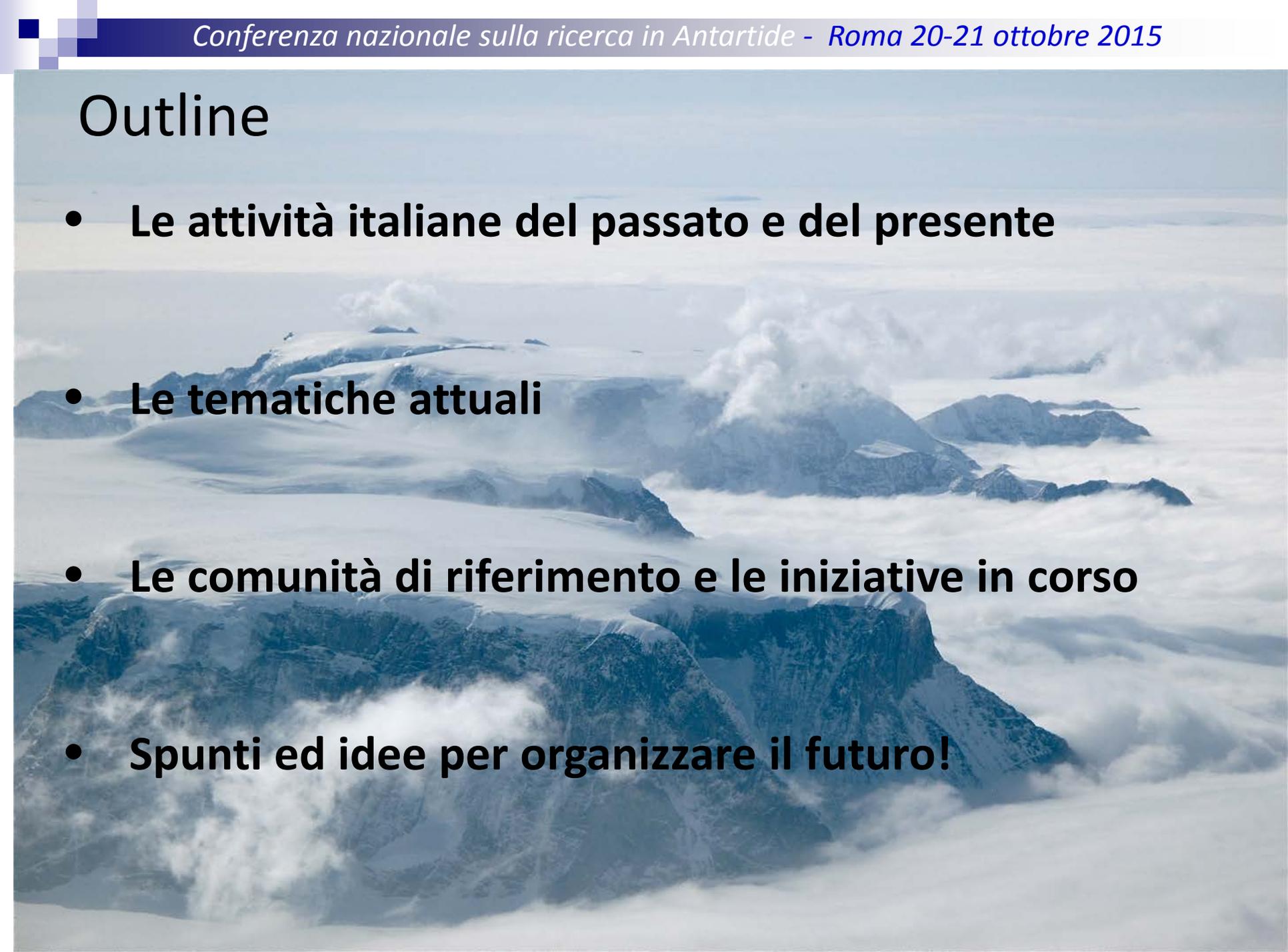


Workshop 1: Antarctic atmosphere and global connections

Giovanni Macelloni – IFAC CNR - Firenze

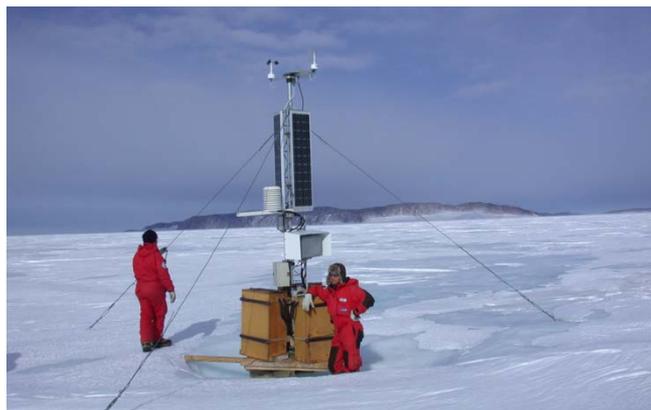
*Alcide Giorgio Di Sarra, Christian Lanconelli, Laura Selbmann,
Roberto Udisti, Angelo Viola, Antonio Meloni*

Outline

- **Le attività italiane del passato e del presente**
 - **Le tematiche attuali**
 - **Le comunità di riferimento e le iniziative in corso**
 - **Spunti ed idee per organizzare il futuro!**
- 
- The background of the slide is a high-angle, aerial photograph of the Antarctic continent. It shows a vast expanse of white ice and snow, with dark, rocky mountain peaks rising from the ice. The sky is a pale, hazy blue, and the overall scene is desolate and majestic.



Serie ventennale di temperatura aria in varie stazioni

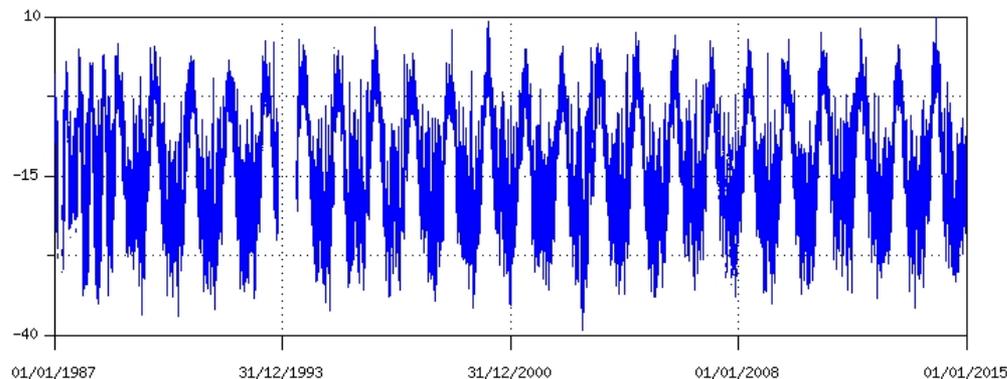


Dati dal 1987!

Misure dei parametri di base dell'atmosfera fin dalle prime spedizioni

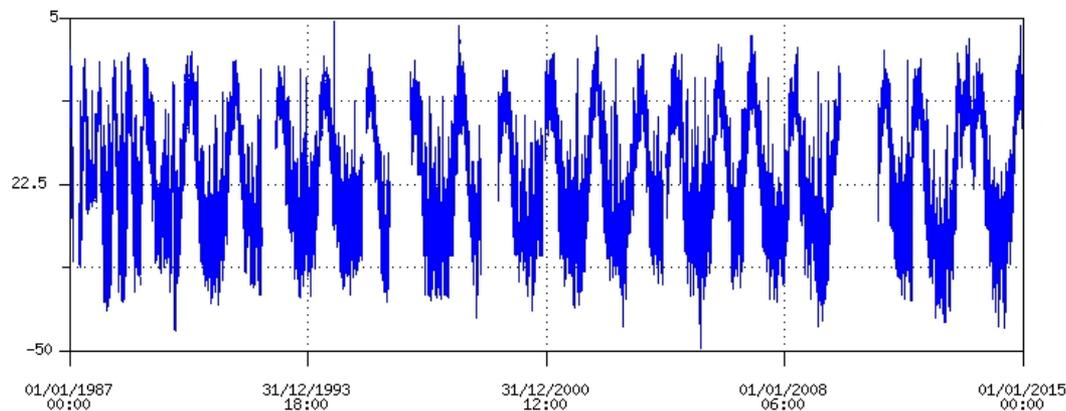
Eneide (7353) Terra Nova Bay
Temperature (°C)
From 01/01/1987 at 00:00 UTC to 31/12/2014 at 23:00 UTC

