GEO-LEO aerosol from Himawari and SGLI onboard GCOM-C

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Motivation

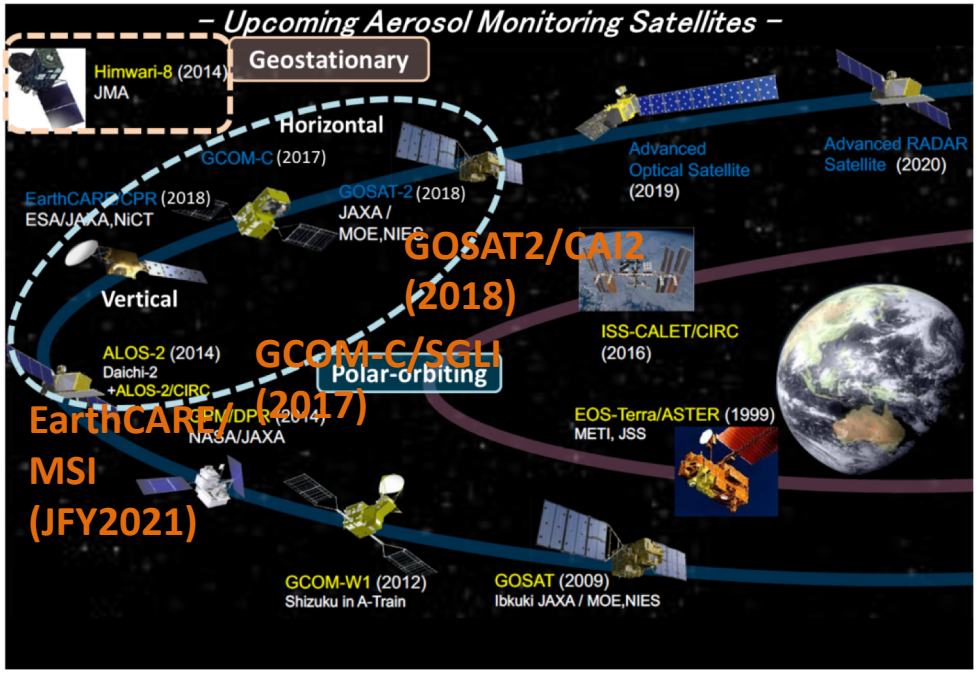
Our final goal

- produce synergistic global aerosol data set
  - using **JAXA Polar-orbiting** and **geostationary** satellites
  - Provided in near real time

This study

- A **common aerosol retrieval algorithm** is developed
  - for various satellite imaging sensors
  - over both land and ocean

Current and Upcoming Aerosol Monitoring Satellite



Target sensors

Geostationary:
Himawari-8/AHI, (GOES-R, MTG)
Polar-orbiting:
Aqua, Terra/MODIS, **GCOM-C/SGLI**, GOSAT2/CAI2, EarthCARE/MSI

Sensor Characteristics

Himwari-8/AHI characteristics

CH	λ(nm)	IFOV (m)
1	471	1000
2	510	
3	639	500
4	857	1000
5	1610	2000
6	2257	
7	3885	
8	6243	
9	6941	
10	7347	
11	8592	
12	9637	
13	10407	
14	11240	
15	12381	
16	13311	

