**Scientific objective:** Document horizontal wind speed and direction

Cycle repeated every 30 min

Repeated every 3° azimuth to cover a 360° sector in 3 min.

SACR operating HS-RHI scans:
- Constant height 875m

**Figures:**

• Insects filtering and second trip echo contamination. (Kollias et al. 2013b, in early release).
• Atmospheric Radiation Measurement (ARM) program fixed site in Oklahoma
  - Continental stratocumulus cloud observation
  - SACR observations are corrected for non-atmospheric returns, gas attenuation, velocity aliasing, insects filtering and second trip echo contamination.

**Introduction**

Recent advancements in radar technology enabled the deployment of scanning cloud radars, that can provide off-zenith view of the cloudy atmosphere. Reconstructing the 3-D cloud structure evolution will enable the study of cloud life cycle, cloud scale turbulence, cloud field anisotropy, evaluate plane-parallel approximation in radiative transfer and improve cloud sub-grid variability parameterization in numerical models.

**Observations**

15 September 2012: Atmospheric Radiation Measurement (ARM) program fixed site in Oklahoma
- Continental stratocumulus cloud observation
- SACR observations are corrected for non-atmospheric returns, gas attenuation, velocity aliasing, insects filtering and second trip echo contamination. (Kollias et al. 2013b, in early release).

SACR operating BL-RHI scans:
- RHI scans from 0-90° elevation at fixed azimuth
  - Repeated every 3° azimuth to cover a 60° sector in 5 min
  - Cycle repeated 4 consecutive times

**Scientific objective:** 3-D cloud life cycle (4-D)

SACR operating HS-RHI scans:
- RHI scans from 0-180° elevation at fixed azimuth
  - Repeated every 30° azimuth to cover a 360° sector in 3 min.
  - Cycle repeated every 30 min

**References**


**3-D BL-RHI Gridding**

- Polar coordinate observation => Need Cartesian coordinate to ease interpretation.
- No gaps in range-height

- Compute, for each observed cloud pixel, the Cartesian coordinates of the radar resolution volume assuming the standard beam propagation model (Doviak and Zrnic 1993)
- Compute the smallest possible 3-D radius of influence to locate all influenced grid cells. Grid cells may be influenced by multiple observations
- If radar volume is larger than grid resolution, all surrounding grid cells within grid resolution will be influenced.
- If radar volume is smaller than grid resolution, only grid cells within the radar volume will be influenced.

- User defined resolution grid and interpolation scheme (Barnes, Cressman, Maximum value, Mean value), gridding of all radar observables.

- Observed velocity is composed of horizontal wind velocity and particle vertical velocity
  - Need to know the environmental flow to perform tracking or,
  - Need to remove the mean wind contribution and the angular dependency to observe horizontal circulations

- Low frequency of soundings and high variability of winds no proper to retrieve horizontal wind
- Use the previous HS-RHI scan and the VAD technique to retrieve the mean horizontal wind speed and direction (Kollias et al. 2013b, in early release).

**New scientific opportunities**

Temporal evolution over 20 minutes [4 consecutive BL-RHI scans]

Temporal evolution of 3-D gridded observations

- All radar moments: Reflectivity, Doppler velocity and Spectrum width
- Large domain: 20km range, 60 degree sector ≈ 120 000km²
  - Could be compared to LES domains

- Combination of HS-RHI to retrieve mean horizontal wind speed and direction and tracking algorithms
  - Could be used to follow cloud life cycle

**Mean horizontal wind speed and direction from HS-RHI**

- Cartesian coordinates of the radar resolution volume assuming the standard beam propagation model (Doviak and Zrnic 1993)
- Compute the smallest possible 3-D radius of influence to locate all influenced grid cells. Grid cells may be influenced by multiple observations
- If radar volume is larger than grid resolution, all surrounding grid cells within grid resolution will be influenced.
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- User defined resolution grid and interpolation scheme (Barnes, Cressman, Maximum value, Mean value), gridding of all radar observables.

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