Aerosol Data Assimilation

Current Situation and Projects of JMA

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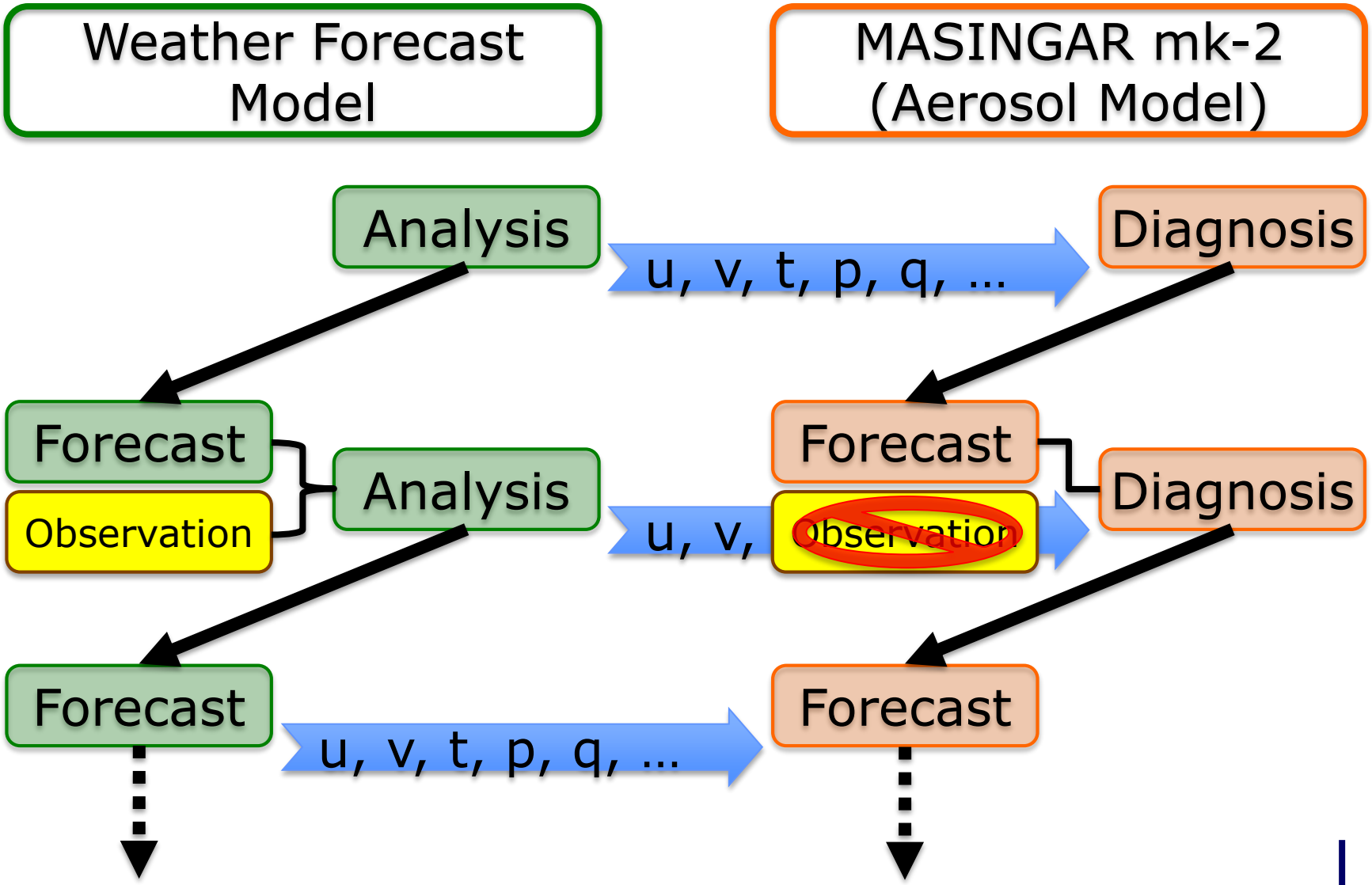
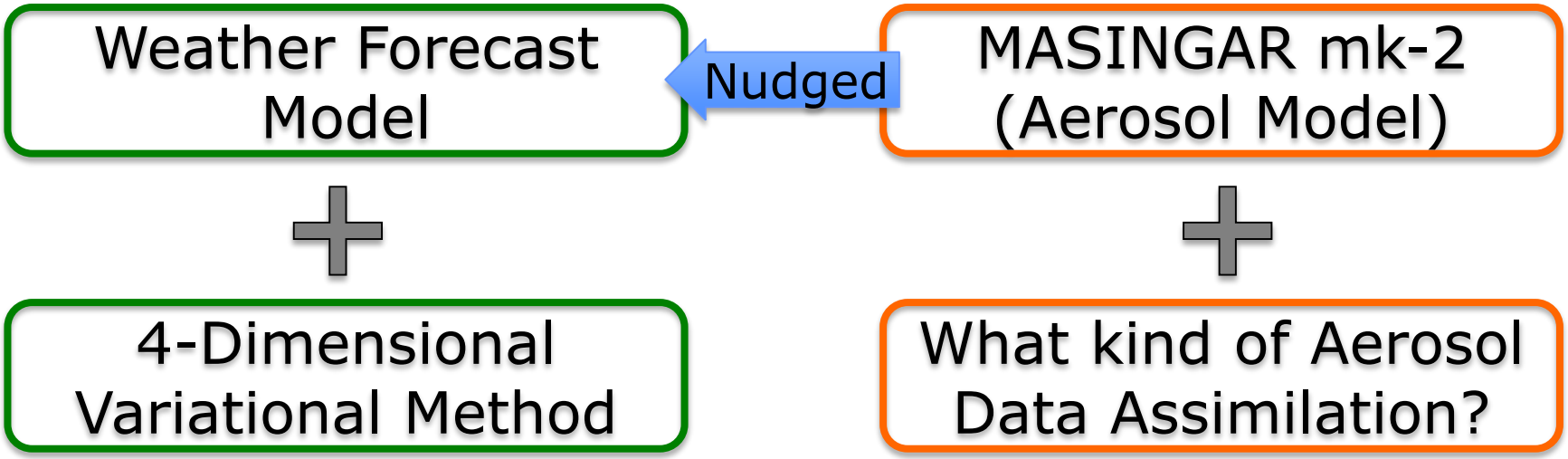
Outlines

- JMA's Operational System
- Research on Ensemble Kalman Filter Data Assimilation
  - Using CALIOP Data
  - Using MODIS Data
- Current Projects
  - Data Assimilation of HIMAWARI-8 for Aerosol Forecasts
  - Data Integration of Multi-Satellites for Aerosol Analyses

