Land-use patterns and photo-oxidation of soot black carbon

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Soot black carbon (BC) is the product of incomplete combustion of fossil fuels and biomass. This poster highlights two datasets that investigate soot BC degradation rates:

1) Trends between soot BC concentration at urban sites and current and historical land use data indicate the main input of soot BC to soil is the actual changing of land use from desert to urban.

2) Organic and soot BC can be degraded by photo-oxidation on short time scales (monthly). Oxygenated functional groups are included in post photo-oxidized soot BC samples that are not found in the pre photo-oxidized samples suggesting that photo-oxidation not only decreases soot BC concentration but also changes its inherent chemical composition.

Background information

Summary of Survey 200 soils  AVG (n = 63)

<table>
<thead>
<tr>
<th>Wt % OC (g OC/g soil)</th>
<th>1.2 ± 0.9</th>
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</thead>
<tbody>
<tr>
<td>Wt % BC (g BC/g soil)</td>
<td>0.2 ± 0.2</td>
</tr>
<tr>
<td>BC/OC (g BC/g OC * 100)</td>
<td>31 ± 24</td>
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</tbody>
</table>

Avg. Black Carbon JTC (%e) -18 ± 3

HOW CAN WE BETTER UNDERSTAND INPUTS AND REACTIVITY OF SOOT BC IN SOIL?

Soot BC concentration is high in the most recently urbanized areas

- Soot BC concentrations are higher at sites closer to city center.
- Urban sites have higher soot BC concentrations than desert sites because of human activities (see 'Background' section).

- Opposite trend is seen for urban sites.
- Soot BC input mechanisms for urban sites are different than those for desert and agricultural sites.

(Desert and agricultural sites are grayed out.)

Photo-oxidation changes chemical composition

- Soot BC prior to photo-oxidation has a different chemical composition than soot BC after photo-oxidation.
- The differences appear in the form of oxygenated functional groups in the post photo-oxidation samples.
- Oxygenated functional groups increase the reactivity of molecules, allowing further reactions driven by biotic and abiotic processes.

Despite the differences in methodology, uncertainty, variability, etc., the order of magnitude difference in the calculated degradation rates for these two data sets is fairly small. As a result we have gained a better understanding of the contribution of photochemical oxidation to soot BC degradation in central AZ.

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