Status of 3D cloud and precipitation products from the ARM scanning millimeter wavelength radars

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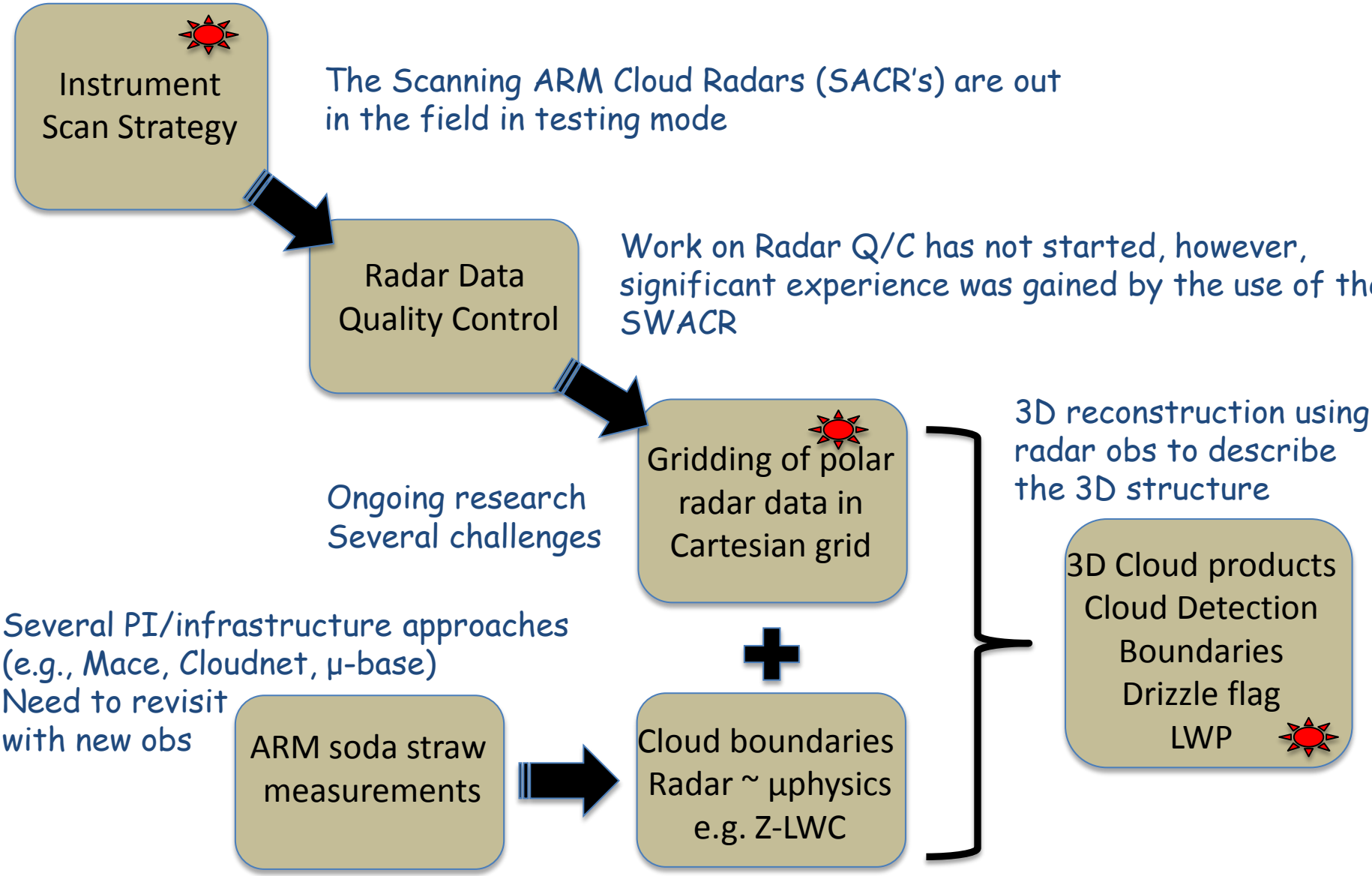
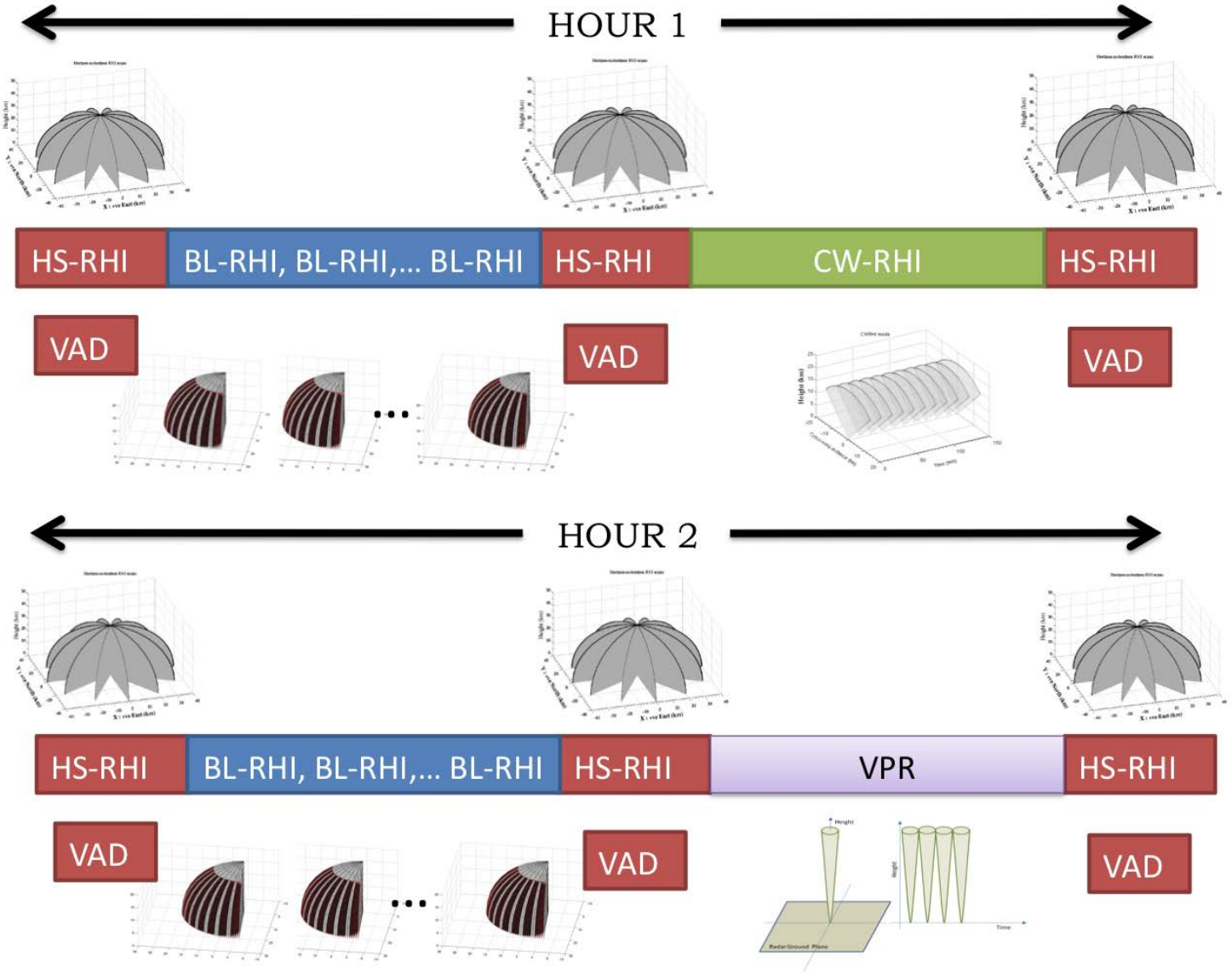
Towards 3D cloud products - Overview

