

Interannual and intraseasonal variability of gravity waves revealed from high resolution AIRS observations

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An analysis was made of high-resolution temperature data from satellite onboard Atmospheric Infrared Sounder (AIRS) over eight years from 2003/2004 to 2010/2011 to examine gravity wave (GW) characteristics around an altitude of 40 km in terms of the interannual and intraseasonal variability in austral summer (DJF). AIRS is a nadir-view instrument and sensitive to the temperature fluctuations with vertical wavelengths greater than 15 km. The S-transform was applied to the data series in both cross-track or along-track directions to estimate GW characteristics. First, the DJF-mean time series of GW amplitudes and precipitation were regressed to the sea surface temperature time series in NINO.3 region. It is shown that both GW amplitudes and precipitation are large to the northeast (southwest) of the South Pacific convergence zone (SPCZ) in the El Nino (La Nina) phase. Second, the intraseasonal variation of GWs were examined in terms of the Madden-Julian Oscillation (MJO). Ten-day-mean time series was examined as a function of the longitude for GW amplitudes and precipitation that were averaged over the latitudes of 0-20S. Large GW amplitudes are observed in association with the eastward migrating precipitation of MJO, which is more clearly described by a regression to the Real-time Multivariate MJO Index. Another interesting finding is that the GW amplitudes are significantly weak when the zonal wind at 100 hPa is eastward regardless of the precipitation amount. These results suggest that the interannual and intraseasonal variations of GWs in the subtropical middle stratosphere are modified largely by ENSO and MJO through the precipitation as GW sources and the zonal wind around the tropopause regulating GW vertical propagation.

Keywords: gravity waves, ENSO, MJO, QBO