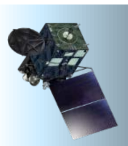
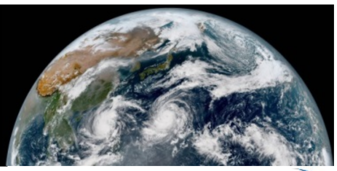


HimawariCast Newsletter

No. 13, 17 January 2020



Japan Meteorological Agency

Contents of this issue

High-resolution Cloud Analysis Information (HCAI)

The Meteorological Satellite Center (MSC) of the Japan Meteorological Agency (JMA) provides a satellite-derived product called High-resolution Cloud Analysis Information (HCAI) using data from the Advanced Himawari Imager (AHI) units on board the Himawari-8/-9 satellites. HCAI data have been provided via the JMA Data Dissemination System (JDDS) every 10 minutes since 11 December 2019.

The Himawari JDDS can be accessed via FTP and HTTPS, but the 10-minute HCAI data are available exclusively via HTTPS (cf. HimawariCast Newsletter No. 12).

HCAI includes information on cloud mask (including dust mask), snow and ice mask, cloud top height, cloud type, and quality control. The generation algorithm used is largely derived from the cloud product algorithm developed by EUMETSAT/ NWC-SAF (the Nowcasting Satellite Application Facility) and NOAA/NESDIS/STAR (the National Ocean and Atmospheric Administration/the National Environmental Satellite, Data, and Information Service/the Center for Satellite Applications and Research). Each of these product elements is described below.

Cloud top height

Cloud top height is determined using a maximum likelihood algorithm based on the GOES-R ABI (Advanced Baseline Imager) Cloud Top Height algorithm.

Cloud mask

Cloud Mask shows information on clear/cloudy status. The Himawari-8 cloud mask algorithm includes a number of cloud detection tests, most of which involve threshold methods based on radiative transfer calculation using NWP-derived atmospheric profiles.

Cloud type

Cloud type information is generated via two-stage analysis. The first stage involves determination of optical and radiative properties (e.g., liquid water and optically thin/thick ice) using the GOES-R ABI Algorithm Theoretical Basis Document For Cloud Type and Cloud Phase. The second involves the generation of HCAI cloud type information to clarify meteorological characteristics.

Dust

Dust information indicates the results of aerosol detection based on an ash detection algorithm developed by NOAA/NESDIS for GOES-R/ABI application. This detection is part of the Himawari-8 cloud mask algorithm.

Snow ice

Snow/ice mask areas are detected using data from Himawari cloud products covering the last four days and a snow depth product derived from data collected by microwave sensors on board low-earth-orbiting satellites.

For more information, refer to HCAI specifications and High-resolution Cloud Analysis Information derived from Himawari-8 data.

Coverage and spatial resolution

Each element has a spatial resolution of 0.02 degrees in both latitude and longitude, and is calculated using observational data from Himawari-8 and -9. The regions of HCAI coverage are as detailed in Table 1 and Figure 1 below.

Registration and communication protocol updating

Access to 10-minute HCAI data can be requested at https://www.jma.go.jp/jma/jma-eng/satellite/jdds.html.

Users accessing HCAI via FTP should update their communication protocols to enable HTTPS provision.

(ANDOU Akiyoshi)

Table 1 HCAI regions and file size

Area Name		Latitude	Longitude	File size	Compressed file size
FD	Full Domain	60N-60S	80E-160W	180 MB	29.5 MB
NC	North Central	45N-20S	90E-155E	50 MB	10 MB
NW	Northwest	60N-5S	80E-145E	50 MB	10 MB
NE	Northeast	60N-5S	135E-160W	50 MB	10 MB
TP	Tropical	25N-25S	80E-160W	75 MB	15 MB
TE	Tropical East	25N-25S	135E-160W	40 MB	7.5 MB
SW	Southwest	5N-60S	80E-145E	50 MB	10 MB
SE	Southeast	5N-60S	135E-160W	50 MB	10 MB

