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The European SKYRAD users network package (ESR.pack): validation of products in comparison to AERONET

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The European Skyrad users network (EuroSkyrad or ESR) was started in 2003 as a Protocol of Agreement between the Institute of Atmospheric and Climate Sciences (ISAC) at the National Research Council (CNR) in Rome (Italy), the Solar Radiation Group (GRSV) at the University of Valencia (Spain) and the Plymouth Marine Laboratory (PML) in the United Kingdom. Although it was conceived as a collaboration platform for sharing experiences on the Skyrad inversion algorithm, currently ESR has grown to be a network of European groups that focus their research on the atmospheric aerosols in Europe and the Mediterranean region, by applying the Skyrad inversion algorithm indistinctly to Cimel CE318 and Prede POM sky-sun radiometers. In fact, one of the main interests of ESR is to describe the performance differences between both radiometers in relation to the international networks SKYNET and AERONET.

Within ESR, a new package (ESR.pack) is being developed in order to elaborate both Cimel and Prede data, and retrieve a complete and comparable set of physical and optical aerosol properties. The ESR package consists of open source code, and is addressed to a) standard users that need to retrieve aerosol properties on their own with a reliable and fast inversion code, and b) advanced users that are interested on developing and testing new methodologies for the atmospheric aerosol characterization. We adopted the Skyrad.pack inversion algorithm (version 4.2) as the package core for the inversion of sky diffuse data. Other features are being added to the package: a new module for the retrieval of AOD from direct sun data (dsproc), an improved in situ calibration method (skyil) and new methodologies to retrieve the columnar water vapor and ozone content.

The present study consists on the validation of the ESR package, by addressing the performance of the new sun direct processing algorithm (dsproc) in comparison to AERONET aerosol optical depth, Angström wavelength exponent and water vapor content retrievals. Furthermore, we assess the comparative performance of both instruments, by the application of the same code to both radiometers. For the comparison, a 3 year database of two collocated Cimel CE318 and Prede POM radiometers has been used. This database was acquired in Burjassot (Spain) a Mediterranean coastal station located in the metropolitan area of Valencia, a city of over 1 million inhabitants in Eastern Spain. To isolate the effect of the algorithm, a periodic and frequent calibration transfer between both instrument was performed on site. The effect of the filter transmission shape was taken into account and discussed in this work.

The results obtained with Cimel agree with AERONET within 0,001 – 0,007 depending on wavelength. Furthermore, a comparison between aerosol optical depth obtained from Cimel and Prede radiometers is also possible by using the same code, and the results agreed better than 0,003 – 0,006. Finally, the comparison of AOD obtained with Prede/ESR against Cimel/AERONET shows a very good agreement (0,004 – 0,007). In general these differences fall within the nominal AERONET uncertainty of 0.01-0.02 for field instruments, and shows the potential of the ESR.pack algorithm to retrieve comparable AOD values with both Cimel and Prede instruments in the framework of the ESR network, and for independent groups.