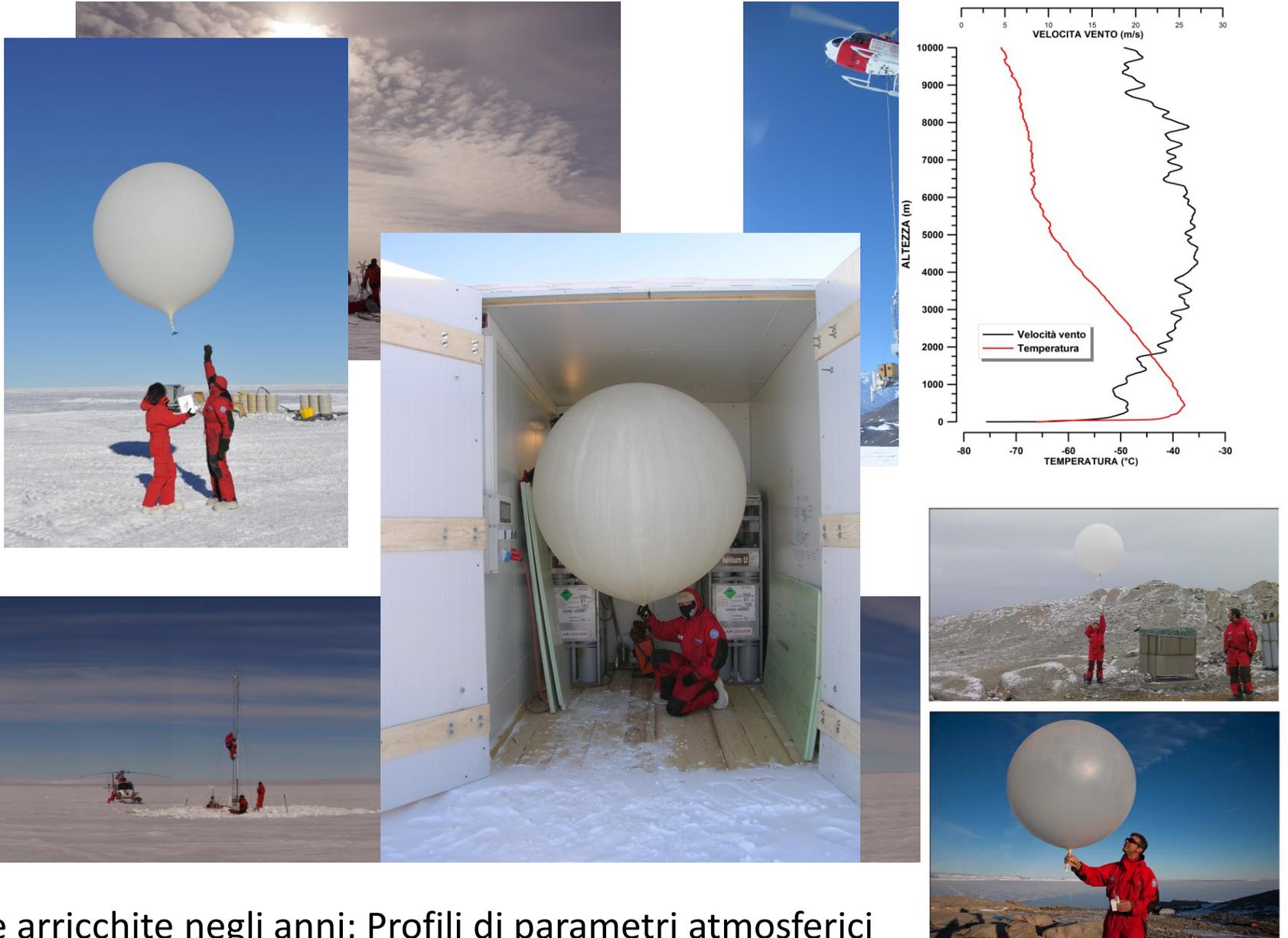
<http://www.climantartide.it>



Zoraida (7352) Priestley Glacier
Temperature (°C)
From 01/01/1987 at 00:00 UTC to 31/12/2014 at 23:00 UTC

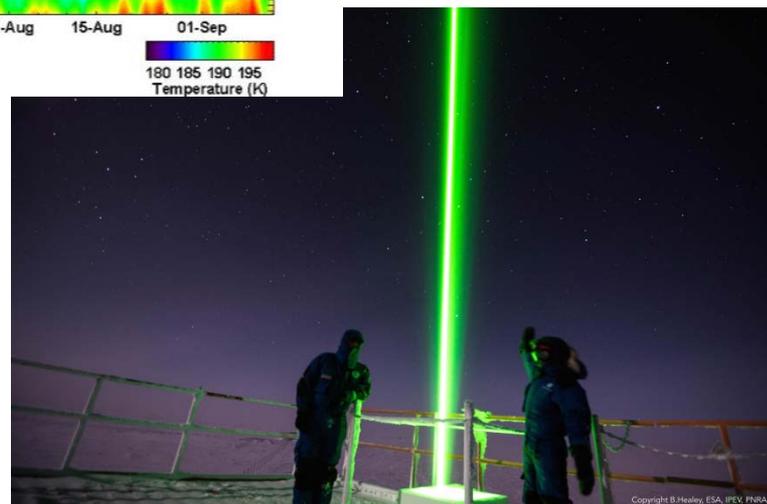
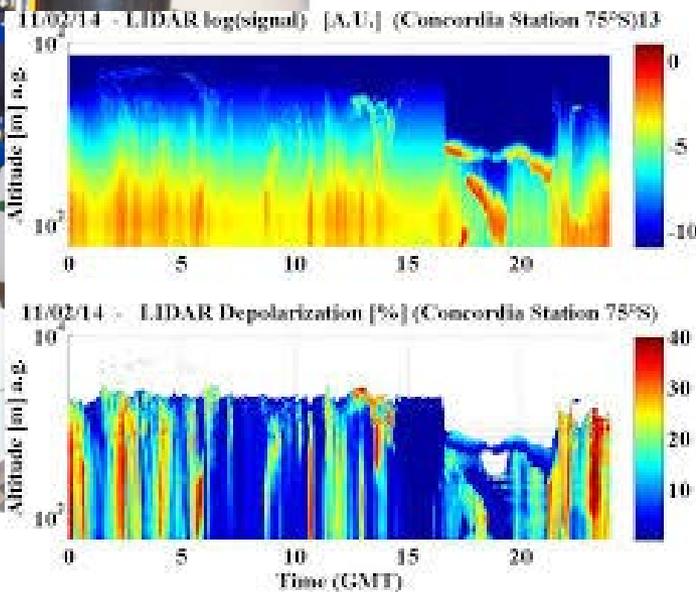
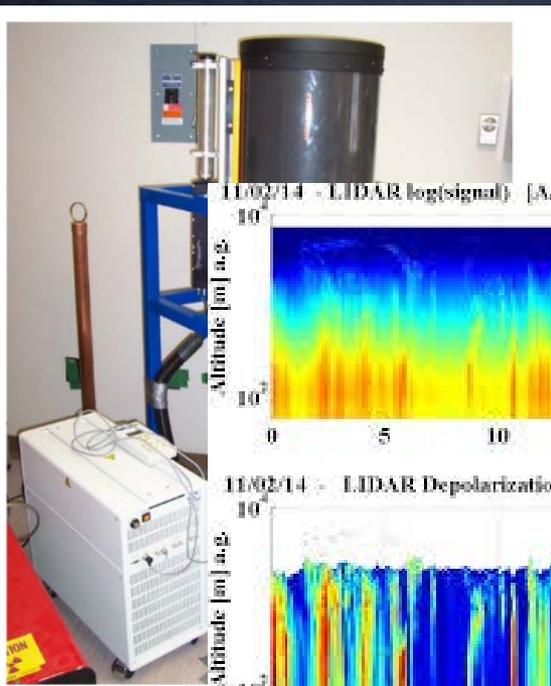
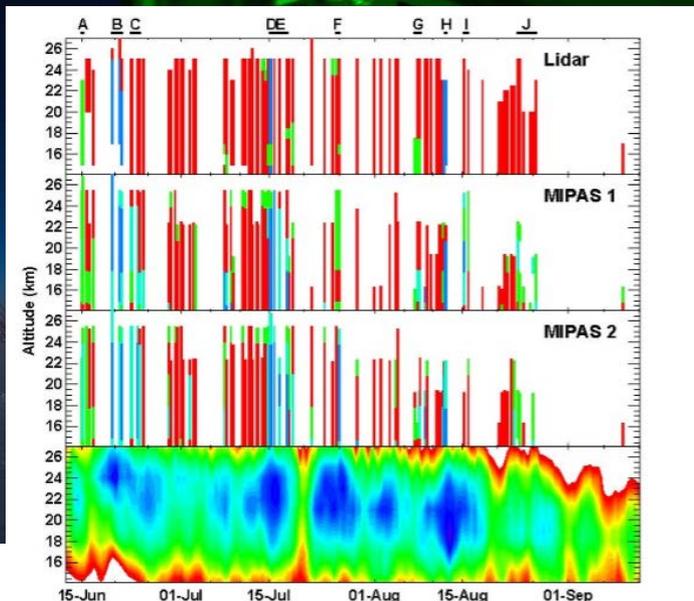
<http://www.climantartide.it>





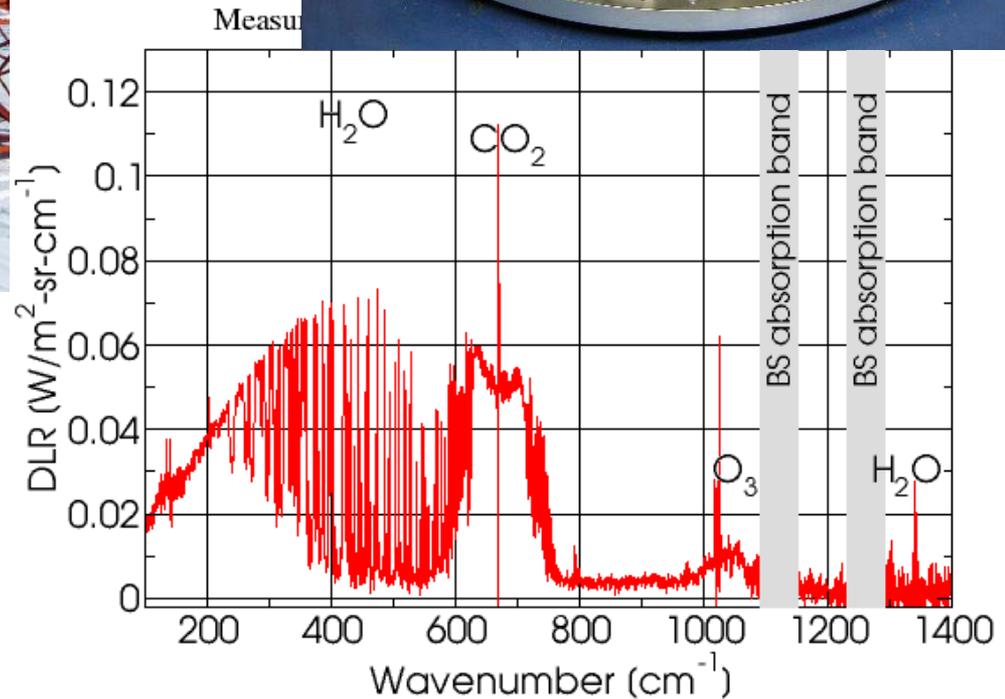
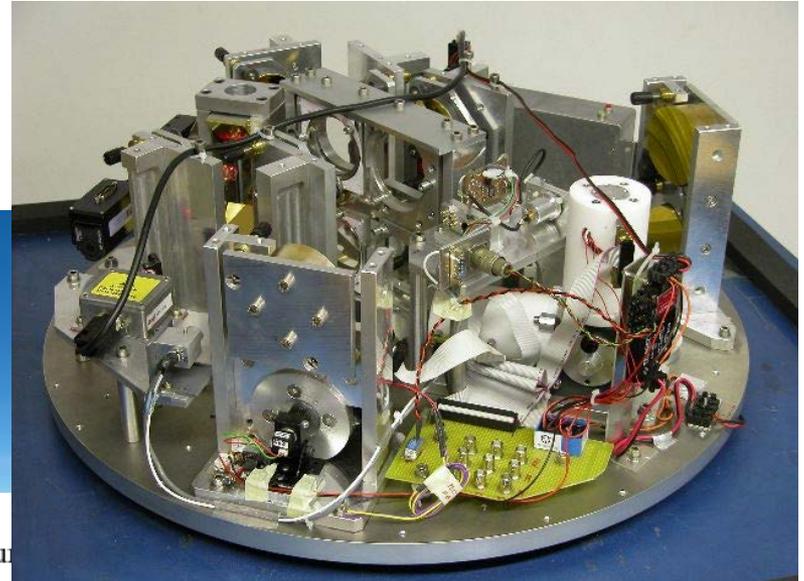
Misure arricchite negli anni; Profili di parametri atmosferici

Misure con strumentazioni più sofisticate dei parametri atmosferici, studio delle nubi e degli aerosol LIDAR in basi italiane e straniere