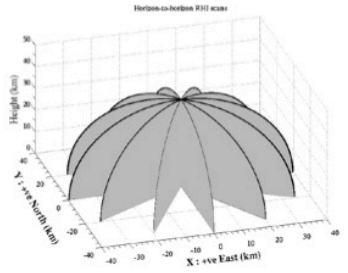


How the SACR's produce 3D cloud and precipitation information?



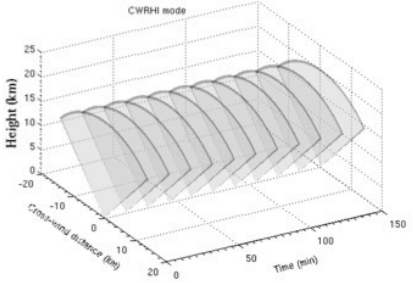
HS-RHI

Hemispheric Sky Cross Sections
6 - Horizon-to-Horizon scans
Duration: 3 min
Repeat: Every 30 min
All-cloud-conditions mode



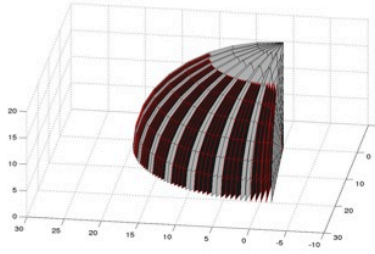
CW-RHI

Cross-Wind Range Height Indicator
Requires wind direction input
Repeat Horizon-to-Horizon scan
N-times
Duration: 15 min to 60 min
Best scan strategy for high clouds



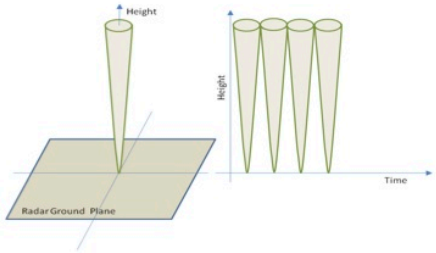
BL-RHI

90° azimuth sector around wind direction. 2° azimuth resolution
Duration: 5 min
Repeat: 3-6 times (lifecycle)
Best scan strategy for low clouds



VPR

Vertically pointing mode
All modes visit zenith frequently
Collection of Doppler spectra
Duration: always in rain
Best scan strategy for precipitation

