



## VIII PORTUGUESE CONFERENCE ON POLAR SCIENCES

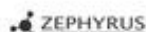
VIII CONFERÊNCIA PORTUGUESA DE CIÊNCIAS POLARES

IGOT-ULISBOA | 26-28 OCTOBER 2016

IGOT-ULISBOA | 26-28 OUTUBRO 2016

PROGRAM AND ABSTRACT BOOK

PROGRAMA e LIVRO DE RESUMOS





## ORGANIZING COMMITTEE

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Gonçalo VIEIRA, CEG/IGOT-ULISBOA  
João CANÁRIO, CQE/IST-ULISBOA  
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Teresa CABRITA, CEG/IGOT-ULISBOA & PROPOLAR  
Ana DAVID, CEG/IGOT-ULISBOA & PROPOLAR

## ENTIDADES ORGANIZADORAS

Centro de Estudos Geográficos / Instituto de Geografia e Ordenamento do Território, Universidade de Lisboa (CEG/IGOT-ULisboa)  
Centro de Química Estrutural / Instituto Superior Técnico, Universidade de Lisboa (CQE/IST-ULisboa)  
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Programa Polar Português (PROPOLAR)  
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## SUPPORT

## APOIOS

Fundação para a Ciência e a Tecnologia (FCT)  
Universidade de Lisboa (ULisboa)  
Instituto de Geografia e Ordenamento do Território da Universidade de Lisboa (IGOT-ULisboa)

## APRESENTAÇÃO

A 8ª Conferência Portuguesa de Ciências Polares é o fórum onde serão apresentados os mais recentes avanços obtidos nos projetos polares nacionais, bem como discutidas as estratégias de cooperação nacional e internacional. A conferência dirige-se à comunidade polar nacional, bem como a todos os investigadores, estudantes, professores e demais interessados nas regiões polares e na sua importância global.

Além da participação de cientistas nacionais, a conferência contará com a presença de cientistas convidados, com os quais Portugal tem vindo a colaborar e a fortalecer parcerias nos últimos anos. Contaremos com a presença da Doutora Renuka Badhe, Secretária Executiva do EPB-European Polar Board, que indicará formas de encurtar as lacunas entre ciência, política e coordenação, do Doutor Soon Gyu Hong, especialista em Microbiologia do KOPRI-Korea Polar Research Institute que nos apresentará uma estratégia de monitorização dos ecossistemas terrestres na região da Península Antártica e do Doutor José Xavier, biólogo marinho que divide o seu tempo de investigação entre a Universidade de Coimbra e o British Antarctic Survey e que, na qualidade de representante de Portugal nos Antarctic Treaty Meetings, nos identificará as prioridades de investigação emergentes na Ciência Antártica.

Associada à 8ª Conferência Portuguesa de Ciências Polares, decorrerá o 7º Workshop de Desenvolvimento de Carreira organizado pela APECS Portugal, que este ano estará subordinado ao tema "Polar quests - Policymaking: Science strikes back".

A Conferência incluirá também um conjunto de sessões adicionais relacionadas com a Ciência Polar que se desenvolve em Portugal. Uma das sessões é dedicada a conhecer a campanha de investigação 2016-2017 do Programa Polar Português (PROPOLAR), com apresentação dos projectos que apoia e a logística nacional associada. Numa outra sessão será dinamizado um painel denominado "Inovação e Desenvolvimento Tecnológico para as Regiões Polares", que tem como objetivo estreitar a ligação entre os cientistas polares e as entidades que se destacam no desenvolvimento de novas tecnologias e no apoio à investigação científica, estimulando o diálogo e a discussão de forma a identificar necessidades e oportunidades de colaboração.

Queremos dar-vos as boas-vindas a Lisboa e à Universidade de Lisboa, e dizer que nos sentimos muito honrados por receber a multidisciplinar comunidade científica nacional que tão profundamente se tem dedicado à investigação, formação e divulgação das Ciências Polares.

Lisboa, 26 de Outubro de 2016

A Comissão Organizadora,  
Gonçalo Vieira, João Canário, Pedro Pina, Teresa Cabrita e Ana David

## INVITED SPEAKERS

### ORADORES CONVIDADOS

#### SOON GYU HONG

Dr Soon Gyu Hong is a PhD Microbiologist from the Seoul National University, South Korea. Currently he is Professor at the University of Science and Technology and Principal Research Scientist at the Korea Polar Research Institute (KOPRI).

Dr Soon Gyu Hong has a qualified teaching career, since 1991, mostly at the Seoul National University but also at the Chungnam National University. His main research interests and activities are related to the evolution and ecology of fungi in Polar Regions, namely related to phylogenetic analysis and DNA sequencing of Antarctic organisms. He is currently responsible for the project 'Long-term ecological researches on King George Island to predict ecosystem responses to climate change'.

Recently, he served as editor of Journal of Microbiology and also as managing editor of Microbiology Journal and Korean Journal of Mycology. His experience also involved administrator activities with "The Korean Society of Mycology" and "The Microbiological Society of Korea".

#### RENUKA BADHE

Dr Renuka Badhe has a PhD in Marine Environmental Biology associated with the British Antarctic Survey and an MPhil in Land Economy with specialisation in Public and Environmental Policy from the University of Cambridge. She currently serves as the Executive Secretary of the European Polar Board, and as the Chair of the EU-PolarNet External Expert Advisory Board. Her prior experiences include working as the Executive Officer at the SCAR Secretariat, with the IUCN Climate Change and Species programme, and with the University of Cambridge. As a part of her responsibilities, she has participated in multinational, intergovernmental and non-governmental meetings, at all levels as an organiser, speaker and delegate. She has contributed to, or co-authored academic peer-reviewed publications, as well as Reports, Working and Information papers for major international meetings. She is also one of the founders of the online forum, Women in Polar Science, which provides a platform for constructive mentorship for girls and women who are interested in STEM fields, and particularly in polar sciences.

#### JOSÉ XAVIER

José Xavier (Cambridge University, PhD) is based at the Institute of Marine Research of the University of Coimbra (Portugal) and at the British Antarctic Survey (UK). He is the Head of Delegation of Portugal at the Antarctic Treaty Meetings, including in the Commission on Environmental Protection. He is also member of international scientific committees of various research programs, expert groups and advisory bodies related to Antarctic science, education and outreach, and policy making. José is the youngest scientist to be awarded the prestigious Marta T. Muse award for his substantial contribution to Antarctic science and policy.



## PROGRAM

### PROGRAMA

27 OCTOBER 2016	HORÁRIO
Registration	08:15 – 13:00
Poster setup	08:15 – 13:00
OPENING SESSION	09:00 – 09:30
<b>INVITED LECTURE</b> Bridging the gap between science, policy and coordination – European Polar Board <b>RENUKA BADHE, EPB</b> CHAIR: GONÇALO VIEIRA	09:30 – 10:00
<b>SOCIAL DIMENSION IN POLAR RESEARCH</b> CHAIRS: JOSÉ XAVIER & SARA APARÍCIO	<b>10:00 – 10:30</b>
Polar research in the social sciences: review and outlook of current research <b>DAVID PICARD, IGD-ULAUSANNE</b>	10:00 – 10:15
Creative polar science communication: scientists, teachers, students and parents learning together <b>PATRÍCIA AZINHAGA, IEUL   PEI</b>	10:15 – 10:30
BREAK 1 – COFFEE/TEA	10:30 – 11:00
<b>INVITED LECTURE</b> LTER program on King George Island terrestrial ecosystems <b>SOON GYU HONG</b> CHAIR: PEDRO PINA	11:00 – 11:30

**EARTH AND ATMOSPHERE PROCESSES IN POLAR REGIONS**

CHAIRS: SANDRA MOGO &amp; JOÃO BRANCO

**11:30 – 12:15**

Recent evolution of permafrost and active layer temperatures in the South Shetlands

11:30 – 11:45

**GONÇALO VIEIRA, IGOT-ULISBOA**

Main lithofacies types and their geochemical and mineral chemistry characterization of volcanic rocks from Fildes Peninsula, complemented by new data obtained during the 2016 field campaign

11:45 – 12:00

**PEDRO FERREIRA, LNEG**

Precipitation in East Antarctica and the role of atmospheric rivers: in ground-based observations and regional climate models

12:00 – 12:15

**IRINA GORODETSKAYA, UAVEIRO****BREAK 2 - LUNCH**

12:15 – 14:00

**APECS PORTUGAL**

Polar quests – Policymaking: Science strikes back

14:00 – 14:15

**SARA APARÍCIO & JOSÉ SECO****POLAR ECOSYSTEMS: STRUCTURE AND FUNCTION**

CHAIRS: PEDRO DUARTE &amp; ANTÓNIO SOUSA

14:15 – 15:15

Extreme polar microorganisms: A biotechnological approach

14:15 – 14:30

**ADRIANA REGO, CIIMAR-UPORTO**

Interplay of microbial communities diversity and soil geochemistry around the largest Adélie penguin colony of Antarctica

14:30 – 14:45

**MAFALDA BAPTISTA, CIIMAR-UPORTO**

Transcriptomic responses to thermal and osmoregulatory challenges of Antarctic notothenioid fish: an insight into responses to global change and genome evolution

14:45 – 15:00

**BRUNO LOURO, CCMAR-UALG**

Antarctic Marine Food webs: new data to address gaps of knowledge in pelagic ecosystems

15:00 – 15:15

**JOSÉ XAVIER, MARE-UCOIMBRA****BREAK 3 - COFFEE/TEA**

15:15 – 15:45

**POLAR BIOGEOCHEMISTRY**

CHAIRS: JOÃO CANÁRIO &amp; JOSÉ SECO

**15:45 – 16:30**

Sea ice physics and biogeochemistry in the Arctic Ocean: empirical and modeling results

15:45 – 16:00

PEDRO DUARTE, NPI

Soil contamination in Fildes, Antarctica: is there an integrated assessment approach to better inform decision making?

