

## INSTITUTE OF POLAR SCIENCES

## MAKE THE POINT

Luisa Patrolecco

When, about three years ago, the establishment of a CNR Institute of Polar Sciences (ISP) began to be envisaged, the location of one of its offices in Rome was totally uncertain, few would have bet on it. And here we are: since two years, the ISP secondary office in Rome is located in the Research Area Roma1 of Montelibretti, with part of the staff in the Research Area Roma2 of Tor Vergata. Bet won? The result is not so obvious: researchers from different backgrounds and disciplinary sectors, logistically fragmented on the territory, with the aggravating circumstance of the pandemic, which did not make the challenge easier. Yet, thanks to the great work carried out by the Management and to the strong enthusiasm of all colleagues in their different roles, the secondary office of ISP-Rome is definitely consolidating. Scientific production took a leap forward during the lockdown, reaching a level! remarkable In fact, scientific multidisciplinary has become a strong point of this office. Among the main activities: the study of the diffusion dynamics of organic micropollutants in polar ecosystems as a function of climate change;

remote sensing and hyperspectral monitoring of the extension of the snowpack; thermodynamic processes occurring in the lower layers of the atmosphere through the Climate Change Tower, one of the most important research infrastructures in the Arctic. The ongoing projects are ten, 3 PNRA, 2 PRA, 2 INTERACT, 3 SIOS, together with several proposals still under evaluation: 2 PNRA, 2 PRA, 4 PRIN, one @CNR. Moreover, ISP-Rome benefits from the valuable contribution of colleagues with administrative tasks and technical management of the ISP web page. There is still a lot to do, we are all aware of it. On the other hand, as researchers we like to take up challenges! To definitely win the bet.

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## **TOP STORIES**

## The metrology in Arctic: intercomparison of thermometers and radiation shields (COAT)

## <u>Angelo Pietro Viola</u>

COAT is a project approved by the expert team on Surface Measurement of the <u>World</u> <u>Meteorological Organization-Commission for</u> <u>Instruments and Methods of Observation</u> (WMO-CIMO) to provide an intercomparison of thermometers and radiation shields (T&S) in the polar environment.

The air temperature measurements, depends on the response of each system T&S to fast temperature changes, residual sun radiation, wind, humidity, etc. This makes the comparability of air temperature measurements, taken around the world, limited, creates inhomogeneities in climate data series and reduces the accuracy and reliability of the long-term air temperature data.

COAT is funded by the <u>European Metrology</u> <u>Program for Innovation and Research</u> (EMPIR) as follow on of the MeteoMet projects and will start in fall 2021 autumn.



COAT working area from the ground .... (Credits: Federico Scoto)

<u>CNR</u>, CEM, <u>INRiM</u> and EDI have designed the operating infrastructure required for the field intercomparison at Ny Ålesund (Svalbard) close to the Climate Change Tower managed by CNR-ISP. The set up for the intercomparison includes 20 separated poles 2 m height fixed in the ground, to

hold 20 sets of T&S. Each set comprises 2 pt-100 (one of them painted in black) in and radiation shield. Different thermometers, not equipped with dedicated shields, will be compared in a Stevenson Screen.



... and from the sky! (Credits: Angelo Pietro Viola)

The Ny-Ålesund metrology laboratory managed by Institute of Polar Sciences-CNR and INRiM, will be involved in this project, by providing onsite traceable calibration of the thermometers.

Finally, a best practice guide to be submitted to the WMO Expert team will be developed. The guide will include standardized testing methods, maintenance protocols and recommendations to improve the performance of instruments for Arctic environments.



COAT working area (Credits: Federico Scoto)



#### Massimiliano Vardè - Marco Casula

#### September 2021

Despite the persistence of the pandemic has slowed down scientific activities, from May to August at the Italian Arctic Station "Dirigibile Italia", Massimiliano Vardè (researcher, ISP-Venice), before, and from early July, Marco Casula (technician, ISP-Venice) took turns as Acting Station Leader. Massimiliano, upon his arrival in early May, had to stop in Oslo for 10 days of quarantine before reaching Svalbard. Marco, thanks to the green pass, managed to get directly to Ny-Ålesund, just in time to celebrate his 30th birthday in good company.

