Cloud Radar Calibration Center activities at SIRTA, CESAR and CHILBOLTON

Services to be provided (at calibration facility and at user site)

- 3 complementary facilities that maintain reference instruments and components
- Mobile reference cloud radar and equipment
- Expertise en cloud radar characterization and calibration
- Provision of absolute calibration service of system parameters and radar observables
- Provision of methods for error quantification
- Provision of cross-reference techniques with other instruments
- Provision of training of radar operators
- Recommendations / requirements signal processing

United Kingdom (Chilbolton)

The Netherlands (TU-Delft)

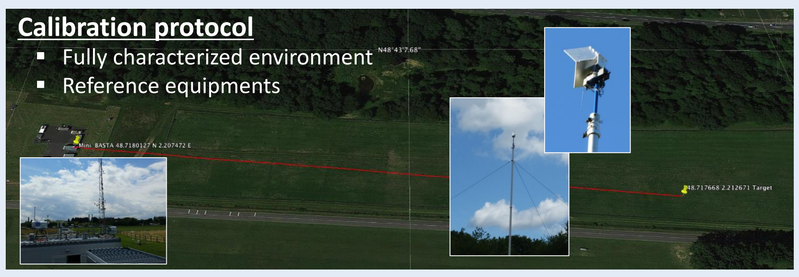
France (CNRS-IPSL)

CRCC AT SIRTA:

Absolute calibration with a reference target

Calibration protocol

- Fully characterized environment
- Reference equipments

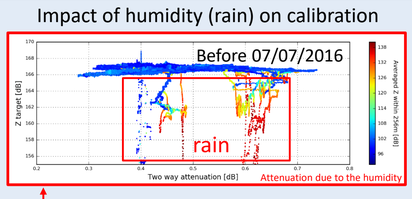


Simplified radar equation and link with the solid target

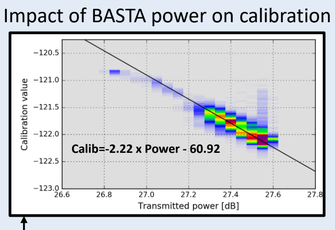
$$Ze\_calibrated\_dBZ = Calibration + 10*\log_{10}(Pr) + 20*\log_{10}(r) + extra$$

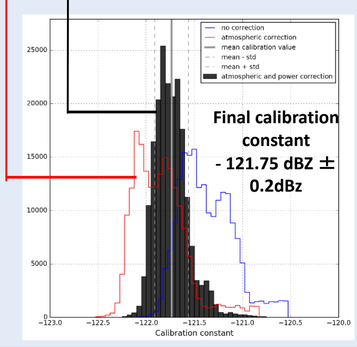
Calibration: Target reflectivity; To be determined: To be determined; $10*\log_{10}(Pr)$: Measured by the radar; $20*\log_{10}(r)$: Distance correction; extra: Gaz attenuation

Impact of humidity (rain) on calibration

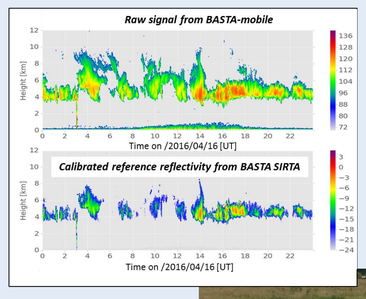


Impact of BASTA power on calibration

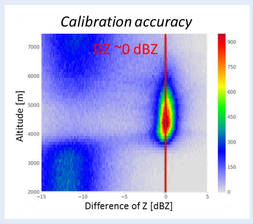




Intercomparison with calibrated reference cloud radar



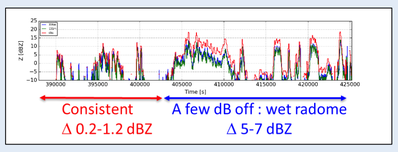
Calibration constant statistic



Validation of Cloud Radar Calib. : relation Rain-Rate versus Z

- Disdrometer + standard pluviometer
- Tilted radar (radome protected from rain) at 30°
- Low precipating event

- RR<0,1mm/h
- Good consistency for dry radome

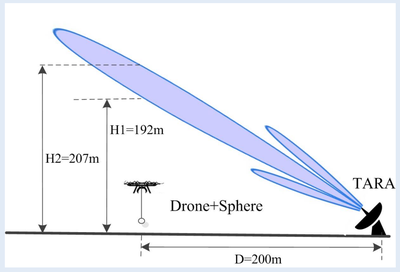


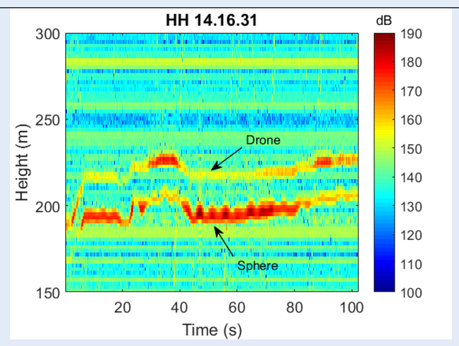
Reference Radar

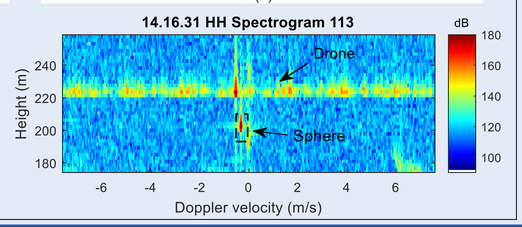
- Fully characterized cloud radar
- Compact, easily transportable
- Scanning capability

