



Proposal for collaboration between Cloudnet and ARM

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Overview

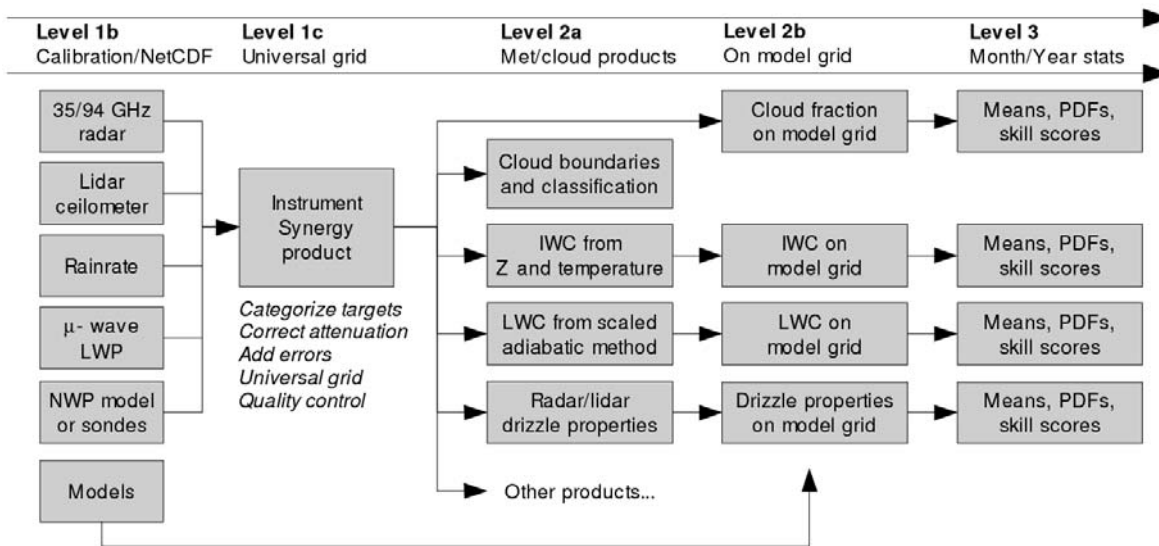
- What is Cloudnet?
 - European project that achieved systematic evaluation of 7 models over 4 ARM-like sites in Europe for a multi-year period
 - European Union funding ended in 2005; since then small amounts of funding obtained to process AMF data and to implement the Cloudnet processing system at Lindenberg for German model evaluation
- Proposal to ARM's "Instrument support" fund
 - Apply Cloudnet processing to 10+ years of ARM & European data
 - Systematically evaluate all models available over all sites worldwide
 - Provide ARM with a working system to evaluate models in *real time*, essential if ARM data are to lead to model improvements
 - Flexibility to add more algorithms/models/sites in the future
- Working name:



