Geophysical Research Abstracts
Vol. 21, EGU2019-18332, 2019
EGU General Assembly 2019

Impact of stochastic physics on climate simulations with EC-Earth: looking at the ocean.

Virna Meccia, Federico Fabiano, and Susanna Corti

Institute of Atmospheric Sciences and Climate (ISAC), National Research Council (CNR), Bologna, Italy (s.corti@isac.cnr.it)

Stochastic physics schemes provide a more realistic representation of the unresolved scales in global circulation models by improving both mean climate and climate variability. We study the impact of including a stochastic physics scheme in the atmospheric component of EC-Earth on the simulated ocean state. The experiments consist of coupled climate simulations in which three ensemble members constitute the control runs and three ensemble members include stochastic physics. For the latter, the Stochastically Perturbed Parametrisation Tendencies (SPPT) scheme is incorporated in the atmospheric component of EC-Earth. The period of simulation spans from 1850 to 2100 and the future scenario corresponds to RCP8.5. The two ensembles present a different climate sensitivity. We compare both ocean states to investigate the ocean model response to a perturbed atmosphere.

The surface net downward heat flux in the ocean results higher for the control runs. The difference is approximately 4 x 1023 J in the entire period of 250 years. The meridional heat transport (MHT) in the oceans results also higher in the case of the control runs. The Pacific and Atlantic oceans contribute roughly with 57% and 43% of the total difference, respectively. The larger amount of MHT in the Atlantic in the control runs respect to the stochastic runs, causes differences in the Atlantic Meridional Overturning Circulation as well.

An abrupt loss of winter sea ice in the Arctic occurs at the end of the simulated period for the control runs only. In this case, the global annual surface air temperature reaches the threshold value for an abrupt collapse of winter sea ice in the Arctic. This feature is not observed when the stochastic physics is included, at least during the analyzed period.

Including stochastic physics in EC-Earth might yield differences in the simulated climate comparable to differences between models.