High temporal resolutions

16 bands in Visible-Infrared

10 minutes interval

GCOM-C/SGLI characteristics

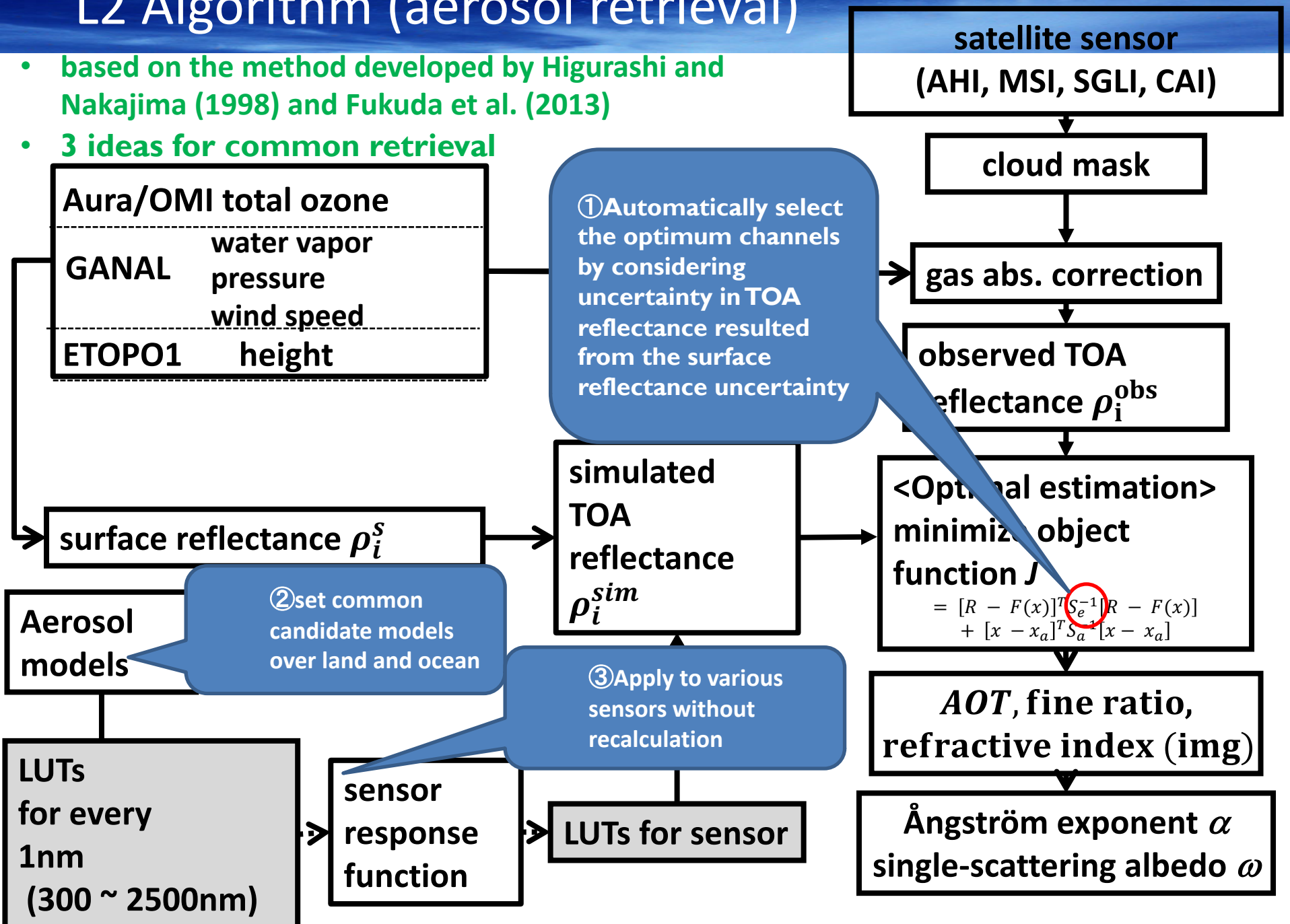
CH	λ(nm)	IFOV(m)
VN1	380	250
VN2	412	
VN3	443	
VN4	490	
VN5	530	
VN6	565	
VN7	673.5	
VN8	673.5	
VN9	763	
VN10	868.5	
VN11	868.5	
POL1	673.5	1000
POL2	868.5	
SW1	1050	
SW2	1380	
SW3	1630	250
SW4	2210	1000
TIR1	10800	250
TIR2	12000	250

High spatial resolutions

19 bands in Visible-Infrared

L2 Algorithm (aerosol retrieval)

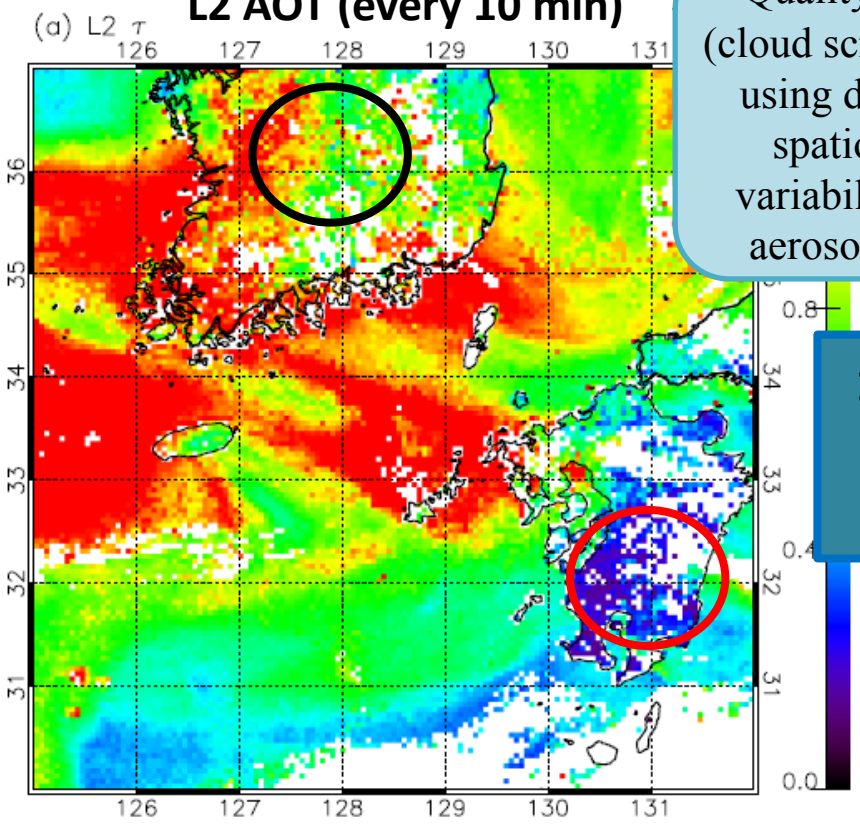
- based on the method developed by Higurashi and Nakajima (1998) and Fukuda et al. (2013)
- 3 ideas for common retrieval



