

Primary contribution of the Australian High to climatology of the stratospheric momentum budget during the austral spring

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In the Southern Hemisphere polar stratosphere, quasi-stationary waves of zonal wavenumber (s) 1 develop in the austral spring, and an anticyclone called the Australian High (AH) emerges before the stratospheric final warming. The AH has similar characteristics to the Aleutian High, which is observed in the Northern Hemisphere throughout winter (Harvey et al. 2002). In this study, contribution of the AH to the climatological momentum budget is examined for the austral spring by using 38 years (1980–2017) of the Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2; Gelaro et al. 2017).

To track the seasonal movement of the AH and the polar vortex, a center of the AH is defined as a location of the maximum of geopotential height, and that of the polar vortex is defined as a centroid, which is obtained by applying the moment diagnostics to the polar vortex (Waugh et al. 1997; Mitchell et al. 2011). The latitude of the AH center is around 35°S in August, then gradually increases, and reaches 55°S in late October. The polar vortex center is almost constant at 85°S until August, but begins to decrease in September and reaches 70°S in late October. The vertical component of Eliassen-Palm (E-P) flux at 10 and 100 hPa gradually increases from early winter to spring, and attains its maximum in September–October. Because the AH is regarded as $s=1$ quasi-stationary waves, the $s=1$ wave contribution to the vertical component of E-P flux is estimated by using a low-pass filter with a cutoff period of 30 days. The contribution reaches approximately 70 % and 50 % at 10 and 100 hPa, respectively, in September–October. Tropospheric origin of the AH will also be discussed.

Keywords: Australian High, climatology, quasi-stationary waves, E-P flux

References

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