JMA's Operational System



JMA's Operational System

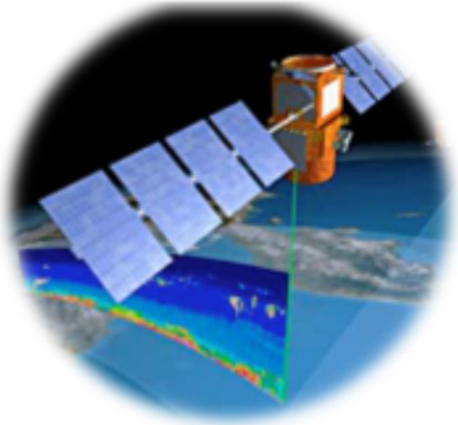


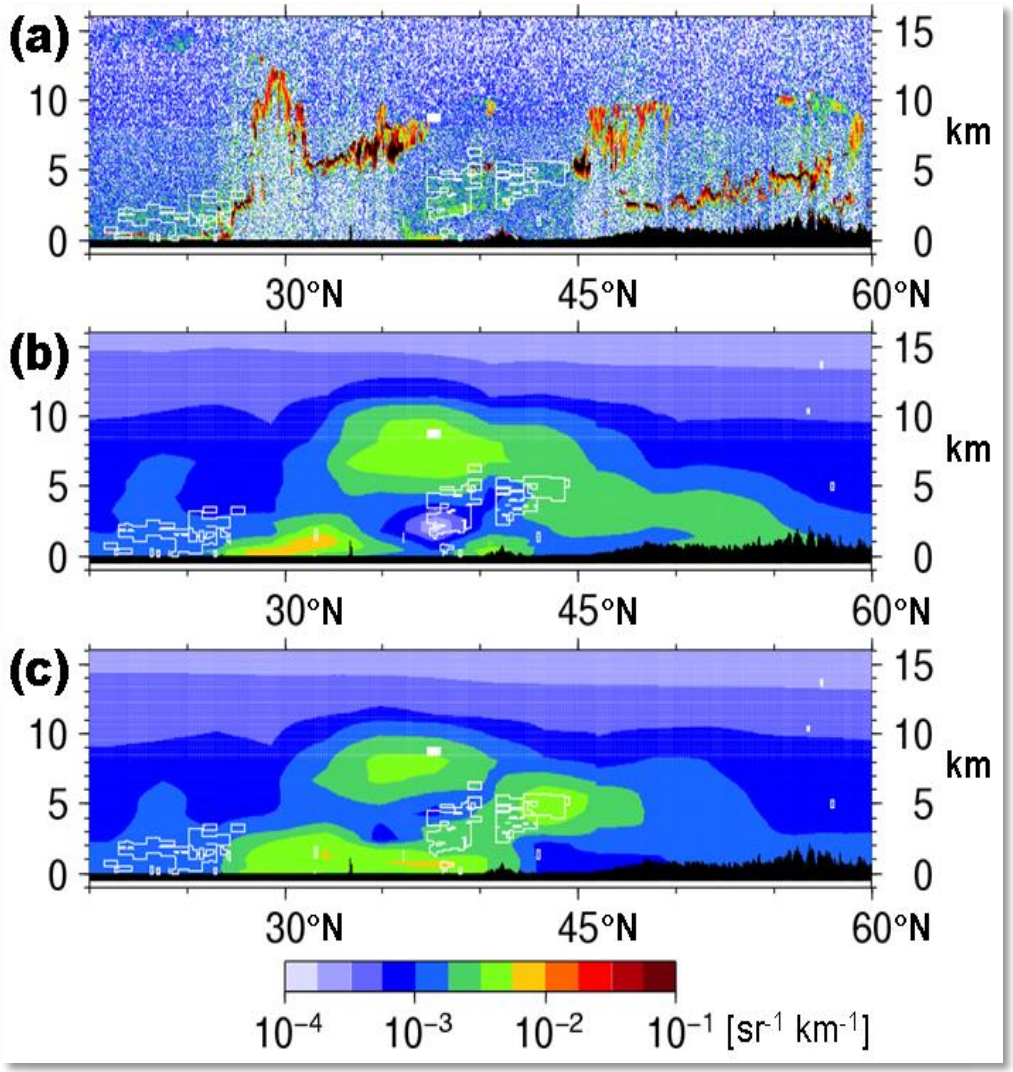
- ✓ The model's adjoint code is required.
- ✓ The Required computational resources are huge.

- ✓ Nudging?
- ✓ OI?
- ✓ 3D-Var?
- ✓ EnKF?

EnKF with Lidar Data

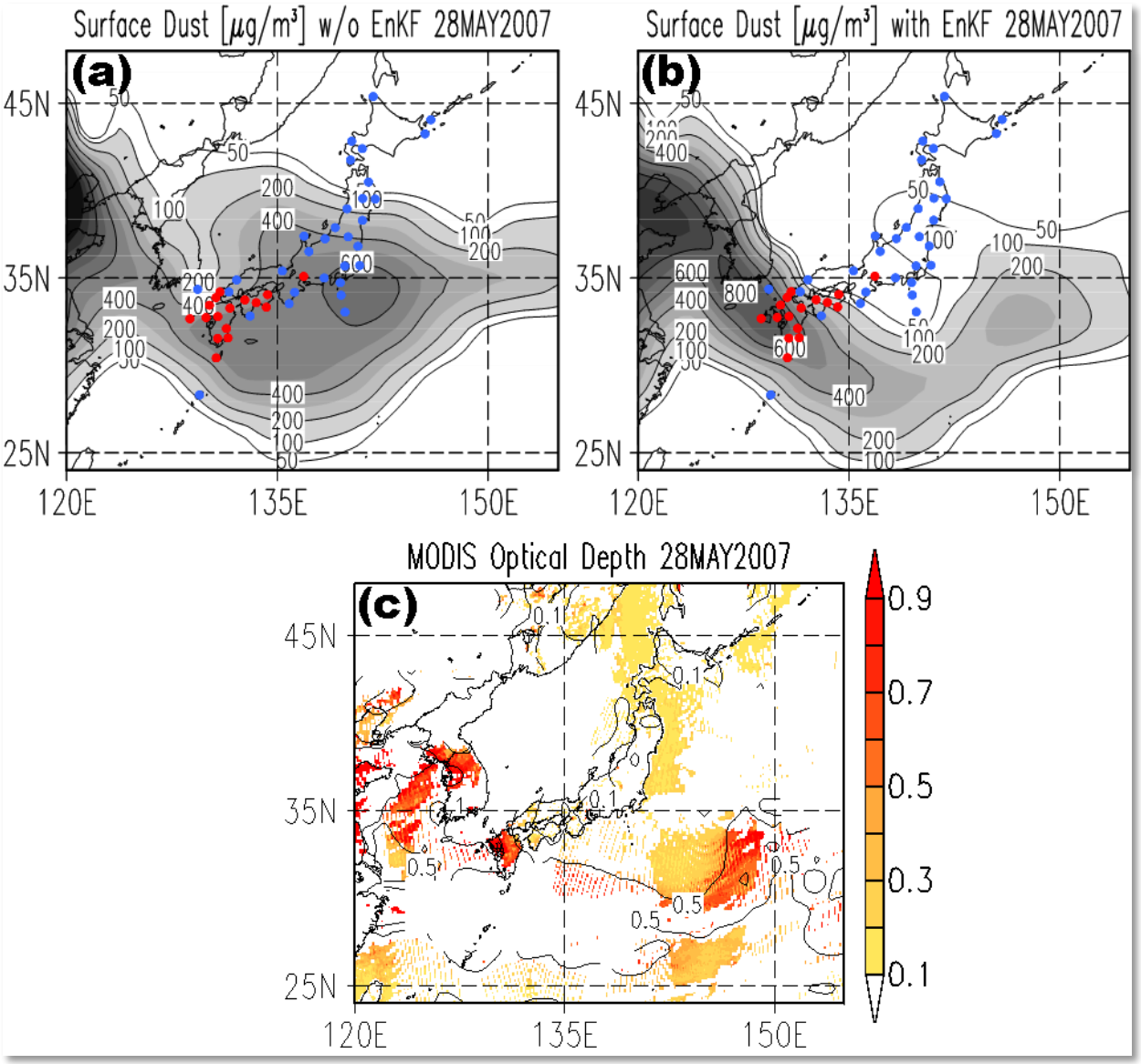
Satellite-borne Lidar (CALIPSO/CALIOP)





Sekiyama et al., ACP (2010)

EnKF with Lidar Data



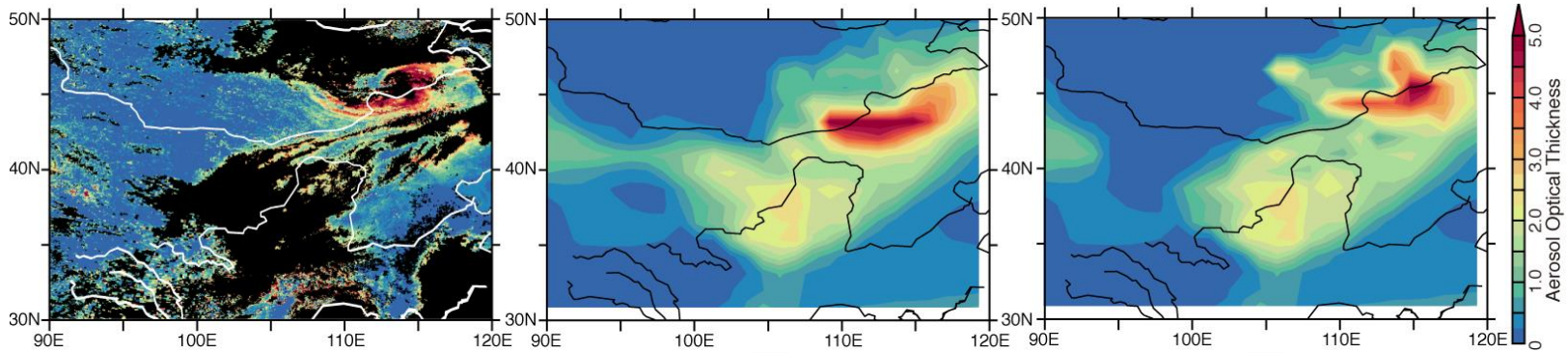
Sekiyama et al., ACP (2010)

