Description of First Generation of SACR's Operational Modes

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The first generation of sampling modes for the Scanning ARM Cloud Radar's (SACR's) is based on cycling (alternating) through four basic scan patterns that are designed to address different scientific objectives. At the beginning of SACR's operations at the ARM fixed and mobile sites, the cycling is preset to fix intervals (static mode). In the future, we plan to adaptively change the scan strategy of the SACR's to best match the cloud and precipitation conditions at the ARM sites. An example of the how the different modes will cycle in a two hour period is shown in Fig. 1. It is important to note that small differences in the sequence of the different modes are expected between different ARM sites.

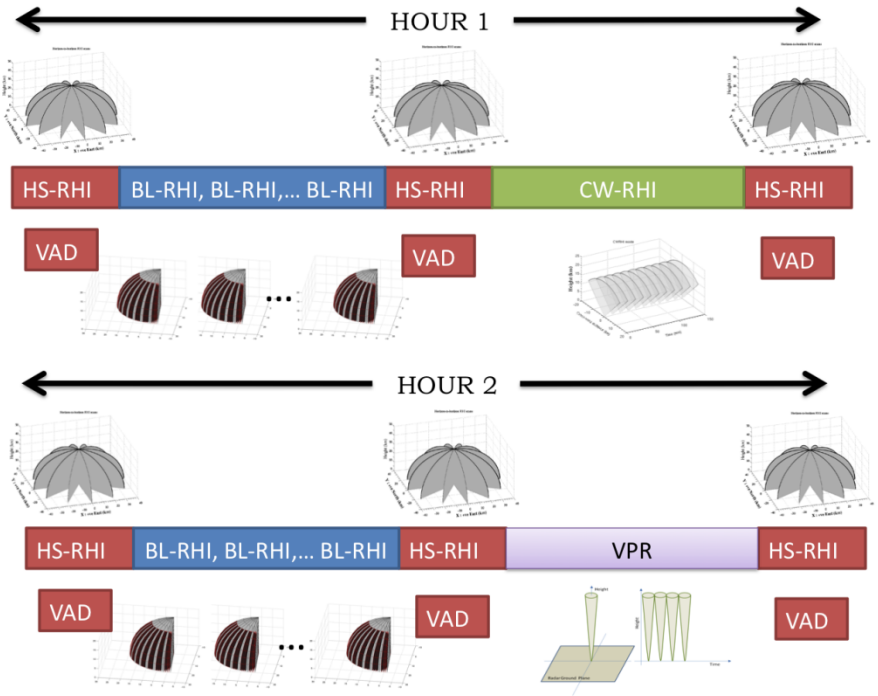

Fig. 1: Example of SACR sampling strategy

The Hemispherical Sky – Range-Height Indicator (HS-RHI) sampling mode is the "atmospheric state surveillance mode". Observations from the HS-RHI mode are available every 30 min and takes approximately 3 min for the HS-RHI mode to complete its sequence of six horizon-to-horizon scans. Between HS-RHI scans (~27 min), observations from three other SACR scan strategies are available.

The Boundary Layer – Range-Height Indicator (BL-RHI) sampling mode is designed to cover a 90 degrees sector of the sky with the azimuth center of the sector align with the mean wind direction in the lower troposphere. Takes approximately 5 min for the SACR to complete the 45 RHI scans

(spaced every 2 degrees azimuth) to cover the 90 degrees sector. The BL-RHI will be repeated 5 times to provide the opportunity to revisit the same cloud systems.

The Cross Wind – Range-Height Indicator (CW-RHI) sampling mode is designed to provide cross-wind horizon-to-horizon scans of the advected cloud systems. Each horizon-to-horizon scan takes 15-20 sec to complete and it is repeated for approximately 27 min.

The Vertically-Pointing (VPR) sampling mode is designed to multi-frequency radar Doppler spectra at profiling configuration. The mode is expected to strengthen the microphysical and dynamical column retrievals in cloud and precipitation systems.

SACR HS-RHI data products description

Raw SACR Measurements: Scanning cloud radar observables in the native radar grid, no interpolation or gridding. However, a significant detections mask (cloud mask) has been applied.

Radar Reflectivity (uncorrected for attenuation): The observed radar reflectivity without correction for water vapor or liquid attenuation

Mean Doppler velocity (uncorrected for folding): The observed mean Doppler velocity with aliasing (folding).

Doppler spectrum width: The second moment of the radar Doppler spectrum

Radar Reflectivity (corrected for attenuation): The observed radar reflectivity corrected for water vapor attenuation. The correction is based on estimating the path-integrated attenuation (dB) at each radar range gate and using the nearest (in time) sounding to extract the water vapor profile.

Mean Doppler velocity (corrected for folding): The observed mean Doppler velocity with aliasing (folding) correction. The correction is based on estimating the horizontal wind projection on the radar line of sight. This is done using the wind direction and magnitude profile from the nearest (in time) sounding.

Value Added Products: The value added products include hydrometeor layers properties (e.g., boundaries, cloud and precipitation classification) and horizontal wind information in the height of the hydrometeor layers. The hydrometeor layers properties are deduced from gridded scanning cloud radar observations and are provided in a star format (top-view of the six horizon-to-horizon scans) and the horizontal wind retrievals are based on the Velocity-Azimuth Display (VAD) technique.

Hydrometeor Detection: 0: No hydrometeor presence in the column, 1: hydrometeor presence in the column

Highest hydrometeor layer top height (cloud top): The height of top of the highest hydrometeor layer in the column

Higher hydrometeor layer thickness (cloud thickness): The thickness of the highest hydrometeor layer in the column

Number of hydrometeor layers (cloud layers): The number of hydrometeor layers in the column separated by clear air (hydrometeor free) layers

Target classification: Cloud and precipitation types using an objective methodology that uses the hydrometeor layer cloud base height, thickness and radar reflectivity values.

Horizontal wind magnitude: The horizontal wind magnitude retrieved in the heights with hydrometeor layers using the observed mean Doppler velocity

Horizontal wind direction: The horizontal wind retrieved retrieved in the heights with hydrometeor layers using the observed mean Doppler velocity