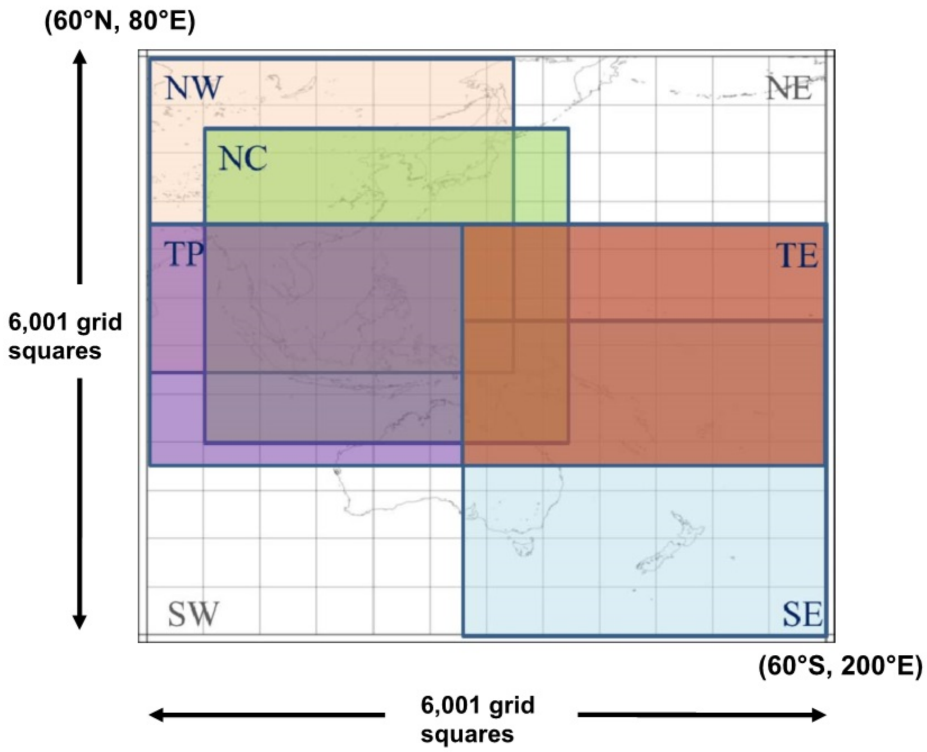


Figure 1 High-resolution Cloud Analysis Information (HCAI) regions

JICA training program for enhanced meteorological services

From 25 September to 7 December, the 2019 JICA Knowledge Co-Creation Program for Reinforcement of Meteorological Services was held in Tokyo with nine invited attendees from Bangladesh, Mozambique, Myanmar, the Philippines, Samoa, Thailand, Tonga and Viet Nam.

This training program is designed to provide National Meteorological and Hydrological Service (NMHS) staff with basic expertise and key techniques for use in numerical weather prediction, satellite meteorology and climate information for advanced meteorological services. It is also intended to build capacity for the application of these resources to the production and delivery of meteorological and climatological information for disaster prevention authorities and other users.

On 7 and 8 October, attendees paid a visit to the JMA Meteorological Satellite Center (MSC) in Kiyose for training on the basics of satellite observation and cloud image interpretation, including techniques for handling RGB imagery derived from Himawari-8/9 data. The delegation took a technical tour of the MSC's Himawari-8/9 control room and attended presentations given by JMA satellite experts.

(OKUYAMA Arata)

Figure 2: MSC seminar

Figure 3: Welcome lunch

Day Convective Storms RGB based on Himawari observation imagery

Risk reduction relating to heavy rain, lightning, tornadoes and other extreme meteorological conditions requires cumulonimbus (Cb) cloud monitoring. In this context, JMA's Day Convective Storms RGB product (also known as Day Convection or Severe Storms) is useful for identifying convective cloud with strong updrafts during the daytime.

The product (consisting of combinations of imagery assigned to the three primary colors) was originally designed for users of the Meteosat Second Generation (MSG) satellites operated by EUMETSAT, and is non-standard among WMO schemes. Nonetheless, it is considered very useful and is widely applied in various areas other than MSG observation.

The product is based on the assignment of red/green/blue to difference imagery for Band 10 (7.3 µm) - Band 8 (6.2 µm), Band 13 (10.4 µm) - Band 7 (3.9 µm) and Band 3 (0.64 µm) - Band 5 (1.6 µm) (Table 2), with the contributions detailed below.

Red: High-level clouds are highlighted in brightness temperature difference (BTD) imagery derived from Band 10 (7.3 µm) and Band 8 (6.2 µm) ($BTD_{B10\text{-}B08}$) with assignment to the red of RGB.

Green: Brightness temperature difference imagery derived from Band 13 (10.4 µm) and Band 7 (3.9 µm) ($BTD_{B13\text{-}B07}$) in the green beam highlights small and/or very cold ice crystals forced to the cloud top by strong convective updrafts.

