

**Fig. 3.** Black contours: annual mean transit time (left, in years) and minimum pressure visited (right, in hPa) of trajectories along time-dependent annually repeating residual streamlines from CMAM. The background color shading quantifies the absolute value of the meridional gradient of the displayed fields (in arbitrary units, darker shading for larger gradients, blue for largest gradients). Thick dashed lines mark average position of the tropopause.

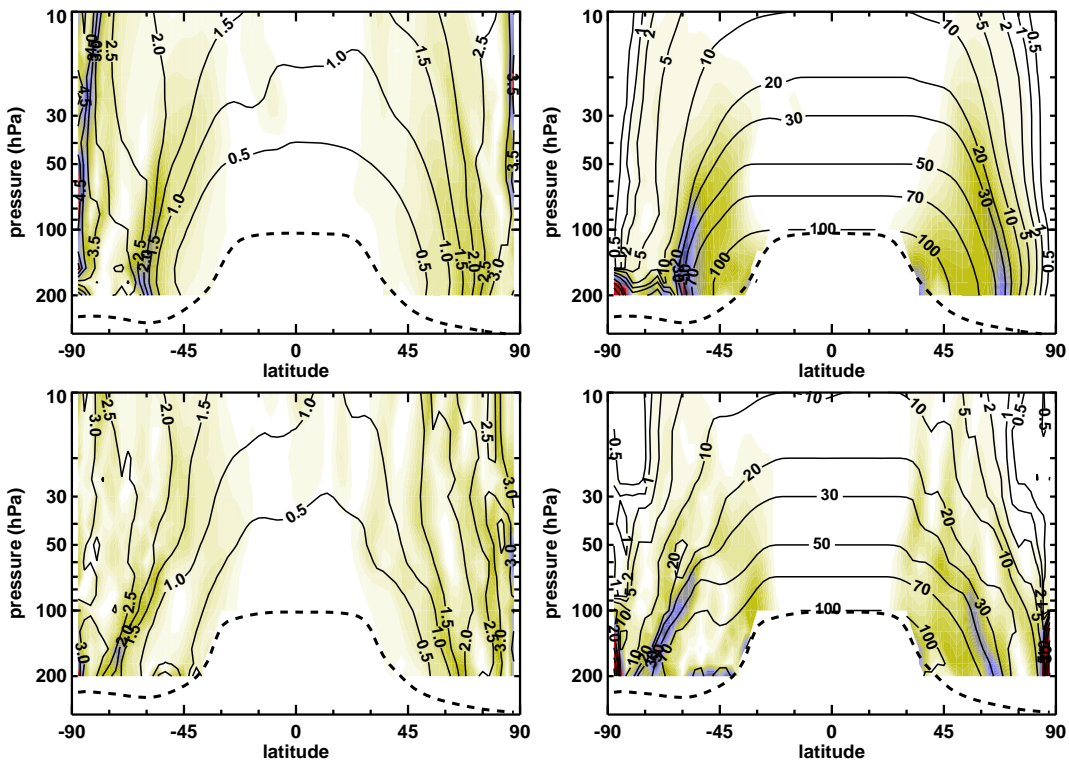
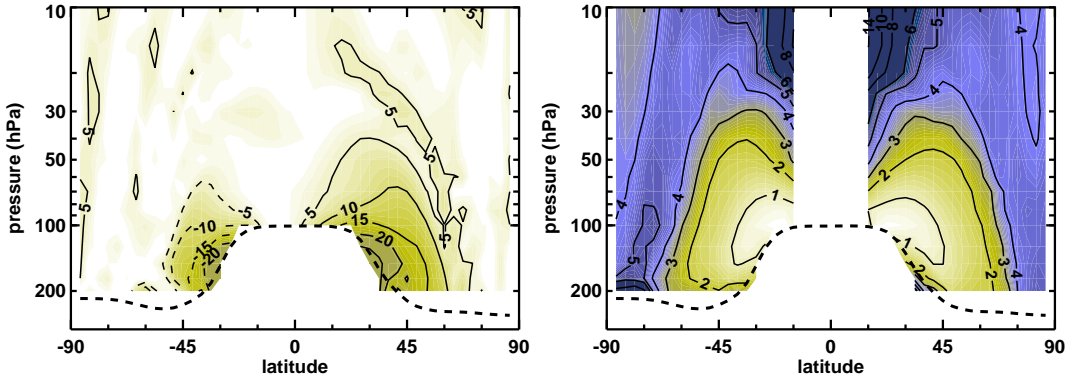
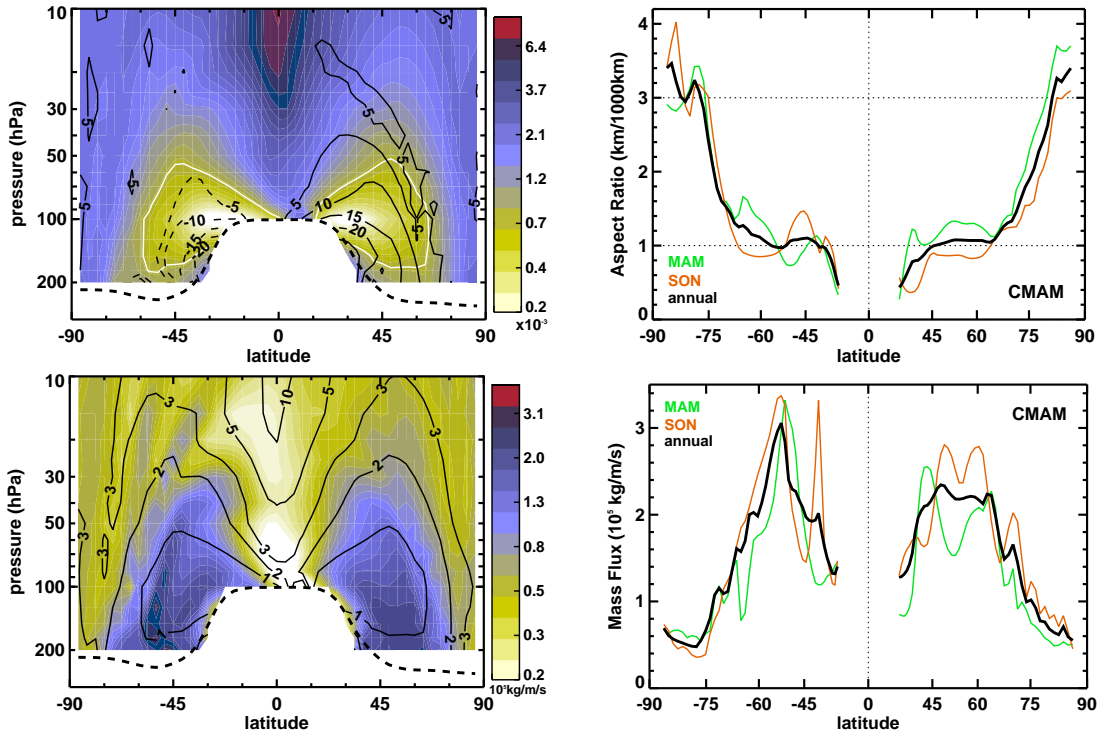


