Geophysical Research Abstracts
Vol. 13, EGU2011-6438, 2011
EGU General Assembly 2011

Modeling the 11-year Solar Signal in the Troposphere

Anne Kubin (1), Janna Abalichin (1), Kleareti Tourpali (2), Ulrike Langematz (1), and Patrick Jöckel (3)

(1) Freie Universität Berlin, Institut für Meteorologie, Berlin, Germany (anne.kubin@met.fu-berlin.de), (2) Aristotle University of Thessaloniki, Department of Physics, Thessaloniki, Greece, (3) Deutsches Zentrum für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany

There is observational evidence for an 11-year solar cycle influence on tropospheric circulation and temperature. Simulations with chemistry climate models (CCM) provide the opportunity to study the downward transfer of the initial solar signal in the upper stratosphere to the troposphere and to identify the processes that lead to the observed changes in the troposphere.

We present results from a CCMVal Reference B1 simulation with the EMAC-FUB CCM forced with observed sea surface temperatures and sea ice, observed abundances of greenhouse gases and ozone depleting substances and three major volcanic eruptions. The QBO in this simulation with the resolution T42L39MA was assimilated. The intention with this experiment is to simulate the period 1960 to 2005 as realistically as possible. A multiple linear regression method is applied to analyse the model output.

We find that the 11-year solar signal in the troposphere in EMAC-FUB is most prominent in late northern and southern winter. Under solar maximum conditions there are positive annular mode-like anomalies in the geopotential height field in the mid-troposphere in February with consistent near-surface temperature changes. Changes in the propagation of planetary waves are found to contribute to the solar signal. Since a positive annular mode implies a more zonally directed flow it is analysed whether the occurrence frequency of blockings is reduced during phases of high solar activity. In July and August there is a solar influence on the Indian monsoon circulation with stronger than average upward motion over the Arabian peninsula at solar maximum. Simultaneously, the upwelling in the Hadley circulation is weakened.