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Modeling the Wavelength and Time Dependence of Solar Forcing of Earth Climate

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Solar forcing is the primary external forcing of terrestrial climate. Climate response to solar radiative forcing is poorly understood, and previous to SORCE there has been limited information about the spectal character of solar variations. Variations in total solar irradiance (TSI) have contributions from spectral bands ranging from the ultraviolet, through the visible, to the near infrared. These three solar spectral regions, UV, VIS, and NIR, force the stratosphere, troposphere, and ocean mixed layers, respectively. UV is responsible for stratospheric heating, and formation of the ozone layer; VIS heats the Ocean Mixed layer and drives upper oceanic circulation; and NIR directly heats the troposphere by water vapor absorption, as well as through cloud and other feedbacks. In this study, we use a simple 1D radiative convective model (RCM) (Arking, 2005) to study the response of surface and atmospheric temperatures to the spectral forcing of solar radiation as observed by the Spectral Irradiance Monitor (SIM) on SORCE. Preliminary RCM results show significant differences in surface temperature when driven by the SIM spectral solar irradiance (SSI) as compared to responses to SSI variations assumed in previous climate studies (e.g. Kurucz and Bell, 1995).