Blue: Reflectivity difference (RD) imagery derived from Band 3 (0.64 µm) and Band 5 (1.6 µm) ($RD_{B03\text{-}B05}$) in the blue beam emphasizes the contrast between ice clouds and water clouds. Band 5 (near-infrared) data exhibit low reflectivity for cloud-top ice crystals.

Color interpretation for Day Convective Storm RGB is shown in Figure 4. Thick clouds appear red due to a large contribution from the red beam of $\mathrm{BTD}_{\mathrm{B10\text{-}B08}}$. Thick Cb clouds with strong updraft appear yellowish due to large contributions from the red of $\mathrm{BTD}_{\mathrm{B10\text{-}B08}}$ and the green of $\mathrm{BTD}_{\mathrm{B13\text{-}B07}}$.

Figure 5 compares Day Convective Storms RGB imagery and sandwich imagery created by overlapping visible (Band 3, 0.64 µm) and infrared (Band 13, 10.4 µm) images. Yellowish areas (marked with A) in Day Convective Storms RGB imagery (top) correspond to very cold (high-level) cloud tops in sandwich imagery (bottom).

Figure 6 compares Day Convective Storms RGB imagery and visible imagery with radar precipitation intensity. Yellow and orange areas featuring heavy rain are seen at A' outside the typhoon center.

Bright greenish and grayish areas are seen at points marked with F. These appear to correspond to supercooled thick water clouds based on other imagery such as Day Microphysics RGB (omitted).

Figure 7 compares Day Convective Storms RGB imagery and sandwich imagery as in Figure 5. The dashed lines indicate overshooting cloud top with a cold-U/V (enhanced-V) form considered to represent the possibility of outstanding overshooting top and to indicate storm severity.

Notable Cb cloud formations can thus be identified via the conspicuous yellowish hue in this RGB imagery. However, yellow parts should be interpreted conservatively because small ice particles are also seen in high-level lee clouds, highly polluted convective clouds (such as pyro-cumulus) and other types.

Day Convective Storms RGB imagery is unsuitable for highlighting low-level clouds and surface characteristics.

(SHIMIZU Akihiro)

Table 2 Band components and related specifications for Day Convective Storms RGB

Color	AHI Bands	Central wave length [µm]	Physical relation to	Smaller contribution to the signal of	Larger contribution to the signal of
Red	B10-B08	7.3-6.2	Cloud top height	Low level clouds	High level clouds
Green	B13-B07	10.4-3.9	Cloud top particle size and temperature	Large ice particles with weak updrafts	Small ice particles with strong updrafts
Blue	B03-B05	0.64-1.6	Cloud top phase	Ice clouds	Water clouds

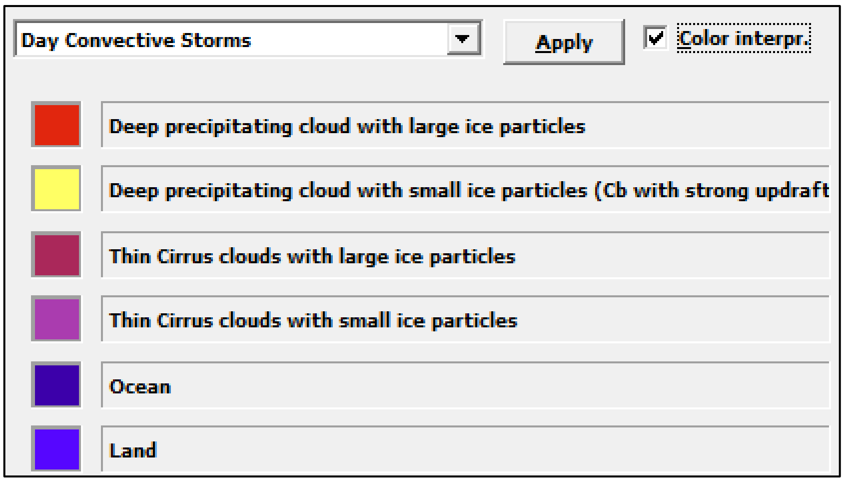
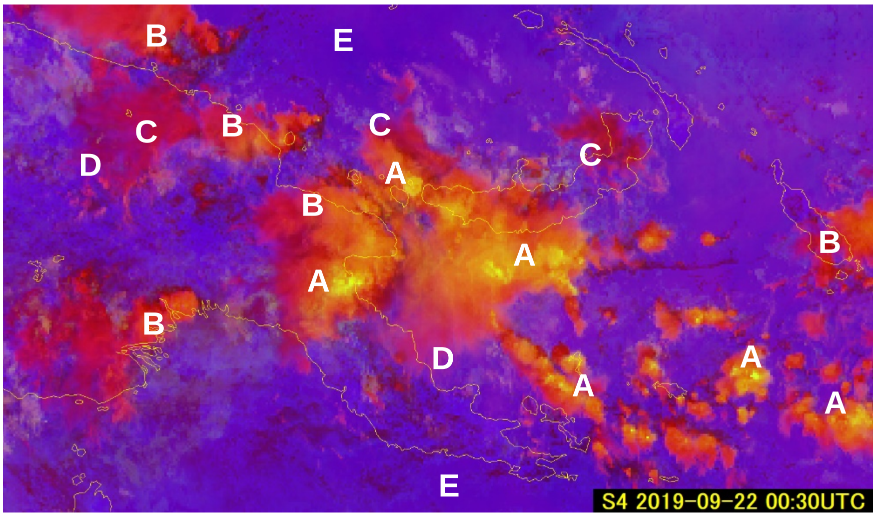


