Aerosol-Related Data Products and VAPS

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ACSM b-1 datastream
- Currently available for SGP and ENA data October 2019 – present.
- Runs daily and provides ACSM calibrated species concentrations, an ACSM volume, and QA/QC checks.
- Assumes CE = 1.

Ozone b-1 datastream
- Provides calibrated, background corrected $O_3$ concentration.
- Available for SGP, OLI, ENA.

CCN average datastream
- Computes the average CCN concentration at multiple SS setpoints.

CCN spectra datastream
- Fits to describe CCN number as a function of supersaturation.
We have generated (by FY20 end) harmonized b-level datastreams for:
- Nano-SMPS
- SMPS
- UHSAS
- APS

These harmonized datastreams standardize variable names and units, including:
- Size distributions in dN/dlogDp units.
  - This will facilitate size distribution inter-comparison.
- Size bin diameter midpoints and upper and lower bounds
- Integrated number concentration, volume, and surface area.
  - Will facilitate inter-comparison.
- QA/QC checks on the data.
SP2 Processing: BC size distributions (Led by Scot Collis Group at ANL)

- Modernizing legacy IGOR code for SP2 processing in Python
- Calculating BC mass and diameter to get size distributions.
- Current status: Implementing filtering and comparing vs. IGOR
- Need to calibrate size calculation

Code at: https://github.com/rcjackson/PySP2
Combines PSAP extinction and Neph scattering data to calculate: aerosol absorption coefficient, SSA, angstrom exponents, asymmetry parameter, corrected scattering, etc.

- Calculations are provided for different PSAP correction algorithms.

AOP VAP is operational and data are available for almost all sites and field campaigns.

- Recently updated the algorithm to detect and correct for PSAP filter changes.
  - Should improve data availability.
Uses MFRSR data to retrieve aerosol optical depth at 7 wavelengths from 415 - 1625nm.

- Recently added a 1.6 um channel to MFRSR and we are updating VAPS to include this channel.
- Runs autonomously at some sites, but needs some hand-processing at challenging sites with frequent cloud cover.
- Will update Langley every 6 months for ENA, NSA, MCQ (challenging sites).
- ENA and MCQ will be processed this FY.
Individual AOD products vary in continuity, data quality, and temporal resolution due to differences in instrument design and data processing.

The QCAOD VAP integrates four AOD products and generates nearly-continuous combined AOD.

- Reports AOD at two wavelengths, 500 and 870 nm.
- High temporal resolution (1-min) for 21-yr period (1997-2018) at SGP.
- Recently available.
We have applied the composition dependent collection efficiency calculation from Middlebrook et al. 2012 to the autonomous ACSM b1 data.

This will generate an ACSM_CDCE datastream, which will run in near real-time.

In general, the CDCE algorithm significantly improved the ACSM/SMPS comparison at SGP, but it isn’t perfect.

- Need to look into other sites.

Should be available for SGP by end of FY20.
We are calculating a parameterized, bulk hygroscopicity (kappa) value by combining CCN and SMPS data.

- Kappa value is calculated for each value of SS.

- We expect data will be released late FY20/early FY21 for SGP.
  - Will work on ENA data next.
  - UHSAS measures size instead of an SMPS.
We are rebooting a CCN vertical profile VAP developed by Ghan, McFarlane, Collins.

- VAP generates the vertical profile of CCN at SS values measured by the CCNC.
- Valid up to cloud base

Will run autonomously at sites with a CCNC and a lidar.

Data will be available starting in FY21.

- We are currently developing this VAP for the SGP site.
- Will validate VAP with aircraft data.
- Will work on ENA site next.

Reference: Ghan, SJ and DR Collins. 2004
Plans for FY 2021

New VAPS starting next year:
- AOD Best Estimate – evaluates multiple AOD datastreams and provides an evaluation of the best estimate at 5 wavelengths.
- Merged Size Distribution – will merge size distributions from multiple instruments (initially nano-SMPS, SMPS, APS)

VAPS expected to come online FY20/FY21:
- ACMS CDCE expected to be extended to most sites and field campaigns
- CCN Kappa for SGP and ENA.
- CCN Vertical profile for SGP and ENA.
- AOD for NSA.

New datastreams:
- b1 processing of CO and SO₂.
- b1 data for ACSM AMF deployments.
Science Product Development Led by a Team of Scientists

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