A detailed analysis of aerosol optical depth calculation in polar regions

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The atmospheric aerosols constitute one of the main uncertainties in climate studies and climate change. In Polar Regions, where this change has shown to be more intense, understanding the role of the aerosols is especially relevant. The International Polar Year 2007/08 is an opportunity to intensify the research effort in polar environments. In this context, a sun-photometer intercomparison campaign of the IPY project Polar-AOD took place in the scientific village of Ny-Ålesund (78º 55'N - 11º 54'E, Svalbard) from 24th March to 5th April 2006. The Atmospheric Optics Group of the University of Valladolid (Spain) participated in this campaign with a Cimel sun-photometer.

In this work we present a set of experimental improvements, derived from the exhaustive analysis of the instrumentation and the available processing algorithms of the aerosol optical depth, together with the contribution of each atmospheric component to the total optical depth, as well as the associated errors, in order to understand how the critical conditions of low pollution of the polar regions affect the accuracy of the evaluation of the aerosol optical depth. The main point is to establish specific features and requirements to perform this kind of measurements in Polar Regions, related to accuracy, environmental conditions, parameters to be taken into account, etc.

The proposed improvements have been applied to the routine measurements carried out by our group at the sub-Arctic location of ALOMAR (Arctic Lidar Observatory for Middle Atmosphere Research), Andoya Rocket Range (Norway) observatory since 2002. This research also resulted in several open topics, which will be further discussed within the IPY projects, hopefully yielding new results in the near future.