

INTERNATIONAL SCIENTIFIC COLLABORATION

ANDRILL (ANtartic geological DRILLing) is an agreement among USA, NZ, Germany and Italy to drill two boreholes more than 1200 m deep through the sea bed in the McMurdo Sound. The same technology as in the Cape Roberts Project (1996) has been used. The samples so obtained furnish information on the climate in the last 25 million years.

EPICA (*European Project for Ice Coring in Antarctica*) began in 1996 at Dome C, where soon after Concordia Station was built. The deep ice coring was completed in 2004, when the depth of 3279 m was reached, thus obtaining the oldest ice sample ever. The analysis of the ice cores has unveiled the history of our atmosphere and climate in the last 800,000 years.

TALDICE (**TALos Dome Ice CorE**) is a joint Project of Italy, France, Germany, Switzerland and UK for ice drilling aimed at the study of climate during the last two interglacial periods (about 250,000 years). The results obtained at Talos Dome supplement the information on the past climate obtained at the coastal sites or from the very deep ice corings (Vostok, Dome C, Dome Fuji).


ITASE (*International Trans-Antarctic Scientific Expedition*) consists of long coordinated journeys on the ice (traverses), where scientists of several Countries onboard of tracked vehicles sample ice on the way by shallow coring.

APE (*Airborne Polar Experiment*) was born in 1995 from an agreement between PNRA and the Russian Institutions Myasishchev Design Bureau and Central Aerological Observatory. The agreement put the capacity of the stratospheric aircraft M-55 Geophysica to good use in order to get measurements in the higher troposphere and lower stratosphere.

BOOMERanG (*Balloon Observations of Millimetric Extragalactic Radiation and Geophysics*), a collaboration between USA and Italy, has obtained the first image of the early Universe and has collected basic information on the first phases of its formation. At that time, just after the Big Bang, it was 1000 times hotter and had a density 1 billion times higher than today.

ENVIRONMENTAL CONSERVATION. Pursuant to the principles of the Madrid Protocol, Italy has set up marine and terrestrial protected areas. International collaboration allows a joint control of those areas: Cape Washington-Silverfish Bay for the protection of the Emperor penguin rockery and the silverfish eggs, which under the sea ice find the best conditions to hatch out; Terra Nova Bay, a site for long-term ecological monitoring.





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The Italian National Antarctic Research Program



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ITALY IN ANTARCTICA

Italy is active in Antarctica since 1985 with the governmental scientific program PNRA (the Italian National Antarctic Research Program). The program is approved and funded by the Ministry for the Education, University and Scientific Research (MIUR).

The main principles for the behaviour of Countries in Antarctica have been stipulated by the Antarctic Treaty (Washington, 1959). Italy joined the Treaty in 1981, under the aegis of the Ministry of Foreign Affairs.

Thanks to the interest shown in getting a better knowledge of the continent through the PNRA, Italy acquired in 1987 the status of Consultative Party in the Treaty and, consequently, the right to vote. On the following year Italy became a Full Member of the Scientific Committee on Antarctic Research (SCAR).

Italy has also been an active party in the constitution of the Council of Managers of National Antarctic Programs (COMNAP), an association of all the national Antarctic programs which promotes the most efficient procedures to support science in the continent.

In 2010 the PNRA has been reorganized following a ministerial decree. The Scientific Committee for the Antarctica (CSNA) sets the strategic lines and evaluates the projects; the National Research Council (CNR) is entrusted with programming

and coordination; the Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) puts into effect the operations in Antarctica.

CNR, ENEA, the Universities and other scientific Institutions place technical and scientific personnel at PNRA's disposal to staff the scientific expeditions, about 200 people per year. The Ministry of Defence contributes as well to the Fulfillment of the Program with specialists from the Army, the Navy, the Air Force.

A contribution to the spreading of the knowledge is given by the National Museum for the Antarctica (MNA), which has three seats located in Genoa, Siena, Trieste.

PNRA has presently one coastal summer Station, named after Mario Zucchelli, the engineer who headed the Program for 16 years, and one Station on the ice plateau, well inside the continent, the latter being inhabited full-year and jointly managed with IPEV (Institut Polair Francais Paul Emile Victor).

PNRA's activities have already yielded remarkable outcomes in many fields such as climatology, astrophysics, biology, Earth sciences, often as a result of international cooperation. Scientific research in Antarctica, the last uncontaminated corner of the Planet, is of paramount value for the knowledge of our past and forecasting of our future.