EnKF with MODIS Data

MODIS AOT compiled by NRL

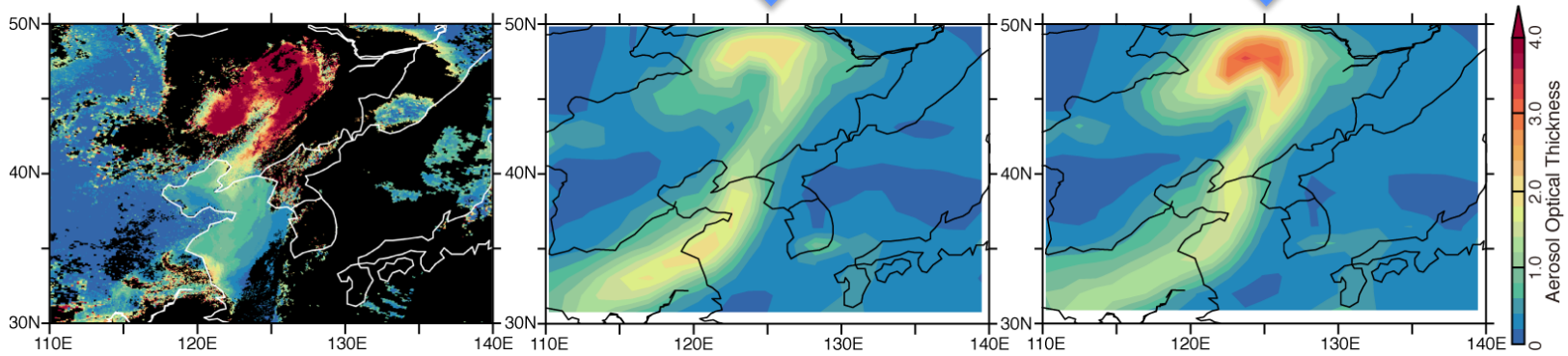
MASINGAR mk-2 without DA

MASINGAR mk-2 with MODIS DA



Analysis 07UTC March 11, 2015

18-h Forecast



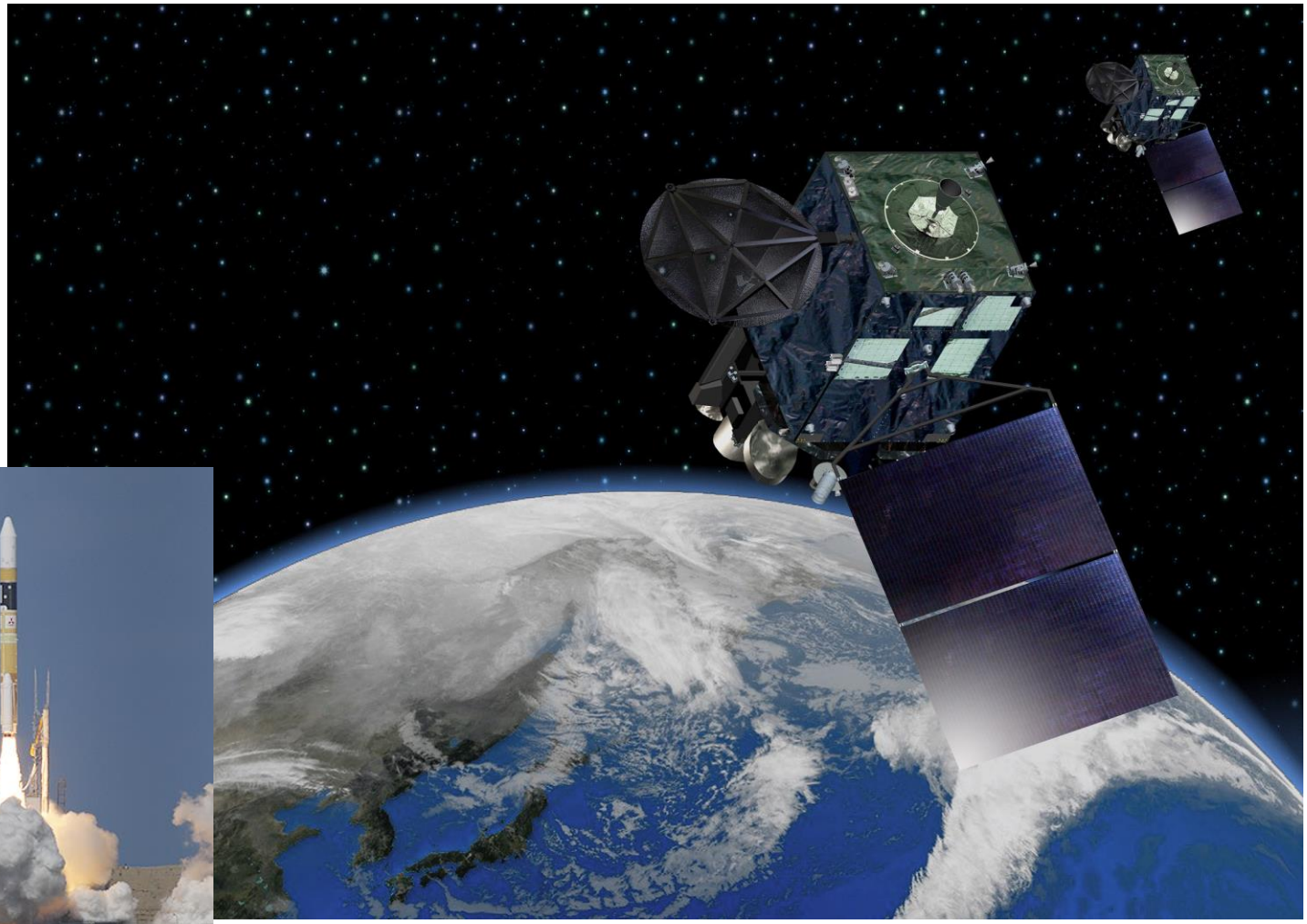
Forecast 04UTC March 12, 2015

Yumimoto et al., submitted

DA is not operational at JMA

- Ensemble Kalman filter is **heavy**
- Lidar measurements are **sparse**
  - CALIPSO's lifetime
  - postponed launch of EarthCARE
- Operational systems require the stability of data access and coverage
  - **What's the best?** MODIS AOT?
  - Another satellite?