Retrieval Results (Himawar-8/AHI)

16 JST 27 Apr. 2018 : continental air pollutant transported to Kyusyu

L2 AOT (every 10 min)

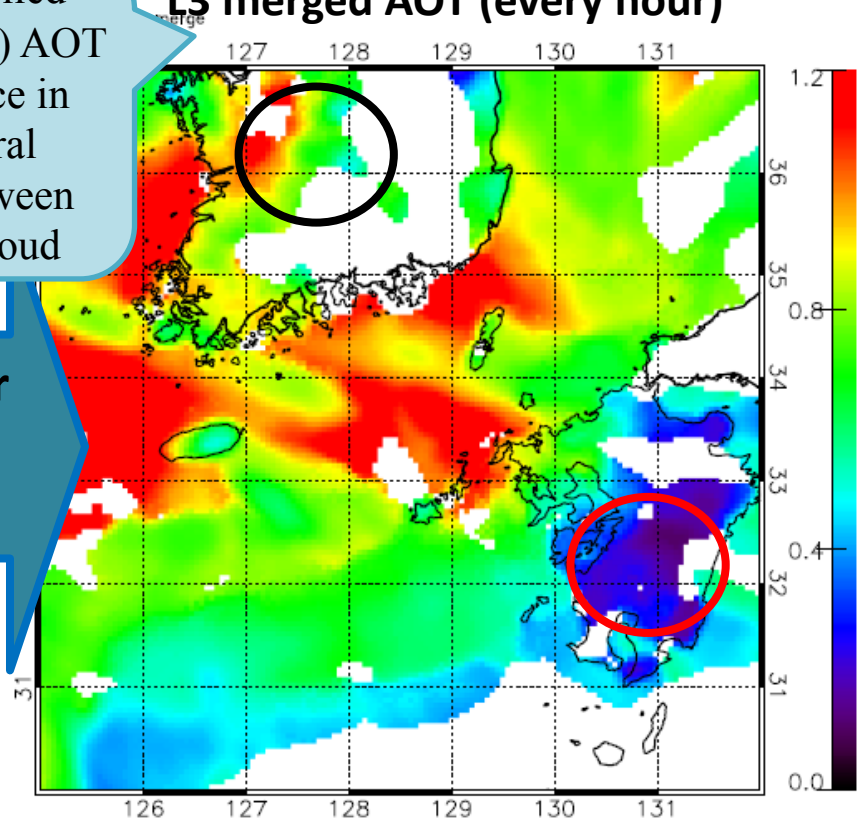


Yoshida et al., 2018

Quality controlled (cloud screening) AOT using difference in spatiotemporal variability between aerosol and cloud

1 hour (6 L2 AOT)

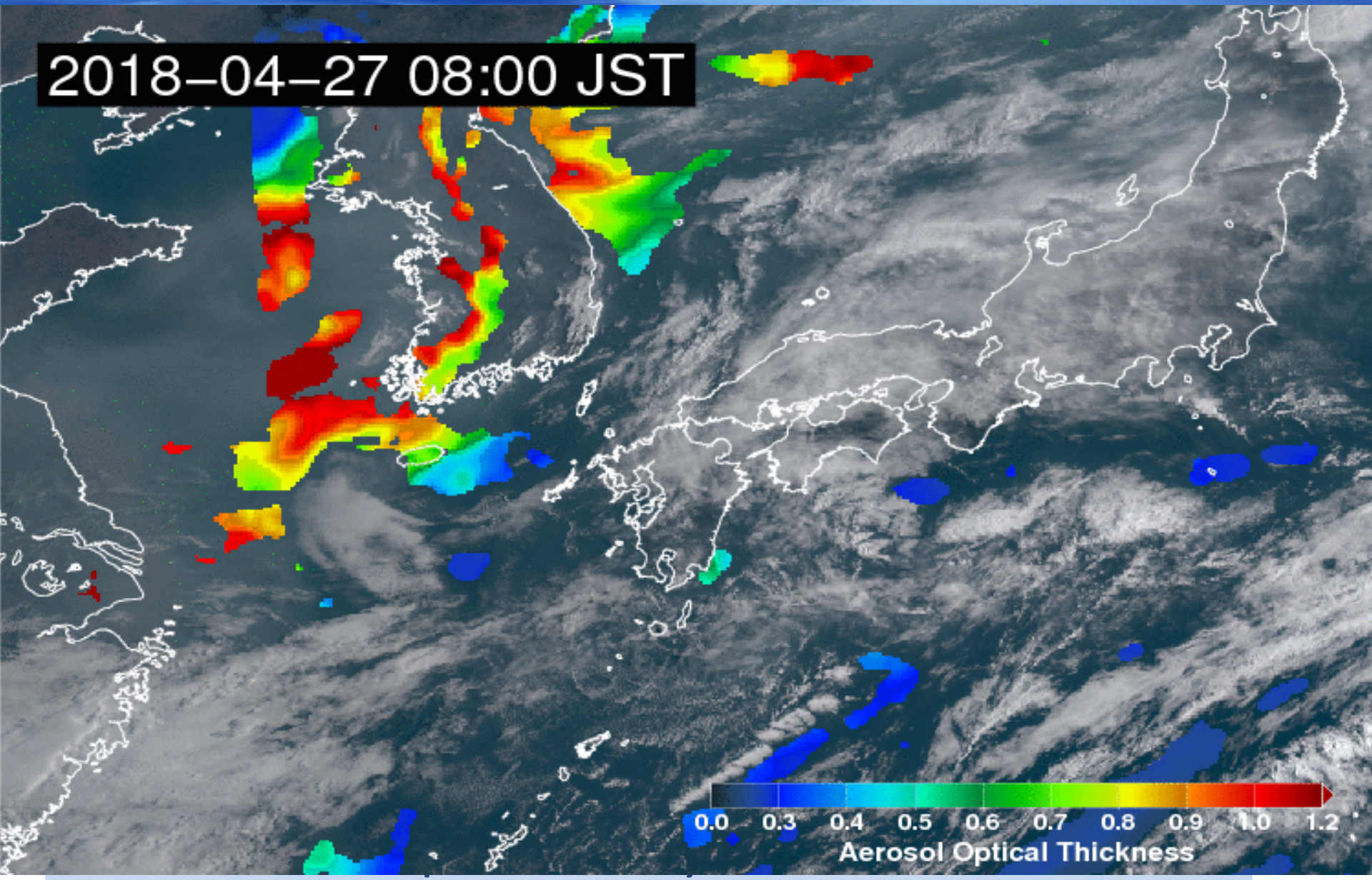
L3 merged AOT (every hour)



