The State of the Western North Pacific in the Second Half of 2009

by Shiro Ishizaki

Sea surface temperature

Figure 1 shows the monthly mean sea surface temperature (SST) anomalies in the western North Pacific from July to December 2009, 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, AQUA/AMSR-E data and *in-situ* observations. Time series of 10-day mean SST anomalies are presented in Figure 2 for 9 regions indicated in the bottom panel.

Positive SST anomalies exceeding +1ºC prevailed around 38ºN, 165ºE during the entire period. In July, positive SST anomalies exceeding +1ºC were found along 15ºN east of 150ºE, and SSTs were below normal around 28ºN, 162ºE. These anomalies were reduced in magnitude and disappeared in October. Positive SST anomalies dominated in the equatorial Pacific, especially east of 160ºE. In July and August, SSTs were generally above normal to the south of Japan. From July to August, SSTs were below normal in the Sea of Japan, where their anomalies turned positive in October (regions 1 and 3 in Fig. 2). After August, positive SST anomalies exceeding +1ºC were found in the East China Sea (region 8 in Fig. 2).

Kuroshio path

Figure 3 shows a time series of the location of the Kuroshio path for the reviewed period. The Kuroshio took a non-large-meandering path off the coast to the south of Honshu Island (between 135ºE and 140ºE). In September, the latitude of the Kuroshio axis at the Izu Ridge (about 140ºE) moved northward from about 32ºN (south of Hachijo Island) to about 33.5ºN (north of Hachijo Island). After November, the Kuroshio flowed at about 33ºN (around Hachijo Island).

Carbon dioxide

JMA has been conducting observations for carbon dioxide (CO_2) in the surface ocean and atmosphere in the western North Pacific, on board the R/V *Ryofu Maru* and the R/V *Keifu Maru*. Figure 4 illustrates the distribution of the difference in CO_2 partial pressure (pCO_2) between the surface seawater and the overlying air (denoted as ΔpCO_2) observed in the western North Pacific for each season of 2009. The sign of ΔpCO_2 determines the direction of CO_2 gas exchange across the air–sea interface, indicating that the ocean is a source (or sink) for atmospheric CO_2 in the case of positive (or negative) values of ΔpCO_2.

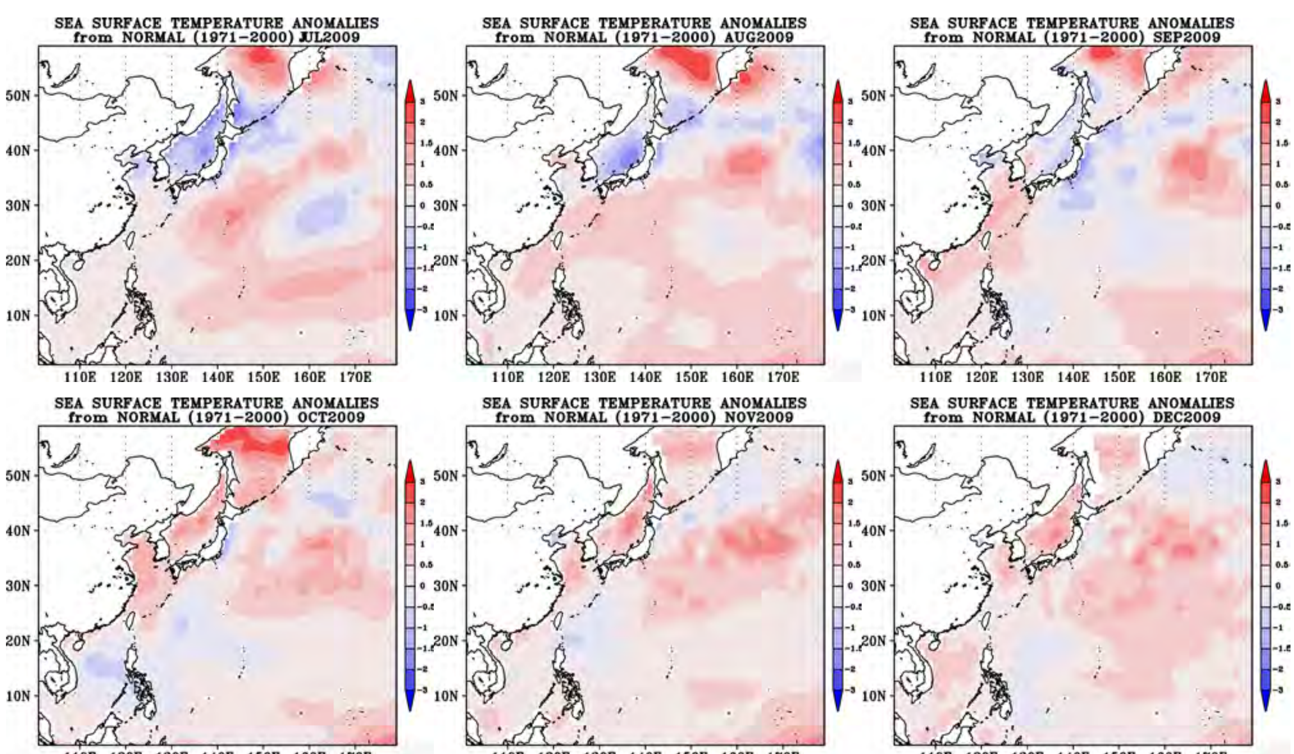
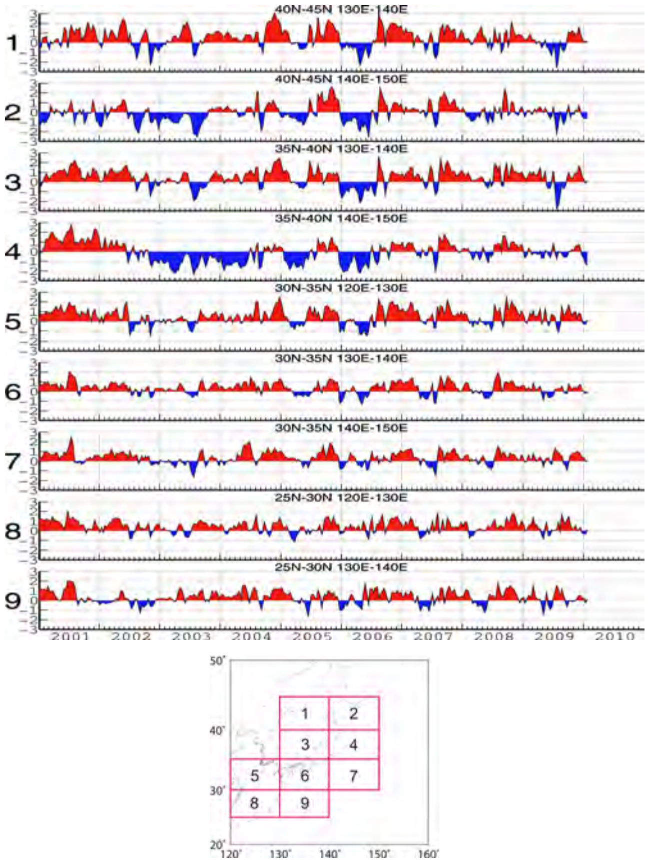
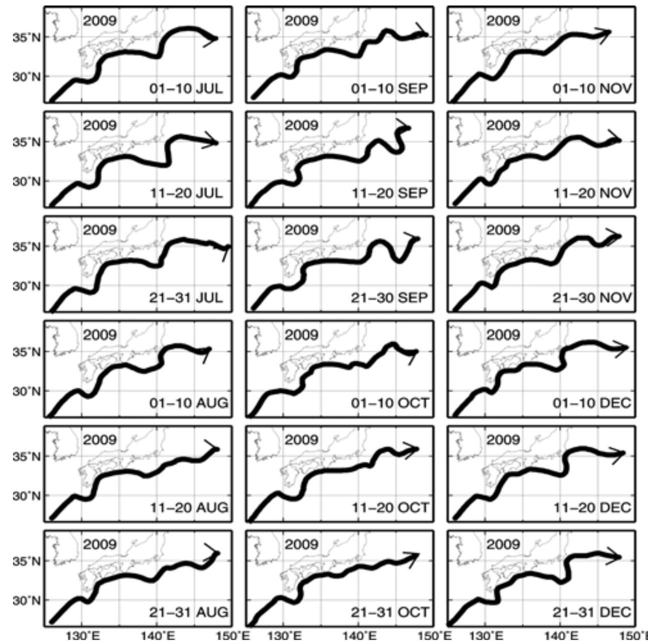


