CONFERENCIA PORTUGUESA CIENCIAS POLARES

19 de OUTUBRO 2012

CENTRO DE QUÍMICA ESTRUTURAL | INSTITUTO SUPERIOR TÉCNICO

LIVRO DE RESUMOS
ABSTRACT BOOK

ORGANIZAÇÃO

ipma · IGOT Instituto de Geografia e Ordenamento do Território · CENTRO DE OCEANOGRAFIA

APOIOS

FCT Fundação para a Ciência e a Tecnologia · PROPOLAR · SCAR · IASC · Caixa Geral de Depósitos · APECS Association of Polar Early Career Scientists Portugal

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O Presidente da República

IV CONFERÊNCIA PORTUGUESA DE CIÊNCIAS POLARES

IV PORTUGUESE CONFERENCE ON POLAR SCIENCES

Consolidação Internacional da Ciência Polar Portuguesa

Strengthening International collaborations of the Portuguese Polar Science

19 – 10 – 2012

Organização/Organization

Instituto Português do Mar e da Atmosfera

Instituto Superior Técnico

Instituto de Geografia e Ordenamento do Território

Instituto do Mar da Universidade de Coimbra

Centro de Oceanografia da Universidade de Lisboa

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Bem vindos à IV Conferência Portuguesa de Ciências Polares!

A Ciência Polar Portuguesa volta a encontrar-se para a sua Conferência Nacional este ano na sua 4ª Edição. Sob o tema a "*Consolidação Internacional da Ciência Polar Portuguesa*" pretende-se este ano afirmar a ciência nacional nos Pólos como uma ciência de excelência e ainda reforçar a cooperação nacional com países estratégicos tanto a nível de investigação no Árctico como na Antárctida.

São três os objectivos centrais do encontro deste ano:

- Rever os desenvolvimentos científicos que tiveram lugar no ultimo ano;
- Identificar futuras oportunidades científicas;
- Fazer um balanço da 1ª Campanha Portuguesa na Antárctida que decorreu entre Dezembro de 2011 e Abril de 2012.

Tal como em anos anteriores, este ano pretende-se consolidar a presença internacional da Ciência Polar Portuguesa. Desta forma, Brasil, Espanha e Reino Unido com quem o Programa Polar Português possui projectos de investigação através dos seus investigadores foram também convidados a partilhar connosco não só a sua ciência mas também a debaterem com as equipas nacionais futuras formas de cooperação. Igualmente o Canadá, pais de excelência em investigação no Árctico, irá estar igualmente presente para avaliar de que forma a cooperação ainda muito vestigiária poderá ser incrementada.

Neste sentido agradecemos a vossa presença neste encontro nacional esperando que, tal como em anos anteriores, este encontro venha constituir um marco na Ciência Polar Portuguesa.

A Comissão Organizadora

Welcome to the IV Portuguese Conference on Polar Sciences!

Welcome to the 4th Portuguese Polar Science Conference! Under the theme "Strengthening International collaborations of the Portuguese Polar Science", it aims to confirm the science carried out by Portugal in the polar regions, focused in excellence, and reinforce cooperation with strategic countries in the Arctic and in the Antarctic.

There are three main objectives:

- Review the scientific developments in the last 12 months by Portuguese research teams;
- Identify future scientific and educational opportunities;
- Evaluate the 1st Portuguese Campaign in the Antarctic carried out between December 2011 and April 2012.

As in previous years, there is a need to internationalize the polar science carried out by Portugal and reinforce our scientific links with our strategic country partners. Therefore, representatives from Brazil, Spain and United Kingdom were invited to participate in our conference to show the polar science carried out in their countries, the links that they already have with Portuguese teams and debate future options of cooperation. Canada, known as a country of conducting excellent science in the Arctic, will also participate to promote future potential collaborations.

We would like to thank you for your presence in this national conference and for contributing for the development of the Portuguese Polar Science.

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Gonçalo Vieira

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- **Professor Warwick Vincent – Laval University and Centre for Northern Studies, *Canada***
- **Professor Andrés Barbosa – Museo Nacional de Ciencias Naturales Madrid – *Spain***
- **Professor Alain Rodger – British Antarctic Survey, *United Kingdom***

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Oradores Convidados / International Guests

Professor Jefferson Cardia Simões

Porto Alegre - BRASIL

Primeiro glaciólogo brasileiro, professor do Instituto de Geociências da UFRGS e pesquisador 1B do CNPq. Geólogo pela UFRGS, Ph.D. em Glaciologia pelo Scott Polar Research Institute (SPRI) da Universidade de Cambridge (Inglaterra) e pós-doutor pelo Laboratoire de Glaciologie et Géophysique de l'Environnement (LGGE) du Centre National de la Recherche Scientifique - CNRS (França). Introduziu no Brasil a ciência glaciológica e a Geografia das Regiões Polares, lecionando nos programas de pós-graduação em Geociências e Geografia da UFRGS, onde orienta alunos de mestrado e doutorado. Participa do Painel Intergovernamental sobre Mudança do Clima (IPCC) como revisor de capítulos sobre a criosfera e a paleoclimatologia.