Kikuchi et al., 2018

- **The high and nearly continuous AOT over land and ocean are estimated**
- **High AOT caused by local noise or insufficient cloud screening was eliminated and interpolated smoothly in L3**

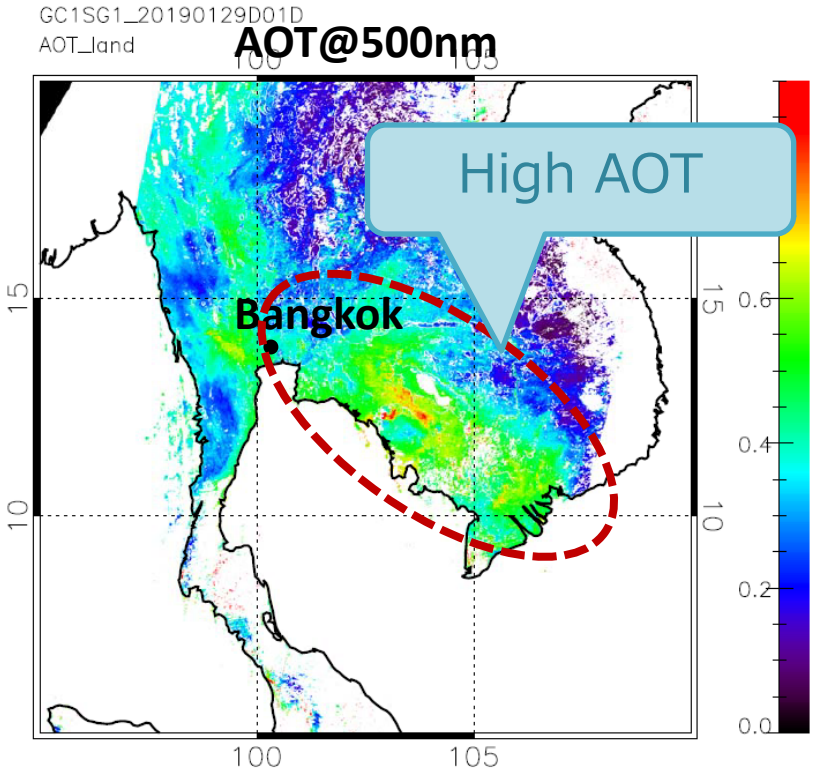
Retrieval Results (Himawar-8/AHI)

