Geophysical Research Abstracts
Vol. 14, EGU2012-5194, 2012
EGU General Assembly 2012

Solar Spectral Irradiance and Climate

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Spectrally resolved solar irradiance is recognized as being increasingly important to improving our understanding of the manner in which the Sun influences climate. There is strong empirical evidence linking total solar irradiance to surface temperature trends - even though the Sun has likely made only a small contribution to the last half-century's global temperature anomaly - but the amplitudes cannot be explained by direct solar heating alone. The wavelength and height dependence of solar radiation deposition, for example, ozone absorption in the stratosphere, absorption in the ocean mixed layer, and water vapor absorption in the lower troposphere, contribute to the "top-down" and "bottom-up" mechanisms that have been proposed as possible amplifiers of the solar signal. New observations and models of solar spectral irradiance are needed to study these processes and to quantify their impacts on climate.

Some of the most recent observations of solar spectral variability from the mid-ultraviolet to the near-infrared have revealed some unexpected behavior that was not anticipated prior to their measurement, based on an understanding from model reconstructions. The atmospheric response to the observed spectral variability, as quantified in climate model simulations, have revealed similarly surprising and in some cases, conflicting results. This talk will provide an overview on the state of our understanding of the spectrally resolved solar irradiance, its variability over many time scales, potential climate impacts, and finally, a discussion on what is required for improving our understanding of Sun-climate connections, including a look forward to future observations.