JMA Assimilation Update

Keiya YUMIMOTO

Meteorological Research Institute, Japan Meteorological Agency, Japan

Taichu Y. TANAKA,Thomas T. SEKIYAMA, Takashi MAKI

Meteorological Research Institute, Japan Meteorological Agency, Japan

Akinori OGI

Japan Meteorological Agency, Japan

Two DA streams

① Local Ensemble Transform KF (LETKF)

- Prototype of the system has been developed.

  - Yumimoto et al., Particuology (2015), Yumimoto et al., Geophys. Res. Let. (2016)

- ~32 ensemble members with TL479 (960 x 480 x 40).
- (Still) too high computational cost for operational (NRT) forecasting.

→ **Future update (2020?~)**

(Keeping development on going)

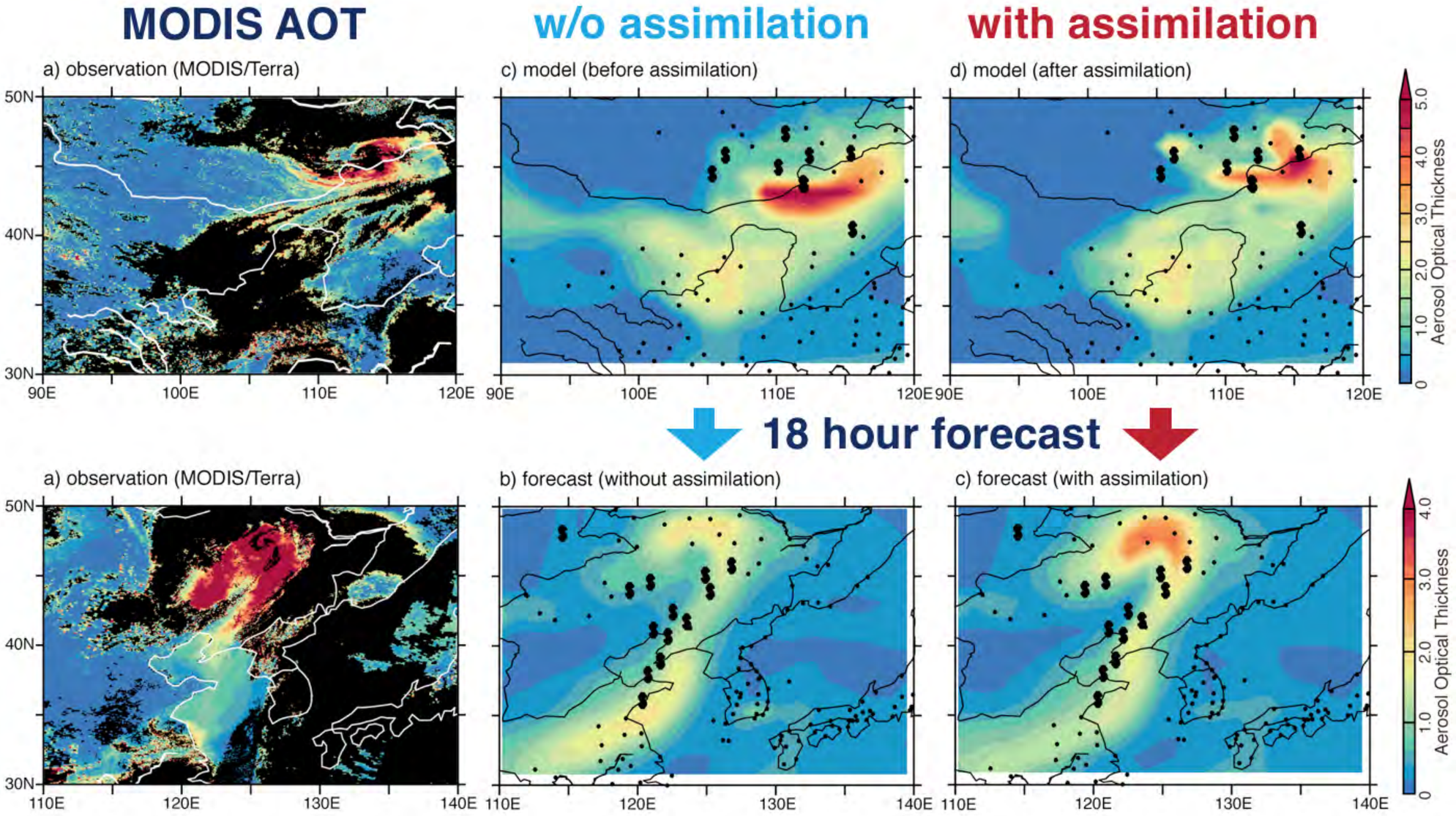
② 2D Variational Assimilation (2D-Var)

- No ensemble, no adjoint of the model.
- Assimilating 2D maps of AOT.
- NRT update method for background error covariance.

→ **Upcoming update (2018~)**

Future update: EnKF with MODIS

DA example with MODIS/AOT for Asian dust



Analysis on
07 UTC
11 Mar. 2015

Forecast on
04 UTC
12 Mar. 2015

Yumimoto et al., Particuology (2015)

Future update: EnKF with HIMAWARI-08

Himawari-8

the next-generation geostationary meteorological satellite (GMS)
launched on 7 October 2014
operational on 7 July 2015
equipped with Advanced Himawari Imager (16 bands)

