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Ozone mixing ratios along the tropopause: How do models represent the transition from the tropics to the extra-tropics?

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The assessment of global tropospheric ozone budgets requires a suitable definition of the tropopause to evaluate the ozone influx into the troposphere. Here, we will apply several definitions of the tropopause (thermal, dynamical, chemical) to model data (ERA-40 and UKCA). The aim is to compare the relative positions of the defined interface levels and the distribution of ozone values along them. For example a dynamical tropopause defined by 2 PV units is commonly lower than the thermal lapse rate tropopause and neither necessarily coincides with a simple chemical tropopause often chosen as 150 ppbv of ozone. Here, we compare the latitudinal and seasonal structure of ozone distributions on chosen characteristic (tropopause) levels for a reference year (2001 in ERA-40). Note, that ERA-40 is an idealised model system with respect to ozone. Therefore we recognise the necessity of an independent validation using observational data, which we discuss briefly. The year 2001 has been used in previous studies, including a study comparing Lagrangian and Eulerian transport through the TTL (Levine et al. 2007), which highlighted the importance and hemispheric differences of sideways transport into the lowermost stratosphere. To complement the earlier studies we focus on hemispheric differences in ozone distributions in the transition region between tropics and extra-tropics as characterised by their mode, mean and skewness. We illustrate the use of this approach as a process-oriented diagnostic in a model context and show seasonal variations. In addition, we explore a chemical tropopause definition chosen as a constant vertical gradient of ozone and not as a constant mixing ratio value and compare the ozone distributions at those levels to the ozone distributions at the thermal or dynamical tropopause.