Tokyo Climate Center, Japan Meteorological Agency

TCC News

No. 53 Summer 2018

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Upgrade of JMA's Supercomputer System

The Japan Meteorological Agency (JMA) began operation of its 10th-generation super-computer system on 5 June 2018 with the aim of improving its meteorological information services. The new system, known as Cray XC50, has 10 times more capacity in terms of meteorological numerical calculation than its Hitachi SR16000/M1 predecessor and to make more than 1.8 quadrillion floating-point calculations per second in theory (see below for specifications). The new system allows JMA to run more sophisticated atmospheric and oceanic models than before, supporting the provision of highly precise very-short- to long-range forecasts.

Using the new system, JMA plans to make various improvements to domestic services and related international services (see this news release for more details). With regard to TCC services, plans are being made to upgrade the Global Ensemble Prediction System (Global EPS) used for one-month forecast products within a year and to upgrade the Seasonal EPS used for three-month and warm/cold season forecast products within a couple of years.

(Atsushi Minami, Tokyo Climate Center)

Comparison of Specifications

	Previous	New
Model	HITACHI SR16000/M1 (Vendor: Hitachi)	Cray XC50 (Vendor: Hitachi)
Theoretical Peak Performance	847 TFlops (*)	18,166 TFlops
Capacity of Main Memory	108 TBytes	528 TBytes
Capacity of Magnetic Disk	348 TBytes	10,608 TBytes

* TFlops: capability to perform a trillion floating-point calculations per second

The new supercomputer system used for JMA's weather and climate prediction
Left: main system Right: sub-system

Primary Factors behind the Heavy Rain Event of July 2018 and the Subsequent Heatwave in Japan from Mid-July Onward

TCC issued a press release regarding primary factors behind the Heavy Rain Event of July 2018 and the subsequent heatwave in japan from mid-July onward. An abstract of the press release and the download link for the full article are as follows.

Abstract

Japan experienced significant rainfall particularly from western Japan to the Tokai region mainly in early July (The Heavy Rain Event of July 2018), which caused widespread havoc nationwide. Extremely high temperatures subsequently persisted throughout most of Japan from mid-July onward.

In this context, the Japan Meteorological Agency (with the help of the Tokyo Climate Center Advisory Panel on Extreme Climatic Events) investigates atmospheric and oceanic conditions considered to have contributed to such climate extremes and summarizes related primary factors. Based on this work, the Heavy Rain Event of July 2018 is attributed to an ongoing concentration of two massively moist air streams over western Japan and persistent upward flow associated with the activation of a stationary Baiu front (Figure 1). The related heatwave is attributed to the expansion of a persistent North Pacific Subtropical High and Tibetan High to the Japanese mainland (Figure 2). The serial occurrence of these two extreme climate events was caused by significant and persistent meandering of the subtropical jet stream in the upper troposphere. The long-term trend of increased intensity in observed extreme precipitation events in Japan and the clear upward trend in amounts of airborne water vapor also suggest that the Heavy Rain Event may be linked to global warming. Global warming and ongoing higher-than-normal zonally averaged tropospheric air temperatures associated with the northward shift of the subtropical jet stream are also considered responsible for the extreme heatwave.

URL:
http://ds.data.jma.go.jp/tcc/tcc/news/press_20180822.pdf

(Yasushi Mochizuki, Tokyo Climate Center)

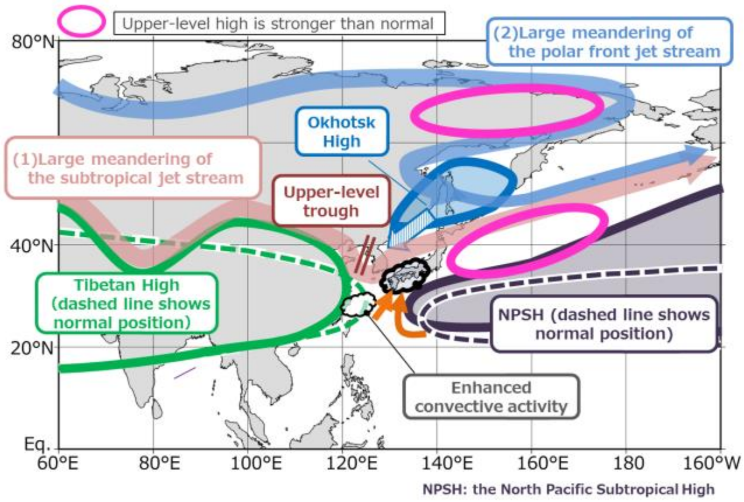


Figure 1 Primary factors behind the unprecedentedly heavy rain affecting areas from western Japan to the country's Tokai region from 5th to 8th July 2018

