Geophysical Research Abstracts
Vol. 20, EGU2018-19186, 2018
EGU General Assembly 2018

A SOLARIS-HEPPA analysis of solar signatures in the CCMI simulations

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The importance of solar forcing on climate is now firmly established . Nevertheless, considerable uncertainty remains in the characterization of solar signals in the climate system in both models and observations. The SPARC SOLARIS-HEPPA initiative aims at narrowing the uncertainties related to solar cycle forcing and its effects on climate. To this end, model experiments performed under the Chemistry-Climate Model Initiative (CCMI) are analysed to examine solar signals in the atmosphere and the ocean. The adopted methodology collectively considers a range of possible pathways whereby solar variability can affect climate, including UV irradiance, energetic particles and their effects on the physics, chemistry and dynamics of the stratosphere. Special emphasis is given on the downward propagation of solar signals from the middle and upper atmosphere to the surface and solar-induced ozone changes and feedbacks arising from atmosphere-ocean coupling. The analysis of free-running (REFC1) and specified dynamics (REFC1-SD) simulations are used to provide evidence for the solar origin of the observed signals in the stratosphere, and infer the role of the dynamics. The analysis of REFC2 simulations, on the other hand, are used to characterise the coupled atmosphere-ocean response to solar variability. The impact of energetic particles on the composition of the middle atmosphere is analyzed and compared with recent satellite observations with a special focus on NO_x and HO_x, and their impact on stratospheric ozone and dynamics is assessed. Finally, the sensitivity of the solar signals to statistical methodology will be carefully addressed. Here we provide an overview of these current activities and highlight selected preliminary results.