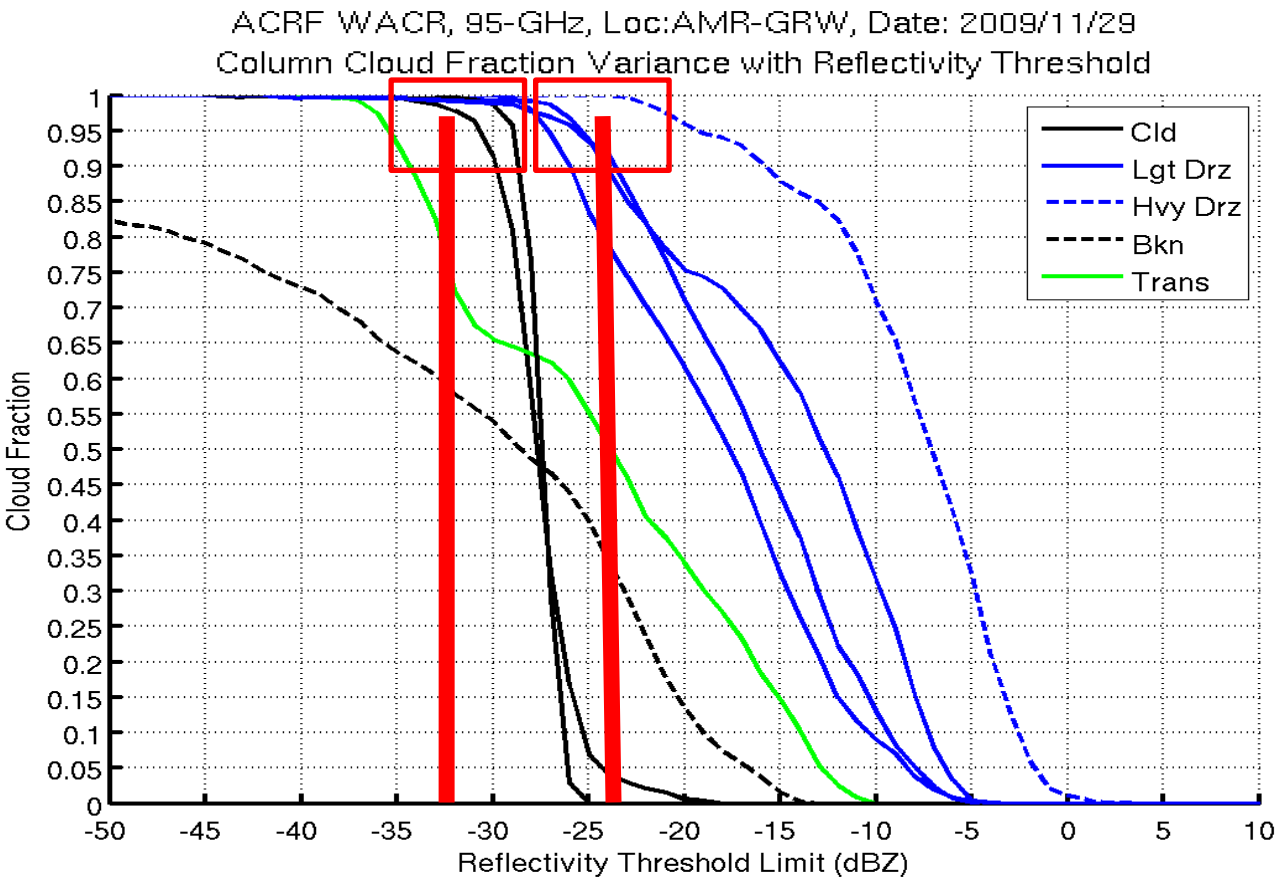


Challenges in gridding 3D cloud and precipitation observations

R^2 drop in radar sensitivity

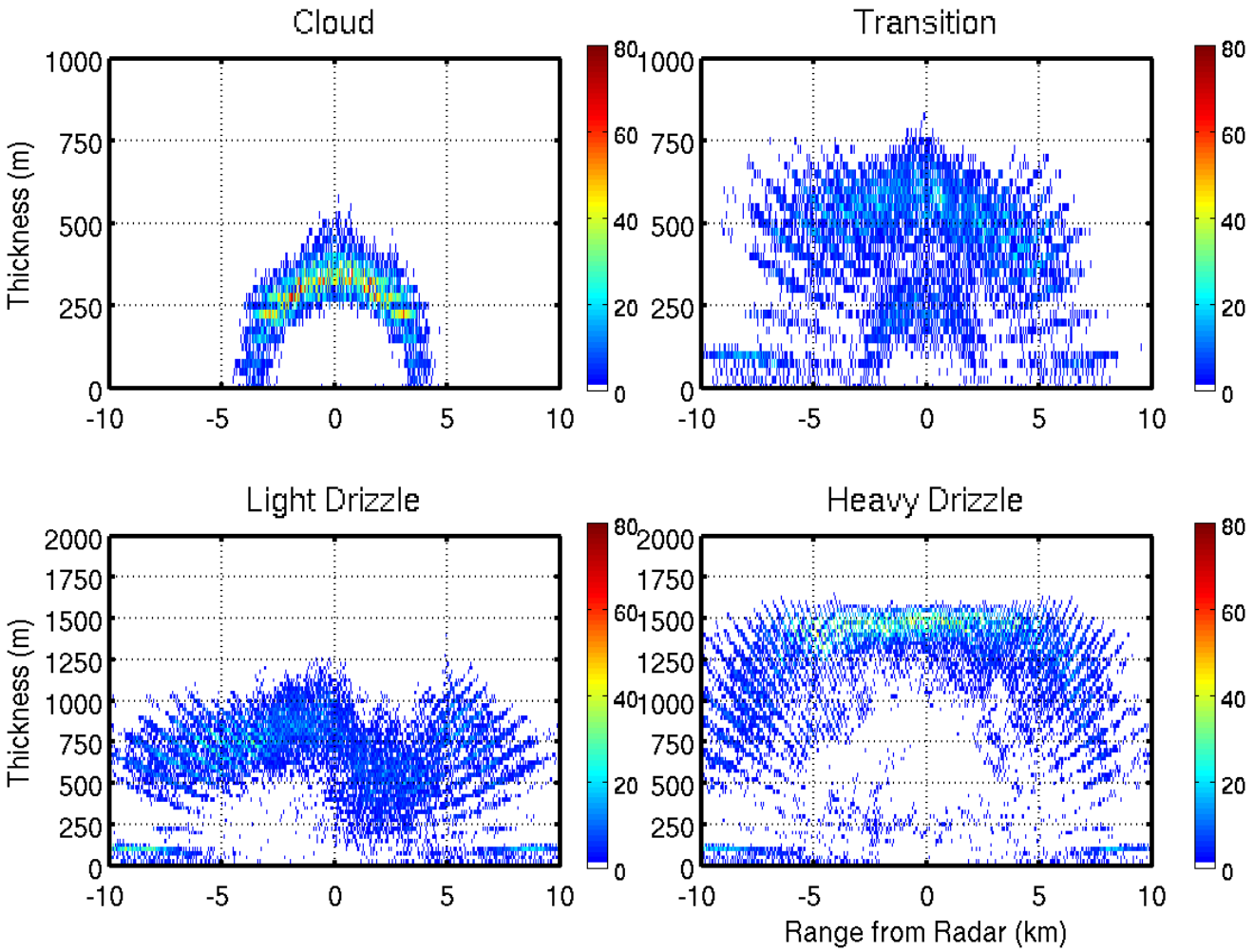
How far out we produce gridded radar observations?

