Update of IMPROVE Carbon Analysis

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Objectives

• Report status of IMPROVE carbon analyses

• Review internal quality control (QC) checks

• Discuss operational challenges and improvements
DRI’s Environmental Analysis Facility (EAF) continuously operates 10-13 Model 2015 Multiwavelength Carbon Analyzers (2016-Present, analyzed over ~261,800 samples with ~120,000 for IMPROVE)

EAF Carbon Laboratory (Magee Scientific, Berkeley, CA and Aerosol, d.o.o., Ljubljana, Slovenia)
Carbon Laboratory Operations

(July 2021 – June 2022 samples, n= ~ 18,399)

• Received ~1,655 IMPROVE samples per month (varies from 0 to ~2,800 samples per month)

• Operated ~15-18 hours per day, 7 days per week until April 2022, reduced to ~6-8 hours per day, 3-5 days per week in recent months.

• Matt Claassen has assumed responsibility since June 2021 in conjunction with Patrick Myers, who started September 2021.
<table>
<thead>
<tr>
<th>Sampling Period</th>
<th>Sample Receive Dates</th>
<th>Number of Samples Received</th>
<th>Analysis Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/1/21 – 12/30/21</td>
<td>8/20/2021-7/13/2022</td>
<td>9,227</td>
<td>July 2022</td>
</tr>
</tbody>
</table>
Carbon throughput averaged ~110 samples per day*

(July 2021 – June 2022)

*Excludes calibration runs
Carbon throughput remained stable after elimination of backlogs at the end of 2021 (Jan 2021 – Oct 2022)
Average 57 runs per day are dedicated to multiple quality control (QC) checks

(July 2021 – June 2022)

Daily QC (excluding manual tests)

Multiple QC per week plus Semi-Annual Calibration

n=22,349 QC runs
A better-insulated stranded wire replaced thermoplastic-insulated copper wire in connections to sample ovens

- Thermoplastic-insulated copper wire burned out periodically on some sample ovens, leading to potential safety hazards and machine downtime
- MG wire consists of outer fiberglass insulation with an inner mica insulation that can withstand high temperatures, up to 450°C
Initiated revised data validation protocol since June 2020

- Processing data by multiple sets simultaneously instead of in small batches.
- Created software to identify and invalidate unusual sample runs to reduce sample re-analysis rates.
Additional criteria were added to facilitate efficient data validation

• Streamlined data-processing has shortened the reporting time.

• Improved machine-learning to validate accuracy
Example 2020-2021 publications and reports using the IMPROVE_A protocol (n=53)


Example 2020-2021 publications and reports using the IMPROVE_A protocol (n= 53)

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