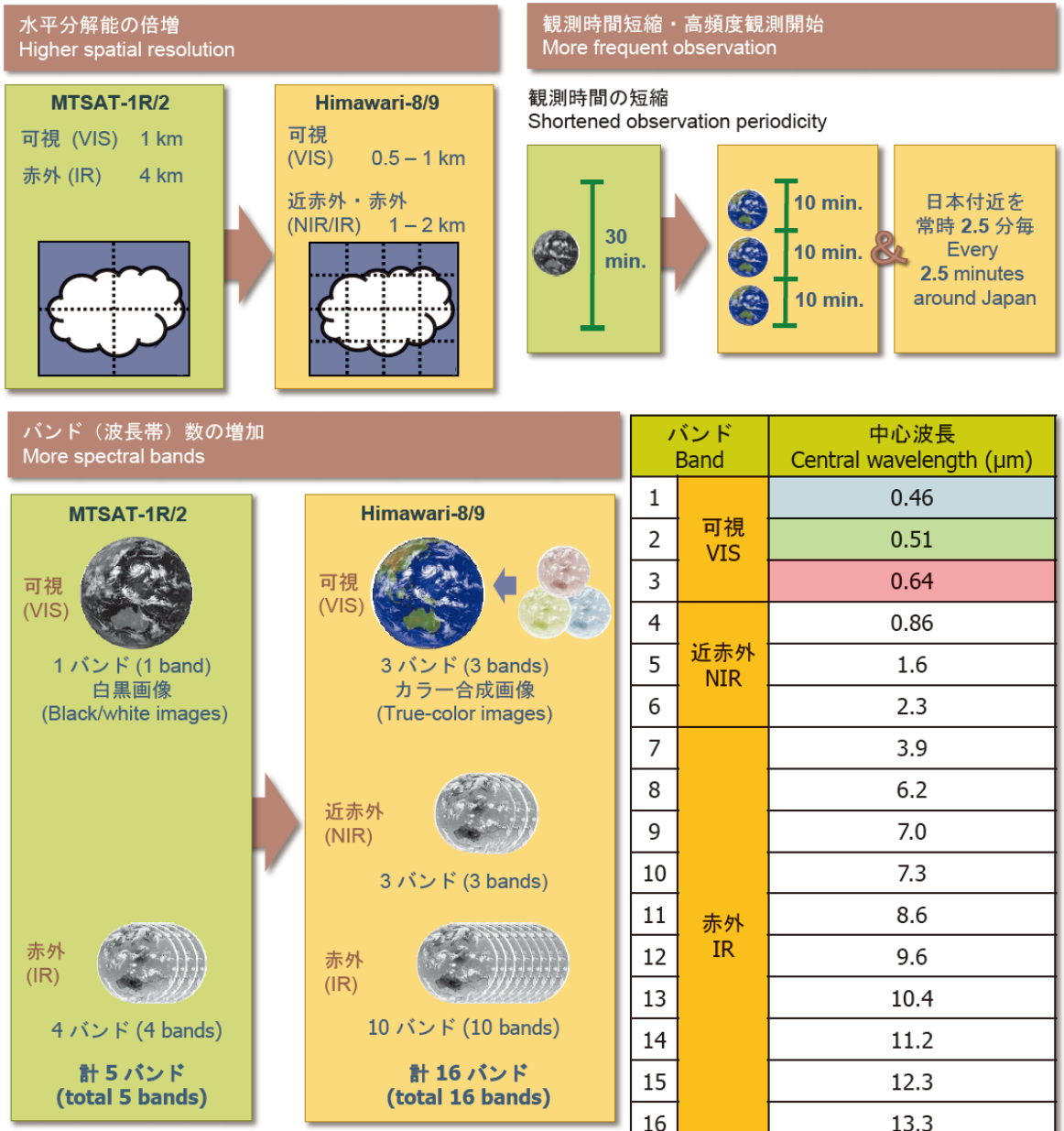
HIMAWARI-8 Project



HIMAWARI-8

- HIMAWARI-8 is a Japanese **geostationary** meteorological **satellite** launched on October 7, 2014.
  - to start operation on July 7, 2015
- Shares common specifications of the VIS-IR imager with GOES-R
- **HIMAWARI-9** (backup satellite) will be launched in 2016.
- The lifetime is **15 years**.

HIMAWARI-8



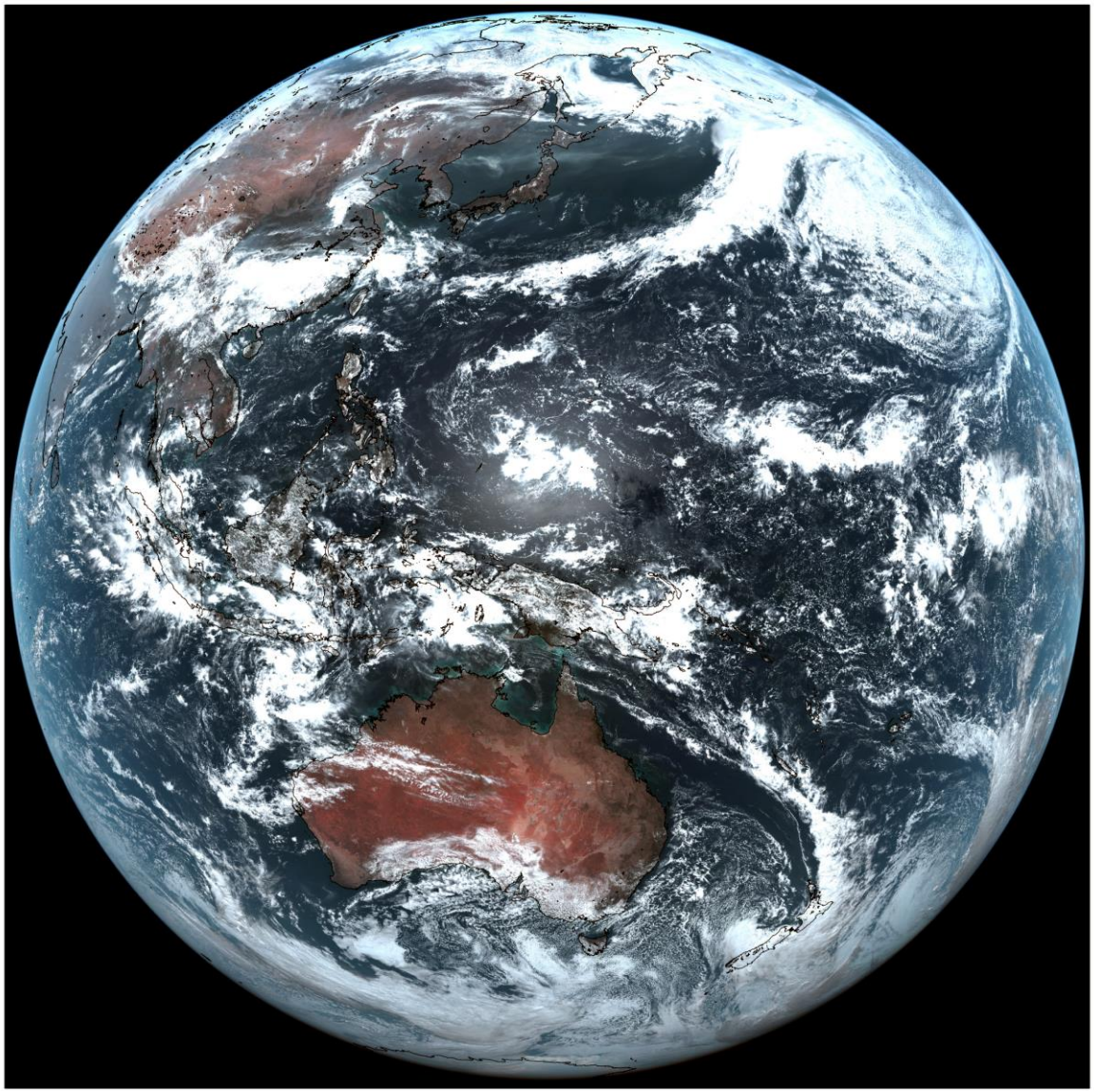
バンド Band		中心波長 Central wavelength (μm)
1	可視 VIS	0.46
2		0.51
3		0.64
4	近赤外 NIR	0.86
5		1.6
6		2.3
7	赤外 IR	3.9
8		6.2
9		7.0
10		7.3
11		8.6
12		9.6
13		10.4
14		11.2
15		12.3
16		13.3

