EMS Annual Meeting Abstracts
Vol. 16, EMS2019-176, 2019


# Downward Propagation of Planetary Wave Packets from the Stratosphere to the Troposphere During the Northern Hemisphere Winter

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Downward propagation of planetary wave packets from the stratosphere to the troposphere is often observed during the Northern Hemisphere winter and their influence on the tropospheric circulation and severe weather has been also reported by various authors. Recent observational studies show that the downward propagation into the troposphere frequently occurs over the North American continent centered around 90W. However, they are mostly limited to case studies and overall features are still unclear. Hence, we investigate the frequency distribution of downward propagation events of planetary wave packets and its relationship to the background field using the Japanese 55-year Reanalysis (JRA-55) data. We calculate Plumb's (1985) wave activity flux (WAF) and extract the downward propagation events over the analysis period (1958-2016) based on a specified criterion value for the vertical component of WAF at 30 hPa. Next, we investigate the longitudinal location of each downward propagation event and classify it into eight sectors of 45 degrees along the longitudinal circle to make a composite analysis of the classified events. Resultantly, over 500 events are extracted during the analysis period and it is found that more than 80% of the events occurred in three sectors between 135W to 0E corresponding to North America and the North Atlantic; these events are shown to be intimately related to the development of the Aleutian High in the stratosphere, which is located in the west of the downward propagation region. As for the other events, a developed anticyclone was also observed in the west of each downward propagation region.