～Session4 Nowcasting～

Introduction of JMA's satellite-based nowcasting products

Shiro Omori

Japan Meteorological Agency

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Contents

～JMA's satellite-based nowcasting products～

- For aviation safety and effective air control
  - Convective cloud information (CCI) product
  - Fog detection product
  - Volcanic ash product
- 2D extension of pointed ground observation
  - Sunshine duration product
- To monitor aeolian dust event
  - Aerosol product
- To monitor the global SST
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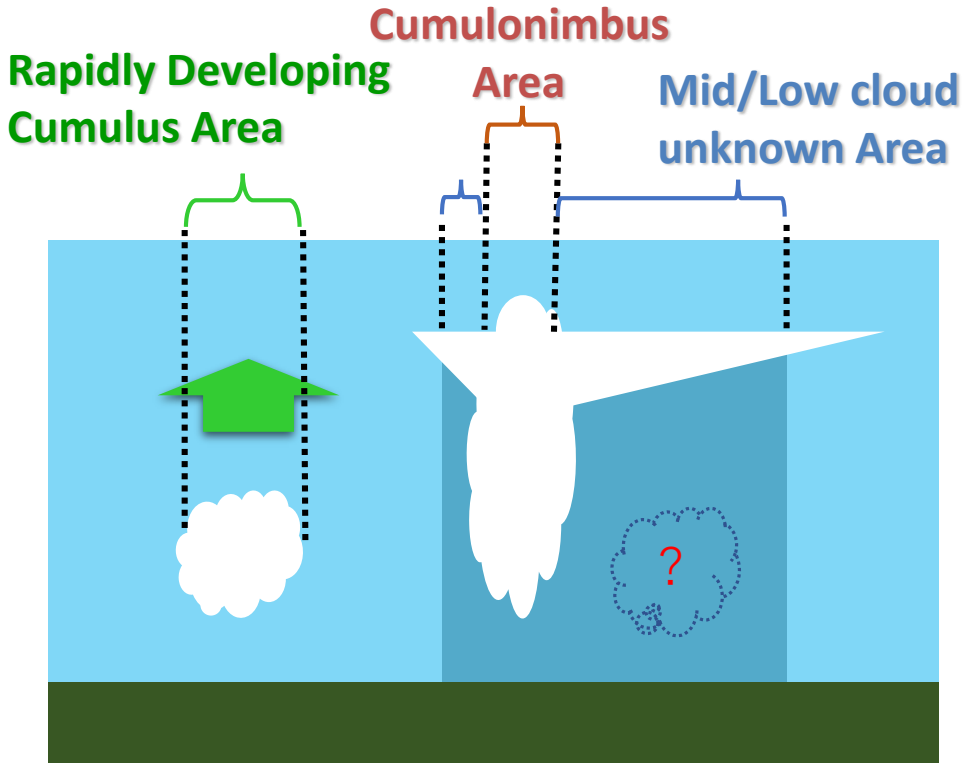
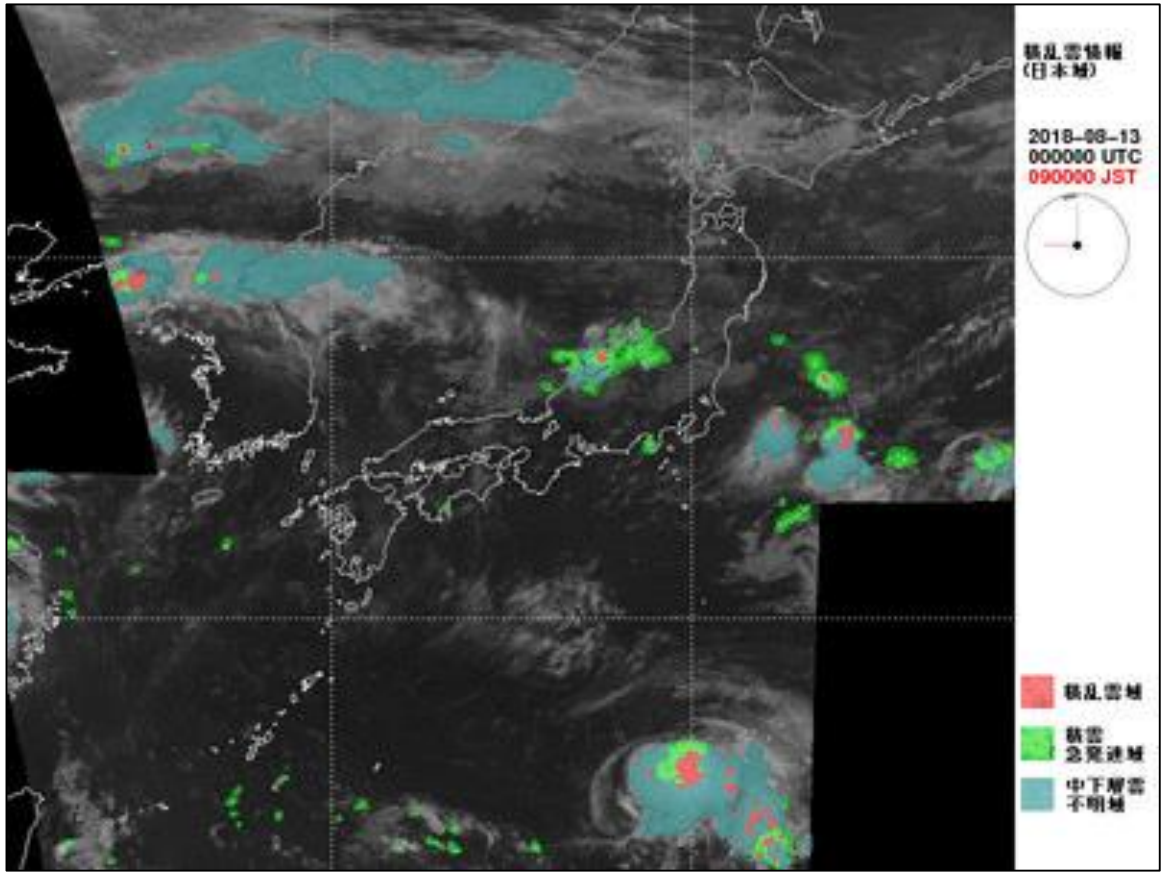
Convective cloud information (CCI) product

- JMA provides aviation operators with CCI, including data on cumulonimbus areas (CBAs), rapidly developing cumulus areas (RDCAs) and mid-/low-cloud unknown areas (MLUAs).