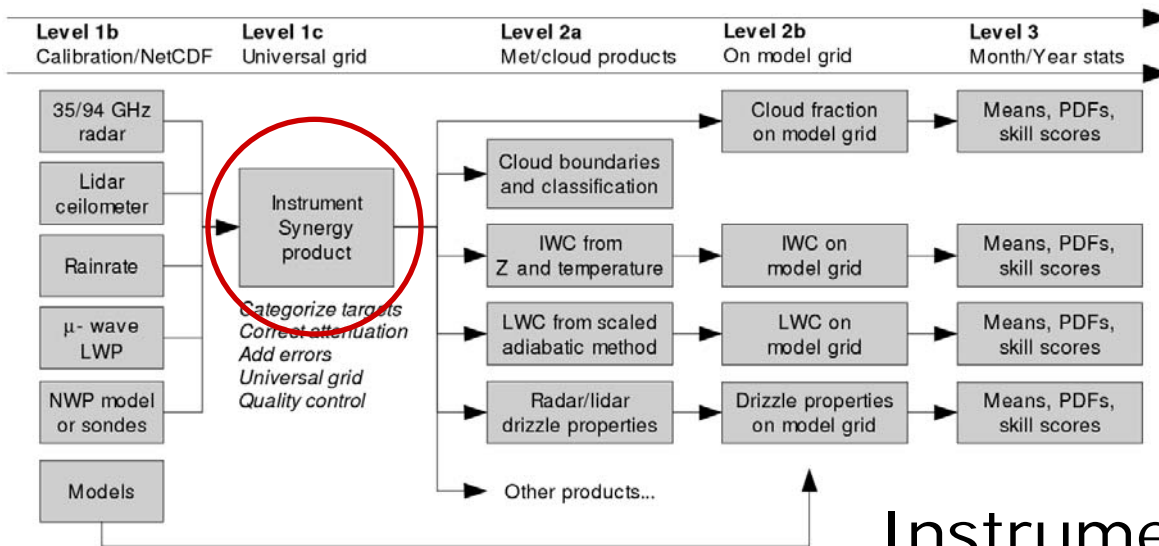
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= *ARMnet!*



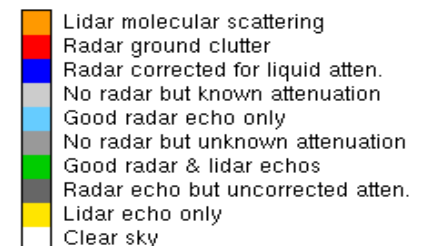
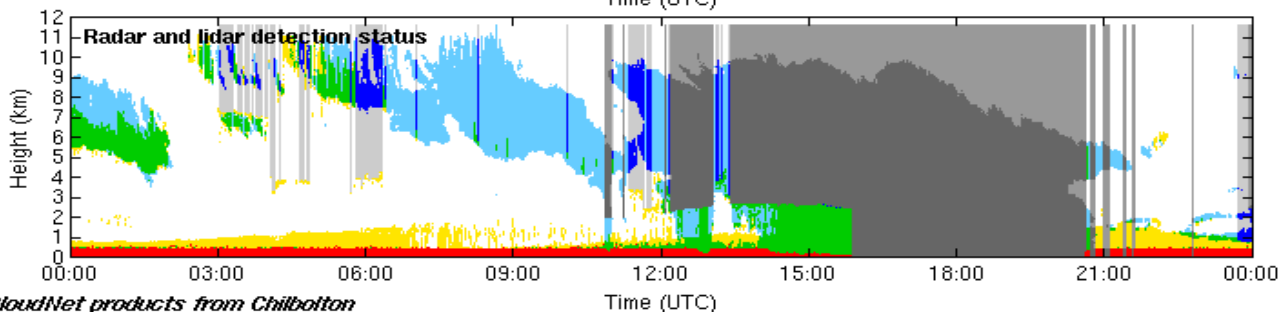
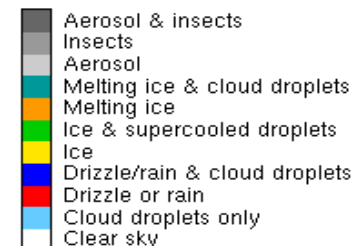
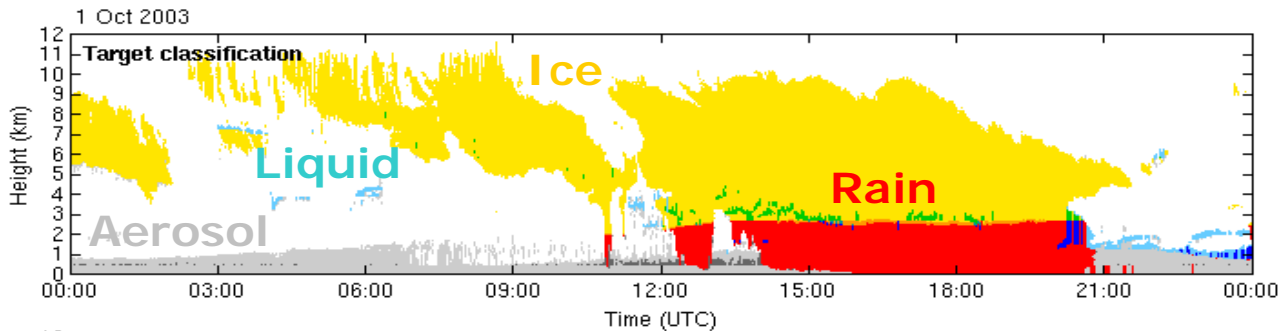
Products

