2. Target region and data

Our target region is shown in Fig. 1. This region contains most of the Pacific Ocean except for the marginal seas (Japan Sea, Yellow Sea and Bering Sea). Because the seasonal variation of pCO_2s is different in different parts of the Pacific, we divided the targeted study area into five smaller regions. The thermodynamic effect dominates the variation in pCO_2s in the North and South Pacific subtropical regions (NP/T and SP/T, respectively; Murata et al., 1996; Takahashi et al., 2002). Upwelling elevates pCO_2s in the equatorial region (EQ; Nakadate and Ishii, 2007; Feely et al., 2006) and the carbon supplied through vertical mixing in winter, and carbon consumption by phytoplankton from spring to autumn affect the subarctic and subantarctic regions (NP/A and SP/A respectively; Ono et al., 2004; Sarma et al., 2006; Takahashi et al., 2002).

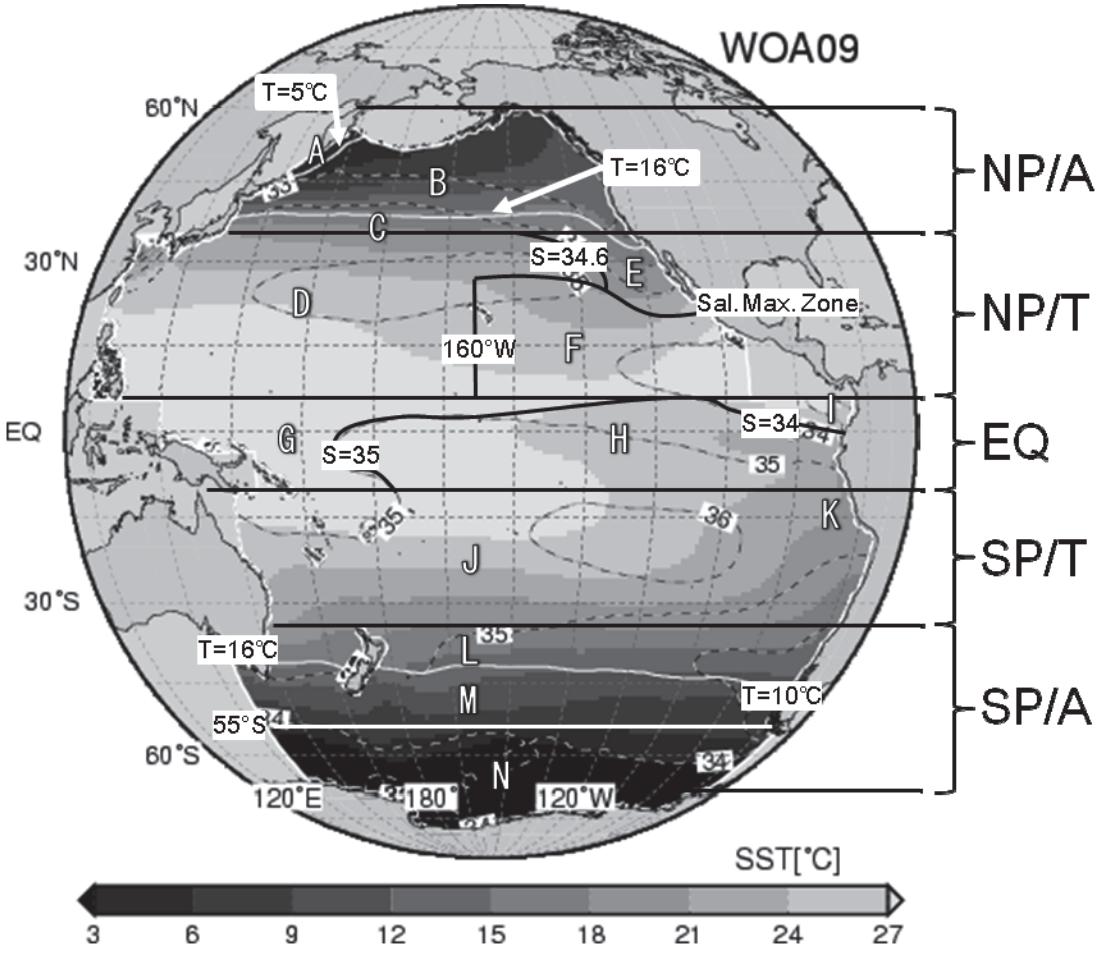

Figure 1. Annual mean SST (shading) and SSS (broken lines) climatology from the World Ocean Atlas 2009 (WOA09; SST, Locarnini et al. [2010]; SSS, Antonov et al. [2010]). NP/A, subarctic North Pacific; NP/T, subtropical North Pacific; EQ, Equatorial Pacific; SP/T, subtropical South Pacific; SP/A, subantarctic South Pacific (see sections 3 and 4). Solid lines delineate 14 smaller regions A–N.

We used the Lamont-Doherty Earth Observatory (LDEO) Database V1.0 (Takahashi et al., 2008) for pCO_2s analysis. This database consists of about 3.5 million pCO_2s measurements collected between 1968 and 2006. There are relatively more pCO_2s measurements from the equatorial and North Pacific and fewer

from the South Pacific.

We used several gridded datasets to estimate pCO_2s and CO_2 flux (Table 1). We used the "Merged satellite and in situ data Global Daily Sea Surface Temperatures" (MGDSST; Kurihara et al., 2006) dataset, analyzed by JMA. SSS was analyzed by the Multivariate Ocean Variational Estimation System/Meteorological Research Institute Community Ocean Model (MOVE/MRI.COM-G; Usui et al., 2006) developed by JMA/MRI. The Chl-*a* fields used are monthly level-3 standard maps of SeaWiFS and MODIS-Aqua data prepared by the National Aeronautics and Space Administration/Goddard Space Flight Center/Distributed Active Archive Center (NASA/GSFC/DAAC; Feldman and McClain, 2010a and 2010b) and downloaded from the Ocean Color Home Page (http://oceancolor.gsfc.nasa.gov/). Monthly sea level pressure (SLP) and U_{10} fields are from the Japanese 25-year Reanalysis/JMA Climate Data Assimilation System (JRA25/JCDAS; Onogi et al., 2007). The atmospheric CO_2 concentrations from JMA were from model calculations using an inversion method based on data reported to the World Data Centre for Greenhouse Gases (WDCGG) (Maki et al., 2010).

As monthly remotely sensed Chl-*a* are not available before 1997, we used monthly Chl-*a* climatology to estimate pCO_2s and CO_2 flux between 1985 and 1997. Because these data sets differ in their horizontal resolution, we used linear interpolation or areal mean values to generate a dataset with 1° × 1° resolution.

Table 1. Gridded datasets used in this study.

Variable	Data	Resolution (longitude × latitude)	Reference
SST	MGDSST	0.25° ×0.25°	Kurihara et al.(2006)
SSS	MOVE/MRI.COM-G	1.0° ×0.3° ～1.0°	Usui et al.(2006)
Chl-a	SeaWiFS Reprocessing 2009.1 / MODIS-Aqua Reprocessing 2009.1	1/12° ×1/12°	Feldman and McClain (2010a, 2010b)
SLP	JRA25(1985-2004)/ JCDAS(2005-2008)	1.25° ×1.25°	Onogi et al.(2007)
10m wind speed			
xCO_2a	Carbon dioxide (CO_2) destribution	2.5° ×2.5°	Maki et al.(2010)