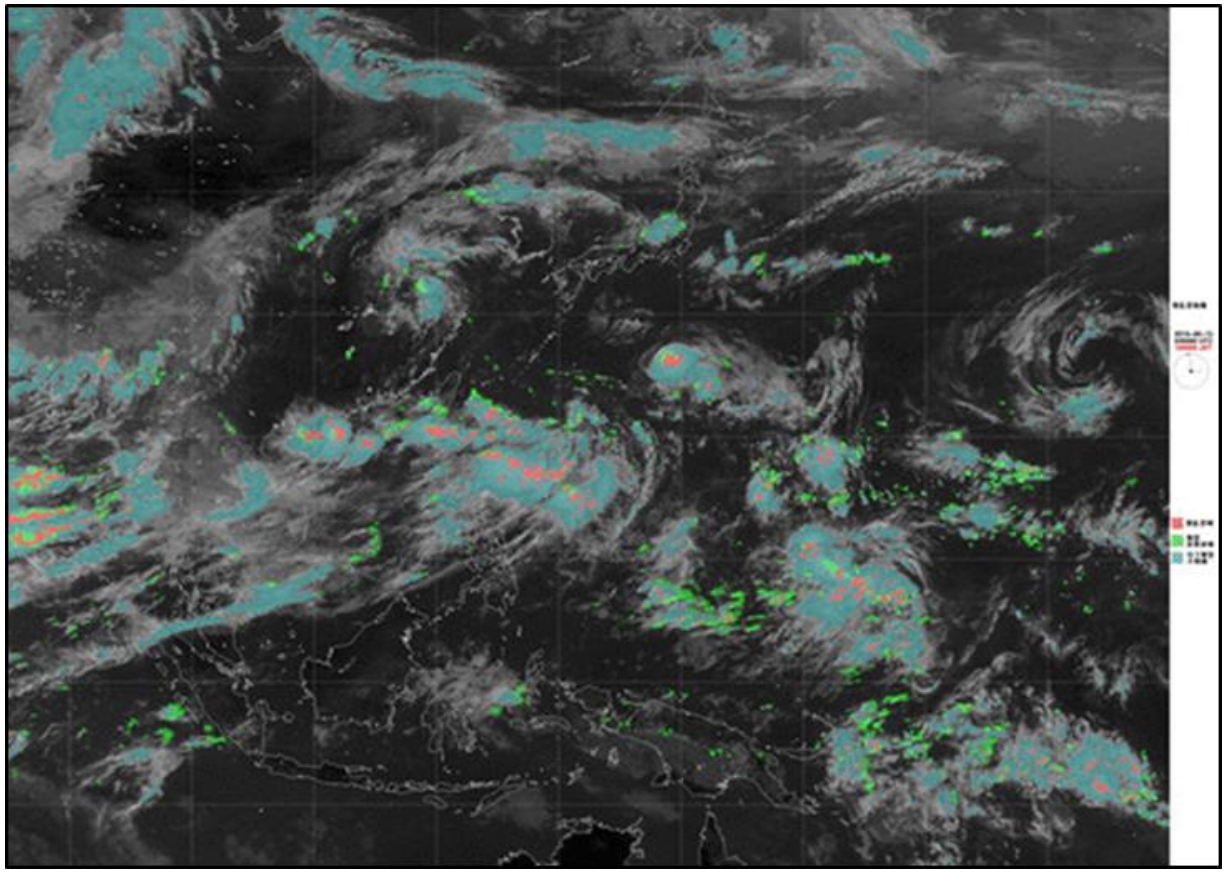


Convective cloud information (CCI) product

Japan Area (every 5 minutes)



Asia and Western Pacific Area (every 10 minutes)



Cumulonimbus

Rapidly Developing Cumulus

Mid/Low cloud unknown

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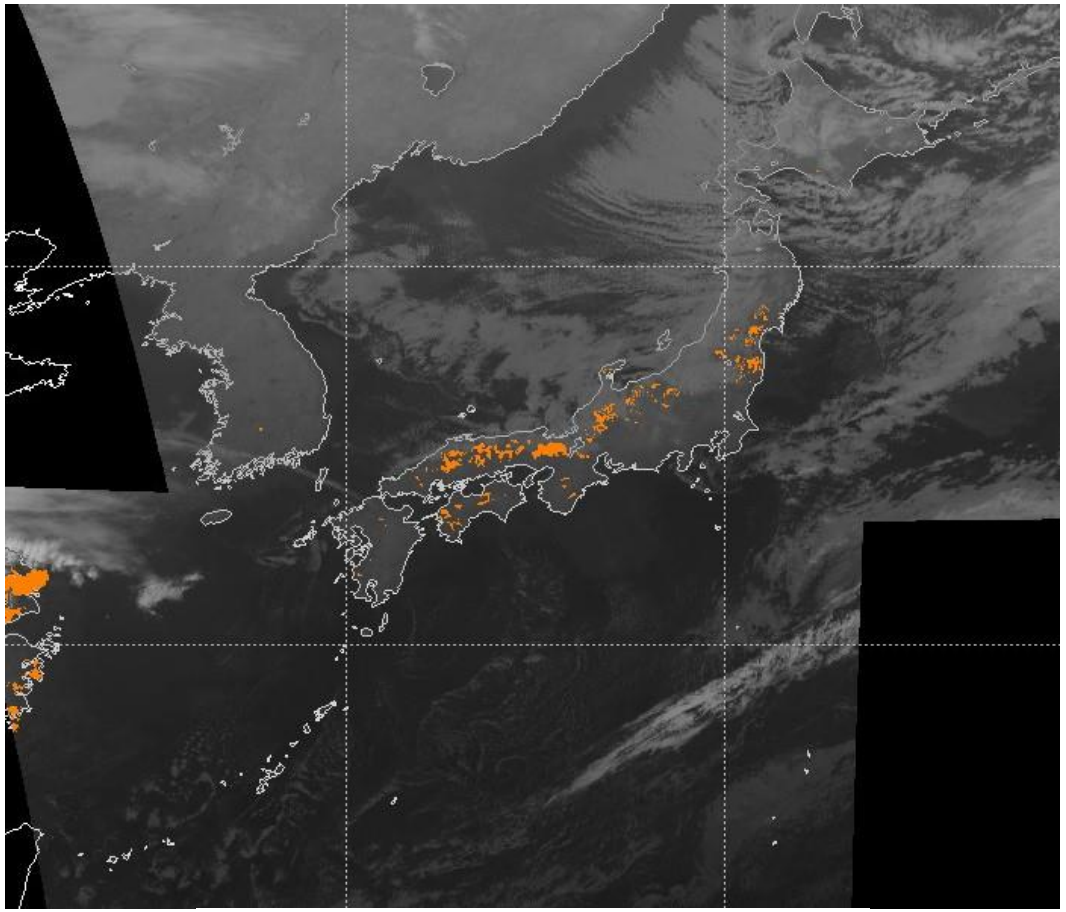
Fog detection product



