Abstract

Recently as climatic change has gradually become more evident, the role that oceans play in it has attracted more attention, and global oceanographic observations are going to be put into practice in the WOCE (World Ocean Circulation Experiment) program of WCRP in order to clarify the role.

Under these circumstances the necessity of understanding the sea conditions of the oceans as a whole is increasing, and the author believes that it is worthwhile to show the basic distribution of sea properties in the Pacific as done in this technical report.

The main aim is to show their distribution; therefore the description in this report is limited to the statement of the characteristics in the distribution of sea properties without any oceanographic analysis.

Levitus' (1982) seasonal mean oceanographic data set, which is used here, consists of temperature and salinity data at standard depths at $1^\circ \times 1^\circ$ grid points of the world oceans. The sea properties treated in this report are potential temperature (θ), salinity (S), potential density (σ_θ), geopotential anomaly (GPA) and velocity of geostrophic current.

θ is calculated based on Fofonoff and Millard (1983) with the reference to the sea surface. σ_θ is calculated by $\sigma_\theta = \rho(S, \theta, 0) - 1000.0$ (kg m^{-3}), where ρ is the density of seawater which is calculated based on UNESCO (1981). GPA is calculated by

$$GPA = \int_{p}^{p_r} \{\alpha(S, T, p) - \alpha(35, 0, p)\}\, dp,$$

where $\alpha = \rho^{-1}$, T is water temperature in situ, p is pressure and p_r is the reference pressure which is taken as 150 bar (1500 db). The velocity of the geostrophic current is calculated by dividing the difference of GPA between any two stations by the distance between them and Coriolis parameter f.

In chapter 1, the horizontal distribution of θ, S, σ_θ and GPA is treated, and such subjects are discussed as warm water in the tropical western Pacific, subtropical high salinity water, low salinity water in high latitudes, subarctic gyre in the North Pacific, subtropical gyres in the North and the South Pacific and the Antarctic Circumpolar Current.

In chapter 2, the seasonal change and the range of annual variation of those sea properties are presented. The change of θ at 100 to 150 m depth from winter to spring (from summer to autumn in the Southern Hemisphere) shows opposite patterns of distribution to

the one near the sea surface, namely descent in the North Pacific and ascent in the South Pacific. Seasonal changes in salinity are not so systematic as temperature change. In the region east of Japan the range of annual variation in θ, σ_θ and *GPA* is large. The range of salinity change is large in the eastern and western parts of the tropical region. The range of *GPA* change is large also in the eastern tropical region and in the region of the Antarctic Circumpolar Current.

In chapter 3, meridional and zonal sections of θ, S, σ_θ and the velocity of the geostrophic current are shown. After the description of the characteristics in their distribution, some relationship between subtropical high salinity water, intermediate water (defined by salinity minimum), potential density surfaces and the velocity field is mentioned. The North Pacific Intermediate Water and the Antarctic Intermediate Water extend toward the low latitudes along the $\sigma_\theta=26.8$ surface and $\sigma_\theta=27.2\sim27.3$ surface respectively, and the eastward current is conspicuous in the velocity field there due to subtropical gyres in the North and the South Pacific.

Lastly, the author wishes to express his thanks to Dr. Sydney Levitus for his permission to publish these maps in this technical report.