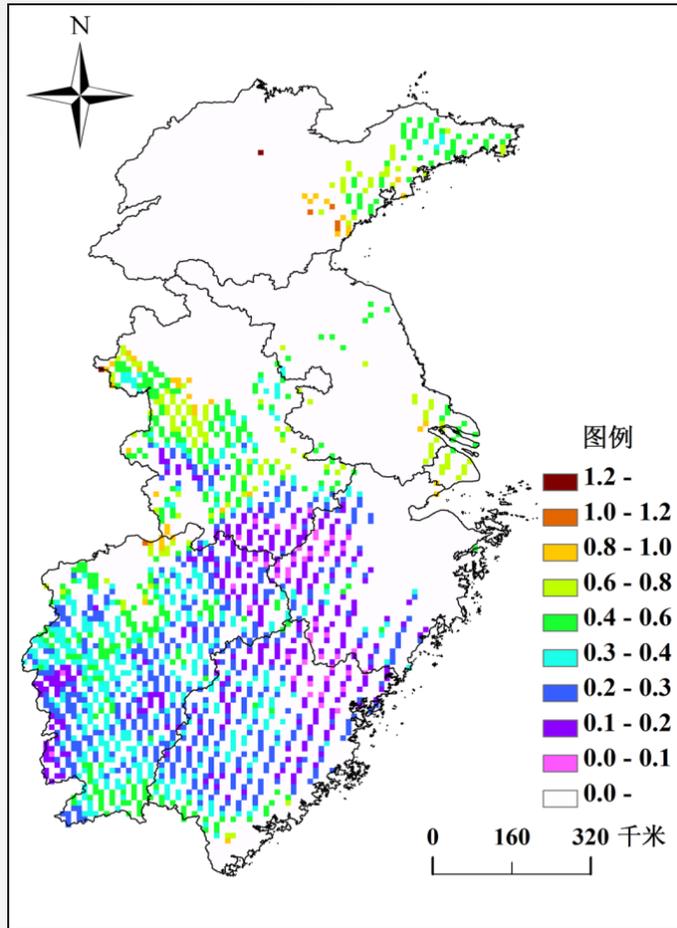
Step 1 : Linear fusion

Step 2 : Model conversion fusion

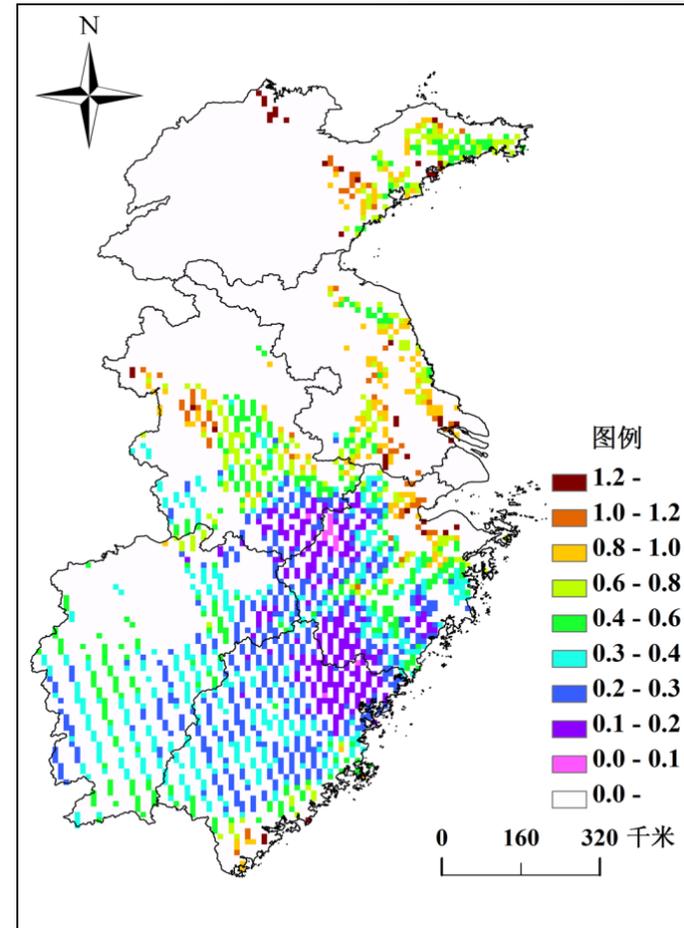
Step 3 : Interpolation



Data Fusion of Aerosol Optical Depth



(a) Terra

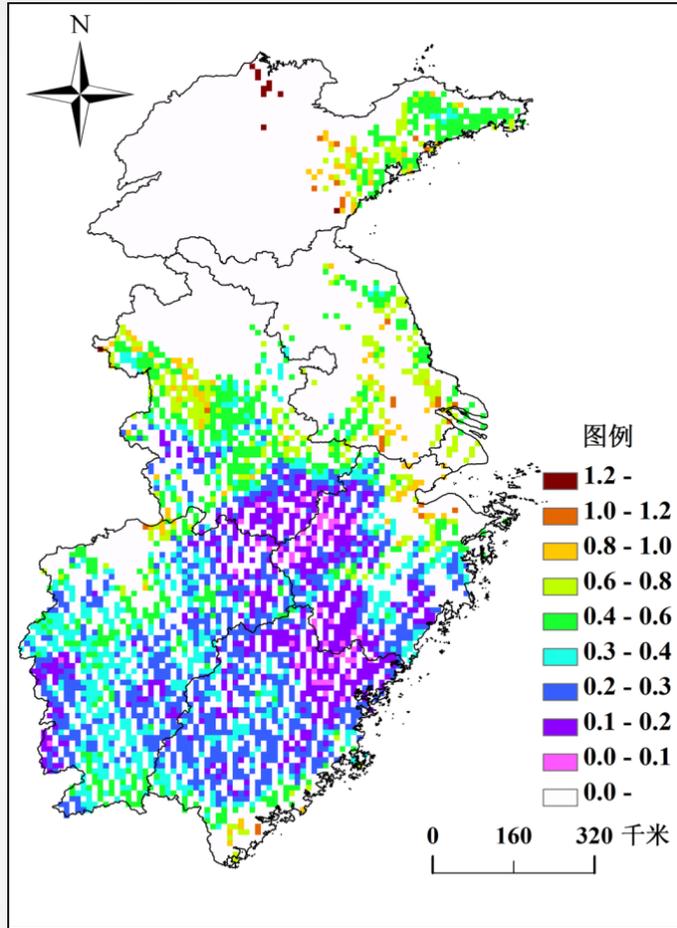


(b) Aqua

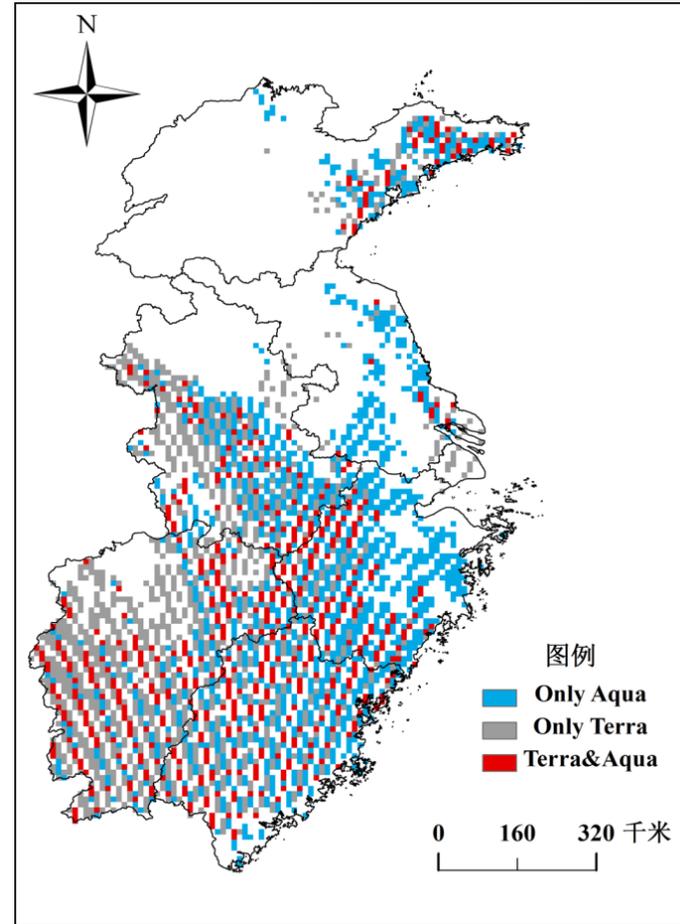