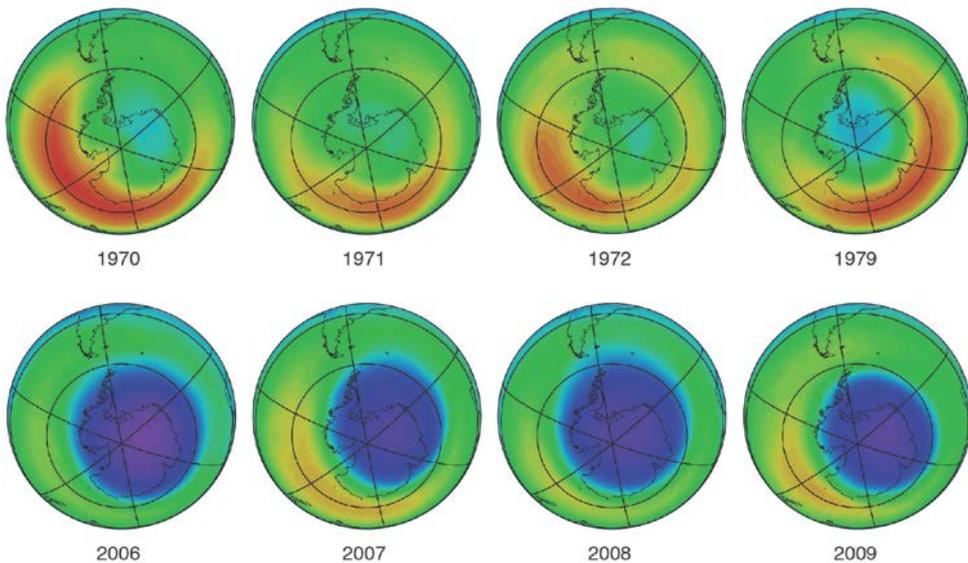
Misura delle componenti chimiche dell'atmosfera



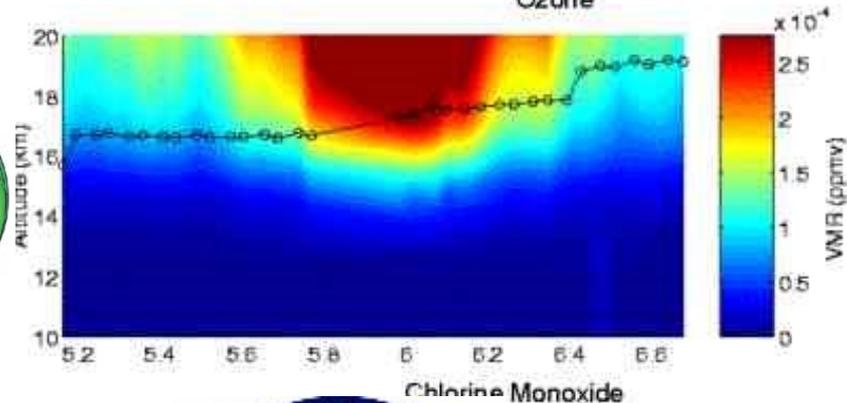
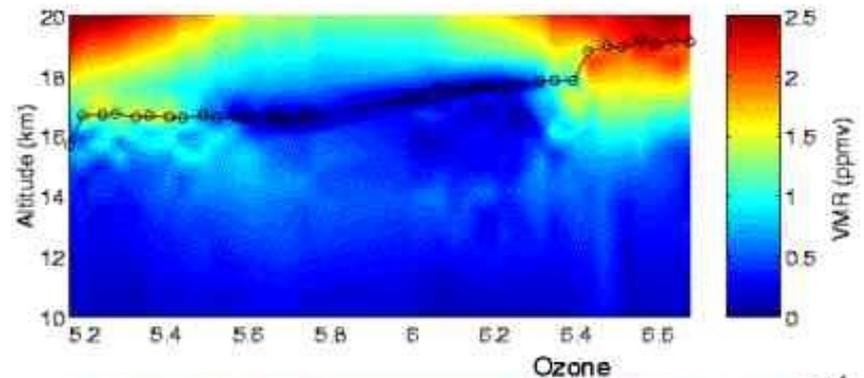
Iniziative internazionali per la misura dell'ozono da aereo



Antarctic Total Ozone
(October monthly averages)

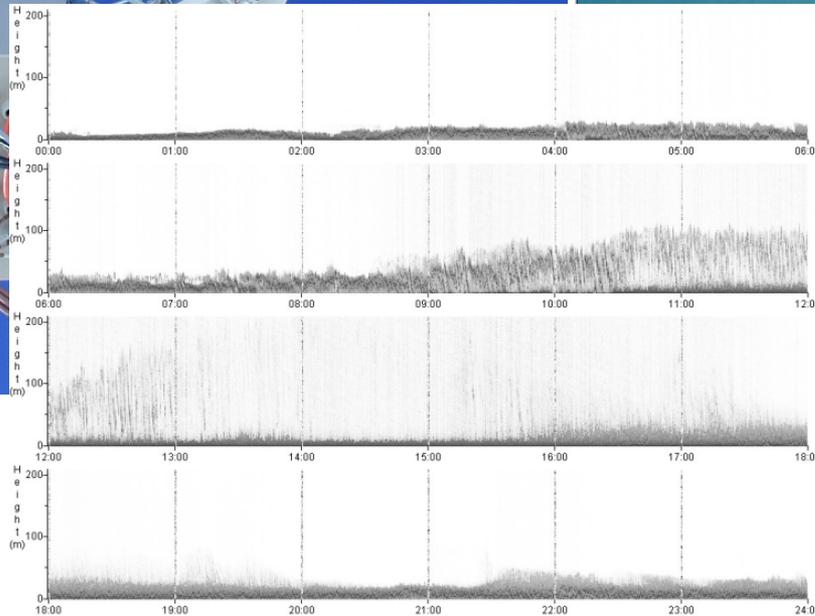
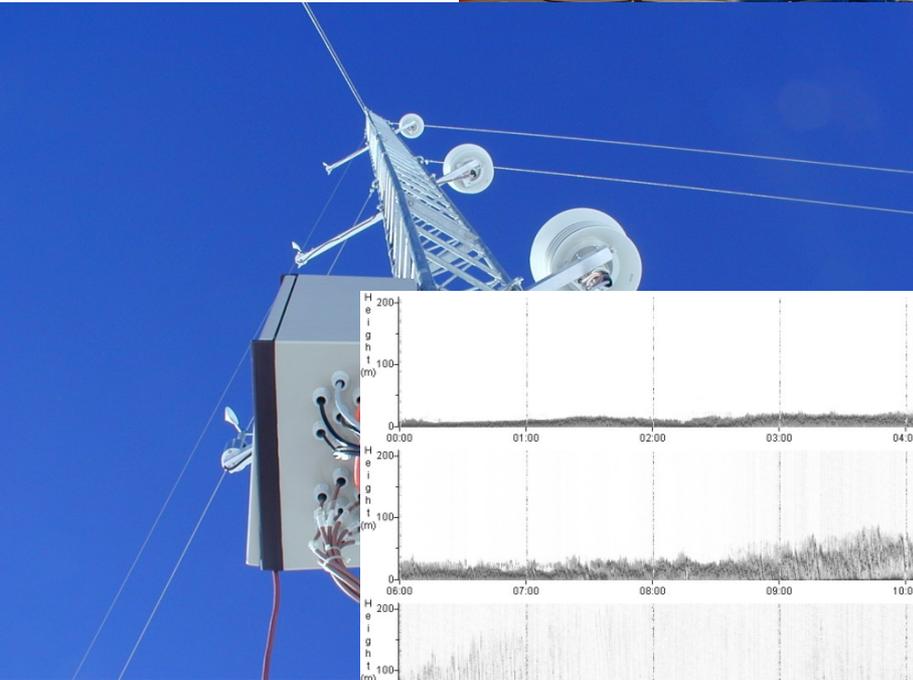


Total ozone (Dobson units)