16:00 – 16:15

JOANA PEREIRA, UAVEIRO

Mercury Methylation rates in Deception Island, Antarctica

16:15 – 16:30

BEATRIZ BENTO, CQE-IST

**POSTER SESSION****16:30 – 18:00****DINNER****20:00 – 22:00****28 OCTOBER 2016****HORÁRIO****POLAR CAMPAIGN – A Step-By- Step Guide To Success****09:00 – 10:00**

Planning and implementation of the PROPOLAR Polar Campaign 2016-17; Tips for planning a successful polar campaign; The Antarctic Treaty and the Protocol on Environmental Protection; Environmental impact assessment of Antarctic projects

TERESA CABRITA, PROPOLAR

Clothing and protection basics

ANA DAVID, PROPOLAR

Besides science, what to expect from a field season in the Antarctic Peninsula?

GONÇALO VIEIRA, PROPOLAR

**POSTER SESSION****10:00 – 11:00**



### PANEL - INNOVATION AND TECHNOLOGICAL DEVELOPMENT FOR POLAR REGIONS

CHAIRS: TERESA CABRITA, PROPOLAR

11:00 – 12:30

Introduction

11:30 – 11:40

A successful partnership between Science and Industry

MANUEL CORREIA GUEDES, IST, ULISBOA

11:40 – 11:50

### ENGAGING STAKEHOLDERS IN POLAR SCIENCE

11:50 – 12:10

A science perspective

CATARINA MAGALHÃES, CIIMAR, U.PORTO

11:50 – 12:00

An enterprise perspective

NUNO TERRÍVEL, Director of Innovation at Amorim Cork Composites

12:00 – 12:10

### Debate - Scientists & Enterprises

CHAIRS: TERESA CABRITA, PROPOLAR

12:10 – 12:30

The debate aims at bringing together polar scientists and organisations dedicated to innovation and technological development in different areas. It is intended to strengthen this link, discuss challenges, and identify needs and collaboration opportunities. Invited organizations and audience are invited to join in the discussion.

O debate tem como objetivo estreitar a ligação entre os cientistas polares e as organizações que se dedicam à inovação e ao desenvolvimento tecnológico em áreas variadas, discutir desafios e identificar necessidades e oportunidades de colaboração. As organizações convidadas e audiência são convidadas a participar no debate

### INVITED LECTURE

Identifying research priorities and emerging issues in Antarctic science related to policy

12:30 – 13:00

JOSÉ XAVIER

CHAIR: PEDRO GUERREIRO

CLOSING SESSION

13:00 – 13:15





# ABSTRACTS

## RESUMOS DAS COMUNICAÇÕES

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INVITED LECTURES, 10-12

PALESTRAS PLENÁRIAS

ORAL COMMUNICATIONS, 13-24

APRESENTAÇÕES ORAIS

POSTER PRESENTATIONS, 25-50

APRESENTAÇÕES EM POSTER

## LTER program on King George Island terrestrial ecosystems

**Soon Gyu Hong**

Division of Polar Life Sciences, Korea Polar Research Institute

King George Island is located in the maritime Antarctic and is an important location to monitor the effects of climate change on Antarctic terrestrial ecosystems. Lichens and mosses constitute the major flora of King George Island and they cover most of the exposed surfaces. Two flowering plants, *Deschampsia antarctica* and *Colobanthus quitensis*, are also found in this area. Lichens, mosses, flowering plants, cyanobacteria and microalgae are the major first producers in the terrestrial ecosystems. Diverse species of bacteria, archaea and microfungi are main biological components of soil ecosystem. They are usually regarded as decomposers in the ecosystems and do important roles in circulation of nutrients. We established monitoring system to detect changes in distribution of major flora and composition of microbial communities according to environmental change. For this purpose, vegetation distribution was studied by ground investigation and remote sensing technology, microbial community structures were studied by high-throughput sequence information, comprehensive geochemical composition was determined, fine geographical map is being prepared from high-resolution image analysis, and climatic condition is being monitored for selected sites to represent diverse ecosystems. This information will serve as basic knowledge to understand function and change of KGI terrestrial ecosystems. We will study physiological response of several selected species of mosses, lichens, and microbial communities to develop *in silico* model to predict their response to changing environment.



## Bridging the gap between science, policy and coordination – European Polar Board

**Renuka Badhe**

European Polar Board, EU-PolarNet External Expert Advisory Board

The European Polar Board (EPB) is an independent voice of European polar research with the principal role of facilitating cooperation in all fields of polar science across Europe and representing European polar research in the global context. EPB seeks to provide policy advice to the European Commission and other international bodies and provides policy makers with strategic information, develops multilateral cooperation and implements joint projects in collaboration with relevant scientific polar international organisations. The EPB's mission is to coordinate European polar research by optimising the use of European research infrastructure and fostering multilateral collaboration between European national funding agencies, national polar institutes and research. Many EPB Members are actively involved in the EU funded project EU-PolarNet, where EPB had provided the platform which brought together 22 European polar organisations. The legacy of EU-PolarNet will be sustained by the Board into the future.



## Identifying research priorities and emerging issues in Antarctic science related to policy

**José Xavier**

MARE, Universidade de Coimbra; British Antarctic Survey

This presentation aims to review the role of the Antarctic Treaty System in coordinating activities in the Antarctic and address the challenges that are faced today by the commission of environmental protection (CEP), within the Antarctic Treaty Consultative Meetings (ATCM). The presentation will also review the results of the 25th Anniversary celebrations of the Madrid Protocol, including the mini-symposium carried out in the Scientific Committee on Antarctic Research (SCAR) Open Science Meeting in Malaysia 2016 on linking Antarctic science and environmental protection.



## Polar research in the social sciences: review and outlook of current research

*David Picard -/- Institut de géographie et durabilité, Université de Lausanne, Switzerland*

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The paper will review recent and ongoing research on polar spaces, issues and politics carried out in the social sciences and humanities, especially within the respective research and action groups associated to the Science Committee for Arctic Research (SCAR). Based on this review, it will discuss the aims and objectives, and the relevance and impact of possible future lines of investigation for polar social scientists, historians and also artists in Portugal.

## Creative polar science communication: scientists, teachers, students and parents learning together

*Patrícia Fialho Azinhaga -/- IEUL & PEI*

*Marta Espírito Santo -/- IEUL & EBVR*

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In the scope of IRRESISTIBLE project scientists, teachers, students and parents joined to discuss and learning about The Polar Regions and Polar Science thought the students' creativity about the topic and Responsible Research and Innovation.

It was followed the implementation of a thematic module to allow the students to explore The Polar Regions and Polar Science topic. Throughout the module the students had the opportunity to talk with a polar scientist, which contributes to engage students in the subject and clarify some issues. That was crucial for the development, by students, of an interactive exhibition on the topic, open to the general public to share knowledge and awareness about the importance of The polar regions and Polar Science. Also, it was organised, jointly run by the teacher and students, a workshop for parents on the topic and how they could help their students in the task of building interactive objects for the final exhibition.

Incorporate scientists, teachers, students and their parents helped engage all in a collaborative learning, especially the students and their parents for which the theme was unknown. The workshop and the joint construction of interactive objects for the exhibition enabled the students and parents not only learn about the topic, but also to create awareness about the impact of these issues on their lives. On the other hand, scientists known new strategies to communicate their science and understood how students can be important vehicles of information for society.

In this communication, we wish to present the initiative as an example of collaboration between scientist and teachers that was extended to students and parents, contributing in this way to the awareness about Polar Science and helping to strengthen the dialogue between science and society.

## Recent evolution of permafrost and active layer temperatures in the South Shetlands

*Gonçalo Vieira -|- CEG/IGOT, Universidade de Lisboa, Portugal*  
*Miguel Ramos -|- Universidad de Alcalá de Henares, Spain*  
*Miguel Angel de Pablo -|- Universidad de Alcalá de Henares, Spain*  
*Gabriel Goyanes -|- CEG/IGOT, Universidade de Lisboa, Portugal*  
*Marc Oliva -|- CEG/IGOT, Universidade de Lisboa, Portugal*  
*Carlos Schaefer -|- Universidade Federal de Viçosa, Brazil*  
*Alice Ferreira -|- CEG/IGOT, Universidade de Lisboa, Portugal*  
*Andrey Abramov -|- Russian Academy of Sciences, Russia*  
*António Correia -|- Universidade de Évora, Portugal*  
*Alexandre Nieuwendam -|- CEG/IGOT, Universidade de Lisboa, Portugal*  
*Carla Mora -|- CEG/IGOT, Universidade de Lisboa, Portugal*

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The Western Antarctic Peninsula has been one of the Earth's regions showing a faster warming rate since the 1950's, with an increase of over +2.5 °C in mean annual air temperatures since 1950. The South Shetland Islands, located some 100 km off its northwestern coast are near the climate limit of permafrost. Changing permafrost will influence the terrestrial ecosystems by modifications in the active layer thickness, ground freezing regime, hydrology, geomorphodynamics and possibly, by changes in biogeochemical fluxes.