Orange: detected fog area

- JMA provides Fog Detection product based on Himawari-8 observation data and numerical weather prediction (NWP) data for the Japan to help domestic aviation operators.
- The product is also used by JMA to monitor fog in sea areas and other places where surface observation sites are scarce.
- The spatial resolution is 0.02-degrees in latitude/longitude, and the time resolution is 5 minutes.

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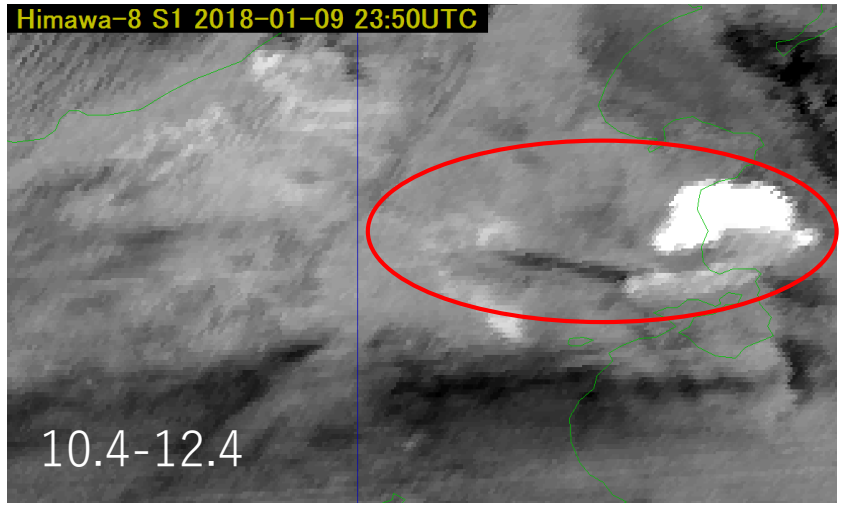
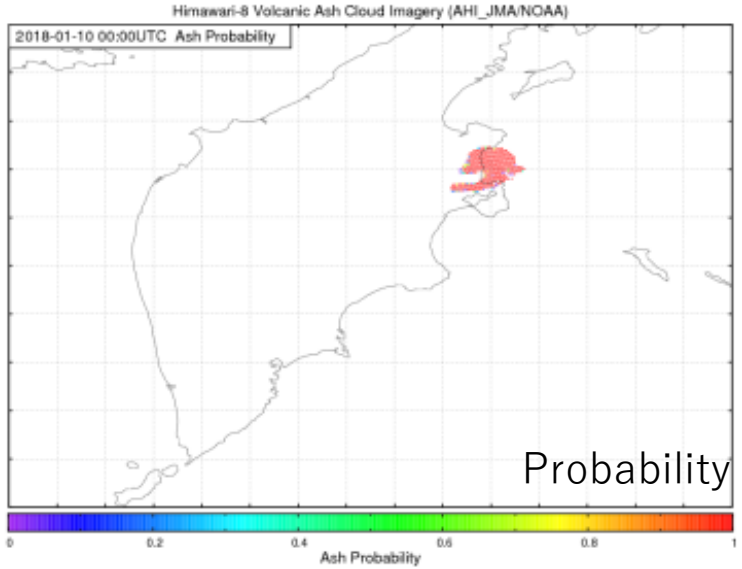
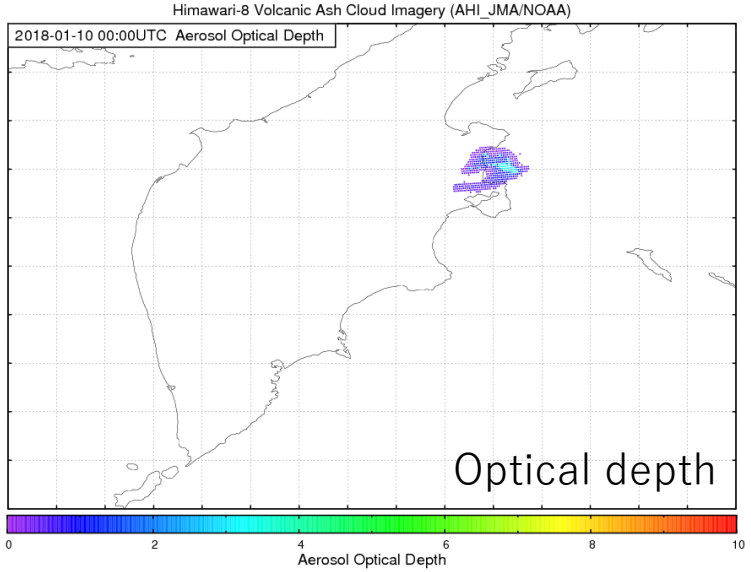
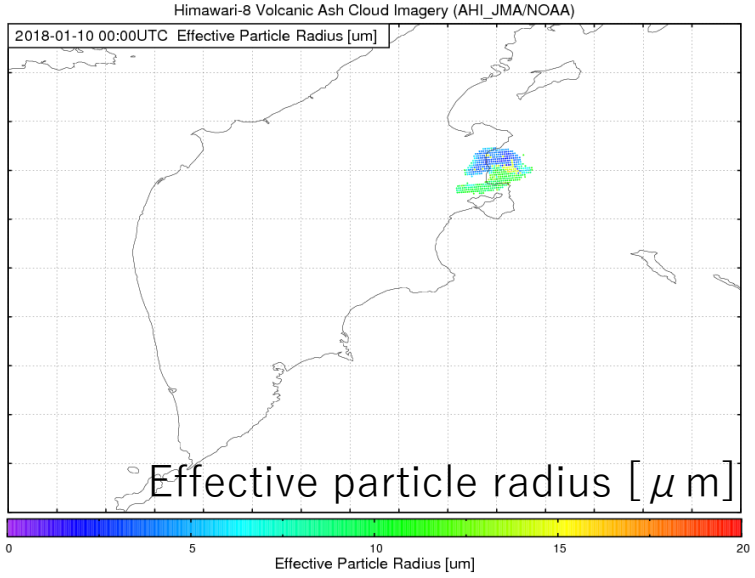
Volcanic ash products