Distribution of AOD at east of China



Data Fusion of Aerosol Optical Depth



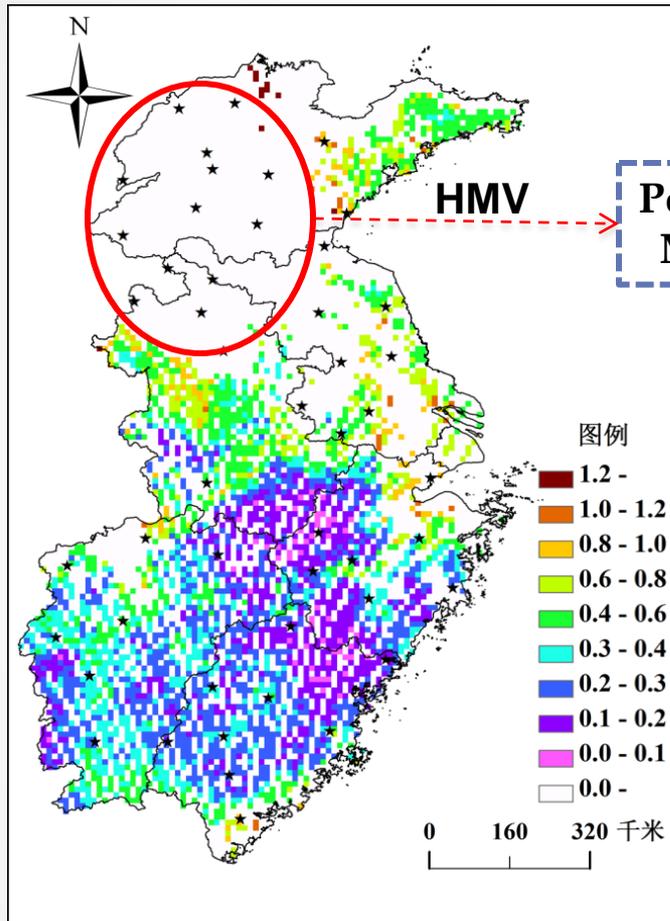
Spatial coverage after linear fusion



Source of AOD data

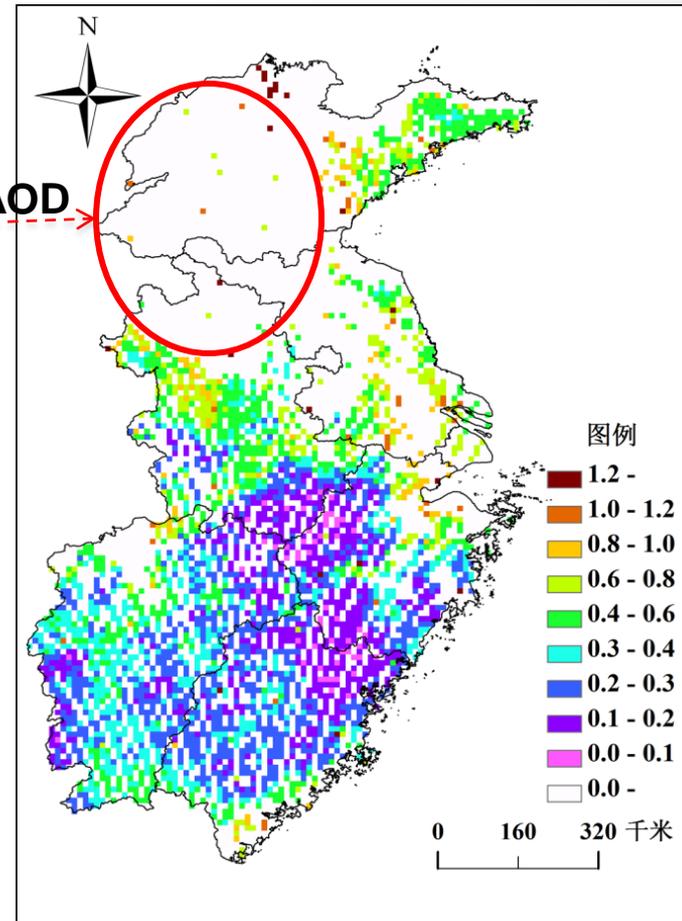


Data Fusion of Aerosol Optical Depth



Distribution of HPMV data from observation sites (stars)

