Development of EAR Multi-Channel Receiver System Using Software Defined Radio

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The Equatorial Atmosphere Radar (EAR) is a VHF Doppler radar operating at 47 MHz with an active phased-array antenna system and located at Kototabang, West Sumatra, Indonesia (0.20S, 100.32E, 865 m above sea level). The details regarding the system design and its specifications are well elaborated by Fukao et al. [Radio Sci., 2003]. The EAR is located in Indonesian Maritime Continent (IMC) where cumulus convections are most active compared to the other part of the world, and hence called as 'engine' of the global atmospheric motions.

The EAR has a circular antenna array of approximately 110 m in diameter, which consists of 560 three-element Yagis. It is an active phased array system with each Yagi driven by a solid-state transceiver module. This system configuration makes it possible to direct the antenna beam by electronic control up to 5,000 times per second. This configuration is the similar as the MU radar, but the EAR has only single receiving channel. This paper describes the initial development of multi-channel receivers for the EAR which enable spaced-antenna (SA) and spatial imaging observations. The SA method uses intense partial reflection echoes, so it is expected to obtain height profiles of wind vector and temperature in the troposphere and the lower stratosphere including Tropical Tropopause Layer (TTL) region combining Radio Acoustic Sounding System (RASS) techniques. Multi-channel receivers are developed using general-purpose software-defined radio with the combinations of Universal Software Radio Peripheral 2 (USRP2) and GNU Radio. The receiver is designed to collect received signals at a frequency of 47 MHz and a sample rate of 10 MS s^{-1}.