

Final project report

<i>Project ID</i>	2004/6.08
<i>Title</i>	The minor atmospheric gases and UV solar radiation as climatic impact factors: sampling and modeling.
<i>Principal investigator</i>	Claudio Rafanelli
<i>Institution</i>	CNR - IDASC (ICES Group)
<i>Email</i>	claudio.rafanelli@e-ices.eu
<i>Duration</i>	3 years
<i>Assigned funding</i>	123.000,00 Euro

Activities and results

The depletion of stratospheric O₃ in Polar Regions and the consequent growing of the UV levels in troposphere, represent two of most important effects of the human activities on the environment and on Global Change in general. Strong growth both in austral hemisphere and in North one in the past years were observed. In this last case the depletion phenomena are more serious because the high density of human presence. In September 2003, the surface of Polar Vortex is reached to a new maximum after the 2000's increase of 12% in respect of past. Inside the ozone hole the region with very low O₃ concentration is grown too. Furthermore in Sept. 27, 2002, the vortex was split in two parts. These are signals of an evolution in dynamics of ozone hole. Another signal of the Global Change in progress is the continuous increase of the ground-levels of atmospheric CO₂. The evaluation of changing needs monitoring techniques for very long periods and having high standards in analyses.

The activities have split in three line:

One studied the interaction between the solar UV irradiance and the total O₃ content. The researches has carried out with long period monitoring campaigns by 3 Brewer spectrophotometers, belonging to PNRA. The first is placed in Belgrano II Antarctic base (77.87° S - 34.62° W) since 1992. It is a node of WMO-GAW for the Ozone Hole forecast network. The second one, since 1994 placed in circumpolar area, at CADIC in Ushuaia (Argentina, 54.82° S - 68.32° W), allows the studies about the Polar vortex boundary. The activity in this site is linked to NSF "UV Polar Network". The third Brewer is installed in Arctic area at Ny Ålesund (Svalbard Island, Norway, 78.50° N - 11.58° E). Here, in similar latitudes of Belgrano II but with different environmental characteristics, the evolution of the phenomena tied with O₃ depletion are monitored too. In that place was been carried out, also, campaigns to test the irradiance UV models and TSC prototypes. The presence of the Brewer in so high latitudes and their operating mode was useful to other PNRA groups. A first project (Mariutti Project) has examined the UV solar radiation on human health, and it was been carried out in Ny Ålesund, to evaluate the doses absorbed during the ozone hole season. A second project concerns the mini ozone holes due to particular proton's events from the Sun (Storini Project).

Are added to this project the activity of another Brewer, in cooperation between the UO and Argentinean DNA, to manage scientifically the Brewer in San Martin Antarctic Base (68.08° S - 67.08° W). This was allowed to monitor at ground, with more details, the extension of ozone hole during the springtime when the vortex rising to southern parts of America.

The second line has studied the evaluation of the irradiance at ground both with instrumental sampling and by radiative transfer models linked with sky situation analyzed by a TSC.

The third line has monitored the background CO₂ in Argentinean base of Jubany (62.23° S - 54.67° W) in cooperation of DNA. The Argentinean has been responsible of logistics and managing, the UO has supported the scientific management and calibration. It has been responsible of the scientific results.

Programma Nazionale di Ricerche in Antartide (PNRA)

Products

A – papers in scientific magazines

1. Damiani A., Storini M., Laurenza M., Diego P., Rafanelli C. – 2008 - Search for the ozone variability related to SEP events during the current solar cycle, *Advances in Space Research*, Ms. Ref. No.: C21-0038-06.
2. Damiani A., Storini M., Laurenza M., Rafanelli C. – 2008 - Solar Particles effects on minor components of the Polar atmosphere, *Annales Geophysicae*, 26, 361-370.
3. Damiani A., E. Benedetti, M. Storini and C. Rafanelli – 2008 - Italian polar data center for capacity building associated with the IHY, *Advances in Space Research*, 41 (1), 223-226.

B – book chapters

1. Rafanelli C., A. Damiani, E. Benedetti, S. De Simone, A. Anav, L. Ciattaglia, I. Di Menno – 2009 - The UV solar radiation in Polar Regions: Impact on environment and human health - on "UV Radiation in Global Change: Measurements, Modeling and Effects on Ecosystems" – Ed. Springer-Verlag and Tsinghua University Press - Heidelberg.
2. Ciattaglia L., C. Rafanelli, J. Araujo, H. Rodriguez – 2008 - "Long-term measurements of the atmospheric carbon dioxide concentration measured at Jubany station indicate a relationship with 'El Niño'" - pag. 390-396 – on "Berichte zur Polar und Meeresforschung - Reports on Polar and Marine Research" - Ed. AWI, Helmholtz Gemeinschaft, Bremerhaven, Germany.
3. C. Rafanelli, L. Ciattaglia, S. Carnazza – 2007 – "I Valori Di Fondo Della CO₂ Atmosferica A Jubany E Le Interazioni Con Il Fenomeno De El Niño" – pag 323-326 - on "Clima E Cambiamenti Climatici, Le Attività di Ricerca del CNR" – Ed. CNR Rome (Italy).
4. C. Rafanelli, A. Damiani, E. Benedetti, M. Di Menno, A. Anav, I. Di Menno – 2007 – "La Concentrazione Di O₃ E Dei Gas Serra Nell'atmosfera Polare" – pag 487-491 - on "Clima E Cambiamenti Climatici, Le Attività di Ricerca del CNR" – Ed. CNR Rome (Italy).