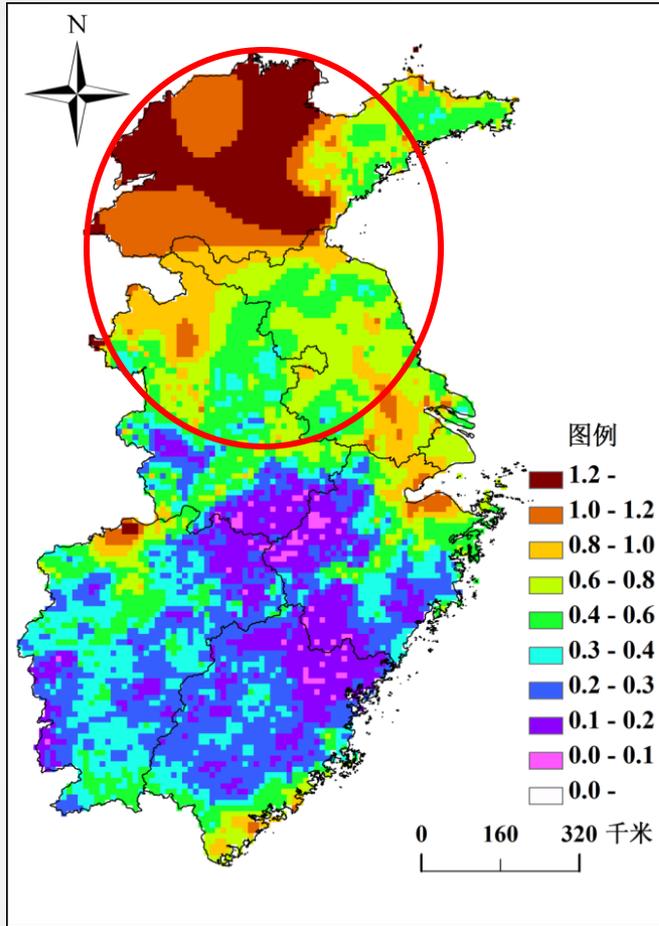
Peterson Model



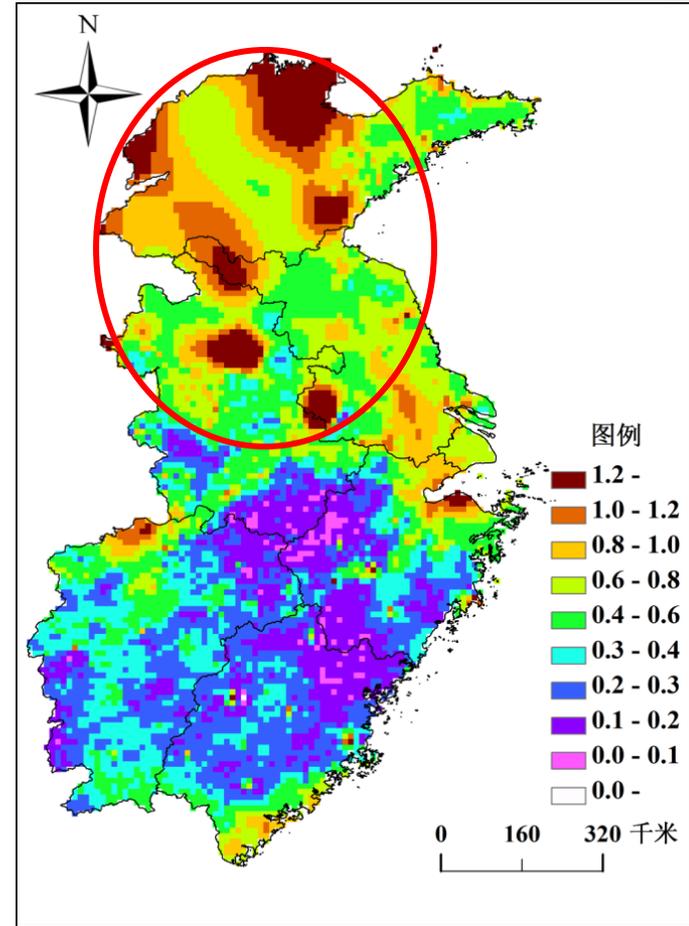
Model conversion fusion



Data Fusion of Aerosol Optical Depth



Without HMV



After model conversion

Thin plate splines interpolation



Data Fusion of Aerosol Optical Depth

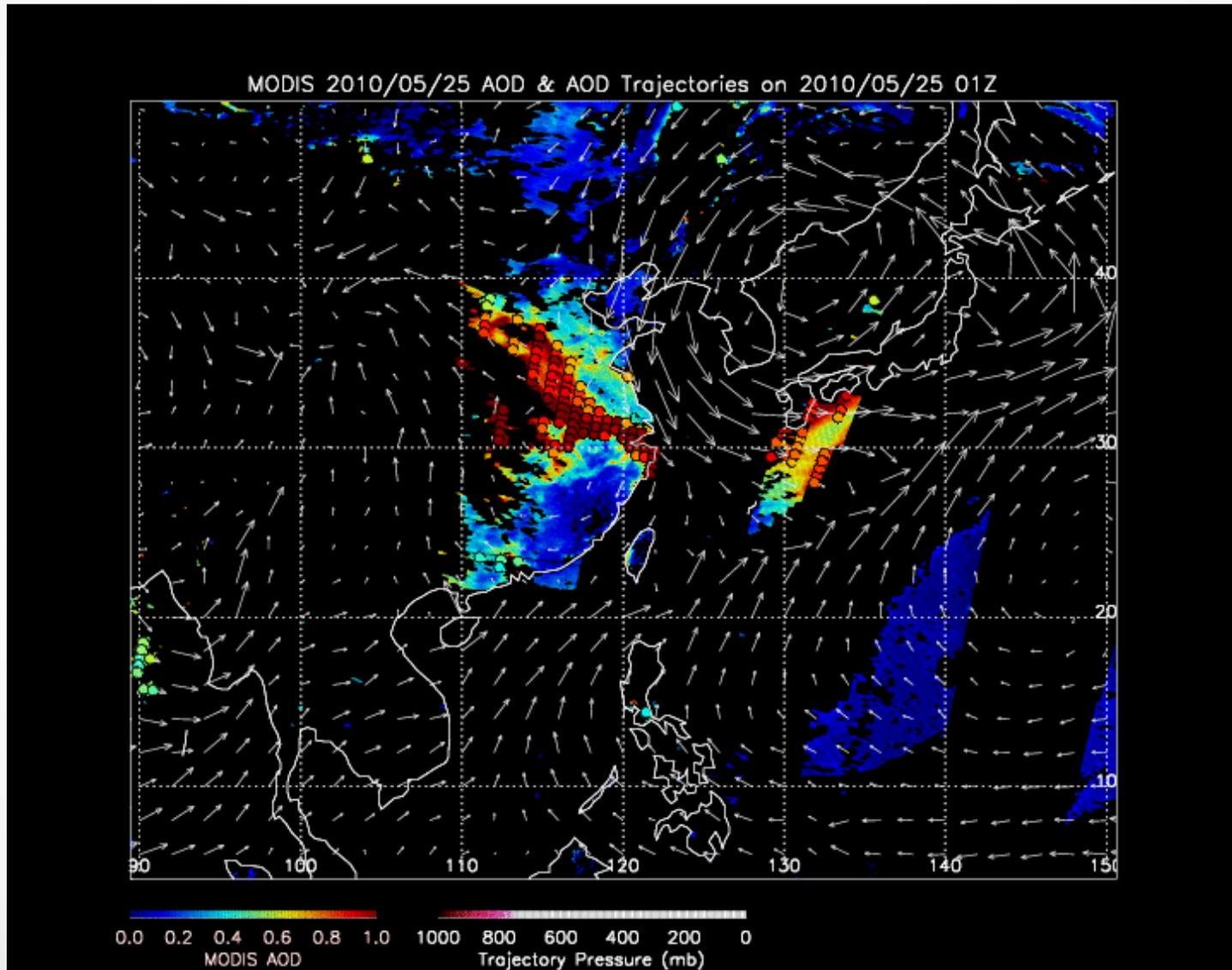
Using **cross-validation** method to validate the fusion steps separately

Fusion step	RMSE
Step1: Linear fusion	0.11
Step2: Model conversion fusion	0.31
Step3: Interpolation	0.35



Application of IDEA-I

