The state of the western North Pacific in the second half of 1998

Satoshi Sugimoto
Oceanographical Division
Climate and Marine Department
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku,
Tokyo 100-8122, JAPAN
E-mail: s_sugimoto@met.kishou.go.jp

Mr. Satoshi Sugimoto is Scientific Officer of the Oceanographical Division of the Climate and Marine Department at the Japan Meteorological Agency (JMA). He is working as a member of a group in charge of monitoring and forecasting sea surface temperature and sea surface current in the western North Pacific. Based on in situ and satellite data, this group provides various oceanographical products. One of the main products is the "Monthly Ocean Report", which is published and distributed by JMA every month. Mr. Sugimoto is now involved in developing a new analysis system for sea surface and subsurface temperature to improve sea surface temperature forecasts in the western North Pacific.

Sea surface temperature

Figure 1 shows monthly mean sea surface temperature (SST) anomalies in the western North Pacific from July to December 1998, computed with respect to JMA's 1961-90 climatology. JMA has operationally produces ten-day and monthly mean SST analysis for 1x1 degree grid points over the western North Pacific, using *in situ* observations. Another daily SST analysis has been performed in seas around Japan, between 20˚N and 50˚N from 110˚E to 160˚E. In this analysis, satellite-derived SST (NOAA/AVHRR) and *in situ* observations are both used. JMA adopts SST of this analysis for that region in the 1x1 degree SST analysis over the western North Pacific from January 1998.

It is remarkable that positive SST anomalies exceeding +1˚C were observed from 160˚E to 170˚W along 40˚N in August 1998, and anomalies exceeding +3˚C were found around 40˚N, 170˚E. These anomalies expanded and moved westward, and SST anomalies exceeding +1˚C prevailed along 30˚N in December.

In the western tropical Pacific, positive SST anomalies exceeding +0.5˚C prevailed west of 150˚E throughout 1998, exceeding +1˚C in the South China Sea and southeast of Philippines.

Time series of regional ten-day mean SST anomalies in the western North Pacific (*Figure 2*) show that SST anomaly of 1998 for region D was the highest in the last ten years. In region B and region C, SST anomalies, which had been almost always negative between 1992 and 1997 except during 1994 for region B, turned positive in July 1998 and December 1997, respectively. SST anomaly for region B exceeded +2˚C in September 1998, and dropped in November 1998, while that for region C was positive throughout 1998. In region F, SST anomaly was negative throughout 1998.

Kuroshio

Figure 3 shows the location of the Kuroshio axes from July to December 1998. The Kuroshio has kept a non-large-meander path, though a small meander of the Kuroshio has persisted near 139˚E since May 1998. Its southernmost position near 139˚E was almost 32˚N in July and in November. Near 132˚E, the Kuroshio has flowed off the coast of Japan since November 1998.

Carbon dioxide

JMA observed the distribution of carbon dioxide concentrations (partial pressure, pCO_2) in the surface water and the overlying atmosphere in the western North Pacific on board R/V *Ryofu Maru* from September 17 to November 10, 1998 (*Figure 4*).

In the area south of the Kuril Islands and north of 48˚N along 165˚E in September 1998, the CO_2 partial pressure in the surface water was lower than in the atmosphere, implying that atmospheric CO_2 was absorbed by the ocean. In the western equatorial Pacific in October 1998, the CO_2 partial pressure in the surface water was higher than in the atmosphere, indicating that oceanic CO_2 was emitted into the atmosphere. This is the first time that the CO_2 concentration in the surface sea water along the equator exceeded 30 μ-atm as compared to those in the atmosphere since November 1996.

