VAP Highlights for the CAPI Working Group

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Introduction

Over the past year work on Value Added Products (VAPs) for the Cloud-Aerosol-Precipitation Interactions (CAPI) working group has focused on three main areas:

1) Continued development of new and existing VAPs
2) Extending existing VAPs to additional sites, including ARM Mobile Facility (AMF) deployments
3) Reprocessing historical data to fix errors and create consistent datasets

1. VAP Development

1a. Planetary Boundary Layer Height (PBLHeight) – NEW

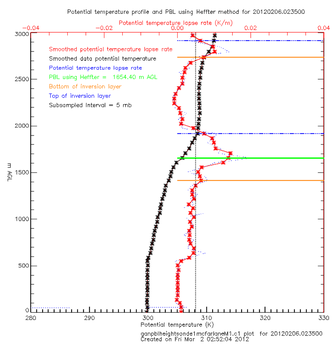
Planetary boundary layer (PBL) depth is important to a wide range of atmospheric processes including cloud formation, aerosol mixing and transport, and chemical mixing and transport. This VAP will implement estimates of PBL height from a range of instruments.

Recent work – Implemented 3 radiosonde-based methods of PBL height determination; Currently evaluating and comparing methods

Next Steps – Implement ceilometer/lidar methods

Future Work - Explore estimates from advanced measurement systems including Raman lidar, radar wind profiler, etc

See Poster by Sivaraman et al. for more details



PBL height calculated with Heffter (1980) method from GAN radiosonde.

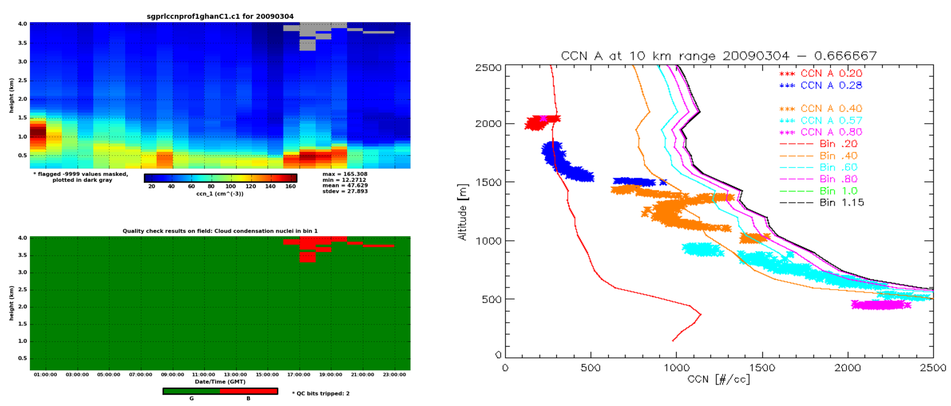
1b. Cloud Condensation Nuclei Profile (CCNProf)

Uses lidar exinction profile plus surface CCN and humidification factor to determine CCN spectrum at cloud base following methodology of Ghan et al. 2006

Recent work - Implemented algorithm, including qc flags. Performed initial evaluation with aircraft data. Placed data in ARM Evaluation area.

Next Steps - User feedback indicates cloudmask from Raman lidar does not adequately screen cloud contamination; will add higher temporal resolution cloud mask information from ceilometer

Future Work – Evaluate for Raman lidar at Darwin; implement and evaluate for micropulse lidar data at SGP; extend to AMF sites w/ lidar and AOS measurements



Calculated CCN profile at 0.15% supersaturation (top left) and quality control flags (bottom left) produced by the VAP for 20090304. Comparison of VAP results to aircraft measurements during RACORO (right).

1c. Radiatively Important Parameters Best Estimate (RIPBE) and Broadband Heating Rate Profile (BBHRP)

RIPBE merges parameters needed for radiative transfer calculation to common grid with qc flags; BBHRP calculates broadband fluxes and heating rate profiles using RIPBE inputs.

Recent work - Processed RIPBE (archive) and BBHRP (evaluation area) 1-min data for 2002-2007 at SGP; Prototype of BBHRP-average file for flux closure evaluation.

Next Steps – Development of RIPBE-avg code; BBHRP-avg and RIPBE-avg data in evaluation area. Code and plots for flux closure evaluation.

Future Work – Implement BBHRP testbed by modifying RIPBE/BBHRP code to work with ARM cloud retrieval ensemble dataset (ACRED) input cloud properties. Extend RIPBE and BBHRP to other sites.