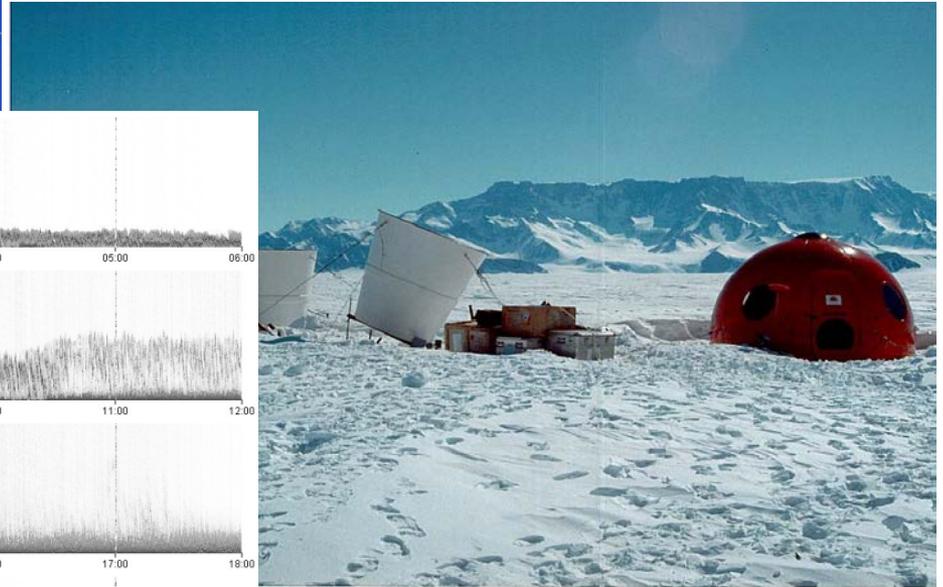


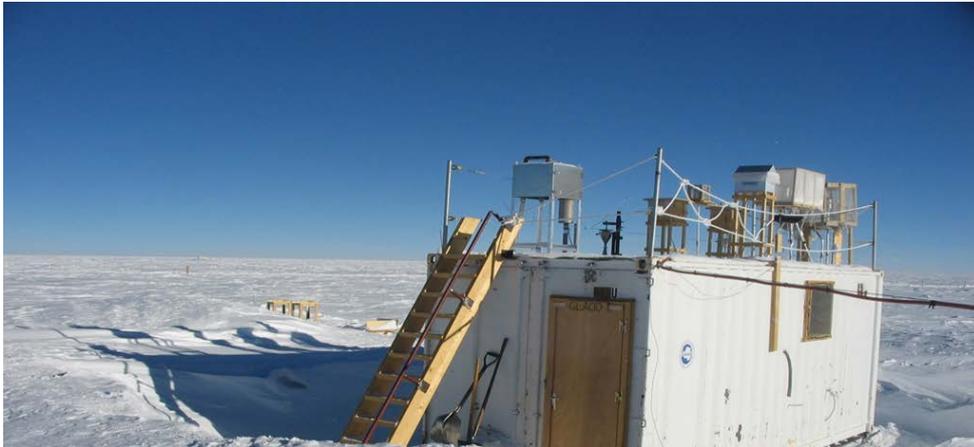


Misure per lo studio delle proprietà fisico-chimiche del PBL

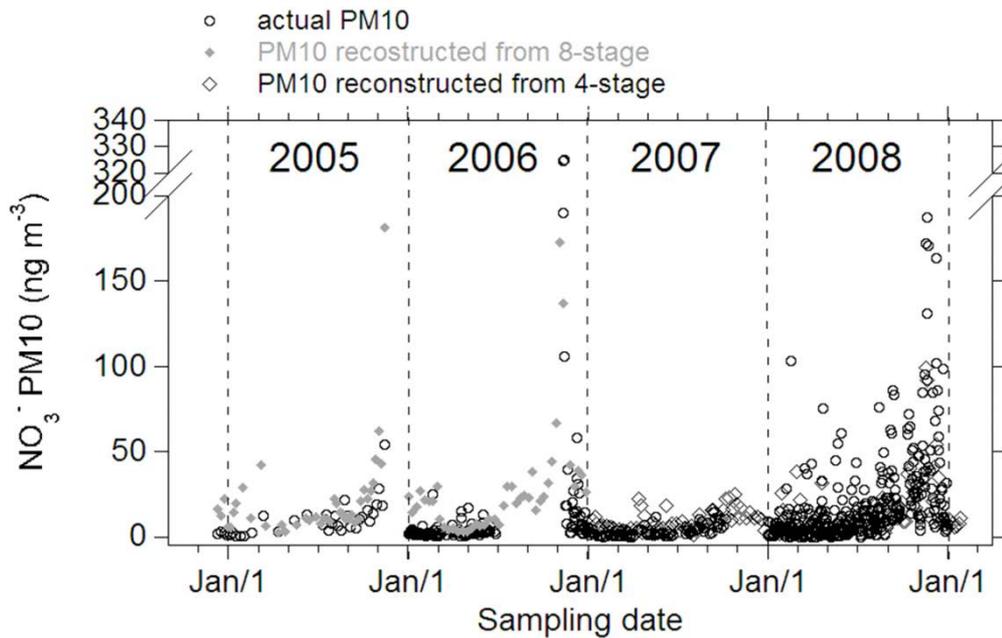
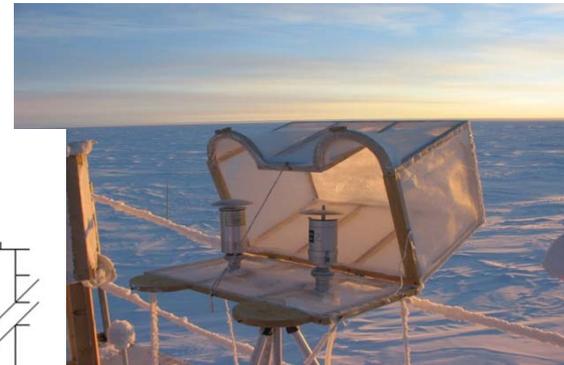


11/02/2014 - Channel 3 - DC-10



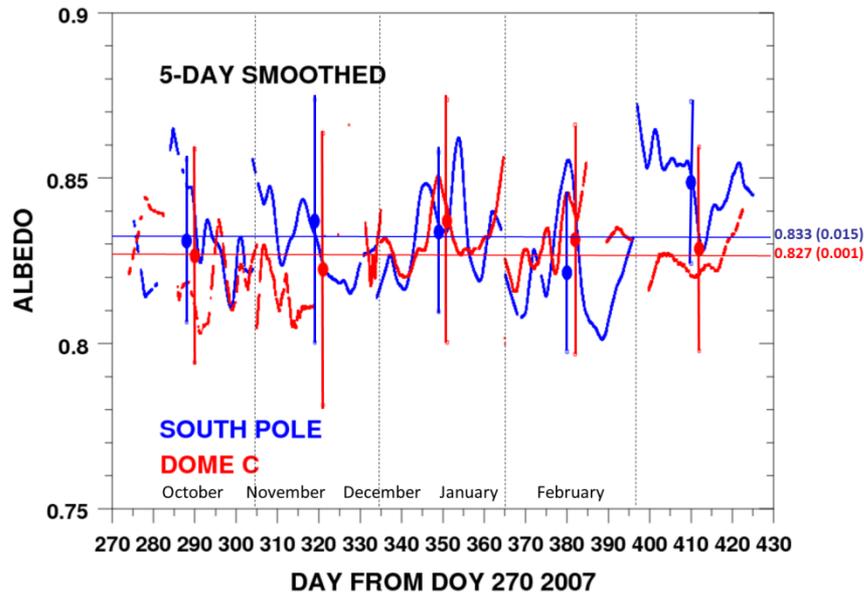


Misure per lo studio della
composizione chimica
dell'aerosol

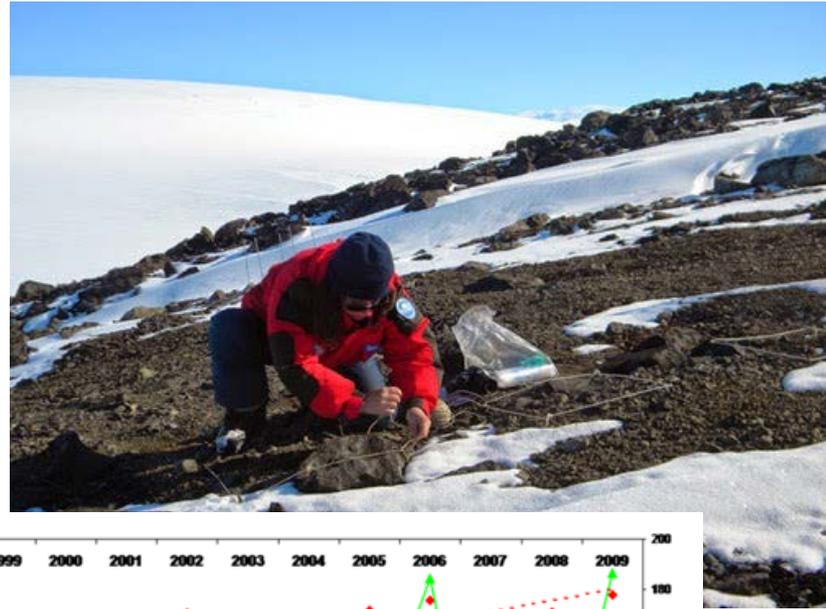




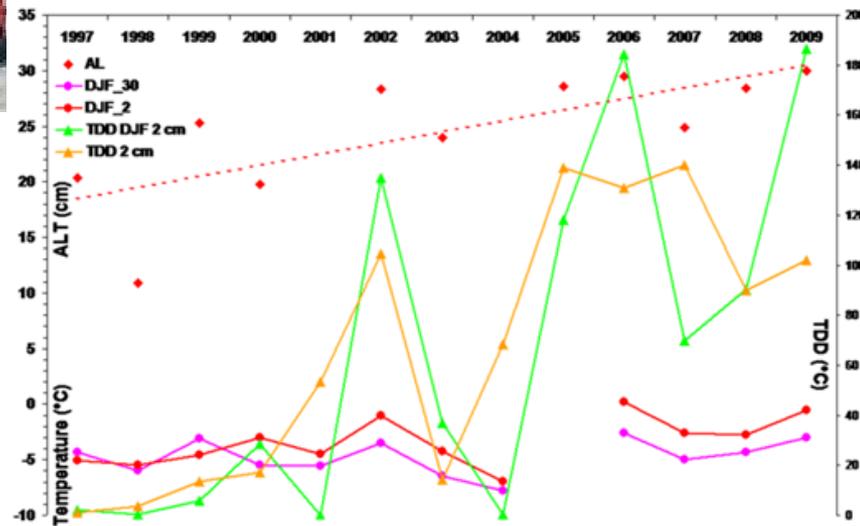
Austral summer 2007/2008 broadband albedo at Dome C and Pole are essentially equal, having a value of about 0.83 ± 0.03