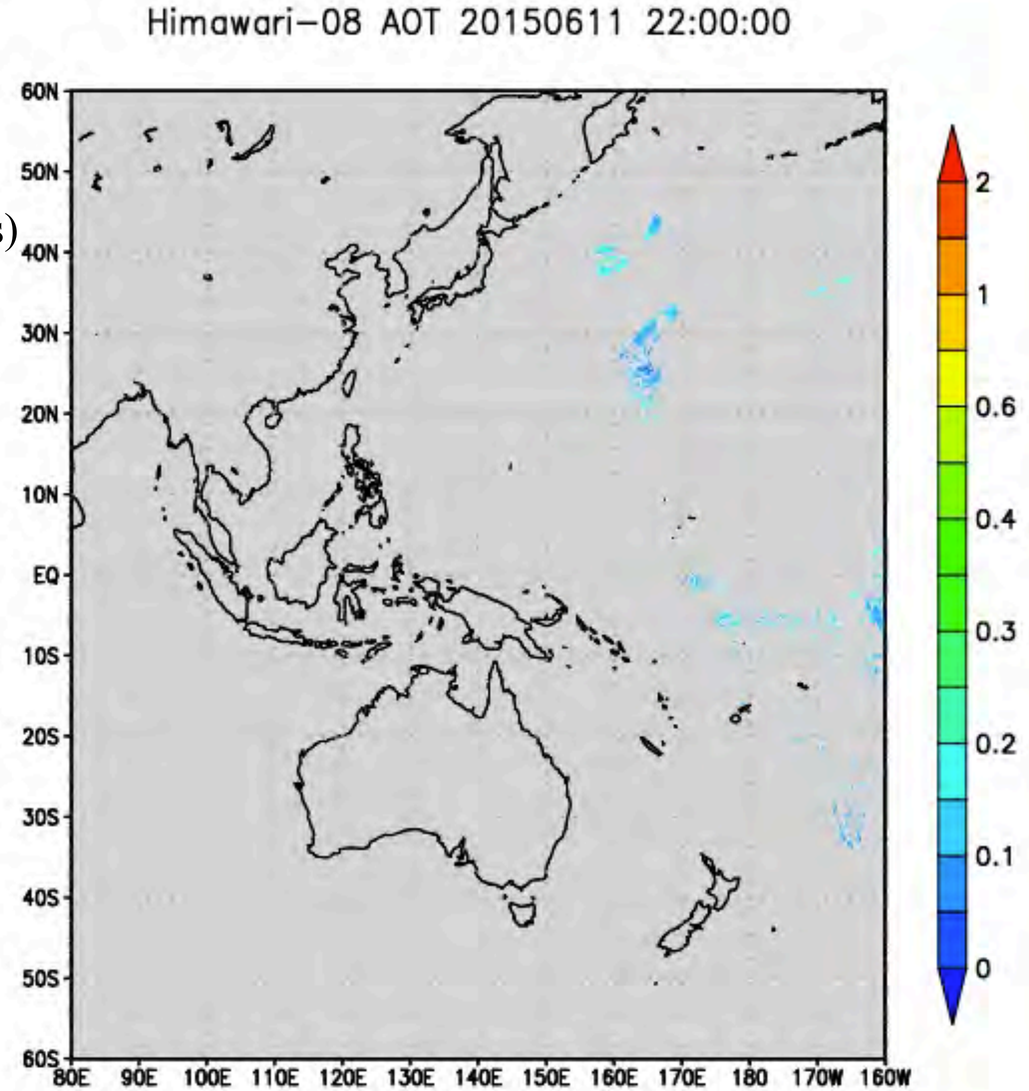
band number		wave length(μm)
1	visible	0.46
2		0.51
3		0.64
4	near infrared	0.86
5		1.6
6		2.3
7	infrared	3.9
8		6.2
9		7
10		7.3
11		8.6
12		9.6
13		10.4
14		11.2
15		12.3
16		13.3

Optically sensitive for aerosol particles

Retrievals of aerosol optical properties (AOPs)

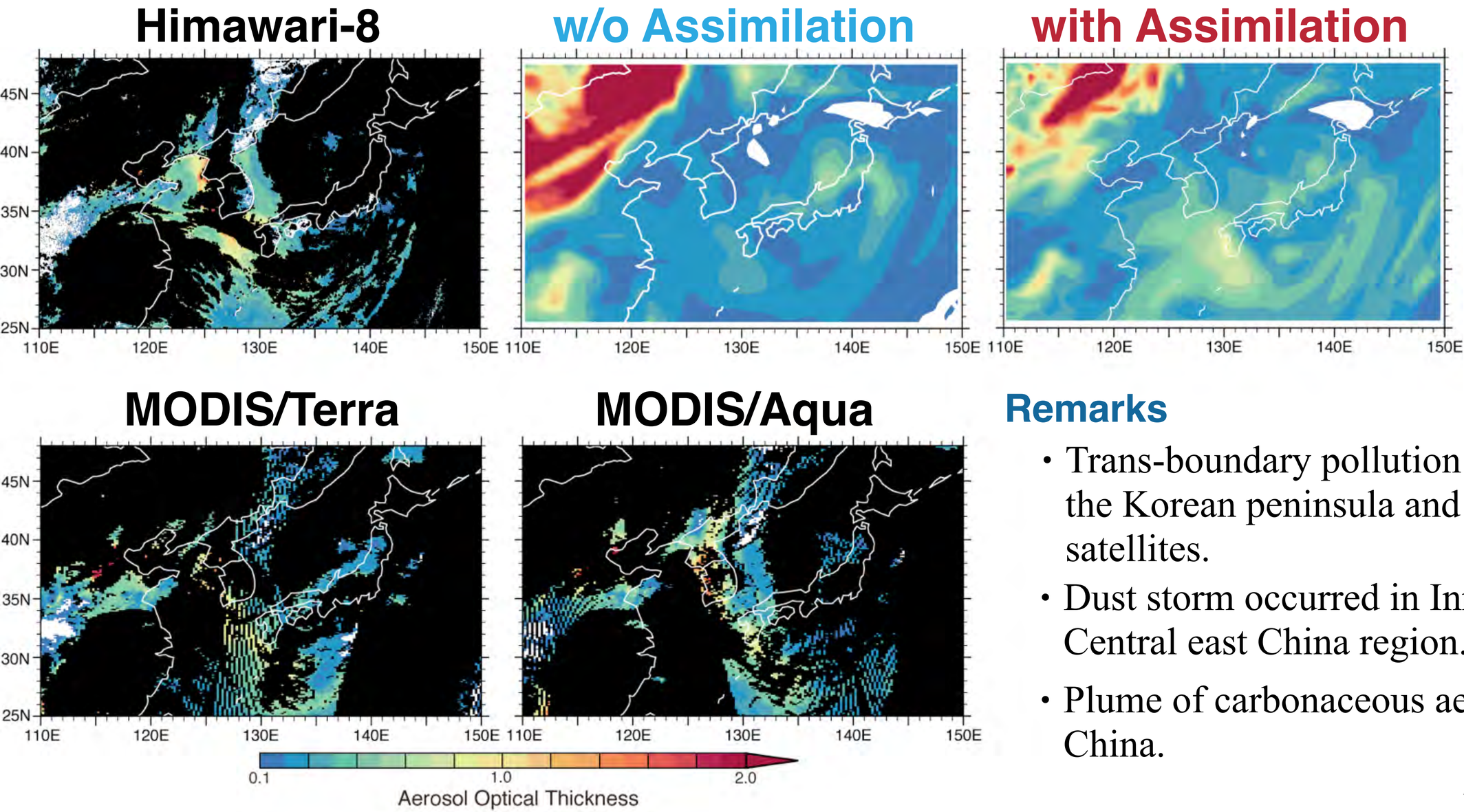
New observational bands.