Professor Alan Rodger

Cambridge - UK

Professor Alan Rodger is the responsible for the development of the Science Strategy of the British Antarctic Survey. The research programme concentrates on key questions of global or fundamental importance that can be best answered by research in the polar regions, such as sea level rise and sustainable use of the polar oceans. He also provides advice to the UK Government on climate change and its impacts.

Professor Warwick F. Vincent

Quebec - CANADA

Dr. Vincent has conducted ecological research on lakes, rivers and coastal oceans in several parts of the world, including the subtropical convergence (South Pacific), Lake Titicaca (Peru-Bolivia), Lake Biwa (Japan) and the St Lawrence River. Most of Dr Vincent's research, books and articles have focused on the polar regions, with his first expedition to Antarctica in 1979. Working with the USA National Science Foundation, he played an early role in the environmental protection of the McMurdo Dry Valleys of Antarctica (a Long Term Ecological Research Site), culminating in an internationally accepted management plan and Environmental Code of Conduct Dr. Vincent is a professor of Biology at Laval University, Quebec City, Canada, and is presently the Scientific Director of the Center for Northern Studies (CEN), an interuniversity centre of excellence for research and training in the Canadian North.

Professor André Barbosa

Madrid - ESPANHA

Investigador *Museo Nacional* de *Ciencias Naturales*, *CSIC*. Ele tem estado envolvido na ciência polar há mais de 15 anos e está a desenvolver uma linha de investigação associada à ecologia de organismos em ambientes extremos e efeitos das alterações climáticas. É investigador principal em vários projetos cientificos. Muito ativo dentro da comunidade cientifica polar Espanhola, e também em organizações como a SCAR.

Apresentações Orais/Platform Presentations

Preliminary major element data for the volcanic rocks collected in the scope of the CONTANTARC Project for Deception Island, Antarctica

Pedro Ferreira[1], Mário Mil-Homens[1], André Mão de Ferro[2], Rogério Calvo[1], João Canário[3], Ana Maria Mota[2]

[1] LNEG, Laboratório Nacional de Energia e Geologia
[2] IST, Instituto Superior Técnico
[3] IPMA, Instituto Português do Mar e Atmosfera

Integrated in the CONTANTARC project, a set of 32 sediment and volcanic samples, collected in different environmental (lake, smokers, beaches, permafrost and rivers) and geographic settings of the Deception Island are being studied.
With the main goal of understanding sources, fate and environmental processes based on the chemical composition of the sediments, all the 32 samples collected were separated through a 2 mm sieve. The lower 2 mm fraction was physically prepared for major and trace analysis, and presently the major elements are being quantified by X-Ray Fluorescence Spectroscopy (XRF).
Additionally, sample rock fragments were also analyzed by XRF to obtain their major element composition in order, firstly, to address the geochemical composition of the volcanics of Deception Island and, secondly, to study and understand the petrology of the corresponding magmas.
The volcanic samples studied maybe included in two distinct textural groups – the first, highly vesicular (vesicles having circular shape with ~1 mm in diameter, occupying up to 50% volume of the rock) and presenting small microphenocrysts of plagioclase, whereas the second group of lavas are massive, and totally aphyric. This is indicative of distinct types of extrusion, probably related with the magmatic volatile content.
The major element geochemistry revealed that all the volcanic rocks analyzed belong to the alkalic volcanic series (typical of the Ocean Island basalts – OIB) and, based on the Total Alkalis vs. Silica (TAS) discriminate diagram, can be classified as basaltic andesites. Only the volcanics of Punta Murature are trachyandesite basalts and are the most incompatible-element enriched samples off all (K_2O/TiO_2 ~0.5). The obtained fractionation trends indicate a major role of olivine and plagioclase in the differentiation of the magmas, but mantle heterogeneities and/or different melt degree should be invoked to explain the distinct geochemistry presented by the Punta Murature lavas, which can only be clarified with the trace element and radiogenic isotopic data.

Sources, transport and speciation of trace metals in environmental compartments of Deception Island (Antarctica)

André Mão de Ferro[1], João Canário[2], Ana Maria Mota[1]

