

INSTITUTE OF POLAR SCIENCES



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Paris - brought together experts and leaders from over forty nations with glaciers and polar regions for the first time.

In the face of the accelerated metamorphosis of the cryosphere in polar and high-altitude regions, the recommendations made by scientists and NGOs emphasised above all the urgency of drastically reducing greenhouse gas emissions and eliminating investments in fossil fuels to limit global warming to 1.5°C, recognising however that this will not be enough to completely stop the disappearance of ice.

All agree on the need to preserve the memory of the ice, and French President Macron himself in his closing speech mentioned the [Ice Memory Project](#), of which the Institute of Polar Sciences is a founder.

As a preamble to the Paris Manifesto for Glaciers and Poles, and before handing over their scientific report to President Macron, the Summit's Scientific Council, followed by the NGOs, stressed the urgency of preserving our Planet's cryosphere for the scientific value and cultural heritage it represents for future generations.

UNDER THE SPOTLIGHT

Conclusions of the One Planet Polar Summit

[Carlo Barbante](#)

Aiming to act for the cryosphere, the One Planet-Polar Summit - held from 8 to 10 November in



REPORT

International Relations Group's activities

[Nicoletta Ademollo](#) and [Working Group on International Cooperation](#)

Representing the Institute as the International Relations Group, we participated in two very important events. From 11th to 14th of September 2023, the [Interact General Assembly](#) took place in the beautiful setting of the Toolik Arctic Station in Alaska (USA). During 3 intense days, we shared best practices, exchanged ideas, and updated each other on progress made since the last meeting.



Group photo of the 2023 General Assembly in front of Atigun Gorge (Alaska, USA)

During the meeting, many discussion points were addressed, it was also very useful to exchange knowledge and experience between the station managers of the various stations that are part of the Interact family. The presentations by the various station managers showed how, during this year, many of the scientific bases have upgraded their remote sensing and communication capabilities, created new IT products for monitoring and community awareness, including the development of very interesting apps; tools that are also very useful for the involvement of indigenous and local communities. In the second part of the meeting, the various partners of the [European project Interact](#) showed the progress of their working groups, most of which have

achieved their final objectives. It was a wonderful and successful event thanks to the kindness and competence of the managers of the Toolik Arctic base who were excellent hosts in an extraordinary environment.

In mid-October from 19-21 October, at the Harpa Concert Hall and Conference Centre in Reykjavík, Iceland, we participated in [Arctic Circle Assembly](#), which was an outstanding and impactful event,



Speakers of the session "The Italian Contribution to Monitoring and Sustainable development of the Arctic" from left: Prof. M. Santarelli (Politecnico di Torino), Prof. C. Barbante (ISP-CNR), Amb. S. Nicoletti (Italian Ambassador to Norway and Iceland), Dr. D. Meloni (Enea), Dr. C. Di Iaconi (IRSA-CNR), Dr. N. Ademollo (ISP-CNR), Dr. V. Vitale (ISP-CNR)

bringing together a wide range of expertise and perspectives to address critical issues in the Arctic region. Arctic Circle is a veritable think tank, where experts from various fields, government officials, scientists, indigenous leaders and concerned citizens come together to discuss, debate, and collaborate on solutions to the most pressing issues facing the Arctic. This year over 700 speakers participated in over 200 sessions covering a wide range of important and highly relevant topics, including climate change, environmental conservation, indigenous peoples' rights, sustainable development, and the geopolitical challenges facing the Arctic region. Our Institute together with the Italian Embassy in Norway organised the session 'The Italian Contribution to Monitoring and Sustainable development of the Arctic'.



NEWS FROM DIRIGIBILE ITALIA

Happy Holidays!

As every year

Mauro Mazzola

..... the December issue of this newsletter allows to take stock of the activities that took place at the station during the last year.

2023 saw the number of projects and researchers present in line with those of previous years, which now stand at about 30 projects and about 1,500 man-days, respectively. Hosted projects include both projects funded by the Program for Research in the Arctic and the EU Recovery Plan, international projects such as Ice Memory, but also INTERACT, SIOS and RCN access projects. The call for 2024 activities closes in these days and we hope to have new proposals!



Ice Memory team at Ny-Ålesund.
Credit: R. Selvatico©CNR-ISP

But there was also big news this year.

The most important is definitely the start of the collaboration with the Guardia di Finanza for safety support of researchers doing field work.



