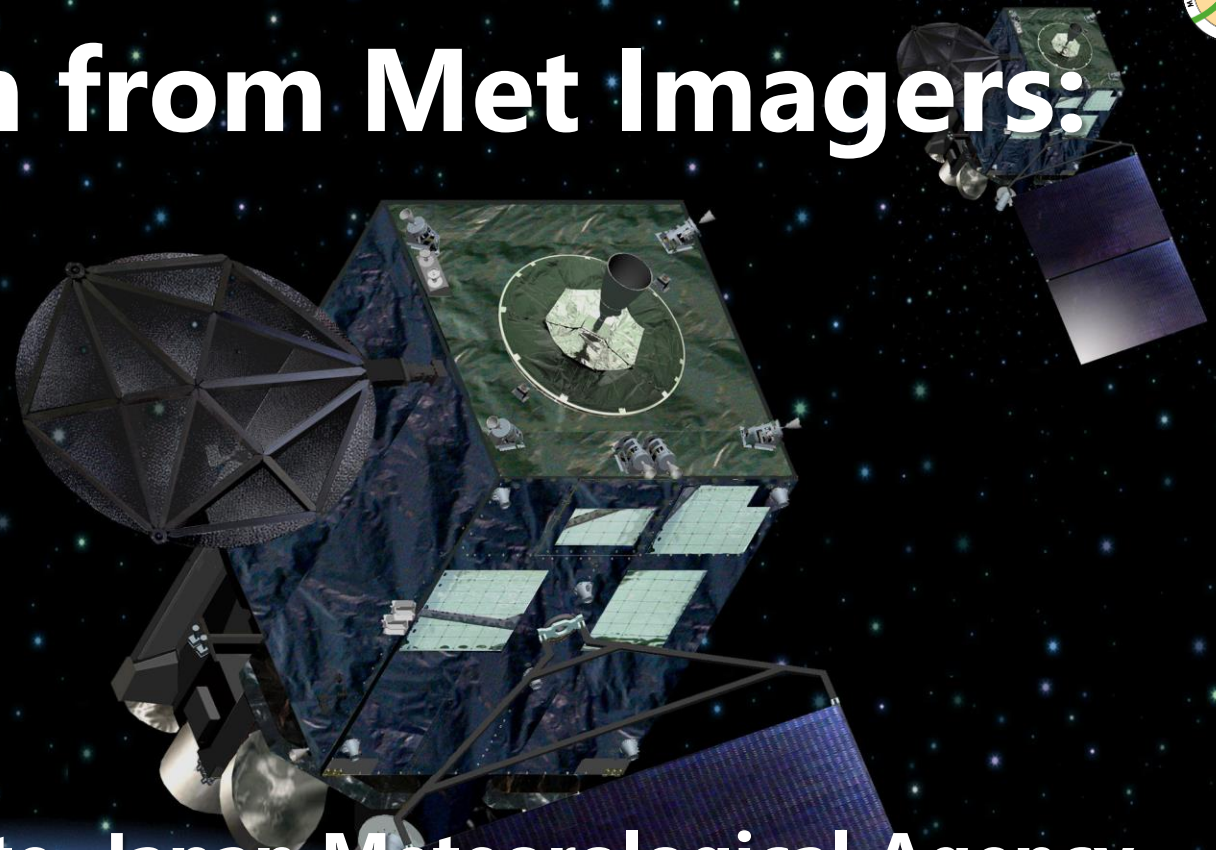
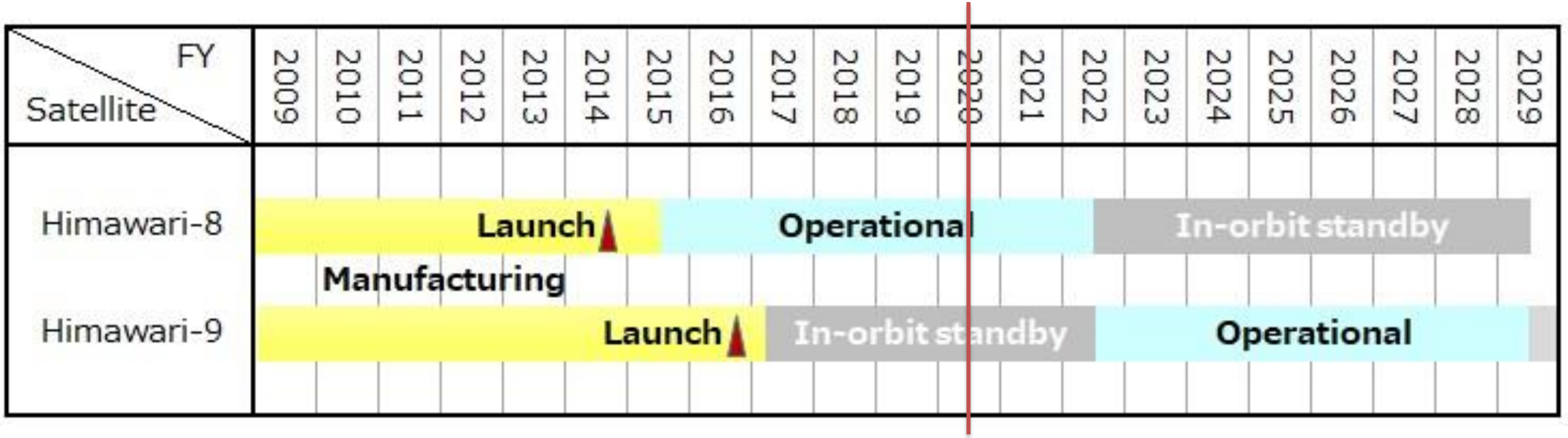
Aerosol information from Met Imagers: AHI (Himawari-8/9) Supplement



