Geophysical Research Abstracts
Vol. 19, EGU2017-2018, 2017
EGU General Assembly 2017

Structure and dynamics of decadal anomalies in the wintertime midlatitude North Pacific ocean–atmosphere system

Jiabei Fang and Xiu-qun Yang
School of Atmospheric Sciences, Nanjing University, Nanjing, China (fangjb@nju.edu.cn)

The structure and dynamics of decadal anomalies in the wintertime midlatitude North Pacific ocean–atmosphere system are examined in this study, using the NCEP/NCAR atmospheric reanalysis, HadISST SST and Simple Ocean Data Assimilation data for 1960–2010. The midlatitude decadal anomalies associated with the Pacific Decadal Oscillation are identified, being characterized by an equivalent barotropic atmospheric low (high) pressure over a cold (warm) oceanic surface. Such a unique configuration of decadal anomalies can be maintained by an unstable ocean–atmosphere interaction mechanism in the midlatitudes, which is hypothesized as follows. Associated with a warm PDO phase, an initial midlatitude surface westerly anomaly accompanied with intensified Aleutian low tends to force a negative SST anomaly by increasing upward surface heat fluxes and driving southward Ekman current anomaly. The SST cooling tends to increase the meridional SST gradient, thus enhancing the subtropical oceanic front. As an adjustment of the atmospheric boundary layer to the enhanced oceanic front, the low-level atmospheric meridional temperature gradient and thus the low-level atmospheric baroclinicity tend to be strengthened, inducing more active transient eddy activities that increase transient eddy vorticity forcing. The vorticity forcing that dominates the total atmospheric forcing tends to produce an equivalent barotropic atmospheric low pressure north of the initial westerly anomaly, intensifying the initial anomalies of the midlatitude surface westerly and Aleutian low. Therefore, it is suggested that the midlatitude ocean–atmosphere interaction can provide a positive feedback mechanism for the development of initial anomaly, in which the oceanic front and the atmospheric transient eddy are the indispensable ingredients. Such a positive ocean–atmosphere feedback mechanism is fundamentally responsible for the observed decadal anomalies in the midlatitude North Pacific ocean–atmosphere system.