Spatial and temporal distributions of atmospheric gravity wave potential energy evaluated using ERA-5 temperature data over the equatorial latitudes

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In this study, we used the temperature profiles retrieved from ERA5, the newest atmospheric reanalysis dataset issued by the European Centre for Medium-Range Weather Forecasts (ECMWF), to evaluate the potential energy (E_P) in the atmosphere from the near ground surface to ~80 km altitude over the equatorial latitudes of ±10°. E_P is calculated from the fluctuation of temperature, which is considered to be generated by atmospheric gravity waves (AGWs), and we have constructed the spatial and temporal distributions of E_P over the equatorial latitudes using the high-resolution data from ERA5. In this study, we will present the variations of E_P in time, altitude, and longitude. Overall, E_P is controlled by the zonal flow of the background atmosphere. Especially the time-varied descending structures of high E_P value coincide with the westerly shear of zero-wind in the stratosphere, which implies the Kelvin wave-mean flow interactions in the stratospheric altitudes. Besides, the longitudinal analysis shows that E_P is higher in the eastern Pacific at all altitudes except around the tropopause. In addition, we checked the E_P values during different atmospheric and oceanic conditions, to examine the possible relationship between El Niño/La Niña and atmospheric gravity waves. With regards to the E_P distribution caused by Kelvin waves in the stratosphere, we will also compare the results with the Kelvin wave amplitudes obtained by the two-dimensional fast Fourier transform (2D-FFT) method in this presentation.

Keywords: Atmospheric gravity waves, Potential energy, Zonal wind, Wave-mean flow interactions, ERA-5