Every 10 min Observation

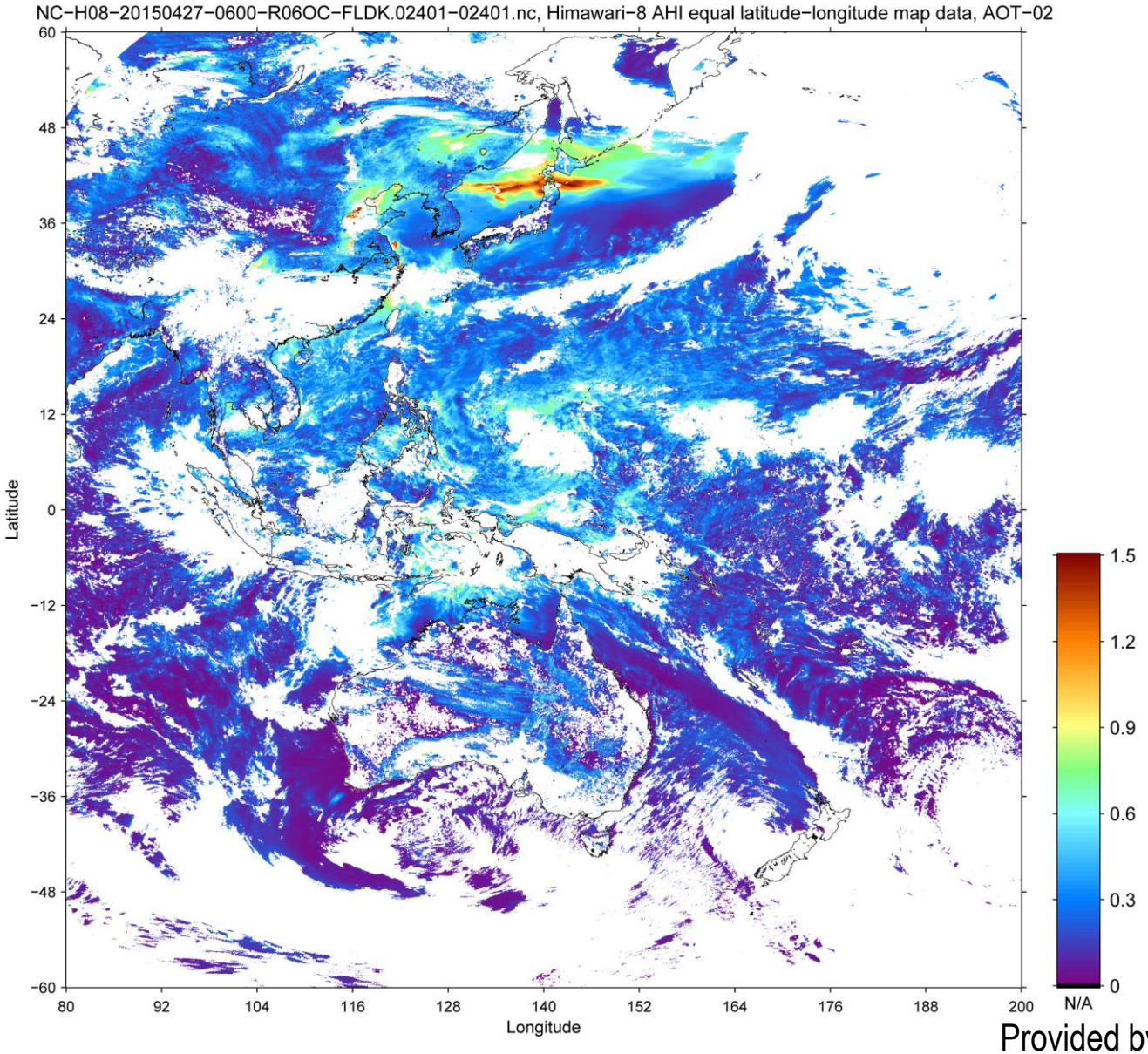
Available for AOT retrieval!

HIMAWARI-8 (RGB image)

HS-H08-20150427-0230-S21-FLDK.02750-02750.nc, Himawari-8 AHI standard map data, albedo-06

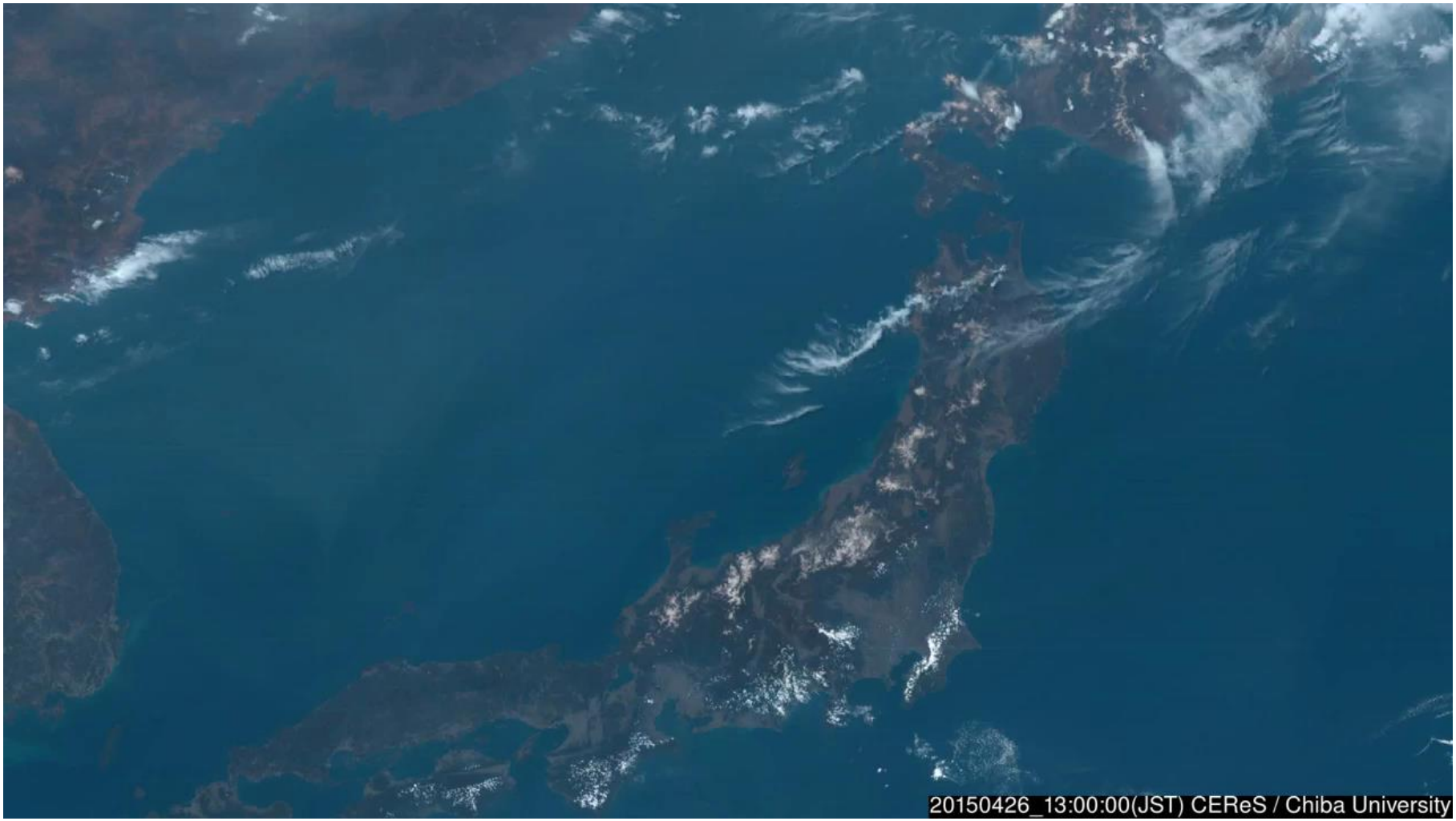


HIMAWARI-8 (510nm AOT)