Lieutenant Colonel Alessandro Alberioli, and Marshall Nicola Zarbo

In fact, two people from the corps' Mountain Rescue team visited our base at the end of the summer for an initial reconnaissance of the environment in which the researchers will be working. This will allow them to better plan their support in 2024, during the period between April and August. During the winter, mountain rescue personnel will also organize training days in Italy for researchers who plan to carry out activities on glaciers near the station.



The second major innovation, also related to the safety of our researchers, is the availability of an electric car for short trips to research facilities, such as CCT and the Gruvebadet laboratory.



During the polar night period, in the presence of polar bears, being able to move around in a car makes the activity safer and more comfortable, the fact that the vehicle is electric avoids disturbing the measurements of atmospheric particulates and gases that are carried out by the researchers.

Sadly, in 2023 our dear colleague Angelo Pietro Viola, who did so much for this base and is sorely missed, passed away.



Angelo Pietro Viola

Turning to current events, the first two doctoral students from the course in polar sciences at Ca Foscari University in Venice reached the base a few days ago for their internship period. More of their colleagues will follow until March 2024. The doctoral students will assist the current base chief Tessa Viglezio in managing monitoring activities. Thanks also to Simonetta Montaguti, who after a year and a half of excellent service to the base has moved on to devote herself to another research project. Good luck!



Simonetta Montaguti e Tessa Viglezio

Last but not least, the CNR recently renewed the contract with KingsBay, the company that runs the Ny-Ålesund Research Village, which will allow us to continue research activities for the next 5 years!



Holtedahlfonna camp - Ice-Memory project



Ice core from Holtedahlfonna – Ice-Memory project



RESEARCH HIGHLIGHTS

The Ice Memory project on Monte Rosa: new deep core drilling on Colle del Lys

[Giulio Cozzi](#)

At the beginning of October 2023, as part of the Ice Memory project, funded by the MUR (Italian Ministry for the University and Research) and coordinated by the Institute of Polar Sciences of the CNR, deep core drilling was carried out on the *Colle del Lys* glacier on the *Monte Rosa* massif. All personnel involved first stayed in Gressoney and then for a few days at the Capanna Gniffetti at 3647 metres above sea level to acclimatise. Afterwards, the researchers went up to Colle del Lys to begin logistical and scientific activities.

The working group, composed of ISP-CNR researchers, personnel from Ca' Foscari University of Venice, INGV, the US company Cryosphere Research Solutions LLC, the Guardia di Finanza and the Aosta Valley-based *Fondazione Montagna Sicura*, began sampling operations at an altitude of over 4100 metres.



The working team at the base camp. Credit: Riccardo Selvatico, CNR-ISP

The core drilling site was identified through georadar surveys carried out earlier, in collaboration with the National Institute of Geophysics and Volcanology (INGV), that made it

possible to recognise the depth and stratigraphy of the underlying ice.



Base camp at "Colle del Lys" (4150 m) Credit: Giulio Cozzi, CNR-ISP

Field work was carried out with efficient speed and in an atmosphere of great enthusiasm, over the course of a week of splendid weather. Two cores of good quality, considering the current climatic context, were taken, measuring 105.89 m and 106.40 m in length using an electromechanical core barrel. Their destinies will be different, in fact, one of the two will be sent to Antarctica to the 'Bank' that stores ice for future research, as envisaged by the Ice Memory project mission, while the other will be studied in the laboratories of the CNR's Institute of Polar Sciences. The climate information contained in the ice of this Alpine site will shed new light on the dynamics of the climate not only in Europe but also on the history of contaminant emissions over past centuries.



Drilling activities. Credit: Riccardo Selvatico, CNR-ISP



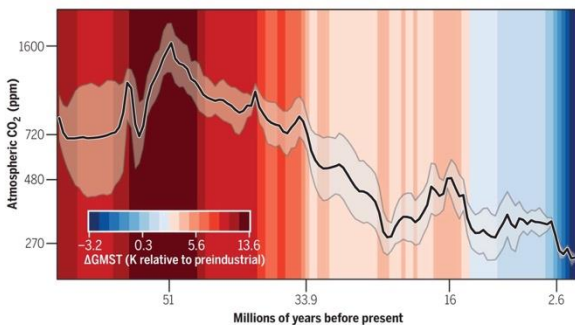
The “Keeling Curve” of CO₂ in the Cenozoic

[Paolo Montagna](#)

A recent international study, which involved the Institute of Polar Sciences of the CNR, and published in “[Science](#)”, has reconstructed the fluctuations of atmospheric CO₂ over the last 66 million years. In this project that lasted seven years, researchers analyzed various geological records, selecting the most reliable data, estimating uncertainties, and refining chronological models.

