# Multistatic Configuration of the Equatorial Atmosphere Radar with Digital Receiver Arrays

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## 1 Background and Objectives

One of important goals of the Equatorial Atmosphere Radar (EAR) is to study detailed dynamical structure of the tropical atmosphere. MST radars have an advantage of being able to study wind velocity field even under a clear air condition, but usually with an assumption of horizontally uniform wind field.

The main objective of this study is to develop a multistatic radar system with the EAR and digital receiver arrays designed for this purpose, which will enable us to directly observe the three-dimensional wind vector field without such assumption. The same receiving system will also be used as an adaptive clutter cancellation system by changing the arrangement of the antenna elements.

## 2 System Configuration

The three velocity components of a scattering volume can be measured by intersecting two receiving antenna beams with the transmitting/receiving beam, and by measuring the line-of-sight velocity by three receivers. Fan beams are used for the receiving antennas to cover a wide height range of the transmitting beam. However, the size of the intersection of the beams becomes small when the transmitting beam is steered to a direction perpendicular to the vertical plane which contains the transmitter and a receiver, because the direction of the intersecting point seen from the receiver becomes a function of height under such condition.

This problem is solved by adding a receiver to each antenna element of the receiving array, with which the received signal is sampled and integrated. The height dependent antenna beam pattern can be synthesized by combining the output of the receiver array. Since the operating frequency of 47 MHz of the EAR is sufficiently low for today's digital processors, received signals can be directly converted into digital data.

This digital receiver configuration provides the maximum freedom in the receiving antenna arrangements. For the purpose of multistatic radar, two linear arrays of about 100m length will be deployed at a distance of 1–2 km from the main antenna. A circular array arrangement surrounding the main antenna will be used for the clutter rejection system. A new adaptive antenna algorithm is used to suppress low-elevation sidelobes while keeping the main lobe unchanged.

## 3 Research Plan

Fiscal years 2002 and 2003 will be devoted to theoretical studies of the antenna systems, basic design of the digital receivers, and field survey of the candidate site for the receiving arrays. Two receiving arrays consisting of about 20 Yagi antennas will be constructed in 2004 and 2005, respectively, and will be used until the end of fiscal year 2006 for various purposes.