Measurement of Free Tropospheric Aerosols in the North Atlantic at the Pico Mountain Observatory

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Pico Mountain Observatory

- → Located on the Pico Island in the Azores archipelago in the North Atlantic
- → On an inactive volcano at 2225 m asl
- → ~3900 km east and downwind of North America

Left: Location of Pico Island, Azores, Portugal

Right: Pico Mountain volcano

Air sampled at the Pico Mountain Observatory

- → This unique location enables sampling of free tropospheric air not affected by local emissions
- → Mainly North American outflow after its trans-Atlantic transport
- → This location is ideal for observations of long-range transported pollutants emitted from anthropogenic and biogenic continental sources

Above: Pico Mountain Observatory station

NEW Aerosol measurements at the Pico Mountain Observatory

- → Past measurements (CO, O_3, NO_{xy}, NMHC, BC, aerosol optical size) and modeling showed outflow of North American tropospheric O_3 and its precursors
- → However, little was known about the aged aerosol
- → For the first time, samples of $PM_{2.5}$ were collected with high-volume samplers onto quartz filters for their chemical characterization

Left: **First two High Volume samplers** installed at the **Pico Mountain Observatory**

Filter samples during 2012 measurements

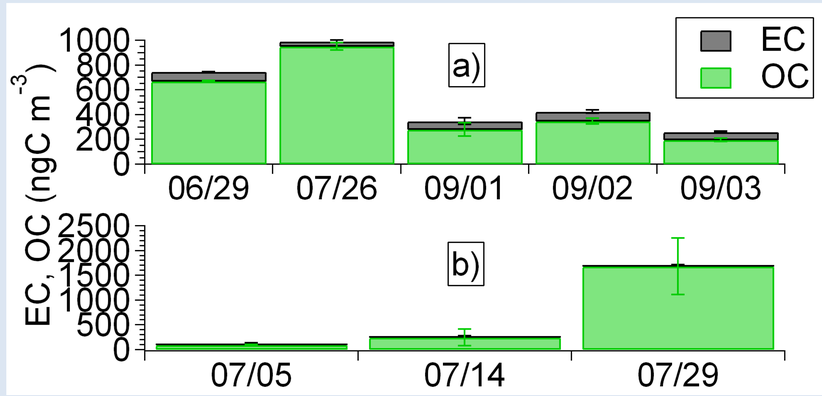
- → Demanding set-up and an unusually wet season led to limited filter sampling during 2012
- → Successful sampling during several periods

Left: Filters sampled in 2012 (Sample # in parenthesis indicates wetted filters)

Sample #	Start date	Start time	Stop date	Stop time
1	06/29	18:50	07/05	16:00
(2)	07/05	16:30	07/14	12:45
(3)	07/14	13:10	07/22	11:36
4	07/26	14:00	07/28	18:00
(5)	07/29	12:00	07/30	11:58
6	09/01	18:00	09/02	17:55
7	09/02	18:00	09/03	17:55
8	09/03	18:00	09/04	17:55

OC/EC analysis of aerosols sampled on filters

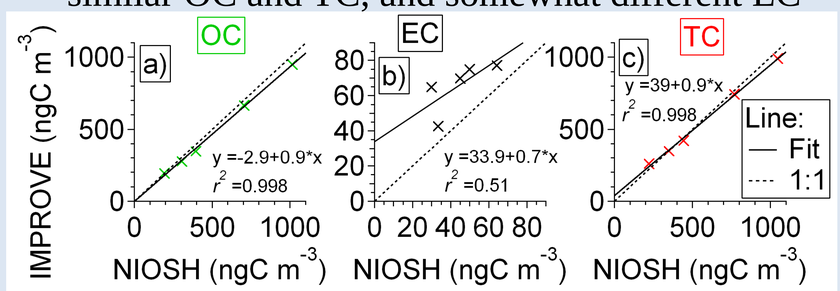
- → More than 80% of carbon is consistently OC
- → Measurements of filters wetted due to clouds / rain are not reproducible (panel b) below)



Above: Amounts of OC and EC from reproducible (a) and wetted (b) filter samples

Comparison of protocols for OC/EC analysis

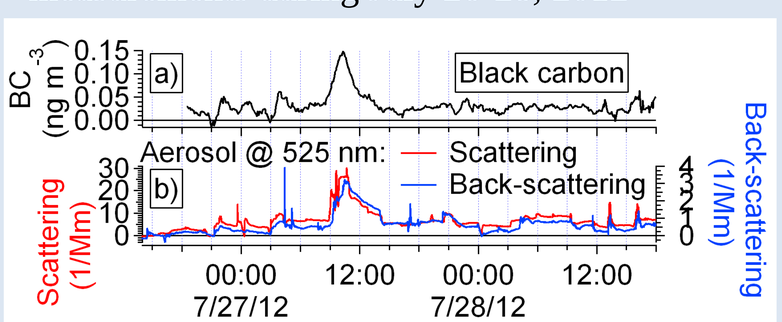
- → Among the most common OC/EC measurement protocols are IMPROVE-A and NIOSH, also know as low- and high-temperature protocols, respectively[1,2]
- → OC/EC analysis with both protocols yields similar OC and TC, and somewhat different EC



Above: Correlation of OC (a), EC (b) and TC (c) results with IMPROVE-A and NIOSH protocols

Comparison with collocated high time resolution aerosol measurements

Below: Aethelometer (a) and nephelometer (b) measurements during July 26-28, 2012



- → Possible pollution plume event on July 27, consistent with high OC/EC measurements
- → More info on aethelometer and nephelometer measurements in Mazzoleni et al., poster **8RA.15**

Conclusions and future work

- → 4 High Volume samples were successfully installed at the Pico Mountain Observatory
- → The demanding position of the Observatory as well as a very wet season interfered with consistent daily filter sampling
- → Nevertheless, several filter samples were collected so far, and measurements are still on-going
- → OC/EC measurements show dominance of OC with possible pollution plume and clean air masses
- → Future work: a) OC/EC analysis of additional filters; b) quantitation of WSOC; c) inorganic chemical characterization; and d) detailed molecular characterisation of WSOC by ultrahigh resolution FT-ICR mass spectrometry

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References

1. Chow, J., et al., AS&T, 34, 23-34, 2001.
2. Wu, C., et al., AS&T, 46, 610-621, 2012.