AOGS 2005

Statistical analysis of convection events and generated high frequency gravity waves over KotaTabang, Indonesia using the Equatorial Atmosphere Radar (0.20^0 S, 100.32^{0}E)

S.K. DHAKA [1], Y. SHIBAGAKI[2], M.K. YAMAMOTO[3], H. HASHIGUCHI[3]
M. YAMAMOTO[3], T. KOZU[4] and S. FUKAO[3]

1. Department of Physics, Rajdhani College, University of Delhi, India
2. Osaka Electro-Communication University, Japan
3. Research Institute for Sustainable Humanosphere, Kyoto University, Japan
4. Shimane University, Japan

An intensive observation campaign was conducted during 10 April - 9 May 2004 over Indonesia – a highly convective region around the globe with one of the objectives to investigate the convection generated high frequency gravity waves in the troposphere and their coupling to the middle atmosphere. During intensive observation period (IOP), Equatorial Atmosphere Radar (EAR), Boundary Layer Radar (BLR), X- Band radar, and other collocated facilities were operated continuously along with launching of radiosondes balloons. Present paper shows the detailed analysis of 3 convection events on 10, 11 and 26 April 2004. The results illustrate the unique characteristic of background wind, which was found highly variable due to dominance of a blend of local circulation and propagation of intra-seasonal oscillation over the Indonesian area. Diversity in convection growth was extremely dominant over the Indonesian region. Convection had shown a tendency to grow in the vertical direction up to 10-15 km rapidly with rainfall (typical time was less than an hour). In other convection cases, which exclude rainfall, convection growth took place horizontally as well as vertically but not as steep as with rainfall. Gravity waves (oscillations with few tens of minutes), which are seen above 15 km, were generated mostly in the middle troposphere by strong convection events, which modulated the vertical winds for several hours (about 6-8 hours). The convection impact on vertical wind was clearly seen growing upward from its core up to the tropopause level. In general, gravity waves above convection tend to have dominant periods in the range of 10 –100 minutes with short vertical wavelength 1- 3 km. Vertical profiles of momentum flux show the range of 3-10 mPa between 15 and 20 km altitude. Present analyses suggest that the upward wave propagation in the stratosphere is outstandingly dependant on the wind shear that tends to vary significantly on day to day basis.

In addition, the intensity of convection and its shape reflected in vertical winds in the form of updraft is also important to show its impact in forcing the reasonably well-developed gravity waves. Temporal history suggests that the structure of vertically oriented updrafts/ downdrafts varies from one event to another. Sometime updrafts are developed in the lower troposphere and stronger than downdrafts, while other time updrafts are more focused in the upper troposphere.