Geophysical Research Abstracts
Vol. 16, EGU2014-1239-1, 2014
EGU General Assembly 2014

Season-dependent predictability and error growth dynamics of Pacific Decadal Oscillation-related sea surface temperature anomalies

Yujie Wu (1,2) and Wansuo Duan (1)

(1) State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China (wuyj@lasg.iap.ac.cn), (2) University of Chinese Academy of Sciences, Beijing 100049, China

By performing perfect model predictability experiments in a fully coupled general circulation model from the point of view of initial error growth, a "summer prediction barrier" (SPB) is found to exist in the prediction of Pacific Decadal Oscillation-related sea surface temperature anomalies (PDO-related SSTA), which refers to the phenomenon that initial errors exhibit a significant season-dependent evolution, with the largest error growth occurring in the ASO season for PDO-related SST events. The SPB may be one of the main factors limiting the predictability of North Pacific sea surface temperature (NP-SST). The physical and dynamical mechanisms of the SPB are then explored from two aspects: thermodynamics and dynamics. In terms of thermodynamics, we demonstrate that the fastest error growth of PDO-related SSTA is mainly due to the largest anomalous release (absorption) of the latent heat flux in the ASO season; while for dynamics, the effect of the vertical gradient of climatological mean sea temperature on the anomalous upwelling (downwelling) dominates the contribution of the dynamical temperature advection to the error growth of the PDO-related SSTA during ASO. The anomalous release (absorption) of the latent heat flux and anomalous upwelling (downwelling) of the ocean currents are both related to the anomalous northwesterly or cyclonic (southeasterly or anticyclonic) wind stress over the PDO-related SSTA region, which indicates that the error growth associated with the SPB of PDO-related SSTA is mainly driven by anomalous wind stress. The error growth associated with the SPB for the PDO-related SSTA may also explain why the SSTA in the Kuroshio–Oyashio Extension (KOE) is much less predictable than in other regions of the North Pacific, as shown by some state-of-the-art climate models. Moreover, not all of the initial errors could lead to a significant SPB. It is implied that there may exit some initial errors with certain spatial patterns that tend to cause the SPB. When these certain initial errors are eliminated from the initial conditions, the skill of forecasting the NP-SST may be improved.