

Response of Polar Mesospheric Clouds to the 11-Year Solar Cycle

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The response of the polar mesosphere to the 11-year solar cycle is investigated using satellite observations from 1979 – 2018 and modeling runs from WACCM-PMC. The occurrence and density of Polar Mesospheric Clouds (PMC), which occur in the cold summer polar mesopause, are controlled by the local temperature and water vapor. Solar maximum is expected to cause higher temperatures and lower water vapor in the upper mesosphere, thus reducing the amount of ice PMCs. The long record from SBUV observations of PMCs have suggested that the ice clouds respond to the solar cycle. While PMCs showed a clear anti-correlation with the solar cycle before roughly 2002, this response is curiously absent during recent years. The observations imply that the main cause of the diminished solar cycle in PMCs near 68°S and 68°N appears to be a dramatic suppression of the solar cycle response of water vapor. The solar cycle response of temperature also decreases after 2002, but observations show that the decreased H₂O response had more than three times the impact on PMCs than the reduction in temperature response. Attribution studies from the WACCM-PMC model help to understand why the solar cycle response in PMCs in the recent 16 years appears to have gone away.