Geophysical Research Abstracts
Vol. 21, EGU2019-7353, 2019
EGU General Assembly 2019

Tuning the Planet Simulator Earth system Model of Intermediate Complexity for climate sensitivity studies

Michela Angeloni (1,2), Elisa Palazzi (1), and Jost von Hardenberg (1)

(1) Istituto di Scienze dell'Atmosfera e del Clima, Consiglio Nazionale delle Ricerche (CNR-ISAC), Torino, Italy, (2) University of Bologna, Bologna, Italy

A state-of-the-art Earth system Model of Intermediate Complexity, the Planet Simulator (PlaSim), is used to determine its equilibrium climate sensitivity and compare it with results from more complex models. Fixed-forcing runs have been performed coupling the atmospheric model of PlaSim with a simple Mixed Layer ocean model and with the Large Scale Geostrophic (LSG) oceanic circulation model, at two horizontal resolutions (600 km and 300 km). The study has required a preliminary tuning of specific model parameters, under different model configurations, such as the horizontal and vertical oceanic diffusion coefficient, the albedo of glaciers, and the ocean and cloud albedo, in order to identify the set-up which better reproduced the characteristics of present climate, by comparing the model's outputs to satellite and reanalysis datasets.

Sensitivity experiments with doubled CO_2 concentrations were run, in order to assess the equilibrium climate sensitivity of the model. In the case of PlaSim coupled with a Mixed Layer ocean, a quite high climate sensitivity of 6.2 K is found, while when PlaSim is coupled with LSG the value is 4.4 K. The latter is more in agreement with the range of climate sensitivity values which are known from the literature and other models and, in particular, found in the latest IPCC Fifth Assessment Report.

The simplified and highly parameterized form of the PlaSim EMIC makes it easier to identify and disentangle fundamental processes and interactions at work, making this model also a suitable tool to study the characteristics of the transitions occurring in one or more Earth system components in presence of tipping points and to identify possible early warning signals.