Himawari-8 AOT with 10-minute intervals



Future update: EnKF with HIMAWARI-08

DA example with Himawari-8/AOT for Asian dust and pollutions



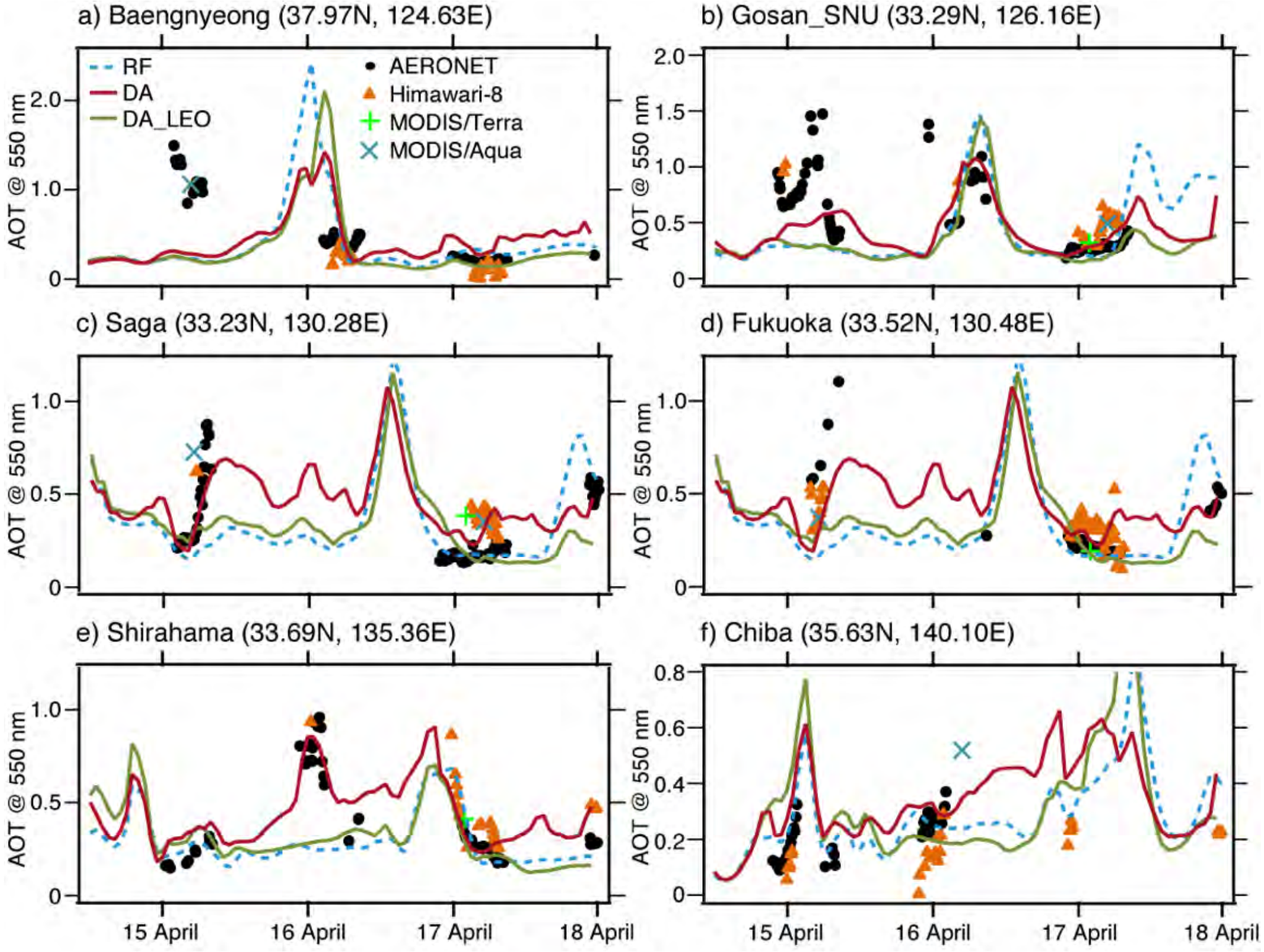
Remarks

- Trans-boundary pollution is captured over the Korean peninsula and west part Japan by satellites.
- Dust storm occurred in Inner Mongolia and Central east China region.
- Plume of carbonaceous aerosols in northeast China.

Yumimoto et al., GRL (2016)

Future update: EnKF with HIMAWARI-08

DA example with Himawari-8/AOT for Asian dust and pollutions



- The DA with 1-hour interval Himawari-8 AOT shows better performance than the DA with twice a day Himawari-8 AOT (imitating LEO satellite).
- Himawari-8 AOT can capture time evolution of aerosol plumes with 10-min temporal resolution (like AERONET AOT!).