Boreholes installed in Deception Island, Livingston island and King George Island aim at identifying regional controls on permafrost and the active layer, but also local and site-specific influences. For the former, we maintain 4 to 25 m depth boreholes with continuous logging of temperatures, as well as associated meteorological stations. For the later, we a number of very shallow boreholes with 0.8 to 2 m depth was installed at diverse settings in the vicinity of the main boreholes. The network is integrated in the Global Network for Permafrost (IPAWMO/GCOS).

Permafrost temperatures across the South Shetlands are warm, between slightly below 0 and -2.0 °C and the ground thermal regime shows a strong dependence from varying snow conditions, as well as thermophysical properties and ice-content of the ground. Active layer thickness varies from 0.4 in the volcanic deposits of Deception Island, to several meters in high diffusivity bedrock. Active layer data since 2000 shows a large interannual variability in mean ground temperatures without any significant climatic trend. However, since 2008 active layer thickness has been decreasing and a general cooling has been observed at the South Shetlands sites, which are the only ones providing longer term data. The reasons for this ground cooling are related to a longer lasting snow cover during spring and summer, inhibiting ground heat gain.

## Main lithofacies types and their geochemical and mineral chemistry characterization of volcanic rocks from Fildes Peninsula (GEOPERM project), complemented by new data obtained during the 2016 field campaign

*Pedro Ferreira -/- Laboratório Nacional de Energia e Geologia*

*Patrícia Azinhaga -/- Instituto de Educação Universidade de Lisboa*

*João Mata -/- IDL-FCUL*

*Rogério Calvo -/- Laboratório Nacional de Energia e Geologia*

*Fernanda Guimarães -/- Laboratório Nacional de Energia e Geologia*

*Gonçalo Vieira -/- IGOT-UL*

*Ana Pestana -/- Laboratório Nacional de Energia e Geologia*

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Detailed geological/lithological mapping (1/5000 scale), performed in the Meseta Norte flat-topped hill of Fildes Peninsula (King George Island, Antarctica), identified two main lithological units outcropping in the area: 1) fine porphyritic lava flows, ubiquitously altered; 2) volcanoclastic rocks, having various grain sizes and compositions, normally interbedded with basaltic lava flows, having lateral irregular thicknesses. These lithologies are frequently intruded by subvolcanic rocks. All studied volcanic rocks have a sub-alkaline character and belong to both low-K (tholeiitic) and calc-alkaline magma series. The silica variation contents extends to almost 20 wt% (from basalt to dacite compositions) and the inter-element chemical relationships indicate that crystal fractionation plays a major role in the geochemical variability. The low HFSE/LILE ratios and Nb rock/primordial mantle negative anomalies are consistent to a volcanic-arc geotectonic setting. Plagioclase (oligoclase-anorthite), augite and spinels (magnetite-ulvospinel series) are the main volcanic rock mineral phases.

The fieldwork in the South Shetland Islands was extended to two new neighboring areas, during the GEOPERM II project (January/February 2016): one in Barton Peninsula, whereas the performed mapping revealed outcrops are dominated by volcanic rocks (lava-flow structures), but plutonic rocks (Diorite and Granodiorite) and volcanoclastic rocks (lapilli tuffs and volcanic sandstone and conglomerates) are also present in the area; the other study area was located in Rip Point (Nelson Island) where the fieldwork was restricted to sampling volcanic rocks (for petrography, geochemical and isotopic characterization) in the vicinity of a well age- constrained plant fossil assemblage (micro- and macroflora, Campanian-Lower Maastrichtian age) previously identified by Chilean and Brazilian paleontologists. A total of 85 rock samples were collected during GEOPERM II campaign.



## Precipitation in East Antarctica and the role of atmospheric rivers: in ground-based observations and regional climate models

*Irina Gorodetskaya -/- CESAM - Centro de Estudos do Ambiente e do Mar, Universidade de Aveiro, Portugal*  
*Maximilian Maahn -/- National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Boulder, Colorado, USA*

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Antarctica has the potential to contribute more than a meter of sea-level rise by 2100 in response to the occurring global climate warming. At the same time intense precipitation events over specific regions of Antarctica can determine the sign of the total mass balance change of the entire ice sheet. For example, several strong snowfall events over Dronning Maud Land (DML) in 2009 and 2011 produced a positive mass anomaly over the East Antarctic ice sheet, counterbalancing the increasing ice discharge from West Antarctica in these years. Using in situ accumulation measurements and radar-derived snowfall rates from Princess Elisabeth station (PE), located in the DML escarpment zone, along with the European Centre for Medium-range Weather Forecasts (ERA) Interim reanalysis, it was shown that the most intense precipitation events at PE (up to 30 mm water equivalent per day) were associated with atmospheric rivers (ARs) - narrow and long-band features of intense moisture transport from lower latitudes (Gorodetskaya et al, 2014). Several ARs reaching the coastal DML contributed 74–80% of the outstanding SMB during 2009 and 2011 at PE. These AR events linked DML snowfall and accumulation to the subtropical moisture sources, namely, the southern Indian and Atlantic Oceans. Moreover, large contribution (46%) to climatologically 'normal' annual snow accumulation amount during 2012 comes from only one intense snowfall associated with an AR. The important role of ARs in the Antarctic ice sheet surface mass balance suggests that climate models require adequate representation of ARs. We will present the results of evaluating two regional climate models - MAR and RACMO-ANT - with respect to precipitation properties and their relationship to atmospheric rivers.

## Extreme polar microorganisms: A biotechnological approach

Adriana Rego -|- Faculty of Sciences, University of Porto, Portugal and CIMAR/CIIMAR—Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Portugal

Maria Sofia R. Costa -|- CIMAR/CIIMAR—Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Portugal

Vitor Ramos -|- Faculty of Sciences, University of Porto, Portugal and CIMAR/CIIMAR—Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Portugal

Soon Gyu Hong -|- Division of Polar Life Sciences, Korea Polar Research Institute, Republic of Korea

Vitor Vasconcelos -|- Faculty of Sciences, University of Porto, Portugal and CIMAR/CIIMAR—Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Portugal

Catarina Magalhães -|- CIMAR/CIIMAR—Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Portugal

Pedro Leão -|- CIMAR/CIIMAR—Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Portugal

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Microorganisms represent an extremely rich reservoir of potentially valuable natural small molecules on the planet, such as polyketides, nonribosomal peptides, terpenes and alkaloids, between other classes of compounds. Among microorganisms, Bacteria are the most prolific producers, including Cyanobacteria, Actinobacteria, Firmicutes and Myxobacteria.

Here, we present our results on the diversity and chemodiversity of microorganisms obtained from environmental samples collected in a cold hyper-arid polar desert, the McMurdo Dry Valleys, Antarctica. Samples were obtained from a rock with endolithic colonization and from a soil transect with decreasing water availability. Two endolithic cyanobacterial strains with high similarity to *Leptolyngbya antarctica* were obtained. In order to isolate secondary metabolites produced by these strains, a large-scale cultivation was performed followed by organic extraction. Bioassays (Antimicrobial, Enzymatic and Cytotoxic) were performed and the promising bioactivity data obtained allowed us to conduct the isolation process. It was found that these strains possess the diterpenoid dehydroabietic acid, a secondary metabolite from the Terpene family, reported by the first time to be present in Cyanobacteria [1]. From the soil samples, a diversity of Firmicutes species with high similarity to *Paenisporosarcina macmurdoensis* and *Sporosarcina antarctica* were isolated as well as two Fungi species, with high similarity to *Penicillium citrinum* and *Dicyma pulvinata*. Future work will include a screening of the bioactivity of the compounds produced from these late identified species following a bioactivity-guided approach in order to isolate the compounds responsible for the activities.

1. Costa MS, Rego A, Ramos V, et al. The conifer biomarkers dehydroabietic and abietic acids are widespread in Cyanobacteria. *Sci Rep.* 2016;6(23436):1-11. doi:10.1038/srep23436.

