

Dynamics of Decadal Sulfur Dioxide Variability in Venus' Atmosphere with a Simple Model

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Water and sulfur dioxide are important trace gases in the atmosphere of Venus. The photolysis of sulfur dioxide in the upper clouds produces sulfuric acid, which forms the thick cloud decks characteristic of the planet's atmosphere. Sulfur dioxide concentrations at the cloud top of Venus have been observed to oscillate on decadal timescales, characterized by sharp spikes and gradual declines. The variation is suspected to occur due to dynamical variability in the deep atmosphere of Venus but the exact mechanism has remained a mystery. Using a simple one dimensional box model where water and sulfur dioxide are cycled between the cloud tops and the deep atmosphere, we explore the dynamics of the sulfur dioxide oscillations. We find that the periodicity of the oscillation is dependent on vertical transport and thermal decomposition timescales in the deep atmosphere, while the shape of the oscillation depends on the transport timescale in the cloud layer.

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