

INSTITUTE OF POLAR SCIENCES

MAKE THE POINT

Carlo Barbante

The Institute of Polar Sciences of the National Research Council of Italy (CNR-ISP) was founded in 2019. Its activities are carried out by a staff of approximately 60 people, supported by approximately 30 collaborators, operating in the headquarters in Venice and in three secondary sites: in Bologna, Rome, and Messina. The mission of the ISP is to contribute to increasing the quality of Italian scientific and technological research in the polar regions, and to provide knowledge on global changes in support of Italian and European environmental policies by the development of new technologies and survey methodologies.

At the moment, the ISP, and all the Italian polar community, can count on 3 research stations both in Antarctica (Mario Zucchelli and Concordia) and in the Arctic (Dirigibile Italia). The Mario Zucchelli and Concordia stations are managed by ENEA and the latter is co-managed with France and permanently occupied. The Dirigibile Italia Station is a sort of fourth "secondary site" of the Institute, being directly managed by the ISP. All these permanent stations and other permanent infrastructures, like the CCT Tower, and the Gruvebadet Laboratory, give researchers the possibility to carry out long-term monitoring. The ISP is currently active in the fields of atmospheric science, biology and ecosystems, studies of the cryosphere, paleoclimate, oceanography, and environmental contamination.



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TOP STORIES Ice Memory: save the ice

<u>Fabrizio De Blasi</u>



(Credits: Roberto Cilenti)

The Gorner glacier on the Monte Rosa massif holds the most studied and important glacial archive in the Alps. On the glacier saddle Colle Gnifetti, the ice is over 80 meters thick. Here, researchers find valuable information on the environment and climate of the last ten thousand years. For this reason, the Italian-Swiss team wants to extract ice cores from the higher, still 'cold' glacier on Monte Rosa as soon as possible for the international project Ice Memory. One of the core samples will be transported to an 'archive' of the Earth's mountain glaciers that will be created in Antarctica. The mission has been organised by the Institute of Polar Sciences (ISP) of the Italian National Research Council and Ca' Foscari University of Venice, in collaboration with the Swiss Paul Scherrer Institute. It will start from Alagna Valsesia (Vercelli), at the foot of Monte Rosa. The researchers will spend two nights at the Capanna Gnifetti refuge (3,600m), in order to acclimatise. If the weather conditions are favourable, the researchers will fly up to more than 4,500 meters a couple of days later, to begin with their work, taking deep core samples. For the duration of the drilling mission, which is expected to last about 10 days, scientists will stay at Capanna Margherita – at 4554 metres the highest

mountain refuge in Europe, built on a rocky peak 128 years ago for the purpose of contributing to scientific research in the field of altitude physiology and, more recently, of climatology. Glacier archives like those at the Monte Rosa massif become increasingly rare in the Alps and this is one of the last chances for scientists to collect ice cores that have not yet been corrupted by climate change and that can offer invaluable information on the history of our climate. The mission, initially scheduled for early May, has been postponed due to adverse weather conditions, however a new attempt to climb Colle Gnifetti will be scheduled as soon as weather conditions allow. During the drilling operations, space will be dedicated to scientific outreach, in fact the press will be allowed to see the high-altitude drilling camp.

The expedition on Monte Rosa is the second in a series of expeditions financed jointly by the Italian Ministry of Education, University and Research, and the Paul Scherrer Institute.

Other information can be retrieved directly from the social channels of the Ice Memory project.



(Credits: Margit Schwikowski)



<u>Mauro Mazzola</u>

June 2021

The covid-19 pandemic has upset everyone's life and way of working. This has not spared the research activities that take place at our base. In fact, a bit of everything has happened in the last year. One of our technicians remained "confined" (albeit voluntarily) until last June. Then we closed the base for the 3 summer months and the routine activities were entrusted to the colleagues of the Norwegian Polar Institute (NPI). In September, the improvement in the international epidemiological situation allowed a group of ISP researchers to reach Ny-Ålesund, but immediately afterwards Norway imposed quarantine on anyone entering the country. From that moment on, we have resumed regularly sending pairs of researchers to



ISP researchers just landed in Norway in September 2020 (Credits: Patrizia Giordano)

the base, generally young post-docs, to manage the activities of the base for periods varying between 2 and 3 months. Some of them are students of the PhD course in polar sciences at Ca' Foscari, with which ISP collaborates.