JMA utilizes **GEOCAT/VOLCAT program** to retrieve volcanic ash **by special courtesy of NOAA/NESDIS.**









Mt. Sheveluch , Kamchatka
(10th Jan. 2018)

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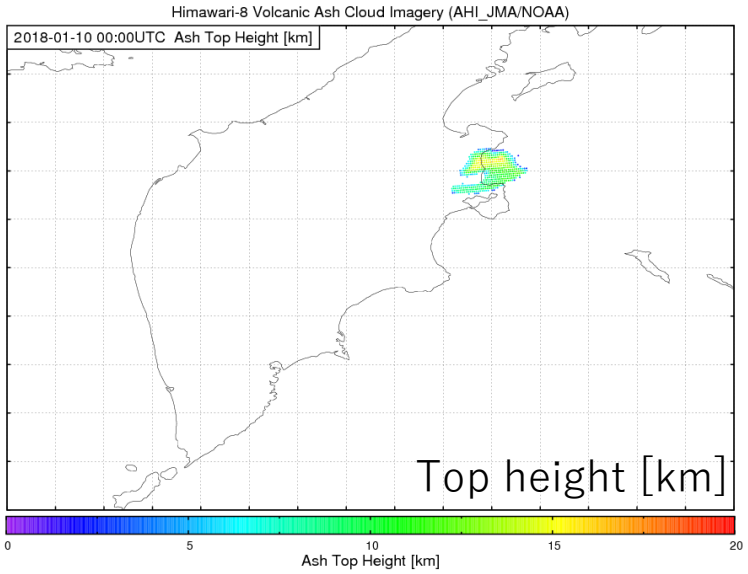

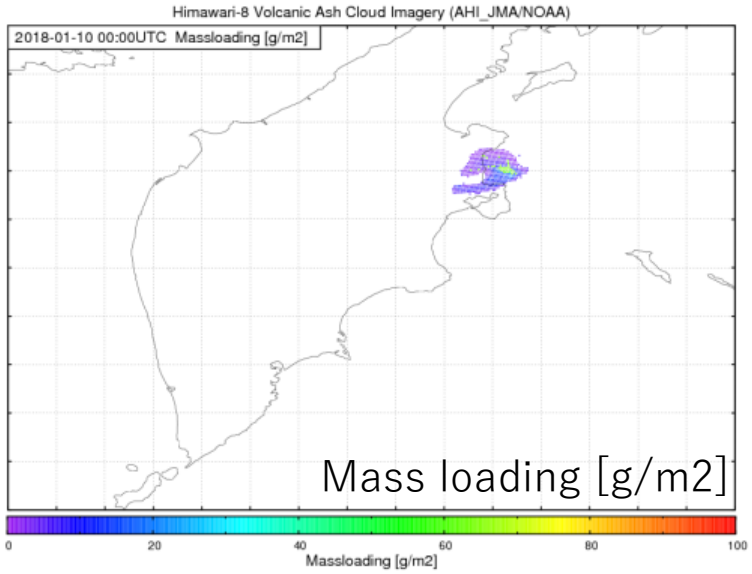

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VA product is produced automatically.