Misure di albedo; trasporto radiativo

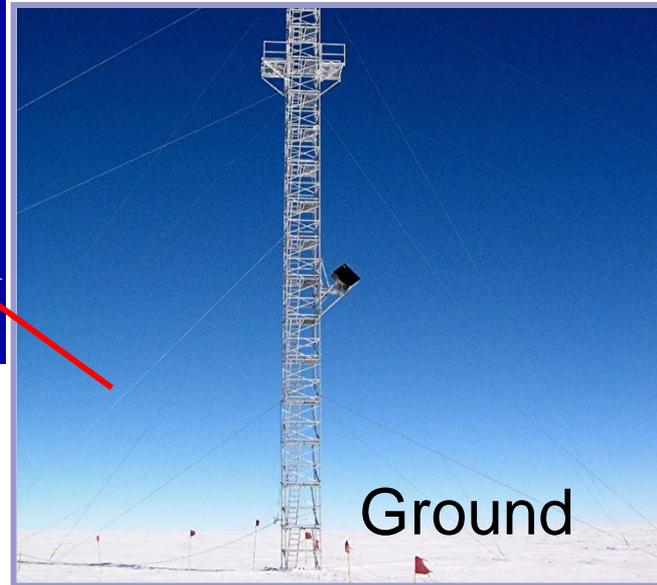
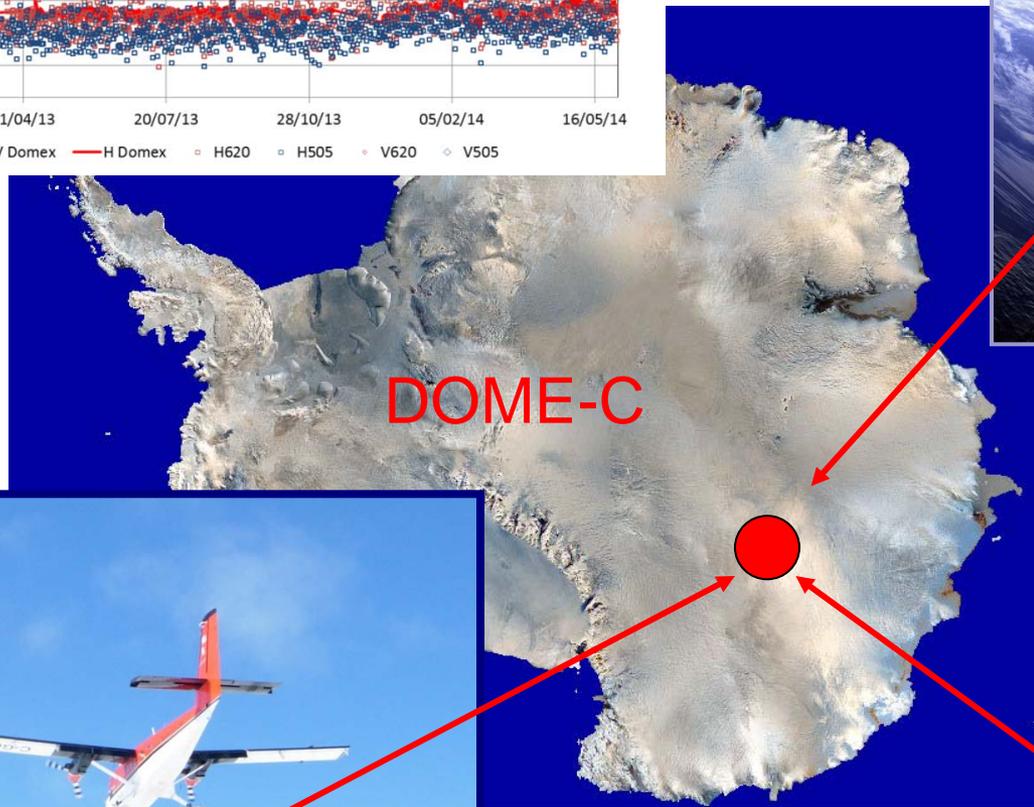
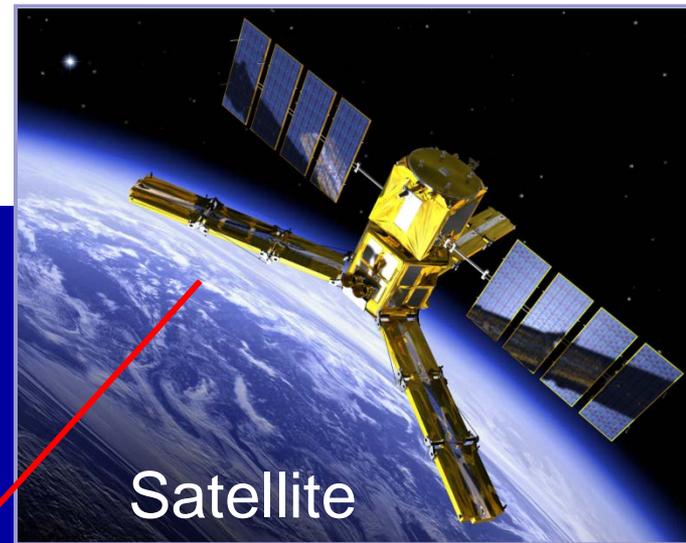
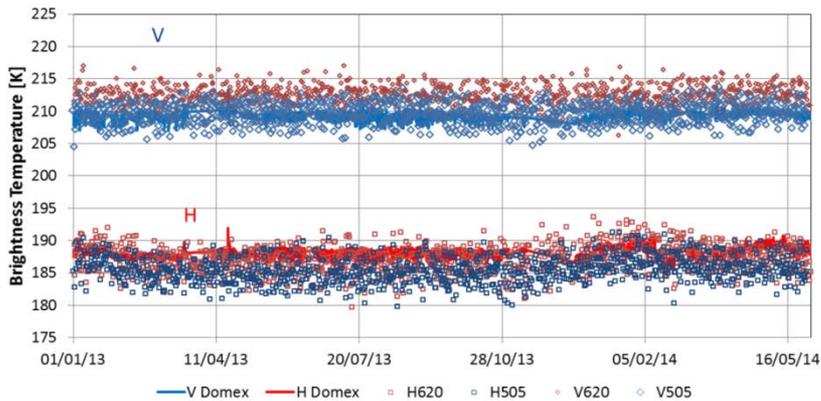


Relazioni fra parametri atmosferici e proprietà fisiche dei suoli e degli organismi



Active Layer (AL) changes at MZS since 1996 and related climatic parameters.

DomeX - V620 - v505



Calibrazione e
validazione di dati
satellitari

WEB OF SCIENCE™

Prodotti della ricerca sull'argomento



Search

[Return to Search Results](#)

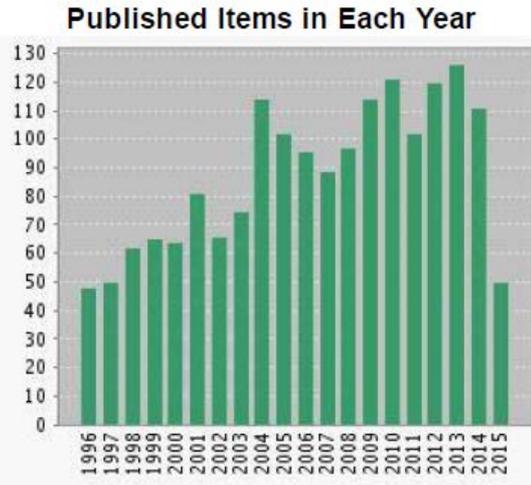
Citation Report: 2.026

(from All Databases)

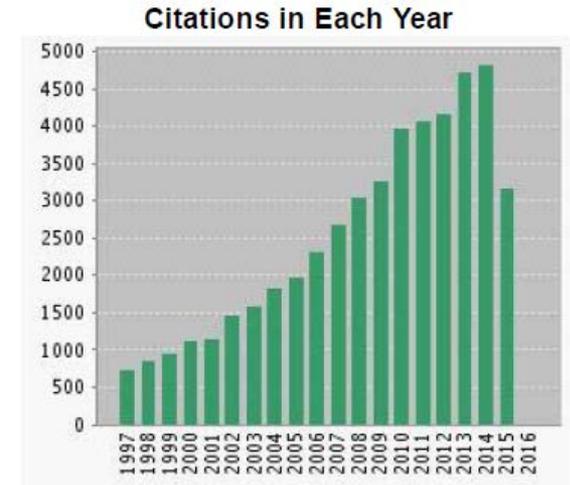
You searched for: **TOPIC:** (antartica atmosphere) [...More](#)

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GALE - ISI WEB OF SCIENCE : ATMOSPHERIC + ANTARCTICA



The latest 20 years are displayed.



The latest 20 years are displayed.

Citation Report: 173

(from All Databases)

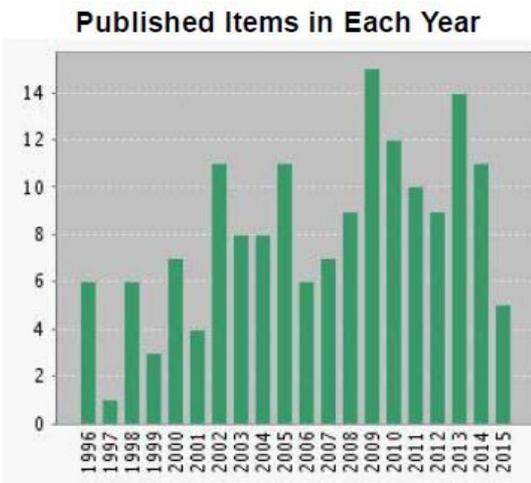
You searched for: **TOPIC:** (antartica atmosphere)

Refined by: COUNTRIES/TERRITORIES: (ITALY)

Timespan: All years.

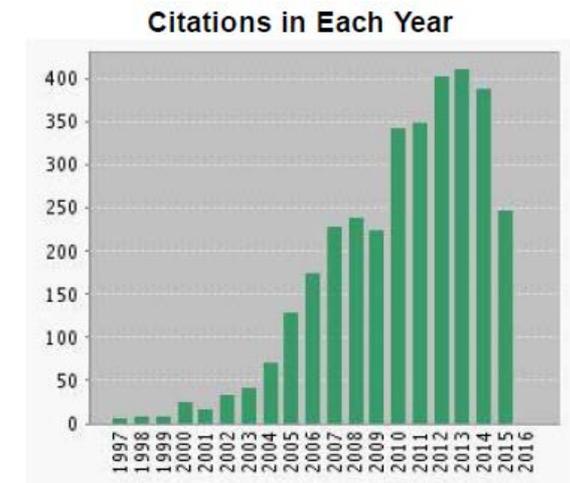
[...Less](#)

ISI WEB OF SCIENCE : ATMOSPHERIC + ANTARCTICA + ITALY



The latest 20 years are displayed.

[View a graph with all years.](#)



The latest 20 years are displayed.

[View a graph with all years.](#)

ANTARCTIC ATMOSPHERE AND GLOBAL CONNECTIONS - SCAR Questions

- 1.** How is climate change and variability in the high southern latitudes connected to lower latitudes including the Tropical Ocean and monsoon systems?
- 2.** How do Antarctic processes affect mid-latitude weather and extreme events?
- 3.** How have teleconnections, feedbacks, and thresholds in decadal and longer term climate variability affected ice sheet response since the Last Glacial Maximum, and how can this inform future climate projections?
- 4.** What drives change in the strength and position of Westerly winds, and what are their effects on ocean circulation, carbon uptake and global teleconnections?
- 5.** How did the climate and atmospheric composition vary prior to the oldest ice records?

ANTARCTIC ATMOSPHERE AND GLOBAL CONNECTIONS - SCAR Questions

6. What controls regional patterns of atmospheric and oceanic warming and cooling in the Antarctic and Southern Ocean? *(Cross-cuts "Southern Ocean")*
7. How can coupling and feedbacks between the atmosphere and the surface (land ice, sea ice and ocean) be better represented in weather and climate models? *(Cross-cuts "Southern Ocean" and "Antarctic Ice Sheet")*
8. Does past amplified warming of Antarctica provide insight into the effects of future warming on climate and ice sheets? *(Cross-cuts "Antarctica Ice Sheet")*
9. Are there CO₂ equivalent thresholds that foretell collapse of all or part of the Antarctic Ice Sheet? *(Cross-cuts "Antarctic Ice Sheet")*
10. Will there be release of greenhouse gases stored in Antarctic and Southern Ocean clathrates, sediments, soils, and permafrost as climate changes? *(Cross-cuts "Dynamic Earth")*
11. Is the recovery of the ozone hole proceeding as expected and how will its recovery affect regional and global atmospheric circulation, climate and ecosystems? *(Cross-cuts "Antarctic Life" and "Human")*

Quali gli strumenti e le iniziative a livello internazionale dove collocare le attività future ?

