3rd International Conference on Earth System Modelling
Vol. , 3ICESM-89, 2012
3rd International Conference on Earth System Modelling

Possible synchronization of internal modes of the tropical Pacific decadal variability to the 11-yr solar cycle

S. Misios and H. Schmidt
Max Planck Institute for Meteorology, Atmosphere, Germany (stergios.misios@zmaw.de)

The possible influence of the 11-yr solar cycle on the coupled atmosphere-ocean system of the tropical Pacific has drawn considerable attention in the recent years. Analyses of observations and historical reconstructions detected either an El Niño-like warming or a La Niña-like cooling in solar maxima. We first show that both signals can be explained without evoking the solar cycle forcing per se. The detected cooling results from the oversampling of La Niña episodes, whereas the El Niño-like response is related to the tropical Pacific Quasi-Decadal oscillation (TPQDO), which is a mode of variability likely excited by internal dynamics of the tropical Pacific system. This does not preclude the possibility that the increased solar forcing favors a La Niña excitation. Likewise, the TPQDO could be synchronized to, not excited by, the solar cycle. To examine the aforementioned possibilities, we conduct simulations with the middle atmosphere version of ECHAM5 coupled to two types of ocean models: a mixed layer and a full-coupled dynamical model. Our simulations do not support the notion of a La Niña excitation in solar maxima. Instead, we find that the solar cycle signal projects on the simulated TPQDO, which is internally excited in a control run with constant solar forcing. The tropical Pacific warms in solar maxima both in the mixed layer and the full-coupled ensembles, with stronger warming in the former ensemble. The tropical Pacific hydrology changes accordingly. Although the tropical upper atmosphere responds immediately to the solar forcing, the tropospheric response lags by 1 to 2 years, in rhyme with the surface response. We further discuss mechanisms whereby the simulated warming over the tropical Pacific may affect remote regions as the North Atlantic Ocean and Europe. There, the full-coupled ensemble successfully captures the solar cycle signals detected in proxy-based surface temperature reconstructions.