Volcanic Cloud Monitoring – NOAA/CIMSS

https://volcano.ssec.wisc.edu/imagery/view/

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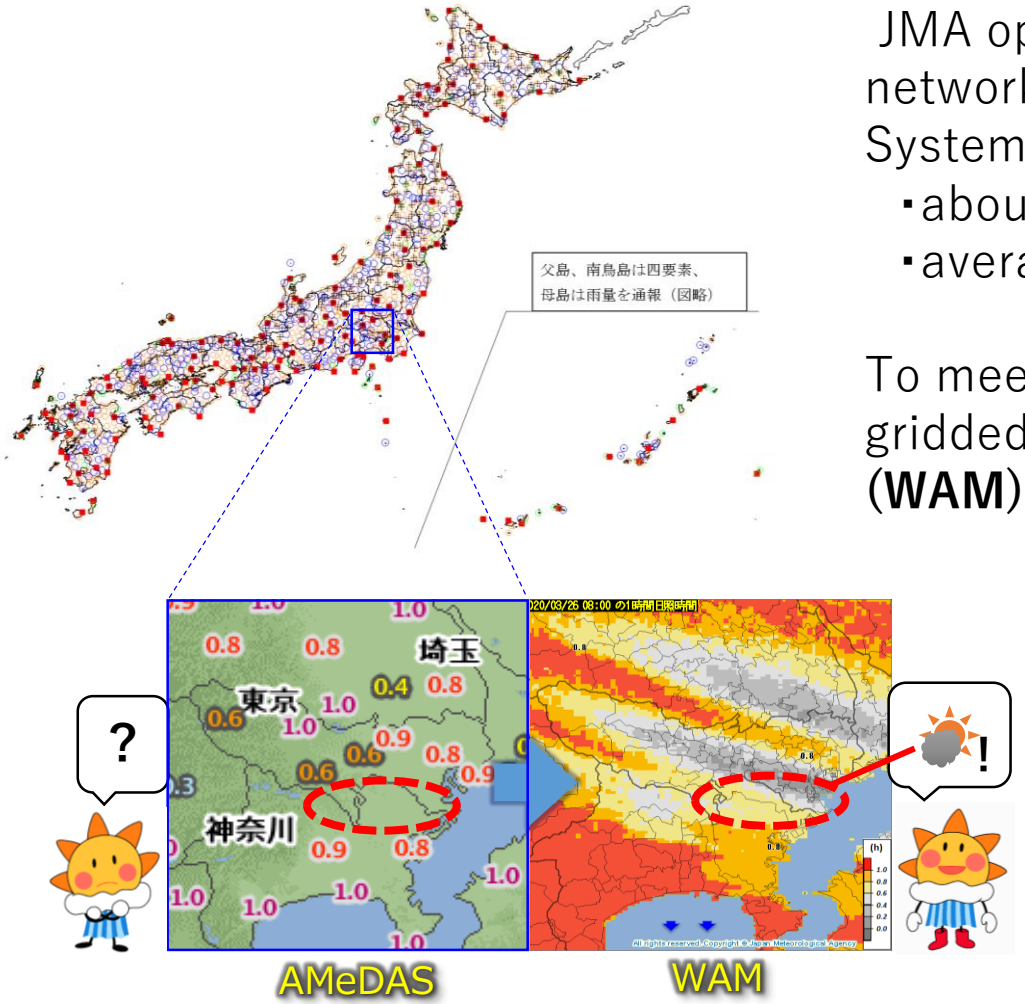
Sunshine duration product



One hour sunshine duration in Tokyo area.

JMA operates surface meteorological observation network "the Automated Meteorological Data Acquisition System (AMeDAS)"

- about 1300 stations
- average intervals is 17 km

To meet user demands for **2-D meteorological information**, gridded weather analysis called **Weather Analysis Map (WAM)** was developed.

WAM shows meteorological information in areas **distant from AMeDAS stations** as well as other region!

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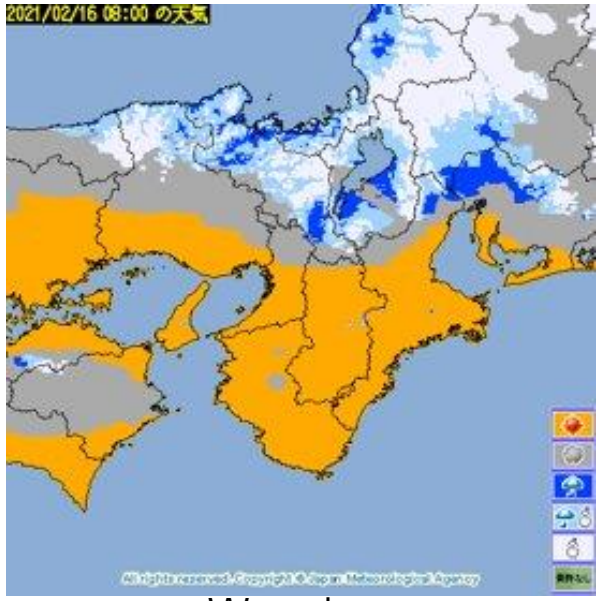
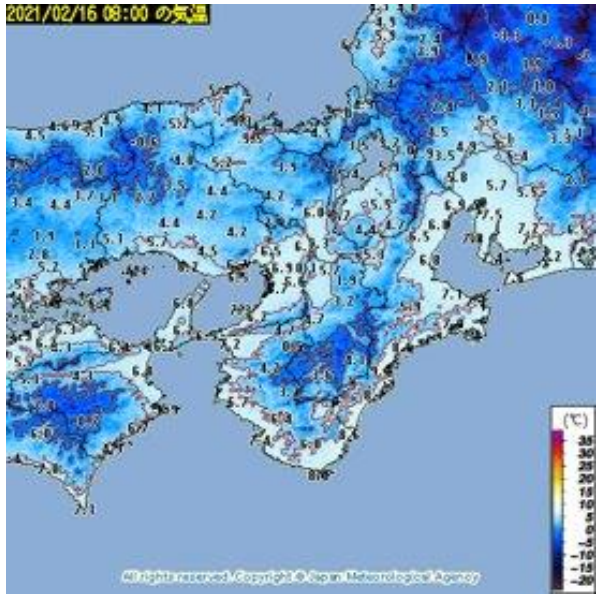
Sunshine duration product

WAM is 2-D information of **surface latest meteorological conditions** estimated from **in-situ and remote sensing observation** data, and NWP-based data.

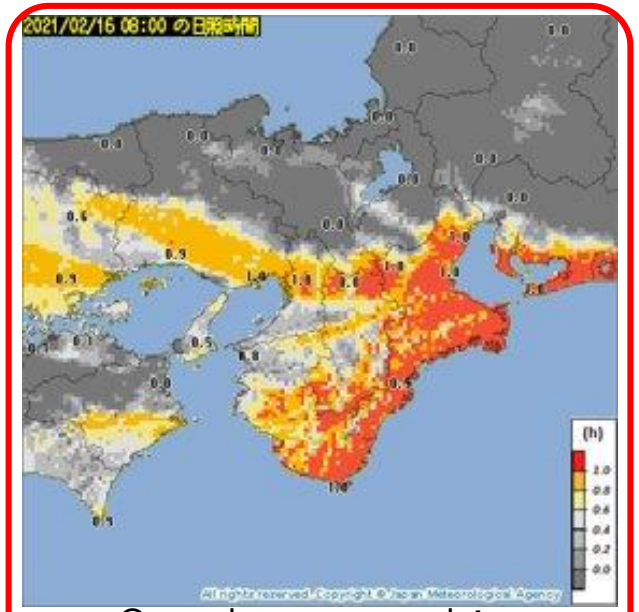
Frequency: hourly
Region: Japan's land area (except for a part of islands)
Resolution: 1 x 1 km^2 size mesh
Provide: Images on JMA's website [https://www.data.jma.go.jp/obd/bunpu/index_en.html]
Binary data (GRIB2) dissemination (via the Japan Meteorological Business Support Center)



