Geophysical Research Abstracts, Vol. 8, 04082, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04082

The impact of tropical and global air/sea coupling upon the NH winter ENSO teleconnection

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We examine the influence of tropical and global ocean/atmosphere coupling upon the development and predictability of the extratropical atmospheric response to ENSO by means of very large ensembles (150) of coupled and uncoupled GCM simulations of the 1997/98 El Niño and 1998/99 La Niña events, in which sea surface temperatures (SSTs) are prescribed in the tropical eastern Pacific. In the control simulations, climatological SSTs are specified elsewhere, whereas in the coupled simulations a bulk mixed layer model is coupled to the atmosphere in the tropical western Pacific and Indian oceans (experiment TROPMLM) or in the entire ocean (experiment MLM).

The differences between the coupled and uncoupled NH winter ENSO responses are modest, with the largest changes occurring in early winter when coupling strengthens the signal over the PNA sector, particularly in TROPMLM. This enhancement is related to increased convection in a small area of the tropical northwest Pacific (TNWP), which turns out to be particularly effective at forcing PNA circulation anomalies. These anomalies interfere constructively with the main ENSO wavetrain emanating from the central equatorial Pacific, so that when the convective response to ENSO projects onto this TNWP region, the extratropical ENSO response is enhanced. The enhanced TNWP convection in the coupled runs, however, is not directly driven by SST anomalies. Furthermore, in the core of winter of an ENSO year, convection is suppressed in the TNWP region and teleconnections therefrom are trapped in the subtropics. These results emphasize the importance of heating and cooling in the northwest tropical Pacific in forcing ENSO teleconnections. The predictability of the mean JFM ENSO response is also increased in TROPMLM, owing to a substantial reduction in the spread of the extratropical ENSO anomalies. The MLM results, on the other hand, suggest that the ENSO-induced SST anomalies in the central North Pacific exert a weak negative damping on the ENSO teleconnection.