Figure 4 Day Convective Storms RGB interpretation in SATAID



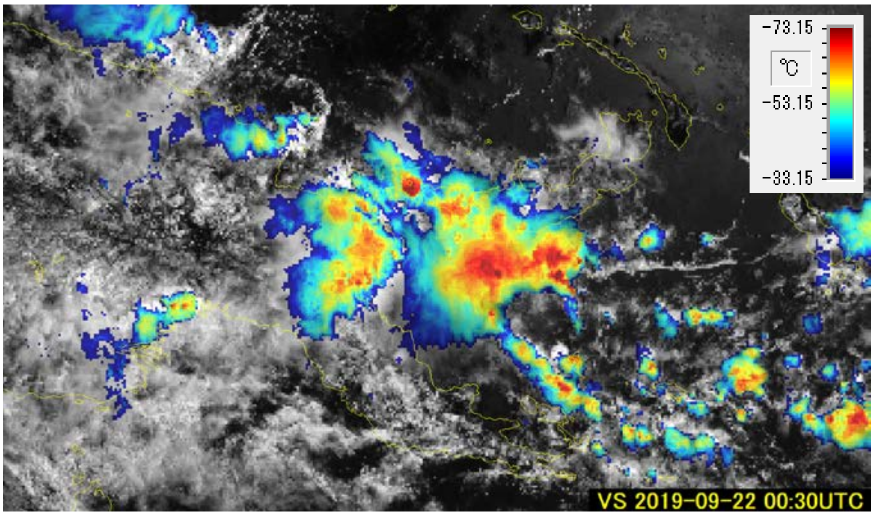


Figure 5 Cb clouds around Papua New Guinea (00:30 UTC, 22 September 2019). Yellowish areas (marked with A) in Day Convective Storms RGB imagery (top) correspond to very cold (high-level) cloud tops in sandwich imagery (bottom).