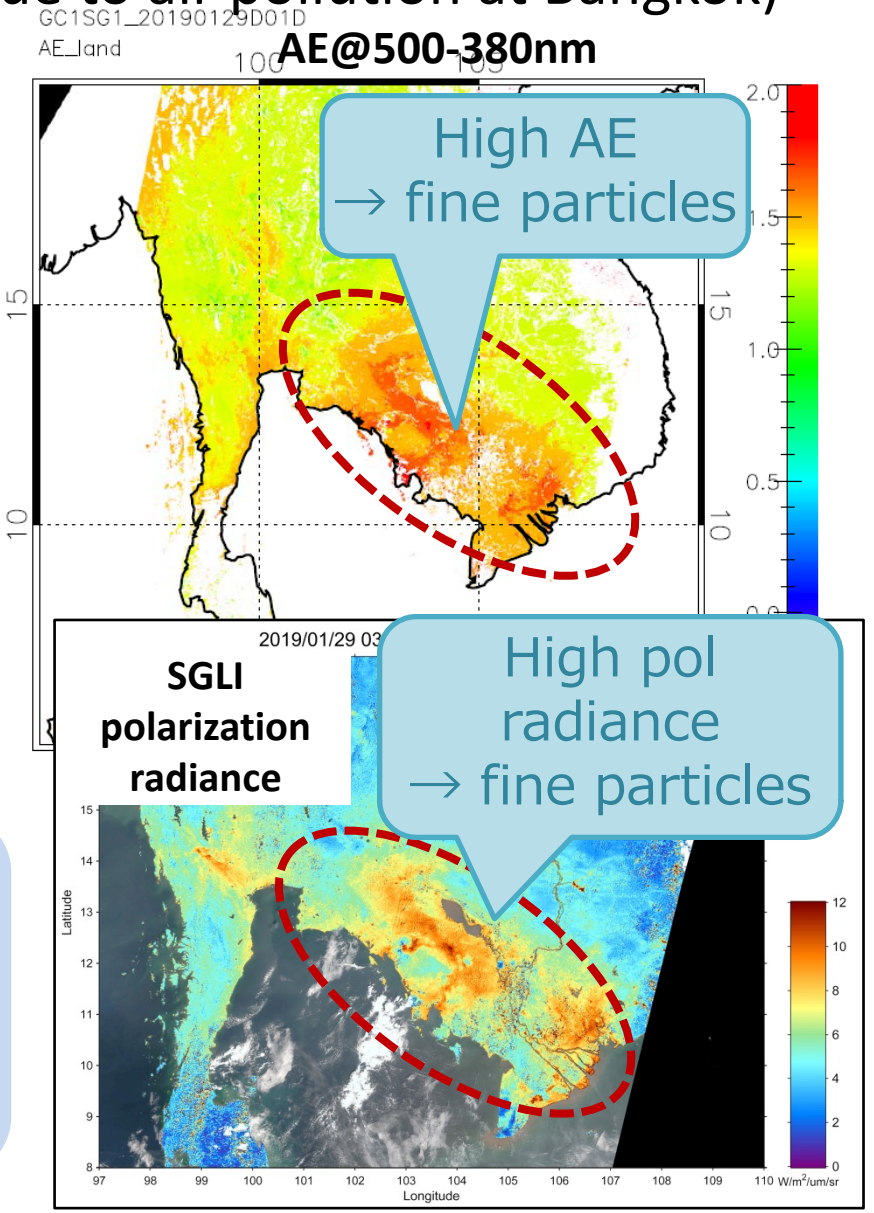


- **Aerosol transport are captured using frequent observation from AHI**

Retrieval Results (GCOM-C/SGLI)