- YOPP: predictability in the polar regions
- WMO Global Cryosphere Watch (GCW)
- SCAR Science Themes: Antarctica and Climate; Observing Systems
- SCAR Standing Scientific Groups: ISMASS/OpMet/ACA/SPeCT/SnowAnt/PACT
(Aerosol and Clouds; Ice sheet mass balance; Snow in Antarctica; Operational meteorology; Atmospheric chemistry at the tropopause; Sea-ice processes)
- NDACC: long-term measurements of atmospheric composition changes
- BSRN: surface radiation measurements
- SPARC – Stratosphere-troposphere Processes And their Role in Climate
- Ant-ERA – Antarctic - Ecosystems Resilience and Adaptation



Alcune Tematiche di ricerca

Sviluppo e consolidamento delle reti osservative

Cambiamenti di lungo periodo nella stratosfera

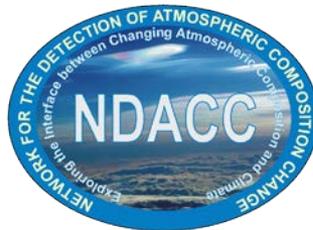
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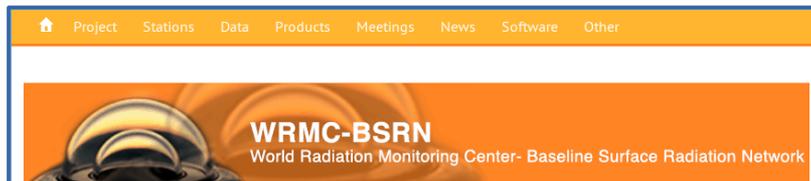
Bilancio di massa

Ruolo di aerosol, vapor d'acqua e nubi sul bilancio della radiazione



Reti osservative e Contenitori di dati:

- Quali sono?
- Come partecipare ?
- Quali gli strumenti e la maturità necessaria per qualificarli?
- Quali le azioni strategiche per garantire la presenza nel tempo?
- Interazione con progetti e/o altre agenzie polari (e.g. Concordia)



Global Cryosphere Watch

World Meteorological Organization

Home About News Cryosphere Now Surface Satellites Activities Outreach Reference Data

Dome-C Site Information

Concordia is a joint French-Italian research facility opened in 2005 on the Antarctic Plateau, Antarctica (75°6 0 S, 123°20 0 E), managed together by PNRA (Italian National Antarctic Programme) and IPEV (Institut Polaire Français Paul Émile Victor). It is built at 3,233 m above sea level on the third highest summit of Antarctica: Dome C.

Although the summit of a local dome, the surface is essentially flat: surface elevation above sea-level varies by only a few meters over horizontal distances of tens of km. Snow fall and accumulation are very small (about 10 cm of snow accumulation per year). The surface is consistently snow covered because the temperature is always way below freezing all year long and melting does not occur. Temperatures hardly rise above -25°C in summer and can fall below -80°C in winter. The annual average air temperature is -54.5°C. Humidity is low and it is also very dry, with very little precipitation throughout the year.

The station is permanently staffed with at least 10 people in the winter (about half of whom with scientific observation duties) and more than 70 during the local summer. This allows a large range of scientific research to be carried out in the field of meteorology, glaciology, geology, and astrophysics, and medical research is also carried out, including one of the GTS. The horizontal homogeneity of the site is also used for the calibration and validation of instruments.

Other Networks to which Dome C belongs:

- GLACIOCLIM network
- GESOA network / obs
- both more than 10 year
- BSRN (Baseline Surface Radiation Network)

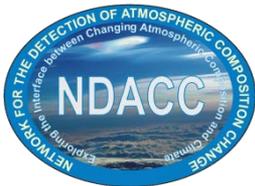
Metadata

- > GCW site type: Core
- > CryoNet site type: Basic
- > WMO ID (if any): NA
- > Latitude, longitude: -75.1, 123.33
- > Altitude min, max (m): 3230,

Baseline Surface Radiation Network (BSRN). All radiation observations and station metadata in an accessible format as well as information to any station participating in the network (GEWEX) under the umbrella of the Global Earth's radiation field at the surface.

computer model estimates of these parameters in the latitude range from 80°N to 90°S (see the GEWEX website for more details) with high time resolution and high accuracy and with high time resolution.

Global Climate Observing System (GCOS) and the BSRN and the Network for the Detection of Atmospheric Composition Change (NDACC) come cooperative networks.



Network for the Detection of Atmospheric Composition Change (NDACC)

Website hosted by NOAA's National Weather Service

Home NWS News NWS Organization

Network for the Detection of Atmospheric Composition Change (NDACC)

NDACC Sites

Clickable map. Click on sitenames to access public data.

Observational Capabilities of the Network for the Detection of Atmospheric Composition Change

Total Column NDACC Observation Capabilities.

The international Network for the Detection of Atmospheric Composition Change (NDACC) is composed of more than 70 high-quality, remote-sensing research stations for observing and understanding the physical and chemical state of the stratosphere and upper troposphere and for assessing the impact of stratospheric changes on the underlying troposphere and on global climate.

While the NDACC remains committed to monitoring changes in the stratosphere with an emphasis on the long-term evolution of the ozone layer, its priorities have broadened considerably to encompass issues such as the detection of trends in overall atmospheric composition and understanding their impacts on the stratosphere and troposphere, and establishing links between climate change and atmospheric composition.

Following five years of planning, instrument design and implementation, the NDACC began network operations in January 1991.

Hot News
Newsletter
Goals and Organization
Instruments
Protocols
M&A Directory
Measurement Stations
NDACC Data Formats
Working Groups:
Dobson (@WMO)
Brewer (@U Manchester)
FTIR (@NCAR)
Lidar (off site)
Microwave (@U Bern)
Satellite (@BIRA)
Sondes (U Wyoming)
Theory (@KIT)
UV/Vis (@BIRA)
Spectral UV
Water Vapor (@U Bern)
Cooperating Networks
NDACC News
Ozone Q&A (@ESRL)
Related Links
Featured Link:
SPARC Report on Halogen/O3 Initiative
SC Resource Page
Contact Us



Esempio di reti: la rete CryoNet – del GCW Network

- the last WMO congress (May 2016) approve a resolution where they agreed that Polar and High Mountain Regions became one of the seven WMO Priorities for 2016-2019, especially to “Improve operational meteorological and hydrological monitoring, prediction and services in polar, high mountain regions and beyond by: (a) operationalizing the Global Cryosphere Watch (GCW); (b) better understanding the implications of changes in these regions on the global weather and climate patters; and (c) advancing the polar prediction under the Global Integrated Polar Prediction System (GIPPS)”.
- Establish the core network of GCW surface measurement sites – **CryoNet**.
- CryoNet is one part of the whole **GCW observing system**, which is, in turn, a component observing system of the WMO Integrated Global Obs
- CryoNet is initially comprised of **existing stations/site**



Rete di dati e/o esperimenti dedicati → Possibile Contributo alla Calibrazione e Validazione dati Earth Observation ?



The CEOS **Working Group on Calibration & Validation** (WGCV) Mission is to ensure long-term confidence in the accuracy and quality of Earth Observation data and products and provide a forum for the exchange of information about calibration and validation, coordination, and cooperative activities.

Dalla Pagina delle attività del Gruppo :

“**DOME C Experiment:**”

Conduct a multi-sensor comparison to evaluate the size of any biases using the Dome C site as a reference standard. This will serve as a pilot for future regular CEOS comparisons over this and other reference sites to ensure data interoperability and to underpin the LSI constellation. The results of the comparison will allow an assessment to be made of the site’s suitability for climate quality calibration.

....al momento non molto esplorato → connessione con GCW

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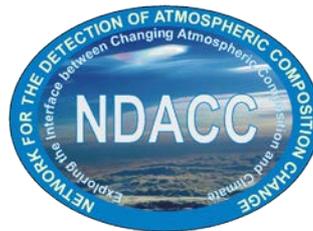
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Bilancio di massa

Ruolo di aerosol, vapor d'acqua e nubi sul bilancio della radiazione





SPARC
Stratosphere-troposphere
Processes And their Role In Climate

Stratosphere-troposphere Processes And their Role in Climate

A core project of the World Climate Research Programme which coordinates international efforts to bring knowledge of the stratosphere to bear on relevant issues in climate variability and prediction.



Themes and activities address areas of societal concern:

- Climate variability and change
- Ozone
- Atmospheric chemistry and aerosols
- **Polar processes**

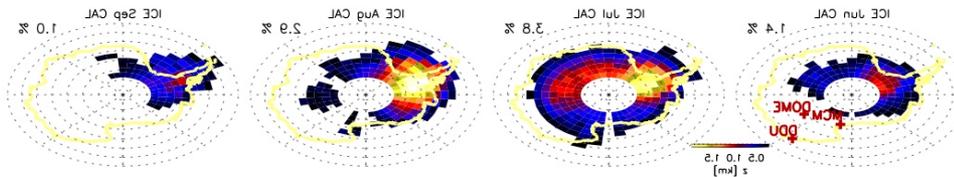


Are Polar stratospheric clouds in Chemistry Climate models reliable ?

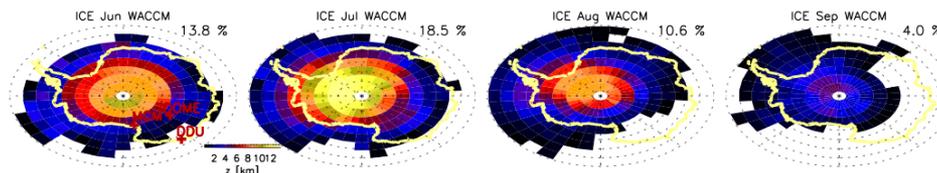
- Problem: Stratospheric temperature biases are a major problem in CCMs and can generate an unrealistic PSC distribution - microphysics can be also unrealistic
- CCMs are used in climate prediction (next CMIP6)
- → Need to have a realistic stratosphere (has a great impact on trop SH circulation & ozone recovery)

