

Interhemispheric differences in the roles of SAO in mid- and high latitudes

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Previous studies showed the existence of the climatological upwelling in the subtropical stratopause region. It is known that the seasonal variation in the subtropical upwelling is closely related to the equatorial semiannual oscillation (SAO). The SAO and the residual circulation in the middle atmosphere are driven by atmospheric waves such as planetary waves and gravity waves. This study shows a dynamical link between the SAO and the subtropical upwelling in the austral and boreal winter from statistical analysis using a reanalysis (MERRA) data. All years (1979-2010) are divided into two groups, strong SAO years and weak SAO years, defined by the zonal wind at the equatorial stratopause. For the austral winter (July), the composite analysis shows the strong connection between the interannual variability of the SAO, the subtropical upwelling, and the planetary wave activity at lower stratosphere. Since interannual variations of the SAO and planetary wave activity affect the subtropical momentum deposition in the mesosphere, the variation in the upwelling is controlled by the SAO and planetary wave activity. In contrast, the planetary wave activity is not correlated to the subtropical upwelling for the boreal winter (January), although the SAO and the upwelling are negatively correlated. The interhemispheric difference is attributable to the difference in the property of the planetary wave. Transient planetary waves are dominant for the austral winter, while stationary component is dominant for the boreal winter.

Keywords: equatorial semiannual oscillation, residual circulation, planetary waves