0.1 Augmentation of MST Radar for SA/Interferometry/Imaging Capability

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National atmospheric research laboratory (NARL) has taken up a major augmentation project, the coherent radar imaging (CRI), which will enhance the capabilities of the present MST radar by many fold. The existing MST radar, with a 32x32 size phased array and a single back-end receiver, was originally configured for Doppler Beam Swinging (DBS) mode. This technique assumes homogeneous (isotropic) background wind vector, which is not always true. The augmentation, basically an addition of multi-receiver system, allows operating the radar in different operational modes such as spaced antenna, Interferometry, imaging etc, in addition to the present DBS mode.

The augmentation is aimed to probe effectively different atmospheric targets such as boundary layer and lower troposphere, convection and precipitation events, upper troposphere, field-aligned plasma turbulence and irregularities in ionosphere, and echoes due to lightning and meteors etc. Each of these targets requires a specific antenna configuration for its study.

Boundary layer and lower troposphere: A small 4x4 transmit array along with three 2x2 receive array modules arranged in an equilateral triangle will be used to probe the boundary layer and lower troposphere. This system will be operated in spaced antenna mode.

Troposphere and mesosphere: A larger antenna system, which contains 19 receive antenna modules organized in a modified 'Y' configuration, is being installed for imaging the troposphere and mesosphere. Each antenna module consists of 19 elements arranged in hexagonal shape. The existing transmit array will be phase coded to realize a broad transmit beam. This system can be operated in imaging mode.

Ionosphere: The ionosphere study requires an Interferometry imaging antenna system aligned in East-West direction. Seven antenna modules will be employed for this purpose. The largest base line length is 270m, which gives 1° resolution. The existing array will be used for transmission.

Lightning and meteors: A wide beam (100˚) Interferometry imaging antenna system is required for studying the echoes due to lightning and meteors whose horizontal spread is very large. One transmit antenna and 17 receive antennas, arranged in 'Mills Cross' configuration, will be used for this application.

The 21-channel receiving system, each consisting of an RF front-end and a direct digital receiver, will be used to collect the data from the receive antenna modules.

The scientific objectives include the study of (i) Evolution of the structure of scattering media and the fine-scale structure of the atmosphere, (ii) The kinematics and micro-physical processes involved in the formation and growth of convection/precipitation, (iii) Anisotropy of turbulent structures in troposphere and mesosphere, (iv) The echoes due to lightning and meteor traces whose horizontal extent is very large and (v) The field-aligned plasma turbulence and irregularities in E and F regions.

The details of the augmentation will be presented at the symposium.