

Black carbon in pristine environment: a study of two Hemispheres

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Black carbon (BC) is the single most important absorbing species in the atmosphere emitted by combustion processes. Climatic implications of BC in warming the lower atmosphere highly depend on the dispersion and chemical complexity of the species. Marine environment is largely devoid of black carbon sources with the exception of shipping routes and thus ideal for studying background levels of BC or its long-term evolution.

Two intensive measurement campaigns on opposite sides of the globe have been undertaken in 2015: Southern Atlantic Ocean cruise around Antarctica and land based North East Atlantic measurement campaign at Mace Head, Ireland. BC measurements were performed by the single particle soot photometer SP2 alongside the suite of other aerosol measurements.

During Southern Atlantic Ocean cruise stretched between South Georgia, western Antarctic Peninsula and Weddell sea BC concentration was below 1 ng/m³ 75% of the time during a 6 week cruise. Elevated BC concentrations were observed only in diluted own ship plumes or in rare South American continental outflow air masses. Similarly low BC concentrations of 1-2 ng/m³ were recorded in the cleanest North Atlantic air masses arriving at Mace Head (Figure 1).

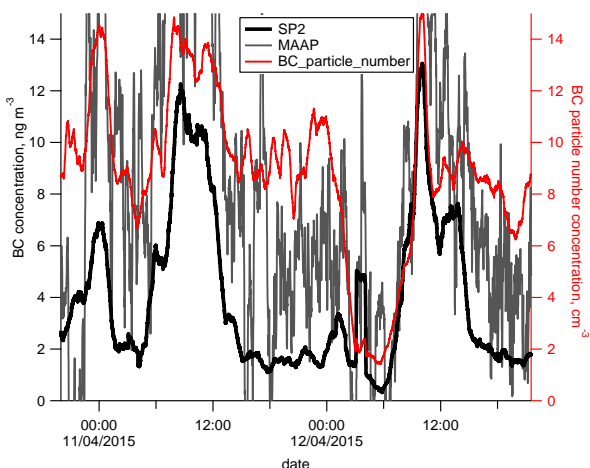


Figure 1. Black carbon mass and BC bearing particle number concentration in clean North Atlantic air masses during spring 2015 at Mace Head, Ireland.

SP2 was compared against MAAP and AE16 at Mace Head in clean and polluted air masses revealing significant departures in mass attenuation cross-section used in absorption based instruments (Figure 2).

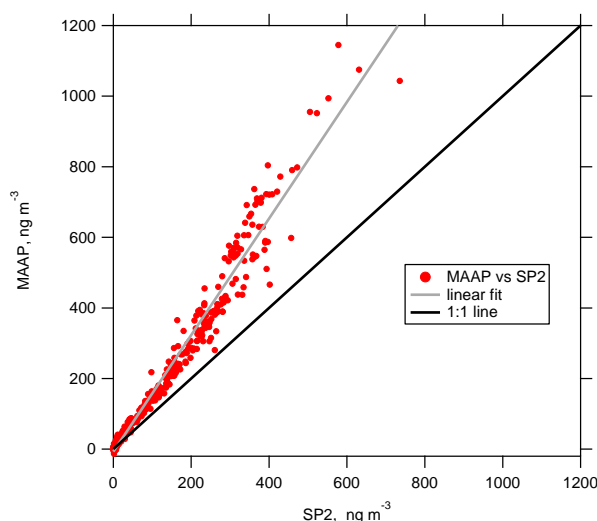


Figure 2. MAAP vs SP2 linear regression of hourly mean concentrations during the entire North Atlantic measurement campaign at Mace Head.

Size distribution of black carbon bearing particles was compared against SMPS spectrum informing about the long-term evolution of primary combustion particles. Observations strongly suggest that pristine environments do exist in certain regions around the globe despite generally assumed polluted atmosphere worldwide.

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