1d. Microwave Radiometer Retrieval for 3-Channel Radiometers - NEW

With ARRA funding, new 3-channel systems (23, 31, 90 GHz) have been installed at the SGP, Manus, and Darwin sites and as part of both AMFs. The 90 GHz channel has approximately 3 times the sensitivity to liquid water compared to the 31 GHz channel, and will therefore markedly improve the accuracy of the LWP when LWP is less than 100 g/m^2. This VAP will update the current retrieval algorithm (Turner et al. 2007) to work with any set of 2 or more microwave channels.

Recent work – Dave Turner has developed a new version of the MWRRET retrieval algorithm that works with the new 3-channel radiometer systems and uses updated absorption coefficients.

Next steps – After the STM, we will begin implementing the new algorithm in the ARM Integrated Software Development Environment (ISDE) framework; add qc flags; evaluate data.

2. Extension of Existing VAPs to New Sites

MWRRET – Updated to work with WACR-ARSCL data. Processed HFE and GRW data for the first time. Reprocessed historical data.

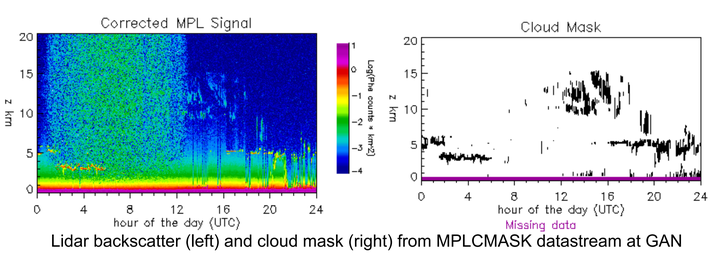
MPLCMASK – Updated to work with historical MPL datastreams and run operationally for AMF; processed all years at all sites (except pre-1999 at Manus due to missing information in data files).

MFRSRCLDOD – Updated to use MWRRET as input for sites with microwave radiometers and to run on SGP extended and boundary facilities. SGP data currently being processed and reviewed; will extend to TWP and AMF sites this year.

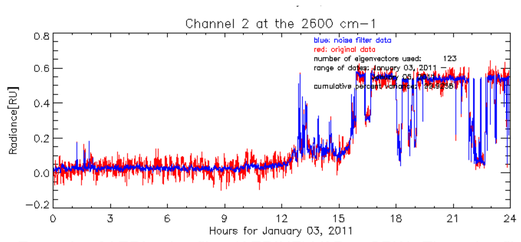
QCRad – Initial AMF datasets at GAN and PGH processed. PGH data running operationally through remainder of deployment.

AERINF – Updated to run operationally for current AMF sites; processed FKB, HFE, GRW

MPLCOD - Current dataset exists only for several years at SGP. Analysis of effort to update to run on MPLCMASK data and run operationally completed; will submit ECR and start work in June.



Lidar backscatter (left) and cloud mask (right) from MPLCMASK datastream at GAN



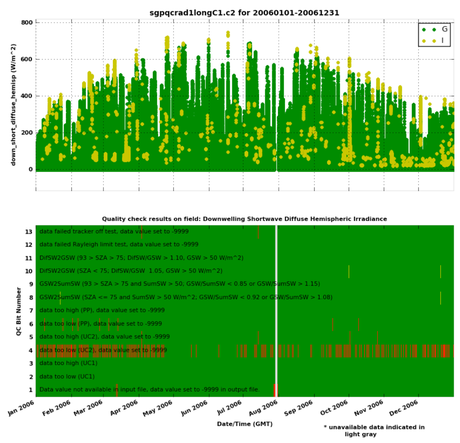
Example of AERI noise filter (AERINF) VAP at GRW. The noise filter significantly reduces the noise seen in the raw data.

3. Reprocessing Historical VAP Data

End-to-end historical reprocessing of all QCRad data to:

1) Use data from previous end-to-end reprocessing of mfrsr datastreams
2) Remove overly restrictive quality-control (qc) test on the LW fluxes that was throwing out good data
3) Correct inconsistencies between the original 'aqc' flags and the ARM standard bit-packed 'qc' flags
4) Implement a correction to the logic for calculating the best estimate SW flux; affects some cases where the best estimate was calculated from morning or afternoon fit
5) Correct the global downwelling SW using fits derived for specific instruments (creates .c2 level files)
6) Write Data Quality Reports (DQRs) for historical data

Status: All permanent and AMF sites (except NSA) have been processed to .c2 level and will be archived by end of March. NSA .c1 has been processed, waiting for information on historical instrument swap out dates to finish .c2 processing. DQRs on all historical data will be finished by end of April.



Yearly summary plot for QCRad downwelling SW diffuse flux.

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