29 Jan. 2019 Thailand (school closed due to air pollution at Bangkok)

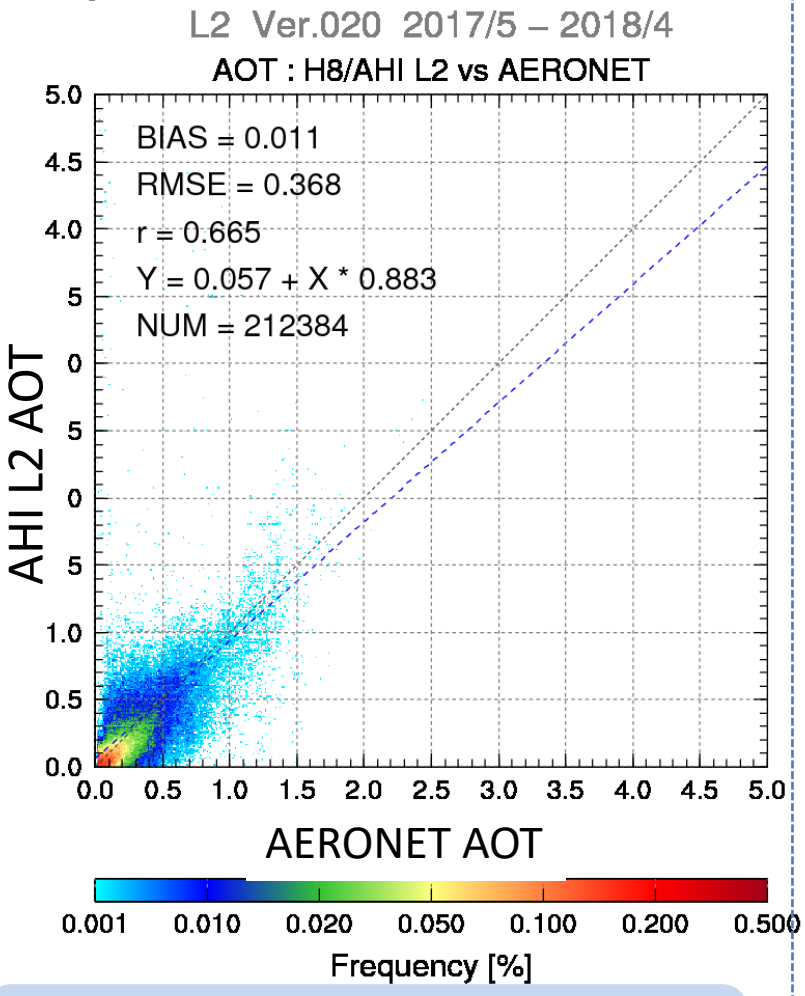




- **The high AOT and AE (i.e. fine particles) are estimated corresponding to local air pollution report**
- **Estimated AOT and AE are consistent with SGLI polarization observation**

Validation (AHI vs AERONET)

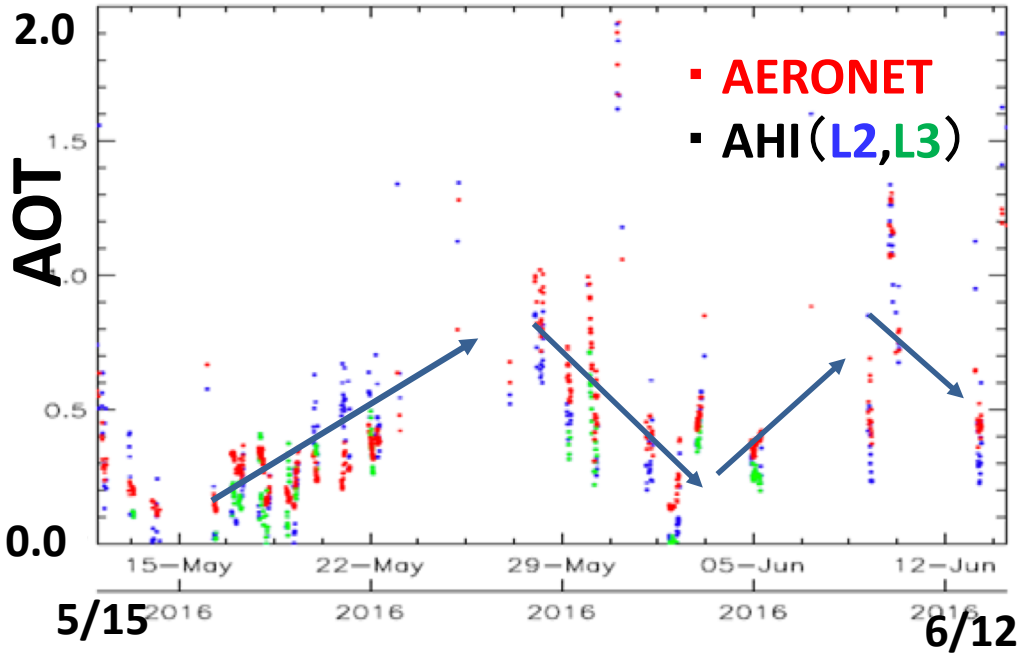
Frequency distributions
: 1 year, all AERONET site



- **AHI AOT is generally consistent with AERONET**

Time variation

Baeksa in Korea



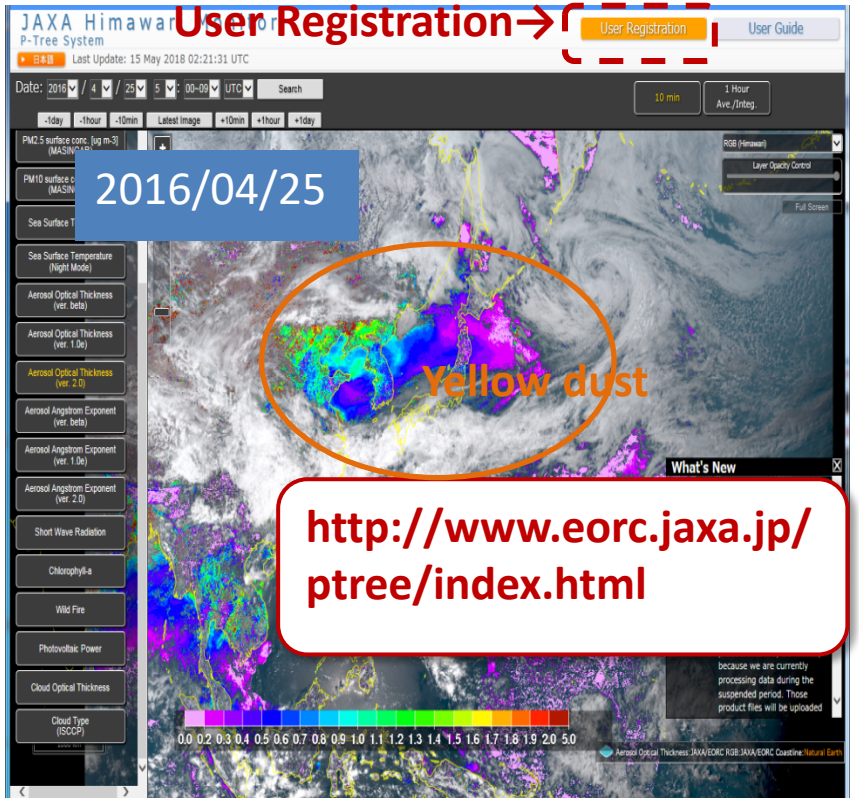
L2: snapshot retrievals every 10 min
L3: cloud screening data using 1hour data