Infusing satellite **Data** into **Environmental Application** - **International**

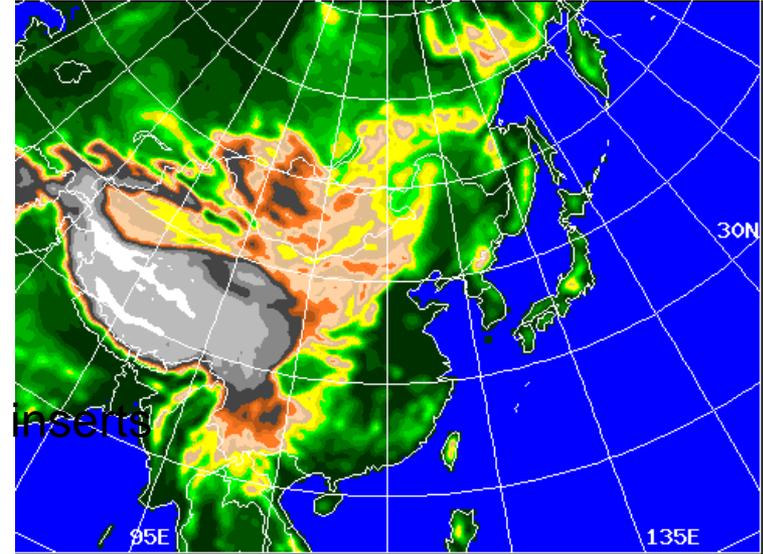




Evaluation of DBCRAS

Direct Broadcast CIMSS Regional Assimilation System

Resolution: 48 km;16 km
Sigma levels: 38
Grid Size: 210 x140; 207x141
Time-step: 240 seconds
Forecast length: 72 hours; 48 hours
Initialization: 12-hr spin-up with 5-7 MODIS inserts
Output: 3 hourly, grib2 format
Initial times (UTC): 00/12 UTC
Initial conditions: 1/2 degree GFS, 6 hr Forecast
Boundaries: 6 hourly, one degree GFS Forecasts
Inputs: Surface, RAOBs,