Taichu Y. Tanaka
Meteorological Research Institute, Japan Meteorological Agency

11 June 2020　CEOS AC-VC-16

Satellite Operation Plan for Himawari-8/9



- Schedule for Himawari satellites.

Japan Meteorological Agency

https://www.data.jma.go.jp/mscweb/en/general/himawari89plan.html

Specification of Himawari-8/9 Imager (AHI)

MTSAT-1R/2 → VIS: 1km, IR: 4km

AHI = Advanced Himawari Imager

	Band	Wavelength [μm]	Spatial Resolution	
VIS	1	0.46	1Km	RGB band Composited
	2	0.51	1Km	
	3	0.64	0.5Km	
	4	0.86	1Km	NIR
	5	1.6	2Km	
	6	2.3	2Km	
IR4	7	3.9	2Km	
IR3	8	6.2	2Km	Water vapor
	9	7.0	2Km	
	10	7.3	2Km	
	11	8.6	2Km	SO_2
	12	9.6	2Km	O_3
IR1	13	10.4	2Km	Atmospheric Windows
	14	11.2	2Km	
IR2	15	12.3	2Km	
	16	13.3	2Km	CO_2

Similar to ABI for GOES-R, but
0.51 μm(Band 2) instead of ABI's 1.38 μm

Products

- Volcanic Ash
- Global Instability Index
- Nowcasting
- Typhoon Analysis
- Atmospheric Motion Vector
- Clear Sky Radiance
- Sea Surface Temperature
- Yellow Sands
- Snow and Ice Coverage

Aerosol products from AHI

- Aerosol Optical Thickness (AOT)
  https://www.data.jma.go.jp/mscweb/en/product/product_AOT.html