The scientific activities of Massimiliano, with the help of Francesco De Rovere, PhD student in Polar Sciences, mainly focused on the continuation of aerosol sampling at the Gruvebadet Atmospheric Observatory (GVB), sampling of snow surface and snow pit in the adjacent snowfield (Gruvelab and iCUPE projects), in addition to the management of ongoing activities projects of other research groups.

Since mid-June, with the improvement of the international epidemiological situation, it has been possible to return to full capacity in the base, to allow the full performance of all the planned research activities. July and August were two very hectic months for different reasons: a new regulation came into force to be able to carry the rifle, concomitant with an above-average presence of bears in the fjord, it was necessary to

make a manual download of Climate Change Tower (CCT) data, and of two divers positioned in the Bayelva river. Marco, in addition to the sampling activities at GVB, escorted with his rifle and provided support to the IGG team for the ISMOGLAC (glacier melt water) and T-Mosaic (measurement of the active layer) projects, to an IRET project on the impact of herbivorous animals on the Arctic tundra (Grazeact), to the ISP MicroPolars project and to the Polarquest team, passing through Ny-Ålesund. In the last two weeks of August, as part of the INTERACT III project, the station, with Luigi D'Acqui (IRET) and the support of Marco, was involved in a remote access action for a soil, plants, water and sediments sampling campaign of the NitroFresh project (University of Aarhus, Denmark).

On 25 August there was the last midnight sun and in a short time we will dive into the dark: winter is coming!



Snow pit sampling (Credits: Massimiliano Vardè)

## **RESEARCH HIGHLIGHTS**

## When microbes meet with a sponge at the Poles...

### Angelina Lo Giudice

One would imagine that life is sporadic or somewhat static at low temperatures, remaining in a suspended state. This is not the case in polar environments: despite their incredibly harsh conditions preclude life in most of its forms, microorganisms can become dominant in terms of biodiversity and biomass. Not only microbes, but even invertebrates can complete their life cycle in cold habitats. Since many years we are contributing to the still scarce knowledge on the phylogenetic affiliation, ecological roles and biotechnological potential of prokaryotes associated with benthic filter-feeding invertebrates (mainly Porifera) from Polar areas. Symbiosis (as one of the most fascinating



Antarctic sponge specimens (Credits: PNRA)

phenomena occurring in nature) brings relevant implications from ecological, evolutionary and bioprospecting perspectives, especially in extreme environments whose peculiar conditions might be responsible for the development of unique adaptation strategies and interactions. These are affected by diverse environmental parameters and require the establishment of complex signal communication systems and fine regulating processes between the host and its symbionts, as well as within the symbiotic community itself. To date, our studies have contributed to the



Sampling at Thetys Bay (Credits: PNRA)

characterization of sponge-associated prokaryotes in terms of diversity, cell-to-cell communication, metabolic and physiological capabilities. Results have highlighted that polar sponge-associated bacterial communities might be sponge species-specific. Interestingly, the occurrence of the different bacterial populations inhabiting the sponge body may be interregulated by bacterium-bacterium interactions, or intra-regulated by the quorum sensing phenomenon. Finally, the production of bioactive metabolites by associated bacteria could be involved in the selection of symbiotic bacteria and their adhesions to sponge surfaces.



Arctic river sponge (credits: Angelina Lo Giudice)

## THE COMMENT

# Permafrost-carbon climate feedback: what's new in the latest AR6 IPCC?

### <u>Tommaso Tesi</u>

The United Nations' Intergovernmental Panel on Climate Change (IPCC) has released in August the first part of its sixth assessment report (AR6), which will represent the new foundation of climate science for years to come <u>https://www.ipcc.ch/report/sixth-assessment-</u> <u>report-working-group-i/</u>.

Among the different Earth System component discussed, the feedback to climate from thawing permafrost was definitely one of the most awaited. In the AR5, permafrost was hardly discussed because this topic was in its infancy. Yet, the AR5 acknowledged its potentially large feedback to climate change but it was too early to make any projection even with low confidence.

