Geophysical Research Abstracts
Vol. 12, EGU2010-3362, 2010
EGU General Assembly 2010

Model Sensitivities and Stratosphere – Troposphere Interactions

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A simplified, Newtonian-forced, general circulation model has been used to investigate the impact of changes in the stratosphere on tropospheric circulation.

First the sensitivity of the model's climatology and of its timescales of internal variability to variations in the surface temperature relaxation timescale have been investigated. Then the impacts of heating and momentum perturbations imposed on the stratosphere have been assessed.
Changes to the surface relaxation timescale are shown to have a significant impact on the model's climatology, influencing both the thermal structure of the lower troposphere and the position of the subtropical jet.

Time series of the anomaly in zonal wind characterising the latitudinal motion of the jet indicate two distinct behaviours, propagating and stationary, which are related to the timescales of internal variability.

Furthermore, the model's response to stratospheric heating perturbations is shown to depend on the surface temperature relaxation. This is thought to be a consequence of the change of the timescales of internal variability related to the jet position which is influenced by the surface relaxation timescale.