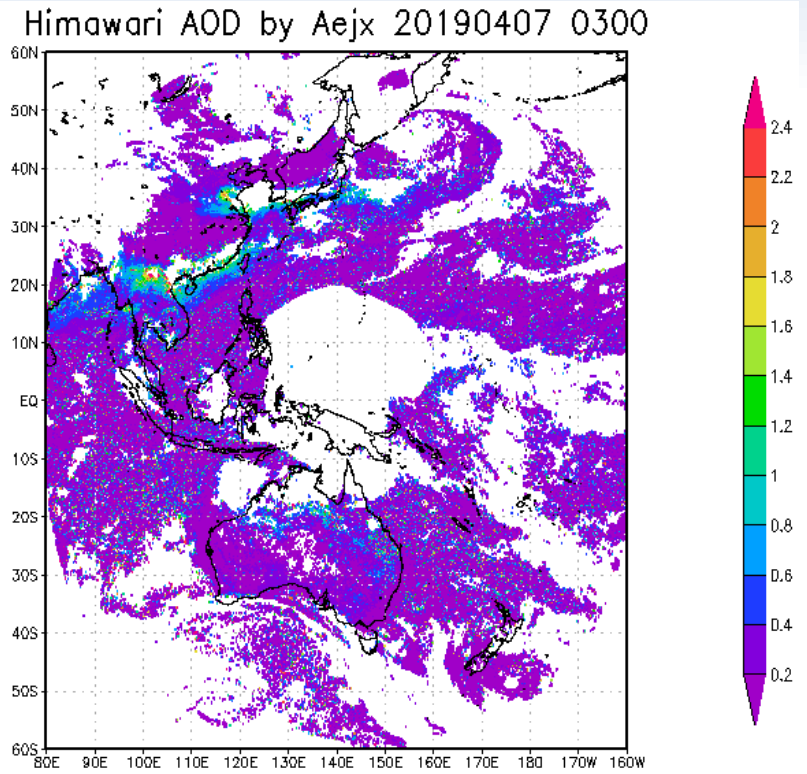
- Volcanic Ash
  https://www.data.jma.go.jp/mscweb/en/product/monitor_volcanicash.html

- Dust RGB composite (EUMETSAT algorithm)
  - Internal use for monitoring (dust) aerosol

Aerosol Optical Depth (JMA's product)

- Aerosol Optical Depth and Angstrom exponent (the latter is derived only over the ocean)

- Retrieval algorithm: LUT
  - 0.64, 0.86 μm (ocean), 0.64, 2.3 μm (land)
  - Aerosol type is assumed to be Asian dust
  - NOT optimized for other aerosol types (e.g. spherical particles)



https://www.data.jma.go.jp/mscweb/en/product/product_AOT.html

JAXA EORC Himawari-8 Aerosol products

- JAXA EORC developed a common algorithm to retrieve aerosol properties for various satellite sensors over land/ocean, and applied it to AHI.
  - Retrieval in real time (less than 1-hour latency).
  - Aerosol optical thickness (AOT), Angstrom exponent
  - Level 2: 10 minutes
  - Level 3: 1-hour, 1-day and 1-month merged product

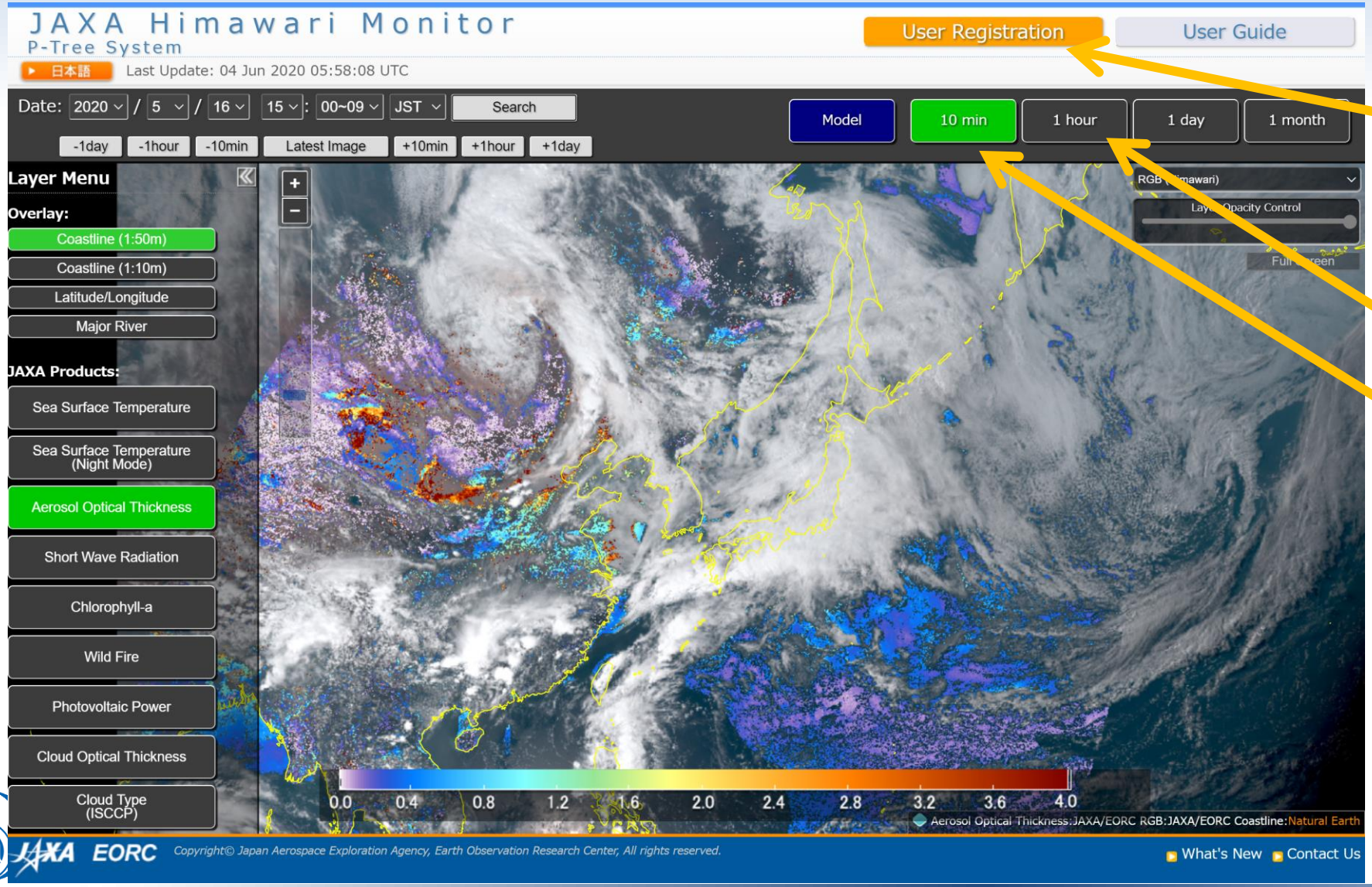
- JMA incorporated the JAXA EORC's aerosol retrieval algorithm for its internal monitoring of aerosols.
- JMA started using Himawari-8 AOT retrieval algorithm for data assimilation of aerosol forecast (aeolian dust forecast).

JAXA EORC Himawari-8 Aerosol products

File type	NetCDF
Latest version	2.1 (Level 2), 3.0 (Level 3)
Observation area	Full-disk
Temporal resolution	10-minute (Level 2), 1-hour (Level 3), 1-day (Level 3), 1-month (Level 3)
Spatial resolution	5km (Pixel number: 2401, Line number: 2401)
Data	Angstrom exponent, Aerosol optical thickness at 500nm, Uncertainty of aerosol optical thickness, QA flag
Notice	Ångström exponent included in this product is under validation. Users should keep in mind that the data is NOT quality assured. JAXA Himawari Monitor aerosol products reference