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Antarctica is the most remote and unspoilt Continent, usually seen as a symbol of pristine environment. However, the impact of human activities dates from the 19th century when the first explorers and seal hunters arrived.
Deception Island, an active Volcano in the South Shetland Islands, with a large flooded caldera named Port Foster is one of the most frequently visited sites in Antarctica.
In order to track the sources of natural and anthropogenic inputs of metals (Hg, As, Pb, Cd and Cu) into that ecosystem, samples were collected from several environmental compartments (water, ice, snow and sediments) in different locations of the island, as well as in saline waters of Port Foster using diffuse gradients in thin film (DGT) devices, from 1 to 20th December.
Preliminary results suggest that natural processes, namely volcanic activity is the most important source of Hg. Mercury levels in water and sediments sampled at the two fumaroles were up to 10000 times higher than in the other sampling sites.
Copper and lead concentrations measured near the Gabriel de Castilla Base were up to 3 times higher than in the other sampling sites suggesting that there is an anthropogenic source of this two metals in or near the base.
Interestingly the concentration of (As) was lower than detection limits (<0,14 ppb) in snow and ice samples. However in spring water samples collected in Irizar mountain (headwaters of Mecon River) As concentrations reach 0.39 ug/L decreasing downstream of Mecon River.
The concentrations determined for CD were lower than the detection limits (<0,010 ppb) in snow, ice, river and lake water samples, however, the concentration found on Port Foster bay were relatively homogeneous, which suggests an internal source on the bay.
These preliminary results pointed to the existence of several sources of contaminants in Deception Island that contribute to a relatively higher contamination of this ecosystem. By comparing the obtained results with the ones determined in the contaminated Tagus Estuary we found that while Hg concentrations are comparable in the two systems, Cu, Pb and Cd are respectively up to 3, 2, and 10 times higher in the Deception ecosystem.

MATAGRO - Monitoring of Atmospheric Tracers with Ground Based Observation. Fifteen years of observations and activities during the XXVII Italian Antarctic expedition at the "Mario Zucchelli" Station (MZS)

D. Bortoli[a, c], F. Ravegnani[c], G. Giovanelli[c], P.S. Kulkarni[a], M. Anton[d], M.J. Costa[a,b] and A. M. Silva[a,b]

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[d]Departamento de Física, Universidad de Extremadura, Badajoz, Spain

The monitoring of the so-called "Ozone hole" and of the atmospheric compounds involved in the ozone chemical cycle is one of the main subject of the international scientific community. At the "Mario Zucchelli Station" (-74.69°, 164.12°) the GASCOD (Gas Analyzer Spectrometer Correlating Optical Differences) equipment is installed since 1995. The time series of vertical content of nitrogen dioxide (NO2) and ozone (O3) and chlorine dioxide (ClO2) obtained during this period allows for the characterization of the Antarctic stratosphere and for the recognition of the periods of occurrence of the ozone hole phenomenon. The full dataset of the spectral data obtained with GASCOD during the period 1996-2009, was re-analyzed with a modified version of the software tool previously utilized. The uncertainties range from 4% up to 8% for O3 and from 3% tup o 6% for NO2. The peculiar features of the seasonal variation of O3 (i.e. during the 'Ozone Hole' periods (mid-August to mid-October) and NO2 total columns (i.e. the normal decreasing during the austral fall and the irregular growing towards the spring months) are clearly identified. For the first time, the NO2 total columns values, obtained with the GASCOD installed at MZS, are compared with the data obtained with satellite borne equipments (SCIAMACHY, GOME and OMI). In addition the activities during the 2011/2012 expedition at MZS, focused on the maintenance of the old GASCOD are briefly described. The actions for the installation of the new equipment, belonging to the GASCODNG/SPATRAM type instrument, foresee for the next Antarctic expedition, are illustrated.

Mercury reactivity during AMDE's in Canadian Sub-Arctic region (Kuujjuarapik, Qc)

João Canário[1], Laurier Poissant[2], Marta Nogueira[1], Martin Pilote[2]

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Abstract:
It was discovered in 1995 that, during the spring time, unexpectedly low concentrations of gaseous elemental mercury (GEM) occurred in the Arctic air. This behaviour was surprising for a pollutant known to have a long residence time in the atmosphere; however the conditions appeared to exist in the Arctic promoting the depletion of mercury (Hg). This phenomenon is termed atmospheric mercury depletion events (AMDE´s). During AMDE the concentration of reactive gaseous mercury (RGM) at the surface may reach relatively high values. Since RGM is very reactive, this mercury specie may be reduced and re-emitted to the atmosphere or it can be available for other biogeochemical processes occurring at the snow pack for example.
In April 2008 during a field campaign in Kuujjuarapik (55,16N, 77.45W) several AMDE's were observed and their effects on the sub-Arctic ecosystem were studied. During those events, GEM, RGM and particulate gaseous mercury (PGM) were continuously measured in three stations in the proximities of the Centre for Northern Studies (CEN). Simultaneously, different snow samples were taken and analysed for total mercury, methylmercury (a strong neurotoxin) and other interpretative parameters. The snow samples were also collected for microbial analysis.
The obtained results showed that up to 80% of the mercury deposit during AMDE's was re-emitted to the atmosphere. In the snow pack the MeHg concentrations in snow increased significantly after the events suggesting an active microbial activity in the snow capable of mercury methylation. These methylation processes were found to be related to the nature of microbial community, the amount of deposit RGM and the amount (mg/L) of inorganic particles.
Interestingly methylmercury concentration decreases during the night indicating also an efficient demethylation process.
These results confirm the importance of AMDE's on the Arctic Hg input and enhance the importance of further studies concerning the understanding the variations and the biogeochemistry of RGM in the boreal ecosystems.