Yumimoto et al., GRL (2016)

Upcoming update: NRT forecasting with 2D-Var

NRT Aerosol forecasting in MRI for ICAP MME

- **TL319L40 (~55 km), 5-day forecasting (sending to ICAP MME)**

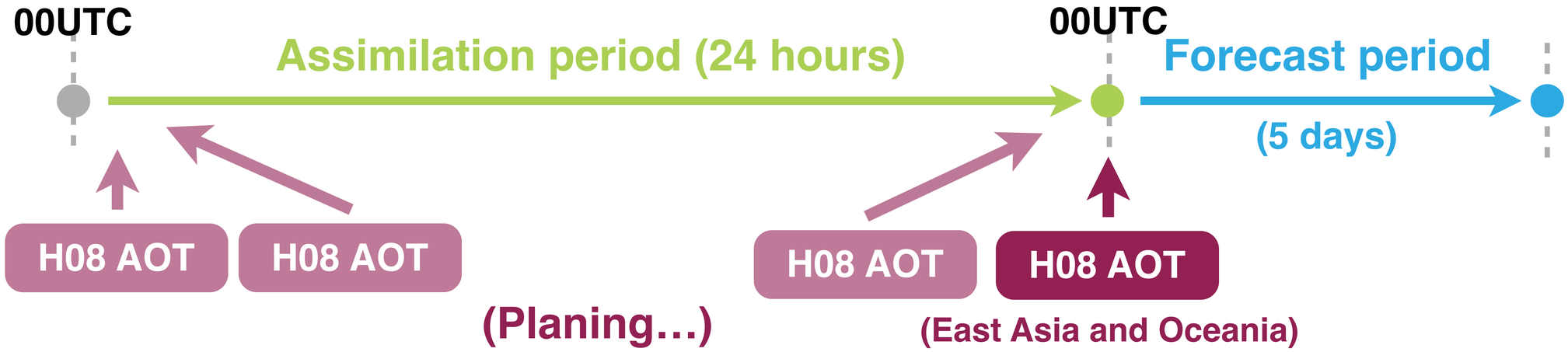
- **TL479L40 (~40 km), 5-day forecasting (to be estimated)**
  (14 Feb. 2016 ~)

✚

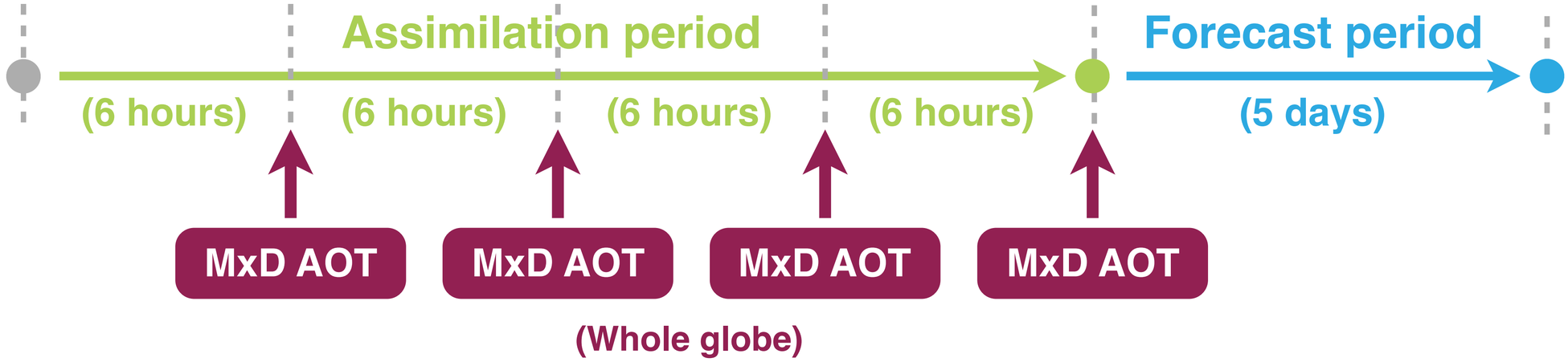
- **TL319L40, 2D-Var/H08, 5-day forecasting (to be estimated)**
  (09 May. 2016 ~)
- **TL319L40, 2D-Var/MODIS, 5-day forecasting (to be estimated)**
  (01 Jun. 2016 ~)
- **TL479L40, 2D-Var/H08, 5-day forecasting (planing)**