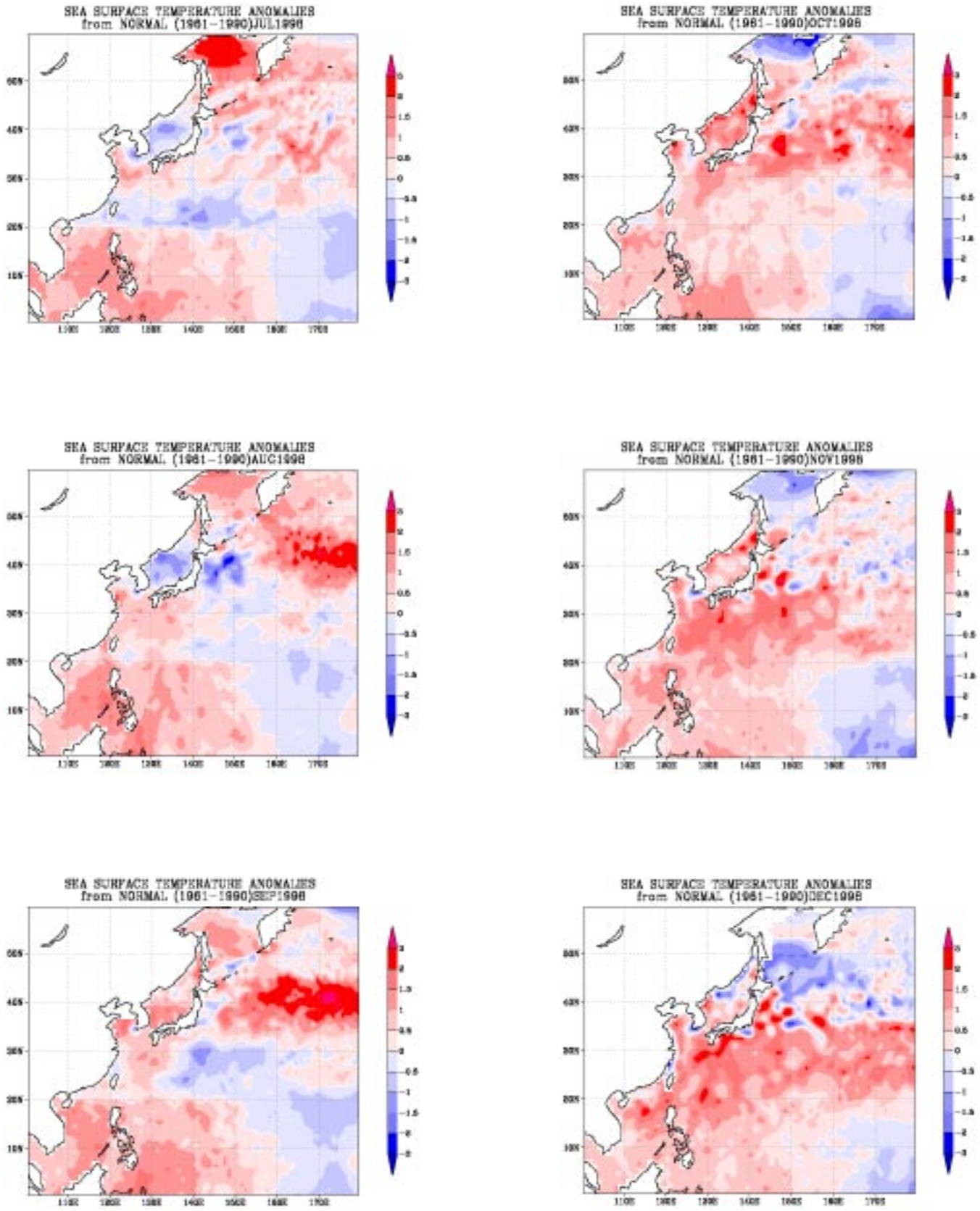

Fig. 1 Monthly mean sea surface temperature anomalies (˚C). Anomalies are departures from JMA's 1961-1990 climatology.

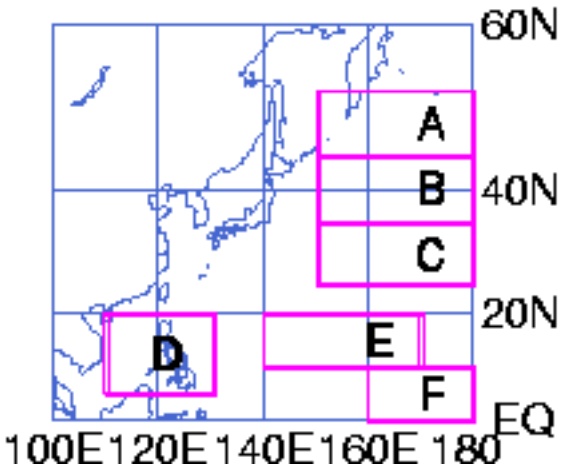

Fig. 2 Time series of the ten-day mean sea surface temperature anomalies (˚C), computed from JMA's 1961-1990 climatology for the areas shown in the bottom panel.

