A multistatic observation with Equatorial Atmospheric Radar extended by digital receiver arrays

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Multistatic radar observation, which receives an atmospheric echo simultaneously from multiple sites, provides a higher space resolution of wind velocity by omitting the assumption of its uniformity which is necessarily exploited for monostatic radar systems. By taking advantage of an adaptive processing, a more precise estimation, in terms of both resolution and accuracy, can be made.

In this study, adaptive multistatic observations were made using two sets of digital receiver arrays.

In a general configuration, an atmospheric radar has a large aperture or array which holds a very high directional gain. For a multistatic system, however, as it is not feasible to employ so many elements in each array as the sharp beam can be formed, interference of clutter becomes more severe in the analysis. Adaptive clutter suppression is an effective technique to eliminate the strong interference from mountains while the receiver array maintains its sensitivity to the echo, even with such a small number of antennas.

In order to satisfy the requirements of both cancelation of interferences and avoidance of degradation in SNR, the Directionaly Constrained Minimum Power with Constrained Norm (DCMP-CN) has been used in this observation.

The first adaptive multistatic observations with using two receiver sites consisting of 10 antennas each, were made between 25-29,Sep,2004 at the Equatorial Atmosphere Radar (EAR), West Sumatra, Indonesia. The each receiver site was about 1300m distant in the west and south respectively, from EAR.

In a Doppler-height spectrum made with conventional time domain clutter suppressions, as the strong clutters have overridden the echoes, an accurate estimation of the Doppler velocity will be hardly made around 0m/s.

In addition to an effect that eliminates the peaks of the clutters, a part of weak echo continuously reaches up to over 7km in height has appeared. It is because the noise floor which is caused by the strong clutter have also been removed.

An effectiveness of adaptive clutter suppression has been presented in a multistatic configuration. This technique enables us not only to estimate the Doppler velocity around 0m/s, to reveal the echo from higher range gates that are unreachable by the conventional beamforming.