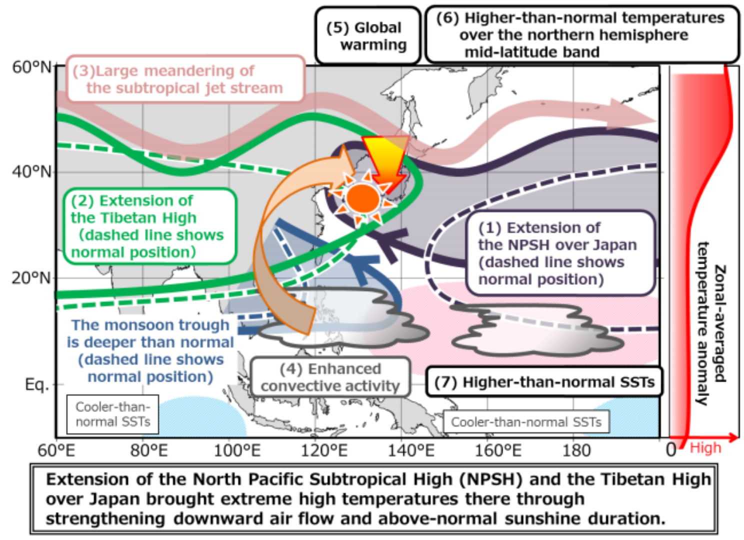


Figure 2 Primary factors behind the unprecedentedly hot conditions observed from mid-July 2018 onward

Sea Ice in the Sea of Okhotsk in the 2017/2018 Winter Season

The maximum sea ice extent in the Sea of Okhotsk for winter 2017/2018 corresponded to the normal.

The sea ice extent in the Sea of Okhotsk for winter 2017/2018 was lower than the normal from late December to early March (Figure 3). The seasonal maximum of 1.124 x 10^6 km^2 was reached on 25 March (Figures 3 and 4) and was near the normal of 1.169 x 10^6 km^2 (based on the 30-year average from 1980/1981 to 2009/2010). Figure 5 shows the overall trend of maximum sea ice extent from 1971 to 2018. Although values for the Sea of Okhotsk show large interannual variations, there is a long-term downward trend of 0.066 [0.035 – 0.098] x 10^6 km^2 per decade (the numbers in square brackets indicate the two-sided 95% confidence interval), which equates to a loss of 4.2 [2.2 – 6.2]% of the total sea area per decade.

(Ryohei Okada, Office of Marine Prediction)

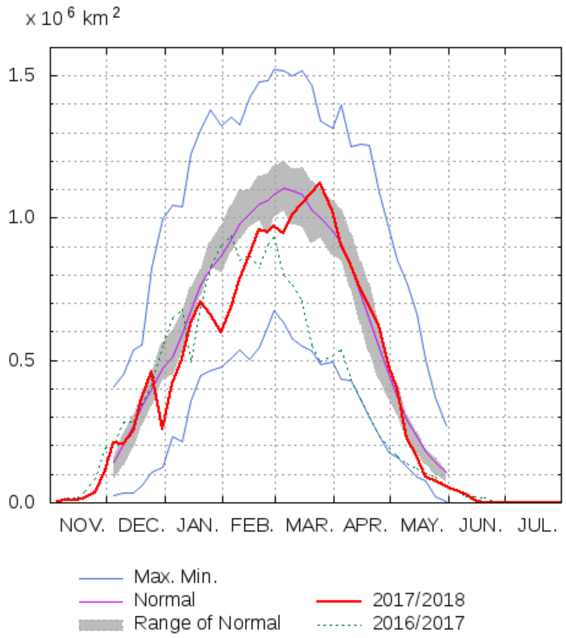


Figure 3 Seasonal variation of sea ice extent at five-day intervals in the Sea of Okhotsk from November 2017 to July 2018
The normal is the 30-year average from 1980/1981 to 2009/2010.

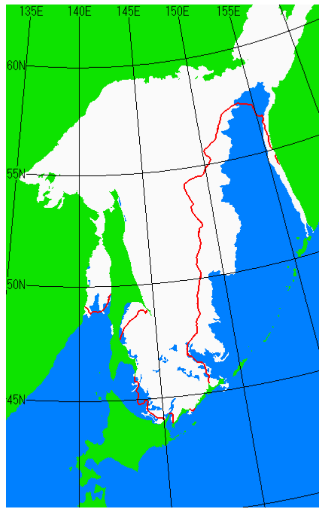


Figure 4 Sea ice situation on 25 March 2018
The white area shows the observed sea ice extent, and the red line indicates the extent of normal coverage (the 30-year average from 1980/1981 to 2009/2010).

