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A parameter study of the atmosphere with a reduced continental distribution with the EMAC-model

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To understand the habitability of terrestrial planets, and so the development of life, it is of crucial importance to study the evolution of the atmosphere of early Earth. Due to plate tectonics the face of the Earth has been changing since its formation and we know that the amount of landmass has grown during the evolution of the Earth. In this contribution we investigate the influence of a highly reduced continental distribution which represents the amount of landmass before 2.5 Gigayears on atmospheric dynamics. For this parameter study we use the Chemistry Climate Model EMAC-FUB (ECHAM5/MESSy Atmospheric Chemistry model, with 39 atmospheric layers) in a setup coupled to a Mixed Layer Ocean model. For the early Earth, we assume here a landmass of about 10% of our present day value.
To analyse in particular the sensitivity of the model dynamics to the geographical location of the landmass, we selected three different continental setups with locations of the landmass at the equator, at mid-latitudes and at high latitudes, respectively. For our numerical experiments we prescribe the present day atmospheric composition, obliquity, and solar luminosity.
We present results regarding the dynamical response of the atmosphere to the location of the landmass with focus on the impact on troposphere-stratosphere coupling.