LOW FREQUENCY TEMPERATURE FLUCTUATIONS IN THE UPPER 400 METERS OF THE CENTRAL NORTH PACIFIC

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ABSTRACT

We investigate the low frequency temperature fluctuations, with time scales of months to years, in the upper 400 m of the Central North Pacific by analyzing the TRANSPAC temperature data collected as a part of the North Pacific Experiment and the temperature data at ocean weather stations. The low frequency temperature fluctuations consist of large scale, quasi homogeneous, fluctuations with space scales comparable to the size of the North Pacific basin and smaller scale, wave-like, fluctuations with length scales of a few hundred kilometers. In the upper 100 m of the ocean the temperature fluctuation is predominantly a seasonal variation, the amplitude of which decreases with depth with a typical e-folding depth of 50 m. The non-seasonal temperature anomaly field has a two layer structure; the temperature anomalies in the surface layer, down to about 100 m, have time scales of 2 to 3 years, and those in the lower layer, deeper than 150 m, have time scales of 4 to 7 years and penetrate down to a few hundred meters. More than half of the wave-like temperature fluctuations at the annual frequency consist of a random field of first order baroclinic Rossby waves travelling in a NW direction with wave lengths of about 300 km and phase speeds of about 1 cm/sec. Both the quasi homogeneous and wave-like parts of the low frequency

temperature fluctuations in the western part of the North Pacific Current area are much stronger than those in the eastern part. Along the Subarctic (42^{o}N) and Subtropical (32^{o}N) Fronts the wave-like temperature fluctuations propagate with phase speeds of about 10 cm/sec, and they reverse their direction of propagation with an annual cycle. We estimate the relative contribution of the quasi homogeneous and wave-like fluctuations, and that of the seasonal and non-seasonal fluctuations, to the change of heat content in the upper 400 m.