The State of the Western North Pacific in the First Half of 2008

by Shiro Ishizaki

Sea surface temperature

Figure 1 shows the monthly mean sea surface temperature (SST) anomalies in the western North Pacific from January to June 2008, computed with respect to JMA's (Japan Meteorological Agency) 1971–2000 climatology. Monthly mean SSTs are calculated from JMA's MGDSST (**M**erged satellite and *in-situ* data **G**lobal **D**aily **SST**), which is based on NOAA/AVHRR data, microwave sensor (AQUA/AMSR-E) data and *in-situ* observations. Time series of 10-day mean SST anomalies are presented in **Figure 2** for the 9 regions indicated in the bottom panel.

In January and February, SSTs were above normal in the area between 15°N and 35°N. In particular, positive SST anomalies exceeding +1°C were found around 25°N, 130°E and east of 150°E, and the latter anomalies remained until June. In March, SSTs were below normal in the seas south of Japan (*e.g.*, Regions 6 and 9 in **Fig. 2**), and negative SST anomalies exceeding –1°C appeared in April. In May and June, negative SST anomalies were also found in the seas east of the Philippines. From January to April, SSTs were below normal in the seas southeast of the Kamchatka Peninsula, where SST anomalies turned positive in May.

Kuroshio and Oyashio

Figure 3 shows the Kuroshio path for the first half of 2008, at intervals of 10 days. In January, the Kuroshio took a meandering path off Tokai (135–140°E). In February, it began to follow a straight path in the same area, and in mid-April returned to a meandering path off Tokai. In May and June, the Kuroshio flowed south of Hachijo Island (33°N, 140°E).

Figure 4 presents the subsurface temperatures at a depth of 100 m in the seas east of Japan for March 2008. This chart is based on the numerical ocean data assimilation system (JMA's Ocean Comprehensive Analysis System).

The Oyashio cold water (defined as areas with temperatures of less than 5°C in **Fig. 4**) is known to extend southward in spring and return northward from summer until autumn (indicated by the green line in **Fig. 5**). In September, November and December 2007, the coastal branch of the Oyashio cold water was indistinct, but it extended almost to its normal location in March 2008 and moved significantly northward in May (**Fig. 5**). Its southernmost point in March was 39.0°N, 142.5°E, which is 50 km north of its normal location.