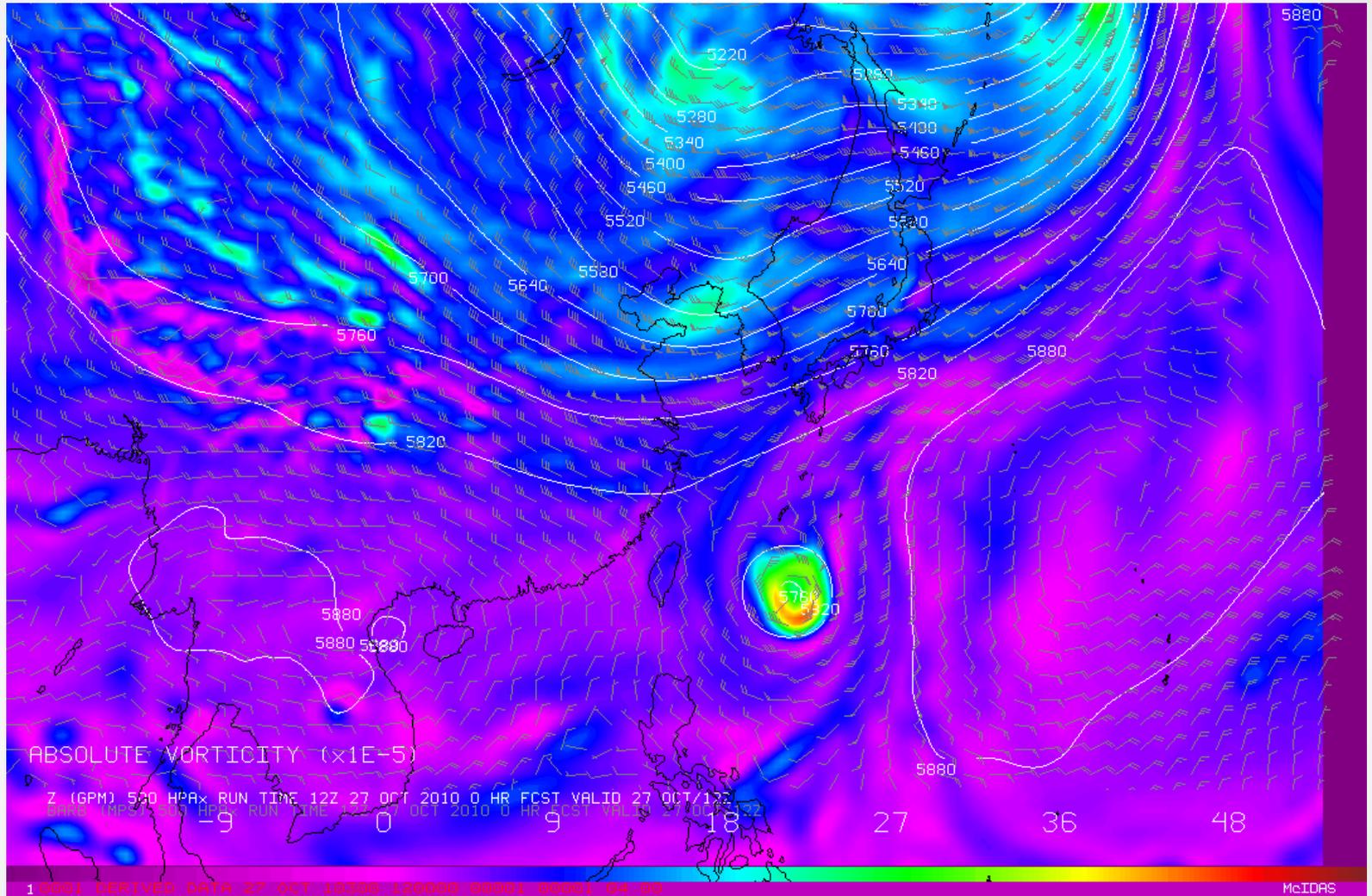


Re-locate (31° N,
121° E)

MODIS: Total precipitable water, cloud-top pressure



Evaluation of DBCRAS



72h forecast at 500hPa, 12UTC 27/10/2010



Evaluation of DBCRAS

Methods

Qualitative and quantitative analysis

Time

00UTC, heavy rain case at Yangtze river delta in June 2011

Data

CRAS output (format: grib2);

Projection: Polar stereographic Resolution:

$0.5^\circ \times 0.5^\circ$

ECMWF: ERA-Interim (format: netcdf)

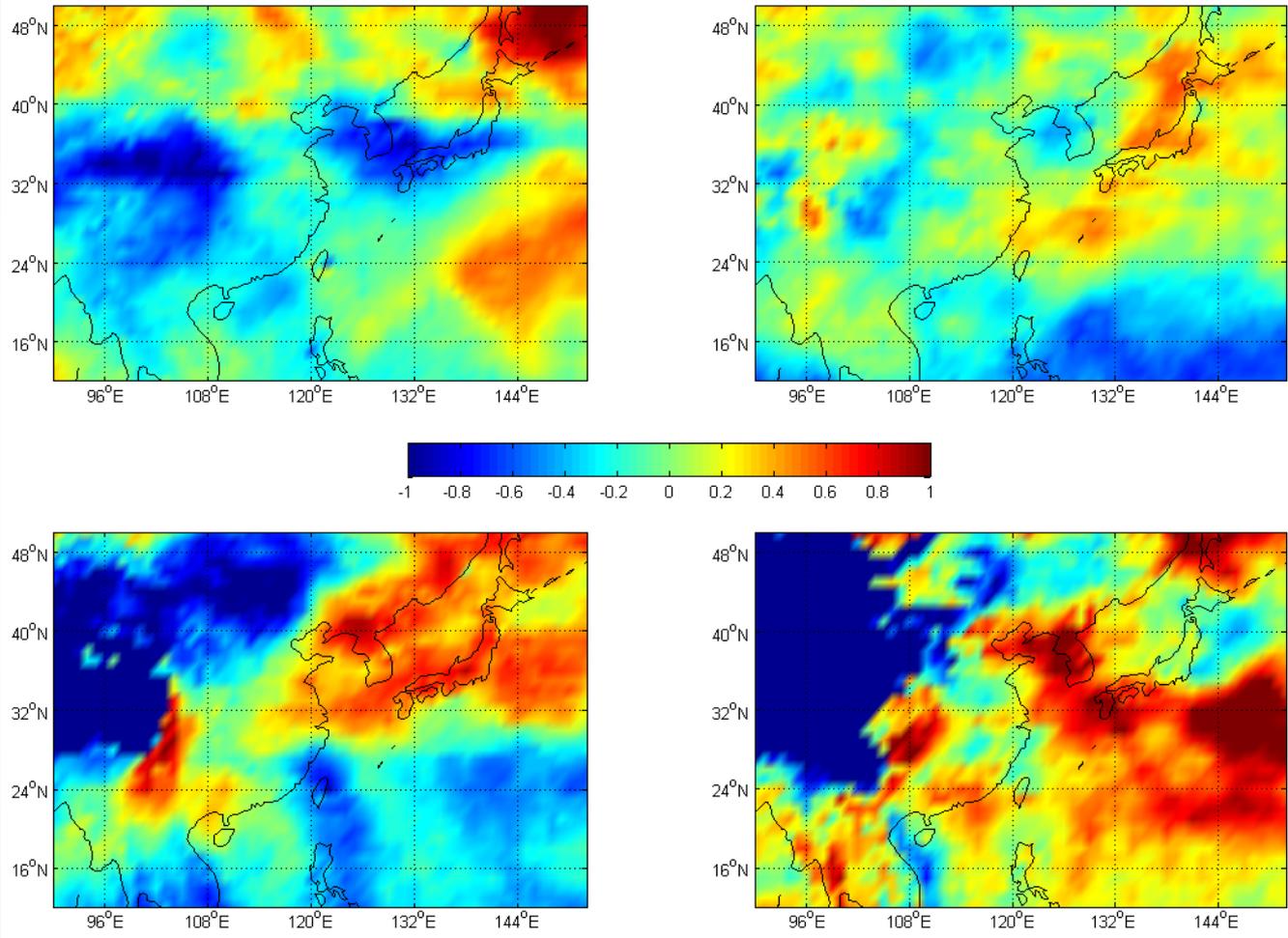
Projection: Cylindrical equidistant Resolution:

$1.5^\circ \times 1.5^\circ$

Other data: **Radiosonde**; **TRMM precipitation** product



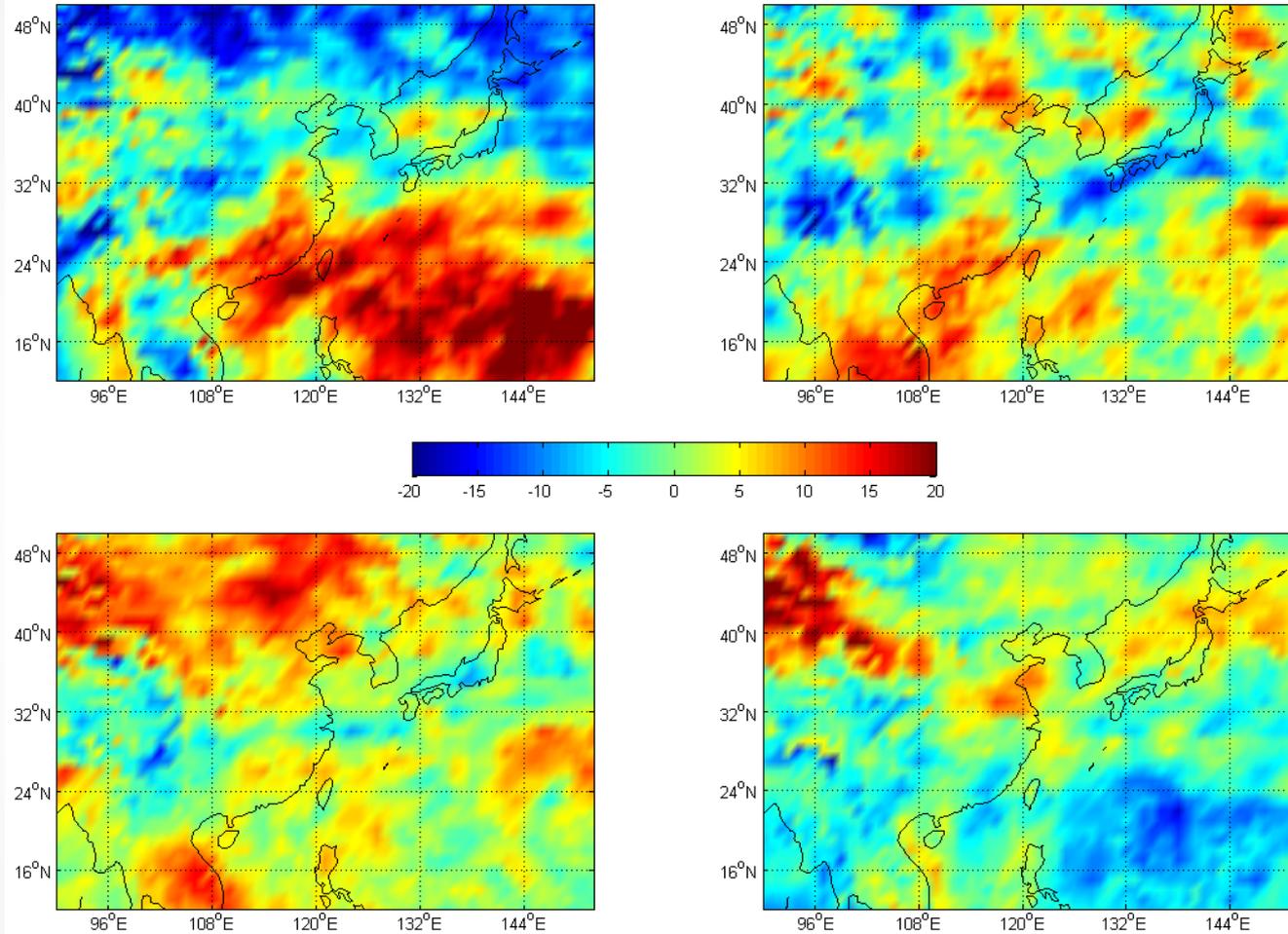
Evaluation of DBCRAS



24h forecast temperature bias
(a) 300hPa (b) 500hPa (c) 700hPa (d) 850hPa



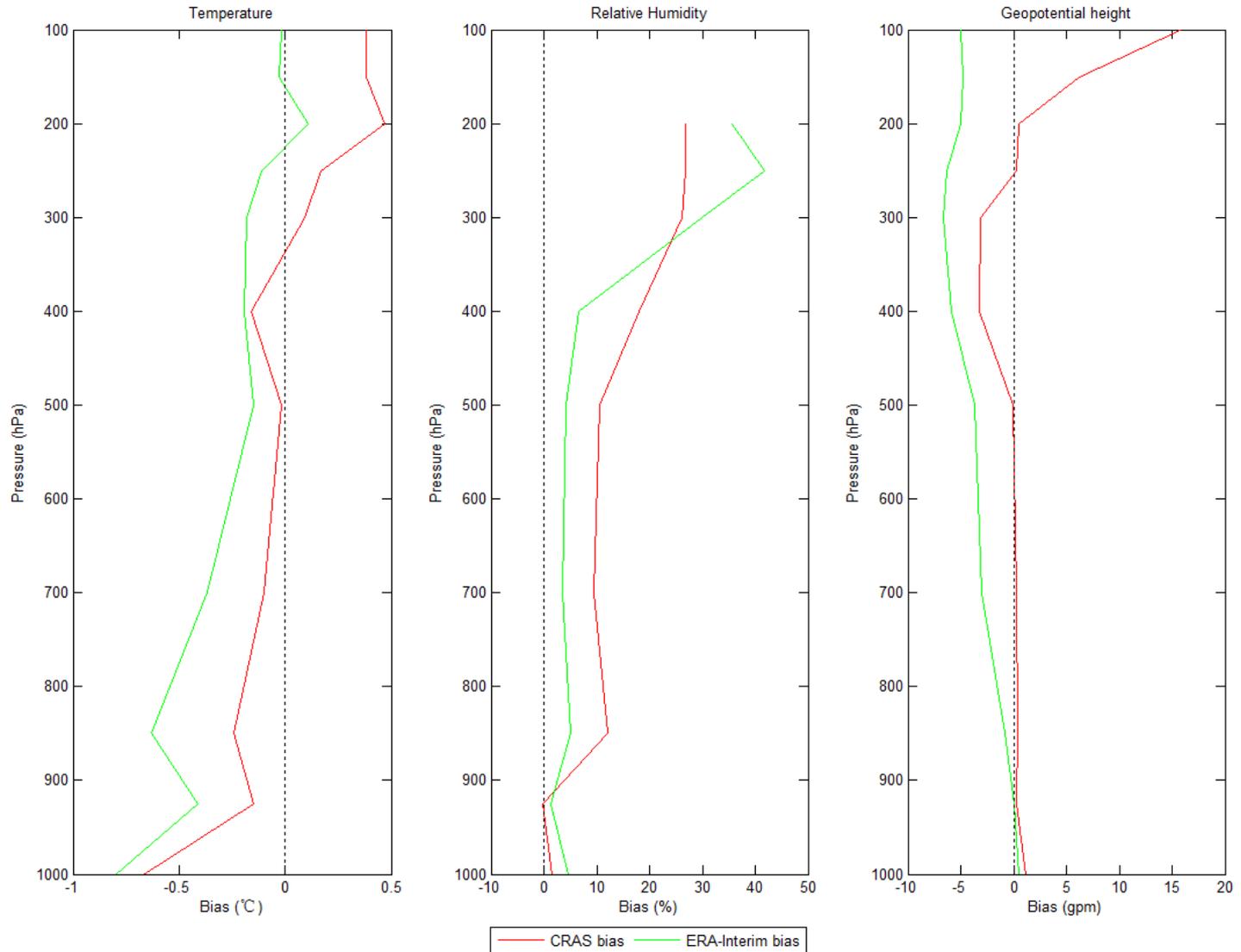
Evaluation of DBCRAS



**24h forecast relative humidity bias
(a) 300hPa (b) 500hPa (c) 700hPa (d) 850hPa**