With spring 2021, although the pandemic has not yet passed and quarantine is still required, some specific field activities have resumed, such as the installation of new instrumentation for gas and aerosol measurement at the CCT and Gruvebadet, and monitoring annual snow cover on the glaciers around Ny-Ålesund.



Climate Change Tower (Credits: Massimiliano Vardè)

We hope that it will soon be possible to put this difficult situation behind us and fully resume scientific activities in the field. Several are already planned for the summer, especially related to biology and hydrology, and we hope that they can be carried out fully and with the participation of an adequate number of researchers and technicians.

RESEARCH HIGHLIGHTS

What happens at Col Margherita?

<u>Jacopo Gabrieli</u>

From the San Pellegrino Pass it takes a few minutes by cable car, recently renovated, to reach the Col Margherita. From the arrival station, with a quick and easy walk you can reach the highest point at an altitude of 2550 m. At every step, the already incredible panorama opens up more and more, revealing in their beauty all the main peaks of the Dolomiti mountains.



Col Margherita Station (Credits: Warren Cairns)

It is right here, in one of the places on Earth where it is easier to imagine the Paradise, that scientists from the Institute of Polar Sciences of the Italian National Research Council (CNR-ISP), study the chemical composition of the atmosphere in order to evaluate what are the impacts of human activities and climate change on the most remote and uncontaminated environments on the planet. Col Margherita station, active since summer 2011, is a node in the Global Atmospheric Watch (GAW) network. The choice of this site was motivated by the extraordinary purity of the air present in this area of the Dolomites which, although relatively close to the populous and industrialized Po Valley, has chemical characteristics comparable to those detectable in the most uncontaminated remote sites. The lack of other monitoring stations in the Eastern Alps also makes it essential both to integrate the data of other observers and to study the dynamics of cross-border transfer of pollutants.

Land mountain areas are by their very fragile ecosystems and are among the regions most sensitive to climate change and the impacts of human activities. Precisely because of this peculiarity, high-altitude regions are often considered real "sentinels of change" as they respond quickly and intensively to climatic and environmental changes.



Instrumentation at Col Margherita Station (Credits: Warren Cairns)

The role of Col Margherita station in this worldwide monitoring network is to study the basic levels of various elements in a high-altitude Alpine site. In fact, the altitude of the site, together with the peculiarities of its geographical position and the circulation dynamics of the air masses, mean that in this station, it is possible to determine the average values of pollutants present in the troposphere, practically without directly suffering from emissions on a local and regional scale.



Col Margherita Station (Credits: Warren Cairns)

THE COMMENT

Amazing levels of Hg in Greenland!

Warren Cairns

Recently, the article in <u>Nature Geoscience</u> entitled "Large subglacial source of mercury from the southwestern margin of the Greenland Ice Sheet" forced mercury into the news.



(J.R. Hawkings et al., Nature Geoscience, 2021. https://doi.org/10.1038/s41561-021-00753-w)

As we all know mercury is a toxic element that can accumulate and magnify in the food chain, especially in its more toxic methylated form. This paper reports levels of dissolved mercury of 1750 pM in waters from the southwestern margin of the Greenland Ice Sheet, which is the equivalent of 121 ng L⁻¹ or 0.12 μ g L⁻¹. This level is very high for aged Arctic snow melt, (our values in Arctic for surface snow are around 25 ng L⁻¹). For comparison, values in Arctic rivers have a maximum of about 14 ng L⁻¹ and the maximum permissible level in European drinking water is 1 μg L⁻¹. Even more concerning is the concentration of 51000 pM (about 10 µg L⁻¹) of particulate mercury in the melt waters and a concentration of 44 nmol g⁻¹ of mercury (8.8 μ g g⁻¹) in the particulate material, which would only be consistent with a viable mercury mine beneath the ice sheet.

