**Programma Nazionale di Ricerche in Antartide (PNRA)**

# Final project report

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| *Project ID* | 2004/2.04 |
| *Title* | Implementation of the BSRN station at Dome Concordia |
| *Principal investigator* | Teodoro Georgiadis |
| *Institution* | IBIMET-CNR Bologna |
| *Email* | t.georgiadis@ibimet.cnr.it |
| *Duration* | 3 years |
| *Assigned funding* | 140.000,00 Euro |

## Activities and results

During the austral summer 2005-2006, a BASIC set of radiometers was installed at the Italian-French station of Concordia. The site offers a unique opportunity for long-term monitoring of the East-Antarctic Plateau atmosphere. To assure high quality measurements, high class radiometers as pyranometer CM22 was deployed on site for measurements of the global and diffuse components of solar radiation, while CG4 pyrgeometer was adopted for longwave measurements. Two pyreliometers (Kipp&Zonen CH1 and Eppley NIP) was installed for direct solar radiation measurements. During summer campaigns, an 8-channels sun-photometer, based on the Carter-Scott SP02 and realized in the frame of a cooperation between ISAC-CNR Bologna and NOAA-CMDL Boulder, allowed to obtain information on the atmospheric turbidity conditions and AOT values. All instrumentation was mounted on a solar tracker (model 2AP) completed with a shadow assembly. Tracker radiometers and sun-photometer were located near the first container of the Concordia Atmospheric Research Observatory (CARO), S-SW of the winter station at a distance of about 700 m from the main buildings, on a platform 2.8 m high to assure the required free horizon. The usual operational range of the tracker was extended by means of extra heating and extra insulation. During 2007 upwelling measurements of SW and LW components were implemented on a 3 meters height steel rack, allowing to obtain first evaluations of the surface radiation balance and albedo at Concordia.
Data recording being supply through Campbell Sci. dataloggers (mod. CR23X and CR10X). Raw radiation data are acquired and stored as 1 Hz samples (downward) and 1 minute averages (upward), while sun–photometric data are stored as 5 sec averages. All dataloggers are connected to a PC housed in the CARO container. Datalogger clock is adjusted with respect the station reference to obtain an accuracy better than 3 sec. The tracker internal temperature is continuously monitored. Routine operation, execute one or more time per day, consists of a visual inspection of the instrumentation for cleaning from ice or snow accumulation, and leveling. The system can be continuously controlled from the main station through the LAN. Data are regularly transferred from CARO to Concordia Station, then send compressed by mail to the station scientist in Italy, on a daily rate (<1 MB). In Italy data are formatted accordingly to the BSRN protocol. Minute based averages, standard deviation, maximum and minimum are calculated and stored in monthly files. An automatic procedure is being developed to perform data processing and quality assurance evaluations in near-real time. Automatic and visual inspected data are submitter to the BSRN network for downward measurements for the period from Jan 2006 to Feb 2010.

## Products

A – papers in scientific magazines


1. Nardino M. and Georgiadis T., 2004: *A simple snowmelt parameterization for an Arctic site*, Il Nuovo Cimento C, 27, 231-240
2. Galli C., Nardino M., Levizzani V., Rizzi R. and Georgiadis T.,2004: *Radiative energy partitioning and cloud radiative forcing at a Po valley site*. Atmospheric Research, 72, 329-351.
3. Boyan Petkov, Vito Vitale, Claudio Tomasi, Ubaldo Bonafé, Salvatore Scaglione, Daniele Flori, Riccardo Santaguida, Michael Gausa, Georg Hansen, and Tiziano Colombo, 2006, *Narrowband filter radiometer for ground-based measurements of global ultraviolet solar irradiance and total ozone*, Applied Optics, 45, pp. 4383-4395.

**B – book chapters**

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C - proceedings of international conferences

