Preferred Solar Signal Transfer in the Asian-Pacific Sector

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Solar impact on the tropospheric subtropical jet (SJ) has been revealed previously from a zonally averaged perspective. The zonal-mean SJ was observed to be weaker in the high solar activity winters. However, some regional features in SJ variations induced by solar forcing might be unrecognized. Here it is found that the second internal mode of the wintertime 200 hPa zonal wind over the Asian-Pacific sector, which exhibits a banded structure (i.e. easterly anomalies within the subtropics and westerly anomalies on the poleward and equatorward sides), greatly resembles the regional solar signal in the Asian-Pacific 200 hPa zonal wind. Notably, the significant response of Asian-Pacific SJ (APSJ) to solar activity in boreal winter exclusively marks its center region, showing a deceleration in westerlies. Following some previous studies revealing the 'top-down' transfer of solar signal, further exploration suggests two possible 'top-down' routes to interpret why solar signal particularly manifests in the APSJ center. One is a tropical route. During the cold season, driven by the solar-associated reduction of Brewer-Dobson circulation, the ozone concentration in the tropical lower stratosphere increases evidently within the zonal range of APSJ center, then heating the air here. The regional upwelling in the tropical troposphere is thereby suppressed, consequently producing a significant weakened APSJ center by the local Hadley cell. The other is a middle-high latitude route. In early winter, the pronounced strengthened westerlies in the mid-latitude stratosphere created by solar forcing are confined to the longitudinal range of APSJ center. As winter progresses, through the wave mean flow interactions, a resultant weakened APSJ center significantly presents in the middle of winter.

Key words: Solar impact, subtropical jet, stratosphere, top-down route