ABSTRACTS (MASTER THESIS)

Observation of Temperature Profiles in Equatorial Region with EAR-RASS

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This study aims to continuously measure temperature profiles in the tropical troposphere (up to about 15-17 km) with high accuracy and high time-resolution by adopting Radio Acoustic Sounding System (RASS) (Figure 1) to the Equatorial Atmosphere Radar (EAR) at Kototabang, west Sumatra, Indonesia (Fukao et al, 2003). We arranged high-power speaker boxes and constructed a sound transmitting system in the EAR.

Because propagation of sound waves in the atmosphere is largely affected by the background winds, we employed a 3D ray-tracing of acoustic waves in order to predict the shape of acoustic wave fronts (Figure 2). Then, we selected appropriate antenna beam directions of EAR that satisfy the Bragg condition, i.e., the wave number vectors for radar waves and the target acoustic waves must be parallel.

As a result, we observed temperature profiles from 2 km to 5-12 km continuously with the time and height resolutions of about 3 minutes and 150 m, respectively. Several temperature profiles were obtained up to about the tropopause at 16 km, although observation period was short. RMS of difference of temperature in the upper troposphere between EAR-RASS and radiosondes was about 0.3 K. We also showed the effect of sound source power and frequency of sound signal on RASS observation quantitatively. We examined two methods of temperature correction by wind velocity.

EAR-RASS results are useful for the studies of peculiar atmospheric phenomena in the equatorial regions, such as the intense cloud convection, structure of the boundary layer, atmospheric waves, and so on.

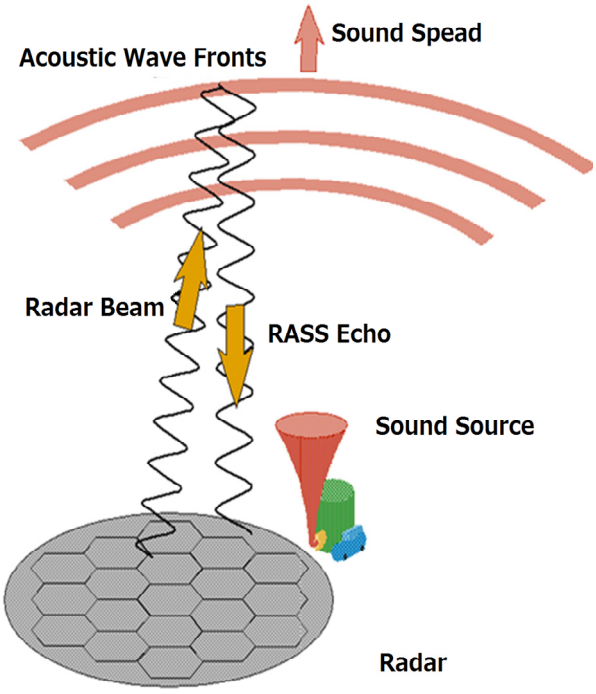

Figure 1. Radio Acoustic Sounding System (RASS).

Reference

[1] S. Fukao, H. Hashiguchi, M. Yamamoto, T. Tsuda, T. Nakamura, M.K. Yamamoto, T. Sato, M. Hagio, and Y. Yabugaki, Equatorial Atmosphere Radar (EAR): System description and first results, *Radio Science*, 38 (3), doi:10.1029/2002RS002767, 2003.

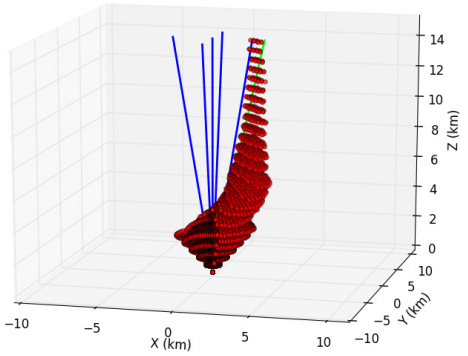

Figure 2. 3D plot of ray-tracing.