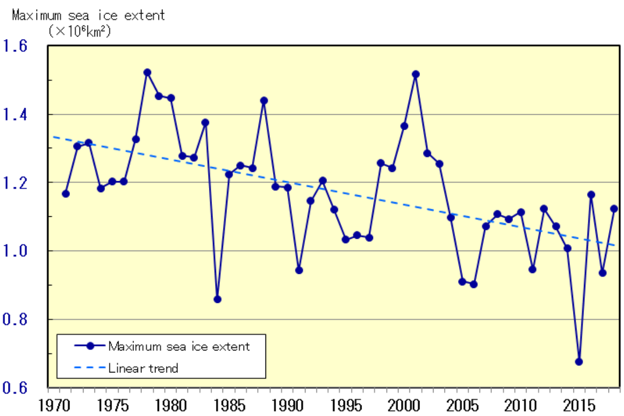


Figure 5 Interannual variation of maximum sea ice extent in the Sea of Okhotsk from 1971 to 2018
Maximum sea ice extent: the greatest amount of sea ice extent observed during the year

Kosa (Aeolian Dust) Events over Japan in January–June 2018

Kosa (Aeolian dust) was observed in Japan on 11 days between January and June 2018, which is close to the average frequency for the last decade.

Kosa is an atmospheric phenomenon in which visibility is reduced when fine sand and dust are blown up from arid and semi-arid areas of the Asian continent and transported to Japan. Observation to detect the presence of Kosa is conducted visually at 59 manned JMA meteorological stations. The monthly normal frequency (i.e., the 1981 – 2010 average) of Kosa events in Japan peaks from March to April, and more than 95% of such events are observed from January to June.

During the first half of 2018, Kosa events were observed on 11 days at one or more meteorological stations in Japan (Figure 6). This was well below the normal frequency (23.0 days), but closer to the average for the last decade (13.6 days). Identification of any statistically significant trend in the frequency of Kosa events is hindered by interannual variability (Figure 6).

Himawari images for a significant Kosa event in March

Images from JMA's Himawari satellites provide useful information for Kosa monitoring. The Dust RGB image from the Himawari-8 satellite for 12 UTC on 27 March 2018 in Figure 7 shows that dust (in magenta) was swept up into a low-pressure system over northeastern China. Major dust storms making visibility less than 2 km were observed at meteorological stations throughout China and Mongolia (Figure 8) in association with the event. Dust RGB images are composites of three thermal infrared Himawari observation bands, allowing identification of dust storms both during the day and at night. Figure 9 shows a True Color Reproduction (TCR) image* from Himawari-8 for 00 UTC on 29 March 2018 (i.e., 36 hours after observation of significant dust storms in China and Mongolia), and illustrates how dust transported to Japan by the low-pressure system covered a large area of Japan. Kosa was observed at several manned stations in Japan on 28 and 29 March 2018 (Figure 10). TCR imagery provides vivid images of atmospheric dust in the daytime.

(Daisaku Uesawa, Atmospheric Environment Division)

*True Color Reproduction imagery

True Color Reproduction (TCR) technology enables the display of earth images taken from space in a way that is familiar to the human eye. The imagery consists of data from three visible bands (Band 1, 2 and 3), one near-infrared band (Band 4) and one infrared band (Band 13). For color reproduction, the RGB chromaticity of AHI is converted to sRGB (an international standard for RGB color space). In this process, as an alternative to the bi-spectral hybrid green method outlined by Miller et al. (2016), the green band is optimally adjusted using Band 2, 3 and 4. To make the imagery more vivid, atmospheric correction (Rayleigh correction, Miller et al., 2016) is also applied. Software for this purpose is provided by the Cooperative Institute for Research in the Atmosphere (CIRA) established by NOAA/NESDIS and Colorado State University in the United States of America.

Acknowledgement

The imagery was developed on the basis of collaboration between the JMA Meteorological Satellite Center and the NOAA/NESDIS/STAR GOES-R Algorithm Working Group imagery team. We would like to acknowledge them for the collaboration and their permission to use the software.