Provided by JAXA

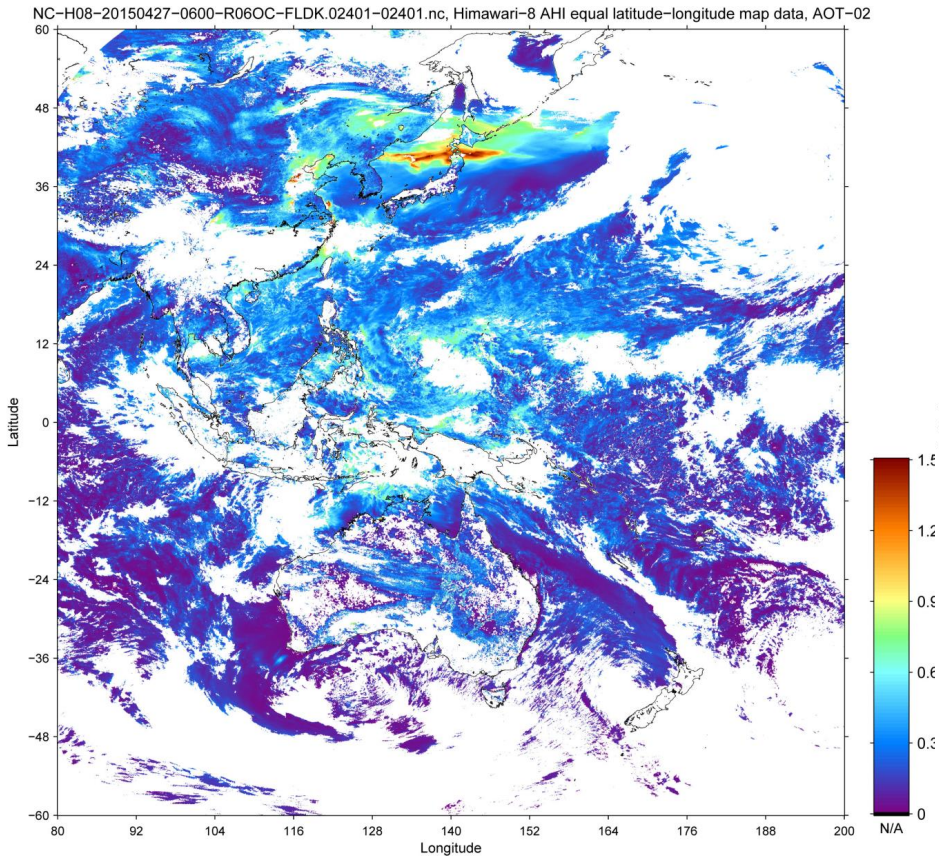
HIMAWARI-8 (RGB movie)



