The state of the western North Pacific in the first half of 2004

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Mr. Toshiyuki Sakurai is a scientific officer of the Office of Marine Prediction at the Japan Meteorological Agency (JMA). He is working as a member of a group in charge of oceanic information in the western North Pacific. Using a new "Ocean Comprehensive Analysis System" (in operation since January 2001), this group produces surface and subsurface temperature, salinity and current maps with 0.25×0.25 resolution in waters adjacent to Japan. Monthly averaged fields obtained from the system are included in the "Monthly Ocean Report" published by JMA. Mr. Sakurai is now involved in developing a new daily analysis system for sea surface temperature in the global ocean, using in situ *observations and data from several satellites with infrared and microwave sensors.*

Sea surface temperature

Figure 1 shows monthly mean sea surface temperature (SST) anomalies in the western North Pacific from January to June 2004, computed with respect to JMA's 1971-2000 climatology. JMA introduced "Merged satellite and *in situ* data Global Daily SST (MGDSST)" analysis in April 2004. MGDSST is calculated from infrared sensor (AVHRR/NOAA) and microwave sensor (AMSR-E/AQUA) data, whose biases are corrected with *in situ* SSTs.

Positive SST anomalies exceeding +1ºC were found from south of Japan to around 35ºN, 165ºE in May. Positive SST anomalies exceeded +2ºC from 30ºN, 140ºE to 40ºN, 170ºE in June. Positive SST anomalies in the seas south of Japan (regions 6 and 9 of Fig. 2) and the East China Sea (region 8 of Fig. 2) have persisted for the last few years. Negative SST anomalies exceeding -1ºC were found around 37ºN, 145ºE from January through June, and around 25ºN, 175ºE in June. The negative SST anomalies in the seas east of Japan lasted from November 2002 to June 2004 (region 4 of Fig. 2).