The question has different answers for different cloud types and for cloud detection vs cloud boundaries



Minimum Detectable dBZ = *f*(range)

Impact of radar sensitivity on determining the 3D location of hydrometeor layers boundaries

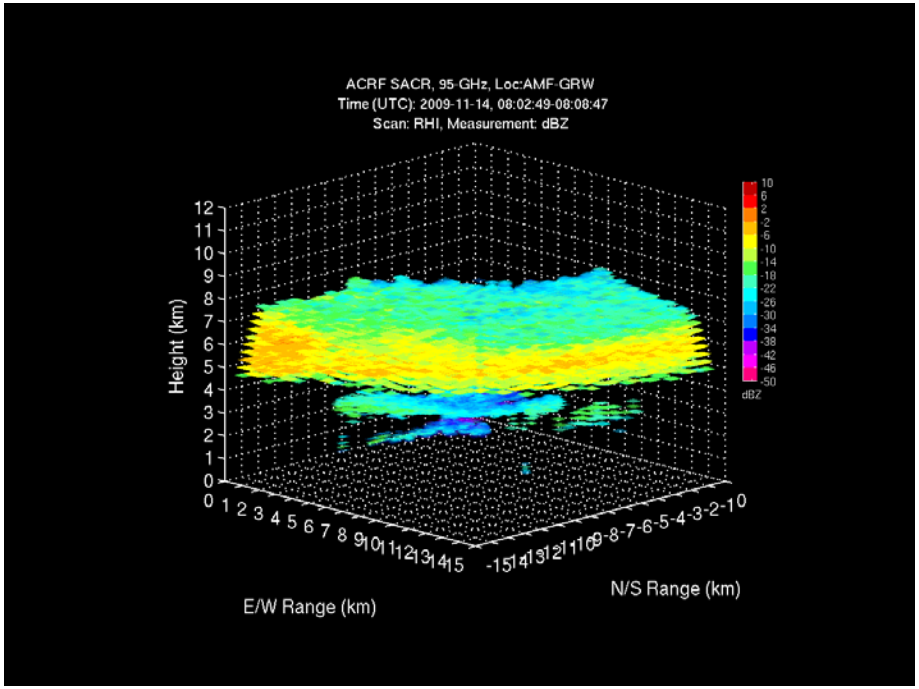


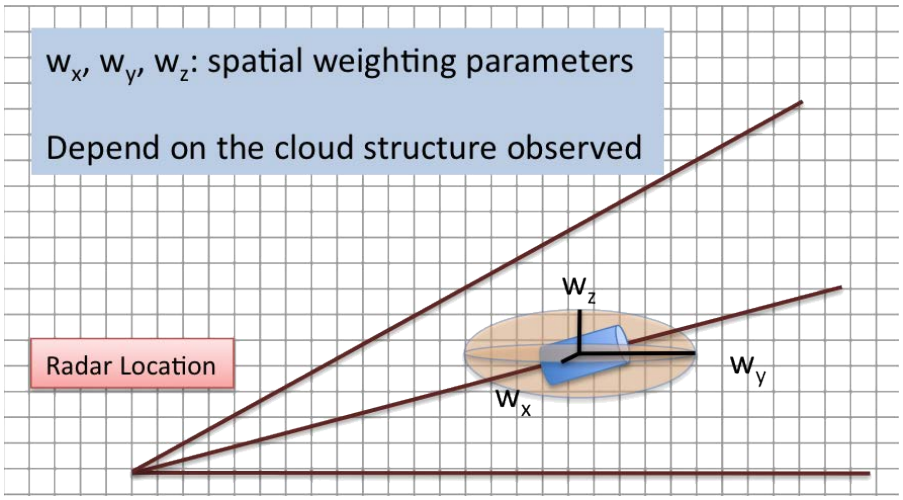
How to interpolate radar observations

The 3D structure of cloud entities differs drastically from the 3D structure of precipitation as captured by scanning weather radars.

Cloud fraction statistics over the ARM sites have clearly demonstrated that cloudiness is associated with two dominant modes: clear or very low cloud fraction (10-20%) or overcast (100%).

We are working on adaptive spatial weighting functions that will depend on information on cloud fraction and radar reflectivity variability at each height from the the SACR polar radar data at each height in the atmosphere.





Summary – Discussion points

- 3D gridded radar observations (beta version) from Azores (~1 month of observations) are available
- Despite the aforementioned challenges, we should be able to have 3D gridded radar observations from ARM sites within the next 12 months once consensus has been reached in the sensitivity limits (~domain dimension) and products (cloud vs drizzle structures).
- 3D retrieval reconstruction: What is important to know in 3D for radiative transfer?
- Putting together a hierarchy list of critical variables will help to prioritize effort and resources.