MARIO ZUCHELLI STATION (MZS)



The Station is located in the area of Terra Nova Bay, 74°42'S, 164°07'E, on the coast, 15 meters a.s.l. It is open from mid-October to mid-February, when temperature ranges from -25°C to +5°C. Katabatic wind often storms in the area with speed suddenly reaching 100 km/h or more. The official time at MZS is the same as in NZ (GMT+11).

The Station accommodates 124 people max, with an average presence of 85. Vehicles, graders, snowmobiles and boats, which amount on the whole to about 40 units, are available. Two to four

helicopters on charter operate in the short range. The Station locally supports most scientific teams with instruments and equipped laboratories, in addition to those in remote camps.

Self-sufficiency is ensured by several facilities such as: a generator system which provides electrical power and, through co-generation, heating as well; a desalter, which makes fresh and drinkable water from sea water; an incinerator; a sewage treatment plant.

All waste is subject to differentiated collection to be locally treated or, alternatively, to be brought back to Italy for recycling or disposal.

MZS is connected to New Zealand by a vessel for personnel and cargo, and by aircraft. Not far from MZS are located the Stations of other countries: Jang Bogo (Republic of Korea), Gondwana (Germany), McMurdo (USA) and Scott Base (NZ). PNRA keeps up a fruitful logistical and scientific cooperation with all of them and other Programs, quite in the spirit of the Antarctic Treaty.

THE ITALIAN-FRENCH STATION CONCORDIA



PNRA by two-engine aircrafts. The official time at the Station is GMT+6.

Concordia is essentially made of two cylindrical three-storey buildings. It has 16 two-bed rooms and is inhabited nonstop since 2005. In wintertime, the Station is managed by a crew of 12 to 16 people. In summertime, with the help of external quarters, the Station accommodates up to 70 people.

Thanks to altitude, low water content of the atmosphere, and low pollution, Concordia is held as the ideal location for astronomical observations and for studying the cryosphere-atmosphere interactions. In addition, the long distance from the ocean favours sensitive seismological recording.

The total seclusion and the harsh environmental conditions make Concordia a sort of laboratory to simulate the problems of surviving in a space vehicle. Biology and medicine studies aimed at understanding man's adaptation to the hostile environment are also performed.

Built after a cooperation agreement between IPEV and PNRA, Concordia is one of the few permanent stations nowadays operating in the continental Antarctica. It is located on a site known as Dome C (75°06'S, 123°21'E), at 3233 metres a.s.l. Here temperature in winter drops down to -80°C.

The station is quite far from the coastal stations of France and Italy (around 1200 km). Heavy loads are mainly supplied care of IPEV by convoys of tracked vehicles and sledges. Light cargo and personnel reach Concordia care of

THE ITALIAN SCIENTIFIC RESEARCH IN ANTARCTICA PROMOTED BY PNRA



THE HISTORY OF THE EARTH IN ROCKS AND SEDIMENTS

In the rocky formations of Antarctica is written a large part of the geological evolution of the Planet. The Italian research is focused on the relationship between geo-tectonic evolution and climatic changes, and on the geophysical characterization of the formations hidden below the ice.

Thematic maps fundamental to the development of new research activities have been issued. The discovery, in the glaciers of Victoria Land, of some areas where meteorites tend to concentrate boosted the studies on planetary geology.



ICE: AN ARCHIVE OF THE EARTH'S ENVIRONMENTAL AND CLIMATIC HISTORY

It is internationally recognized that the study of the ice of the continental ice cap is at the top of PNRA's research. Through the analysis of samples obtained from levels down to 3000 metres in the area of Concordia Station it has been possible to go back up to 800,000 years ago as far as the properties of the atmosphere are concerned. The study has also revealed

that in the last 200 years CO2 concentration has reached values never attained previously, thus confirming that the human activities have the responsibility of the planet's warming up, due to the well-known greenhouse effect.



THE ROLE OF THE SOUTHERN OCEAN IN THE GLOBAL REGULATION OF CLIMATE

Italian oceanography is aimed at investigating the Circumpolar Current and the physical, chemical, biological processes which make the Ross Sea extremely interesting. From the ecology standpoint the Ross Sea is an area of high productivity while it strategically regulates the global climate as a consequence of the large polynyas, i.e. patches of sea which remaining ice-free also in winter.