https://www.eorc.jaxa.jp/ptree/userguide.html

JAXA Himawari Monitor website

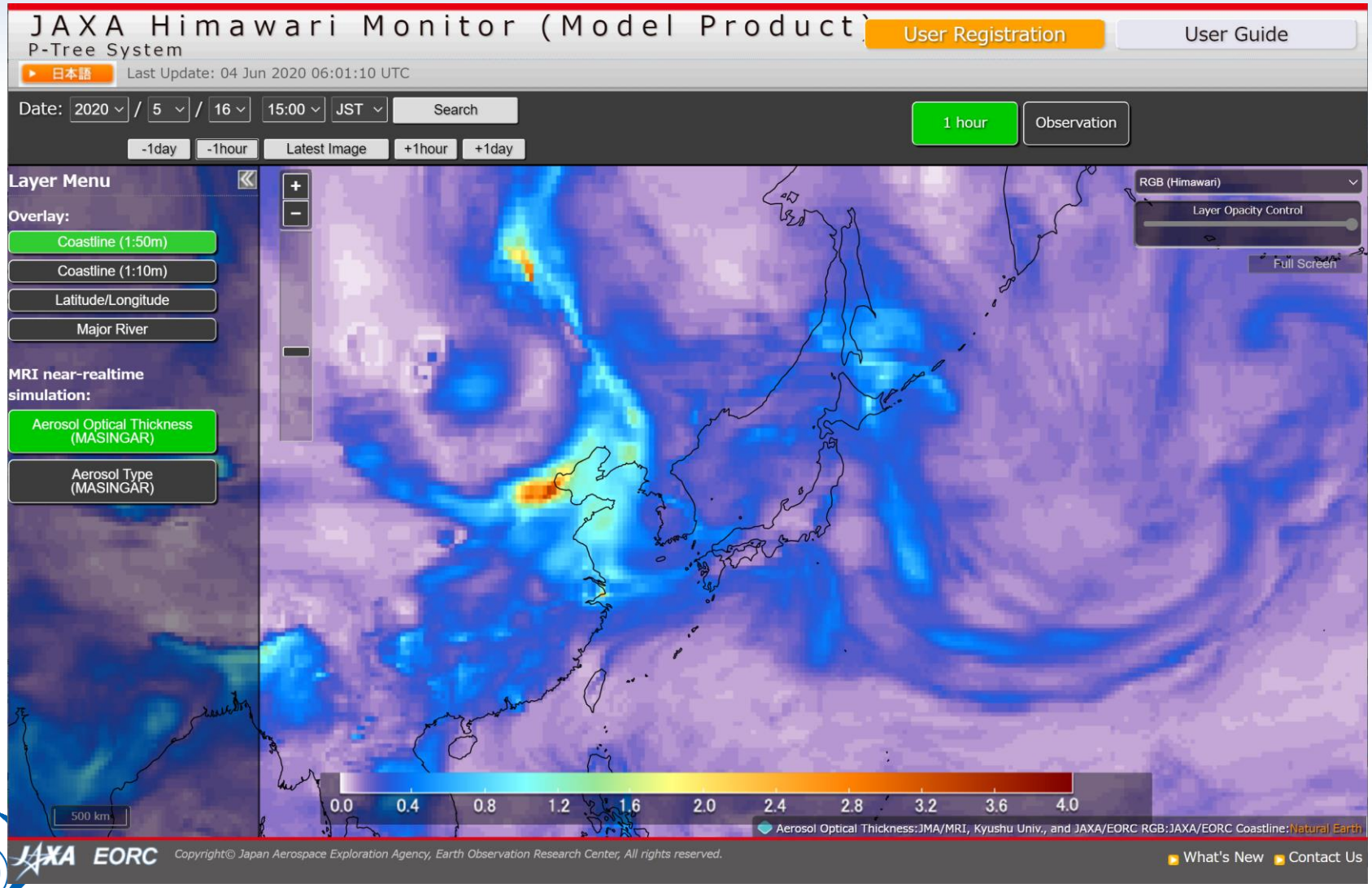


User registration

L3: 1-hour merged

L2: 10-minutes

JAXA Himawari Monitor: model product

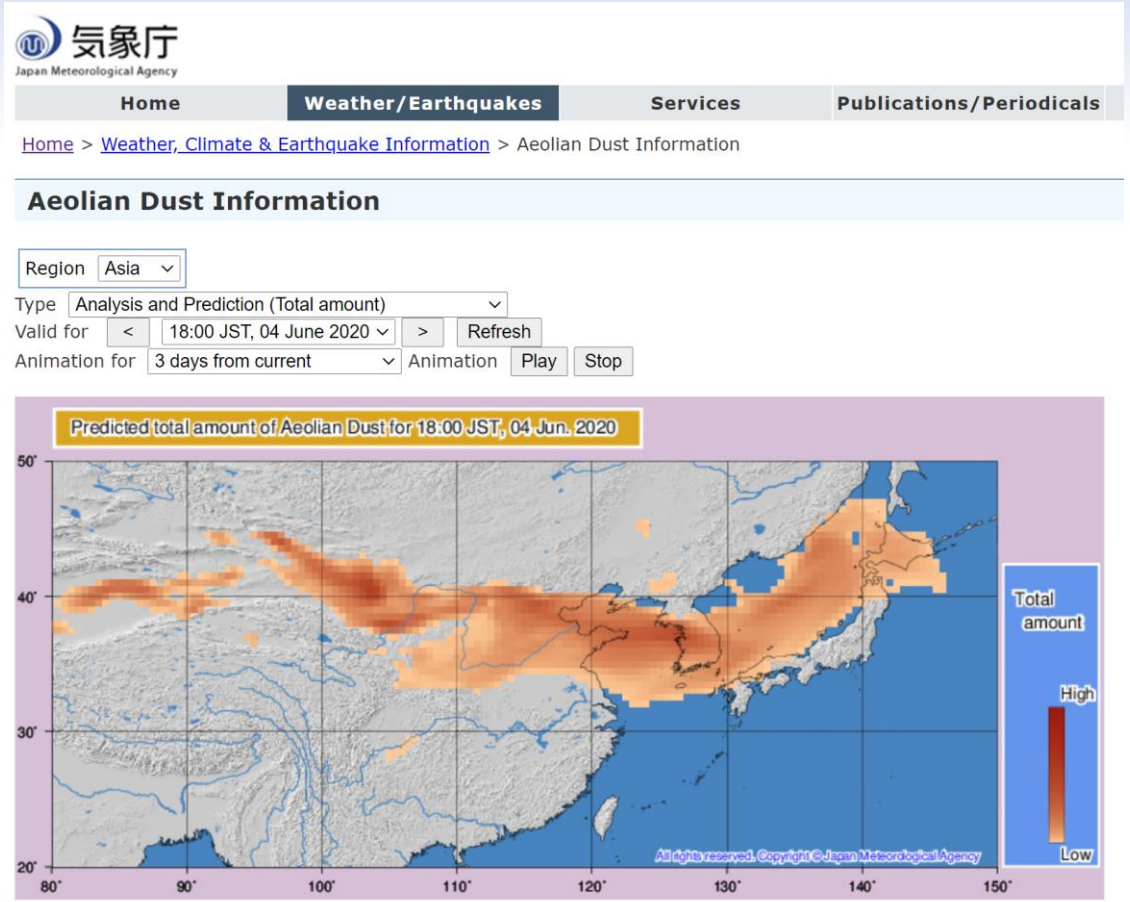


Data assimilated aerosol distribution product is also available.
(computed by MRI/JMA)

