Final project report

Project ID:	PEA2002 6/08
Title:	Sensitivity studies on satellite-based remote sensing of precipitation at high latitudes
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Duration:	2 years
Assigned funding:	€ 30.000,00

Activities and results

Precipitation is unquestionably a fundamental parameter for climate studies. Techniques to measure precipitation from low earth orbiting satellite (LEO) measurements make use of microwave (MW) frequencies in the range of 10-85 GHz, obtaining reliable results at low latitudes, especially over sea, whereas evident emission/scattering signals probe the presence of precipitation events. The comparison between MW brightness temperatures and ground-based precipitation measurements (radar and rain gauges) allow to generate and calibrate algorithmic strategies to estimate precipitation. Those algorithms fails if applied to mid- high latitudes, mainly due to the different optical thickness of cyclones but also because the variable emissivity of the snow-ice covered surface effectively contaminates the MW signal coming from the clouds. Further difficulties arise, focusing on Antarctica, since the number and quality of ground-based measurements do not allow to assess the significance of the observed multi-frequency brightness temperatures.

Moving from the above considerations, the project has investigated the problem by building up cloud-radiation scenarios to perform sensitivity studies concerning the possibility to effectively extract precipitation-related information from multifrequency microwave measurements acquired by operational LEO satellites.

During the project two different mesoscale cloud resolving models, namely the University of Wisconsin nonhydrostatic modeling system (UW/NMS) and the PSU/NCAR mesoscale model (MM5), both equipped to optimally simulate the polar environment, have been run -- for some case studies effectively occurred over Antarctica coasts -- to generate the microphysically detailed cloud truth. Model outputs -- consisting of mixing ratio of 5 hydrometeors, cloud water, rain water, groupel, snow ed ice, water vapour mixing ratio, the temperature profile, and some parameters describing the characteristics of the surface – have been used as the input for TBSCAT (Rosenkranz, 2002), a radiative transfer algorithm capable to associate simulated multifrequency brightness temperatures, at Special Sensor Microwave/Imager (SSM/I) and Advanced Microwave Sounding Unit (AMSU) frequencies, to each simulated cloud profile. The result has been a huge cloud-radiation database that has been used for sensitivity studies aimed at better interpreting the satellite-based multifrequency brightness temperatures and their potential role in providing information for quantitative precipitation estimation algorithms.

The sensitivity studies have been carried on, even perturbing some of modeled parameters, to better isolate the correlation of each channel with precipitation occurrence, surface emissivity and temperature profile. Results have shown how the temperature and water vapour sounding channels, embarked on AMSU, can represent the base to organize an algorithm for precipitation monitoring over Antarctica.

Products

A – papers in scientific magazines

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B – book chapters

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C - proceedings of international conferences

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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. Antarctica Cloud-Radiation Database, derived by cloud mesoscale models UW-NMS and MM5.

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

U.O. COL-DIE (CNR-ISAC Roma)
Coordinatore: Dietrich Stefano Ricercatore

- Mugnai Alberto Dir. Ric.
- Di Paola Francesco Art. 23
- Santorelli Elena collaboratore ric.
- Formenton Marco collaboratore ric.
- Sanò Paolo collaboratore ric.
- Casella Daniele collaboratore ric.

Date:

22/10/2008