Weather
(2016.3-)



Surface temperature
(2016.3-)



One-hour sunshine duration
(2020.9-)

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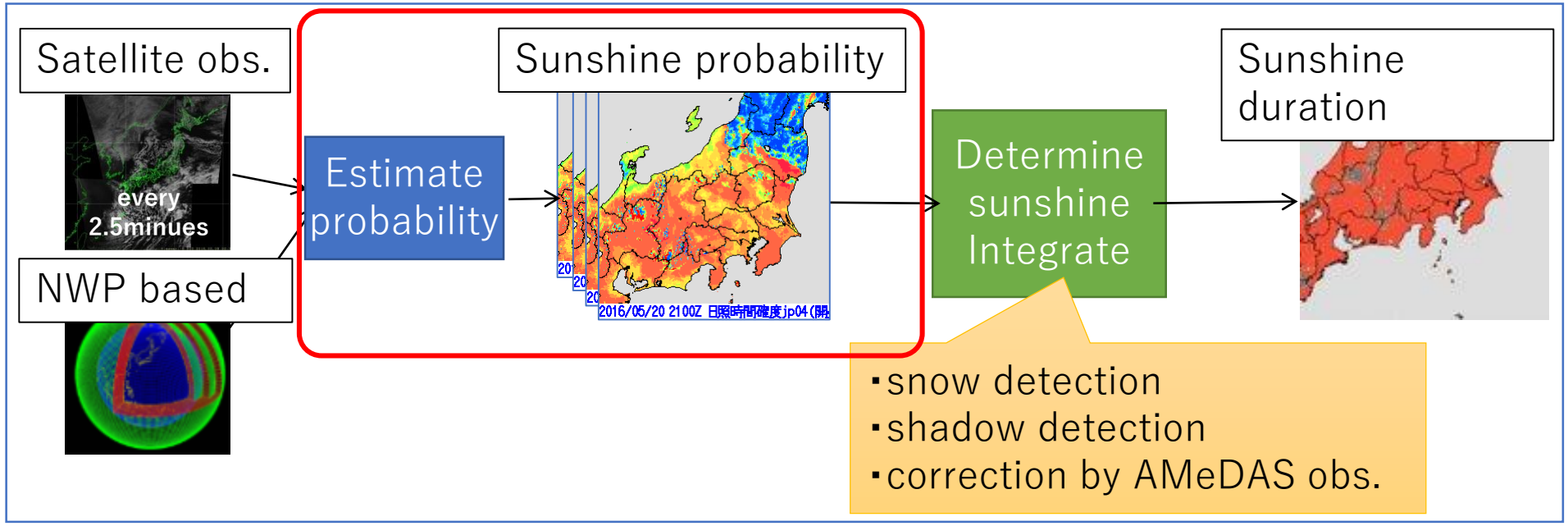
Sunshine dulation product

～Outline of Algorithm～

Sunshine durations are defined as period "direct solar radiation intensity is at least 120W/m^2".
(This value corresponds to an interception less than around 91% relating to cloud, atmosphere, and terrain.)

Estimate sunshine probability in every 2.5-minute Himawari-8 observation scene, **determine whether there is sunshine or not** at each scenes and **integrate number of sunshine scenes** to be sunshine duration



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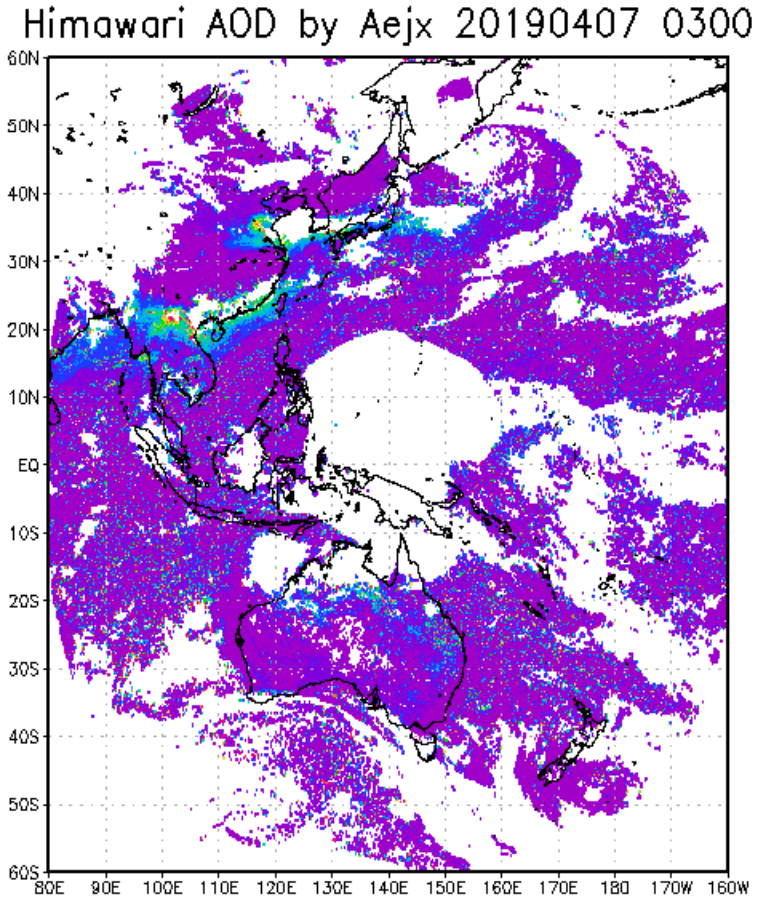
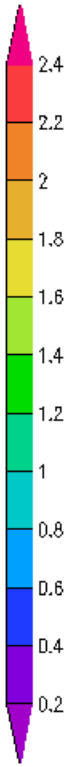
Aerosol Product (VIS-NIR)