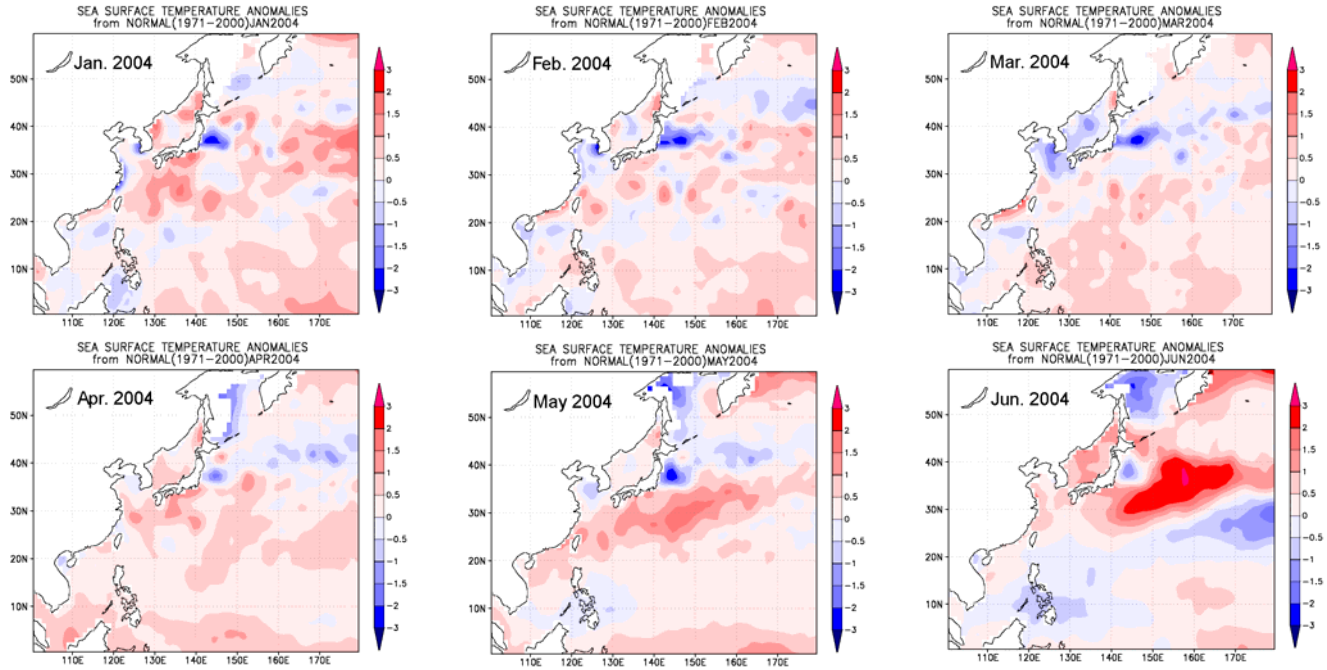

Fig. 1 Monthly mean sea surface temperature anomalies (ºC) from January to June 2004. Anomalies are deviations from JMA's 1971-2000 climatology.

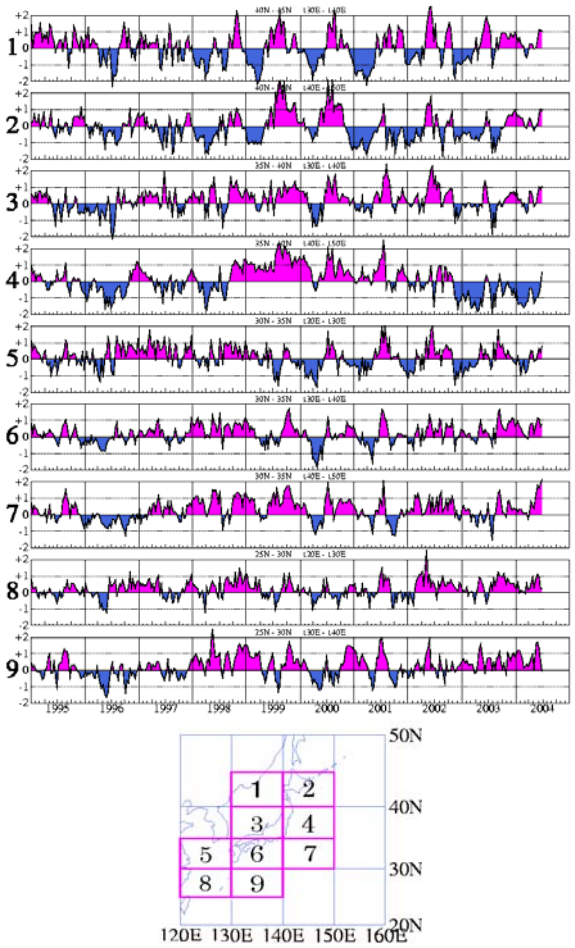

Fig. 2 Time series of the ten-day mean sea surface temperature anomalies (ºC) from JMA's 1971-2000 climatology for the areas shown in the bottom panel.

Kuroshio and Oyashio

In seas southeast of Kyushu, a small meander was formed in November 2003, and its scale was reduced from late February to early March. However, it rapidly developed and moved eastward from mid-March to early April, and the Kuroshio flowed far-off the coasts in the south of Shikoku after mid-April (Fig. 3).

Figure 4 shows subsurface temperature at a depth of 100 m east of Japan for March 2004. This chart is based on the numerical ocean data assimilation system (JMA's Ocean Comprehensive Analysis System).

The Oyashio cold water (area colder than 5ºC in Fig. 4) is known to extend southward at its southernmost position in the spring and return northward from summer to autumn (green line of Fig. 5). The coastal branch of the Oyashio cold water extended southward considerably in March 2004 and reached 36.5ºN, 142ºE, which was south of the climatological mean by 220 km (Fig. 4). It returned to almost the same latitude as the climatology in April and May, and extended southward again to 160 km south of the climatology in June (Fig. 5).

