

IMPROVE – CSN
Carbon Monitoring Workshop

UCD 1/22/08 to 1/23/08

Attendees

- Chuck McDade, UCD
- Max Peterson, RTI
- Neil, Frank, EPA
- Sherri Hunt, EPA
- Judith Chow, DRI
- Warren White, UCD
- Lowell Ashbaugh, UCD
- James Flanagan, RTI
- John Watson, DRI
- Mike Kleeman, UCD
- Ashley, Mefferd, UCD
- William Malm, NPS
- Joann Rice, EPA
- Bret Schichtel, NPS
- Phil Lorang, EPA
- Antony Chen, DRI
- Jay Turner, Wash. U.
- Marc Pitchford, NOAA

Motivation

- Carbon is an abundant and critically important PM species for health and visibility effects
- PM carbon monitoring data has greater uncertainties than the other PM species
 - Artifact uncertainty contributes to overall uncertainty
 - OC/EC split and determination of thermal subspecies are sensitive to small differences in analytical protocol and sample matrix effects
- Recent transitions in the IMPROVE and CSN monitoring methodologies for PM carbon affect the data
 - IMPROVE changed carbon analyzers
 - CSN is transitioning to IMPROVE-like samplers and analysis
- Available information are not sufficient to adequately understand and reduce uncertainties

Goals

- Develop an action plan (12 to 24 months) to generate the information to support the following needs
 - Consistent approach to adjust for organic PM monitoring artifacts
 - Algorithms that relate carbon PM data from IMPROVE and CSN
 - Algorithms that relate old and new analyzer generated IMPROVE carbon PM data
- Make recommendations for interim approaches to address to the same three needs until better approaches are developed

Approach

- For each of the three needs
 - Review available pertinent information
 - Identify and discuss information gaps
 - Develop action plans to generate the new information to improve our understanding
 - Discuss interim approaches for coping until better methods can be developed
- Challenges
 - No new resources have been identified to conduct additional measurements or studies
 - Both networks need to continue operations while working on this issue
 - Both networks are unlikely to radically change monitoring approaches in the foreseeable future

Technical Overview

- OC artifact
 - IMPROVE adjusts for a positive artifact by subtracting the six-site median backup filter value
 - CSN (old version) doesn't adjust for a positive artifact and doesn't have backup filters at any sites, but does have short ambient exposure field and trip blanks
 - New CSN does have backup filters at all sites and field blanks that stay in the sampler for the sampling duration, as well as trip blanks
 - Question of whether we want OC to represent atmospheric concentration or what's weighed on the FRM samples
- Relating IMPROVE to old CSN data sets using a regression model
 - Changed at 2004 → 2005 TOR transition
 - Vary with CSN sampler (MetOne is the most common)
 - Suggest a seasonally varying additive artifact in CSN OC (relative to IMPROVE)
 - Suggest a multiplicative negative artifact in IMPROVE OC (relative to CSN)
 - MetOne observations from 2005-6 at seven sites can be linearly transformed into IMPROVE values with rms errors of EC: 0.4 ug/m³ (27% of mean value) and TC: 0.8 ug/m³ (16% of mean value) – these are comparable to IMPROVE collocated precision

Technical Overview (continued)

- Relating original IMPROVE carbon (pre-2005) to new IMPROVE carbon using network median trends
 - Total carbon is unchanged
 - Elemental carbon fraction of total carbon increased in 2005 when new analyzer was used by ~10%
 - Organic carbon ratio decreased by a few percent
 - Some of the individual carbon thermal subfractions changed more than the EC/TC [OC1↓, OC2↑, OC3↓, OC4↓, OP↑, EC1↑, EC2-]
- Topic paper, agenda, presentations, and summary are available on the IMPROVE website
http://vista.cira.colostate.edu/improve/Publications/Workshops/Carbon_Jan2008/CarbonMeeting2008.htm

Overview of Action Plan

- Re-analysis of archived filters
 - Use new IMPROVE method to investigate historic variations in IMPROVE network median EC/OC trends (2004/2005, 96 filter; late 1994, 48 filters; pre-2005 sites with collocated CSN, 72 filters); ~\$11.3k – status, recently authorized.
 - Use new IMPROVE method to analyze CSN filters at 6 IMPROVE/CSN collocated urban sites (60 filters per site); ~\$26k – status, decision pending but high priority
 - Recalculate OC/EC for CSN filters collected prior to July 8, 2003 using new Sunset Labs software on raw thermal dataset (all filters); ~\$20k – status, decision pending but high priority
- Information exchange consistency
 - CSN distribution of site metadata and data advisories similar to IMPROVE; status, decision pending but low priority
 - IMPROVE distribution of blank datasets similar to CSN; status, underway

Overview of Action Plan (continued)

- Data analysis
 - Further regression analysis to related IMPROVE and CSN; no additional cost – status, underway (Warren White)
- Special Studies
 - Additional artifact literature review*
 - Source-specific sample tests for artifacts*
 - Effects of face velocity on artifacts*
 - Laboratory study of negative artifact*
 - Laboratory studies of vapor absorption on quartz filters (e.g. accumulation rate and stability of as a function of chemical and physical conditions); ~\$50k – status, decision pending
 - Study longer exposures of field blanks and secondary filters for CSN network for the pre-conversion to IMPROVE methodology; ~\$60k – status, being discussed (see next bullet)

* Proposal not received and no longer being solicited

Overview of Action Plan (continued)

- Network Changes

- Design and implement changes to CSN collection of various blanks (increase field blank exposure, reduce number of trip blanks); ~\$20k, status, under discussion (progress is slow)
- Continue collocation of old CSN & new CSN, and CSN & IMPROVE during transition to new CSN; status, anticipate doing this, but details not yet determined
- Increase spatial coverage of IMPROVE backup filters (double the number of backup filter sites to 12, reduce the number of field blanks for cost-neutral change); \$0 – status, implemented

Follow-on Activities

- Continue to track implementation and assess results of the action plans
- As more data becomes available, assess the comparability of the IMPROVE and new CSN (i.e. IMPROVE-like) carbon data from collocated sampling sites
- Determine if another joint network workshop would be helpful to plan additional activities and/or operational changes (~1 year from now)
- Disseminate results of assessments (e.g. IMPROVE data advisories, papers, journal articles, etc.)