Geophysical Research Abstracts
Vol. 19, EGU2017-6811, 2017
EGU General Assembly 2017

Deriving daily and seasonal variations in meteorological gravity wave parameters from a tropical infrasound station and comparisons with lightning strike data form ATDnet and TRMM LIS.

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A wealth of work has shown that meteorological gravity wave parameters can be derived from both satellite data and weather balloons. Satellite data has good temporal and spatial coverage but can only probe the lower stratosphere and mesosphere. Radiosonde wind and temperature profiles can also be used to infer gravity wave information in the upper troposphere and lower stratosphere. Both methods have been used to investigate seasonal variations in gravity wave parameters at these heights. However, these methods cannot be used to infer gravity wave parameters near the surface. One method to detect atmospheric gravity waves at the surface is by using an infrasound array. Infrasound arrays consist of several microbarometers which are spaced kilometres apart. As the wave passes over the array subtle pressure perturbations are subsequently detected at each microbarometer. The temporal differences in each microbarometer's time series allow a gravity wave's velocity, back azimuth, ground based frequency and amplitude to be calculated using the progressive multichannel correlation method. In order to calculate further meteorological values such as wave number, velocity perturbations and hence find the momentum flux for each gravity wave, data from meteorological station in close proximity to the array need to be combined with the infrasound data, which is explored here. Gravity wave parameters calculated from infra sound data combined with meteorological data over several years will be shown for a station (IS17) in the Ivory Coast. Blanc et al 2010 showed an annual variation in gravity wave back azimuth due to the shifting of thunderstorms associated with the ITCZ. A spectral analysis of all gravity wave parameters has revealed daily and seasonal variations, which are further explored. To further understand the seasonal variations observed data from the Tropical Rainfall Measurement Mission (TRMM) rainfall estimate and TRMM LIS lightning data are used to relate how the location and intensity of thunderstorms in relation to IS17 causes variations in the gravity wave parameters. Initial results show that thunderstorms are closer to IS17 during March to June, and hence produce larger pressure perturbations and hence larger momentum fluxes. In August to October the thunderstorms are more distant and hence smaller pressure perturbations are detected. Pressure perturbations reach a minimum in northern hemispheric winter as the ITCZ shifts south. To investigate daily variations, the ATDnet data will be used to test the hypothesis that gravity waves detected in the early hours of the morning have distinct characteristics, as they arise from more distant thunderstorms to those detected early evening from nearby thunderstorms. Much can be learnt from this about how the intensity of gravity waves changes due to source and location from source. Ultimately, better gravity wave parametrizations are envisaged which are based on intensity and distance from the gravity wave source.