Reference

Miller, S., T. Schmit, C. Seaman, D. Lindsey, M. Gunshor, R. Kohrs, Y. Sumida, and D. Hillger, 2016: A Sight for Sore Eyes - The Return of True Color to Geostationary Satellites. Bull. Amer. Meteor. Soc. doi: 10.1175/BAMS-D-15-00154.1

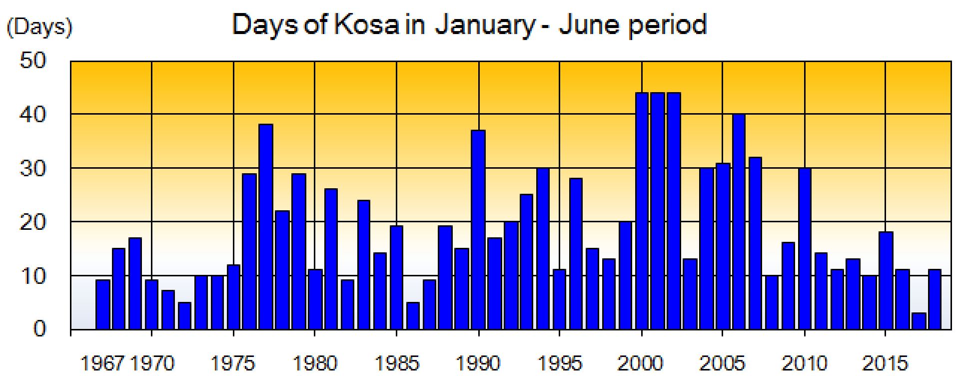


Figure 6 Annual numbers of days on which Kosa was observed at one or more meteorological stations in Japan from January to June
For more on the remarkably low frequency recorded in 2017, see TCC News No. 49.

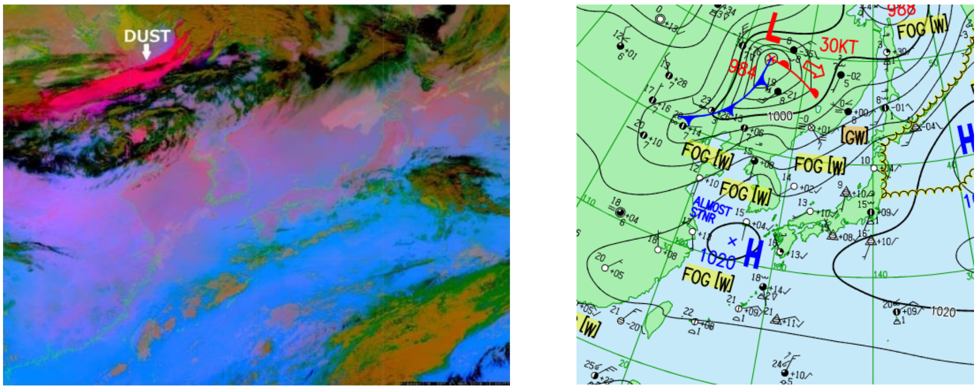


Figure 7 (Left) Dust RGB image from the Himawari-8 satellite, and (right) a synoptic chart for 12 UTC on 27 March 2018
Dust is shown in magenta.

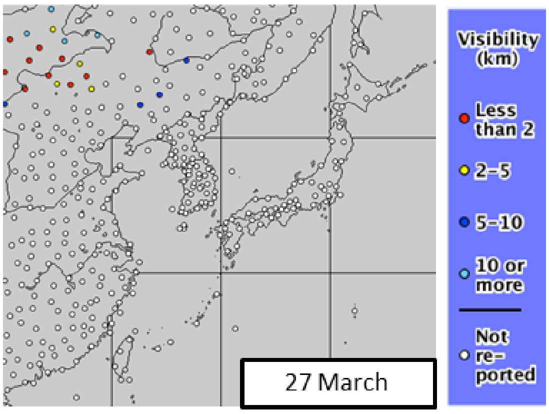


Figure 8 Meteorological stations reporting dust or sand for present weather and visibility for 27 March 2018
Visibility is denoted by color plots.

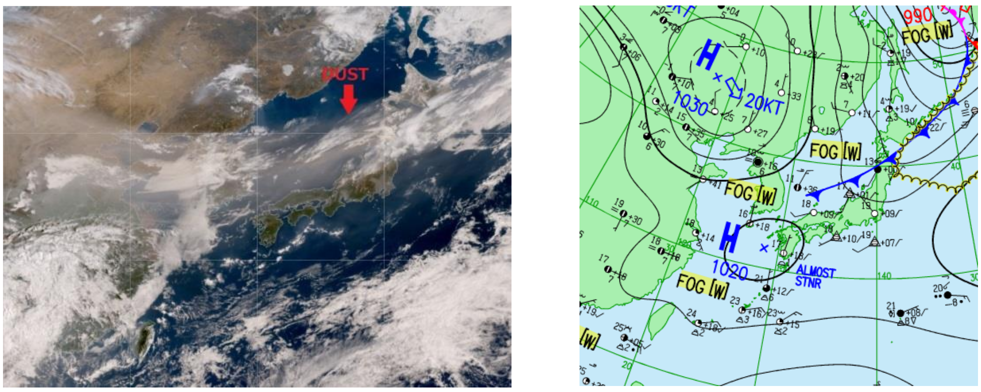


Figure 9 (Left) True Color Reproduction image* from the Himawari-8 satellite, and (right) synoptic chart for 00 UTC on 29 March 2018