Upcoming update: NRT forecasting with 2D-Var

- **TL319L40, 2D-Var/Himawari-8, 5-day forecasting**

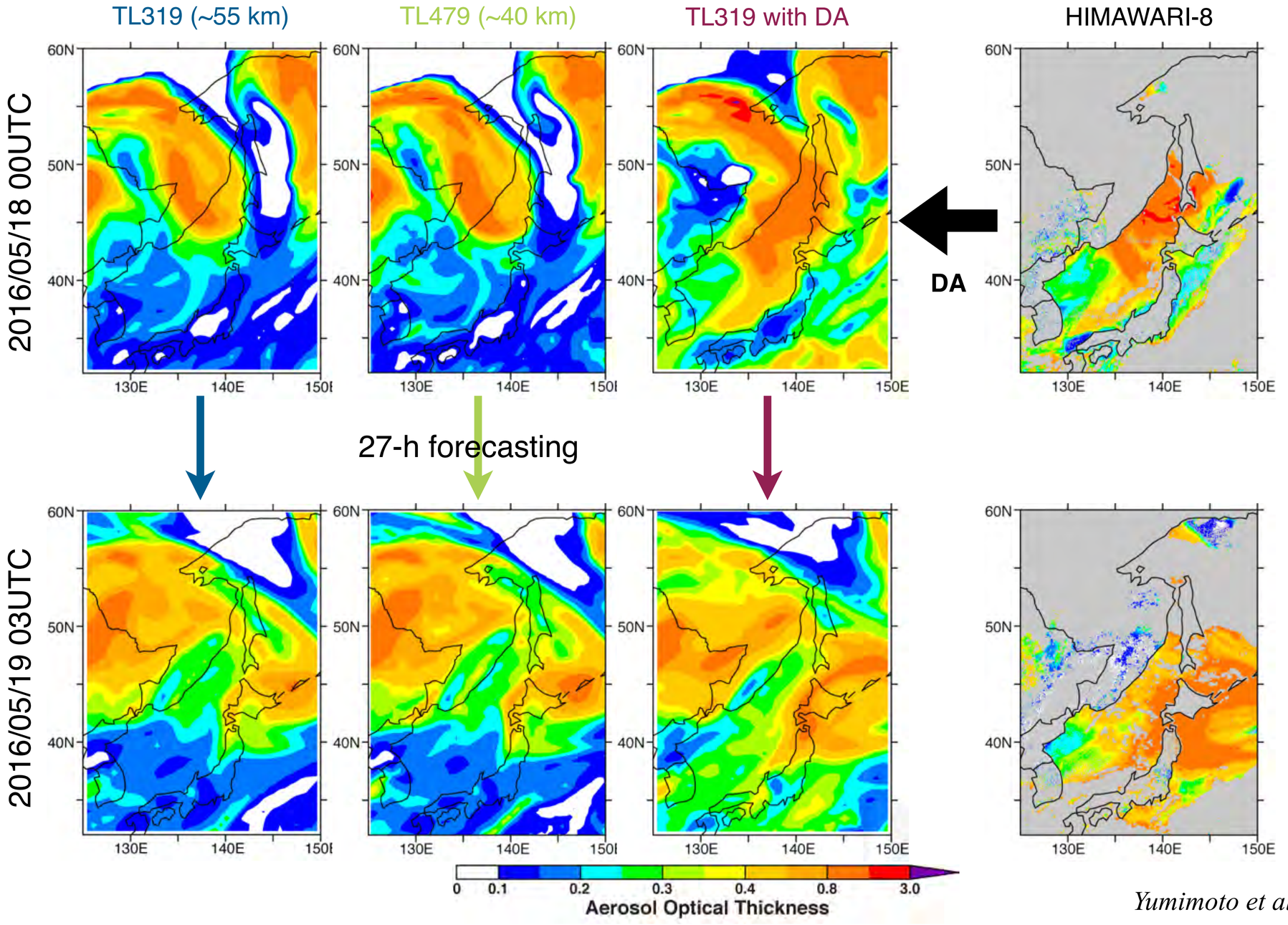


- **TL319L40, 2D-Var/MODIS, 5-day forecasting**



Upcoming update: NRT forecasting with 2D-Var

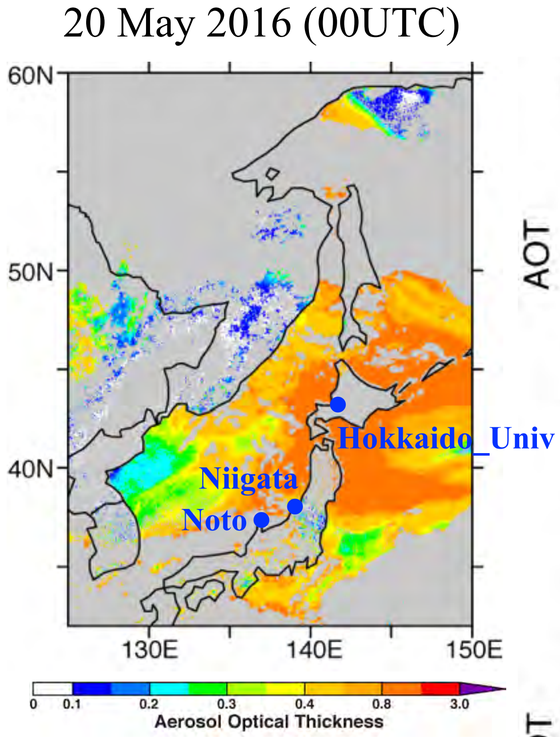
Forecasting of Smoke from Siberian Forest Fire