In a <u>press release</u> the authors report "Particulate mercury carried by glacial flour (the sediment that

makes glacial rivers look milky) was found in very high concentrations of more than 2000 ng L^{-1"}. The high levels in the particulate matter suggest that the source is geological not anthropogenic, since mercury deposited during atmospheric depletion events is the highly soluble ionic form.

However, there are a lot of unknowns and this merits further study. Particularly worrying are the level of methyl mercury found in the water column. The levels of up to 16.2 pM (3.5 ng L^{-1}) are considerably higher than those that we have found in the past in the Venetian Lagoon (0.13 ng L⁻¹) and could pose a risk to the local population if these concentrations have managed to biomagnify up the food chain.

This paper highlights that the effects of climate change on the globe's glaciers are not just limited to sea level rise. As these glaciers melt, materials and substances from the past can be released into the rivers and oceans and re-enter the water cycle and the food chain.

This an urgent need to check these results as the levels are quite incredible. If found to be true they pose a large health risk to the local population and ecosystem. It would become imperative to carryout biomonitoring of the local population to see if they are exposed, and analysis of mercury at all trophic levels of the local food web.



(Credits: Nicoletta Ademollo)





Massimiliano Varde Inclus Inclus Inclus Inclus



Gruvebadet building, once housed the Ny-Alesand miners' showers (hence the name), was restructured to become an atmospheric observatory on 2010. Now it includes numerous activities to study the composition of the atmospheric aerosol and other parameters of environmental interest.

(Credits: Marco Casula)

..... and from MESSINA

For the Messina office in 2021, a positive two-year period has ended since the establishment of the Institute. Five scientific projects four National of the PNRA, two of which led by researchers of the headquarters, and one international in collaboration with the Chinese Academy of Sciences - have finished their activities. On the other hand, activities have begun for three PNRA, two PRA and two INTERACT projects, in which the Messina researchers participate as heads of the Research Unit or Principal Investigator. There are many scientific publications produced as part of these project activities from the topic of marine biology to astrobiology, including participation in three chapters of the world Ocean Assessment II.



Francesca Spataro e

Secondary site of Messina





POLAR CHRONICLES AND

Leonardo Langone

The permanent oceanographic moorings on Svalbard. Two different research teams from the Bologna office will set off to maintain the oceanographic moorings operated by the Institute of Polar Sciences. In early September, the first group will recover the 3 moorings currently active in Kongsfjorden. Mooring Dirigibile Italia (MDI) was first deployed in the inner fjord in Sept. 2010 and since then has continuously acquired currents, temperature and salinity data at different water depths. A time-series sediment trap allows the sampling of



Sediment trap recovery (Credits: Patrizia Giordano)

sinking particles. A new sediment trap for microplastics collection, a time-series passive sampler of trace metals and organic pollutants in solution, an acoustic recorder, a PAR sensor and a sensor of fluorescence and turbidity

..... CURIOSITIES

<u>Clara Turetta</u>

Polar auroras are a fascinating phenomenon due to a diffuse luminescence that often takes on different colours and changing shapes. Northern lights in the northern hemisphere and southern lights in the southern hemisphere... a coloured ribbon up to 1000 km long, with predominantly green or reddish hues, that illuminates the sky in the polar night. Auroras are generated by the activity of the sun and are linked to the charged particles that are emitted in all directions during solar flares. When these particles reach the terrestrial ionosphere, they interact with the magnetic field and

will be added to the instrumented array. Mooring MAP (Mooring Aldo Pontremoli) was positioned last year near the mouth of the Bayelva river for the study of the remobilization of the permafrost. Mooring KIM (Krossfjorden Italian Mooring) is working on the entrance to the Krossfjorden and provides information related to the influence of the Atlantic Ocean on the fjord waters. After downloading the data and changing the batteries, the 3 moorings will be put back for another year of measurement.

