



### CPR L2, cloud and precipitation validation

Discussion

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## SPECIFIC NEEDS FROM GROUND-BASED STATIONS



- CFADs of Doppler radar measurements
  - ice clouds as reference for Doppler velocity
  - at low levels to evaluate surface clutter removal
  - for different particle conditions at the surface (i.e., rimed vs unrimed snow)
- Correlation between radar reflectivity & mean Doppler velocity
  - important for antenna pointing corrections (C-APC)
- Contextual information from complementary instruments:
  - LWP from microwave radiometers
  - Precipitation measurements at the surface

### DATA STANDARDS FROM GROUND-BASED STATIONS & NETWORKS

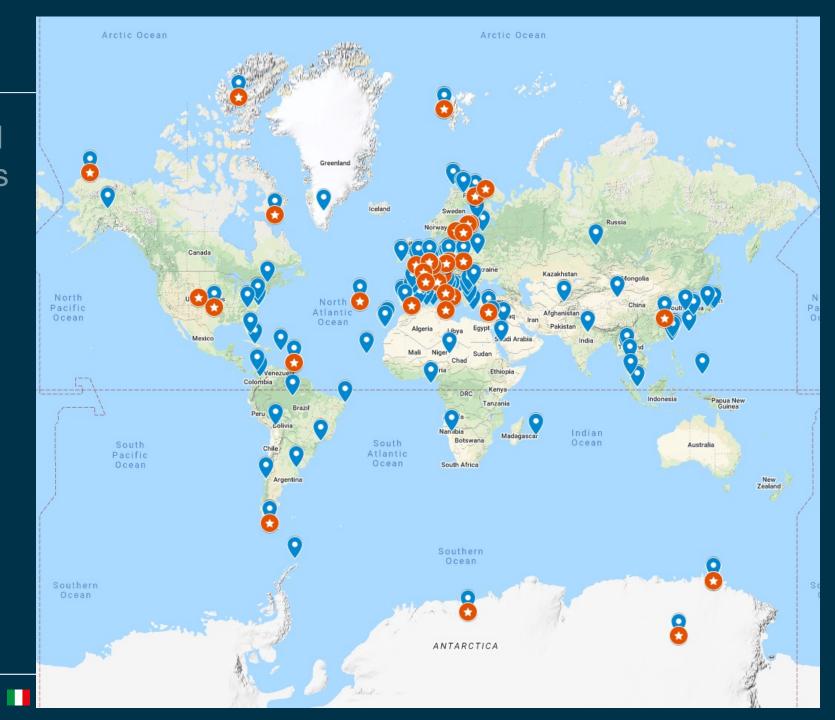


#### Common approaches / strategies

- Collocation with EarthCARE
- quality control/calibration
- instrument limitations
  - different radar frequencies
- Use of complementary observations
  - e.g. upcoming "spectral CloudNet" products

### GAPS IN SPECIFIC TARGETS

- Do we have ground-based stations or field campaigns (existing or planned) in all important climatological regimes?
- How do we supplement existing ground-based stations to enhance their value in Cal/Val activities?
  - e.g. add lower frequency profiling radars in certain sites



### WHAT IS THE ROLE OF AIRBORNE MEASUREMENTS?



- How critical are direct aircraft underflights of EarthCARE?
  - CPR L2
  - Cloud
  - Precipitation
- Essential validation measurements?
  - In-situ
  - Remote-sensing
- Relationships between retrieval model parameters (i.e., covariance between number concentration and mean snow particles; scattering libraries)

### WHAT IS THE ROLE OF SATELLITE OBSERVATION (PoR) IN THE CAL/VAL ACTIVITIES?



- Statistical validation & continuity with future/previous satellites?
  - CloudSat/CALIPSO
  - MODIS & other imager retrievals
  - ACCP activities?
- Direct validation with complementary satellite observations (e.g. GPM, Aeolus, microwave radiometers, imagers)

#### WHAT IS THE ROLE OF MODELS?



- ECMWF provision for EarthCARE
  - Cooperation with field campaigns & networks

 Data Assimilation for active instrument monitoring (c.f. Aeolus); applications to EarthCARE's CPR

### VALIDATING CLOUD RETRIEVALS FROM A NON-RADAR PERSPECTIVE



- ATLID & MSI:
  - Ice optics, IR and solar radiance models
  - Passive retrievals (M-COP)
  - Lidar retrieval (A-ICE)

- ACM-RT & BBR:
  - Sensitivity of ACM-RT and radiative closure to liquid clouds not detected by ATLID

### FUNDING NEEDS FOR EXISTING/PLANNED DATASETS



 Support is needed to develop the aforementioned data summaries and relationships from existing ground-based stations and airborne field campaigns (e.g., how do we best make sure of excellent datasets collected by the ACCP suborbital program?)

 Are the data collected by field campaigns immediately useful to L2 Cal/Val activities?

Who is generating CFADs and statistical summaries?

### FORWARD SIMULATORS: BRIDGING BOTTOM-UP AND TOP-DOWN SAMPLING



 Converting from ground-based to EarthCARE-like observations (e.g E3SIM, radar simulators, CR-SIM, FRM4Radar)

 Can synergistic L2 retrievals (ACM-CAP & ACM-COM) be used to model ground-based instruments?

# HOW CAN WE USE GROUND-BASED NETWORKS?



- Precipitation validation using operational (polarimetric) weather radar networks:
  - US (NEXRAD), Europe (OPERA), Finland, UK, etc.
  - Challenge: limited overlap between in moderate precipitation seen by both W-band and weather radars?
- Networks: how to make the most use of Actris, MPLnet, ARM networks?
  - Target classification: cloud base, mixed-phase layers, etc.
  - What about validating cloud & light precipitation retrievals?

### HOW DO WE MOVE FORWARD? (DO WE HAVE TO CENTRALIZE THE PROCESS?)



- Evaluation of algorithms before launch:
  - Aircraft campaigns with EarthCARE-like & EarthCARE+ payloads
  - Resources available for these activities?

Preparations for statistical validation (before launch)

Preparations for direct validation (commissioning phase and beyond)