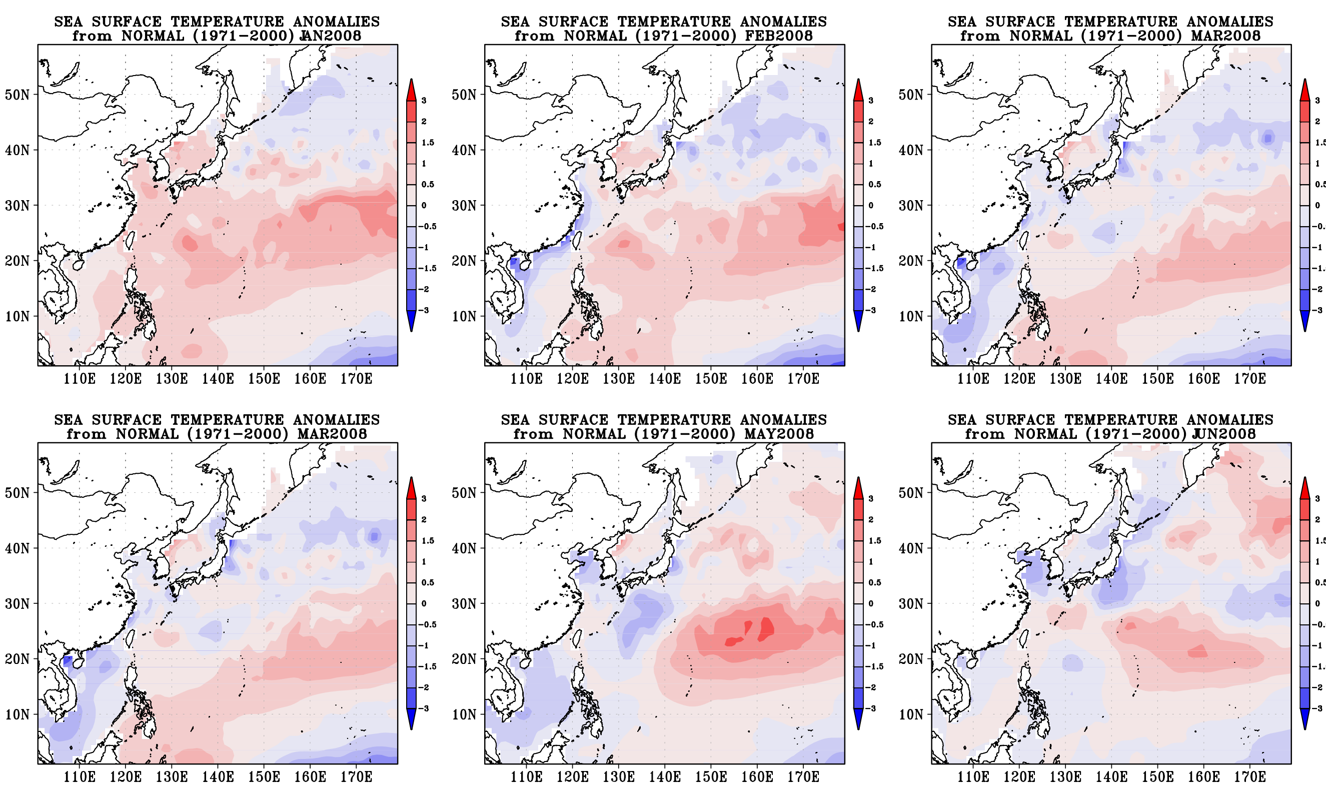

Fig. 1 Monthly mean sea surface temperature anomalies (°C) from January to June 2008. Anomalies are deviations from JMA's 1971–2000 climatology.

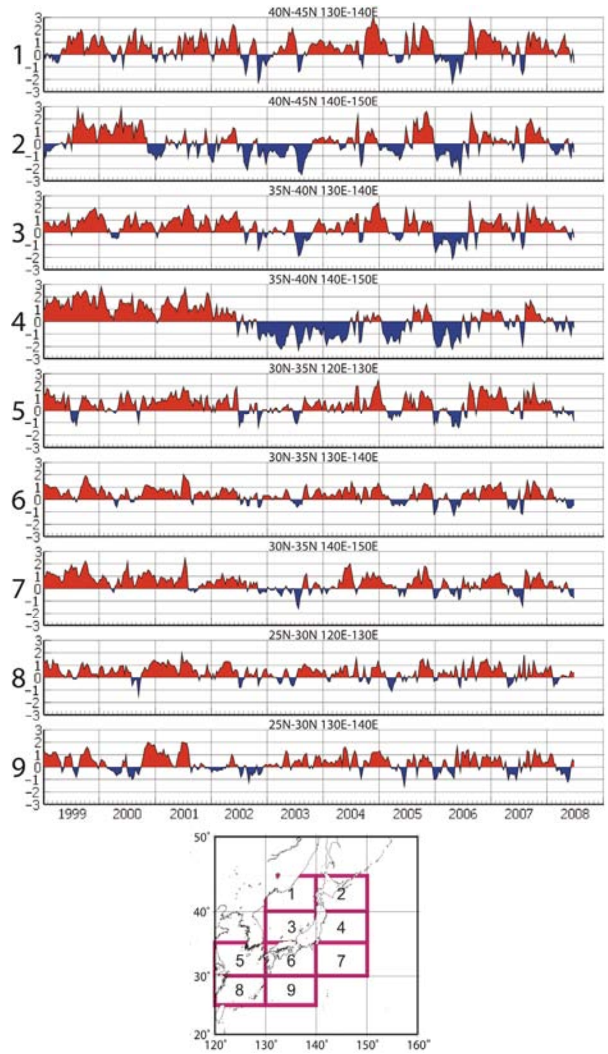

Fig. 2   Time series of 10-day mean sea surface temperature anomalies (°C) averaged for the sub-areas shown in the bottom panel. Anomalies are deviations from JMA's 1971–2000 climatology.

