The State of the Western North Pacific in the Second Half of 2010

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 2010, 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, MetOp/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 particular, positive anomalies exceeding +3ºC were found there in October. From July to November, SSTs were below normal between 45ºN and 52ºN. In the equatorial Pacific, positive SST anomalies dominated west of 150ºE, while negative values were seen east of 160ºE. From August to October, SSTs were above normal in the seas around Japan. In August and September, positive SST anomalies exceeding +3ºC prevailed in regions 1, 2 and 3. In July and October, negative SST anomalies were found in the East China Sea.

Kuroshio path

Figure 3 shows time series of the location of the Kuroshio path during 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 August, the latitude of the Kuroshio axis at the Izu Ridge (about 140ºE) moved southward from about 34ºN (north of Hachijo Island) to about 33ºN (around Hachijo Island). At the end of December, the Kuroshio was flowing at about 34ºN (north of Hachijo Island).

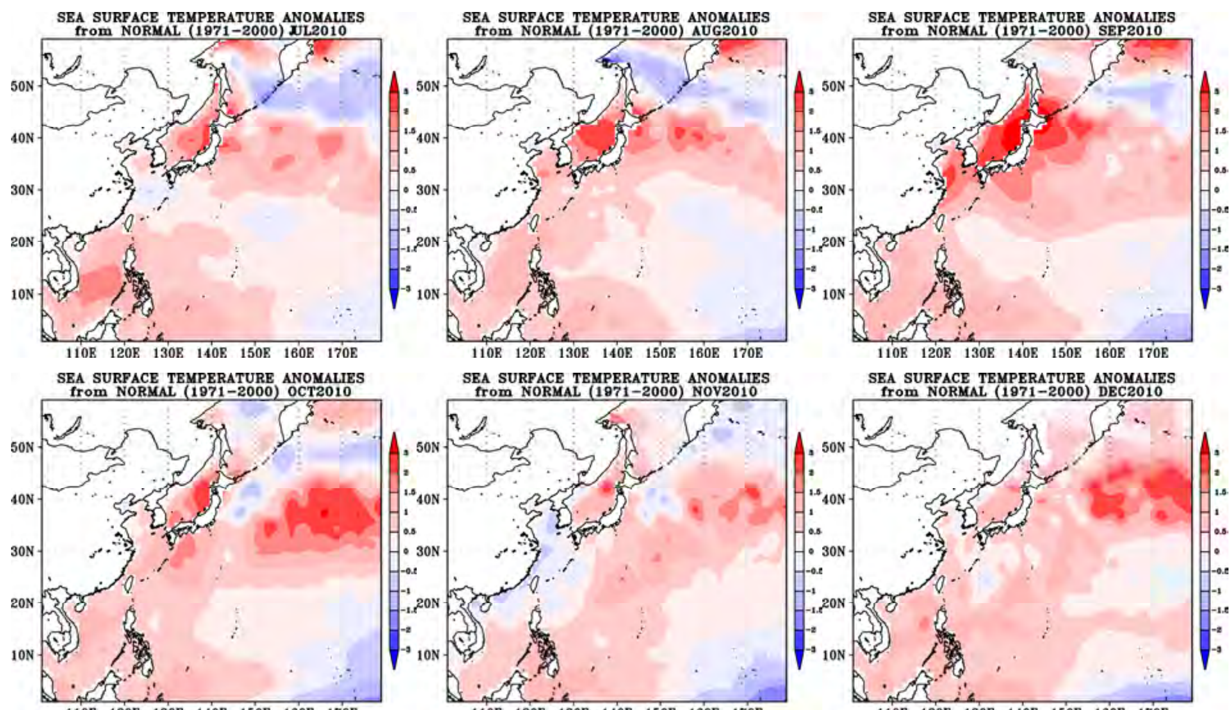

Fig. 1 Monthly mean SST anomalies (°C) from July to December 2010. Anomalies are deviations from JMA's 1971–2000 climatology.

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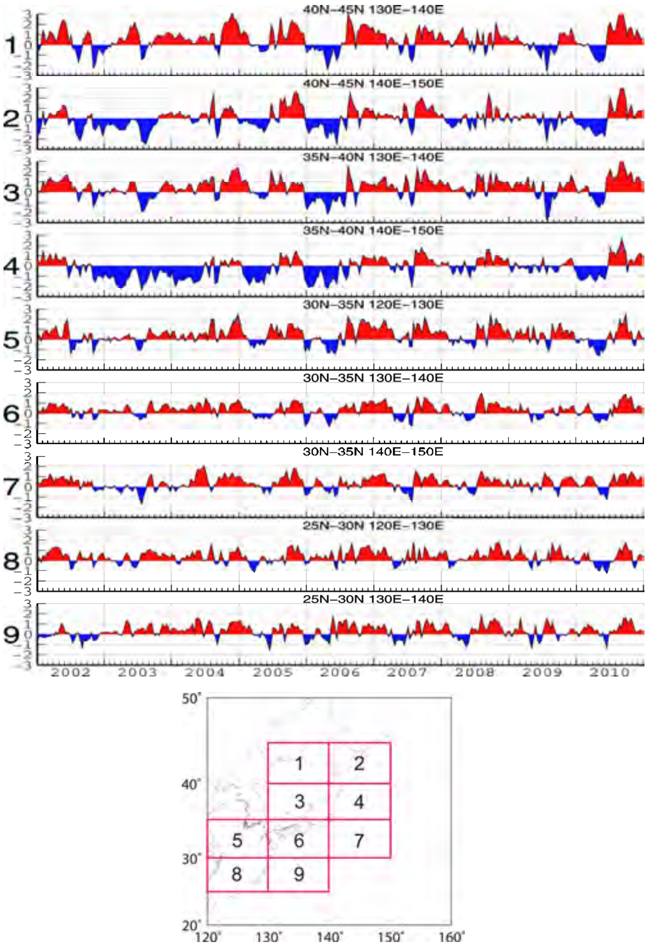

