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Simulated sensitivity of the tropical climate on extratropical thermal forcing

Talento, Stefanie [1(*)]; Barreiro, Marcelo [1]

1 - Universidad de la República | (*) Uruguay

Tropical-extratropical interactions are typically considered as the tropics driving the extratropics, with El Niño Southern Oscillation and its associated atmospheric teleconnections being a typical example of this interaction. However, paleoclimatic studies and numerical simulations show that the interaction in the opposite direction is also possible and that, in this case, the involved connections are both atmospheric and oceanic. Moreover, climate changes during the 20th century are characterized by an inter-hemispheric difference in sea surface temperature (SST) which has been suggested as a possible driver to decadal droughts in the Sahel and a weakening of the southeast Asian monsoon. This study investigates the Intertropical Convergence Zone (ITCZ) response to extratropical thermal forcing applied to an atmospheric general circulation model (ICTP-AGCM) coupled to a slab ocean. The applied forcing pattern consists in cooling in one hemisphere and warming in th e other poleward of 40°, with a resulting global average forcing equal to zero. We perform two sets of experiments, changing the background state for the simulations: in the first set no ocean flux correction is applied to the slab model, while in the second set a monthy-varying ocean heat flux correction is imposed in order to keep the simulated SST close to present-day conditions. In each set of experiments we analyze several simulations increasing the amplitude of the forcing. In all the cases the boundary surface conditions used are realistic. We examined several aspects of the response: precipitation, SST, winds, energy budget changes and cloud cover. We find that, independently from the background state, the ITCZ is shifted toward the warmer hemisphere and that the stronger the forcing, the larger the shift. Contrasting the experiments with or without flux correction we find that the response is stronger and more zonally symmetric in the case without the oceanic correction.