The Oceanic Structure along 137^{0}E Line During The Period of 1990-2002

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Keywords:NEC,STMW,NPIW,double diffusive convection,Turner Angle

The hydrographic observation along 137^{0}E from 3^0 N to 34^{0}N has been occupied by the Ryofu Maru, the Japan Meteorological Agency (JMA) since 1967 to present. Up to present, various studies have been carried out to investigate the variability of current systems and water masses such as the Kuroshio, the North Equatorial Current (NEC), the Sub-Tropical Mode Water (STMW), the North Pacific Intermediate Water (NPIW) and so on (e.g., Qiu and Joyce, 1991). Recent introduction of CTD observation in 1988, replacing reversing thermometers and Nansen bottles enables us to detect more detailed oceanic structures in the western Equatorial Pacific.

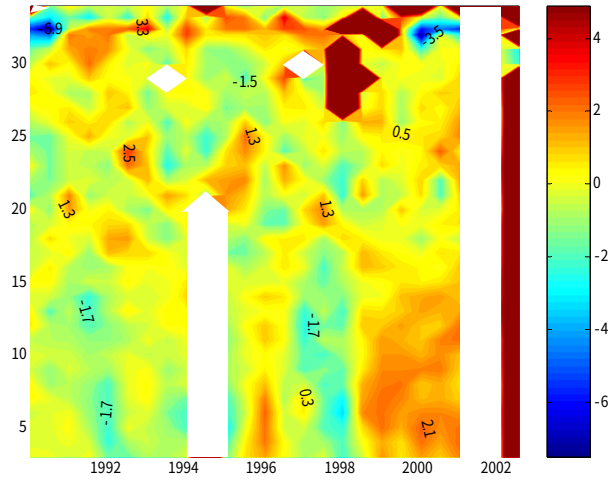

Figure 1. The Surface Dynamic Height Anomalies averaged in total 13 summer and winter cruises from 1990 – 2002. (Units: m^{2}s^{-2}).

In the present thesis, based upon this, this line is revisited to compare the mean fields of temperature, salinity and density obtained from CTD data to those from the old method ones. Then the activity of double diffusive convection was investigated. The activity of double diffusive convection is well described by the density ratio or the Turner Angle defined by, $R_\rho = \alpha\theta_z / \beta S_z$, $Tu = \tan^{-1}\left(\left(R_\rho + 1\right)/\left(R_\rho - 1\right)\right)$ where $\alpha\theta_z$ and βS_z are the mean vertical gradients of density contributed by potential temperature and salinity, respectively.

The general oceanic features found along this line such as the NPIW, the STMW, the NEC and its counter current (NECC), and the Kuroshio well agreed with the results of previous

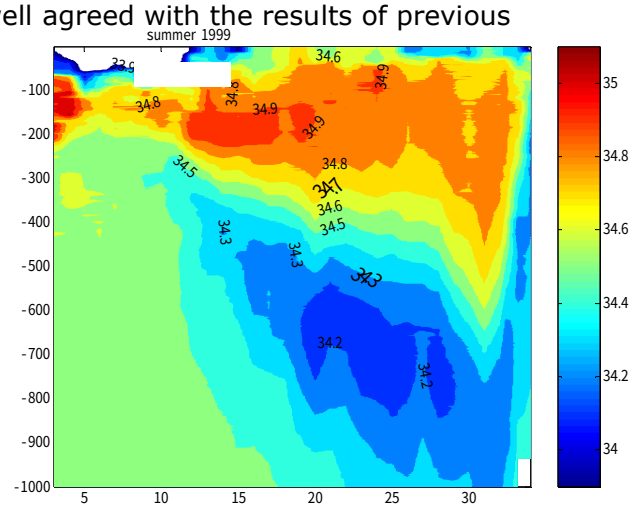

Figure 2. Distribution of salinity along the 137^{0}N, 3^0-34^{0}N, showing the NPIW core split in two cells in summer 1999 (Units psu, white gap is no data). X axis represents the North latitude and Y axis for the depth (m).

studies having substantial slight differences. It is clear that the CTD data is having better resolution. The boundary of NEC and NECC (11^0-15^{0}N) is clearly seen in the surface

dynamic height anomalies (SDHA) averaged over 13 winters and summer cruises, The SDHA tends to be high in the warm water region of the Kuroshio. The same phenomenon occurred in the equatorial western Pacific warm water region, but during the El-Nino periods this region shifted eastward and SDHA becomes lower, then vice versa during the La-Nina periods.(Fig.1).

From the salinity distribution, it is found that in several years, the core of the NPIW split to form two cells, around 27^0N both in summer and winter. The upper limit of the core is at 500m, and the lower one is 900m.(Fig.2).

Detailed density ratio analyses were done by grouping observation stations into 7 areas from north to south as was done by Qiu et al. The histogram plots of the Turner Angles in lower latitude equatorial region show that the peak is around 40^0 to 50^0 (statically stable region-moderate salt finger) showing that on average, the double diffusive convection is less active in the low latitudes. From 14.5^0N, however, another peak occurred in the salt finger (one form of double diffusive convection) regime at 60^0 ($R\rho$=3.7~3), and prevails the peak in the stable regime. This feature continues to the northernmost latitude of observations. We might say that in the temperate zone the salt fingering is more active. The salt fingering activity seemed to increase within the split core of NPIW but still not convincing as the main reason. Perhaps the other lateral mixing process (instead of vertical) is causing the splitting such as the intrusion of more saline water. Further study is needed.