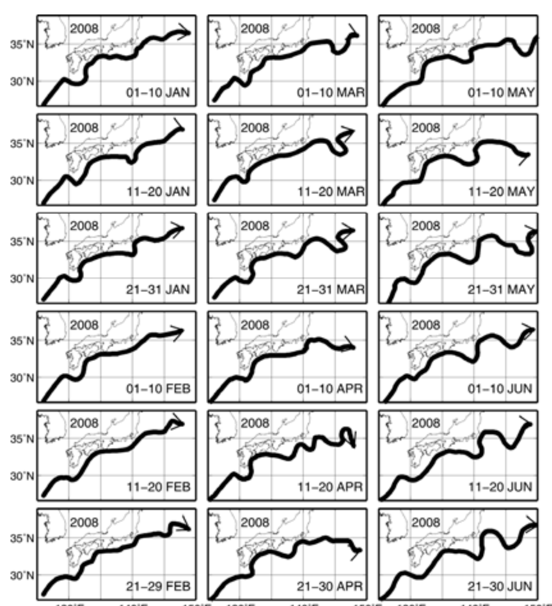

Fig. 3   Location of the Kuroshio path from January to June 2008.

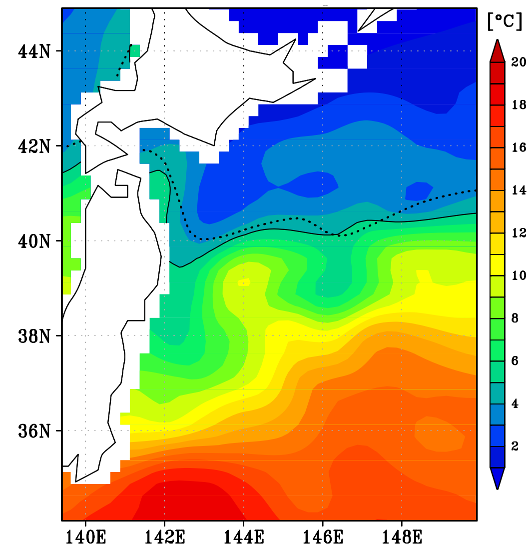

Fig. 4   Subsurface temperatures (°C) at a depth of 100 m east of Japan for March 2008. The solid line denotes the 5°C isotherm, while the dotted line is its climatology (30-year average values from 1971 to 2000).

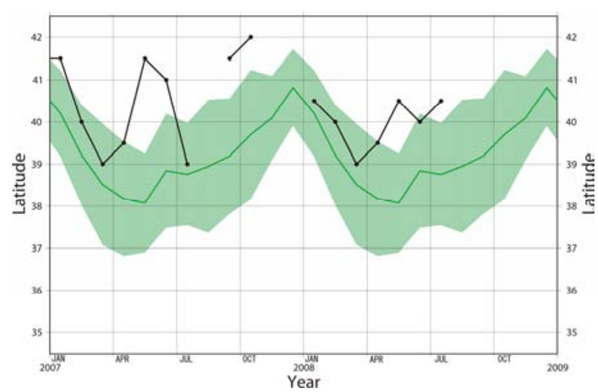

Fig. 5   The southernmost position of the coastal branch of the Oyashio cold water from January 2007 to July 2008 (black line), and the 30-year average values (green line), with a range of one standard deviation (green shading) from 1971 to 2000. In September, November and December 2007, no distinct coastal branch was detected.

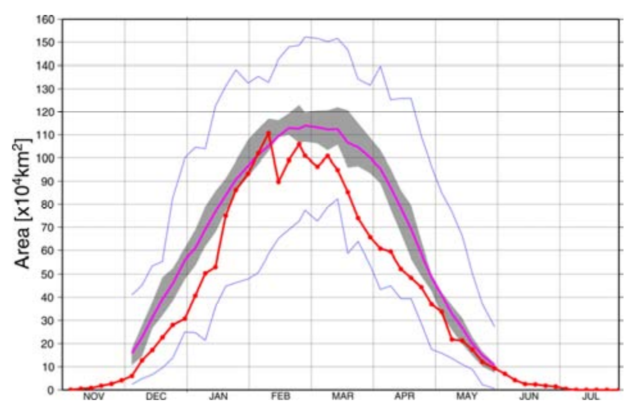

Fig. 6   Time series of sea ice extent in the Sea of Okhotsk from November to July 2008 (red line: 2007–2008 analysis; pink line: JMA's 1971–2000 climatology; blue lines: maximum/minimum sea ice extent since 1971; gray area: normal range).