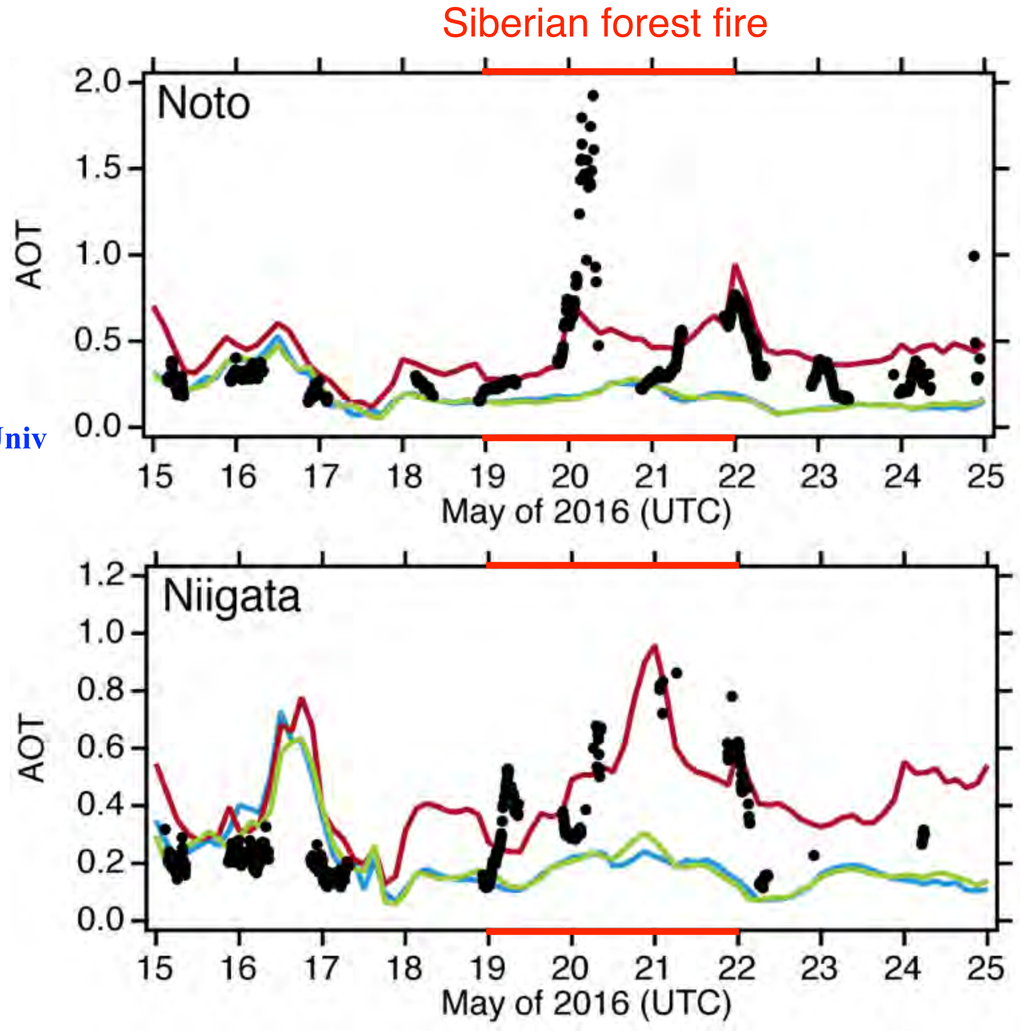


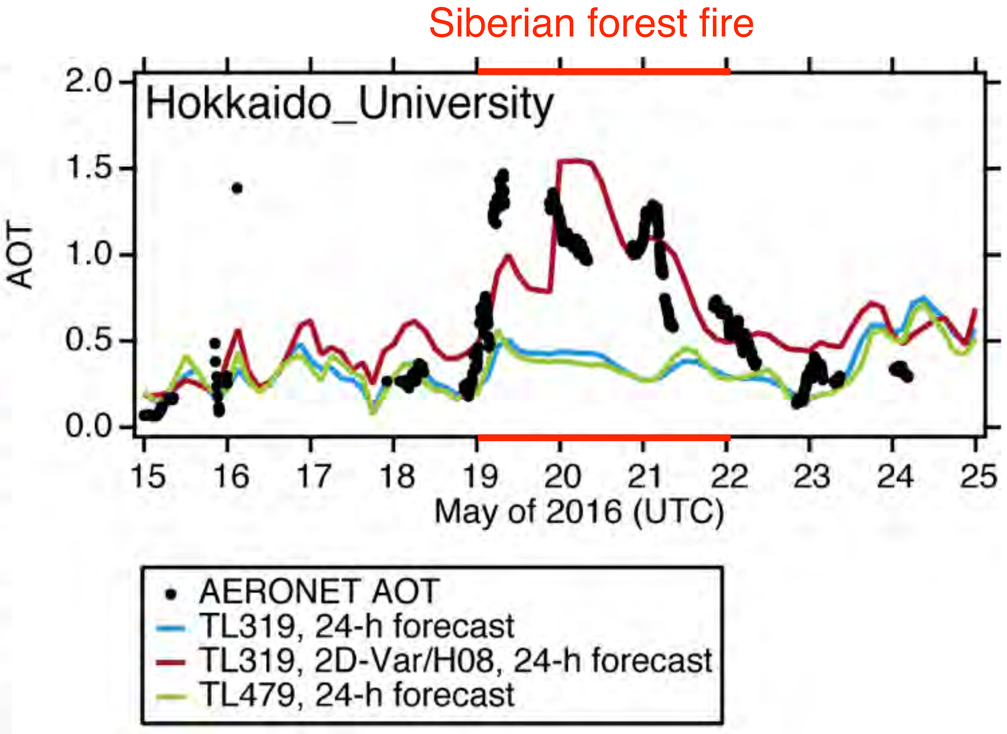
Yumimoto et al., in prep.

Upcoming update: NRT forecasting with 2D-Var

AERONET vs. 24-forecast AOT (during the Siberian forest fire)