1. C. Lanconelli, A. Lupi, M. Nardino, V. Vitale, P.Calzolari, F. Evangelisti, U. Bonafè, G. Trivellone e D. Bortoli, 2004: *Estimation of fractional sky cover, cloud type and cloud forcing effects at terra nova bay station (75°s) from broadband radiation measurements,* Proceedings ICCP2004, 14th International Conference on Clouds and Precipitation Bologna, Italy, 18-23 July 2004, pp. 389-392.
2. Lanconelli C., L.Agnoletto, M.Busetto, A.Lupi, M.Mazzola, B.Petkov, C.Tomasi and V.Vitale, 2007, "*Estimation of fractional sky cover, cloud type and cloud forcing effects at Mario Zucchelli and Concordia stations (75°S) from broadband radiation measurements*", I.U.G.G. XXIV General Assembley- Perugia Italy, July 2-13, 2007, MS003 Symposium - Aerosol Radiation and Clouds, 5046, IAMAS Association Symposia and workshops book of abstract, p. 164.
3. C. Lanconelli, M. Busetto, R. Schioppo, V. Vitale, R. Stone, A. Lupi, M. Mazzola, M. Nardino, T. Georgiadis**,**2008 *Status of BSRN measurements at Concordia station (Dome C - Antarctica),* BSRN 10th SCIENCE AND REVIEW WORKSHOP, Utrecht, The Netherlands 7-11 July 2008. Appeared on SUMMARY REPORT FROM THE TENTH SESSION OF THE BASELINE SURFACE RADIATION NETWORK (BSRN) (De Bilt, The Netherlands, 7-11 July 2008) DECEMBER 2008 WCRP Informal Report N° 11/2008. p. 3.
4. C. Lanconelli, M. Busetto, R. Schioppo, V. Vitale, R. Stone, A. Lupi, M. Mazzola, 2008, *First analysis on albedo measurements at Concordia station and comparison with South Pole evaluations,* BSRN 10th SCIENCE AND REVIEW WORKSHOP, Utrecht, The Netherlands 7-11 July 2008. Appeared on SUMMARY REPORT FROM THE TENTH SESSION OF THE BASELINE SURFACE RADIATION NETWORK (BSRN) (De Bilt, The Netherlands, 7-11 July 2008) DECEMBER 2008 WCRP Informal Report N° 11/2008. p. 8.
5. C. Lanconelli, M. Busetto, V. Vitale, B.Petkov, M. Mazzola, A. Lupi, L. Moggio, 2010, *Radiation regime and cloud characteristics of the East Antarctic Plateau; as derived from a 4-year record from Dome Concordia*, Eleventh BSRN Scientific Review and Workshop, Queenstown, New Zealand, 13-16 April 2010. SUMMARY REPORT FROM THE ELEVENTH Baseline Surface Radiation Network (BSRN) Scientific Review and Workshop (Queenstown, New Zealand, 13-16 April 2010) August 2010 WCRP Informal Report N° 08/2010, p. 13

**D – proceedings of national meetings and conferences**

1. V. Vitale,. C. Lanconelli, A. Lupi, M. Nardino, T. Georgiadis, F. Calzolari, F. Evangelisti, U. Bonafe', C. Tomasi e G. Trivellone, 2004: Estimation of fractional sky cover, cloud type and cloud forcing effects at Terra Nova Bay from broadband radiation measurements, Tenth Workshop Italian Research on Antarctic Atmosphere (M. Colacino Ed.), SIF Conference Proceedings, Vol. 89, 71-81.
2. Vitale V., C. Lanconelli, L. Agnoletto, M. Busetto, R.S. Stone, M. Nardino, T. Georgiadis, B. Petkov, A. Lupi, and M. Mazzola, 2007, *Implementation of a BSRN station at Dome C - Antarctica: first measurements of radiative fluxes and aerosol optical depth,* XI Workshop Fisica e Chimica dell'Atmosfera Antartica, Roma, 10-12 Aprile 2007, book of abstract, 34.
3. Lanconelli C., L. Agnoletto, M.Busetto, A.Lupi, M.Mazzola, B.Petkov, V.Vitale, M.Nardino, C.Tomasi and V.Vitale, 2009: *Estimation of fractional sky cover, cloud type and cloud forcing effects at Mario zucchelli and concordia stations (/5°S) from broadband radiation measurements, 11th* Workshop Italian Research on Antarctic Atmosphere (M. Colacino Ed.), SIF Conference Proceedings, Vol. 97, 85-94.
4. Lanconelli C., Agnoletto L., Busetto M., Lupi A., Mazzola M., Petkov B., Vitale V., Nardino M., Tomasi C., T. Georgiadis, 2009: Estimation of fractional sky cover, cloud type and cloud forcing effects at Mario Zucchelli and Concordia Stations (75°S) from broadband radiation measurements. Comunication at the XCV Congresso Nazionale della Societá Italiana di Fisica, Bari, 28 September - 3 October 2009.

**E – thematic maps**

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**F – patents, prototypes and data bases**

1. Implementation of the BSRN station at Dome C, with adaptation of all the instrumentation at the extremely low temperature conditions through adeguate temperature controls and cohibentation.
2. Realization of the facility for the radiometer calibration on the roof of Institute of atmosferic Science and Climate (ISAC) Bologna.
3. Develop and debug of the software including data acquisition, data transfer and data analysis.
4. Develop of a procedure for the quality control of the whole BSRN dataset.
5. 50 Monthly BSRN formatted and archived files - see http://www.pangaea.de/PHP/BSRN_Status.php

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

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

1. Emanuele Pirolo, 2008, Misure dell'albedo superficiale sul plateau est antartico, Graduate thesis, Universy of Padova, Phisycs Dept., 2007-2008, Relatore Vito Vitale, 23 pp.

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## Research units

**Unita' Operativa IBIMET-CNR**

| | |
|---|---|
| Teodoro Georgiadis | (Coordinatore) |
| Marianna nardino | (ricercatore tempo derterminato) |
| Osvaldo Facini | (Ricercatore) |

**Unita' Operativa ISAC-CNR**

| | |
|---|---|
| Vito Vitale | (Primo Ricercatore, Resp. Scientifico stazione) |
| Claudio Tomasi | (Dirigente ricerca) |
| Christian Lanconelli | (post doc – Resp. Tecnico Stazione) |
| Angelo Lupi | (post doc) |
| Ubaldo Bonafe' | (Specialista tecnico) |
| Giuliano Trivellone | (Specialista tecnico) |

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Date: 09-02-2011

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