Geophysical Research Abstracts
Vol. 19, EGU2017-5015, 2017
EGU General Assembly 2017

Comparing the effect of low wind spead parameterization on heat fluxes in atmosphere only and coupled ocean-atmosphere simulations

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The turbulent fluxes across the ocean/atmosphere interface represent one of the principal driving forces of the global atmospheric and oceanic circulation. Representation of these fluxes presents a challenge due to the small scale acting turbulent processes compared to the resolved scales of the models. Beyond this subgrid parameterization issue, a comprehensive understanding of the impact of air-sea interactions on the system is still lacking.

We are developing a methodology to investigate how differences in the parameterizations affect the water supply of the atmospheric column in the tropics, the ocean heat content and the equator-pole redistribution of heat and water by the oceanic and atmospheric circulation. We focus on the representation of the latent heat fluxes in the tropics. We investigate how the representation of the heat transfer coefficient in weak winds affect the climate response considering both atmosphere only and ocean-atmosphere coupled simulations with the IPSL climate model.

We compare simulations where the only difference is the activation of a function that increases latent heat fluxes during periods of weak wind. This allows us to isolate the behavior of the Pacific warmpool region where low winds occurs frequently. Although the heat transfer coefficients are very similar for a given parameterization between atmosphere only and ocean-atmosphere coupled simulation the surface heat fluxes are very different. We analyze in detail the ocean feedbacks and the role of the latent heat fluxes by looking at the energy transport carried out by the atmosphere considering the divergent part of the moist static energy. Differences appear between the coupled and uncoupled models due to the role of the ocean which dampens a large part of the disturbance caused by the modification of parameterization.