Stratosphere Troposphere Radar for Wind Profiling over the Central Himalayas

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Atmospheric dynamics over the Himalayan mountains is of considerable interest in the context of changes in the flow patterns and its impact over the Indian monsoon system. However, observational facilities are nearly non-existing in this region for continuous observations of vertical distribution of winds. The continuous monitoring of vertical structure in the wind is necessary to understand the total meteorology of any region. In this perspective Stratosphere Troposphere (ST) Radar has great potential to provide the profiles of vertical velocities and also the vertical structure of the horizontal velocities of different types of monsoon clouds with very high temporal and elevation resolutions.

The ST Radar system is being setup in the central Himalayan region at ARIES, Nainital (29.37N; 79.45E, 1958 m amsl). Based on physical constraints of locating a large flat land amidst the mountains to locate a 50 MHz radar and considering the inadequacy of 440 MHz to cover a height region of 20 KMs, with a reasonable PAP due uncertainties of the inertial subrange at tropical latitudes, the ST radar was designed using a novel frequency band of 200 MHz. This ST Radar is designed to operate at 206.5 MHz with peak power around 230 Kw. Wind profiling in the tropics beyond the tropopause is quite challenging and the optimum choice of carrier frequency is dependent upon the availability of radio refractive index variability at the Bragg scale. The choice of 200 MHz band is justified from the point of view of providing detectable signals for estimating wind spectrum. This system uses the two most popular technique viz. the Doppler Beam Swinging (DBS) and Spaced Antenna Drift (SAD) technique. The ST Radar will be configured as an Active Aperture Distributed Phased Array using state of art Solid State TR module and Digital Signal Processing techniques to cover a height region from 1 km to 20 km with variable height resolutions from 300 to 75 meters as a function of height.

Observations from this system would play a major role in weather and climate related studies over India and particularly in Indo-Gangatic region. This will provide a strong support in other diverse applications and studies like aviation meteorology, stratosphere-troposphere exchange of ozone and dynamics of many trace constituents, interaction between synoptic scale and mesoscale processes and middle atmospheric sciences. This Radar will also help in near real time forecasting of air pollution by providing accurate wind data and mixing depth estimates. Instrumental details, with preliminary experiments and balloon flight results will be presented.