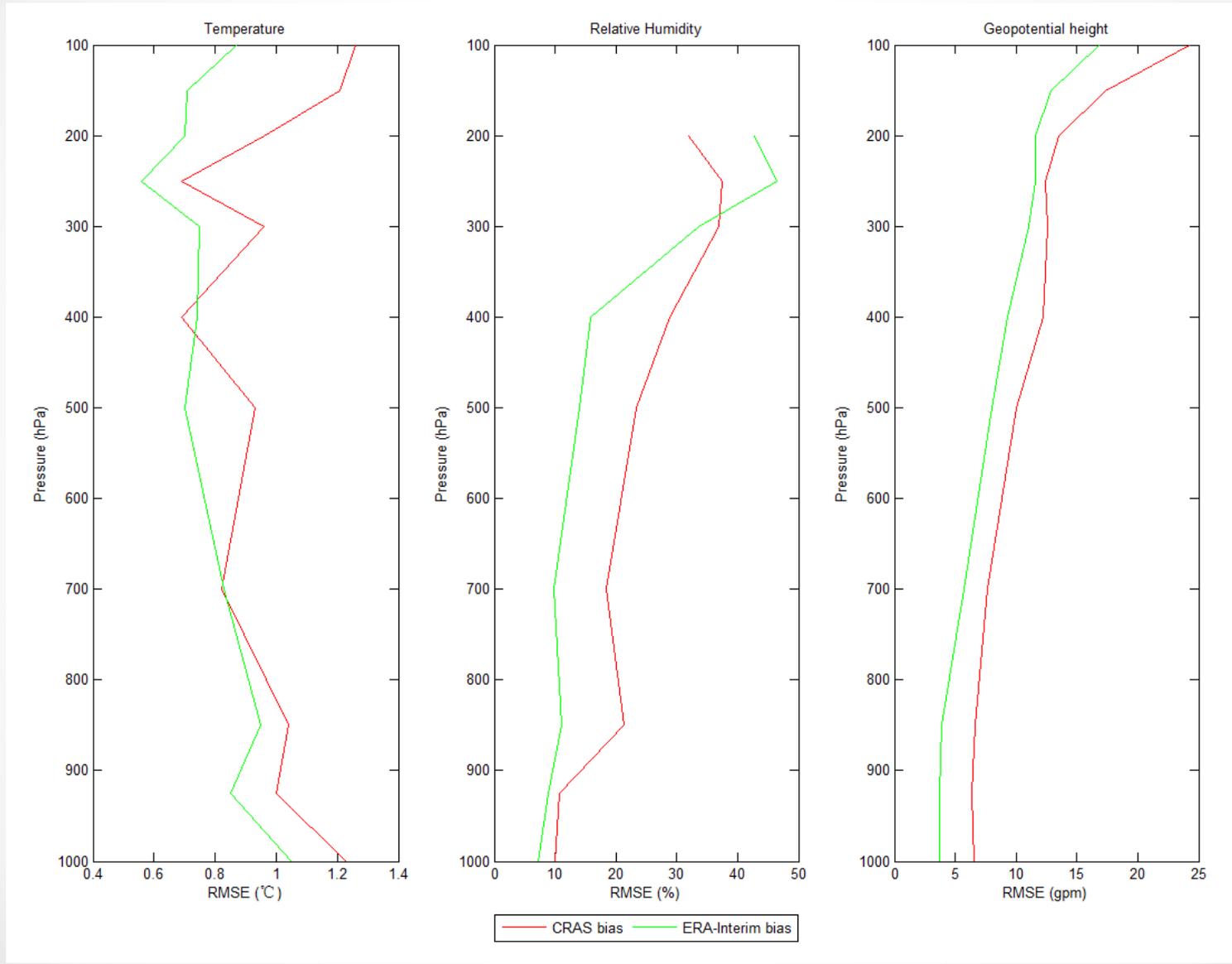


Evaluation of DBCRAS





Evaluation of DBCRAS

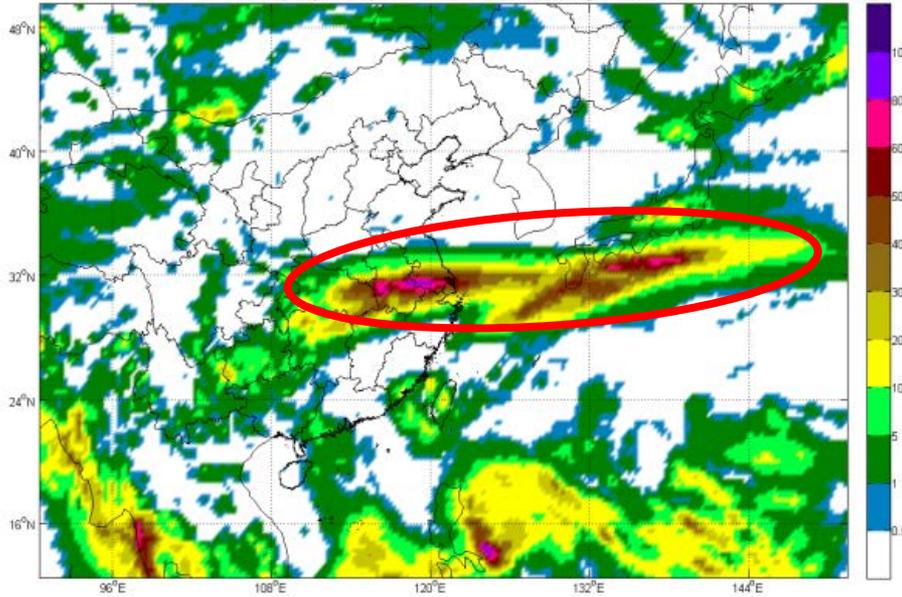




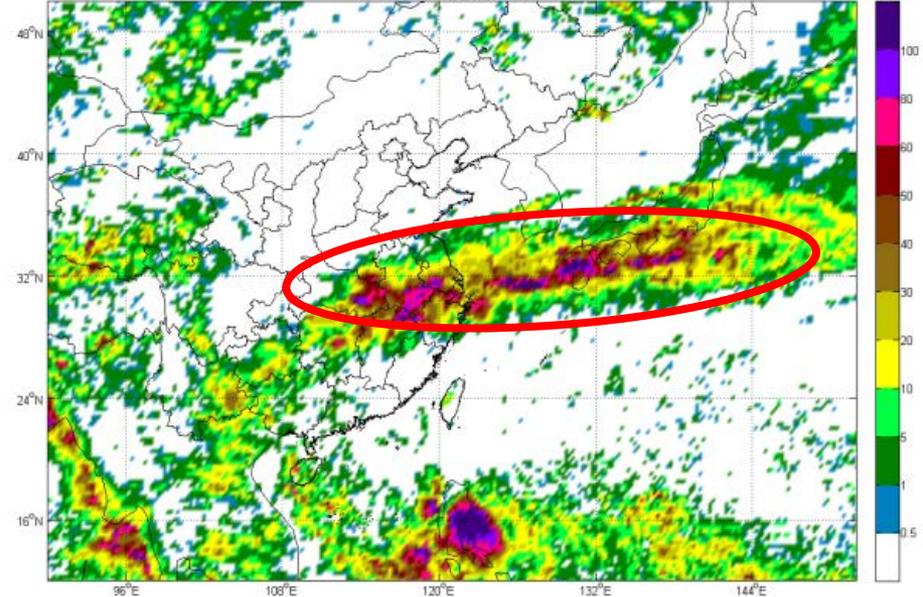
Evaluation of DBCRAS

Forecast of 24h accumulated precipitation compared with TRMM precipitation

Accumulated precipitation by CRAS 00-24h forecast assimilating CTP and TPW



TRMM-based daily precipitation





Researches supported by IMAPP

Xiaoyun Zhuang : Localization of temperature profile retrieval

Yunzhu Chen : Data fusion of aerosol optical depth

Cong Zhou : Research on CO₂

Yuanyuan Chen : PM 10 forecast

Yan'an Liu : Assimilation of CrIS in regional model

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Thank You !