



Climatology and trend of the extratropical dynamical and thermal tropopauses in ERA-40

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A climatological comparison of the extratropical tropopause pressure obtained from the dynamical and thermal definitions is presented using the ERA-40 reanalysis for the period 1960-2001 and Northern Hemisphere. Temperature (T) at isobaric levels between 500 hPa and 70 hPa and isentropic potential vorticity (PV_{θ}) between 270 and 440 K were extracted from the 60 vertical levels of the model at $2.5^{\circ} \times 2.5^{\circ}$ and 6 hours resolution.

Following the WMO criterion, the thermal tropopause is defined as the first layer where the temperature lapse rate is less than 2 K km^{-1} for a depth of at least 2 km. The dynamical tropopause is determined from the lowest vertical level where PV_{θ} exceeds a critical value. A critical threshold of $PV_{\theta} = 3.5 \text{ PVU}$ was adopted, following Hoerling et al (1991). The pressure at the thermal (dynamical) tropopause was computed by linear interpolation assuming that p varies with $T^{1/k}$ ($\theta^{1/k}$).

Results reveal good agreement between both definitions. Maximum discrepancies tend to occur at subtropical latitudes. Both definitions capture well global and regional signatures of the atmospheric circulation, including strong gradients of the tropopause pressure around the subtropical jet stream and maximum standard deviations over preferred regions of storm tracks.

A linear regression applied to the extratropical seasonal mean values confirms the decreasing trend in tropopause pressure for the second half of the twentieth century.