

James Brenton

Jerry Harder, Peter Pilewskie, Erik Richard

Laboratory for Atmospheric and Space Physics

University of Colorado, Boulder

j_brenton@neo.tamu.edu

(979-229-9223)

30 July 2009

Solar Variability and the Effects on the Earth's Atmosphere

It is known that the Earth's climate is dependent on the Sun as its primary source in radiative energy. It is also known that the Sun goes through minimum and maximum cycles, involving variability in the Sun's magnetic field, temperature, and sunspots. This variation has little effect on the sun as a whole, with as little as a tenth of a percent of the total solar irradiance experiencing change. However, the Earth maintains a fine balance of radiative energy, and how these cycles impact the Earth's climate is still a topic of research. For instance, as the atmosphere absorbs the Sun's radiation across the full spectrum, different layers of the atmosphere experience a change in temperature. Through the circulation of the Hadley, Mid-Latitude, and Polar cells, air is transported through different atmospheric layers, causing warmer air to be carried throughout the atmosphere. These thermodynamic processes could have an effect on both weather and, given enough time, climate. The goal for this study is to determine on what scale this solar variability affects the Earth's atmosphere, in order to lead to a greater understanding of Sun-Earth interaction and the climatological effects thereof. This study used two sets of data. The first was data gathered from the solar irradiance monitor (SIM) and total irradiance monitor (TIM) instruments on board the SORCE satellite. This data was taken from 16 May 2004 to 20 May 2009 using ten day averages due to solar differential rotation. Among these averages, a reference ten day average was chosen during solar minimum to represent the "quiet sun", which was taken to be five days prior to November 9, 2007, up to five days after November 9, 2007. The second set of data came from the models produced by MODTRAN 5, an atmospheric radiative transfer modeling program. Several

different parameters were entered into the program such as time of year, the global location, and the irradiance gathered from the ten day averages.