Fig. 4. As Fig. 3 but for JRA25 (top) and ERA40 (bottom) for 1979–2001.



**Fig. 5.** Annual mean stratospheric entry latitude (left, in degrees, southern latitudes dashed, zero contour omitted) and scaled transit time (right, in years) of residual circulation trajectories from CMAM. The scaling used on the right is given by  $90^\circ/(\varphi_a - \varphi_e)$ , where  $a$  and  $e$  refer to arrival and entry latitudes, respectively. In the tropics,  $\varphi_a \approx \varphi_e$ , which results in exceedingly large values – the region equatorward of  $30^\circ$  is therefore omitted on the right. Thick dashed lines mark average position of the tropopause.



**Fig. 6.** Trajectory vertical to horizontal aspect ratio  $r$  (km per 1000 km, top) and integrated mass flux along trajectories (in  $10^5$  kg/m/s, bottom) for CMAM. Left: annual means as a function of arrival pressure and latitude (color shading, note logarithmic scale). Stratospheric entry latitudes (contours, in degrees, southern latitudes dashed, zero contour omitted) and the contour  $r = 1 \cdot 10^{-3}$  (white) are overplotted in the top. Annual mean trajectory aspect ratio  $r$  (contours, in km per 1000 km, note irregular contour spacing) are overplotted in the bottom. Right: as a function of arrival latitude with arrival pressure set to correspond to  $\Theta_{\text{TP}} + 30$  K (roughly the top of the ExTL). Note stretched abscissa, which is proportional to  $\cos\varphi$  to highlight extratropical areas (tropical values, equatorward of  $30^\circ$ , are omitted). Green: boreal spring, brown: boreal autumn, black: annual mean $_{20}$