Chemical properties of snow in the Arctic NUNAVIK region (Canada)

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Snow and ice are critically important environmental components of the ecosystem in polar latitudes, affecting energy balances and Hydrologic cycles and can thus directly affect the behaviour of chemicals in the environment on the local, regional and global scales. Snowfall has the potential to significantly contribute for the deposition of airborne particles, organic compounds or contaminants.
Aiming to chemically characterize snow and understand hoe she affects the surrounding environment, by April 2008 in the region of Kuujjuarapik- Whapmagoostui, Québec (Canada), surface snow (3stations) and the snow pack (11 station) were sampled and analysed for several chemical parameters like nutrients, carbon, nitrogen, suspended matter and contaminants.
Results revealed that surface snow under vegetation is high in particles enriched with carbon, nitrates, humic substances and metal such as Fe, Cr, Co, As, Cd, Cu, Pb and Ni while snow near Kuujjuarapik village is high in ammonia, phosphates, silicates, organic carbon and Al. Highest concentrations of Zn and Hg, where observed in the snow over the frozen Great Whale River. The analysis of the snow pack (120cm) revealed that the top layer (20 cm thick) presents higher concentrations of nutrients, carbon and Al decreasing with depth until bottom layer. Opposite behaviour was observed for Fe, Cr, As, Pb, Ni and Zn with increased concentrations in the bottom layer.
These findings suggest that snow deposition plays an important role in Artic ecosystems contributing for the atmospheric deposition of several chemical parameters including contaminants. When melting, snow will add these compounds to soils, and aquatic systems whose fate and transport mechanisms have to be accounted for when we intend to establish global warming impact in the Arctic.

Usnea antarctica as a proxy for mapping snow patterns in Fildes Peninsula (King George Island, Antartica)

Gonçalo Vieira[1], Carla Mora[1], Pedro Pina[2], Carlos Schaefer[3]

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Snow cover distribution during the cold season is one of the main controls on ground thermal regime and can be a determinant factor for the presence of permafrost.
In the South Shetlands, an archipelago located at the climatic boundary of permafrost the role of snow is still poorly understood. Ground temperature data from Livingston Island shows that slight differences in winter snow tickness induce significant differences in ground temperatures, with coldest sites occurrying is thinner.
During the warm season, snow insulates the ground from warming and therefore seems to favour permafrost presence, at least in the sporadic permafrost belt. In this contribution we study the spatial distribution of winter snow cover targeting at the distribution of the convex relief snowfree areas. These same areas are dominated by dense covers of Usnea antarctica lichens and our working hypothesis is that by mapping them we will be able to map snowfree surfaces.
In January 2012 we have conducted a detailed ground truthing survey of Vegetation and geomorphology at the Meseta Norte in Fildes Peninsula and used it to produce a map of the Usnea antarctica. dominated areas. This map is then compared with a QuickBird early spring scene in order to evaluate the ability to use Usnea maps as snow thickness proxies.
The final map is also compared with field observations on nivo-aeolian corrasion features on rock surfaces that support the occurrence of repetitive patterns of ice-free areas during the cold season.
This research is part of the projects SNOWCHANGE and PERMANTAR-2 (PTDC/AAC-CLI/098885/2008) integrated in the Portuguese Polar Campaign – PROPOLAR and funded by the FCT.

Results of a repeated geoelectrical survey performed in a CALM site in Livingston Island (Maritime Antarctica)

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Under the framework of the projects PERMANTAR (Permafrost and Climate Change in the Maritime Antarctic) and PERMANTAR-2, in January and February, 2009, and January, 2012, two geoelectrical surveys using an electrical resistivity tomography (ERT) methodology were conducted in a Circumpolar Active Layer Monitoring (CALM) site in the Hurd Peninsula of Livingston Island (Maritime Antarctica) with the objective of studying the spatial and time distribution of permafrost in the area. Geoelectrical methods are particularly useful for permafrost studies because of the significant increase of the ground's electrical resistivity when it is partially or totally frozen. Two ERT profiles were done in the CALM site during two years with the same orientations. The measured apparent resistivity values were mathematically inverted to obtain two-dimensional geoelectrical models for each of the ERT profiles. The models show high electrical resistivity values (of the order of 10^4 Ω.m) in some zones along the ERT profiles. The interpretation of the electrical resistivity models is that the high electrical resistivity values appear to be associated with areas with superficial frozen material and not permafrost.

Two and a half years of activities and results of Project ANAPOLIS

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This presentation makes a synthesis of the activities and results obtained during the development of project ANAPOLIS funded by FCT since 2010 (reference PDCTE/CTE/099/2008) whose main scientific objective is to make the analysis of polygonal terrains on Mars based on Earth analogues (Figure 1). The project is constituted by 3 Portuguese and 1 Norwegian research teams [1]. Martian networks are being analysed through remotely sensed images of very high spatial resolution (between 0.25 and 6 m/pixel), whereas terrestrial polygonal networks are being studied in detail at test sites in the Arctic region at 78oN of latitude, Svalbard (Norway) together with aerial and satellite images with resolutions of 0.06-0.20 and 1 m/pixel, respectively.