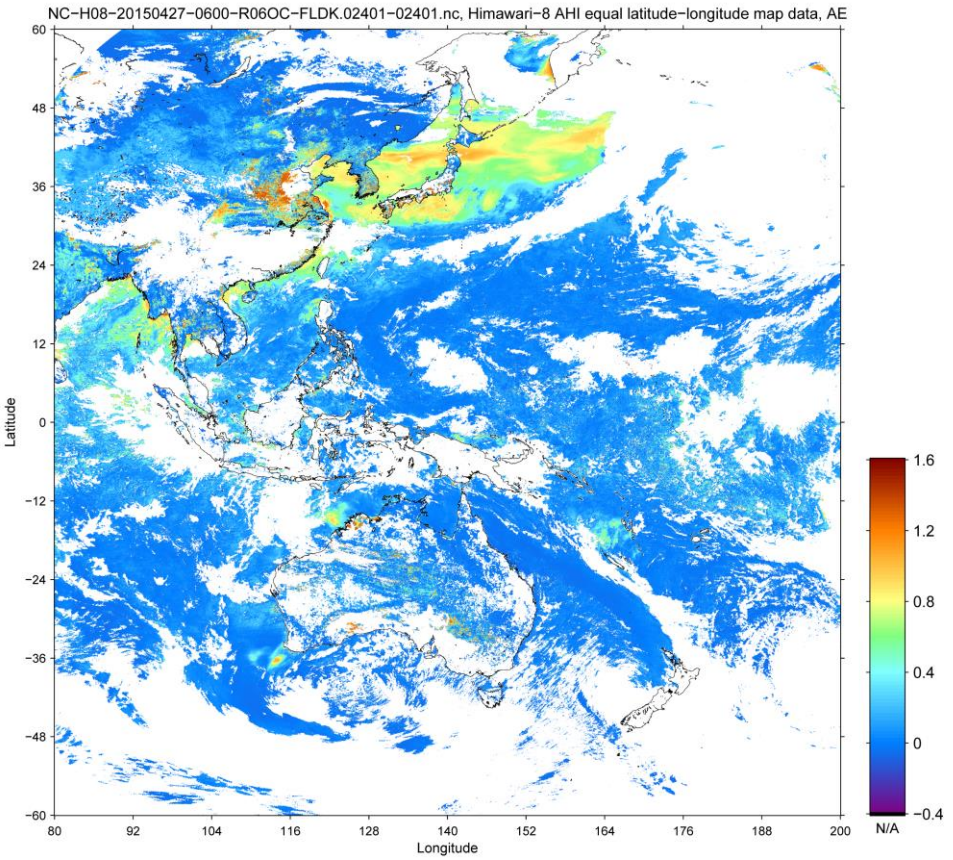
Provided by CEReS/Chiba University

HIMAWARI-8

AOT 06UTC 27 April 2015



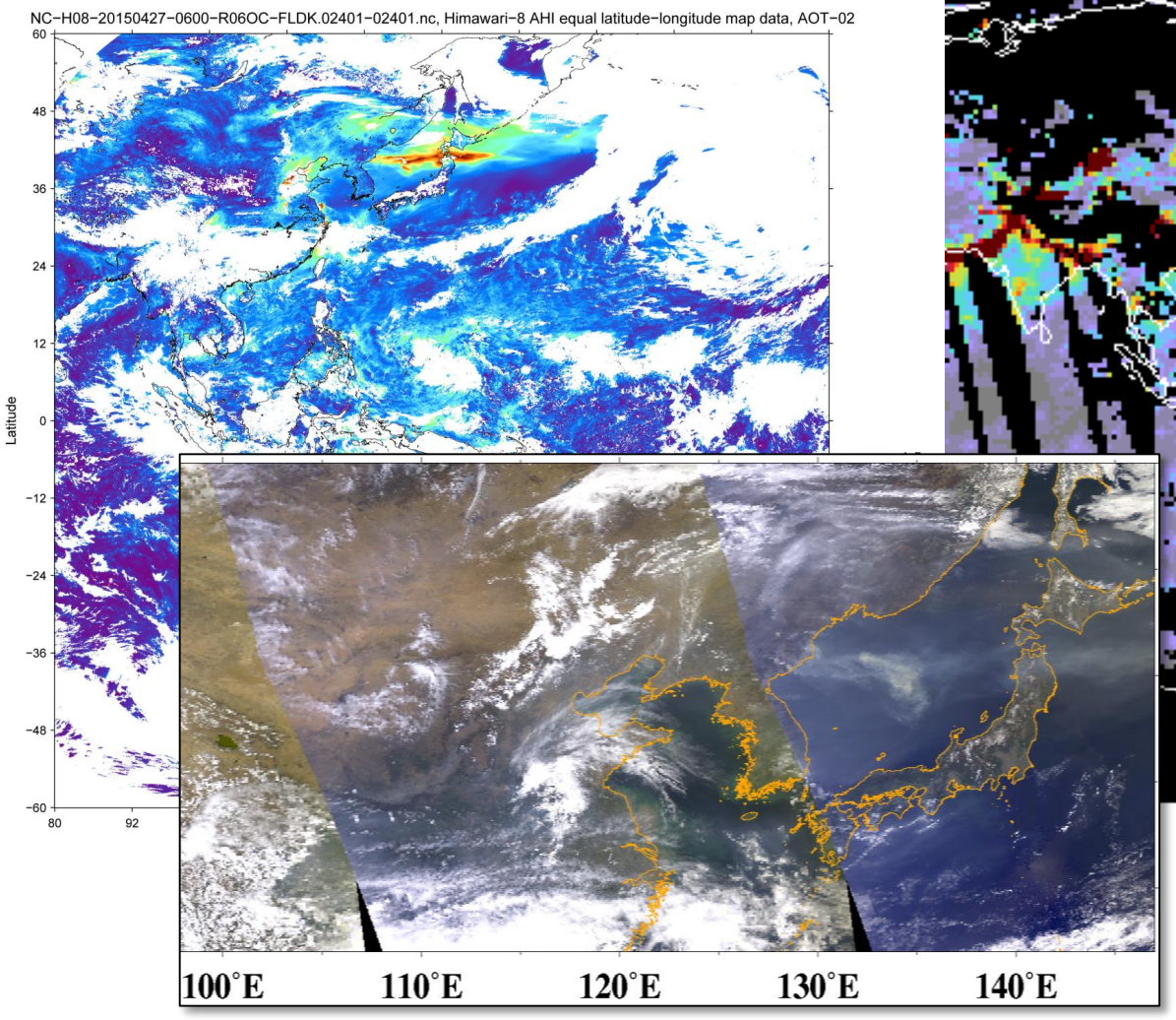
AE 06UTC 27 April 2015



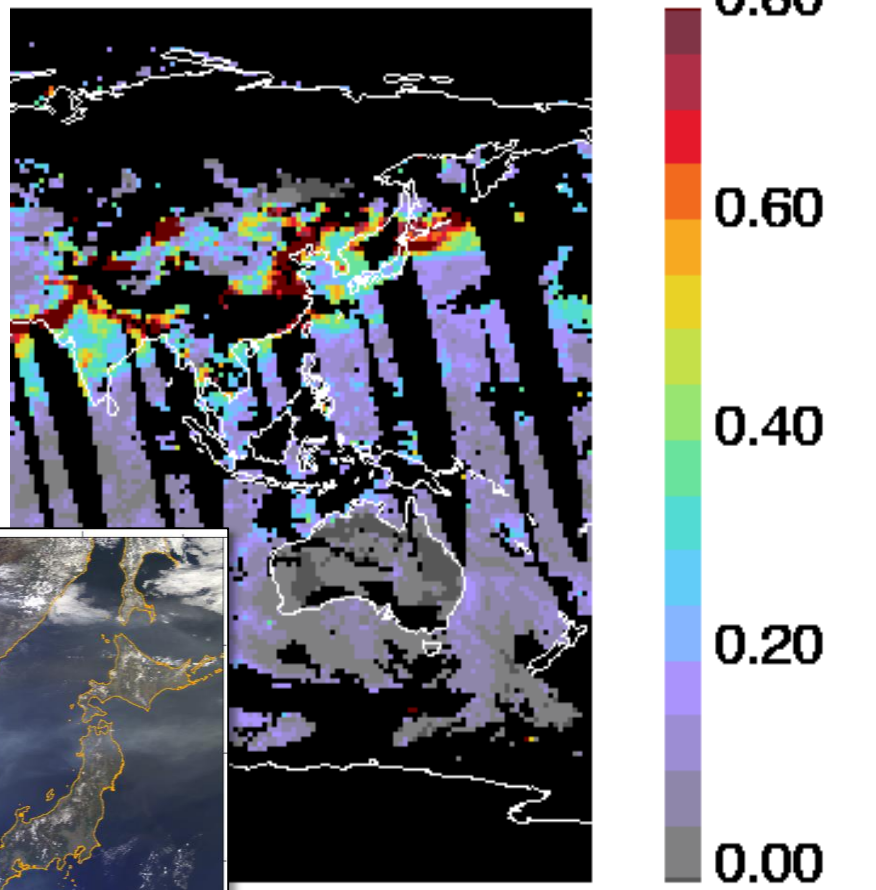
Provided by JAXA

HIMAWARI-8

AOT 06UTC 27 April 2015

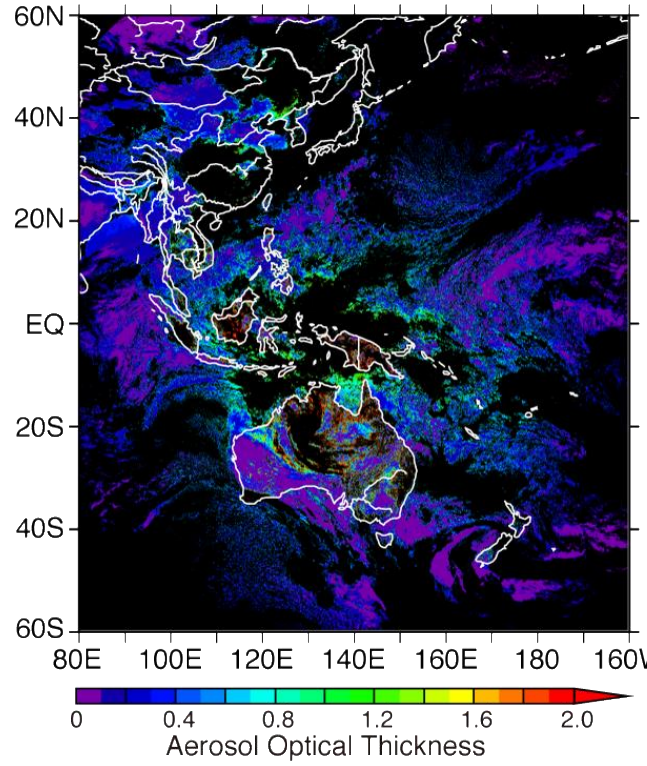


MODIS

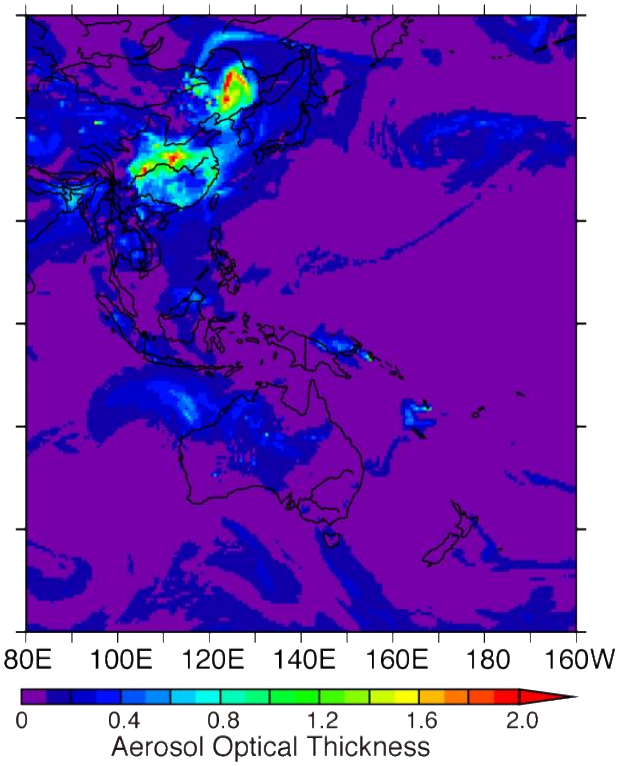


HIMAWARI-8 EnKF DA

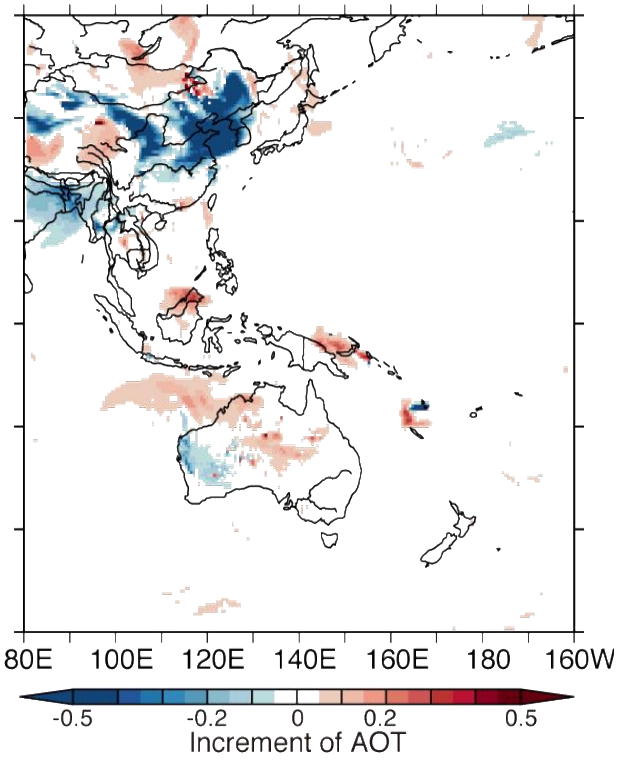
HIMAWARI-8 AOT



MASINGAR with DA



DA Increment



MASINGAR mk-2 (TL319≈60km) data assimilation test (22 Feb 2015) with the Local Ensemble Transform Kalman filter (LETKF)

HIMAWARI-8 EnKF DA

- **JAXA** is developing the HIMAWARI-8 AOT retrieval algorithm.
  - JMA doesn't have an AOT retrieval staff…
- **JMA** is testing the aerosol forecast system using HIMAWARI-8 AOT with EnKF.
- JMA's supercomputing system will be replaced in **2017**.
  - The HIMAWARI-8 aerosol data assimilation system will be installed.