Fig. 1 Monthly mean SST anomalies (°C) from July to December 2009. Anomalies are deviations from JMA's 1971–2000 climatology.





Left column:

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

Right column:

Fig. 3 Location of the Kuroshio path from July to December 2009.

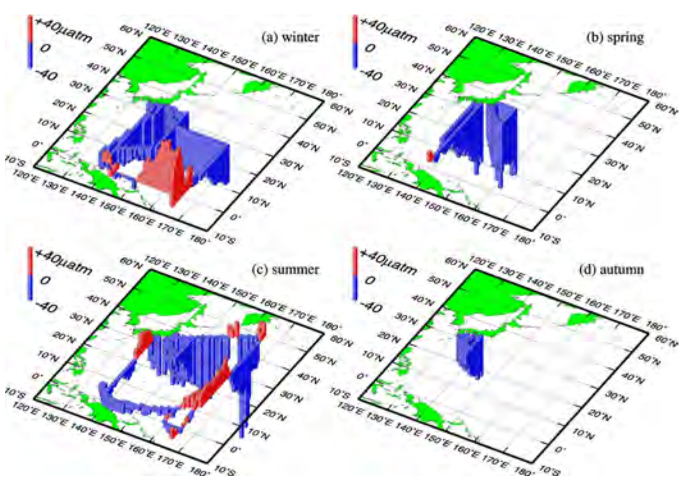


Fig. 4 Difference in CO_2 partial pressure between the ocean and the atmosphere in the western North Pacific in 2009. Red/blue pillars show that oceanic pCO_2 is higher/lower than atmospheric pCO_2. Seasons are for the Northern Hemisphere.

In the subtropical region, typically between 10–35ºN, the ocean widely acted as a CO_2 sink in the winter and spring of 2009. Some CO_2 source areas were found in the summer of 2009.

In the eastern part of the equatorial region, the ocean acted as a strong CO_2 source in the winter of 2008 because of the presence of water with a high concentration of CO_2 in the area. Even though the previous La Niña event had ended in the spring of 2008, trade winds were still intense in the western and central Pacific. This suggests that the CO_2-rich water found in the eastern area was derived from the eastern equatorial Pacific, where the surface water has high CO_2 concentration. The intense trade winds weakened after the spring, and no strong CO_2 source area was found in the summer of 2009.

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.