

Final project report

<i>Project ID</i>	2004/6.06
<i>Title</i>	<i>Precipitating Clouds in Antarctica: Satellite Remote Sensing and Modeling</i>
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<i>Duration</i>	3 years
<i>Assigned funding</i>	70000,00 Euro

Activities and results

Atmospheric circulation, cloud cover, and precipitation are not well known for Antarctica because of limited analysis, and uncertainties in new data sources. The focus of this project was mainly on precipitation, aiming at providing a quasi real time web-based tool for the estimation of the instantaneous amount of snowfall all over the region.

Two data sources have been used: satellite and cloud model.

Simulations of snowfall events occurred in Antarctica, performed with the UW-MNS model developed at the University of Wisconsin and with the PSU/NCAR mesoscale model (known as *MM5*), allowed to build a cloud-radiation database over which a Neural Network Algorithm has been trained to estimate precipitation from satellite microwave brightness temperatures acquired by Advanced Microwave Sounding Unit (AMSU) and Microwave Humidity Sounder (MHS) embarked on low earth orbiting satellites of the National Oceanic and Atmospheric Administration (NOAA) and aboard ESA Meteorological Operational (MetOp).

The web site <http://antartide.artov.isac.cnr.it/> represents the final synthesis of this project.

It makes continuously available (images and ASCII files) both satellite-based (SB) data products and MM5 model output (MO) in quasi real time for the whole Antarctic region:

SB Precipitation

Precipitation estimates are computed with a neural network algorithm specialized for Antarctica that we have developed in this project following the approach described in Surussavadee and Staelin (C. Surussavadee and D. H. Staelin, "Global Millimeter-Wave Precipitation Retrievals Trained with a Cloud-Resolving Numerical Weather Prediction Model, Part I: Retrieval Design," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 46, no. 1, pp. 99-108, Jan. 2008).

SB Water Vapour

Water Vapour measurements are computed with Melsheimer and Heygster algorithm (Melsheimer, C. and Heygster, G.: Improved retrieval of total water vapour over polar regions from AMSU – B microwave radiometer data, *IEEE Trans. Geosci. Remote Sens.*, 46, 2307–2322, doi: 10.1109/TGRS.2008.918013, 2008.)

Each real time provided MM5 simulation, initialized using [NCEP High Resolution Global Forecast System \(1 degree GFS\)](#), forecasts next 54 hours over 3 nested resolution grids covering 35 vertical levels for 6 domains:

- 1) Whole Antarctica, 48.6 km resolution grid (119 x 129 pixels)
- 2) Victoria Land and Ross Sea, 16.2 km resolution grid (144 x 249 pixels)
- 3) Terranova Bay, 5.4 km resolution grid (30 x 30 pixels)
- 4) Dome C, 5.4 km resolution grid (30 x 30 pixels)
- 5) Terranova Bay, 1.8 km resolution grid (30 x 30 pixels)
- 6) Dome C, 1.8 km resolution grid (30 x 30 pixels)

Presently the web site provides following MOs:

[Pressure](#)
[Temperature](#)
[Mixing ratio](#)
[Cloud water mixing ratio](#)
[Cloud ice mixing ratio](#)
[Rain water mixing ratio](#)
[Snow mixing ratio](#)
[Ground temperature](#)
[Sea surface temperature](#)
[Snow cover flags](#)
[Land use category](#)
[Accumulated precipitation \(1h\)](#)
[Pressure perturbation](#)
[Surface pressure minus Ptop](#)
[U component of horizontal wind](#)
[V component of horizontal wind](#)
[Vertical wind component](#)

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. Antarctic Precipitation Retrieval Algorithm from AMSU/MHS sensors data
2. Automatic web-based tool for quasi real time monitoring of Antarctica meteorological conditions

G – exhibits, organization of conferences, editing and similar

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

1. Research Fellowship to Dr. Margherita Liberti

Research units

U.O. COL-DIE (CNR-ISAC Roma)

Coordinator: Dietrich Stefano
Mugnai Alberto

Programma Nazionale di Ricerche in Antartide (PNRA)

Di Paola Francesco
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Casella Daniele
Margherita Liberti

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Notes: