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The solar cycle response in WACCM-3 transient simulations

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A composite analysis of the response to the 11-years solar cycle in Whole Atmosphere Chemistry Climate Model (WACCM-3) transient simulations, which include the observed solar cycle and Sea Surface Temperatures, reveals that the response in wind and temperature throughout the tropical stratosphere, though similar in structure and significance, is stronger than in WACCM-3 simulations with fixed (perpetual solar maximum versus minimum conditions and SSTs) forcings. The direct solar effect (i.e. radiative heating) alone cannot explain the different patterns in the modeled stratospheric signal amplitude.

Changes in meridional transports will be investigated, along with the role of incorporating observed SSTs in climate simulations and the transfer of the signal between different atmospheric regions. Furthermore, we will determine if solar-induced changes in tropospheric climate through wave-induced indirect effects become more significant in the extra-tropics when tendencies related to the ozone depletion are removed. No validation attempt was done in our work, considering (i) the uncertainty in observed temperature response, (ii) the inability of WACCM-3 to incorporate the solar-QBO interactions, and (iii) our original scope of depicting the dynamical nature of solar-induced circulation changes in climate simulations.