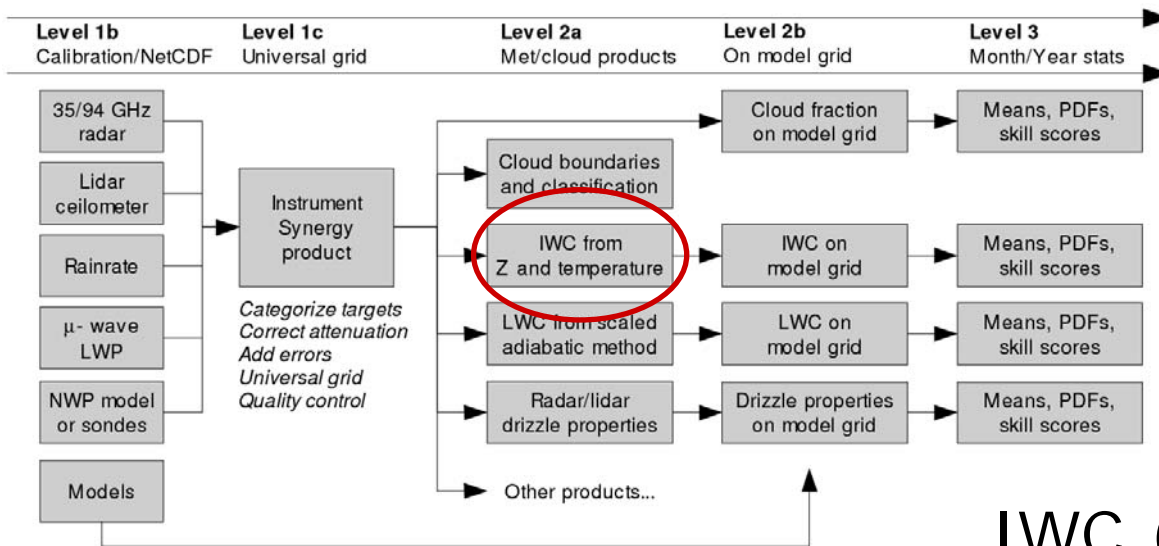


Level 1c

Instrument synergy product

- Radar, lidar, rain-gauge, microwave radiometer on same grid
- Classify targets, correct radar attenuation, add errors...