CRCC AT CESAR:

Drone-aided absolute calibration



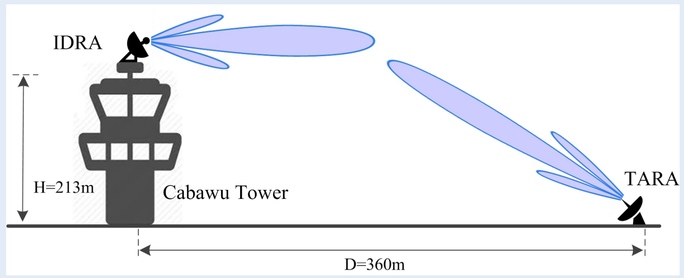




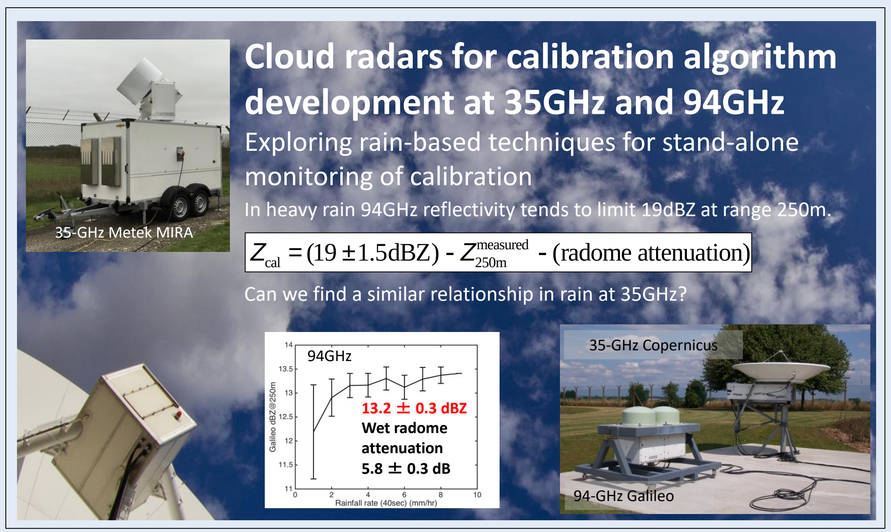
Calibration advantages

- Suitable to all radar sites.
- Comparatively cost-effective.
- For mobile radars, easy to redo calibration process.
- For vertical pointing cloud radar, possible to calibrate.

Radar-based secondary target intercomparison

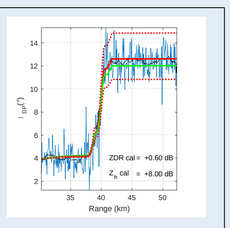


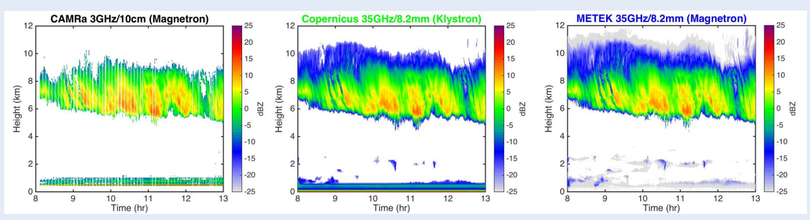
CRCC AT CHILBOLTON:



Reference high-resolution 3-GHz radar (25m antenna)

For evaluating stand-alone calibration techniques. Calibrated to 0.3dBZ using inter-dependency of Z, ZDR and Φ_{DP} in moderate rain.





35GHz absolute calibration achieved by comparing Rayleigh scattering ice above 5km, which at 35GHz must have the same dBZ as at 3GHz.

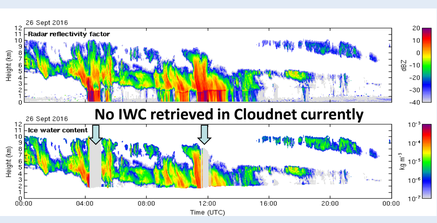
Wet radome/antenna attenuation

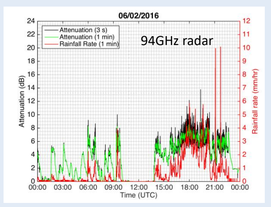
One goal of Cloudnet is to compare IWC of clouds, derived from observed Z, with NWP model values.

Important to validate IWC of rain-producing clouds.

Currently not possible due to wet radome/antenna that attenuates radar signal.

Need to correct for this.





Quantify one-way radome attenuation from power detector placed above the antenna. Even light rain gives significant losses at 94GHz.

Ongoing work applying this technique to wet antenna effects for widely used 35GHz radars.

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