## Interplay of microbial communities diversity and soil geochemistry around the largest Adélie penguin colony of Antarctica

*Mafalda Baptista -/- CIIMAR, Universidade do Porto, Portugal*

*Maria Monteiro -/- International Centre for Terrestrial Antarctic Research, University of Waikato, New Zealand*

*Catarina Magalhães -/- CIIMAR, Universidade do Porto, Portugal*

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At Cape Adare, northern Victoria Land, Antarctica, we conducted a soil survey across Ridley Beach, site of the largest Adélie Penguin rookery in Antarctica and the adjacent Adare Ridge to test the hypothesis that the guano at the penguin colony site would drive the microbiome and the soil geochemistry with a great influence on the circulation and transfer of elements from near shore environments to terrestrial Antarctica habitats. Genomic analysis of prokaryotic community composition based on next-generation sequencing of 16S rRNA gene amplicons, analysis of soil nutrients (NO<sub>3</sub><sup>-</sup>, NO<sub>2</sub><sup>-</sup>, NH<sub>4</sub><sup>+</sup>, PO<sub>4</sub><sup>3-</sup>), and C and N elemental analyses, were performed in all 63 sampling sites. Results show a clear distinction between the soil geochemistry at the penguin colony and the adjacent ridge, with significantly higher total organic and inorganic C and N, and inorganic nutrient contents at the colony sites. As expected, the dominant bacterial phyla were shown to be different in both locations, with Actinobacteria, Bacteroidetes, Firmicutes and Proteobacteria comprising on average 10%, 40%, 40%, and 10% of the total prokaryotic communities at the colony, while at the ridge, Acidobacteria, Actinobacteria, Bacteroidetes, Firmicutes and Proteobacteria were the preponderant phyla, comprising on average 20%, 20%, 40%, 10, and 10% of the total bacterial communities. Moreover, at the ridge, the *Archaea Parvarchaeota* and *Thaumarchaeota* were also shown to be present (2% and 3%, respectively, of the total prokaryotic communities). Previous work regarding bacterial communities composition in Antarctica's soils has shown, Firmicutes to be abundantly present in active ornithogenic soils, while Actinobacteria, Bacteroidetes and Proteobacteria were present in former ornithogenic soils. This study shows the presence of these communities at both colony and ridge sites, opening the way for mapping the extent of the influence of the penguin colony in soil microbiome dispersion.

## Transcriptomic responses to thermal and osmoregulatory challenges of Antarctic notothenioid fish: an insight into responses to global change and genome evolution

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The extreme temperatures and geographic isolation of the Antarctic have led to distinct and strong selective pressure for development of a highly adapted endemic stenothermal fauna living in narrow ranges of cold temperatures waters. It is therefore of great interest to understand the Antarctic fish homeostatic adjustments to relatively rapid salinity decrease and temperature increases resulting from global warming. *Notothenia rossii* fish were collected at Admiralty Bay, King George Island and were transferred to experimental tanks placed in a cold room with temperature maintained at 0-2°C. After a period of acclimatization in the tanks with water at normal temperature (1.5-2°C) and salinity (30ppt), fish were exposed to gradual changes in water temperature (up to 8°C) or/and salinity (down to 10ppt) over a period of eight days. Multiple tissues were sampled, of which gill and liver samples were selected to perform differential gene expression analysis via RNAseq. The reference *N. rossii* transcriptome required as template to perform quantitative analysis of gene expression was de novo assembled from 20 tissue samples. The de-novo transcriptome assembly resulted in 57.000 gene expressed products with an N50 of 1366bp, which is indicative of a good assembly and representative of the whole body transcriptome. The characterization of the liver and gill whole transcriptomic responses to stress challenge allows pinpointing which genes and pathways are being significantly expressed and responsible for the physiological response to achieve homeostasis, as seen in previous physiological studies of the same experimental challenge. These have shown that increased temperature and reduced salinity induced higher branchial enzymatic activity, although a decrease in plasma osmolality. The project outcome is expected contribute to current knowledge of Antarctic fish ability to adapt to global warming.

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## Antarctic Marine Food webs: new data to address gaps of knowledge in pelagic ecosystems

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In the last few years, two publications out of the SCAR Horizon Scan (i.e. Kennicutt II et al. 2014 Nature, Kennicutt II et al. 2015 Antarctic science) have focused on identifying gaps on knowledge in Antarctic science that should be addressed in the coming two decades. Due to be touching such wide range of research areas (e.g. from Oceans, atmosphere, astronomy, geology), there was a need to specify more clearly the challenges in marine ecosystems, using the SCAR Horizon Scan database. In this presentation, we provide an overview of the research areas that are relevant to Antarctic marine research based on our most recent publication coming out of the SCAR Horizon Scan (Xavier et al. in press, Front. Mar. Sci.). Furthermore, we provide a review of our publications in the last year while trying to address the issues put by the SCAR Horizon Scan. This include a research review on the status of Antarctic pelagic marine ecosystems and research papers on the feeding ecology of Weddell Seals, Patagonian toothfish, wandering albatrosses and black-browed albatrosses, useful for food web modelling purposes (e.g. Seco et al. in press JMBA). Moreover, a research paper on trace metals on Gentoo penguin feathers (Pedro et al. 2015 PLoSone) will show its potential to be applied to future research and monitoring programs. Finally, such results will be put into educational and policy perspectives, valuable to bring Antarctic science into policy making at the Antarctic Treaty Consultative Meetings (ATCM'S).

## Sea ice physics and biogeochemistry in the Arctic Ocean: empirical and modeling results

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The drifting pack ice north of Svalbard (80-83°N), was studied from January to June 2015, during the Norwegian Young Sea Ice (N-ICE2015) expedition. The main goal was to improve the understanding of the energy budget of the Arctic Ocean, the sea ice mass balance and the seasonal dynamics of the ice-associated ecosystem under the new ice regime, dominated by first-year ice. The atmosphere, the sea water and four different ice floes were monitored, including different types of ice: multiyear, first year ice and a refrozen lead. This dataset was used to force the Los Alamos Sea Ice Model (CICE) and evaluate its capacity to reproduce the physical and biogeochemical changes observed in some of the ice types monitored during the cruise, over time scales of ~1 month. The 1D vertical version of CICE was used, coupling thermodynamic with vertically resolved biogeochemical processes. Various model setups were tested, including different sea surface forcing setups, based on heat fluxes across the mixed layer. Model results were used to close the ice energy budget and to get insight into the most critical aspects to properly forecast sea ice thermohaline- and biogeochemical dynamics. Obtained results show a good model performance regarding ice thickness, salinity and temperature and less so for nutrients and sea ice algae. We hypothesize that improvements in biogeochemical modeling may be achieved by complementing brine drainage with a diffusion parameterization and biogeochemical modeling with the introduction of an explicit formulation to forecast chlorophyll and regulate photosynthetic efficiency.

## Soil contamination in Fildes, Antarctica: is there an integrated assessment approach to better inform decision making?

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Antarctica has been subject to increased human pressure for at least the past half-century. This study assessed soils of Fildes Peninsula, where trace element pollution is thought to prevail. Four soil samples were collected from different locations and assessed following tier 1 methodologies for chemical and ecotoxicological lines of evidence (LoE) used in typical soil Environmental Risk Assessment (ERA). Trace element quantification was run on soil samples and sequential extracts, and elutriates were used to address their ecotoxicity using a standard ecotoxicological battery of tests. The highest levels of trace elements were found for Cr, Cu, Ni and Zn, which were well above baseline levels in two sites located near previously identified contamination sources. Trace element concentrations in soils were compared with soil quality guidelines to estimate the contribution of the chemical LoE for integrated risk calculations; risk was found high, above 0.5 for all samples. Total concentrations in soil were consistent with corresponding sequentially extracted percentages, with Cu and Zn being the most bioavailable elements. Bacteria did not respond consistently to the elutriate samples and cladocerans did not respond at all. In contrast, the growth of microalgae and macrophytes was significantly impaired by elutriates of all soil samples, consistently to estimated trace element concentrations in the elutriate matrix. These results translated into lower risk values for the ecotoxicological compared to the chemical LoE. Nevertheless, integrated risk calculations generated either an immediate recommendation for further analysis to better understand the hazardous potential of the tested soils or showed that the soils could not adequately sustain natural ecosystem functions. This study suggests that soil ecosystem in Fildes has been inadequately protected and supports previous claims on the need to reinforce protection measures and remediation activities.

## Mercury Methylation rates in Deception Island, Antarctica

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Mercury studies in locations with volcanic activity such as Deception Island (DI) are scarce, but of great importance since active volcanism is a major source of geogenic Hg. This natural Hg can become a potential source of contamination for indigenous wildlife.

Previous results from the CQE team showed the presence of relatively high concentrations of both Hg and methylmercury (MeHg) in Port Foster waters, considerably higher than the ones reported for open waters of the Atlantic or the Southern Ocean, suggesting exceptional conditions for Hg methylation processes in the water column of Port Foster. This study is therefore a contribution to better understand these processes in this remote ecosystem.

A field campaign took place in February 2016 and sediments and water samples were collected in several areas of DI. These samples were incubated using the Hg stable isotope ( $^{199}\text{Hg}/^{201}\text{MeHg}$ ) technique, which was used for the 1st time in Antarctica, and methylation rates were calculated.

Results showed that in some sites abiotic or instantaneous methylation played an important role in the transformation of inorganic to organic Hg at a rate higher than is frequently reported in other sites. Biotic methylation was also determined. In water samples the methylation rates varied between 0,7 and 7,6%/day, which are similar or up to 13 times higher than the ones found in polar waters of the arctic.

These results clearly showed that Port Foster Bay presents favourable conditions for Hg methylation. These findings coupled with the high residence time for water (ca. 1.7 yr) inside the bay may explain the elevated concentrations of both Hg and MeHg in this ecosystem.