Joint research project for aerosol DA since 2014

EORC/JAXA × MRI&MSC/JMA × RIAM/Kyushu univ. × NIES/MOE


HIMAWARI 8/9

+


EarthCARE

+

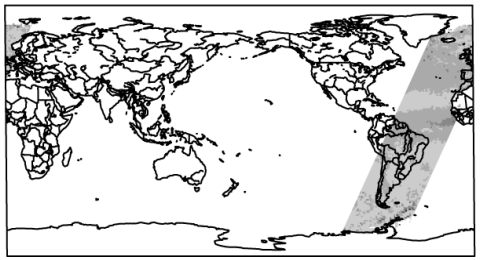

GCOM-C

+


GOSAT-2

Joint research project for aerosol DA since 2014

EOS1



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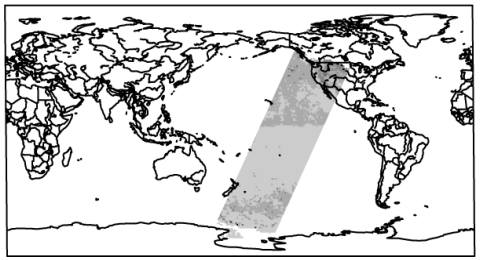
EOS2



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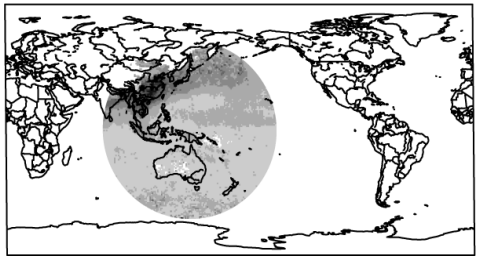
GSO1



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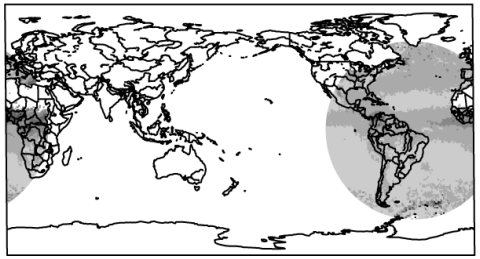
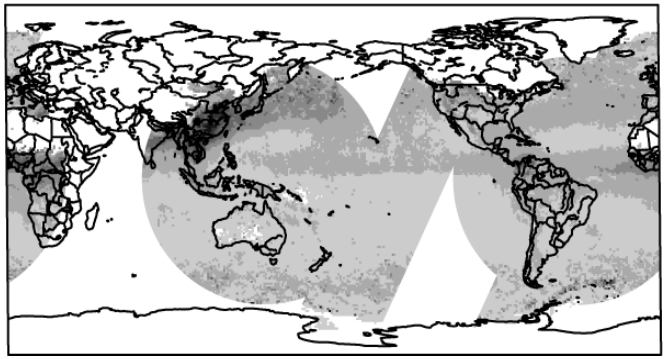
GSO2



Combined



Difference between MODIS and CALIOP

Atmos. Meas. Tech., 4, 131–141, 2011
www.atmos-meas-tech.net/4/131/2011/
doi:10.5194/amt-4-131-2011

Atmospheric

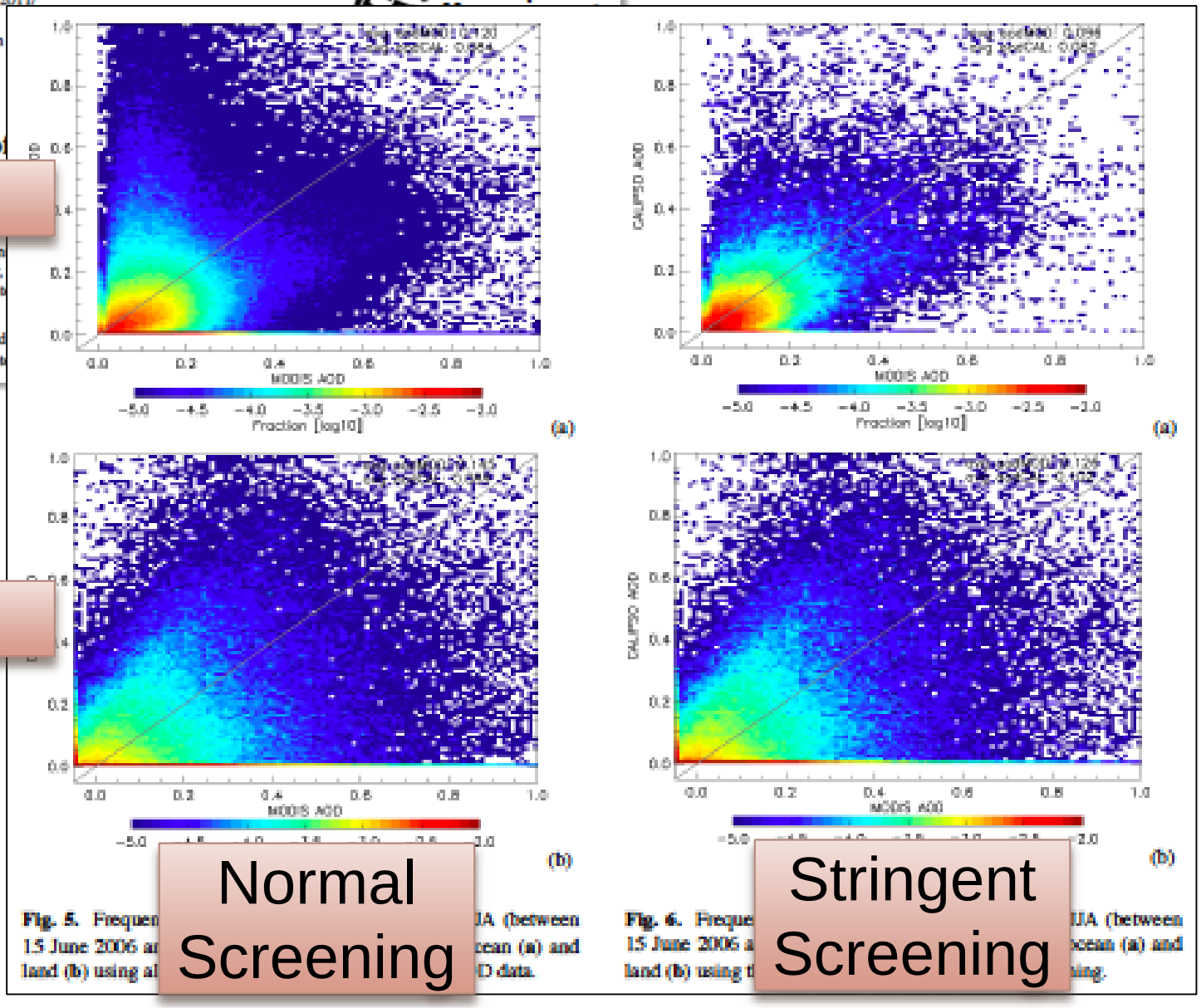
Intercomparison of

[1]Science Systems and Application
[2]NASA Langley Research Center,
[3]NASA Goddard Spaceflight Cent
[†]deceased

Received: 7 July 2010 – Published
Revised: 6 January 2011 – Accept

Ocean

Land



Normal Screening

Stringent Screening

Fig. 5. Frequen … JA (between 15 June 2006 a… ean (a) and land (b) using al… D data.

Fig. 6. Freque… JA (between 15 June 2006 a… ean (a) and land (b) using t… ing.

Thank you!