- Aerosol product is retrieved from Himawari-8/9 visible and near-infrared channel.
  - Band 1 to 6
- The product is not only used to monitor aeolian dust events, called as “Kosa” in Japanese but also used to data assimilation to aerosol forecast.
- Every 10 minutes, 0.05deg horizontal resolution
- We use a retrieval algorithm developed by JAXA (Yoshida et al. 2018)

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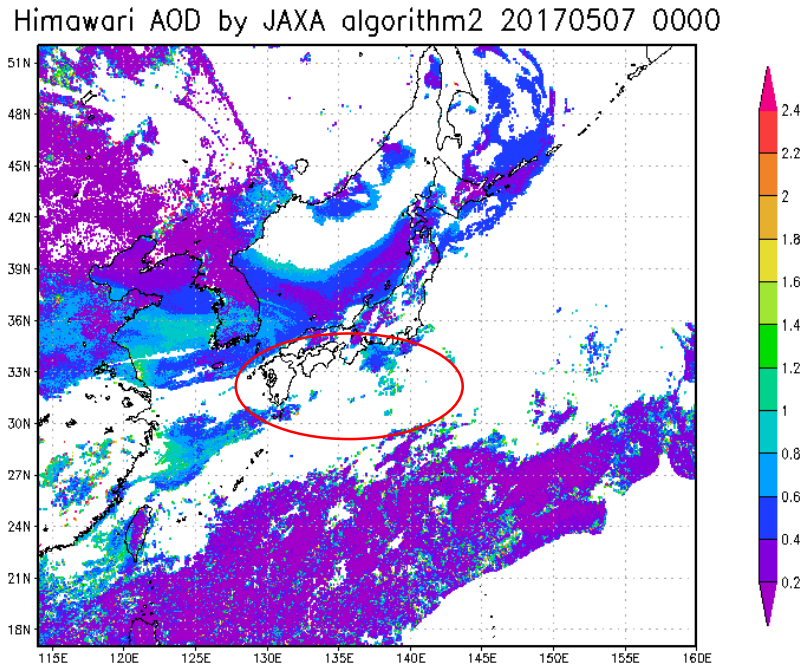
Aerosol Product (VIS-NIR)



- The Himawari-8 VIS-NIR Aerosol product detected a dust storm moving across the Yellow Sea on 7 May 2017. (left figure)
- There is an area with large AOD in the red circle on the left image that shows some aerosols are there.
- That day, the dust was recorded at the observatories of Japan.

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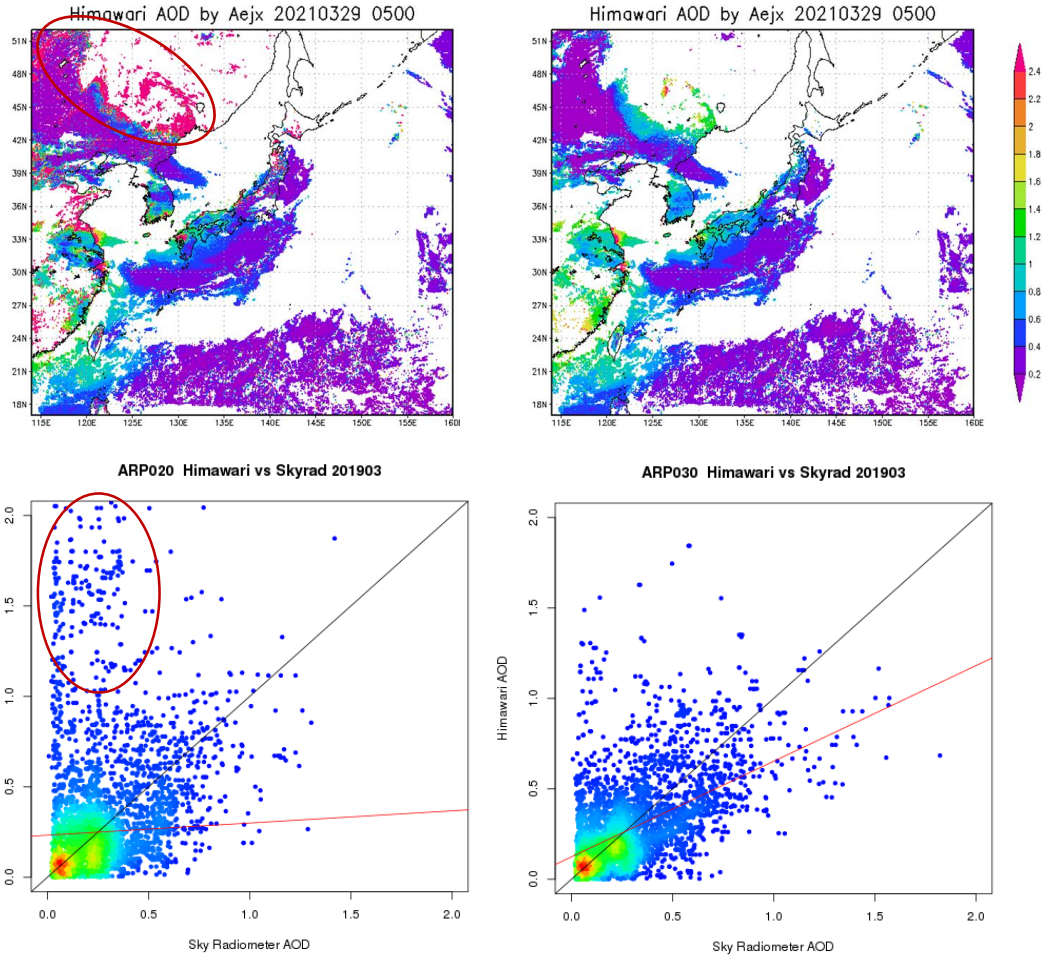
Aerosol Product (VIS-NIR)

Original AOD

New AOD



- JMA applied an updated version of the algorithm in 2020 developed by JAXA for operation in January 2022 (Yoshida et al., 2021).
- The Outliers (corresponding to high values but low aerosol loading) observed with the original algorithm are mitigated with the new version.
- Aerosol parameters retrieved using the new algorithm are also more coincident with in-situ data.

