Session: C9 Poster: M92A

A Study on premonitory sign of ENSO event

Qing Yun Zhang[†];
[†] Chinese Academy of Sciences, China, People's Republic of
Leading author: zqy@mail.iap.ac.cn

The ENSO prediction has attracted focus of many scientists around the world. Although the scientists have developed some classic theories mainly based on tropical atmospheric and oceanic datasets [Bjerknes, 1969; Suarez and Schopf, 1988; Cane et al., 1990; Jin, 1997], however the ENSO prediction still lies some uncertainty unresolved. As an outgrowth of the wintertime air-sea interaction near the Kuroshio Extension (Hanawa and Suga, 1995), the North Pacific Subtropical Mode Water (STMW) was chosen to identify the possible contribution of the combined mid-latitude air-sea variability to the SST variability over the Eastern Equatorial Pacific. The monthly STMW index is defined as the volume of the water. In order to understand the relationship between STMW and the sea surface temperature anomaly (SSTA) over the eastern equatorial Pacific, the lead-lag correlation between the monthly departure of the STMW index and the Nino3 index was calculated based on 528 monthly data points for 1958-2001. It shows that the correlation peaks when the STMW leads the Nino3 index by 18 months, exceeding the 99.9% confidence level. This correlation indicates that a positive (negative) STMW anomaly may be a premonitory sign of a warm (cold) SSTA over the eastern equatorial Pacific. To investigate this connection more explicitly, the correlation coefficient between the summer (May-June-July, MJJ) STMW index and the winter Nino3 index of the following year (18 months later) was calculated. The results show that when removing the decadal trend of the two series (n=35), the coefficient increases from 0.36 to 0.61 and exceeds the 99.9% significance level (r=0.53). This indicates that the connection between the summer STMW and the winter Nino3 index of the following year (18 months later) is more significant on an inter-annual time scale. So, to focus on this time scale, the decadal variations of the summer STMW index and winter Nino3 index were removed by a high-pass filtering step. The summer STMW anomaly then appears to be a premonitory sign of SSTA over the Nino3 in the winter of the following year (18 months later). The premonitory connection involves an air-sea coupling between the longtime persistent mid-latitude SSTA induced by the remote re-emergence of STMW and the following spring subtropical atmospheric circulation anomalies. Examination of the air-sea interaction reveals that the following spring subtropical atmospheric circulation which responds to the longtime persistent SSTA is dominated by the anomalous negative (positive) geopotential height downstream of the negative (positive) SSTA in the strong (weak) STMW case. Then, the tropics adjust to these anomalies through coupled dynamics, producing ENSO-like pattern of variability.Details of the connection and possible process are presented,and this should be useful in forecasting the occurrence of this important phenomenon.