How does the air-sea interaction affect climate predictability?

Cheng-Ta Chen[1,2] and Jun-Lien Chu[1]
National Taiwan Normal University, Department of Earth Sciences[1]
and Institute of Marine Environmental Science and Technology[2]
88, Sec. 4, Ting-Chou Rd., Taipei 116, Taiwan
chen@rain.geos.ntnu.edu.tw

Abstract

El Niño-Southern Oscillation (ENSO) is recognized as the prominent mode of interannual variability of the atmosphere-ocean system in the tropics. Its climatic impact is not restricted locally to the tropical Pacific. Through the so-called 'atmospheric bridge' process, the sea surface temperature (SST) variations lead to rainfall and atmospheric circulation anomalies outside the central and eastern tropical Pacific. These atmospheric perturbations, in turn, influence the underlying ocean through modulation of the surface heat and radiative fluxes, thereby generating SST anomalies outside of tropical Pacific. It has been demonstrated that SST is the major contributor to the potential climate predictability using signal to noise ratio from ensemble climate simulations. Nevertheless, most of previous assessments on climate predictability are based on simulations driven by observed global SSTs. It is not clearly discriminate the role of local SST in the regional climate predictability. Whether they enhance or reduce the climate predictability due to remote ENSO forcing?

The relative influences of remote SST forcing by ENSO and local SST forcing by air-sea interaction on the seasonal climate predictability have been investigated using two sets of multi-member ensemble general circulation model experiments. Observed monthly sea surface temperature (SST) variations in the deep tropical eastern/central Pacific (DTEP) have been inserted in the lower boundary of this model through the 1950–99 period for both experiments. At all maritime grid points outside of DTEP, the model atmosphere has been either forced by imposed with seasonal SST climatology, or coupled with an oceanic mixed layer model with variable depth. The seasonal SST climatology used in this prescription procedure is based on averages of the output from the mixed layer coupled run. Therefore the climatic mean SST forcing outside of DTEP is the same. The predictability differences among model experiments are tested using Monte-Carlo method and Kuiper statistics. The impact of remote forcing and local air-sea interactions on potential climate predictability will be discussed.