- **AHI AOT successfully represent the time variation of AERONET**

Data distribution

Himawari-8/AHI:
JAXA Himawari Monitor

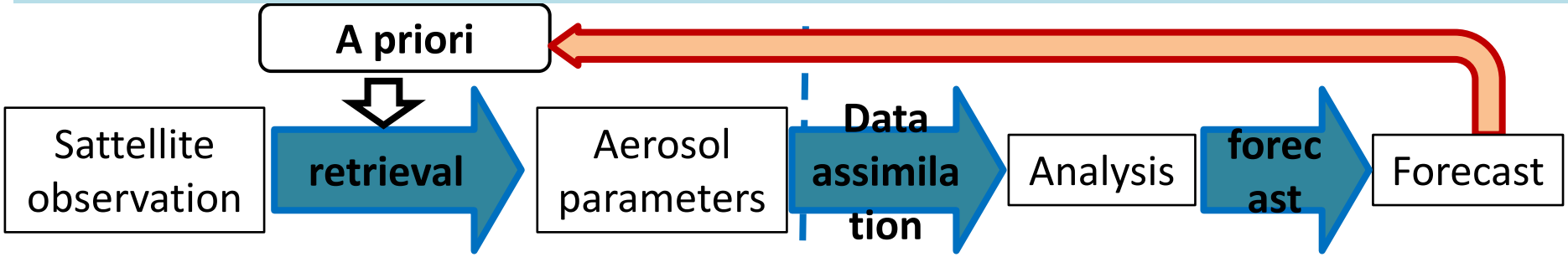
GCOM-C/SGLI:
G-Portal



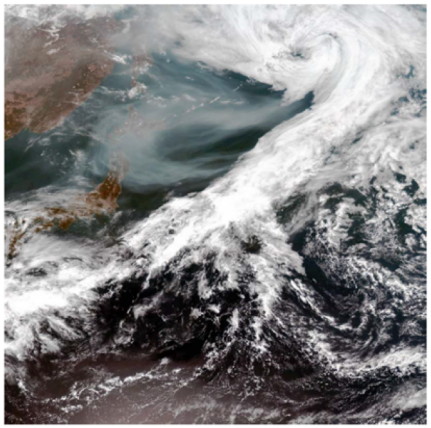
- distribute original (Level 1) and geophysical (Level 2) products
- Data can be achieved with simple user registration

Next step: Utilization of aerosol transport model

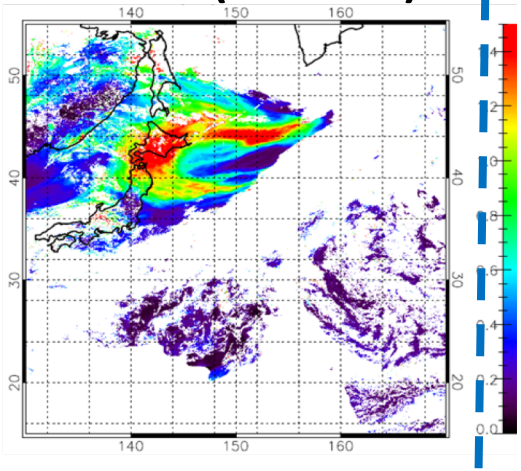
aerosol data assimilation system collaborated with MRI and Kyusyu-Univ.



Osberved RGB

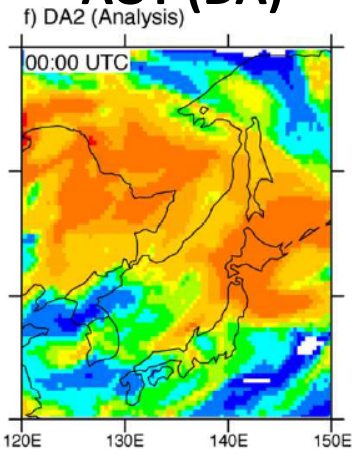


AOT (satellite)

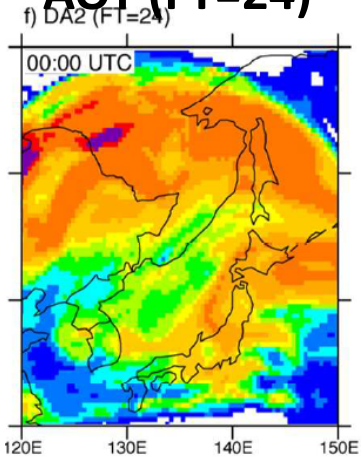


Yoshida et al.,2018

AOT (DA)



