Geophysical Research Abstracts
Vol. 13, EGU2011-831, 2011
EGU General Assembly 2011

Evaluation of the IPSL-CM5 Earth System Model air-sea fluxes in tropical regions

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Ocean-atmosphere interactions represent a key component of the hydrological cycle in tropical regions and their variability has profound influences on low-latitude climate. We set out to investigate the link between the parameterization of ocean-atmosphere fluxes in global circulation models and climate variability at large regional scales across the tropics, in order to set the stage for the future implementation of new surface flux schemes over the ocean.

We consider the recent CMIP5 ensemble climate simulations for the historical period 1979-1995, run with the latest version of the IPSL Earth System Model in coupled (IPSL-CM5) and corresponding atmosphere stand-alone (AMIP) modes. In order to identify the major drawbacks related to processes missing from the model, we evaluate the model representations of heat and momentum surface fluxes by comparing them to several observational climatologies (e.g, OAFlux, HOAPS) for selected regions associated to warm pools and upwelling in the tropical ocean basins. The comparison considers uncertainties from observations as well as from atmospheric internal noise.

Focusing on the link with sea surface temperature, we also make a comparison between the IPSL-CM5 and the AMIP simulation results in order to assess the effects of ocean-atmosphere feedbacks on the surface flux variability at different time scales. This analysis will lead to a more in-depth investigation of the relationships between processes in the atmospheric boundary and ocean mixed layers and the variability of ocean-atmosphere fluxes and sea surface temperature in the tropical oceans.