

Dynamic impacts of wintertime stratosphere on the tropospheric circulation

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Recent observations have suggested that the strength of the stratospheric polar vortex influences circulation in the troposphere. A mechanism to explain how the behavior of the stratosphere may affect tropospheric weather patterns has been proposed. Stratospheric forcing, through the mechanism of "downward control," weakly forces the Arctic oscillation - a mode of variability in sea-level pressure. This forcing is then reinforced in the troposphere by interactions with transient eddies in the lower atmosphere, creating a substantial amplification of the signal. We believe the weak forcing in the stratosphere, which is directed downward, stimulating the internal modes of variability that are already there. These pre-existing modes are fundamental to the dynamics of the lower atmosphere.

We use a simple global climate model of the atmosphere to study the mechanism. By applying a torque to the stratosphere, we can study the effects upon internal modes of variability in the troposphere. In this study, we impose both steady forcing and periodic forcing in the stratosphere. We also use a zonal mean version of the model to study the effects of the wave activities.