

On the low frequency variability of the general circulation: observations and models

I. Bordi (1), K. Fraedrich (2), F. Lunkeit (2), A. Sutera (1)

(1)University of Rome "La Sapienza", Department of Physics, I-00185 Rome, Italy

(2)Meteorologisches Institut, Universität Hamburg, D-20146 Hamburg, Germany

The observed low frequency variability of the zonally averaged atmospheric circulation in the winter Hemisphere is found amenable to an interpretation where the subtropical jet is flanked by a secondary mid-latitude one. Observations suggest also that the link between the stratosphere and the troposphere modulates the variability of the tropospheric double-jet structure. Moreover, the summer Hemisphere is characterized by a strong mid-latitude jet sided by an intermittent subtropical one and easterly winds in the stratosphere. This work addresses the question about the role of the eddies in generating and maintaining these key features of the general circulation by means of a simplified general circulation model. Model solutions for different parameter settings and external radiative forcings in the stratosphere have been studied with and without eddies active on the system. The main finding is that the eddy dynamics alone, through the baroclinic instability processes in an atmosphere subjected to radiative forcing and dissipation, may account for the observed meridional variance of the tropospheric jets. Moreover, results suggest that the Hadley cell can extend to the pole overlying the Ferrel cell, a feature supported by observations in the summer Hemisphere. The meridional temperature gradient reversal in the summer stratosphere contributes to the observed low frequency variability introducing an intermittent formation of a subtropical jet and the occurrence of easterlies in the tropical stratosphere. Finally, the poleward propagation of the zonal wind anomaly, when it occurs, is related to the activity of synoptic eddies.