After 7 years and hundreds of published studies, AR6 attempts the first carbon trajectories as a result of thawing permafrost. Since AR5, we now have a better understanding of the carbon stock in norther Polar Regions (1460-1600 PgC, Peta grams of carbon). However, despite accumulating evidence about the reactive nature of permafrost carbon upon thawing, there is an evident lack of general consensus about on its ongoing effect to climate. While there is high confidence that in summer permafrost regions act as carbon sinks there is low confidence about the carbon respiration during the dark periods. It appears evident that wintertime observations in permafrost soils are too short to allow proper upscaling. When we look into the different Green House Gases (GHGs) the picture becomes even fuzzier. For example, atmospheric measurements and inversion at regional/global scale do not show any detachable trend in CH<sub>4</sub> release despite significant increase in air temperature. Yet, there is robust evidence that some CH<sub>4</sub> emissions in the land and ocean realms have increased locally as a result of climate change.

For future scenarios, near surface permafrost extent is expected to decrease with high confidence by the end of 2100 and 2300. There is also high confidence that thawing permafrost will release carbon but there is low confidence about (i) timing, (ii) magnitude and (iii) linearity. In the former Coupled Model Intercomparison Project 5 (CMIP5), Earth System Models (ESMs) did not include the feedback from thawing permafrost, and this remains largely true for CMIP6. Yet some models contributing to CMIP6 do include degradation within the active layer deepening and they all obtained a net release in warming scenarios. Because of this limited ESM capacity, the new AR6 presents results obtained by permafrost-enabled land surface models. An ensemble of these models suggests that the expected permafrost feedback per degree of global warming by 2100 is 18 (3.1-41) PgC for CO<sub>2</sub> and 2.8 (0.7-7.3) Pg Ceq for CH<sub>4</sub>. Yet, the AR6 of these models do not include abrupt thawing in icerich which instead can account for most of the acknowledges that, apart a few exceptions, most documented reactivation of previously frozen-lock carbon. Thus, models exclusively based on gradual release result in large underestimations of the true potential feedback to climate.

In conclusion, the AR6 clearly reveals that critical uncertainties still remain about the response of permafrost in a warming scenario, despite the evident progresses since AR5. More work is clearly needed to accurately feed the next generation of socio-economic models.



(Credits: U.S. Geological Survey - USGS)

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Research Station (Arctic Norway)!

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Greetings from .... Dirigibile Italia

(Sualbard Islands)

## POSTCARDS FROM THE FIELD .....

As part of the PNRA project "Microbial response to human Pollutants in polAr lakes -MicroPolAars", carried out in collaboration with the Cavanilles Institute of Valencia (Spain), the sampling activities of water and sediment from lakes around NY-Alesund have just been completed. The project aims at characterizing the microbial communities (bacteria and yeasts) inhabiting polar lakes, with particular attention to xenobiotic-degrading microbes.

Maria Papale

ts: Maria Papale e Sa

Ιn the context of the "Benthic INTERACT project filter-feeding Invertebrates from the Arctic as accumulators of Pollutants and tolerant bacterial communities - BIP" we carried out sampling activities along the PASVIK River to microbiological conduct and chemical analyses. The project aims at relating the microbial associated communities with benthic filter-feeding organisms with the level of environmental water. contamination (river sediment and sponges).

Angelina Lo Giudice Luisa Patrolecco III Inn

(https://arcticresearch.wordpress.com/2021/08/20/porifera-in-thepasvik-river-accumulators-of-bacteria-and-contaminants/)

## POLAR CHRONICLES AND ......

#### Massimiliano Vardè

The Midsummer party. In the Scandinavian countries it is traditional to celebrate the summer solstice, and a party was also organised in Ny-Ålesund choosing "pirates" as the theme of the party. The local organizing committee in the weeks preceding the event dedicated a couple of hours of his free time, one day per week, to prepare the party. The Pirate party started at 5pm on Saturday 26 June (day chosen because close to the summer solstice and Norwegian midsummer night) having a welcome drink based on rum "the grog" and a choir who sang songs on the theme of pirates.

The kitchen staff of the <u>Kings Bay</u> took care of the meat and vegetable dinner prepared on the grills outside, on the square in front of the harbor warehouse. Inside, a stand was set up with other food and drinks, coloured lights, a place to make up the participants and a space where 2 KB employees played guitar and drums. A treasure hunt enlivened the party: 4 teams challenged each other, with competitions of skill, in search of the treasure of pirates, following the directions on the "pirates" maps prepared for the occasion.