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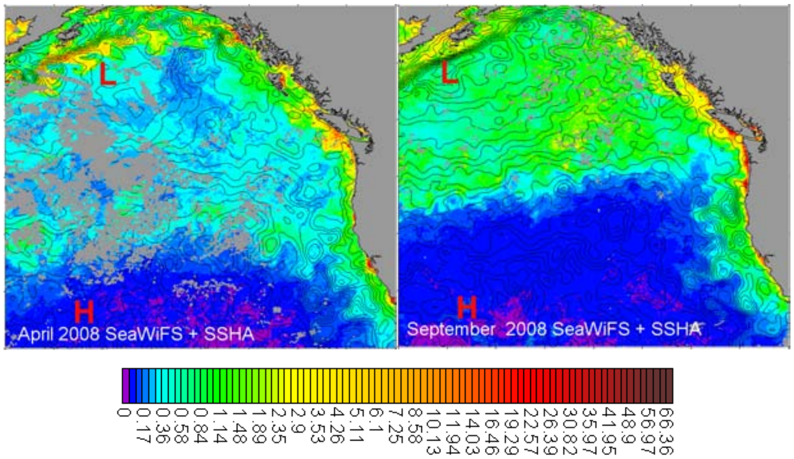

Fig. 2 Monthly composites of sea surface chlorophyll in April and September 2008, as measured by SeaWiFS, plotted over contours of sea surface height anomaly. Colour scale for chlorophyll in mg m $^{-3}$ is at the bottom of the figure. SeaWiFS data provided by NASA. Black contours of sea surface height anomaly (SSHA) are at intervals of 5 cm. Lowest and highest sea levels are indicated by L and H. SSHA for this image is based on data provided by AVISO, and referenced to the dynamic ocean topography of Foreman et al. *(*Geophys. Res. Lett. *2008, L22606) that resolves sharp changes in sea level in the continental margin.*

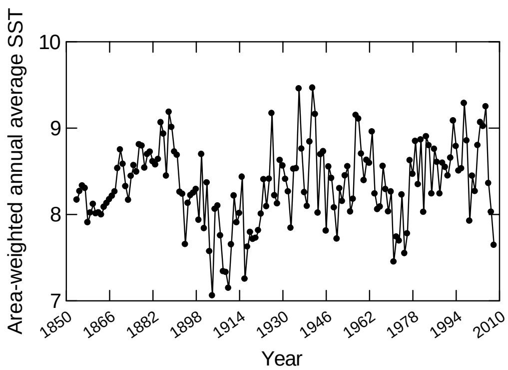

Fig. 3 Annual area-weighted average of SST in the Gulf of Alaska (1854–2008).

The surface of the Gulf of Alaska was cold in 2008. An area-weighted annual average SST, computed from the NOAA/Extended Reconstructed SST database, in the region 50–60°N, 165°W–coast, reveals that 2008 was the tenth coldest year in the Gulf of Alaska since 1854 (**Fig. 3**). The final month of 2008 had the highest value of a North Pacific Index (not shown, but calculated from NOAA/NCEP (National Center for Environmental Prediction) sea level pressure data after Trenberth and Hurrell, 1994) observed in any December since the beginning of the NCEP re-analysis period in 1948.

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Sea ice in the Sea of Okhotsk

The extent of sea ice in the Sea of Okhotsk was below normal (30-year average values from 1971 to 2000) throughout almost the whole period from December 2007 to May 2008 (**Fig. 6**). It reached its seasonal maximum of 110.69×10^4 km^2 on February 10, exceeding the highest value for the previous season. The accumulated sea ice extent, defined as the sum of the 5-day sea ice areas from December to May, was 2058.54×10^4 km^2. This was smaller than the previous season, and its ratio to the normal value (1971–2000 average of 2574.3×10^4 km^2) was about 80%.

Shiro Ishizaki (s_ishizaki@met.kishou.go.jp) is a Scientific Officer of the Office of Marine Prediction at the Japan Meteorological Agency (JMA). He works as a member of a group in charge of oceanic information in the western North Pacific. Using the data assimilation system named "Ocean Comprehensive Analysis System", this group provides an operational surface current prognosis (for the upcoming month) as well as seawater temperature and an analysis of currents with a 0.25 × 0.25 degree resolution for waters adjacent to Japan. Shiro is now involved in developing a new analysis system for temperature, salinity and currents that will be altered with the Ocean Comprehensive Analysis System.