Geophysical Research Abstracts
Vol. 16, EGU2014-1991-1, 2014
EGU General Assembly 2014
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GISS GCMAM Modeled Climate Responses to Total and Spectral Solar Forcing on Decadal and Centennial Time Scales

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We examine the influence of the SORCE (Solar Radiation and Climate Experiment) SIM (Spectral Irradiance Monitor) observed spectral solar irradiance (SSI) variations on Earth's climate. We apply two reconstructed spectral solar forcing scenarios, one SIM based, the other based on the SATIRE (Spectral And Total Irradiance REconstruction) model, as inputs to the GISS (Goddard Institute for Space Studies) GCMAM (Global Climate Middle Atmosphere Model) to examine the climate responses on decadal and centennial time scales. We show that the atmosphere has different temperature, ozone, and dynamic responses to the two solar spectral forcing scenarios, even when the variations in TSI (Total Solar Irradiance) are the same. We find that solar variations under either scenario contribute a small fraction of the observed temperature increase since the industrial revolution. The trend of global averaged surface air temperature response to the SIM-based solar forcing is 0.02 °C/century, about half of the temperature trend to the SATIRE-based SSI. However the temporal variation of the surface air temperature for the SIM-based solar forcing scenario is much larger compared to its SATIRE counterpart. Further research is required to examine TSI and SSI variations in the ascending phase of solar cycle 24, to assess their implications for the solar influence on climate.