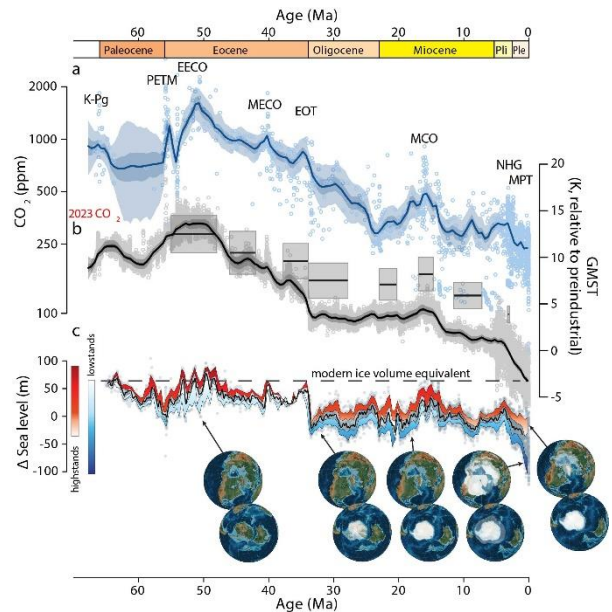
Over 6000 data points were analyzed, obtained from various biological and geochemical proxies from terrestrial and marine archives, such as the isotopic composition in the shells of carbonate organisms collected from marine sediments, the density of stomata in fossil leaves, and the chemistry of paleosols. The results of the study indicate a clear positive relationship between CO₂ levels and the mean global terrestrial temperature and suggest that a doubling of atmospheric CO₂ could raise the planet's average temperature by 5-8 °C, an increase significantly higher than previously predicted.

The study confirmed that the warmest period was about 50 million years ago, with CO₂ levels reaching 1600 ppm and temperatures up to 12°C higher than today. About 34 million years ago, the reduction in CO₂ led to the development of the current Antarctic Ice Sheet.



Reconstruction of atmospheric CO₂ over the last 66 million years, obtained from the analysis of ice cores, ancient soils, and ocean sediments. Credits: [Science](#)

Subsequently, there was a further decrease in CO₂, a period during which the ancestors of many of today's plant and animal species evolved. This highlights how variations in this greenhouse gas have an impact not only on the climate but also on ecosystems. Furthermore, the study found that the current level of CO₂ in the atmosphere, which is 420 ppm and mainly caused by human activity, has not been reached in the last 14 million years.

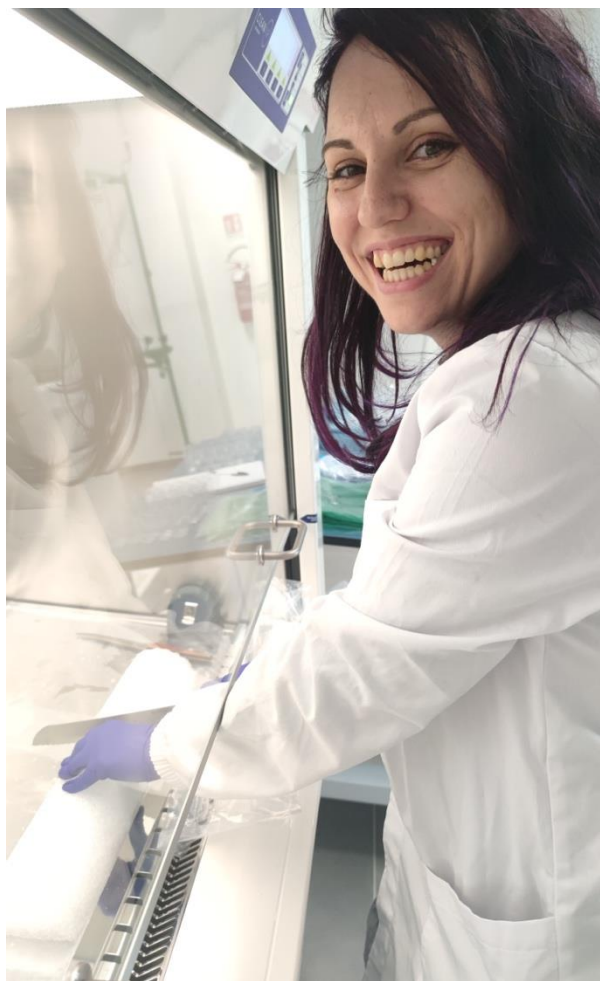


Reconstruction of atmospheric CO₂ (A), global mean surface temperatures (B), and sea level (C) over the last 66 million years. Credits: [Science](#)



