The State of the Western North Pacific in the Second Half of 2011

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 2011, 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. In July, SSTs were above normal north of 30ºN and east of 170ºE. The positive SST anomalies extended westward, and anomalies exceeding +1ºC prevailed east of 145ºE in September. These anomalies shrunk after October and were observed only east of 165ºE in December. SSTs were below normal in the seas south of Japan (around 20ºN, 130ºE) in July. The negative SST anomalies extended eastward, and anomalies exceeding –1ºC appeared around 25ºN, 140ºE in September. In November, positive SST anomalies exceeding +1ºC prevailed in regions 3, 5, 6, 8 and 9 (Fig.2).

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). The latitude of the Kuroshio axis at the Izu Ridge (~140ºE) was about 34ºN (south of Miyake Island) during most of this time. From the end of September to the beginning of October, the Kuroshio was flowing at about 33ºN (around Hachijo Island).

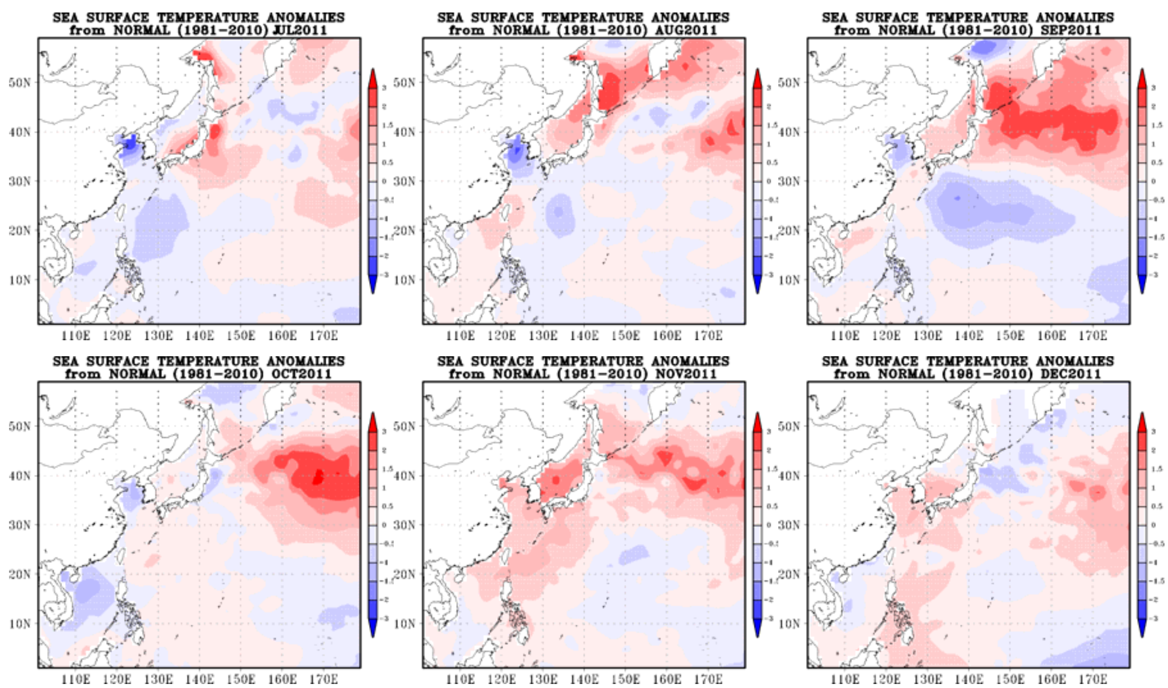

Fig. 1 Monthly mean SST anomalies (°C) from July to December 2011. Anomalies are deviations from JMA's 1971–2000 climatology.

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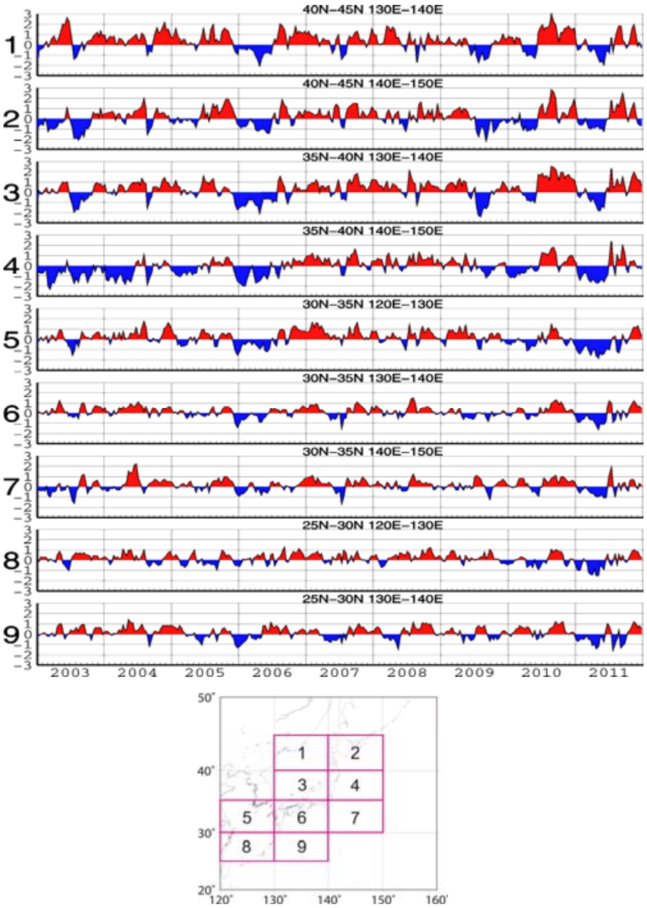

