Contribution ID: **68** Type: **Oral**

Assessment of the 11-year solar cycle signals in the middle atmosphere in multiple-model ensemble simulations

Monday 16 September 2024 14:10 (20 minutes)

To better understand possible reasons for the diverse modeling results and large discrepancies of the detected solar fingerprints, we took one step back and assessed the "initial" solar signals in the middle atmosphere based on large ensemble simulations with multiple climate models —FOCI, EMAC, and MPI-ESM-HR. Consistent with previous work, we find that the 11-year solar cycle signals in the short wave heating rate (SWHR) and ozone anomalies are robust and statistically significant in all three models. These "initial" solar cycle signals in SWHR, ozone, and temperature anomalies are sensitive to the strength of the solar forcing. Correlation coefficients of the solar cycle with the SWHR, ozone, and temperature anomalies linearly increase along with the enhancement of the solar cycle amplitude, and this reliance becomes more complex when the solar cycle amplitude exceeds a certain threshold. In addition, the cold bias in the tropical stratopause of EMAC dampens the subsequent results of the "initial" solar signal. The warm pole bias in MPI-ESM-HR leads to a weak polar night jet (PNJ), which may limit the top-down propagation of the initial solar signal. Although FOCI simulated a so-called top-down response as revealed in previous studies in a period with large solar cycle amplitudes, its warm bias in the tropical upper stratosphere results in a positive bias in PNJ and can lead to a "reversed" response in some extreme cases. We suggest a careful interpretation of the single model result and further re-examination of the solar signal based on more climate models.

Solicited or Contributed

Contributed

Presenting author

Wenjuan Huo

Author list and affiliations

Primary author: HUO, Wenjuan

Co-authors: POHLMANN, Holger (Max Planck Institute for Meteorology); KRÖGER, Jürgen (Max Planck Institute for Meteorology); MATTHES, Katja (GEOMAR Helmholtz Centre for Ocean Research Kiel); WAHL, Sebastian (GEOMAR Helmholtz Centre for Ocean Research Kiel); SPIEGL, Tobias (Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung); LANGEMATZ, Ulrike (Freie Universität Berlin)

Presenter: HUO, Wenjuan

Session Classification: Climate response / Earth Radiation Budget / S2S prediction

Track Classification: Climate response / Earth Radiation Budget / S2S prediction