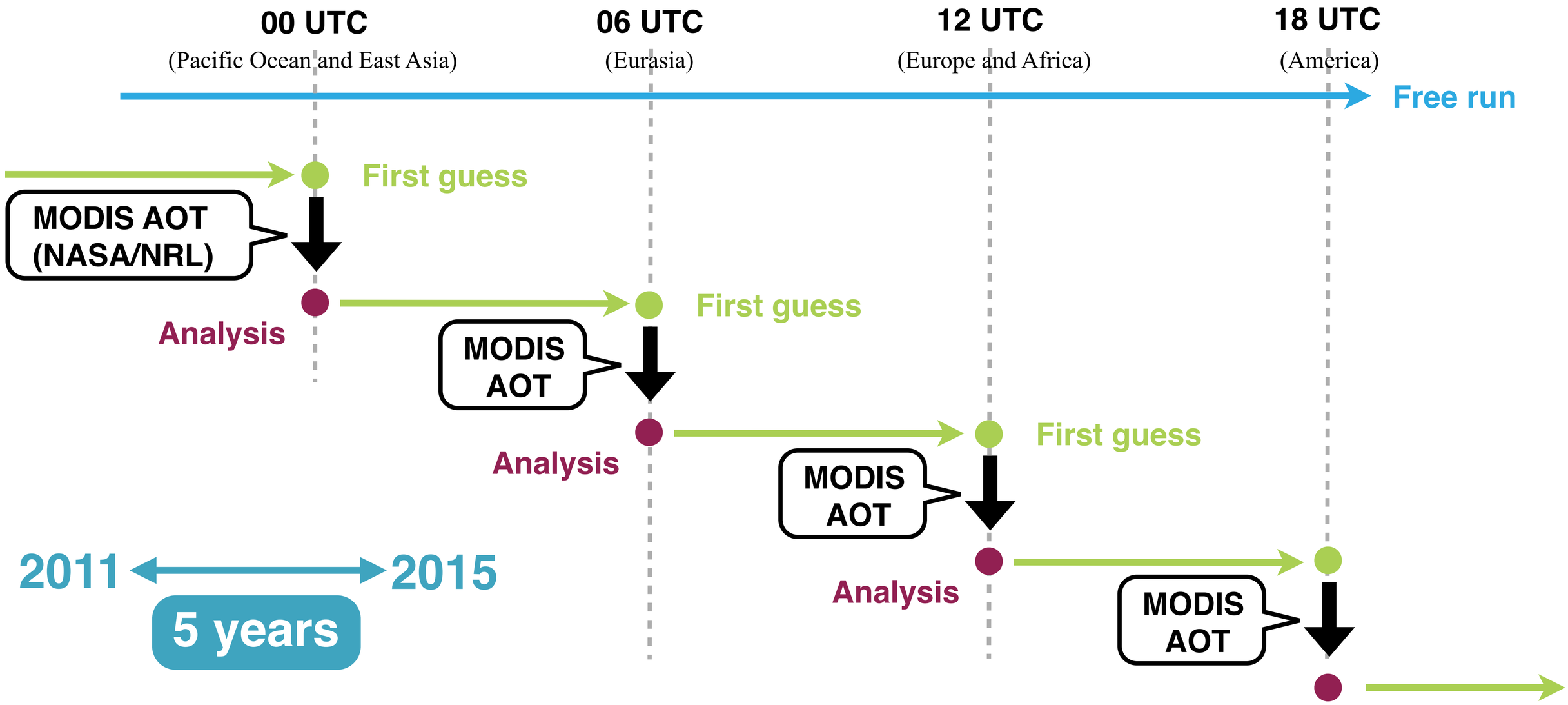






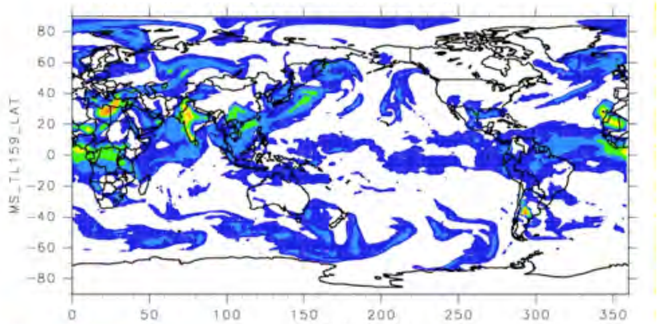
JMA Aerosol Reanalysis (JRA Aero? version Alpha)

JMA aerosol reanalysis is under development

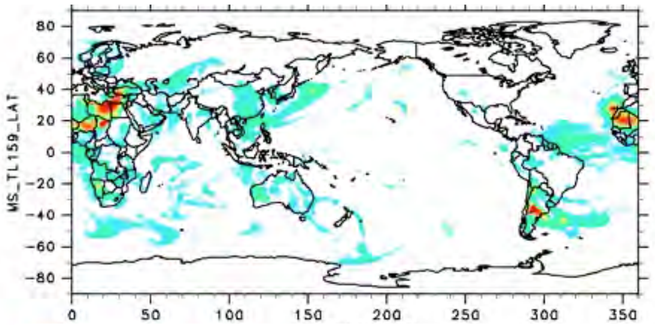


JMA Aerosol Reanalysis (JRA Aero? version Alpha)