Fig. 2 Time series of 10-day mean SST anomalies (°C) averaged for the sub-areas shown in the bottom panel. Anomalies are deviations from JMA's 1971–2000 climatology.

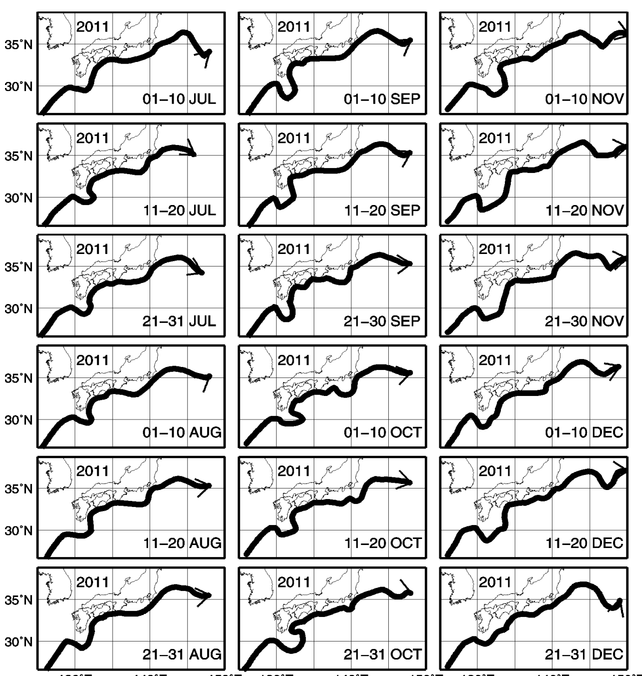

Fig. 3 Location of the Kuroshio path from July to December 2011.

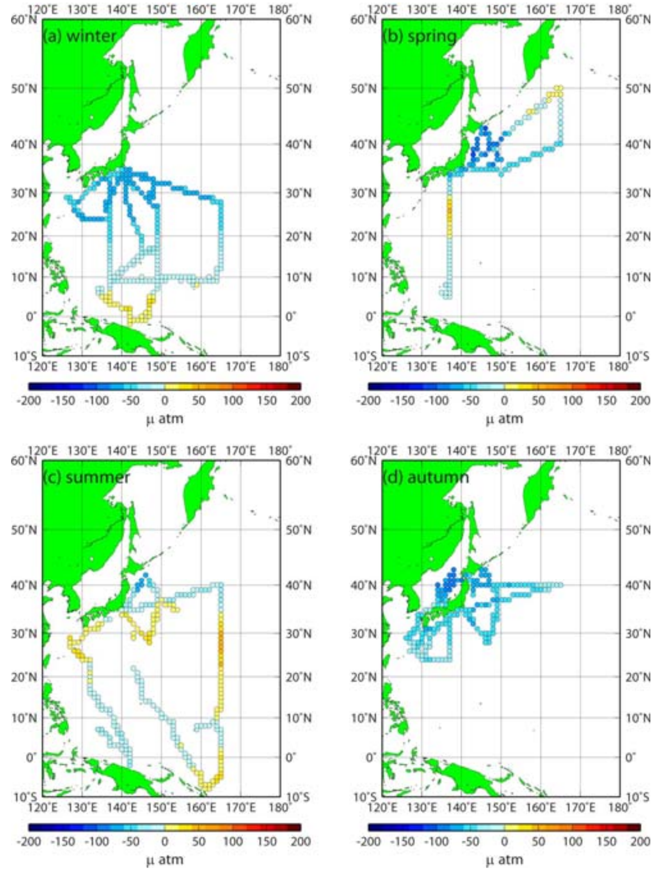

Fig. 4 Difference in CO_2 partial pressure between the ocean and the atmosphere in the western North Pacific in 2011: (a) winter (January–March), (b) spring (April–June), (c) summer (July–September) and (d) autumn (October –December).

Carbon dioxide

JMA has been conducting observations for carbon dioxide (CO_2) in the 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 2011. 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 winter and autumn of 2011, the ocean widely acted as a CO_2 sink, with the exception of the equatorial region. In the spring and summer, subtropical regions turned into a weak CO_2 source due to thermodynamically increased pCO_2 in seasonally warmed seawater. The greatest negative value of ΔpCO_2 (–107 μatm) was found around 40ºN, 145ºE in spring, and was probably caused by enhanced biological activity.