Fields campaigns were held in three consecutive summer periods between 2010 and 2012 in Adventdalen, Svalbard (Figure 2) to gather a diversified and large amount of field data [2, 3].

These tasks concerned accurate determination of the geometry and topology of the networks, extensive and detailed topographical surveys, detailed geomorphological mapping, active layer measurements, aerial flights with an UAV (Unmanned Aerial Vehicle) for capturing very high resolution remotely sensed images, ground-truth construction for the classification/validation of aerial images, soils sample collection, among others. The data collected in the field, the several datasets of remotely sensed images of Svalbard and Mars and all outputs produced are organized into a geographical database. The features measured on the terrestrial networks are being confronted with those of Martian networks and are helping us in their understanding.

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[2] Pina P., Vieira G., Christiansen H.H., Barata T., Saraiva J., Bandeira L., Lira C., Jorge M., Mora C., Ferreira A., Oliva M., Trindade A., Poelking E., Machado A., Neves M., Lousada M., 2011, Characterizing polygonal terrains in-situ on Adventdalen (Svalbard) for comparison with Martian analogues: The 2010 field campaign. LPSC2011-Lunar and Planetary Science XLII, Abs #1387, Lunar and Planetary Institute, Houston TX.

[3] Pina P., Vieira G., Christiansen H.H., Barata T., Oliva M., Neves M., Bandeira L., Lousada M., Jorge M., Saraiva J., 2012, Analog studies of ice-wedge polygons in Svalbard: 2011 field campaign, topology and geometry, LPSC2012-Lunar and Planetary Science XLIII, Abs #2353, Lunar and Planetary Institute, Houston TX.

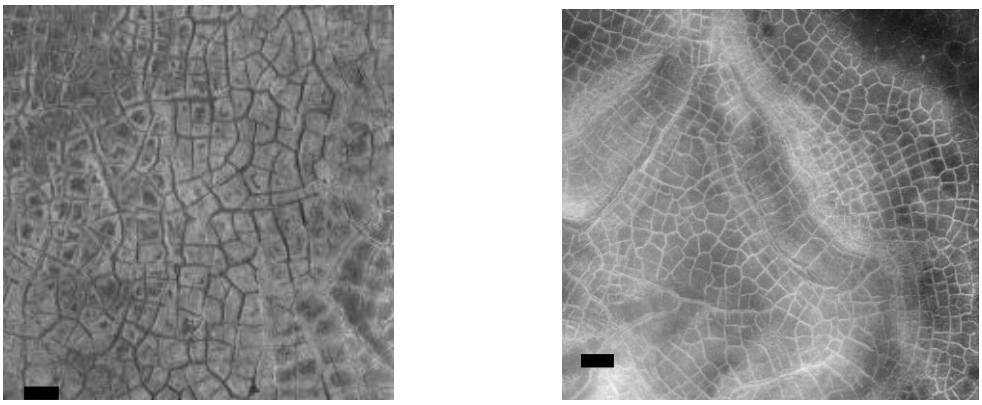

Figure 1. Polygonal networks on Svalbard (left) and Mars (right). Svalbard image (6 cm/pixel) was acquired by an UAV from GeoKolibri; Mars image (25 cm/pixel) was captured by HiRISE camera of MRO probe from NASA. (the bars correspond to 50 m).

Figure 2. Mosaic of aerial images (20cm/pixel) of the study area of ANAPOLIS (Adventdalen, Svalbard, 78oN) (the width of this image is about 25 km). (images Norsk Polarinstitutt).

Are growth and survival of black-browed albatross chicks affected by ticks?

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Parasites and disease are both believed to play a role in the regulation of seabird populations, but conflicting results have been produced by several studies. A number of negative direct or indirect consequences of tick infestation have been found or suggested for several seabird hosts, but other studies have been inconclusive. In this study, the effects of the tick *Ixodes uriae*, an obligate parasite of seabirds, upon the chicks of the black-browed albatross *Thalassarche melanophris* are investigated, during two years at a colony on the Falkland Islands. Unexplained death episodes among black-browed albatross chicks during the brooding period in some colonies on the Falklands, where the parasite has a high prevalence, raised the possibility that it could be inducing either death or morbidity. The results of two studies are here reported: on the first we assessed the effects of ticks on the condition and survival of albatross chicks by determining the tick load on 5 day old chicks in 2008/09 on 3 different plots; on the second we used an experimental approach where one group had ticks removed daily and a control group was left unmanipulated. For each chick daily measures of tick load, weight and bill length were taken in 2009/10 during their first 14 days of life. Despite very high prevalences in both years (more than 98% of the chicks were infested), the tick load was significantly higher and the mass of 59 day old chicks was significantly lower in 2008/09. High mortality levels were recorded in 2008/09 but no effects over survival were observed in 2009/10. Our experimental disinfestation clearly indicated that ticks reduced mass gain and depressed the growth of chicks. Even without fully disentangling other potential causes, our results suggest that the consequences of *Ixodes uriae* over its hosts can be severe, especially under hyperinfestation conditions. This study adds relevant information to understand *Ixodes uriae*-host interaction, but more research is necessary.