## POSTER PRESENTATIONS

### APRESENTAÇÕES EM POSTER

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Pedro Quinteiro, ISPA
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Gonçalo Vieira, IGOT-ULisboa
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João Canário, CQE-IST

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Maura Lousada, CERENA-IST
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24. Sources and distribution of polychlorinated biphenyls (PCBs) in contaminated soils from Ardley Cove Area (King George Island, Antarctica)  
João Branco, IGOT-ULisboa

## Portugal education and outreach: bringing polar science to wider audiences

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Continuing the successful education, outreach and communication work developed in the last 10 years, most recently through the projects “Profession Polar Scientist” and “Education Propolar “, coordinated by polar educators and polar scientists in collaboration with the Association of Polar Early Career Scientists (APECS), Polar Educators International (PEI) and the Portuguese Polar Program PROPOLAR, Portugal have been developed initiatives to bring polar science to a wide range of audiences.

In this presentation, we wish to review our national activities in a wider international context, providing examples of taking polar science until the classroom, the development of a close collaboration between scientists and teachers/educators in SCAR, ATCM, APECS and PEI.

Nationally, we produced educational materials relevant to educational institutions: short movies (aka frostbytes), an itinerant photo exhibition and organizing POLAR WEEKS. Also, national polar science education workshops (Mamarrosa 2014 and Lisbon 2016), directed to polar educators. Internationally, Portugal has been highly active at the Antarctic Treaty Consultative Meetings and on the SCAR Education and Outreach subcommittee, to promote a network of information exchange and collaborations of Parties on Education and Outreach, Polar scientists and educators have co-organized the International Polar Science Education Workshop (Hannover, 2015) organized by PEI, and actively participated in the international master class in collaboration with PEI. Various papers on the issue have started to be published (e.g. Xavier et al. in press; May et al 2014, Walton et al 2013, Zicus et al. 2011, Baeseman et al. 2011). In conclusion, Portuguese polar community (Polar scientists and educators) has carried out a wide range of E&O activities, with an international network, that has produced useful tools and materials that can be applied by other countries.

## What makes polar teams unique? Proposing a conceptual framework for team effectiveness in the Poles

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Current teamwork models are applicable mainly to artificial teams (e.g., experiments) or management teams. Life at Earth's Poles is most extreme, with living and working conditions pushing human beings to their limit capacity. Here, teamwork can hardly be compared to experiments or business work teams. Due to the harsh environment teams are facing unique challenges and team functioning is often crucial for mission success or even survival of the team members. The aim of this research is to adapt current teamwork models to teams working in Poles taking into account the unique environment they are working in, and propose a framework and research agenda to improve current knowledge on teamwork in the Poles.

A systematic literature review (SLR) is performed to select research documents about teamwork effectiveness in the Poles. Literature selection is ongoing.

The number of studies on teamwork effectiveness in the Poles is limited. Whereas most studies have emphasized the effects that living and working in the Polar Regions have on individual and collective emotions and well-being, little research exists regarding key factors such as group composition, leadership, and team processes. Following these results, a conceptual framework of teamwork effectiveness is proposed.

The absence of a strong theoretical framework to understand teamwork in the Poles hinders our understanding of what really matters to ensure team effectiveness in this particular environment. The existence of such a framework can help Polar scientists, maintenance personal, HR managers, and policy makers designing better human resource management practices that are aimed at improving the quality of human collaboration processes in the Poles.

To the best of our knowledge, this paper presents a first SLR on teamwork in the Poles and puts forward a theory driven research agenda to improve current knowledge on how do humans collaborate in extreme earth regions.

## The EU-PolarNet/COMNAP/INTERACT Polar infrastructure database cooperation: facilitating the management of Polar logistics and promoting science access

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*Andrea Colombo -|- COMNAP*  
*Terry Calaghan -|- INTERACT*  
*Morten Rasch -|- INTERACT*  
*Elmer Topp-Jorgensen -|- INTERACT*  
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EU-PolarNet is the European consortium in expertise and infrastructures for polar research, involving 22 organisations and several international partners, aiming at developing an Integrated European Polar Research Programme, co-designed with all relevant stakeholders. In order to facilitate this objective, a new database on European Polar facilities, vessels, aircraft and key observatories has been prepared. The database structure was developed in close cooperation with the Council of Managers of National Antarctic Programs (COMNAP) and the International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT), allowing the database to be designed following the requirements of the three organisations. The common database structure is available for each organization to archive and manage its own data, facilitating the development of specific products, such as catalogues or websites. The three databases are easily updatable and transferrable and will facilitate the development of a number of products targeting at maximising the efficiency of infrastructure management, utilization and access by scientists. On the European side, the European Polar Board, a partner of EU-PolarNet will manage the European Polar infrastructure database and a webGIS platform will allow for easy access and dissemination. EU-PolarNet is funded by the European Commission's Horizon 2020 programme.

## Useful images to communicate about science: Expedition to the Arctic

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Communicating about scientific results to public audience is a challenge. Many questions can be posed about how to deliver effective public communication. Do we want to raise awareness or create attitudinal change related to environmental issues? Can a one-size fits all science-led approach be effective when it comes to communicating to a diverse public, not always science literate?

Contemporary communication tools may be, for some, outside our comfort zone of practice. Therefore we need to look for new partnerships/opportunities that could deliver our messages in the hope of gaining wider interest and engagement with a society which has become increasingly disengaged with their natural surroundings. The arts speak to many different audiences, all ages, social classes and nationalities. The barrier that has been thrown up between the worlds of science and art is being shown to be artificial and unhelpful.

This presentation refers to different scientific expeditions that were written and drawn for scientific projects communication results.

## Habitat and trophic ecology of Antarctic squid using stable isotopic analysis: Where do young and adults live and what do they eat?

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Cephalopod beaks are hard chitinous structures resistant to digestion and that differ between species, being commonly used to identify cephalopod species from predators' stomach contents. These structures grow along the cephalopod life without replacement, which turns into a powerful tool to study the individual life. Stable isotopic analysis (SIA) of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  is a technique that allows to study marine organisms' habitat and trophic ecology, respectively. The main objective of this study is to validate and establish SIA, applied to different beak parts, as a routine method to study habitat and trophic ecology along the individuals' life. As model species, we used the endemic Southern Ocean squid *Kondakovia longimana*, one of the main cephalopod prey of Antarctic top predators.

Several upper (UB) and lower beaks (LB) were sectioned in tip of the rostrum and a section along the hood and crest (UB) and tip of the rostrum, a section along the lateral wall and the wing (LB). Sections were posteriorly sectioned into four equal subsections and all the pieces analysed for  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ .

Values of  $\delta^{13}\text{C}$  (-26.3 to -20.6‰) remain stable along the beak. In opposite,  $\delta^{15}\text{N}$  values (3.2 to 8.2‰) show an increase along the beak, with tip of the rostrum presenting the lowest values and the farthest subsection, relatively to the tip of the rostrum, and wing the highest. Our results show that the tip of the rostrum gives information about the individual earliest life-stages and the farthest regions about the latest individual life-stage.

This study confirms SIA as a reliable technique to study habitat and trophic ecology of cephalopods. To study ontogenic changes along the cephalopod life we should use the tip of the rostrum and the section along the hood of the UB. However, to study changes between the young and adults of the same individual, we can only use the tip of the rostrum and the end of the hood in the upper beaks or the tip of the rostrum and the wing in the lower beaks.

## Everything is not everywhere: Antarctica Dry Valleys as an extreme counterexample

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Understanding the mechanisms that determine the spatio-temporal structuring of microbial communities and how these respond to environmental change are major challenges in microbial ecology, however there is still debate as to whether microorganisms exhibit any biogeographic patterns. Microbial communities from Antarctica Dry Valleys, with a long isolation history, will certainly be a perfect object of study to determine the mechanisms that maintain genetic heterogeneity as well as functional resilience among microbial communities. In this study, we design an experiment to test how the same disturbance applied to different microbial communities living in extreme habitat conditions drive diversity and functional relationships. We hypothesized that the microbial communities native to the two Dry Valleys initially be unique, but would converge on a microbial community with similar structure and function, as a result of the same disturbance applied. Although, our results demonstrated that when communities from different Antarctica Dry Valleys (Miers and Beacon) are subject to the same experimental disturbance the community turnover, at the overall community and rare biosphere levels (for 16S rDNA and 16S rRNA data), diverge with time, even though both communities were subject to the same highly selective pressure. Results from this study reinforce the idea that microbial abundance and diversity distributions, including the rare biosphere, varies greatly within the same ecosystem (Antarctica Dry Valleys).

Interestingly, the drastic divergence in community composition at both 16S rDNA and 16S rRNA levels was not clearly reflected in function, since our results suggested a conversion in the predicted functional capabilities, based on PICRUSt analysis of 16S rRNA transcripts. Indeed our findings represent an actual observation of the importance of microbial seed banks in maintaining the diverse functional capabilities of a microbial community.