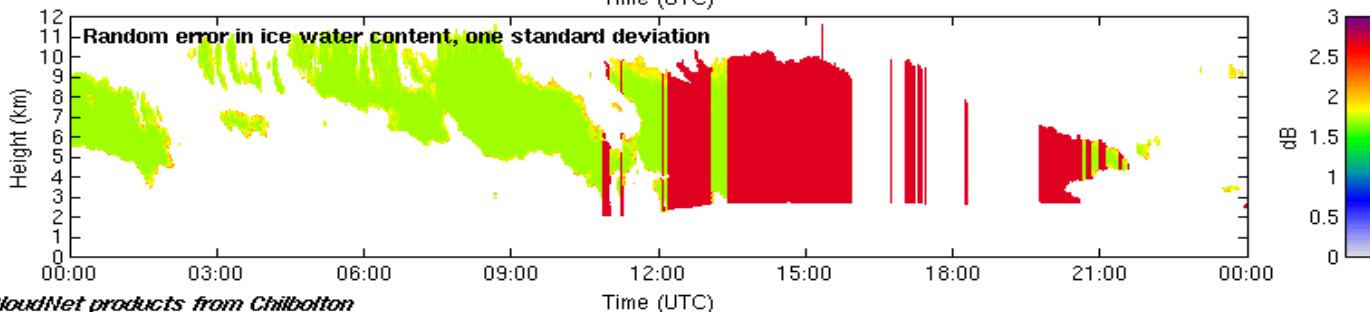
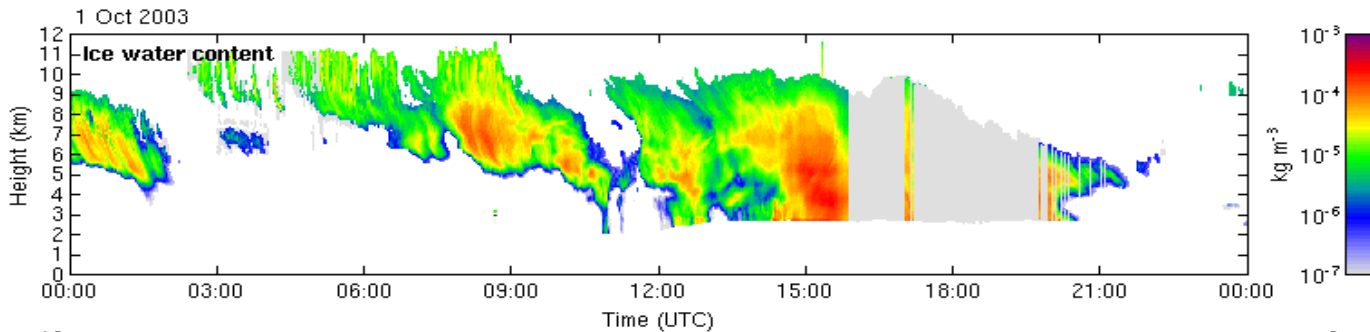


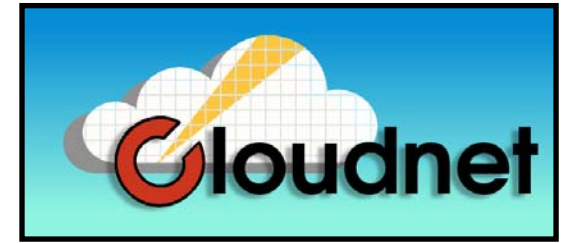
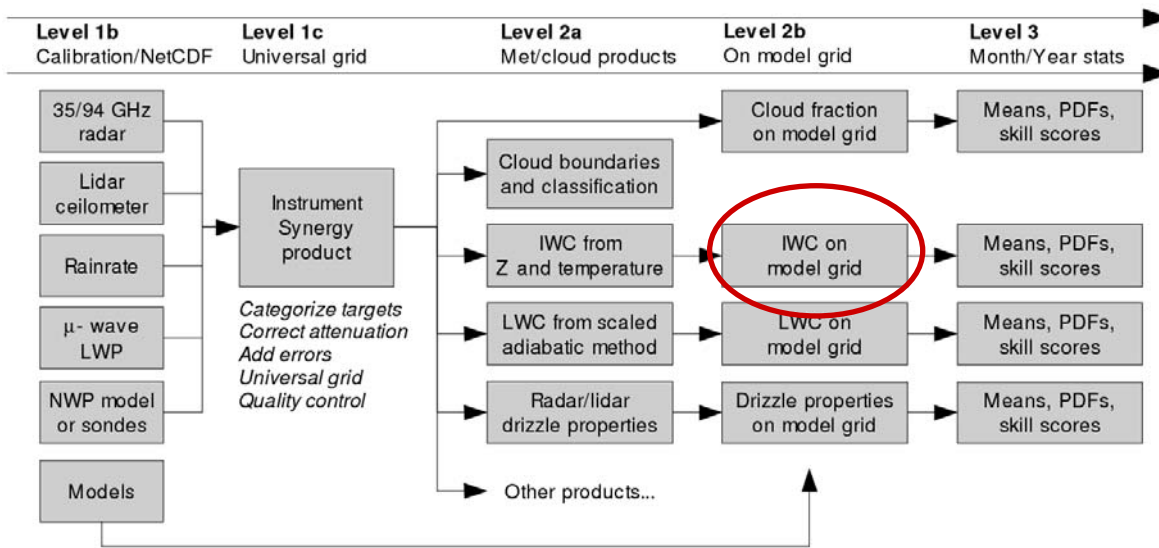