Adaptive responses of Antarctic fish to environmental temperature and salinity

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Antarctic fishes have evolved in a stable thermal and haline environment for roughly 30 million years. Recent climate changes contributed to a significant rise in water temperature and the forecast models indicate the rate of such changes will increase in coming years, especially in the coastal areas of maritime Antarctica, possibly leading to ice melting and freshening of shallow waters in enclosed areas.

In experiments run in 2005 and 2012 we exposed two species of Notothenidae, *Notothenia coriiceps* and *N. rossi*, to rapid but gradual changes in water temperature or/and salinity to evaluate the response of several physiological processes. Fish collected around the Rothera (UK) and Arctowski (PL) stations using traps or fishing poles were transferred to experimental tanks in cold rooms and after an adjustment period, acclimated from natural temperatures (0-2°C) to 4-6°C using thermostat-controlled heaters, and from 32 ppt to 20-10 ppt by addition of freshwater to recirculating tanks, both over a period of up to 10 days.

Although we have not recorded significant mortality or changes in behavior between the groups, our preliminary data shows that both cortisol, a key player in the stress response, and gene expression of metabolic-related proteins were upregulated in fish exposed to heat change. Additionally, the rise in temperature induced a dependent increase in plasma osmolality while decreasing branchial Na^+/K^+-ATPase activity.

These results show that fish are responsive to environmental change, but that their physiology may be compromised, namely on osmoregulation. What is the metabolic scope for adaption is still undetermined.

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Marine Resources in the Southern Ocean: Insights from Top Predator Diets on the Role of Krill and Cephalopods

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In the Southern Ocean, most exploitation of marine resources has focused on seals (18th and 19th centuries), whales (until the mid 20th century) and more recently fish (marbled rockcod (Notothenia Rossii), grey notothenia (*Lepidonotothen squamifrons*), toothfish *Dissostichus* spp. and mackerel icefish *Champsocephalus gunnari*) and Antarctic krill *Euphausia superba* have been exploited commercially in the Southern Ocean. Of these, krill and the latter two fish species are still exploited. Today, there is the need to not only assess and manage the species that are already being targeted but also species that have the potential to be targeted in the future, such as cephalopods.

Antarctic krill and cephalopods are known to play a key role in the food web of the Southern Ocean, being part of the diet of numerous predators, including penguins, seals, albatrosses and whales. For Antarctic krill (as a keystone species in the Southern Ocean), its fishery management approach is both precautionary and ecosystem based, focusing on the Antarctic krill catches and on predators that are either directly or indirectly on Antarctic krill. On the other hand, most knowledge on cephalopods still originates largely from analysis of stomach contents collected from their natural predators, because methods for direct sampling at sea are inefficient.

In this study, we aim to analyse the diet of predators of Antarctic krill and cephalopods (2 species of penguins, 3 species of albatrosses and 2 species of toothfish) in order to:

- Assess the importance of Antarctic krill in the diets of penguins, useful for assessing krill fisheries assessment
- Assess the importance of cephalopods in albatrosses and toothfish, useful for assessing future precautionary measures on cephalopod fisheries
- Evaluate how this information shall be incorporated into modelling food web dynamics.

Our results show that the dependence on krill depends highly on the location of breeding colony, and breeding cycle, of the top predators (e.g. gentoo penguins at South Georgia feed more on fish than gentoo penguins from the Antarctic Peninsula), that albatrosses feed on a wide range of cephalopods (from Antarctic, sub-Antarctic and subtropical waters) according to their foraging range while breeding, and that, using a modelling approach, potential shifts in krill abundance might have a wide range of potential consequences in different warming climate scenarios.

Stable isotopic signatures of the cephalopod fauna in South Georgia waters

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Albatrosses can be used as biological sampling tools to investigate poorly known organisms, such as the Southern Ocean cephalopods. In the present study, the cephalopod species found in the diet of three albatross species - wandering albatross (Diomedea exulans), black-browed (Thalassarche melanophrys) and grey-headed (Thalassarche chrysostoma) albatrosses), were identified and analyzed to investigate, for the first time, the cephalopod community structure around South Georgia. The trophic level and habitat of 14 cephalopod species were examined through the stable isotopic signatures of their beaks, namely the ratio of $\delta^{15}N$ ($^{15}N/^{14}N$) and $\delta^{13}C$ ($^{13}C/^{12}C$), respectively.
The top 4 cephalopod species (by order of their importance by number and by mass), found in the albatrosses diets were Kondakovia longimana, Martialia hyadesi, Moroteuthis knipovitchi andGaliteuthis glacialis . Based on the ratio of $\delta^{13}C$ ($^{13}C/^{12}C$) in the lower beaks, the main species found were from Antarctic and sub-Antarctic waters. The only squid species that presented signatures from Subtropical waters where Illex argentinus, with -17.31‰, and could had been caught near South Georgia (while being a common bait in longliners) or near Patagonian shelf (within its geographical range). The cephalopods were grouped in four trophic levels according to the ratio of $\delta^{15}N$ ($^{15}N/^{14}N$), spreading out in a continuum between crustacean (such as M. hyadesi) and fish-eating species (such as Gonatus antarcticus).
South Georgia community showed higher trophic levels than cephalopods community of Kerguelen (more than 2 ‰ of difference for H. eltaninae, M. knipovitchi, K. longimana, G. antarcticus and C. veranyi), which may be related to its strongest seasonal carbon uptake in the ice-free zone. Additionally, it may also indicate : i) the presence of a longer phytoplankton copepod-myctophid-higher predator food chain, since the nitrogen signatures were lower to those recorded in a phytoplankton-krill-higher predator food chain and ii) the possible scarcity of krill during the sampled season.