## Shifts in Arctic microbial communities during the winter-spring transition

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One of the main concerns about the Arctic Ocean has been the changing sea ice regime with a reduction in the summer sea ice extent and a shift in dominance from thicker, perennial multiyear ice towards thinner, first-year ice. The Norwegian Young Sea Ice (N-ICE2015) expedition, that took place in drifting pack ice north of Svalbard between January and June 2015, was motivated by this changing ice regime with the goal of studying its physical and biogeochemical consequences. We will present preliminary results on seasonal changes in Arctic microbial communities obtained during the N-ICE 2015 expedition using molecular tools. Seawater samples were collected at 5, 20 or 50, and 250 m depth in March, April and June to characterize microbial communities at taxonomic (SSU rRNA amplicon) and at functional (metagenome) levels aided by environmental data – metadata – collected. The taxonomic assignment of SSU rRNA amplicon sequencing data was performed running an automated pipeline at SILVAngs web server. The prokaryotic plankton composition displays a higher bacterial abundance (Proteobacteria, Bacteroidetes) over archaea that mirrors their greater diversity. Archaeoplankton, dominated by ammonia oxidizing thaumarchaeotes (AOT; photosensitive), shows a progressive migration from the surface to deeper (darker) mesopelagic waters during the winter-spring transition. The co-occurrence with the nitrite oxidizing bacteria Nitrospina in March suggests nitrifying activity in wintertime. Surprisingly, the high abundance of the hydrocarbonoclastic bacterial genera *Alcanivorax* and *Marinobacter*, usually associated with algae, co-occurred with the anaerobic/microaerophilic marine parasitoid Syndiniales group I (Alveolata) suggesting a possible symbiosis. To conclude, the thinning of the Arctic ice pack could change the observed AOT's seasonal dynamics due to more and earlier light penetration into the under-ice water column, with consequences for N and C budgets.

## Shifts on bacterial community diversity in Antarctica Fildes Peninsula soils with different levels of metal concentrations

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The Antarctica continent is one of the most remote places on earth. It is known for their extreme conditions such as low water availability and humidity, extreme low temperatures, high salinity and UV radiation and many more. Many factors have been suggested to affect the communities on Antarctica continent since salt accumulation, temperature, soil moisture, carbon, nitrogen, phosphorous, landscape position, geographical proximity, heavy metals, Ph, conductivity and many more. Although these factors may appear correlated with bacterial diversity in some studies, they are not always related with bacterial diversity when present, suggesting the existence of a huge gap on our knowledge on the relation between these factors and the bacterial community structure and abundance on the Antarctica continent. Fildes Peninsula in King George Island is one of these ice free regions comprising several research stations. Although their presence on these region, very few studies have been performed aiming the bacterial diversity in Fildes Peninsula. The continuously activities on Fildes Peninsula conduct to the appearance of many pollution problems like heavy metal contamination which have been shown by the few studies regarding heavy metals contamination on these sites showing high levels of some heavy metals such as Pb and Cd are due to anthropogenic activities. Therefore, there is a necessity to understand if these anthropogenic impacts such as heavy metals are affecting the bacterial communities on Antarctica. For that reason, in this study it was assessed the influence of eight heavy metals (As, Cu, Zn, Cd, Hg, Pb, Ni and Cr) on the bacterial community structure (20 sites) and diversity (9 sites) from Fildes Peninsula (King George Island).

## Physiological and molecular stress response in *Notothenia rossii*: modulation of HPI sensitivity by environmental challenges

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The evolution in extreme stenothermal isolation created a highly endemic fish fauna in which several components of the physiological stress response appear to be less or non-reactive when compared to other fish taxa. However there is reduced information on the endocrine response to chronic and acute stress. Here we looked at the HPI sensitivity by evaluating cortisol secretion and gene expression upon thermal, osmotic and handling challenges.

Experiments were performed in Arctowski (PL) station in King George Island, in summers of 2012 and 2013. *Notothenia rossii* were collected by boat using fishing poles and transferred to experimental tanks in cold-rooms acclimated to natural temperatures (0-2°C). Fish were exposed to rapid/gradual changes in temperature (to 4-6-8°C using thermostat-controlled heaters) and salinity (to 20-10‰ by addition of freshwater to recirculating tanks) over a period of up to 10 days. In a second experiment the HPI axis was manipulated by injecting blockers/agonists of cortisol release or its receptors prior to environmental acclimation. Fish were deeply anesthetized in tanks and upon blood collection, sacrificed by spinal section. Tissue samples were collected for gene expression and enzymatic analysis.

Exposure to altered conditions had no effect in immediate mortality. Increased temperature reduced overall activity and response to stimuli, although it had no clear effect on energetic substrates. Fish responded to HPI manipulation in a way similar to temperate species. Both cortisol and gene expression of metabolic-related proteins and glucocorticoid- and mineralocorticoid receptors (GR, MR) were modified after heat and salinity shock, and the cortisol response to handling appeared to be reduced, indicating loss of sensitivity. However genes for heat-shock proteins HSC70, HSP70 and HSP90 showed little change in transcription both in gill and liver, and only liver GRP78 appeared reduced by salinity and increased by temperature. In conclusion, these Antarctic fish are somewhat reactive to environmental change, but that their ability to accommodate rapid or adaptive responses may be compromised.

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## Preliminary analysis of the endocrine stress response to temperature in the Sub-Antarctic fish *Eleginops maclovinus* (Eleginopsidae, Notothenioidei)

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The formation of the Antarctic Circumpolar Current (ACC) about 34 MYA created the Southern Ocean causing evolutionary processes to occur in isolation while temperatures rapidly decreased from about 20°C to present extreme values near -1.8°C. The major group of Antarctic fishes, the perciform suborder Notothenioidei, diversified from a single ancestral group in parallel with climate change under strong selective pressure, developing a highly endemic cold-adapted fish fauna, with many structural and functional constraints, including a sub-responsive stress axis. A few ancestral notothenioids escaped ACC confinement during the last 14 MYA and colonized more temperate waters. Since then, these groups have been isolated, evolving in extremely cold and stable Antarctic waters or in adjacent waters 5–15°C warmer. These sub-Antarctic relatives provide information on the functional or genetic features that were retained and those selected under a very cold or mild environments. We looked at the HPI sensitivity by evaluating cortisol secretion upon stressful events under different thermal regimes.

Three sets of experiments were performed in the Calfuco station, UACH, Chile, during March 2016. 1. Fish were acclimated at 17°C in 5 groups (n=8) and fed ad libitum for 7 days. Four groups were stressed (30 sec chasing + 30 sec air exposure) and terminated at 1, 4, 24 and 48 hours post stress while the non-stressed group was sampled on day 8; 2. Six (2x3) groups (n=8) were exposed to acute temperature changes by abrupt transfer from 17°C to 10, 17 and 24°C and sampled at 1 or 4 hours after transfer for each temperature; 3. Exposure to long term temperature change with 2x3 groups at 17°C gradually acclimated to 10, 17 and 24°C for 7 days. On the 8th day one group per temperature was stressed as above and terminated 1 hour after stress. Upon anesthesia fish were sampled for blood and sacrificed by spinal section. Multiple tissues were collected for determination of gene expression and enzymatic activities related to temperature and oxidative stress. Evaluation of these analyses is currently underway and the results will be presented and discussed.

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## The role of sulphur on trace elements biogeochemistry in permafrost thaw Lakes (Canadian Sub-artic)

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Rising temperatures are contributing to the rapid thaw of Arctic permafrost, and this may be a driving factor for the release of trace elements, organic carbon and greenhouse gases into water and air. Several studies have evaluated the concentrations of carbon compounds and some trace elements in thaw lakes. However, little attention has been given to sulphur. The chemistry of this element is of environmental importance because it plays a key role in the degradation of natural organic matter and also influences other trace elements biogeochemistry.

In order to understand the role of sulphur in trace element-biogeochemical processes in thaw lakes, field campaigns were undertaken in the Canadian subarctic where 4 thaw lakes were sampled. Water samples were collected at different depths and analysed for dissolved sulphur compounds (sulphide and sulphate). Lake sediments and nearby soils were also sampled and analysed for particulate sulphides and X-ray diffraction analysis were performed to identify crystalline sulphides. Finally, subsamples of soils, sediments and water were analysed for total particulate and dissolved organic carbon and several trace-elements.

In all lakes the origin of sulphur was mainly from plant organic matter degradation, however we cannot exclude sulphur deposition in the form of sulphates. Sulphate was identified as an important electron acceptor in the degradation of dissolved organic matter with the consequent formation of sulphides. These sulphides in the deepest waters promoted the precipitation of other trace elements, resulting in a sediment surficial layer enriched in trace element amorphous sulphides.

These preliminary results pointed to the importance of the sulphur biogeochemistry in permafrost thaw lakes and its strong linkage to lake origin, thus signalling the need for a full regional assessment of sulphur related processes, based on a large and detailed survey of thaw lake origin.

## Sources and distribution of polychlorinated biphenyls (PCBs) in contaminated soils from Ardley Cove Area (King George Island, Antarctica)

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Compared to the Arctic, much less is known about sources, biogeochemistry and fate of contaminants in Antarctica. The frozen continent is considered pristine; however human presence in Antarctica has resulted in a sharp increase in anthropogenic pressure, leading to pollution problems, predominantly near scientific stations. The South Shetland Islands may be particularly vulnerable to human impacts as they contain one of the highest concentrations of research stations on the continent. Consequently, appropriate environmental monitoring is essential to inform the actions of Treaty Parties and national programme managers active in this region. Among other contaminants polychlorinated biphenyls (PCBs) are of great concern. PCB's are manmade organic compounds, and pollution due to PCBs has been a global environmental problem because of their persistence, long-range atmospheric transport and bioaccumulation. Moreover, the knowledge about distribution and fate of these compounds are still scarce in Antarctica.