LIFE AND ADAPTATION OF ORGANISMS

Being located on the shore, MZS is a privileged observatory for research on marine and terrestrial biology and ecology. Studies aim at understanding the trophic chain and the adaptation to extreme temperatures. Actually Antarctica displays a set of unique environments where organisms have developed specific mechanisms to keep their metabolism active at low temperatures, thus reaching a high level of endemism. Presently much interest is paid to the effects of climate changes on the Antarctic biota.



ANTARCTICA AS DRIVING POWER OF THE CLIMATE AND COOLING SYSTEM OF THE PLANET

Solar radiation, the katabatic winds pattern, transport of aerosols and gases from remote areas, dry and wet deposition, dynamics of stratospheric ozone and UV flux at ground level are among the items most studied by PNRA since its beginning. A large network, made of over 20 automatic meteo-stations surveyed by a satellite constellation, is operating in the Northern Victoria Land and is being continuously expanded.

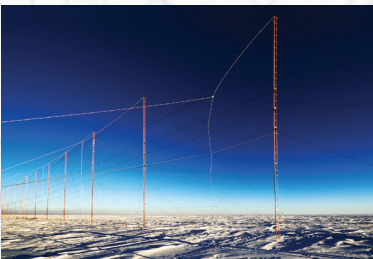
At Concordia radiative and meteorological parameters, snowfall and, more generally, high and low atmosphere are monitored.



THE EARTH'S MAGNETIC FIELD, THE IONOSPHERE AND THE INFLUENCE OF THE SUN

Networks of geomagnetic and ionospheric observatories are installed at MZS and Concordia, and allow the study of the interactions of the solar wind with the terrestrial magnetic field and the ionosphere.

The purpose is assessing the "space weather" to forecast the quality of navigation and communication systems.



MAN'S ADAPTATION TO EXTREME ENVIRONMENT

The Antarctic environment, above all onto the ice cap during the polar night, shows analogies with the space environment.

On this grounds at Concordia Station, which stays isolated for more than 9 months, international studies are performed on man's adaptation to hypoxia, loneliness and lack of natural light.



DEEP SPACE OBSERVED FROM ANTARCTICA

At Concordia Station there is a concentration of astrophysical studies which range from the detection of galactic or extragalactic infrared sources to the microwave background radiation and the search for a footprint left by the gravitational waves at the Big Bang. The ultimate goal is to reconstruct the first instants of the Universe.

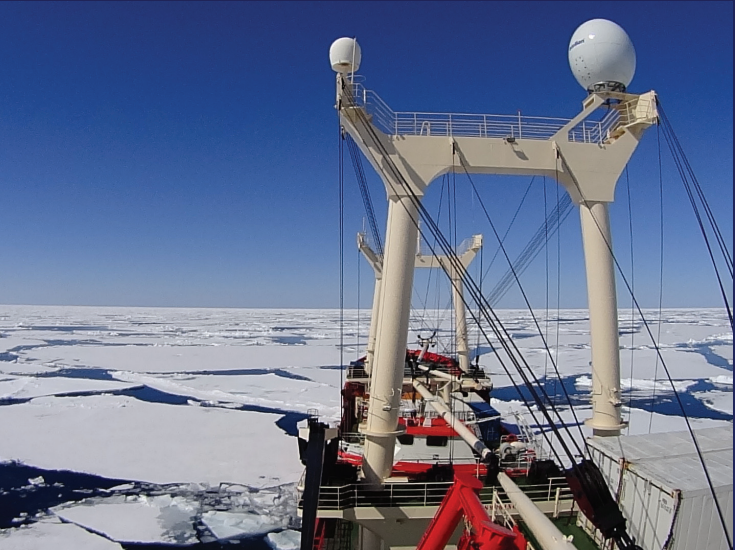


How to reach Antarctica



By air

New Zealand is the nearest Country to MZS. The aircraft chartered by the Italian expedition takes off from Christchurch (NZ) and carries some personnel and cargo. The aircraft is a Hercules L-100. The flight takes about 8 hours. Landing is made possible by an air strip built onto the sea ice by the team which has already opened the Station.



By sea

The ship has been the traditional means to reach Antarctica. Such a means is still unreplaceable when it is necessary to carry heavy loads. The vessel most used by the PNRA has been the M/N Italica. She is 130 meters long and has been equipped to support also scientific research at sea. Italica sails from the harbour of Lyttelton (NZ) and having crossed an often stormy Southern Ocean, reaches Terra Nova Bay in about ten days.

