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Development plan of three dimensional imaging with Equatorial Atmosphere Radar

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Turbulent mixing at small scales in the lower atmosphere is an important process contributing to energy dissipation and vertical transport of heat and materials. Small scale turbulence associated with clouds can also play an important role for mixing and can significantly impact on precipitations. Convective instabilities due to mixing of dry air with cloudy air through entrainment at the top or bottom of clouds can also be an important source of turbulence in addition to radiative cooling processes. In 2004, the MU (Middle and Upper atmosphere) radar was upgraded for radar imaging capabilities. Imaging observation mode has enabled us to improve the spatial and range resolutions of the MU radar.
The Equatorial Atmosphere Radar (EAR) is an VHF atmospheric radar located in Kototabang (10 0.32E, 0.20S), West Sumatra, Indonesia. It is operated by collaboration between the Research Institute for Sustainable Humanosphere (RISH), Kyoto University and National Institute of Aeronautics and Space of Indonesia (LAPAN) since 2001. The EAR is a large monostatic radar which operates at 47.0 MHz with peak output power of 100 kW. The EAR uses a circular antenna array, approximately 110 m in diameter, which consists of 560 three-element Yagi antennas. Each antenna is driven by a solid-state transmitter-receiver module. This system configuration allows the antenna beam to be steered electronically up to 5,000 times per second. The EAR has the capability to switch five frequencies (47MHz, 47MHz+-250kHz, and 47MHz+-500kHz) on a pulse-to-pulse basis. The frequency domain interferometric imaging (FII) technique can provide us better range resolution than pulse length. An active phased-array system, similar to that of the MU radar, has the good performance of fast beam steerability. However, the EAR has only one receiving channel. We plan to develop multi-channel receiving system for the EAR to obtain independently 24 channel data. To combine FII technique, we can obtain three dimensional imaging of atmospheric turbulence and ionospheric disturbance.