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Wet deposition of particulate carbon to the central North Atlantic Ocean

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Wet deposition is known to play an important role in removing particulate carbon from the atmosphere. However, current information on the spatial and temporal variability of particulate carbon in precipitation is still scarce, representing an important limitation to validate global models that simulate transport and concentration of carbonaceous aerosols, and consequently is affecting predictions of anthropogenic forcing on climate. The main objective of this study is to increase the present knowledge about wet deposition of elemental carbon (EC) and water insoluble organic carbon (WIOC) to the central North Atlantic Ocean.

Precipitation samples were collected in the meteorological station of Angra do Heroísmo (GAW ID: ANG), located at the south coast of Terceira Island, Azores, Portugal, using an automatic wet only collector. Sampling was performed on a daily basis between December 2009 and October 2010. The particulate carbon content of samples was concentrated on quartz fiber filters, which were then dried at ambient temperature and stored frozen until analysis. The elemental carbon and organic carbon particulate fractions accumulated in filters were measured by a thermal–optical method developed at the University of Aveiro and commonly used for the measurement of carbonaceous matter in aerosols.

EC and WIOC concentrations in precipitation were found to be low and in the range of values reported before in northern hemisphere background sites. Analysis of backward air trajectories arriving at the Azores during the sampled precipitation events revealed a dominant westerly transport over the ocean, which explains the observed low concentrations. A few episodes of high EC concentrations were related to air masses coming directly from continental Europe. The contribution of EC to water insoluble total carbon (WITC) was about 10%, on average, reflecting the lower scavenging efficiency of EC than WIOC. The results also showed a seasonal variation in the concentration of particulate carbon in precipitation, with the lowest values in winter and the highest in summer, suggesting that dilution during periods of more intense rainfall is a major factor controlling the abundance of water insoluble carbon. On the other hand, the largest wet deposition flux occurred during the rainy season, in winter, and the lowest flux during the dry season, in summer, a consequence of the seasonal variation of daily rainfall amount.