AOT (FT=24)



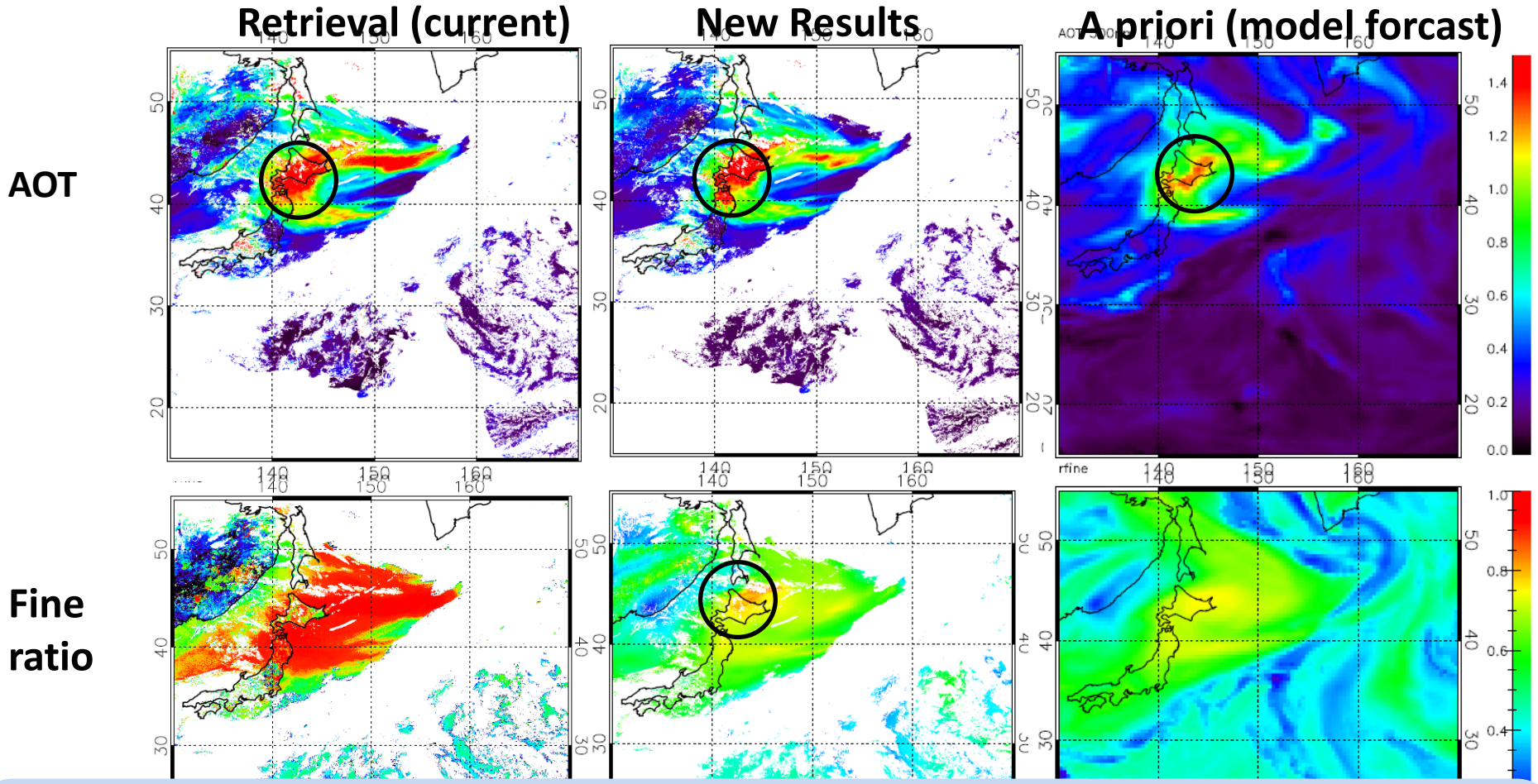
Yumimoto et al.,2018

Retrieval @JAXA

Data assimilation and forcast @MRI

Preliminary Results

02UTC, 19 May 2016: Aerosol originated from wildfires



- less noisy AOT and fine ratio
- AOT seems to well capture observed aerosol front
- Fine ratio is highly dependent on a priori, but slightly updated by the observation
- Should be validated in future

Summary

- We developed **a common algorithm** to retrieve aerosol properties for various satellite sensors over land and ocean.
  - common aerosol models
  - common lookup tables
  - automatic selection of the optimum channels

- This method was applied to the **Advanced Himawari Imager (AHI) /Himawari-8** and **SGLI/GCOM-C**.

- The retrieved AOT are generally **consistent with MODIS and AERONET** product.

- The retrieved product is distributed at **JAXA Himawari Monitor and G-portal.**

- **The utilization of aerosol properties forecasted by a global aerosol transport model** for a priori of retrieval seems to improve the retrieval, but should be validated in future.