In 2013/2014 a field campaign were performed on Fildes Peninsula in the Ardley cove area. 82 soil were sampled and analysed for several PCBs congeners namely, 26, 52, 101, 118, 138, 153 and 180. Other interpretative parameters were also determined (e.g. organic carbon).

Results showed that the total concentrations of PCBs varied between 0.05 and 178 ng/g, being extremely elevated in six sampling sites (> 10 ng/g) that can be considered highly contaminated. These sites were in the vicinity of the scientific stations and the high PCB levels may be related with the presence of electrical power generators. Also, in these contaminated areas the proportion of higher chlorinated PCB compounds (less mobile) is higher.

Our work, in agreement with the evidence of earlier researchers, suggests a potential contamination problem in Fildes bay. It is hoped that environmental managers operating in the area will note these data and take appropriate action.

## Cooling trend in the Antarctic Peninsula during the 21st century and cryospheric responses

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Almost all papers and international reports (e.g. IPCC, 2013) published during the early 21st century focusing on terrestrial and marine ecosystems of the Antarctic Peninsula (AP) have described this region as one of the fastest warming on Earth since the mid-20th century. However, a reassessment of the decadal climate variability from 1950 until 2015 using data from ten stations distributed across the AP region suggests a significant cooling since 1998–2000 within the long-term warming trend. For the 1986–2015 period, mean annual air temperatures (MAAT) were still negative in all sites, ranging from -1.8 to -8.3 °C. The coldest decade was 1956–1965 in the southern AP region and 1966–1975 in the northern section, whereas 1996–2005 was the warmest decade due to the powerful effects of El Niño of 1997–1998. Since then, temperatures have dropped across the region, with 2006–2015 MAATs significantly lower than the previous decade in the N-NE of the AP (0.6–0.9 °C), South Shetland Islands (0.5–0.6 °C), Orkney Islands (0.2 °C), but still slightly higher in the SW corner of the AP (0.1–0.2 °C). This decrease was mainly compelled by lower autumn and winter temperatures, which control the presence of sea ice, and in turn, influence temperatures inland. The consequences of this significant cooling trend have impacted the cryosphere in the region: increase of extent and duration of sea ice, positive glacial annual mass-balances and thinning of the active layer of permafrost.

## Proposal for environmental protection of the ice-free area of Elephant Point (Antarctica)

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The Antarctic Treaty provides the general environmental policies for all areas south of parallel 60 °S. In addition, some enclaves have a higher degree of environmental protection. Most of the Antarctic protected areas have been designated based on national geopolitical strategies, giving special attention to areas where access and logistics are easier. This paper focuses on Elephant Point, an ice-free area of 1.16 km<sup>2</sup> in Livingston Island (South Shetland Islands) where activities are only regulated by the Antarctic Treaty system and no further environmental protection exists. By using a geoecological approach based on the geomorphology together with the distribution of the fauna and flora existing in this peninsula, we distinguished six geoecological environments: Rotch glacier, proglacial environment, moraine system, bedrock plateaus, marine terraces and present-day beach. The distribution of fauna and flora is highly conditioned by the age of deglaciation as well as by the glacial, paraglacial and periglacial geomorphological landforms and processes. Besides this, five well-preserved archaeological sites were found in Elephant Point. These sites were used for sealers and whalers who sailed across the Maritime Antarctic during the XVIII-XIX centuries. The rich biodiversity together with the high geomorphological and historical significance of this peninsula within the Maritime Antarctic constitutes the scientific basis to propose Elephant Point to be designated an Antarctic Specially Protected Area in order to preserve the unique scientific heritage existing in this small peninsula.



## LATA - Loadings and Tectonics of Antarctica peninsula

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The LATA (Loadings and Tectonics of Antarctica peninsula) project aims to:

- a) Model the ocean tide loading (OTL) in and around of the Antarctica Peninsula using gravity and GNSS;
- b) Compute the angular velocities of the Antarctica Peninsula tectonic block in order to verify its internal stability and to evaluate its relative deformation with respect to other tectonic units;
- c) Contribute for the study of the human activity on the permafrost around Primavera base.

Due to logistic limitations, the LATA project, initially approved in 2014, only has installed the GNSS station (including a weather station) on the Argentinian base of Primavera in January 2016. We plan to conclude the installation in 2017 by adding more power backup in order to ensure the acquisition of data during the winter time. We were also planning to carry out gravimetric observations to improve the loading analysis during the 2017 campaign which will not be possible due to the lack of support.

Concerning the GNSS observations, at least 4 years of data will have to be collected to be able to estimate the tidal displacements with sufficient accuracy to discriminate between the various ocean tide models. Although many GNSS stations already exist on the Antarctic Peninsula, most of them are only occupied during campaigns. Our new CORS station thus complements existing stations on Antarctic Peninsula.

The position time-series (computed using GIPSY-OASIS and HECTOR) will be submitted to a tidal analysis, using the Eterna software to estimate the displacements due to OTL at the major tidal harmonics (M2, S2, N2, O1, P1 and Q1).

We will estimate several angular velocity models using the estimated secular motions for all available stations in Antarctica. Particular models will be developed for the Antarctica Peninsula in order to evaluate the level of stability between this geological province and the rest of the Antarctica plate.

## Mapping and characterizing sorted stone circles fields with UAV imagery in Barton Peninsula, King George Island

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Stone circles are a type of patterned ground formed in periglacial environments with a remarkable geometric regularity. These metric shapes are formed in frost-susceptible soils due to freezing and thawing cycles in a convection-like circulation of soil in the active layer of permafrost [1]. Besides their evident geomorphic importance, the periodic burial and exhumation of material may play an important role in the soil carbon cycle and their connection to permafrost conditions. These changes may designate them as potential paleoclimatic indicators [2]. Although the processes underlying their formation are relatively well understood, their geometric characteristics and seasonal dynamics are supported by sampling and monitoring of very few circles [2], preventing obtaining robust statistics and an overall spatial analysis of large fields. Imagery with milli- to centimetre resolution captured by UAVs [3] can contribute to a more complete geomorphic description and monitoring of the dynamics associated to this type of patterned ground at large scale. We present the procedures developed and some preliminary results obtained along a complete processing chain, starting in the UAV surveys to acquire the images, going through the creation of image mosaics and DEMs and followed by the processing of the images in order to extract meaningful information of the stone circles. The study sites are located in Barton Peninsula (King George Island, 62°S), where extensive fields of sorted stone circles are found, being the methodology validated with reference information captured at ground level [4].

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## High resolution mapping of Hurd Peninsula (Livingston Island, Antarctica) with a UAV

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The region of the Antarctic Peninsula is showing one of the strongest warming rates on Earth since the 1950's, with an increase of about 2.5°C in the mean annual temperatures. The permafrost environment, which currently is at a critical threshold in the South Shetlands, may suffer drastic changes if the warming trend is to continue. The detailed mapping of these ice-free areas is of great interest to periglacial and ecological studies, which can greatly benefit from remotely sensed images. These images have been recently captured with unprecedented detail with the deployment of UAVs. Our team has been surveying Barton peninsula (King George Island) with UAVs for the past 4 years. During this period we have extracted detailed DEM data and produced high resolution orthophotos of most of the peninsula with multi-temporal observations, both in true color and near infrared [1]. During this last 2016 campaign we not only repeated this task but also carried out UAV surveying around the Global Terrestrial Network for Permafrost (GTNP) sites and the rockglacier of Hurd peninsula in Livingston Island. The high resolution (10 cm/pix) digital elevation models and mosaics of orthophotos (4 cm/pix) obtained, created with state-of-the-art structure from motion techniques, resulted in high resolution geomorphological and surface maps. DGPS control points were extracted to spatially correct these maps to half a centimeter precision. This study also contributed to the PERMANTAR-initiative team's effort since 2011 in monitoring the deformation of the rockglacier using GNSS and DINSAR.

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## Detailed mapping and georeferencing of Barton Peninsula (King George Island, Antarctica) using high resolution images acquired with an UAV

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This poster will describe the procedure of acquiring high resolution remotely sensed images with an Unmanned Aerial Vehicle (UAV) in Barton Peninsula (King George Island, 62 °S, 58 °W, Antarctica) and the steps carried out to create a georeferenced map by processing the previous gathered images.

The mapping consists in the estimation of the ground topography from multiple view sources by generating mosaics. The resulting georeferenced mosaics will be later merged together and, thanks to some GCP (Ground Control Points), acquired by ground-truthing in different key points in the area, the position accuracy of terrain features could be increased.

The resulting high-resolution map, allows to easily recognize the main surface types in the area, an area characterized by different vegetation and geomorphological features associated with permafrost phenomena. Among this surfaces types we could identify, bare soil, snow, stone circles, mosses and lichens.