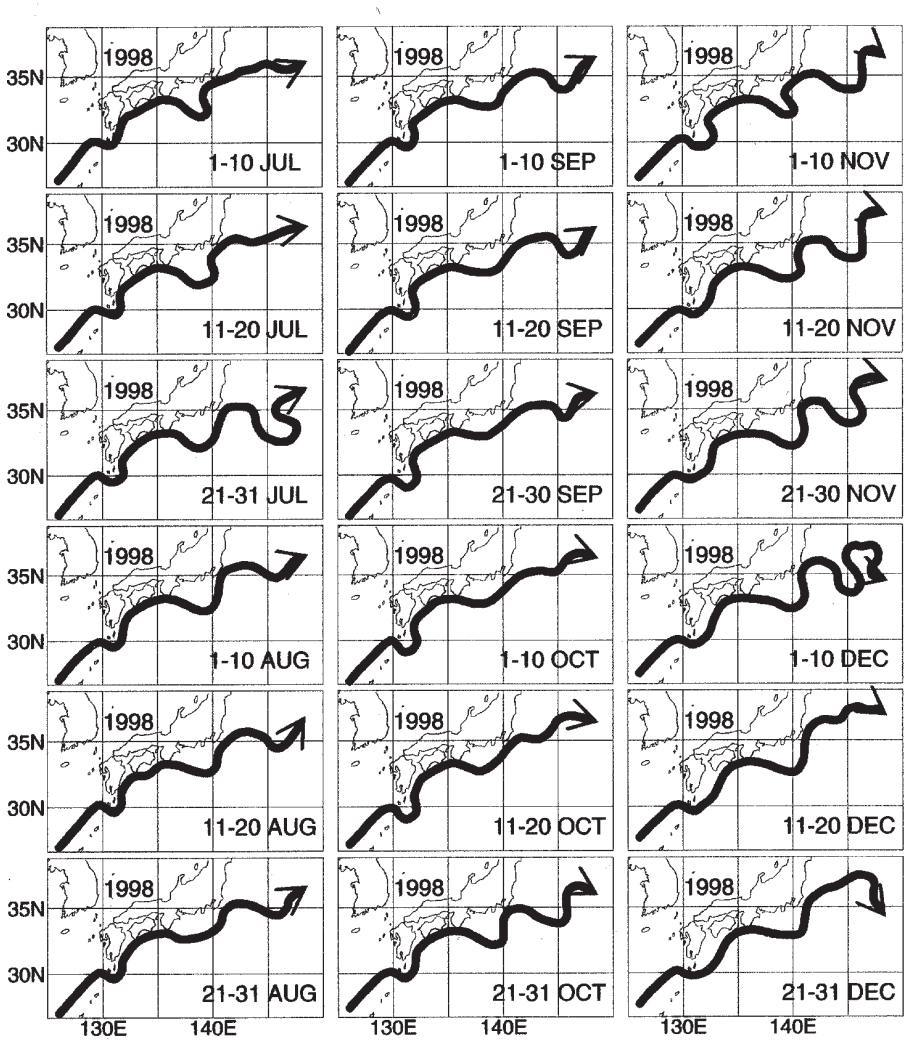

Fig. 3 Location of the Kuroshio axis from July to December 1998.

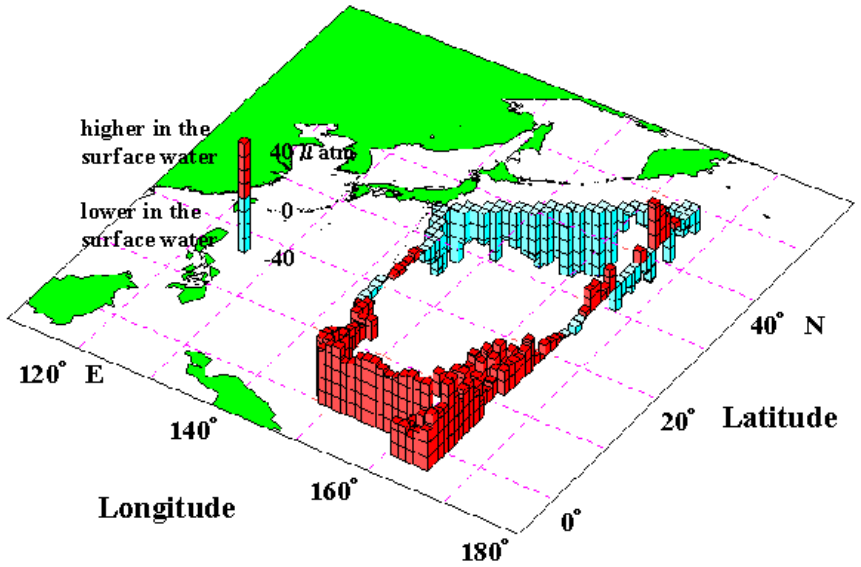

Fig. 4 CO_2 concentration difference between the surface water and the overlying atmosphere in the western North Pacific observed by the R/V Ryofu Maru *from September 17 to November 10, 1998. Red upward pillars indicate that the ocean emits CO_2 into the atmosphere, and blue downward pillars indicate atmospheric CO_2 is absorption by the ocean.*