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Analysis of aerosol optical properties from continuous sun-sky radiometer measurements at Halley and Rothera, Antarctica over seven years

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The Antarctic continent is located far from most anthropogenic emission sources on the planet, it has limited areas of exposed rock and human activities are less developed. Air circulation over Antarctica also seems to prevent the direct transport of air originating from anthropogenic sources of pollution at lower latitudes. Therefore Antarctica is considered an attractive site for studying aerosol properties as unaltered as possible by human activity. Long term monitoring of the optical and physical properties is necessary for observing possible changes in the atmosphere over time and understanding if such changes are due to human activity or natural variation.
Columnar aerosol optical and physical properties can be obtained from sun-sky radiometers, very compact instruments measuring spectral direct and diffuse solar irradiance at the visible wavelengths and using fast and efficient inversion algorithms. The British Antarctic Survey has continuously operated two Prede Pom-01 sun-sky radiometers in Antarctica as part of the ESR-European Skynet Radiometers network (www.euroskyrad.net, Campanelli et al, 2012). They are located at Halley and Rothera, and have operated since 2009 and 2008 respectively.
In the present study the aerosol optical thickness, single scattering albedo, Ångström exponent, volume size distribution and refractive index were retrieved from cloud-screened measurements of direct and diffuse solar irradiance using the Skyrad 4.2 pack code (Nakajima et al., 1986).
The analysis of the daily and yearly averages showed an important increase of the absorbing properties of particles at Halley from 2013 to the beginning of 2014 related to the increasing presence of smaller particles (from 2012) but with a non-significant variation of aerosol optical depth. The same increase of absorption was visible at Rothera only in 2013.
Air pressure measurements, wind directions and intensity, and vertical profiles from radio-soundings, together with HYSPLIT model back-trajectories were considered in order to understand the origin of these particles (if locally produced or due to large scale transport) and to verify if the events in the two sites are related or not.
In addition some single days' events, showing both high aerosol optical thickness and absorption, were also studied.

References:
Campanelli et al, 2012, "Monitoring of Eyjafjallajökull volcanic aerosol by the new European Skynet Radiometers (ESR) network", Atmospheric Environment 48 (2012) 33-45

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