Polar Early Career Scientists

[Giuditta Celli](#)



Giuditta Celli, a 3rd year PhD student in polar science, is spending her 6 months period abroad at the University of Manitoba, in Winnipeg, Canada. The PhD project is focused on the East Antarctic Plateau, where snow and ice core samples were taken in the 2019-2020 Australian summer during the East Antarctic International Ice Sheet Traverse (EAIIST) Project. The samples are being analysed to understand if and how, the fluxes of photochemical elements such as mercury and iodine, between the snowpack and the atmosphere, are influenced by increased amounts of solar radiation that can reach the snowpack surface during the ozone hole formation. A first paper has been published with preliminary results (Celli G., et al. «Bromine, Iodine and Sodium along

the EAIIST Traverse: Bulk and Surface Snow Latitudinal Variability», Environmental Research). The results of this will be supplemented with field and laboratory tests at the University of Manitoba, focusing on mercury, a toxic and dangerous element for living beings. Here, the sunlight penetration into the snowpack is evaluated in the field with a spectroradiometer to obtain a UV-Vis spectrum correlated with the snow depth. These data will be used in the second part of the laboratory experiment, where a defined amount of snow sampled from outside, will be irradiated with a solar simulator, to reproduce in a controlled environment, the natural mercury emission from the snowpack. This will be monitored throughout the reaction period. The results of this project would help us to have a better understanding of how mercury behaves in the snowpack and how deep in the snow it is sensitive to solar radiation. This will in the end, help our interpretation of the influence of the ozone hole on the geochemical cycle of mercury.



Surficial snow sampling



Halogens in the SE-Dome ice core, a valuable seasonal signal

Delia Segato



SE-Dome, or South-East Dome, is one of the Greenland sites with the highest snow accumulation, where an average of 3 meters of snow is deposited each year. Thanks to this, impurities that accumulate in the snow are largely preserved due to the deposition of overlying snow layers. By analyzing these snow layers, we can observe seasonal trends, helping us understand when and why we find higher concentrations of certain chemical species compared to others.

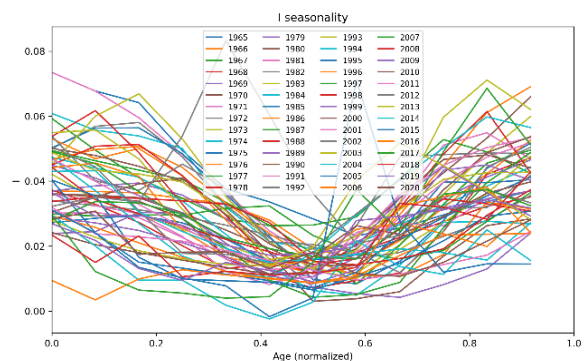
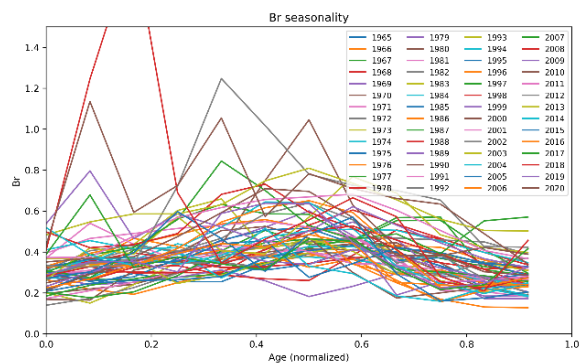
For this reason, in 2020 a Japanese team extracted the SE-Dome ice core. This core, measuring 250 meters in length, allows the reconstruction of the deposition of chemical species dating back to 1827. The core was then cut into sections of a few centimeters to obtain a high-resolution signal. The samples were sent to CNR-ISP in Venice, where I conducted the analysis of bromine and iodine using an inductively coupled plasma mass spectrometer (ICP-MS).

Bromine and iodine are species whose atmospheric chemistry is influenced by sea ice dynamics. During the polar spring, bromine is emitted from the surface of seasonal sea ice during processes known as bromine explosions. Iodine is emitted under similar circumstances but due to a different process, namely emission by algae living in sea ice. These algae accumulate high concentrations of iodine (specifically hypoiodous acid) intracellularly through enzymatic processes

and release it due to oxidative stress caused by solar radiation during the polar spring. These processes lead to an enrichment of iodine in the atmosphere compared to seawater, which then deposits onto the snowpack in concentrations influenced by these biochemical processes. Reconstructing the concentration of halogens in ice cores allows us to understand the dynamics of sea ice at the time when deposition occurred.

