Geophysical Research Abstracts
Vol. 13, EGU2011-11669, 2011
EGU General Assembly 2011

TIL and tropopause ozone distribution in the tropics

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The vertical profiles of ozone concentrations, temperature and static stability (N2) from the ozonesoundings belonging to the Southern Hemisphere Additional Ozonesonde (SHADOZ) and the World Ozone and Ultraviolet Radiation Data Centre (WOUDC) networks in the time period 1998-2009 are analyzed to explore the thermal and chemical structure of the tropopause inversion layer (TIL) in the tropics.
The TIL can be identified through singular levels in the relative vertical ozone gradient (ratio between the ozone vertical gradient and ozone mixing ratio concentration) and static stability vertical profiles, that are highlighted using a thermal tropopause-referenced system.
The horizontal distribution of the static stability maximum above the tropopause and the region around it is consistent with that of the tropopause sharpness, S. The analysis performed in this study shows that S is highest where the TIL is strongest. Both quantities match the zonal structure of cold point tropopause temperatures, that are lowest in the regions of strongest deep convection. Based on the temperature soundings, the highest values of S are indeed found in the Pacific warm pool region and central east Africa, while the smallest ones are found at the subtropical stations considered in this study, e.g., La Reunion (21° S) and Irene (26° S), in agreement with previous results using GPS RO measurements.
Between 30° S and 30° N, there is a clear coupling in the vertically varying structure of N2 (that is commonly used to define the TIL) and the relative vertical ozone gradient about the tropical tropopause, both quantities having singular points at approximately corresponding altitudes, one slightly below the tropopause (about 500 m-1 km) and the other one above the tropopause. While the peak in the static stability above the tropopause varies from about 1 to about 4 km depending on the distance from the Equator, the relative maximum in the ozone vertical gradient is located about 1 km above the thermal tropopause, regardless of the latitude. This may be ascribed to different radiative and dynamical mechanisms determining the chemical and thermodynamical structure of the TIL.