Level 2a

IWC (observational grid)

- Ice water content reported with errors on radar-lidar grid
- Larger error above melting-layer; not reported if rain at ground

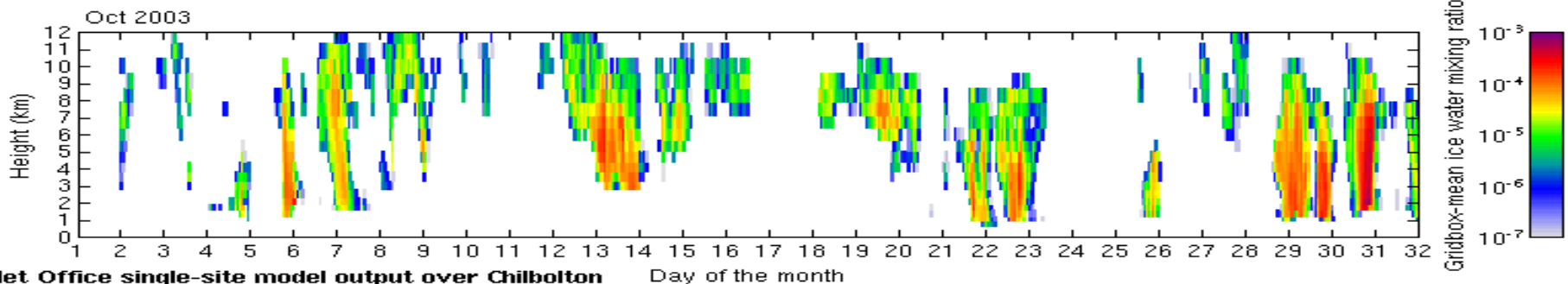
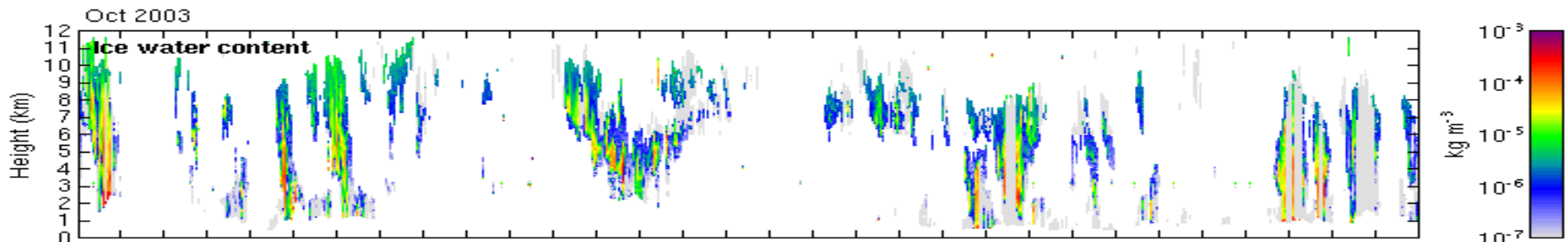


