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Aerosol light absorption in the North Atlantic: trends and seasonal characteristics during the period 1989 to 2003

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Abstract. Aerosol light attenuation on quartz fibre filters has been measured since February 1989 at the Mace Head Atmospheric Research station near Carna, Co. Galway, Ireland, using an Aethalometer.

The frequency of occurrence of the hourly averaged aerosol absorption data is found to be bimodally distributed. The two modes result from clean marine air and anthropogenically polluted continental air both being advected to the station dependent on the prevailing wind direction. The hourly averages of the marine portion of the aerosol light absorption are found to follow closely a lognormal distribution with a geometric mean of 0.310 Mm^{-1} . The hourly averages of continental sector aerosol absorption are neither normally nor lognormally distributed and have an arithmetic mean of 6.36 Mm^{-1} , indicating the presence of anthropogenic sources for BC east of the Mace Head station.

The time series of the monthly averaged attenuation coefficient σ_{att} of both marine and continental sector aerosol shows an increase from 1989 to 1997 and a levelling off thereafter.

The monthly maximum of marine sector σ_{att} is found in May. Trend and seasonal characteristics of the clean marine aerosol attenuation coefficients observed at Mace Head appear to be driven by meteorological factors, as indicated by rainfall data and by trends in the North Atlantic Oscillation (NAO) indices. The observed increasing trends of the continental sector σ_{att} from 1989 up to 1997 are possibly related to changes in BC emissions over Ireland, calculated from UNSTAT (2002) fuel consumption data.

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