Fig. 2 Time series of 10-day mean SST anomalies (°C) averaged for the sub-areas shown in the bottom panel. Anomalies are deviations from JMA's 1971–2000 climatology.

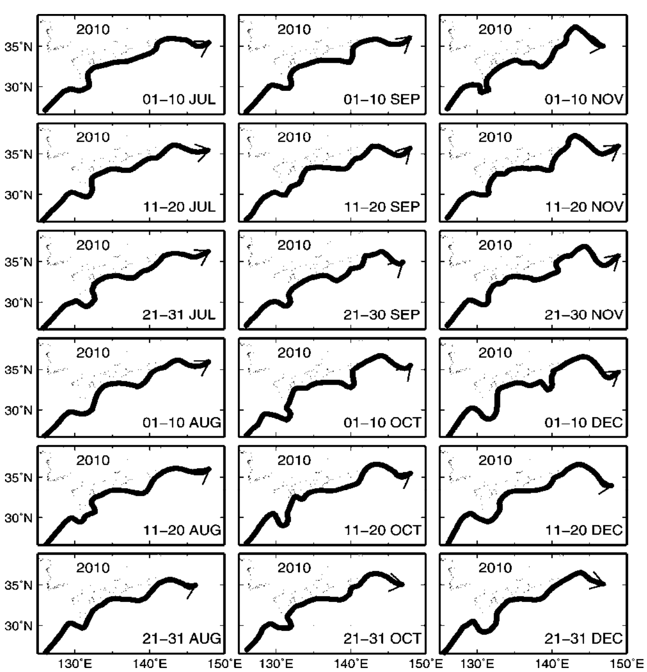

Fig. 3 Location of the Kuroshio path from July to December 2010.

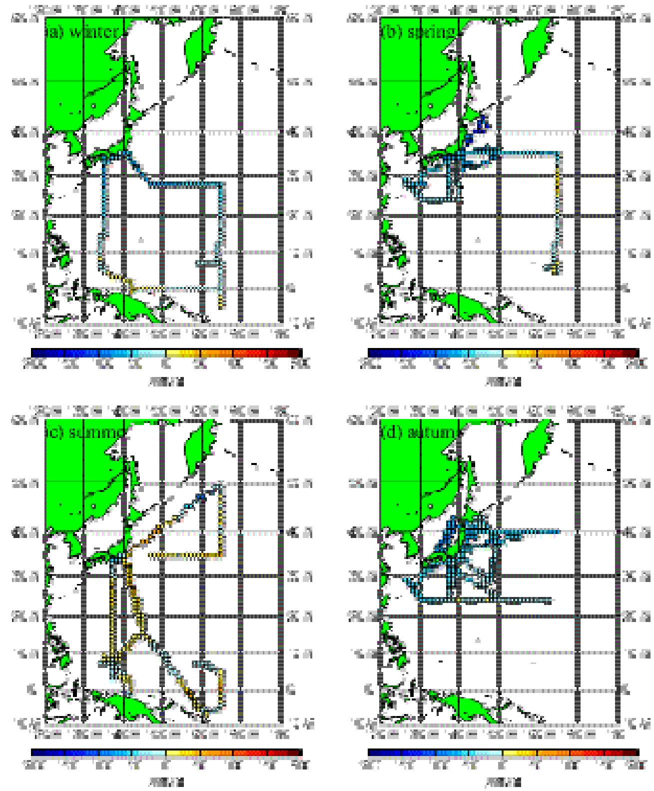

Fig. 4 Difference in CO_2 partial pressure between the ocean and the atmosphere in the western North Pacific in 2010: (a) winter (January–March), (b) spring (April–June), (c) summer (July–September) and (d) autumn (October –December).

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 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 2010. 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.

In the subtropical region, typically between 10–35ºN, the ocean widely acted as a CO_2 sink in the winter, spring and autumn, and as a CO_2 source in the summer of 2010 due to thermodynamically increased pCO_2 in seasonally warmed seawater. The greatest difference in pCO_2 values (–150 µatm) was found around 40ºN, 145ºE in spring, and was probably caused by enhanced biological activity. In the equatorial region, the ocean east of 150ºE acted as a weak CO_2 sink in the winter of 2010, but the region turned into a CO_2 source in the summer. In association with the La Niña event that occurred in the summer, eastern CO_2-rich surface water may have moved westward in response to strengthened easterly trade winds in the central equatorial Pacific.