Ultimately, the chronological evolution of the last features is a good indicator of the climate change's affecting this Antarctic region.

The analysed data was obtained during Antarctic campaigns in 2014 and 2015, through PROPOLAR (Portuguese Polar Program) in collaboration with KOPRI (Korean Polar Research Institute) and INACH (Instituto Antártico Chileno).

## Air temperature and snow cover effect on ground surface temperatures in Byers Peninsula, Antarctica.

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The global warming is affecting Antarctica, especially the western Antarctic Peninsula region, and snow cover thickness (Sn) regime changes were recently reported in Livingston and Deception Islands, at the South Shetland Archipelago. To quantify the relation of air temperature (Ta) and snow cover (Sn) variations with ground surface temperatures (Ts) evolution during the 2009-2016 period, we performed multilinear regression analyses of the data acquired at the Limnopolar Lake CALM-S site on Byers Peninsula at Livingston Island. Two different scenarios were used: Scenario A considers the Sn presence/absence, and Scenario B considers the Sn thickness in discrete values. The aim of this study is to evaluate the input temperature data when certain Sn thickness is not available. The complete dataset was analyzed for each scenario, both yearly and seasonally (thaw and snow seasons for all the study period or each year), to complete 48 cases during 2009-16 period. The obtained results are statistically consistent, with slight differences between both scenarios. We get similar general equations given by  $Ts(-)=1.54+0.90\cdot Ta(-)-1.84\cdot Sn(cm)-0.63\cdot Ta(-)\cdot Sn(cm)$  when only Sn presence/absence information is available (Scenario A), and by  $Ts(-)=0.90+0.55\cdot Ta(-)-0.02\cdot Sn(cm)-0.01\cdot Ta(-)\cdot Sn(cm)$  when Sn thickness data is available (Scenario B). The effect of the snow cover, Sn in the surface temperature Ts, is 0.01 – 0.04°C/cm (when thickness data are available), while the Ta affects to the Ts at a rate of 0.25 – 1.1°C.

## **Snow cover influence in the active layer and permafrost thermal regime. First campaign of the PERMASNOW project: objectives and instrumentation.**

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The thermal behavior of permafrost and the active layer is influenced by the isolation effect caused by the snow layer accumulation on the soil surface. During previous research projects, our team has focus in the experimental study of the thermal evolution of permafrost and the active layer in a highly climatic variability at south polar region: the South Shetland Islands, on the north tip of the Antarctic Peninsula. Thus, we set various field station at different sites in Livingston and Deception Islands focused on the measurement of the temperature evolution in several boreholes at different depths and the analysis of the active layer dynamics related to the local meteorological parameters. Next 2016-17 Antarctic campaign, will start a new project named PERMASNOW which have as one of its main objectives to characterize the soil, the snow cover, and their thermal effect on permafrost evolution. For this reason, we will deploy a set of new instrumentation to acquire information about key snow and soil parameters as snow density, snow thickness evolution, snow water equivalent, snow surface temperature, contents of liquid water and ice, soil humidity and soil resistance to penetration. The resulting data will be correlated with the thermal records obtained for permafrost and the meteorological parameters. With all of this information, we seek to characterize the snow influence in permafrost and the active layer thermal evolution.

In this work, we develop a complete description of the instrumentation and their physical principles, as well as for the new instrumental setting for the experimental sites and their capabilities.

## Oriented ice-wedge polygons and oriented deposition - Meanders as an evidence.

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Ice-wedges were classified by Lachenbruch (1962) into orthogonal and non-orthogonal systems. The main difference in this scheme is that tetravalent vertices predominate over trivalent in the first type. Nevertheless, the striking pattern of some networks constituted by oriented polygons has no underlying theory to explain those arrangements. Black (1982) mentions that they could result from the relief in the associated meanders, while Lachenbruch (1962) points that they were probably generated by horizontal thermal gradients near the edges of gradually receding bodies of water.

In the oriented polygons sector of a polygonal network, the base soil material on point bar meanders has a well-defined lined up layout, according to the water lines that have previously made the deposition. The main cause for wedges asymmetry may this way result from the base material settlement orientation. Laboratorial simulations with plastic cracking materials show results with similar oriented patterns.

Meanders are a typical example of orientated deposition showing, all over the Arctic were polygonal networks co-exist, an oriented pattern in its internal bend or depositional areas, which coincides with the point bars orientation. On the other hand, in the external curved part of the meanders, where erosion occurs, the patterns are clearly not oriented, which may indicate that a previous aeolian deposition can be favored over the fluvial.

To quantify these differences in the patterns, we are developing a method based on remotely sensed imagery and elevation data. The study area is located in the Colville delta in Alaska which includes several meanders below the delta zone with extensive polygonal networks. VHR imagery of WorldView-2 and 3 satellites (0.5 m/pixel) from 2014 to 2015 is being used, together with the Stereo-Photogrammetric Digital Surface Model (SETSM) from the Polar Geospatial Center, University of Minnesota with a spatial of 2 m. Preliminary results that permit separate quantitatively the oriented from non-oriented patterns are presented.

## Individual particle analysis of atmospheric aerosols at a remote site, north of the Arctic Circle

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In this work we present data collected by our team in the Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR) during the past few years. The ALOMAR station is located in Andøya island close to the town of Andenes (69°16'N, 16°00'E, 380 m a.s.l.) on the Atlantic coast of Norway, approximately 300 km north of the Arctic Circle. The facility is managed by the Andøya Space Center, and the site is well-suited for measurements of remote background aerosols due to the absence of large regional pollution sources.

Aerosol samples were deposited onto 47 mm Millipore polycarbonate membrane filters with homogeneous size distribution pores of 0.2  $\mu\text{m}$  using an in-line filter holder. The filters were replaced once daily during the measurements period. Then the filters were analyzed with scanning electron microscopy with energy dispersive x-ray analysis. In this way we obtained the total aerosol concentration and the size distribution as well as the chemical composition and morphology of the individual atmospheric aerosols. A HITACHI SEM-2700 scanning electron microscope was used to provide high resolution images of the particles and, a RONTEC energy dispersive x-ray system allowed to obtain the information about elemental composition of the particles.

In spite of being a time consuming technique, this method allow to obtain a lot of information about the particles as the concentration, size distribution, chemical composition and aggregation state. Moreover, it allows to obtain information not available by any other technique, as the morphology of individual particles.

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## Hurd rock-glacier measured surface deformation from historical frames and satellite imagery.

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In the last 50 years the region west of the Antarctic Peninsula has suffered the highest mean annual atmospheric-temperature rise of Antarctica. The South Shetland Archipelago is located a few kilometers northwest of the Antarctic Peninsula tip. The mean annual temperature of the atmosphere in this part of maritime Antarctica is close to 0 degrees Celsius and therefore favorable to permafrost freeze-thaw annual cycles very sensible to mean annual atmospheric-temperature changes.

Among the studied geomorphologic indicators of permafrost are rock-glaciers found in steep slope domains consequence of slow landslides or solifluction of thawed water-saturated rock-debris and sediments. Rock-glacier surface velocity can be an important indirect observation to allow the monitoring of permafrost backwards in time and both decimeter-level pixel resolution of visible-band and synthetic-aperture radar imagery from satellite are useful, although limited to as far back as the last decade of the 20th century. Recovery of 1950's stereo-pairs and Structure from Motion processing allowed inferring horizontal displacements of the Hurd rock-glacier deformation ridges over 50 years.

Every austral summer since 2011 several benchmarks on the rock-glacier body are being measured through phase-differential GNSS positioning. Some of these benchmarks are located in comparable areas of the rock-glacier body also measured from the orthographic images. Very similar overall patterns and displacement levels are inferred by both methods and therefore no clear acceleration of the rock-glacier body displacement was assessed.

## Ground surface thermal regimes in Barton Peninsula, King George Island – Antarctica. Preliminary characterization

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Located in the region of the Antarctic Peninsula, Barton Peninsula on King George Island, presents extensive ice-free areas, with summer snow accumulating mainly in concave sites and playing an important role in the control of ground surface temperatures. The region has been characterized by significant warming during the 20th Century until 1999, but since then, a cooling trend has occurred, with increasing longer lasting summer snow cover. Landforms such as active sorted stone circles and solifluction lobes are characteristic of the periglacial environment of Barton Peninsula, with permafrost widespread at least in the plateaus but with a still unstudied distribution. On the scope of microclimatological studies, in February 2015, two sets of air and near surface ground temperature sensors were installed in two sites with the objective of better understanding the thermal coupling at the ground-atmosphere interface: one site at a plateau position, west of Baekje Hill (site A), at 175m a.s.l. and the other on a hill 65m a.s.l., 450m southeast of King Sejong Station (site B). Both sites measured air temperature and near surface ground temperature. At Site B, we additionally monitored surface ground temperatures at two spots downhill: one midslope, and the second one close to the limit of a late lying snow patch at the slope bottom. Nearly one-year data were collected between February 2015 and late January 2016. This poster shows the preliminary characterization of the air and ground surface temperature data with a focus on analysing the effects of snow cover on the ground temperature regime in different topographic settings. Meteorological data provided by KOPRI are used for assessing the statistical representativity of the study period in the last decade.