

Final project report

<i>Project ID</i>	2004/11.04
<i>Title</i>	Realization of remote UV radiometer with innovative spectral characteristic to measure the UV global irradiance in the range between 290 and 380 nm, operating in hostile environment.
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<i>Duration</i>	3 years
<i>Assigned funding</i>	50.000,00 Euro

Activities and results

The UV spectral measurement at ground it's a diffuse method to determine the stratospheric ozone content. The main objective of the project was the assembling of the UV filter radiometer (named F-RAD) for the measurements of the Sun global irradiance at the Mario Zucchelli Station (MZS), Terranova Bay, Antarctica. The main parts of the instruments are: the entrance radiation optical system, the filters selecting the wavelength of interest and the control system, hardware and software, governing all the measurement steps. The main requirements were: time resolution of one minute and spectral resolution less than 1 nm.

- The entrance optical system was the same optical entrance of the Spectroradiometer Brewer, a semi-sphere fused silica, chosen in order to have a spare part available in the market.
- Interference filters of F-RAD was the critical parts of the instruments. They represented the most relevant technological improvement of the project. The filters will be manufactured by an electron gun evaporator with the ion beam assistance. The plant was properly upgraded. Single cavity Fabry-Perot design was the filter structure finally chosen.
- The National Instrument modules (Compact Field Point) were the main components of the radiometer control system. They are able to control the phototube parameters, the Peltier Cell for the temperature stability during the acquisition and the electrical engine of the rotating wheel on which are positioned the filter.

Activities in Antarctica

The researchers of the project have been participated at two Antarctica campaign, the XXI campaign, 2005, and the XXV campaign, 2009.

- XXI Campaign: during this campaign the radiometer was tested in the Antarctica environment in order to check the reliability of the different components and the optical stability of the filters. The radiometer was back in Italy and properly upgraded.
- XXV Campaign: the radiometer F-RAD was definitively placed on the roof of one of the MZS building and connected with the Local Area Network of the base. At the moment it works properly and the UV data are daily downloaded in Italy.

Results

The main results of the project is the availability of spectral UV data acquired with high time resolution, each wavelength was measured 1430 time per day and high spectral resolution, the filters have a FWHM of 0.5-0.8 nm. F-RAD was placed in Antarctica in November 2009 and works properly, the different parameters are checked daily. In figure 1 F-RAD in the final position at MZS is shown.

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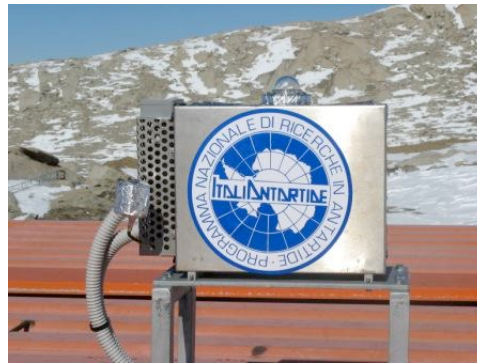


Figure 1. F-RAD at the MZS, Antarctica

In figure 2 and 3 respectively are reported the daily measurements at a wavelength of 296.5 nm and the preliminary reconstruction of the UV spectrum.

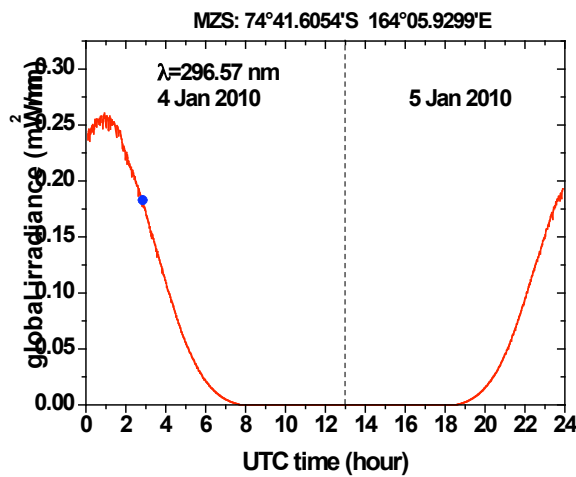


Figure 2. global irradiance measured at MZS, the blue dot is the instant of OMI satellite overpass.

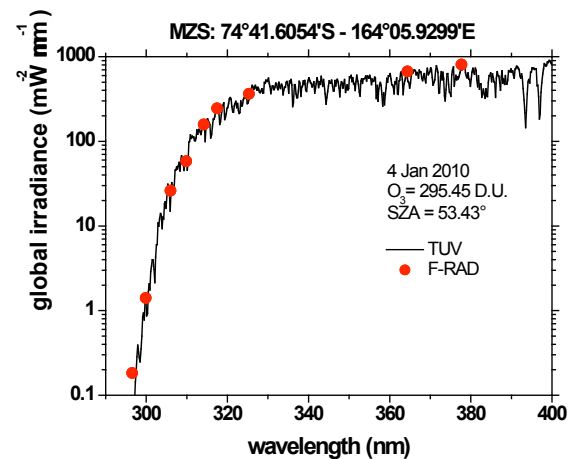


Figure 3. Spectral irradiance measured during the overpass of the OMI satellite.

The UV spectrum reconstruction from nine measured wavelengths was obtained with the TUV code by the Atmospheric Chemical Division of the National Center for Atmospheric Research, Boulder, Colorado, USA.

The UV radiation measurements daily downloaded from MZS could constitute a useful database to monitor the behavior of the columnar ozone on the measurements site. Additional UV measurements points on the Antarctica is very important to observe the evolution of the Ozone Antarctica vortex at the hearth surface.

Products

A – papers in scientific magazines

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B – book chapters

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C - proceedings of international conferences

1. Oral presentation at the next Conference of European Geosciences Union General Assembly 2010 Vienna,

Programma Nazionale di Ricerche in Antartide (PNRA)

Austria, 02 – 07 May 2010.

D – proceedings of national meetings and conferences

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E – thematic maps

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F – patents, prototypes and data bases

1. Prototype of UV radiometer, named F-RAD, at the moment placed in Mario Zucchelli Station, Antarctica.
2. Database, in progress, of daily UV measurements in MZS.

G – exhibits, organization of conferences, editing and similar

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H - formation (PhD thesis, research fellowships, etc.)

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Research units

Research Unit of The Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)

Name	Role	Institution
Scaglione Salvatore	Researcher	ENEA
Daniele Flori	Researcher	ENEA
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Andrea Anav	Researcher	CNR
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Date: 30 of April, 2010

Notes