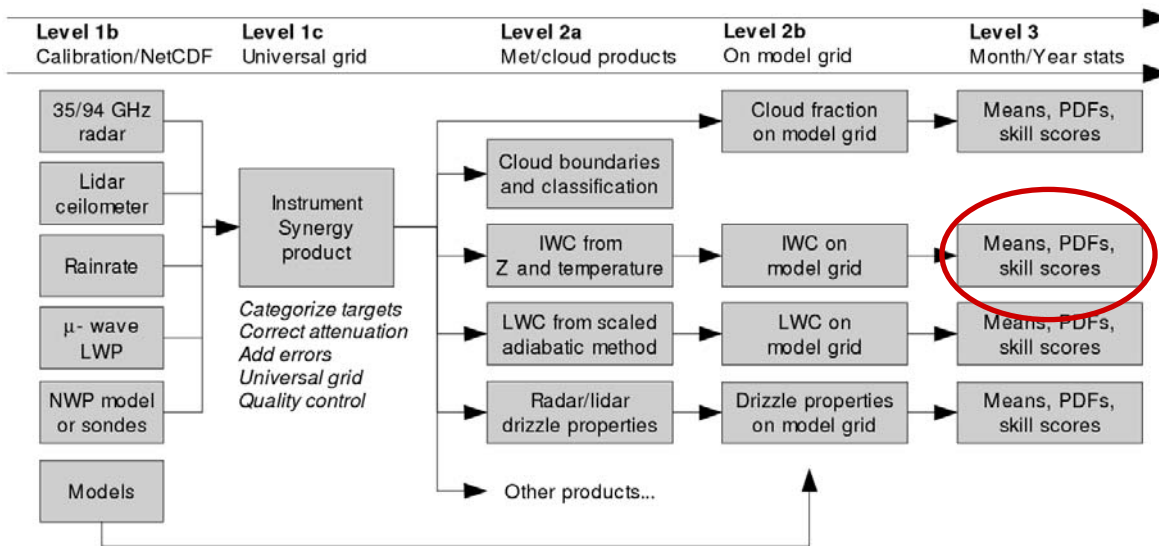


Level 2b

IWC (model grid)

- IWC averaged separately to the grid of each model
- Separate variables with/without snow; radar sensitivity included

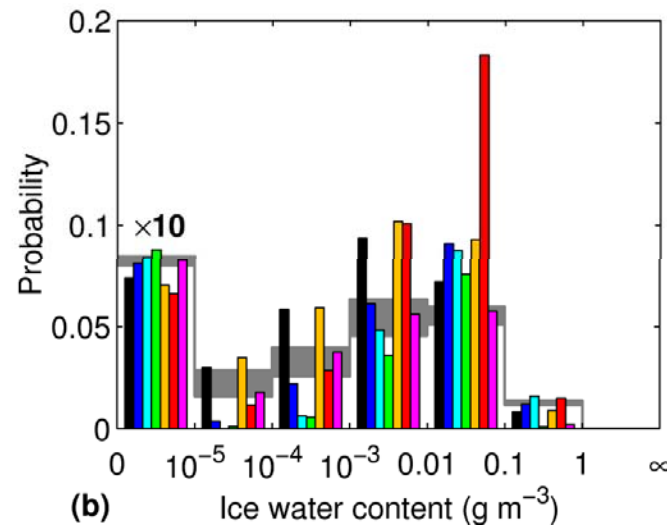
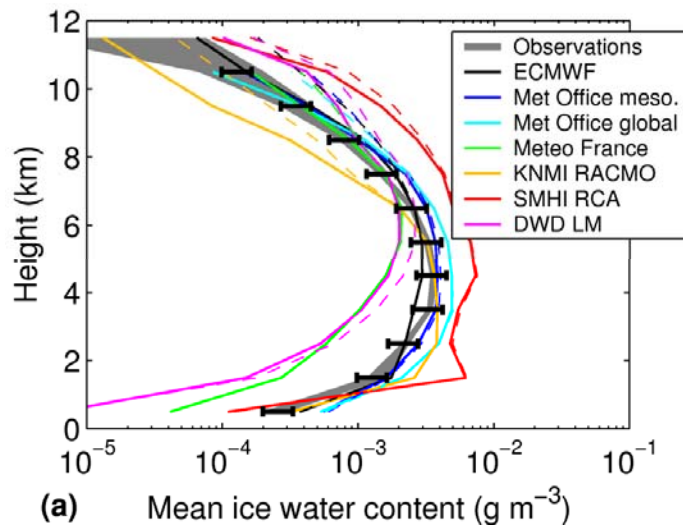