Data assimilation of AHI AOT for dust forecast

JMA started operation of aerosol data assimilation for its aeolian dust forecast using the AOT product retrieved by JAXA aerosol algorithm.

- The operation started from 29 Jan. 2020.

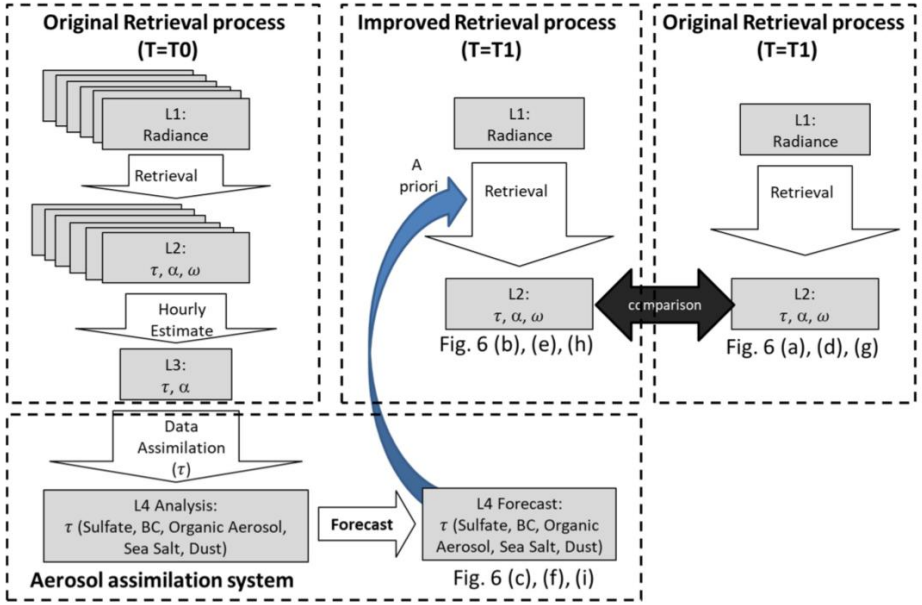


JMA's Aeolian Dust Information website
https://www.data.jma.go.jp/gmd/env/kosa/fcst/en/fcst-c_as.html