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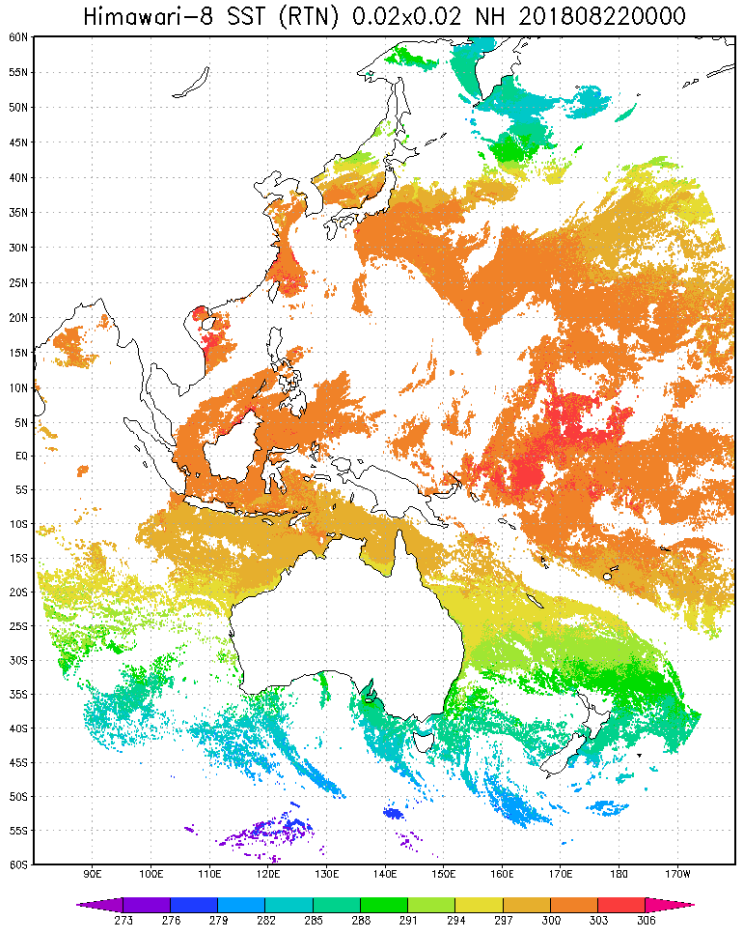
Sea Surface Temperature (SST) Product



- Himawari-8 SST product is derived from infrared data of Himawari-8.
  - Band 07, 11, 13, 14 and 15
- Every 10 minutes, 0.02deg horizontal resolution
- We use a retrieval algorithm developed by JAXA, based on a quasi-physical algorithm (Kurihara et al. 2016)

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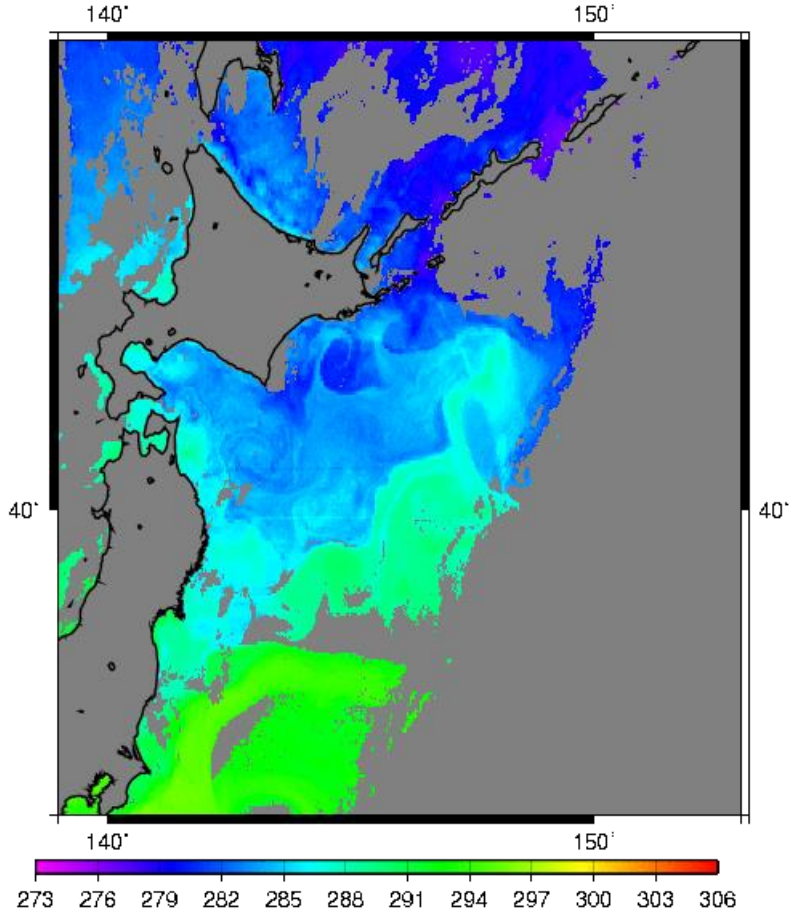
Sea Surface Temperature (SST) Product

Himawari–8 SST 2019.05.24~25 Every 10 min



Gray: cloud or land

- High resolution: Thanks to the high-resolution sensor of Himawari-8/9, we can obtain SST which has unprecedentedly high resolution as a geostationary satellite.
- High frequency: Every 10 minutes this product is being distributed. The high frequent observation gives us much data that is not affected with cloud.

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Thank you for your attention !

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