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Influence and impact of the parametrization of the turbulent air-sea fluxes on atmospheric moisture and convection in the tropics

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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 and are also responsible for various phenomena like the water supply to the atmospheric column, which itself is extremely important for atmospheric convection. Although the representation of these fluxes has been the subject of major studies, it still remains a very challenging problem. Our aim is to better understand the role of these fluxes in climate change experiments and in the equator-pole redistribution of heat and water by the oceanic and atmospheric circulation. For this, we are developing a methodology starting from idealized 1D experiments and going all the way up to fully coupled ocean-atmosphere simulations of past and future climates. The poster will propose a synthesis of different simulations we have performed with a 1D version of the LMDz atmosphere model towards a first objective of understanding how different parameterizations of the turbulent fluxes affect the moisture content of the atmosphere and the feedback with the atmospheric boundary layer and convection schemes.

Air-sea fluxes are not directly resolved by the models because they are subgrid-scale phenomena and are therefore represented by parametrizations. We investigate the differences between several 1D simulations of the TOGA-COARE campaign (1992-1993, Pacific warm pool region), for which 1D boundary conditions and observations are available to test the results of atmospheric models. Each simulation considers a different version of the LMDz model in terms of bulk formula (four) used to compute the turbulent fluxes. We also consider how the representation of gustiness in these parameterizations affects the results. The use of this LMDz test case (very constrained within an idealized framework) allows us to determine how the response of surface fluxes helps to reinforce or damp the atmospheric water vapor content or cloud feedbacks.

Previous results show that, depending on the parameterization used, large differences appear under low wind conditions, which correspond to wind regimes for which traditional bulk formulae are poorly constrained. A particular emphasis will be put on the analysis of these regimes and on the improvement induced by the representation of gustiness. Preliminary results suggest that the model produces fewer situations with high unrealistic fluxes in these regimes when the gustiness parameterization is implemented. This poster will present the major differences between the explored parametrizations, the link between variables and fluxes and the way these differences impact the atmosphere moisture content and trigger the convection.