Gravity wave characteristics over the equator observed during CPEA campaign using simultaneous multiple stations data

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The vertical and temporal variations of inertia-gravity waves are studied by means of an intensive radiosonde campaign conducted from 10 April to 09 May 2004 at five sites, including the Equatorial Atmosphere radar (EAR) site at Koto Tabang (0.2^oS, 100.32^oE) in west Sumatra, Indonesia. The four other balloon sounding sites are located about 75-400 km away from EAR. Dominant gravity waves with periods 2-3 days and vertical wavelengths of about 3-5 km showing clear downward phase propagation were detected, particularly in the upper troposphere and lower stratosphere (UTLS) region. The gravity wave energy is found to become the largest at around 20 km altitude, although the enhancement was not continuous, but intermittent. The wave activity was similar at all the five sites with a slight phase shift, which suggests that the horizontal scale of the wave is larger than the distance between the sites. We have applied a correlative analysis to delineate the horizontal propagation characteristics of gravity waves, and estimated the horizontal wavelength (λ_h) to be about 1700 km propagating towards 30^o south from the east during 26-30 April 2004 which is further verified by hodograph analysis for individual profiles. During 10-14 April 2004 and 5-9 May 2004, λ_h and direction of the propagation is found to be 2700 km and 3250 km and, $26^o$and 3^o north from the east, respectively. The spatial and temporal variations of the convection, which is thought to be a major source for the generation of gravity waves, is also studied using satellite data of outgoing long-wave radiation (OLR). We noticed clear eastward advection of large super cloud clusters (SCCs) from the Indian Ocean to the maritime continent, sometimes moving towards the observational sites. The source of the gravity waves is strongly related to this slowly eastward-advecting tropospheric convection implying that the wave activity we are looking in the UTLS region is already generated by far distant sources located west of EAR. We also present a case study where large wave activity did not correspond to the particular cloud convection.