Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03696, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03696
EGU General Assembly 2008

Impact of conservative dynamics on the Lagrangian mean static stability in the extratropical tropopause region

A. R. Erler and **V. Wirth**
Institute for Atmospheric Physics, University of Mainz, Germany

Recent studies found a layer of increased static stability above the extratropical tropopause using a tropopause based quasi-Lagrangian averaging technique. The current paper explores to what extent this "tropopause inversion layer" (TIL) can be explained by purely dynamical mechanisms.

We provide a general formulation of the problem by considering the material rate of change of static stability (N^2) for a quasi-horizontal material layer in a stably stratified atmosphere under hydrostatic adiabatic conditions. Both the horizontal divergence/convergence and the vertical shear can contribute to a change in Lagrangian mean static stability. In the special case of an isentropic layer, the shear-based mechanism disappears, and the Lagrangian mean static stability can be related to the layer's variability in pressure thickness and pressure altitude. Variability of pressure thickness is associated with enhanced Lagrangian mean static stability, while variability in pressure altitude is associated with a decrease.

These concepts are applied to numerical simulations of baroclinic life cycles in a dry channel model. Previous work has shown that these simulations exhibit a tendency for enhanced Lagrangian mean static stability right above the tropopause. Our analysis quantifies the impact of the aforementioned dynamical mechanisms on TIL-formation in this model, and thus facilitates the interpretation of earlier results.