C - proceedings of international conferences

1. Damiani A., Storini M., Rafanelli C. – 2008 – Effects of SEPs in the atmospheric chemistry: an overview, *Proceedings of 11th Workshop Italian Research on Antarctic Atmosphere, Rome 2007*.
2. Rafanelli C., De Simone S., Damiani A., Lund C., Erdvardsen K., Svenoe T., Benedetti E. – 2008 - A first attempt to evaluate the total ozone column by brewer spectrophotometer during the arctic winter, *Quadriennial Ozone Symposium 2008, Tromso (Norvegia), 29 June-5 July*.
3. Rafanelli C., De Simone S., Damiani A., Benedetti E., Araujo J., Ochoa H., Lund C., Erdvardsen K., Svenoe T. – 2008 - The total ozone content in polar regions measurements in antarctic Belgrano and arctic Ny Alesund stations, *SCAR – IASC IPY Open Science Conference, San Pietroburgo (Russia), 8-11 July*.
4. Rafanelli C., M. Poscolieri, S. De Simone, M. Lupieri, M. Di Menno – 2007 - Ground-based cloud coverage remote detection and monitoring: major drawbacks and solutions – *Proceedings of 27th Earsel Simposyum, 4 - 7 Giu., Bolzano*.
5. Carnazza S., L. Ciattaglia, C. Rafanelli, S. De Simone – 2007 - Characterization of the atmospheric CO₂ concentration values obtained at Jubany station and their relationship with the origin and trajectories of the air masses – *Proceedings of XI Workshop On Antarctic Atmosphere – Rome 10 -12 Apr*.
6. Damiani A., M. Storini, C. Rafanelli – 2007 - Effects of SEP's in the atmospheric chemistry: an overview - *Proceedings of XI Workshop On Antarctic Atmosphere – Rome 10 -12 Apr*.
7. Di Menno I., C. Rafanelli, S. De Simone, M. Di Menno – 2007 - High performance spectrograph for solar UV 250-400 band – *Atti SPIE "Remote sensing and Modeling of Ecosystem for Sustainability" – 28-29 Aug. - San Diego Ca, USA*.
8. Benedetti E., Damiani A., Rafanelli C., Morici L., Storini M. – 2008 - Italian Polar Information System, *SCAR – IASC IPY Open Science Conference, San Pietroburgo (Russia), 8-11 July*.
9. Damiani A., Storini M., Rafanelli C. – 2008 - A proxy for the SEP incoming in the high-latitude terrestrial atmosphere, *37th COSPAR Scientific Assembly, Montreal (Canada), 13-20 July*.
10. Rafanelli C. – 2007 - Climate change and the question of energy – *International Conference: Climate Change And Development, Pontifical Council for Justice and Peace, Città del Vaticano 26-27 Apr*.
11. Damiani A., Storini M., Rafanelli C., Laurenza M. – 2007 - Atmospheric chemical changes in Polar caps during December 2006, *Abstract Book, 1352, XXIV IUGG, Perugia (Italy), 2-13 July*.
12. Damiani A., M. Storini, C. Rafanelli, M. Laurenza, A. Gardini – 2007 - Atmospheric chemical changes in Polar caps during December 2006 – *Proceedings of XVI IUGG Conference, Perugia, 2-13 Lug*.

D – proceedings of national meetings and conferences

1. Rafanelli C., Benedetti E., Damiani A., Morici L. – 2007 - Il NADC italiano in JCADM, *Workshop Il problema dei dati nelle Scienze della Terra, Rome, 19 December*.

E – thematic maps

--

Programma Nazionale di Ricerche in Antartide (PNRA)

F – patents, prototypes and data bases

G – exhibits, organization of conferences, editing and similar

--

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

--

Research units

- Andrea Anav Researcher CNR-IDAC
- Luigi Ciattaglia Researcher CNR-IDAC
- Ivo Di Menno Technician CNR-IDAC
- Massimo Di Menno Technician CNR-IDAC
- Alessandro Damiani Researcher CNR-IDAC
- Emanuela Piervitali Researcher CNR-IDAC

Date: 29.03.2010

Notes: --