Example: PSC seasonal Volume evaluation

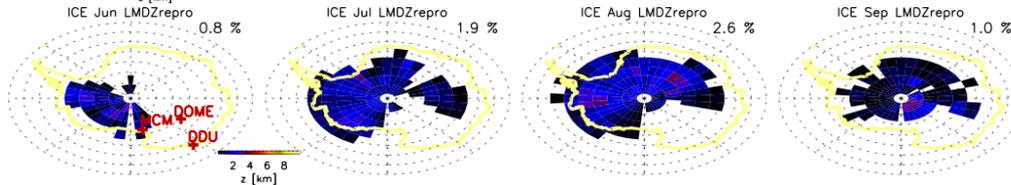
CALIOP Lidar



WACCM NCAR model



LMDZ IPSL model



Tematiche di ricerca

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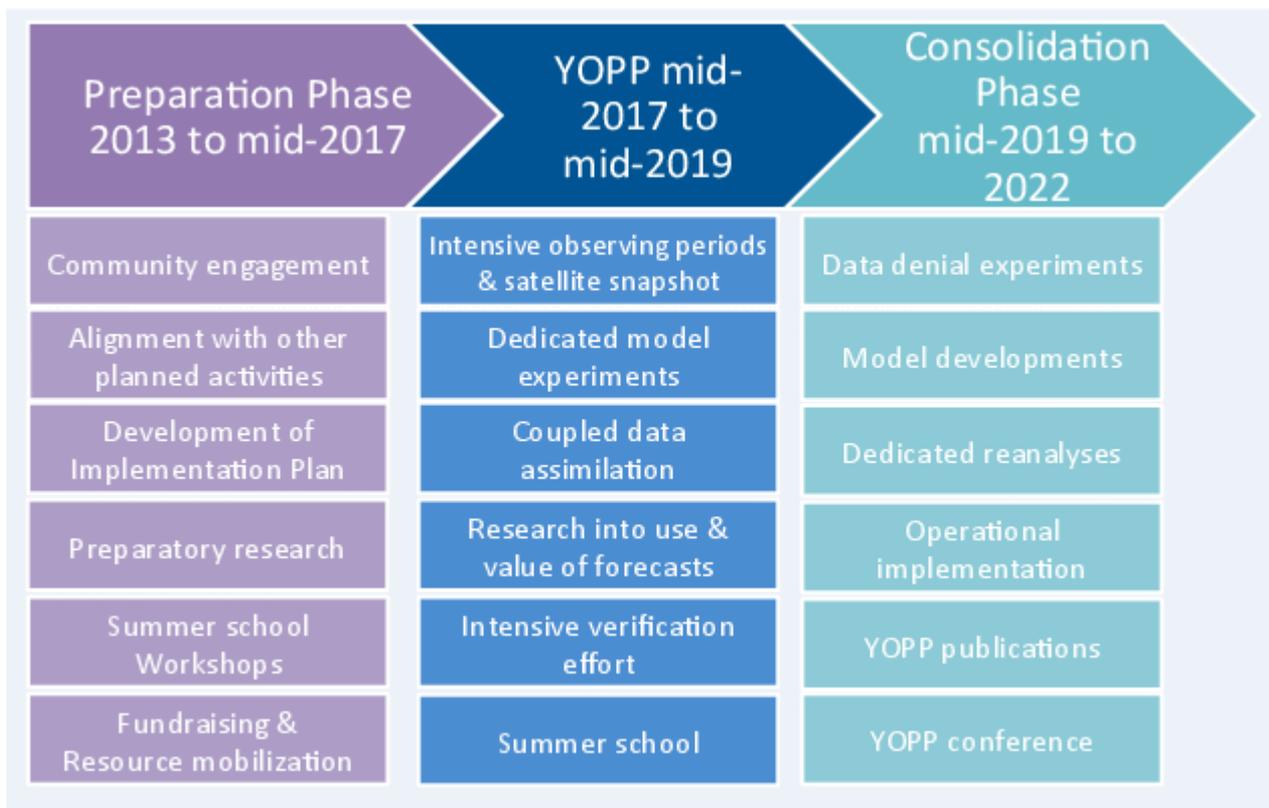
Ruolo di aerosol, vapor d'acqua e nubi sul bilancio della radiazione





MISSION

Enable a significant improvement in environmental prediction capabilities for the polar regions and beyond, by coordinating a period of intensive observing, modelling, verification, user-engagement and education activities.

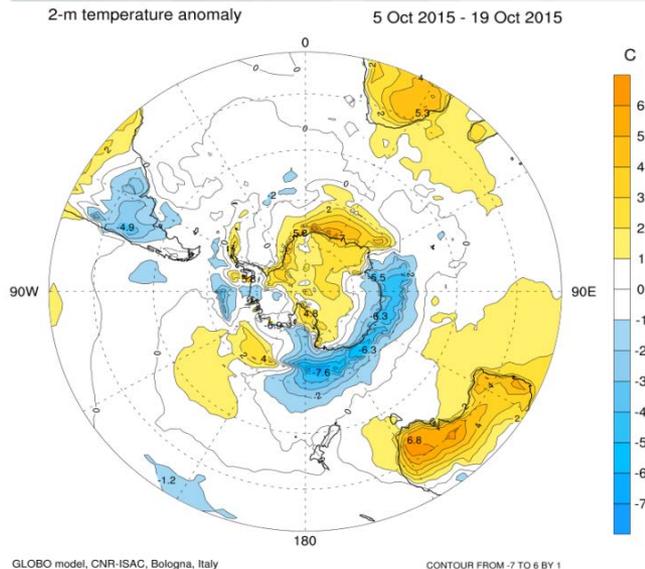




subseasonal-to-seasonal prediction
(<http://s2sprediction.net/>) promosso dal
WWRP/WCRP

Alcuni Temi di interesse attivi da svolgere in area polare:

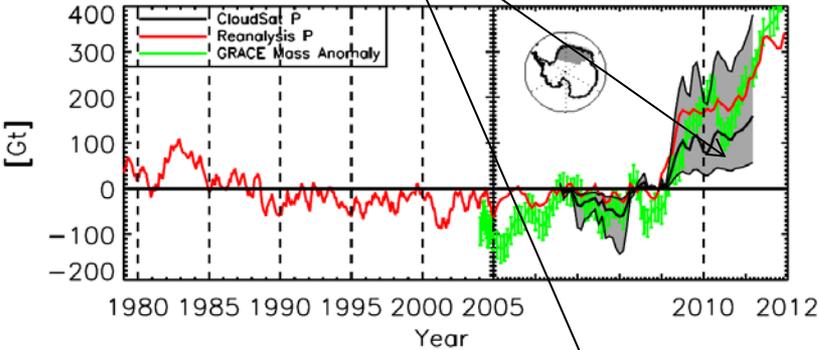
- Previsione di nebbie in aree marine polari mediante modellistica numerica (Belmont Forum 2014)
- Parametrizzazione di processi sotto-griglia in modelli meteorologici
- Diagnostica di cicloni esplosivi e variabilità interannuale (da ERA-Interim)
- Energetica di cicloni extratropicali – conversione baroclina, effetti di vapor d'acqua, migrazione verso le alte latitudini
- Influenza del gradiente latitudinale di temperatura sulla dinamica delle medie e basse latitudini in una gerarchia di modelli e ruolo delle onde planetarie nella circolazione generale



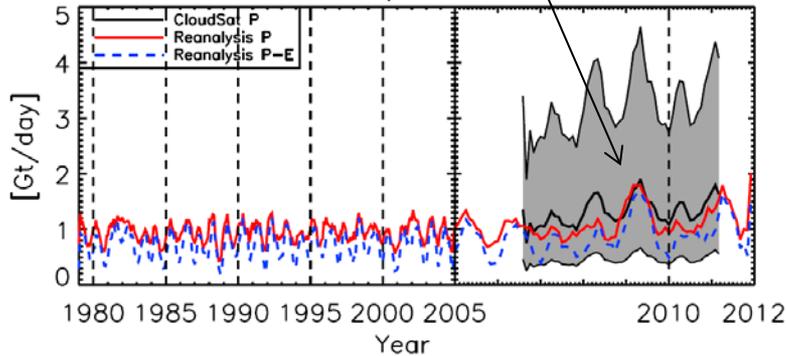
Esempio di previsione di anomalia bisettimanale di T2m sull' emisfero sud

Stima delle Precipitazioni in regioni polari

Incertezza
Accumulation



Precipitation



The Global Precipitation Measurement mission is an An international satellite mission (NASA/JAXA) that sets new standards for precipitation measurements worldwide using a network of satellites united by the GPM Core Observatory.

Tematiche di ricerca

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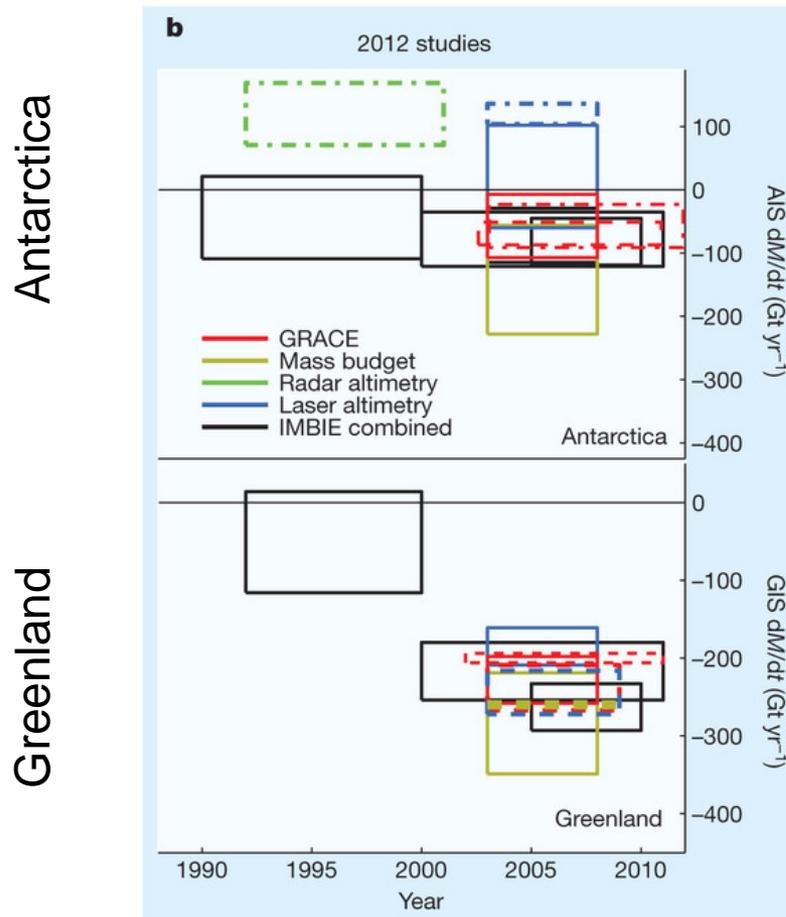
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Bilancio di massa