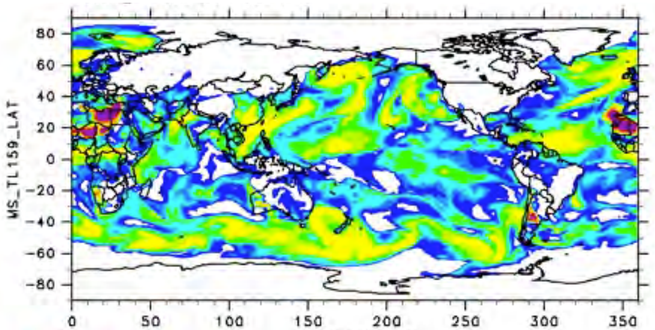
AOT



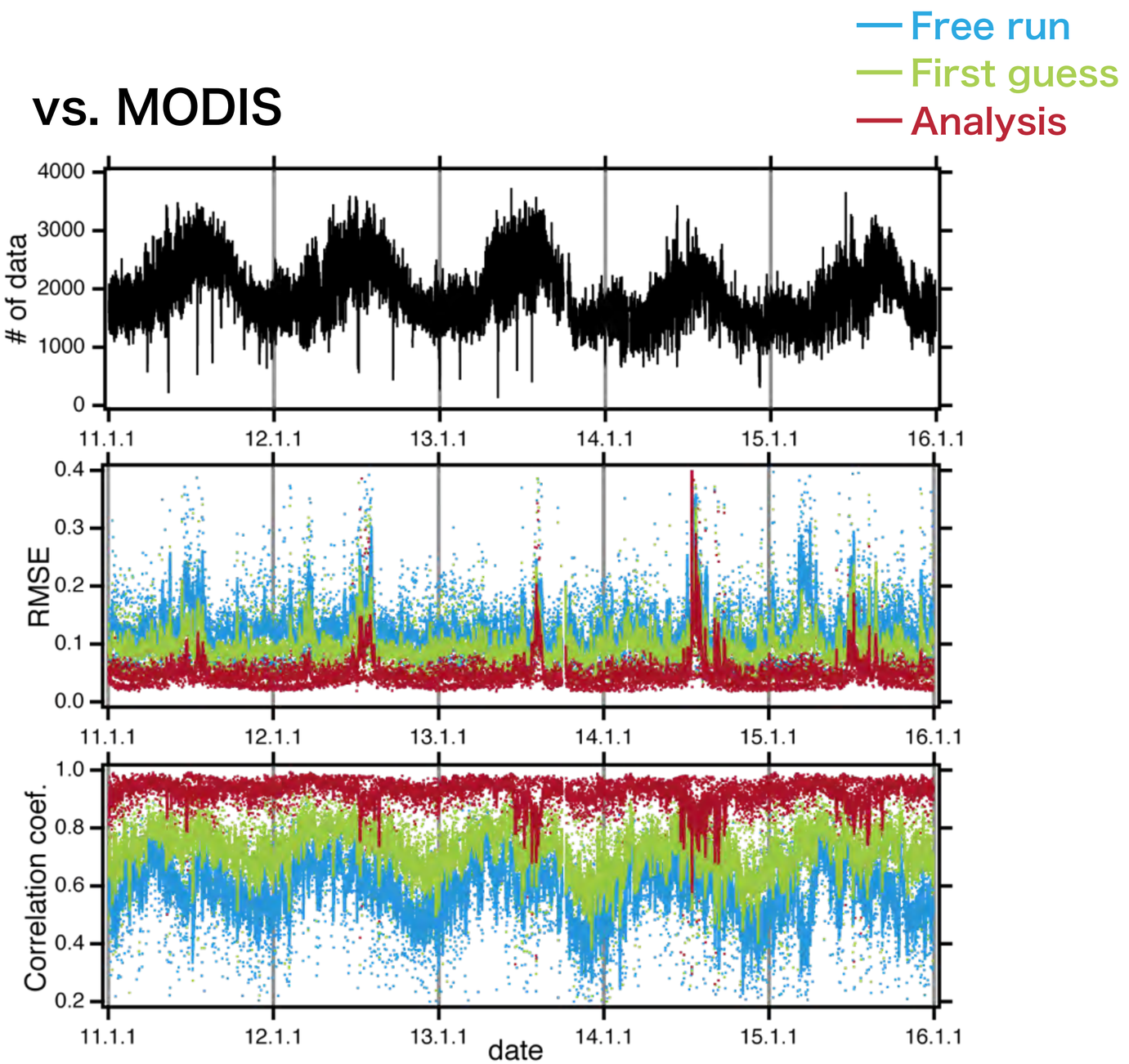
dust deposition



TSP

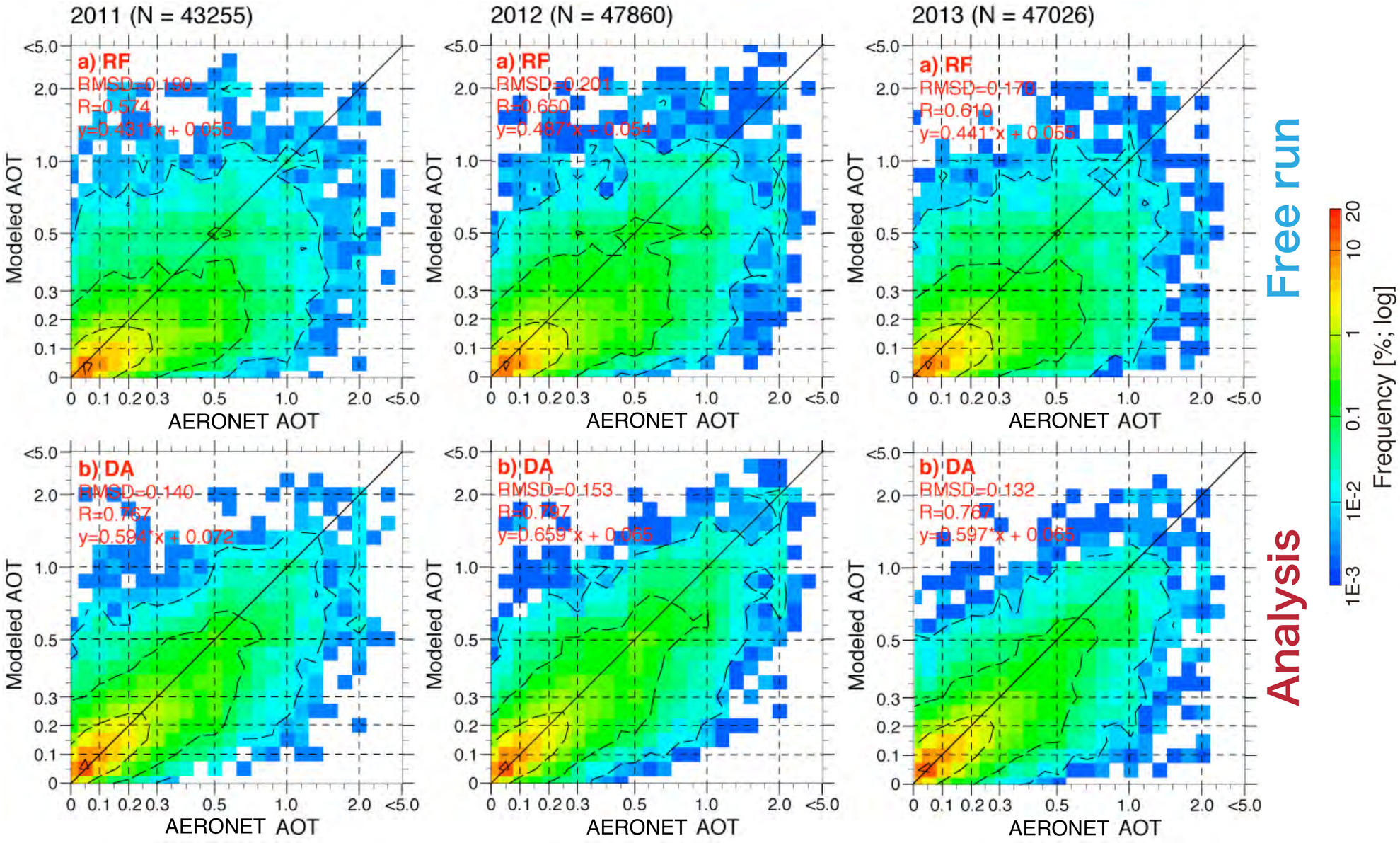


vs. MODIS



JMA Aerosol Reanalysis (JRA Aero? version Alpha)

Validation with AERONET Level 2.0



Daily averaged AERONET AOT vs. daily modeled AOT

Daily modeled AOT includes nighttime values.

Yumimoto et al., in prep.

Summary of 2015–16 progress in JMA DA

- **JMA is developing two streams of aerosol DA.**
    1. **EnKF based DA system —> future update**
    2. **2D-Var based DA system —> upcoming update**
- **NRT forecast assimilating Himawari-8 retrievals works well.**
- **MASINGAR forecast with finer resolution or/and data assimilation will appear in ICAP MME soon.**
- **JMA aerosol reanalysis is under development (Version Alpha).**

    Is now the time to think about MIP for aerosol reanalysis?