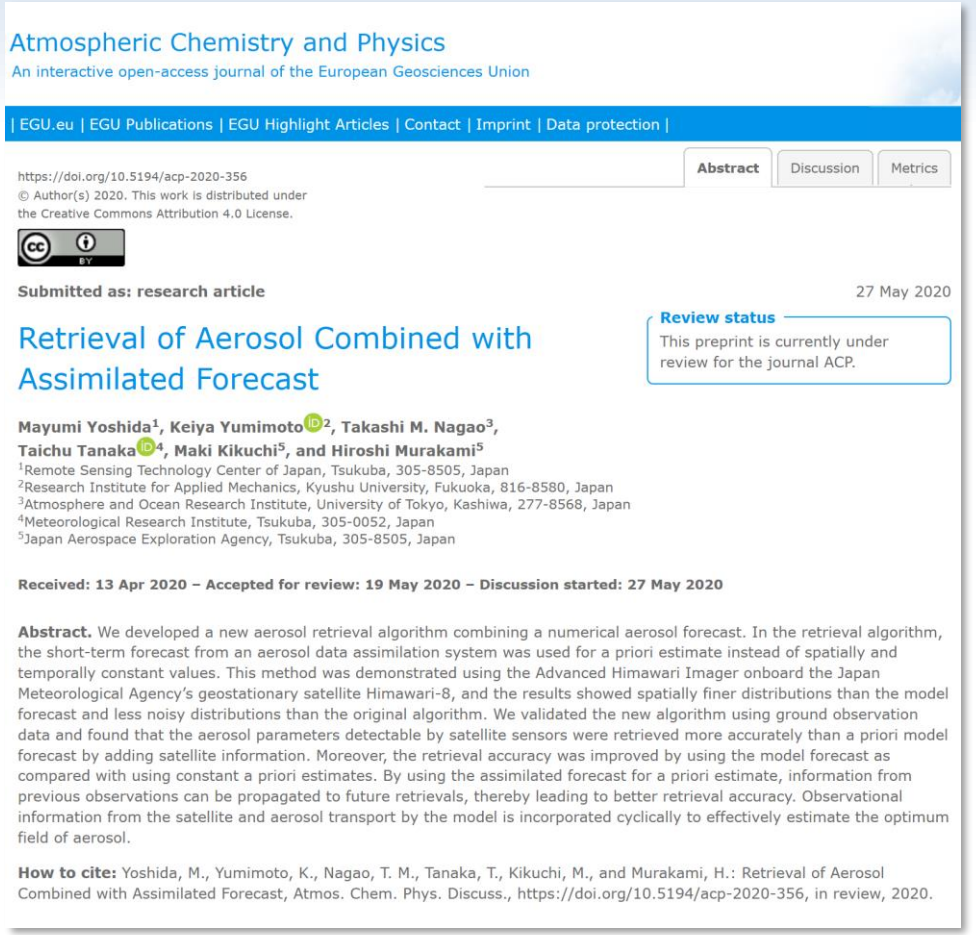
Recent study: aerosol retrieval with aerosol forecast

Utilization of aerosol properties forecasted by a global aerosol model for a priori of retrieval

(see AC-VC-15 Yoshida et al.)



Flowchart of data processing for aerosol retrieval at time T1.



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Review status
This preprint is currently under review for the journal ACP.

Retrieval of Aerosol Combined with Assimilated Forecast

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Abstract. We developed a new aerosol retrieval algorithm combining a numerical aerosol forecast. In the retrieval algorithm, the short-term forecast from an aerosol data assimilation system was used for a priori estimate instead of spatially and temporally constant values. This method was demonstrated using the Advanced Himawari Imager onboard the Japan Meteorological Agency's geostationary satellite Himawari-8, and the results showed spatially finer distributions than the model forecast and less noisy distributions than the original algorithm. We validated the new algorithm using ground observation data and found that the aerosol parameters detectable by satellite sensors were retrieved more accurately than a priori model forecast by adding satellite information. Moreover, the retrieval accuracy was improved by using the model forecast as compared with using constant a priori estimates. By using the assimilated forecast for a priori estimate, information from previous observations can be propagated to future retrievals, thereby leading to better retrieval accuracy. Observational information from the satellite and aerosol transport by the model is incorporated cyclically to effectively estimate the optimum field of aerosol.