Both bromine and iodine measured in the SE-Dome ice core show a clear seasonal signal. The bromine seasonality, with its summer peaks highlighted in all 38 years analyzed in this core, illustrates how bromine explosions on the surface of sea ice influence the chemical composition of the atmosphere and snow. In contrast, iodine is present at lower concentrations during the summer months, likely due to photochemical re-emission from the snowpack.

The results are preliminary, and a more in-depth study will be needed to correlate these findings with recent environmental variations in the South Greenland area. These studies are crucial to better understanding the halogen cycle and its impact on atmospheric chemistry.



Seasonality of bromine and iodine in the SE-Dome ice core



POSTCARDS FROM THE FIELD

One Planet-Polar Summit in Paris concludes

In view of the future goals for cryosphere research, the Paris Declaration for Glaciers and Poles includes some important announcements:

- President Emmanuel Macron's announcement of more than one billion euros to support French polar research.
- Launch of the United Nations Decade for Polar and Glacial Sciences from 2025 to 2035.
- Ice Memory is one of the 'major projects already agreed', which will be a key part of the Decade.
- Protection of the most threatened natural areas at the poles and on glaciers.
- Determined participation in the International Year of Glaciers in 2025.

Carlo Barbante



The Research Night, held on 29 September 2023, is a European initiative to celebrate science and bring the public closer to future scientific challenges. ISP researchers participated at this event with an exhibition entitled "Amongst the Polar Ice to study the Earth". They illustrated the characteristics of the polar areas and the current research activities carried out. To stimulate the interest of the younger public, recreational activities focused on the exhibition theme, were organised.

- Luisa Patrolecco Paolo Plini Serena Sapia
 Emilianina Valentini Chiara Ripa
 Marco Salvatore Sabina di Franco Gianmarco Barone
 Chiara Marinelli Rosamaria Salvatori Tanita Pescatore
 Francesca Spataro
 Jasmin Rauseo Sara Liburdi



Credits: Francesca Spataro, Luisa Patrolecco©CNR-ISP





UPCOMING EVENTS

- [Managing Marine Ecosystems in a Rapidly Warming Arctic](#), 16-18 April 2024 – Fram Center, Tromsø, Norway. Third International Conference on Ecosystem Approach to Management in the Arctic Large Marine Ecosystems. The conference will exchange current lessons and best practices for the implementation of EBM in the Arctic and examine how these practices reflect the knowledge, the goals, the advice, and the voices of the people living in and from the Arctic. [Early bird registration here.](#)
- [Summer school on Ice Sheets and Glaciers in the Climate System](#). The next Karthaus course will be held from 22 May to 31 May 2024 in Karthaus (northern Italy). The course is open for applications. [Deadline for applications is 10 January 2024.](#)
- [Arctic Science Summit Week \(ASSW\) 2024](#). The Arctic Science Summit Week (ASSW) 2024, including the Arctic Observing Summit, will be held in Edinburgh, Scotland. ASSW 2024 will take place from 21 – 29 March 2024.
- [IASC State of Arctic Science Report](#) - International Arctic Science Committee. The International Arctic Science Committee, is a non-governmental organisation that aims to encourage, facilitate and promote cooperation in all aspects of arctic research in all countries engaged in arctic research and in all areas of the arctic region.
- [Urgent messages from the South: Antarctic and Southern Ocean Science and policy. Strategic Plan 2023 - 2028](#). The Scientific Committee on Antarctic Research (SCAR)'s new strategy focuses on the climate crisis and the role of SCAR as the leading scientific organization on Antarctica.
- [International Polar Year 2032-33](#) - International Arctic Science Committee. In October 2023, the organisations currently involved in the Planning Group have released an [initial concept note](#) and timeline for the 5th International Polar Year 2032-33. Why an International Polar Year in 2032–33? This is a critical decade for people and the planet. A 5th International Polar Year (IPY) will provide a vital opportunity to close outstanding major knowledge gaps through targeted attention and globally-coordinated action enabling polar researchers, knowledge holders, rights holders and stakeholders to achieve major breakthroughs in the knowledge required to protect the global environment, develop effective national and local strategies to mitigate and adapt to environmental changes, and accelerate progress towards achieving the UN Sustainable Development Goals.



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