Posters

Poster 1

The ecological dichotomy of ammonia oxidizing archaea and bacteria in the hyper-arid soils of the Antarctic Dry Valleys

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The McMurdo Dry Valleys of Victoria Land is the largest ice-free areas Antarctica and considered to be the most physically and chemically extreme terrestrial environment on Earth. In such harsh conditions, microorganisms dominate and are believed to drive key biogeochemical processes in the system; however fundamental questions on the biodiversity and environmental controls of these microbial communities remain unanswered. In this study we investigated the diversity and abundances of archaeal (AOA) and bacterial (AOB) ammonia oxidizers in four Dry Valleys with highly variable soil geochemical properties: Miers Valley (MV), Upper Wright Valley (UW), Beacon Valley (BV) and Battleship Promontory (BP). Results revealed clear differences in soil bacteria 16S rRNA gene copy numbers, with one order of magnitude more bacterial biomass in MV and BP compared with the BV and UW Valleys. In agreement with the quantitative data, pyrosequencing of 16S rRNA gene and ARISA analyses showed significantly higher levels of bacterial diversity in MV and BP compared with BV and UW. Generally low AOB and AOA amoA genes diversity was observed; from a total of 210 clones of AOA and AOB amoA, only four AOA and AOB OTUs were recovered in the four Dry Valleys. However, clear differences were observed in the relative abundances of AOA and AOB among the Dry Valleys evaluated. While beta-proteobacterial AOB amoA genes dominated the ammonia-oxidizing community in soils from MV and BP, higher abundance of AOA amoA genes was found in UW and BV soils. In agreement, pyrosequencing analysis recovered AOB 16S rRNA sequences only at MV and BP valleys. Our results suggested that the extremely harsh conditions of UW and BV soils characterized by colder year-round temperatures, lower availability of liquid water and much higher conductivity values may connected with the lower observed bacterial diversity and abundance, and the numerical dominance of AOA within the ammonia oxidizers microbial communities of these extreme Antarctica ecosystems.

Poster 2

Feeding ecology of top predators in the Southern Ocean: Have we always have been under-estimating the role of cephalopods in their diets?

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Dietary studies are essential understanding the role of top predators in the Antarctic marine ecosystem and therefore, form an integral component of most monitoring programs around the Antarctic.
Cephalopods (e.g. squid and octopods) play an important role in the Antarctic, being a major component in the diet of many Antarctic predators, such as whales, albatrosses, seals and penguins. Cephalopods are identified mainly using their chitinized upper and lower beaks, but because it has been assumed that the number of upper and lower beaks would be the same in predator diet samples, more effort has been put into creating keys for the lower beaks, which are more easily identifiable from morphology.
In this presentation, we will show results evaluating critically whether the number of upper and lower beaks differs in diet samples collected from a major cephalopod predator, the wandering albatross (*Diomedea exulans*), potential biases in the estimation of predator diets are assessed, and upper:lower beak ratios in published studies of other seabirds, seals, whales, and fish from around the world reviewed.
The ratio of upper to lower beaks in diet samples from predators varied greatly in a single year, between years, and biases were greater for certain cephalopod species, resulting in underestimation of their relative importance. We will recommend that diet studies MUST consider using a new way of analyzing the diets of Antarctic top predators, using both upper and lower beaks (instead of just using lower beaks), in order to improve the assessment of the contribution of different cephalopods to predator diets, and consequently to be incorporated in assessment/management of Antarctic marine resources in the future.