The second research group will embark on Laura Bassi, the Italian icebreaker by OGS. The task will be to restore the mooring S1 that the CNR has been maintaining in close collaboration with OGS since 2014. In recent years this mooring, located in the Strait of Fram, has been serviced thanks to the support of the ship Alliance by IIM in the Arctic "High North" cruises. In 2020, the maintenance of this mooring could not be carried out due to COVID. In March 2021, S1 mooring released on its own and began to drift. Thanks to a satelliteconnected beacon, we were able to follow its drift and to organize a "Search and Rescue" activity. After a 110mile chase, a Norwegian Coast Guard patrol vessel recovered all instruments and brought them back to Tromso. The efficiency of the recovered instrumentation will be checked, data will be downloaded, trap samples will be stored, and after thorough maintenance, the mooring will be deployed again in its original position. A second mooring of Norwegian colleagues will be also deployed, in a coordination effort between the naval infrastructures of the two countries and with the agreement that next year the mooring servicing can be done by using a Norwegian ship.



Ny-Ålesund, Svalbard Islands (Credits: Federico Dallo)

ionize the neutral atoms present. The recombination of ions and electrons causes energy to be emitted in the form of green light in the case of oxygen and red light in the case of nitrogen.

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IN BRIEF

- The <u>sampling campaign on Monte Rosa</u> of the Ice-Memory project, organised by the Institute of Polar Science of the CNR and Ca' Foscari University of Venice in collaboration with the Swiss research centre Paul Scherrer Institute, has been successfully concluded. During the mission, the research team extracted two ice cores over 80 metres long, at an altitude of 4500 metres. In the segment closest to the rock, the sample could contain information about the climate and environment up to 10,000 years ago. If analysis confirms this, it will mean that the oldest ice in the Alps will be preserved in Antarctica's 'glacier library'.
- New AMAP reports released on 20.05.21, including <u>Arctic Climate Change Update 2021</u>. A key finding is that the increase in Arctic annual mean surface temperature between 1971 and 2019 was three times higher than the increase in the global average.
- Also released the <u>European State of the Climate 2020</u>, compiled by the Copernicus Climate Change Service (C3S), with a special focus on the Arctic.
- The first sampling campaign, scheduled for August, of the bipolar "MicroPolars" PNRA project, coordinated by Maria Papale is now approaching. Sampling activities, conducted in a lacustrine systems in Ny-Alesund, will see the participation of the Universities of Pisa and Valencia (Spain) and will have the aim of relating microbial communities and pollution levels.
- As part of the INTERACT "BIP" project, coordinated by Angelina Lo Giudice, researchers and associates from the Messina and Rome offices, in collaboration with the University of Pisa, will conduct a sampling campaign along the Pasvik River (Arctic Norway), for the study of benthic filter-feeding organisms as accumulators of microbiological and chemical contaminants. The researchers will stay at the NIBIO Base in Svanhovd.

UPCOMING EVENTS

- The XLIII ATCM (<u>Antarctic Treaty Consultative Meeting</u>) kicks off in Paris from 14 to 24 June. Maurizio Azzaro will be a member of the Italian delegation and alternate of the Head of Delegation Dr. Orazio Guanciale of MAECI in the WG2 (Science, Operations, Tourism) and in the plenary session.
- The EU's Arctic influence: presentation of <u>a report on the EU actions affecting the arctic</u>. EU-funded virtual seminar on 17 June, 2021, 14:30-17:00 (CET).
- In September, the first workshop of the Institute of Polar Science (ISP) will take place in Rome at the CNR. Leading figures in polar research are expected to speak.