A: Cb cloud with strong updrafts or high-level cloud with small ice particles

B: Thick high-level cloud with large ice particles

C: Thin cirrus cloud with large ice particles

D: Thin cirrus cloud with small ice particles

E: Ocean

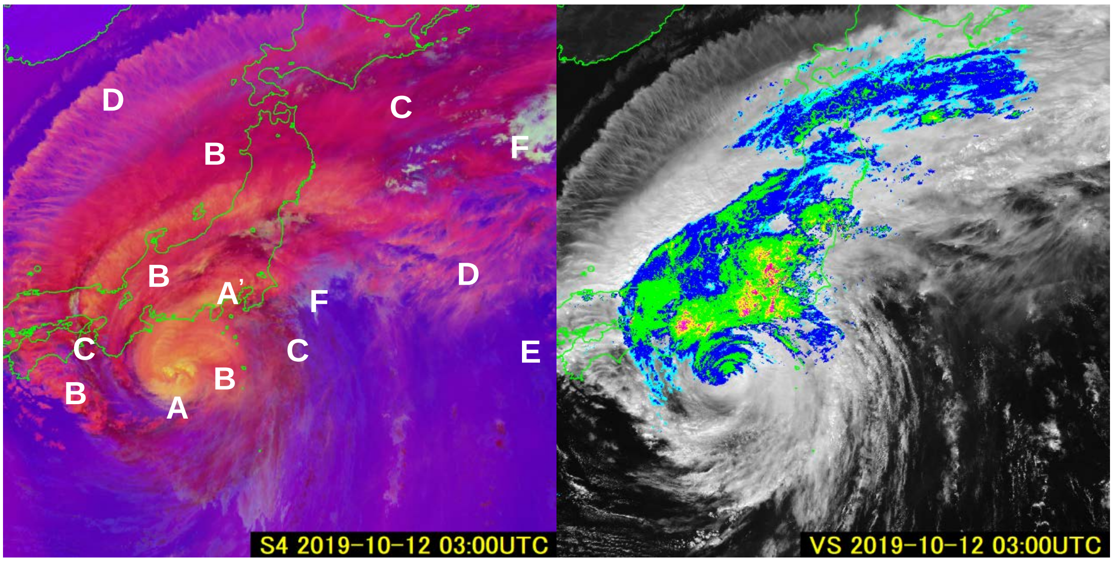


Figure 6 Typhoon Hagibis (T1919) approaching Japan (03:00 UTC, 12 October 2019)
Left: Day Convective Storms RGB image; right: visible image (Band 3: 0.64 μm) with radar intensity
A, A’: Cb cloud with strong updrafts or high-level cloud with small ice particles
B: Thick high-level cloud with large ice particles
C: Thin cirrus cloud with large ice particles
D: Thin cirrus cloud with small ice particles
E: Ocean
F: Super-cooled thick water clouds

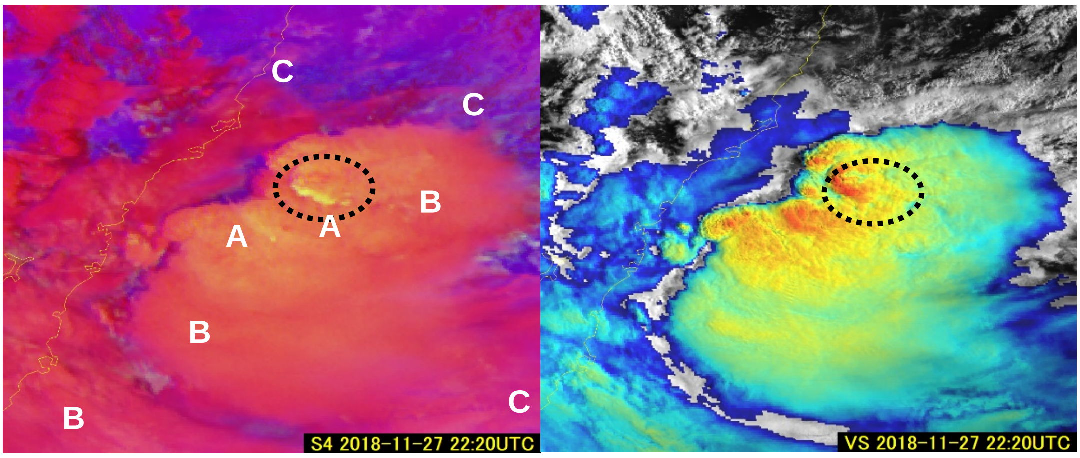


Figure 7 Huge Cb clouds around the eastern coast of Australia (22:20 UTC, 27 November 2018)
Left: Day Convective Storms RGB image; right: sandwich image. The dashed lines indicate overshooting cloud top with a cold-U/V (enhanced-V) form.
A: Cb cloud with strong updrafts or high-level cloud with small ice particles
B: Thick high-level cloud with large ice particles
C: Thin cirrus cloud

Feedback

JMA welcomes feedback from users on HimawariCast data usage, and particularly invites articles to be posted in this newsletter. Such input will help other users consider new ideas for their services.

The Agency also invites questions on HimawariCast services. These may relate to the functions of the SATAID program, interpretation/analysis of multi-band imagery or other areas of interest. Feel free to send queries to be answered in this newsletter.

All articles and questions are welcomed. Your contributions are greatly appreciated.

Comments and Inquiries

Comments and inquiries on this newsletter and/or the HimawariCast Web Page are welcomed.
Back numbers of HimawariCast Newsletters:
"Dissemination via communication satellite: the HimawariCast service", MSC/JMA
http://www.data.jma.go.jp/mscweb/en/himawari89/himawari_cast/himawari_cast.html

Mr. Akiyoshi ANDOU
Senior Scientific Officer, Satellite Program Division, Observation Department
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku, Tokyo, 100-8122, Japan
Fax: +81-3-3217-1036
Email: metsat@met.kishou.go.jp