Final project report

Project ID: 2002/6.5
Title: The minor atmospheric gases and UV solar radiation as climatic impact factors: sampling and modelling
Principal investigator: C. Rafanelli
Institution: CNR – Acoustic Institute "O.M. Corbino"–ICES Group
Email: c.rafanelli@e-ices.eu
Duration: two years
Assigned funding: € 103.229,00

Activities and results

The project has analysed the time evolution and climatology of some minor atmospheric gases, by ground-based measurements. The project has been structured in tree research lines: studies of stratospheric ozone hole in Antarctic polar vortex during the austral spring. In this line the ozone depletion by UV spectral measurements was been studied. The second line studied the UV irradiance level at ground in remote site, both as consequence of the atmospheric photochemistry and as cause of effects on biosphere. It studies the UV modelling for a right reconstruction of irradiance spectra. Finally the third line has studied the background levels of CO$_2$ by continuous automatic sampling in Antarctica Peninsula, to evaluate the trend and the time evolution for the implication in large-scale phenomena such as oceanographic event of "El Niño".

The results of Project has been the studies of ozone depletion over Ushuaia (Argentina) and Belgrano II (Antarctica) Similar studies was carries out in Arctic region, NY Ålesund (Svalbard Islands, Norway), and in particular has been activated a full control of the Brewer spectrophotometer by remoteness. This will be important for the next campaigns during the polar nights.
Other results have been the studies about vertical profiles of ozone in the same Arctic and Antarctic areas. Several papers on the consequences in stratosphere, by solar energetic particles (SEP) were publishes. In agreement with WMO, all the data are uploaded into the WOUDC data Center to forecast the ozone hole.
Other result of the Project is the developing of the solar UV modelling with a new model of irradiance, settled by the Project, named WL4UV. This model will be very useful to evaluate the environmental dose for the human protection from UV, studies carried out with other PNRA-Project directed by dr. G. Mariutti of ISS of Rome. With this project was carried out studies on personal dosimetry for human protection in presence of low values of ozone and consequent increasing of solar UV radiation fluxes.

Studies on developing of prototypes have produced a prototype of a total-sky camera (TSC) to evaluate in real time, by hardware and software, the cloud situation of the sky. A second prototype is a fast spectral-radiometer (UV spectrograph) for the UV radiation with 250–400 nm of spectral range. It will be useful both outdoor and indoor measurements.
The last line of research studies the climatologic trend of background tropospheric CO$_2$. By continuous measurements in Jubany base (Antarctica) the effect on large scale phenomena, like El Niño have been studied. As the ozone data, also the carbon dioxide concentration data have been uploaded into the WDCGG data base.

Products

A – papers in scientific magazines

**B – book chapters**

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**C - proceedings of international conferences**

3. Rafanelli C., A. Anav, I. Di Menno, M. Di Menno, G. R. Casale - 2003 - UV solar irradiance with cloudiness at high latitudes; a comparison between radiometer GUV 511 and model's outputs - Proceedings SPIE Ultraviolet ground- and Space-based measurements, models and effects - San Diego, Ca. USA, 4-6 Agosto.

**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 TSC.
2. Prototype of fast UV spectroradiometer (spettrograph).

**G – exhibits, organization of conferences, editing and similar**

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

2. E. Piervitali, PhD thesis on "The solar UV irradiance in Polar areas and its consequences on radiative transfer model in presence of clouds" – Siena University – PhD School in Polar Sciences, XX cycle.

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**Research units**

- Andrea Anav – Senior Scientist CNR – IDAC
- Luigi Ciattaglia – Senior Scientist CNR – IDAC
- Ivo Di Menno - Technician CNR – IDAC
- Massimo Di Menno - Technician CNR – IDAC
- Elena Benedetti - fellowship CNR - IDAC
- Alessandro Damiani - fellowship CNR – IDAC
- Luca Mannella - fellowship CNR - IDAC
- Emanuela Piervitali – fellowship CNR – IDAC

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