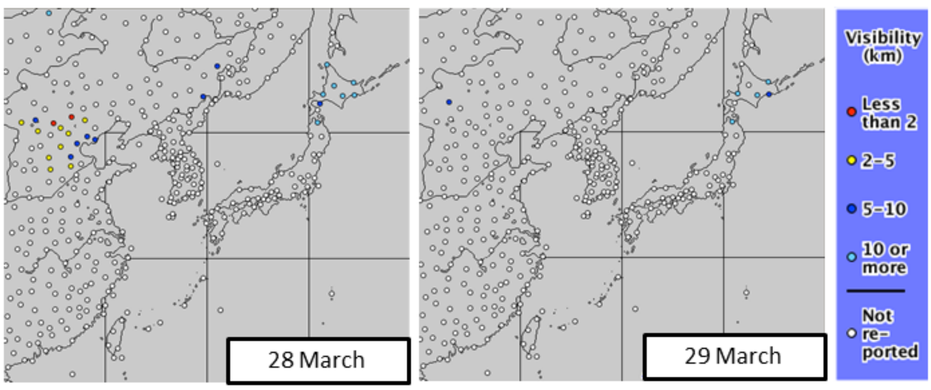


Figure 10 Meteorological stations reporting dust or sand for present weather and visibility for 28 – 29 March 2018
Visibility is denoted by color plots.

TCC Experts Visit the Philippines

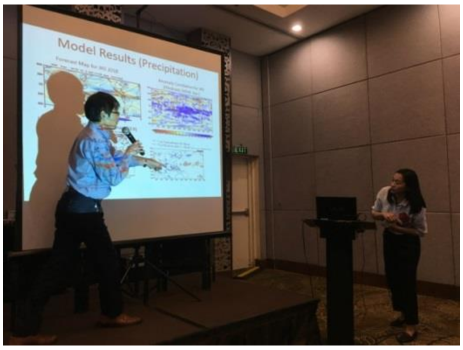
TCC arranges expert visits to National Meteorological and Hydrological Services (NMHSs) to support capacity building for climate services and facilitate the effective transfer of technical expertise on TCC products and tools.

As part of such efforts, two TCC experts visited the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) from 10 to 12 July 2018 to provide training regarding the generation of seasonal forecast. The training was also intended to promote the effective use of TCC's Interactive Tool for Analysis of the Climate System (iTacs, a web-based application). The visit was conducted as follow-up to the 2017 TCC Training Seminar (see TCC News No. 51 and the TCC website for details).

With the attendance of 8 staff from regional branches of PAGASA and a dozen from its headquarters, the TCC trainers began with a practice session for basic iTacs operation. On the second day, presentations were given on expertise and techniques necessary to generate seasonal probabilistic forecast products using a statistical downscaling method. The trainers also outlined verification of probabilistic forecasts and related interpretation in terms of climatological and meteorological dynamics. Using this background expertise and the TCC's handy guidance tool, attendees produced seasonal forecasts for their own regions in the Philippines and gave presentations on their achievements. Another significant outcome of the seminar was the advanced iTacs operation expertise gained by the attendees.

The visit also provided valuable opportunities for TCC in terms of awareness regarding the latest status of PAGASA's climate services, and TCC staff engaged in fruitful discussions on future collaboration with PAGASA. TCC will continue to arrange expert visits to NMHSs in Southeast Asia and elsewhere as necessary to assist with operational climate services.

(Hiroshi Ohno and Yasushi Mochizuki, Tokyo Climate Center)



You can also find the latest newsletter from Japan International Cooperation Agency (JICA).
JICA's World (July 2018)
https://www.jica.go.jp/english/publications/j-world/1807.html
JICA's World is the quarterly magazine published by JICA. It introduces various cooperation projects and partners along with the featured theme. The latest issue features "The Gender Issues in Conflict and Disaster Supporting the weak and vulnerable in our society".

Any comments or inquiry on this newsletter and/or the TCC website would be much appreciated. Please e-mail to tcc@met.kishou.go.jp.
(Editors: Yasushi Takatsuki, Yasushi Mochizuki and Atsushi Minami)

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