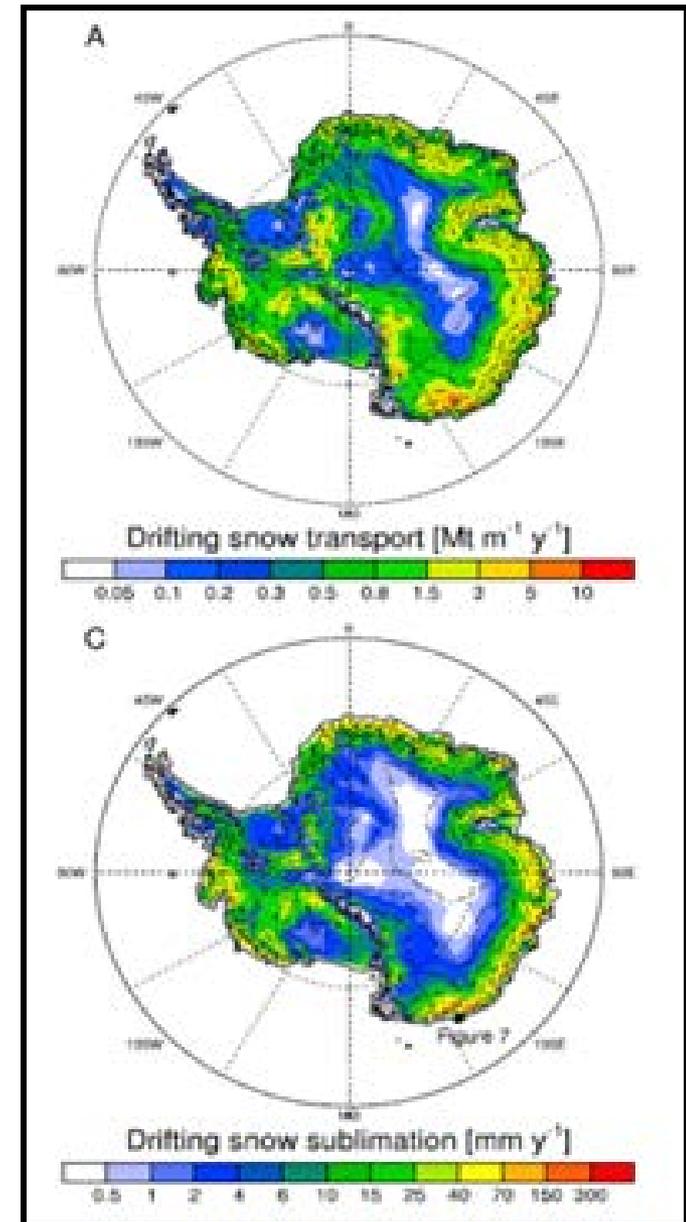
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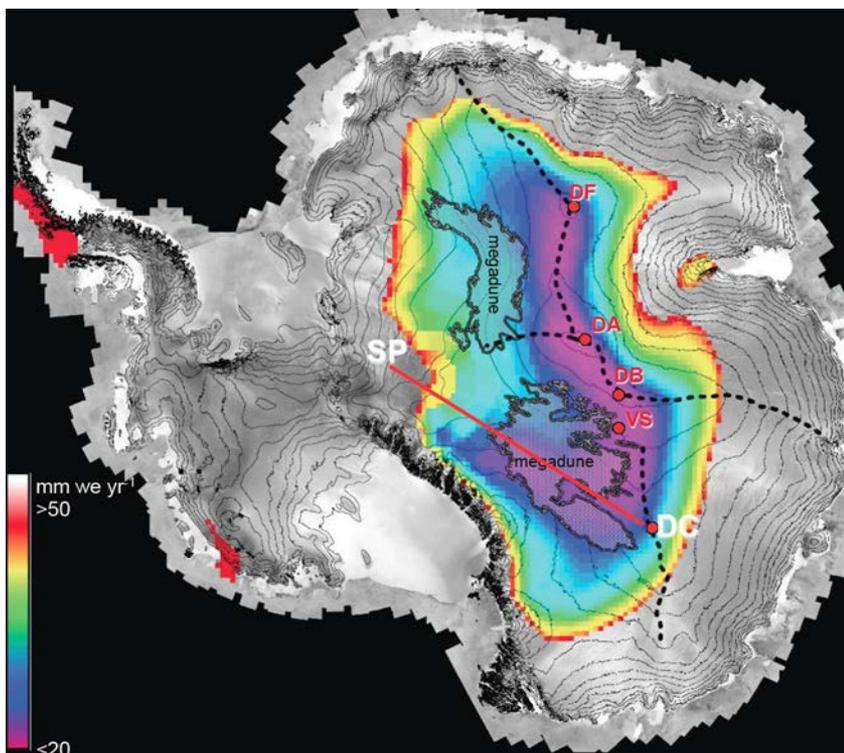
Misura *drifting snow* (*drifting e blowing snow*) quale contributo al miglioramento dell'accuratezza della stima della perdita di massa della calotta antartica. Attualmente stimata in $\sim 30\text{-}200\text{Gt yr}^{-1}$ con un'incertezza $\sim 40\%$, dovuta all'incertezza su SMB e sull'impatto del



Perditi di Massa della calotta (Gt Yr⁻¹)



East Antarctic International Ice Sheet Traverse (EAIIST)



A French-Italian-American project for a Dome C – South Pole traverse

Key Atmospheric Questions:

1. How do Dome C and South Pole compare in representing the atmospheric chemistry of the remote, clean Antarctic atmosphere?
2. What are common and different features in atmospheric chemistry and snow-atmospheric exchanges?
3. What forcings are exhibited through diurnal radiation and boundary layer dynamics cycles at Dome C and how does the absence of a diurnal cycle affect snow and atmospheric chemistry at South Pole?

Tematiche di ricerca

Cambiamenti di lungo periodo nella stratosfera

Processi nella stratosfera ed ozono polare

Influenza della circolazione stratosferica sui processi meteorologici alle alte e medie latitudini

Predicibilità e meteorologia nelle regioni polari

Bilancio di massa

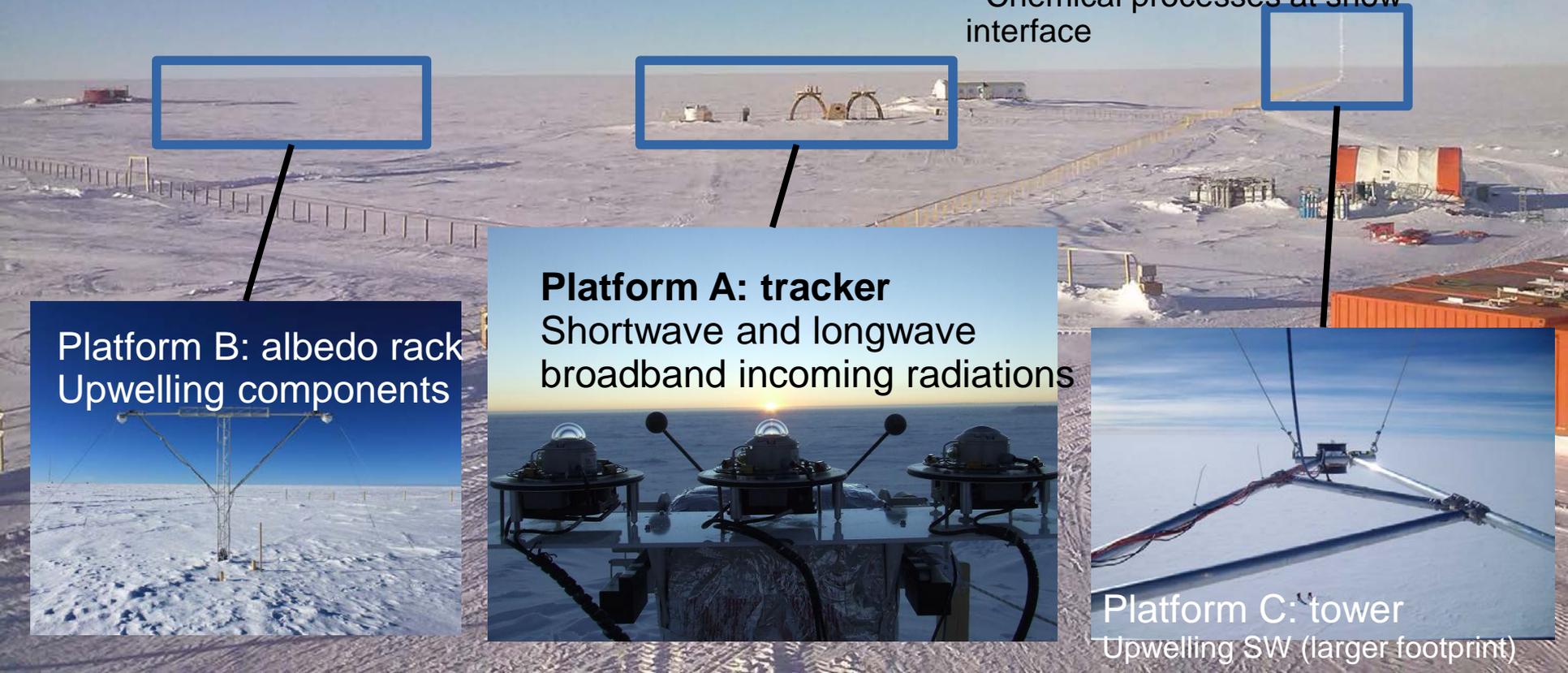
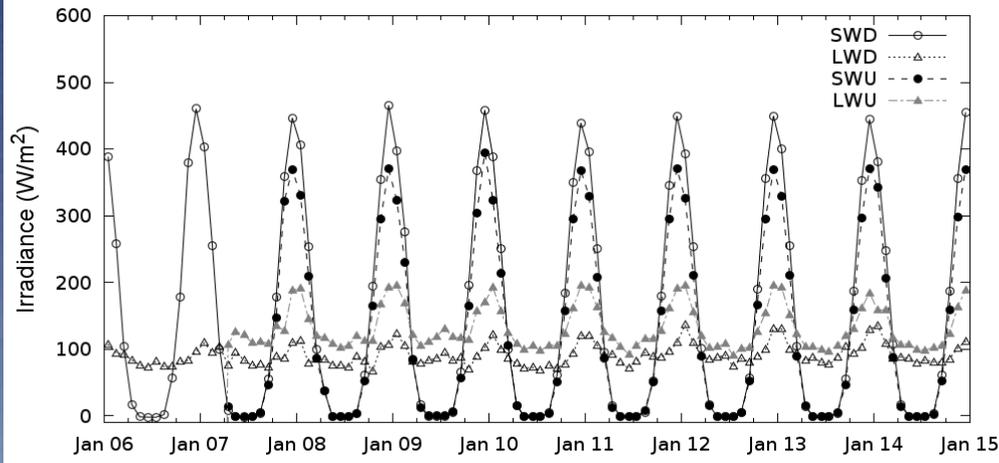
Ruolo di aerosol, vapor d'acqua e nubi sul bilancio della radiazione



Baseline Surface Radiation Network

(osservatorio 2009/B.04)

- Surface radiation balance
- Albedo, Spectral albedo (Strap-b)
- Atmospheric transparency
- Cloud radiative forcing
- Columnar gas contents wv, ozone
- Columnar Aerosol Content
- UVA, UVB, erithemal doses
- Chemical processes at snow interface



Platform B: albedo rack
Upwelling components

Platform A: tracker
Shortwave and longwave
broadband incoming radiations

Platform C: tower
Upwelling SW (larger footprint)

Arctic and Antarctica – Bi-Polar view!



Necessità di integrare e coordinare le attività fra i due poli



Esempi di attività in Artico



Alcuni spunti per la discussione

GENERALI:

Quali sono le richieste della comunità internazionale ?

Quali le collaborazioni in atto e quali quelle da intraprendere?

Sviluppo di idee e strategie per il rafforzamento della presenza internazionale del programma.

Obiettivi:

Aumento delle capacità osservative

Contributo alla validazione di prodotti satellitari e modelli climatici

Miglioramento dei modelli di previsione e meteo-climatici

Strumenti :

Programma nazionale e adesione a opportunità Europee ed internazionali (EC, ESA, WMO, etc.)

Basi Italiane Esistenti e presenza in basi Internazionali

Sviluppo di Sensori e misure

Gestione dati esistenti e futuri presenza in network di distribuzione

Grazie per l'attenzione !!

