

Project Details

ROSES ID: NRA-01-OSS-01

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Program Element: Independent Investigation: Solar Helio LWS

Project Title:

Role of the stratosphere in amplifying the 11-year solar cycle

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Summary:

Research during the past several years suggests that there is a discernable influence of 11-year solar variability on the atmosphere, in particular the stratosphere. There is also strong observational and modeling evidence that low-latitude stratospheric circulation anomalies are communicated poleward and downward through a dynamical mechanism involving planetary-scale waves. This process amplifies circulation anomalies and draw them downward as far as the Earth's surface, where they affect weather and climate. The proposed investigation will relate solar cycle effects in the tropical stratosphere to extratropical anomalies, and the amplification of these anomalies as they progress downward through the atmosphere. We propose to: 1. Use a variety of observational data sources to study tropical wind variability in the stratosphere. This region appears to be crucial not only for direct solar effects but for the communication of a solar signal to the extratropics. 2. Examine the development, in latitude, height, and time, of equatorial stratospheric circulation anomalies related to solar variability. We will use annular mode indices as a tool to examine hemispheric variability related to the solar cycle. 3. Use a primitive equation model spanning the troposphere, stratosphere, and mesosphere to probe the observational findings, and to examine the effects of changes to and timing of equatorial stratospheric wind anomalies. The proposed study represents an important component of NASA's Living With a Star Program, which is focused on an increased scientific understanding of the Sun-Earth system as it affects weather, climate, and society. In addition, we will use data from current and past NASA missions. The proposed study is relevant to the Living With a Star Program for three reasons: 1. The focus is on the dynamical role of the stratosphere, how stratospheric processes are sensitive to solar forcing, and how wave-induced momentum transport can amplify solar signals, drawing these signals poleward and downward. 2. The proposed effort involves a combination of data analysis and numerical modeling, with a goal of improving our understanding of how solar variability is linked to surface weather and climate, which affects life and society. 3. An improved understanding of these processes should enable us to better separate natural solar variability of the climate system from anthropogenic trends.

Publication References:

Summary: "

Reference: Role of the stratosphere in amplifying the 11-year solar cycle - Baldwin, Mark P. NwRA

Summary: no summary

Reference: Baldwin, Mark P.; Dunkerton, Timothy J.; (2005), The solar cycle and stratosphere troposphere dynamical coupling, Journal of Atmospheric and Solar-Terrestrial Physics, Volume 67, Issue 1-2, p. 71-82., doi: 10.1016/j.jastp.2004.07.018