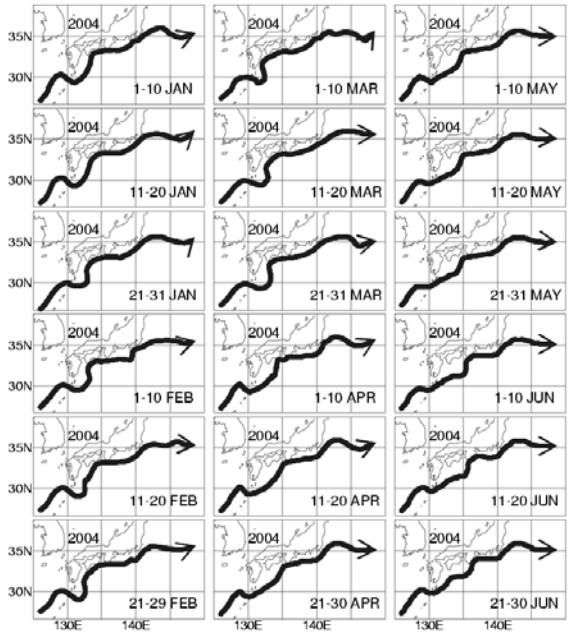

Fig. 3 Location of the Kuroshio axis from January to June 2004.

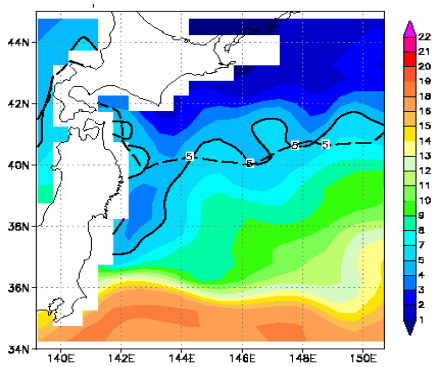

Fig. 4 Subsurface temperature (ºC) at a depth of 100 m east of Japan for March 2004. Solid lines denote 5ºC isotherm, and dashed lines that of the climatology (30-year averaged values from 1971 to 2000).

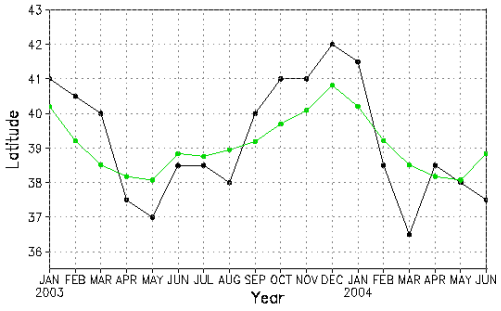

Fig. 5 The southern-most position of the coastal branch of the Oyashio cold water from January 2003 to June 2004 (black line) and the climatology (green line, 30-year averaged values from 1971 to 2000).

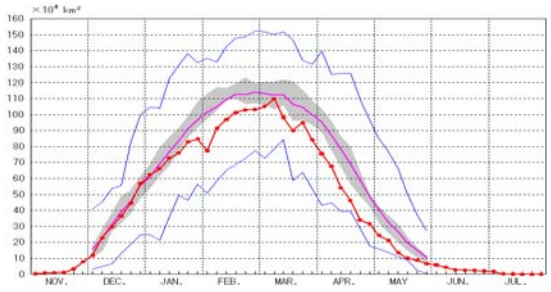

Fig. 6 Time series of sea ice extent in the Sea of Okhotsk from November 2003 to July 2004 (pink line - JMA's 1971-2000 climatology; red line – 2003-2004 analysis; blue line - maximum/minimum of sea ice extent in the period 1971-2003; grey area - within the normal range.

Sea ice in the Sea of Okhotsk

The extent of sea ice in the Sea of Okhotsk was near the climatology (30-year averaged values from 1971 to 2000) from November 2003 to mid-January 2004 (Fig. 6). After late January, it was below the climatological mean. The sea ice area reached its maximum on March 10 at 109.91× 10^4 km^2, which is less than the climatology. This means that about 70% of the Sea of Okhotsk was covered with sea ice (Fig. 7). A small amount of sea ice flowed into the Pacific from mid-February to mid-April.

Fig. 7 Sea ice extent (white area) in the Sea of Okhotsk on March 10, 2004.