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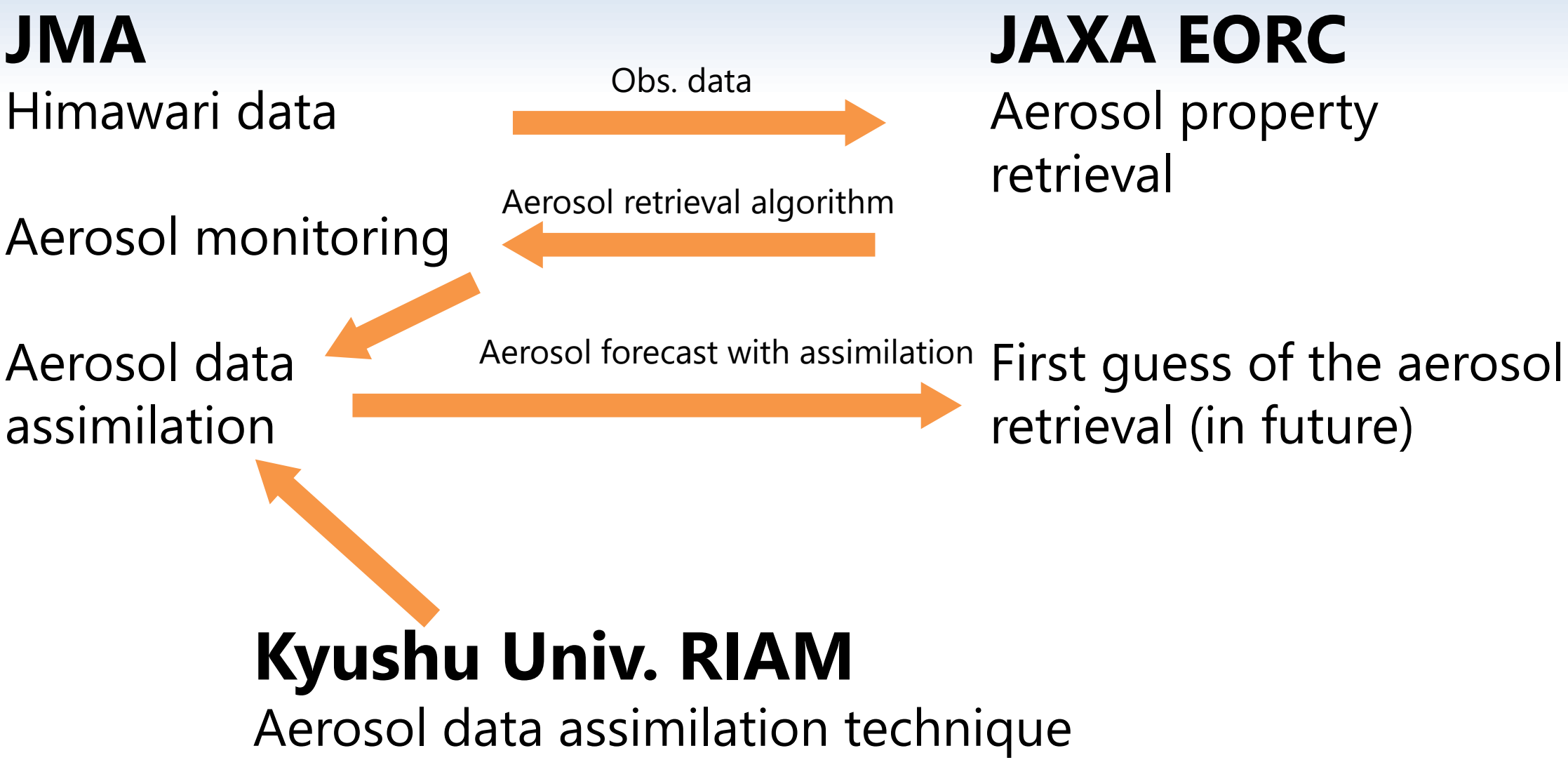
Discussion paper available
https://doi.org/10.5194/acp-2020-356

Collaboration: JMA, JAXA and Kyushu Univ.



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  https://www.eorc.jaxa.jp/ptree/index.html
- Himawari Imagery (in Japanese)
  https://www.jma-net.go.jp/sat/himawari/image.html