
RECENT RESEARCH ACTIVITIES

Development of a digital receiver for imaging atmospheric radars

(Laboratory of Radar Atmospheric Science, RISH, Kyoto University)

Masayuki Yamamoto, Tong Gan, Hiroyuki Hashiguchi, and Mamoru Yamamoto

Radar imaging is a technique that enhances radar range and angular resolution using multiple frequencies and receivers. MU radar, which has the capability of radar imaging, has demonstrated that radar imaging is indispensable for resolving fine-scale dynamical processes caused by atmospheric instabilities. Further, additional use of auxiliary sub-arrays contributes to reduce undesired received signals (i.e., clutter signals) from the ground and flying objects (aircrafts, birds, and insects). However, atmospheric radars which have the capability of radar imaging are not common. In order to implement radar imaging capability to the existing atmospheric radars, a digital receiver with a low purchase cost, high-rate sampling capability of received signals, and configurable real-time signal processing, is necessary.

In order to implement radar imaging capability to the Equatorial Atmosphere Radar (EAR) installed in Indonesia, we are now developing a digital receiver. Figure 1 shows a schematic diagram of the digital receiver for the EAR. The digital receiver comprises of two general-purpose software radio receivers (USRP produced by Ettus Research) and a personal computer (PC). In order to start sampling of received signals, transmission trigger pulse (TX trigger pulse) supplied by the EAR is collected by the USRP. Another USRP is used to sample IF received signals. In order to synchronize the transmission and reception frequencies of the EAR, 10-MHz reference and 1 pulse per second (PPS) signals supplied by the EAR are used.

By installing the single digital receiver, the EAR attains oversampling (OS) capability up to 10 mega-samples per second. OS is useful for improving the vertical resolution using radar imaging. After enhancing the vertical resolution, we will install the multiple digital receivers for enhancing the angular resolution and for reducing clutter signals. Implementation of the digital receiver to other atmospheric radars is also carried out.

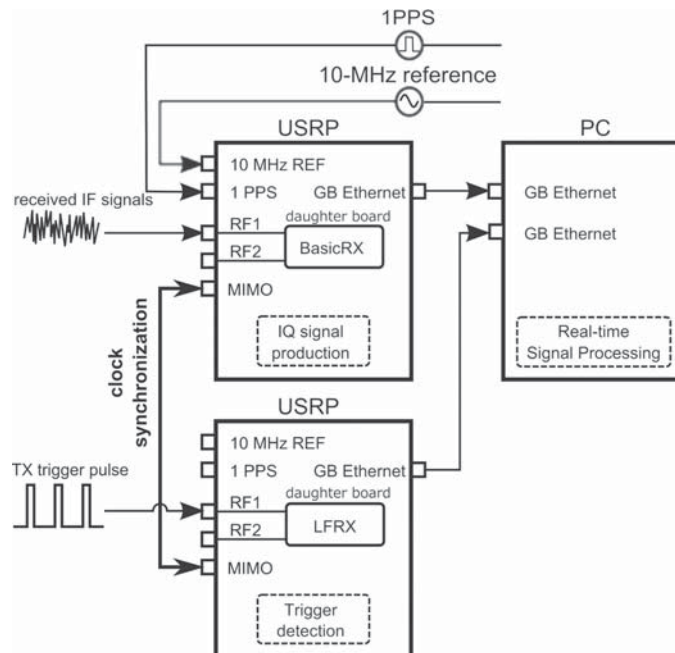


Figure 1. Schematic diagram of the digital receiver.