In Ny-Ålesund at the end of June, there were around 80 people: all dressed in pirate theme to attend the party. The most demanding showed off beautiful pirate costumes, others wore improvised costumes. For themed parties, the community of Ny-Ålesund generally uses costumes and second-hand items each year, borrowing them from an old warehouse in the village. A peculiarity of the 2021 party was the presence of

## ..... CURIOSITIES

**First in Antarctica: the Māori.** The history books of Antarctic exploration report, as a period of discovery of Antarctica, the early 1800s. A new study published in the Journal of the Royal Society of New Zealand, by a group of researchers led by Priscilla Wehi of Manaaki Whenua Landcare Research, would show instead that the first to set foot in Antarctica were indigenous Polynesian peoples .... and long before 1800! Oral histories by Māori tell of an explorer named Hui Te Rangiora who, in 650 A.D., led the vessel Te Iwi-o-Atea to "a foggy, misty and dark place not seen by the sun," finding summits that "pierce the skies" but were "completely "bare and

children who by local regulation cannot live in Ny-Ålesund: their presence was due to the stop in the port of Ny-Ålesund of the boat "<u>TOPTOTOP Global Climate</u> <u>Expedition</u>" which collects testimonies on climate change to raise awareness among society and policy makers. In fact, Dario Schwoerer's crew included his wife Sabine and 4 of their 6 children, born and raised in 20 years of worldwide expeditions. But that's a separate story!

The Pirate Party was a great party and like any holiday or leisure event, it helps to get acquainted with the permanent staff of Ny-Ålesund and with other scientists. Finished in the first hours of the Arctic night, everyone came back happy and tired, to their respective bases to go to sleep, ... accompanied by sunlight (which at 79°N, mid-April to late August, lasts for 24 hours).



without vegetation on them." Beyond describing Antarctic icebergs, the histories include what seems to be a description of marine mammals.



Landscape of Antarctica (Credits: PNRA)



## **IN BRIEF**

- September 9<sup>th</sup> the first Italian Workshop on air pollution from particulate matter at high altitude entitled "AEROSOL IN MOUNTAIN SITES" took place in Falcade (BL). The workshop was organized by the Italian Aerosol Society in collaboration with the INSTITUTE OF POLAR SCIENCE-CNR, INSTITUTE OF ATMOSPHERIC SIENCE AND CLIMATE-CNR, Ca' Foscari University of Venice, University of Perugia, ARPA Valle d'Aosta and the Municipality of Falcade.
- ICE MEMORY goes to the south and stops at the Gran Sasso, in Abruzzo (Italy). At the beginning of September some ISP researchers have done a survey to plan recovering of ice cores to preserve evidence of the Calderone, the last and now only glacial snowfield in the Apennines.

## **ABOUT US**

 In "Radar Magazine" Alfonso Lucifredi, naturalist and scientific journalist, talks about the Ice Memory project that involves ISP researchers in the collection of ice-cores, cold archives of the climate of the past. <u>https://www.radarmagazine.net/ice-memory-proteggere-la-memoria-del-ghiaccio/</u>

## UPCOMING EVENTS

- From 22 to 24 September **the first workshop of the Institute of Polar Science** will be held in Rome, at the CNR headquarters, with the participation of leading figures in polar research. The workshop will be carried out in presence, but remote connection will be available.
- Next 12-13 October 2021 at Gif-sur-Yvette (France) the <u>Beyond EPICA Science Consortia meeting</u> will be held. The remote participation, at least in the plenary sessions is foreseen. The meeting will focus on general project presentations (including plans for the next field season and WPs report), Science Consortia workshops and the project EXCOM meeting.
- Next 2–3 November 2021 at Scandic Fornebu, Oslo the third <u>Svalbard Science Conference</u> will take place, organized by the Svalbard Science Forum and the Research Council of Norway in cooperation with The Norwegian Polar Institute and The Ny-Ålesund Science Managers Committee (NySMAC). The conference will focus on achieving excellent science through cooperation; enhance quality within Svalbard research, strengthen interdisciplinary and international networks and consolidate Svalbard as an attractive platform for Arctic research.

