Project Title:
Solar-Induced Variations in Polar Mesospheric Clouds

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Project Information:
Solar-Induced Variations in Polar Mesospheric Clouds Polar Mesospheric Clouds (PMC) are located near the high-latitude summertime mesopause near 83 km in a region which is susceptible to both anthropogenic influences from below, and to external influences from above. Their ground-based manifestation, noctilucent clouds (NLC), has been observed for over a century. Yet, we are far from understanding the relationship of atmospheric forcing and mesospheric cloud response, particularly on time scales of a year or more. It is evident that PMC/NLC activity exhibits a ten-to-eleven year periodicity, most likely a result of the 11-year variation in ultraviolet solar irradiance and its effect on the ambient water vapor at 83 km. However up to now, there have been no attempts to model this interaction, nor to explain why solar minimum surprisingly precedes maximum PMC/NLC activity by 2-3 years. We first propose an analysis of four extensive PMC data sets to establish a unified database for long-term PMC variability, from seasonal to decadal time scales. Secondly, we propose to model the influences of atmospheric transport, temperature, water vapor and nucleating particles on PMC occurrence and brightness. Two models will be used. The first simulates the two-dimensional atmospheric transport on seasonal to decadal time scales. The second describes the one-dimensional behavior of ice particle properties in supersaturated conditions. Our aim is to create a self-consistent two-dimensional model of the atmosphere forced by seasonal and solar cycle variations, which includes PMC properties that will be constrained by the satellite data. In this way we will establish a theoretical basis for long-term variability near the summer mesopause. variability, from seasonal to decadal time scales. Secondly, we propose to model the influences of atmospheric transport, temperature, water vapor and nucleating particles on PMC occurrence and brightness. This is done through the use of two self-consistent models, one simulating the atmosphere, the second describing the ice particle properties in supersaturated conditions. Our aim is to create a model of PMC physical and optical properties, forced by atmospheric variations and constrained by the available satellite data.models, one simulating the atmosphere, the second describing the ice particle properties in supersaturated conditions. Our aim is to create a model of PMC physical and optical properties, forced by atmospheric variations and constrained by the available satellite data.

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