Programma Nazionale di Ricerche in Antartide (PNRA)

Final project report

Project ID:	2.01/2002
Title:	Highly accurate surface-based radiation measurements: implementation of a BSRN station at Dome Concordia
Principal investigator:	dr. Teodoro GEORGIADIS
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Duration:	2 years
Assigned funding:	€ 155.000,00

Activities and results

The research project, aimed to carry out continuously and with high accuracy surface radiation measurements at the Italian-French station Concordia (lat. 75° 06' 06" S, long. 123° 23' 42" E, height 3233 m a.m.s.l.). In terms of the BSRN measurements categories, the plan was to implement a BASIC set of measurements, including direct solar irradiance, diffuse sky irradiance, global irradiance and long-wave downward irradiance. Highly accurate short-wave and long-wave radiation measurements at Concordia station can: (a) provide accurate and representative information on the radiation regime at the surface in the East-Antarctic Plateau region; (b) supply with high accuracy essential input parameters to both mass balance and climatic models for a crucial area; (c) provide surface irradiance measurements for validating satellite measurements as well as climatic models parameterisation schemes and results and (d) give useful information for PBL studies and characterizations. Since Dome C present many differences from South-Pole (the other measurement point on the Antarctic interior), the most important being in cloud and wind regimes, measurements carried out routinely and continuously at Concordia will improve considerably our knowledge on the radiation balance over the Antarctic plateau, its spatial variability, seasonal and interannual cycles.

The measurement station was implements during the austral summer 2005-2006. To assure high quality measurements in a so hard environment, high class radiometers as pyranometer CM22 and pyrgeometer CG4 was deployed on site for measurements of global, diffuse solar radiation and longwave downwelling radiation. Two pyreliometers (Kipp&Zonen CH1 and Eppley NIP) was installed for direct solar radiation measurements. All instrumentation was mounted on a solar tracker model 2AP-Gear Drive completed with a shadow accessory, data recording being supply through a Campbell datalogger. The usual operational range of the tracker was extended by means of extra heating and extra insulation. 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 so to have an horizon quite perfect (only the main station representing an obstruction of 2° in zenith and ~5° in azimuth at about 60° (NE). Row radiation data (1Hz samples) are acquired as differential input and stored in the CR23x datalogger. Row data are transferred in Italy, where data are reduced on the base of BSRN protocol and minute averages, standard deviation, maximum and minimum are calculated and stored in daily files. An automatic procedure is being developing to perform in near real-time data processing and quality assurance evaluations.

Products

A – papers in scientific magazines

1. Orsini A., Tomasi C., Calzolari F., Nardino M., Cacciari A. and Georgiadis T., 2002: *Cloud cover classification through simultaneous ground-based measurements of solar and infrared radiation.* ***Atmospheric Research***, 61, 251-275.
2. Nardino M. and Georgiadis T., 2003: *Cloud type and cloud cover effects on the surface radiative balance at different Polar Sites.* ***Theor. And Appl. Climatol.***, 74/3-4, 203-215.

B – book chapters

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C - proceedings of international conferences

1. T. Georgiadis, V. Vitale e G. Genton, 2001: *High accurate surface-based radiation measurements: implementation of a BSRN station at Dome C*, Proceedings Workshop Atmospheric Sciences at Dome C, Roma 20 aprile 2001, pp. 15-25.
2. M. Nardino, A. Lupi, V. Vitale, T. Georgiadis, F. Calzolari, F. Evangelisti, C. Tomasi, D. Bortoli, and G. Trivellone, 2002: Cloud effects on the radiative balance terms at Terra Nova Bay. *SIF Conference Proceedings*, Vol. 80, pp. 145-161, Ninth Workshop «Italian Research on Antarctic Atmosphere» (M. Colacino, Ed.), Editrice Compositori, Bologna (Italy).
3. V. Vitale: *Highly accurate surface-based radiation measurements: implementation of a BSRN station a Dome Concordia*, 7th BSRN Scientific and Review Workshop, Regina (Canada), 28-31 Maggio 2002, WCRP Informal Report No. 18/2002, pp. 8-9.
4. Nardino M., Georgiadis T., Rossi F.: *Determination of cloud fraction, cloud type and cloud radiative forcing at different Polar sites.* XXVIII SCAR Open Science Conference on "Antarctica and the Southern Ocean in the Global System", Brema (Germania), 26-28 luglio 2004.
5. C. Lanconelli, M. Nardino, A. Lupi, V. Vitale, T.Georgiadis e F. Calzolari: *First activities and future improvements implementation of a BSRN station at Dome C (Antarctica)*, 8th Science and Review Workshop for the Baseline Surface Radiation Network (BSRN), Exeter (Regno Unito), 26-30 luglio 2004, WCRP Informal Report No. 4/2005, pp. G3-G4.

D – proceedings of national meetings and conferences

1. Nardino M., Galli C., Calzolari F.: S*tudio degli effetti della copertura nuvolosa nella ripartizione superficiale dell'energia solare.* LXXXVIII Congresso Nazionale SIF, Alghero, 26 settembre - 1 ottobre 2002.
2. S. Argentini, V. Vitale, T. Georgiadis et al.: *Results and future perspectives of a physico-chemical Laboratory for the Study of the Antarctic troposphere at Concordia Station*, comunicazione presentata al X° Workshop sull'Atmosfera Antartica e SCAR Workshop on Oceanography, organizzato dal Programma Nazionale di Ricerche in Antartide (C.N.R., ENEA), Roma. 22-24 ottobre 2003. Il sommario è stato pubblicato nel Book of Abstract del meeting, pp. 23-24.

E – thematic maps

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F – patents, prototypes and data bases

1. prototipo di una all-sky camera dal costo contenuto, basata su elementi commerciali.
2. Software per la classificazione delle condizioni di nuvolosita' a partire da misure digitali di una all-sky camera
3. Software e procedure di acquisizione, correzione e pre-analisi di dati radiometrici.
4. metodologie/parametrizzazioni per la determinazione delle caratteristiche di nuvolosita' a partire da misure di radiazione.

G – exhibits, organization of conferences, editing and similar

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

1. Tesi di dottorato dott.ssa Marianna Nardino "effetti della copertura nuvolosa nella ripartizione dell'energia solare", Universita' degli studi di Sassari PhD Course XVI cycle.

Research units

Unita' operativa MOR-GEO

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