Geophysical Research Abstracts
Vol. 15, EGU2013-1157, 2013
EGU General Assembly 2013

Analysis of the Slab-Ocean El Nino Atmospheric Feedbacks in Observed and Simulated ENSO Dynamics

Dietmar Dommenget (1), Sabine Haase (2), Tobias Bayr (2), and Claudia Frauen (1)

(1) Monash University, School of Mathematical Sciences, Atmospheric Science, Clayton, Australia (dietmar.dommenget@monash.edu), (2) GEOMAR, Kiel, Germany

In a recent study it was illustrated that the El Nino Southern Oscillation (ENSO) mode can exist in the absence of any ocean dynamics. The primary purpose of this study here is to further explore these atmospheric slab ocean ENSO dynamics and therefore the role of atmospheric positive feedbacks in model simulations and observations. The positive solar radiation feedback to SST, due to reduced cloud cover for anomalous warm SSTs, is the main positive feedback in the slab ocean El Nino dynamics. The combination of latent and sensible heat fluxes leads to the propagation of the SST anomalies from the east to the west, which allows for oscillating behavior. The strength of the positive cloud feedback is strongly related to the strength of the equatorial cold tongue.
Several indications are found that these dynamics are indeed observed and simulated in different models. The CMIP3 AGCM-slab ensemble of 13 different AGCM simulations shows unstable ocean-atmosphere interactions along the equatorial Pacific related to stronger cold tongues. In observations and in the CMIP3 and CMIP5 CGCM model ensemble the strength and sign of the cloud feedback is a function of the strength of the cold tongue. In summary, this indicates that the slab ocean El Nino dynamics are indeed a characteristic of the equatorial Pacific climate that is only dominant or significantly contributing to the ENSO dynamics if the SST cold tongue is sufficiently strong. In the observations this is only the case during strong La Nina conditions. The presence of the slab ocean ENSO mode in observations and CGCM model simulations implies that ENSO is a family of physical modes of variability that do not need to have the same spatial pattern nor do they need to have the same time scales.