Level 3

IWC statistics

- Means, PDFs, skill scores reported for each month/year & model



- Detailed results reported by Illingworth et al. (BAMS 2007)
- See also www.cloud-net.org and my talk on Thursday

ARMnet proposal

- Two processing streams
 - Process past 10+ years of data
 - Implement system at BNL for *near-real-time* processing; highlighted as key requirement by NWP modelers
- 10+ sites to be processed worldwide
 - Six fixed ARM sites: SGP, NSA, Darwin, Manus, Nauru
 - AMF: Niamey, Murgtal...
 - Europe: Chilbolton (UK), SIRTa (F), Cabauw (NL), Lindenberg (D)
- 12+ models to be evaluated
 - Regional NWP: Met Office 12/4/1.5-km, German DWD
 - Global NWP: ECMWF, Met Office, Meteo-France, NCEP
 - Regional climate (NWP mode): Swedish SMHI RCA, Dutch RACMO
 - Global climate (NWP mode): GFDL, NCAR (via CAPT project)
 - *Other models, e.g. MMF? Different versions of the same model?*
- Algorithms to be used
 - Cloud fraction, IWC (Z,T), LWC (scaled adiabatic), drizzle flux
 - *Flexible framework for any others to be added*

ARMnet schedule: Year 1

- *Task 1.* Update Cloudnet framework for ARM
 - Modify Instrument Synergy product to work with full range of ARM instruments and conditions experienced at various sites
 - Apply Gaussiat et al. (2007) technique to re-calibrate microwave LWP using clear-sky regions detected by lidar
 - Adapt the classification to make optimal use of the micropulse lidar and various MMCR recording modes, particularly for insect clutter rejection and lidar molecular/aerosol discrimination
 - Develop formal methodology for evaluating tropical clouds, accounting for poor sampling of isolated deep convection and sensitivity to high cirrus
- *Task 2.* Application to past data
 - Apply the processing to data recorded at all sites since 2000
 - Release to the community via ARM archive

ARMnet schedule: Years 2-3

- *Task 3.* Implement processing system at BNL
- *Task 4.* Add new algorithms
 - In collaboration with ARM scientists, incorporate some existing ARM algorithms into this framework - they could then be automatically compared with all models at all sites
 - Establish framework for comparing algorithms and combining the best aspects of each
- *Task 5.* Add new models
 - Solicit input from new models (NCEP, CAPT climate models etc.)
 - Develop tools to convert into Cloudnet NetCDF model format
 - Adjust processing depending on nuances of each model scheme (e.g. representation of snow, convection scheme etc.)
- *Task 6.* Implement near-real-time model evaluation
 - Develop online visualization system for products and statistics

Summary

- Cloudnet's key achievement:
 - Complete system from measurements to evaluation of all models, rather than stopping with the retrievals and letting each modeler evaluate their own model
- Considerable investment went into Cloudnet
 - With a little more investment, the benefits of this system could be available for the ARM Program
- "Instrument Support Fund" the recommended route
 - Cost: just under \$100k/year for 3 years
 - Provides 60% of a postdoc, plus necessary travel to BNL
- Collaboration
 - The suggested activities represent my perception of what would be most useful to the ARM Program but fully open for discussion
 - Would welcome the opportunity to collaborate with ARM scientists in this project