QOS2016-48, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

The project ICARO: cutting-edge technology for ground-based measurements and vertical profiles of solar radiation

J.M. Vilaplana (1), A. Serrano (2,3), M.L. Cancillo (2,3), J.A. Bogear (1), J. Alonso (4), A. Mesa (5), A. Gomez (5), M. Anton (2,3), A.A. Piedehierro (2,3), G. Sanchez (2,3)

(1) National Institute for Aerospace Technology - INTA, Atmospheric Research and Investigation Area, Atmospheric Observatory "El Arenosillo", Huelva, Spain (vilaplanagjm@inta.es), (2) Departament of Physics, University of Extremadura, Badajoz, Spain, (3) Instituto Universitario de Investigación del Agua, Cambio Climático y Sostenibilidad, University of Extremadura, Badajoz, Spain, (4) Departament of Mathematics, University of Extremadura, Badajoz, Spain, (5) National Institute for Aerospace Technology - INTA, “El Arenosillo” Test Centre, Huelva, Spain

Clouds and aerosols exert a plethora of effects on the Earth’s radiation budget. Their key role in climate has been widely emphasized by the IPCC, and they remain the largest source of uncertainty in respect to climate change assessment. Thus, better monitoring and a comprehensive description of their effects on the radiation is required for a more accurate understanding of climate and its changes.

CCD-based spectroradiometers constitute an innovative, promising and versatile technology for a thorough measurement of the solar radiation’s spectral structure. While the widely used broadband radiometers provide only wavelength-integrated radiation, CCD spectroradiometers allow to have spectrally resolved measurements. Moreover, CCD spectroradiometers are also particularly useful to analyze the effect on different wavelengths under cloudy conditions, when the radiation field varies rapidly, and a complete spectrum registered by a scanning spectroradiometer does not suitably discriminate these fast variations.

Other vanguard technologies such as remotely piloted aircrafts (RPAs) also offer new and interesting possibilities for many applications such as monitoring the Earth. In particular it could be used for monitoring the atmosphere at different levels and, therefore, obtaining profiles of several meteorological variables under different sky conditions. Moreover, the National Institute for Aerospace Technology (INTA) has a wide experience in aeronautical activities. Indeed, INTA is the national center responsible for aerospace certification, and El Arenosillo site (Huelva) is the common location for essaying flights with RPAs in Spain.

Additionally, the Spanish radiometric stations of INTA/"El Arenosillo" and UEX/Badajoz are dedicated to continuously monitoring the solar radiation field and its main attenuation factors, by means of a large variety of instrumentation: Brewer spectroradiometer; Dobson spectrophotometer; broadband radiometers for measuring total and ultraviolet solar radiation, and its global, direct and diffuse components; multichannel radiometers; pyrgeometers; ceilometers; all-sky cameras; etc.

In this framework, ICARO project is being developed by the National Institute for Aerospace Technology (INTA) and the University of Extremadura (UEX), being funded by the Ministerio de Ciencia y Competitividad of Spanish Government under contract CGL2014-56255-C2-1-R. This research project combines the aforementioned vanguard technologies with ground-based instrumentation. This project benefits from the small size of CCD spectroradiometers and proposes to install this instrumentation at two ground stations in Spain (at Badajoz and El Arenosillo) and also in an RPA, jointly with other meteorological and radiometric sensors, cameras, etc. Based on all these facilities, this project is mainly aimed at monitoring the solar radiation at ground and the vertical profile in low and middle troposphere (up to 5000 m). This work shows the main activities carried out within the ICARO project implementing the use of these vanguard technologies in order to achieve a comprehensive description of the radiation field under different scenarios regarding clouds and aerosols.