Poster 3

Integrating Climate and Ecosystem Dynamics (ICED) project: Response of Southern Ocean ecosystems to change

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This poster is focused on Southern Ocean ecosystem research and the response of individual species, food webs and whole ecosystems to change. The Southern Ocean supports unique ecosystems, components of which are commercially exploited, and has an important influence on global carbon and nutrient budgets. Whilst some areas of Antarctica and the Southern Ocean are undergoing rapid warming, other areas are cooling and the consequences of such change on pelagic food webs, their capacity to maintain fisheries and their role in biogeochemical cycles are largely unknown. Understanding the response of these ecosystems to past, current and future climate change and commercial exploitation is crucial to developing management strategies for the Southern Ocean, and elucidating its role in the Earth System.
The Integrating Climate and Ecosystem Dynamics in the Southern Ocean (ICED) programme. ICED's integrated circumpolar approach is facilitating international cooperation and coordination, linking national capacity and expanding a multidisciplinary community with expertise on Southern Ocean ecosystems and the impacts of related processes on climate, ocean, sea ice and biogeochemistry. This approach is necessary to predict the likely responses of Southern Ocean ecosystems to change and to support the management and protection of the ecosystem services of this globally important ocean. Because of its sensitivity, contrasts and relatively simple ecological structure, the Southern Ocean also serves as a model system for developing methods for global application and providing early warnings of the effects of change. We welcome contributions from programmes with a Southern Ocean focus, including SOOS, SOLAS, CLIVAR and CCAMLR. This session will also provide a forum for integrating the results of the recent ICED-SENTINEL workshop *'The state of knowledge- initial assessments of change in Southern Ocean ecosystems'* to the wider SCAR community and other relevant Southern Ocean studies. ICED is a regional programme of the IGBP's IMBER programme. For more information please visit www.iced.ac.uk

Poster 4

Project PENGUIN – SCIENCE: Competition between penguin species in the Antarctic Peninsula: do they need on the same prey?

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The project PENGUIN, within the national program PROPOLAR, is a research project financially co-supported by the Portuguese Foundation for Science and Technology (FCT), Bulgaria Antarctic Institute and the Spanish Antarctic Programme, within the work of the Expert Group on Birds and Seals of SCAR (SCAR-EGBAMM), international program Integrating Climate into Southern Ocean Dynamics (ICED) and Evolution and Biodiversity of the Antarctic (SCAR-EBA). The project brings scientists from Portugal, Spain, Bulgaria, United States of America, United Kingdom and Brazil to investigate how different species of penguins compete for food in Livingston Island (Antarctic Peninsula). This region has suffered major effects due to climate change. The fieldwork was carried out from the Bulgarian Base, with the collaboration of the Spanish Base, with weekly zodiac trips to the gentoo *Pygoscelis papua* e chinstrap *Pygoscelis antarctica* penguins to collect diets, feathers and blood. The diets (from stomach contents and scats) provided information on the feeding ecology of the penguins within hours/1-2 days, whereas the blood will provide information on the diets from a period of up to a week and feathers information of when they were produced (in March-April in the previous year). The diet samples were already analysed and showed that both species of penguins fed mainly on Antarctic krill *Euphausia superba* (> 98% by mass) with the same sizes. These results clearly show that both species highly compete for the same prey. As Antarctic krill abundance has been declining in the last 40 years in Antarctic Peninsula, it is likely that both (or one of the penguins) might be obliged to change their diets or their populations may decline.

Poster 5

Stable isotopes indicate sex-specific and individual foraging consistency in wandering albatrosses

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The wandering albatross (Diomedea exulans) is regarded as a generalist predator, but can it be consistent in its foraging niche at an individual level? This study tested short- and long- term consistency in the foraging niche in terms of habitat use, trophic level and, by inference, prey selection. Fieldwork was carried out at Bird Island, South Georgia, in May- October 2009, during the chick-rearing period. Blood (plasma and cells) and feathers for stable isotope analyses ($\delta^{13}C$ and $\delta^{15}N$) were sampled from 35 adults on their return from a foraging trip during which they carried stomach temperature, activity and Global Positioning System loggers. Results suggest short-term consistency in foraging niche in relation to both oceanic water mass and trophic level, and long-term consistency in use of habitat. Consistent differences among individuals partly reflected sex-specific habitat preferences. The proportion of consistent individuals (i.e. with a narrow foraging niche) was estimated at c. 40% for short-term habitat and trophic level (prey) preferences, and 29% for longer-term habitat preference, suggesting this is an important characteristic of this population and potentially of pelagic seabirds in general. Foraging consistency was not related to body condition or level of breeding experience, instead it may reduce intra- specific competition.

Poster 6

An interactive application for the quantitative analysis of polygonal networks

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The research project ANIMAR – Automated Annotation of Images from the Surface of Mars (PTDC/CTE-SPA/110909/2009), funded by FCT, aims at the identification of different types of surface features on the planet Mars. Polygonal networks constitute one of the most interesting subjects of study within this framework [1], given their similarity in morphology and possible origin with terrestrial periglacial ice-wedge examples.

Image analysis is of great help in this study; its methods can be applied to the segmentation and characterization of the networks, and can be easily translated into suitable computational platforms such as MATLAB®. The algorithms employed so far in this research were nonetheless far from constituting an optimized sequence and being easy to use. Hence came the idea of creating a graphic user-friendly interface, integrating the different steps in the processing of the images; thus, a user can easily try different approaches and immediately evaluate the results obtained in the analysis of complex images, either of Mars, Earth, or any other planetary body.

In this work, we illustrate the current stage of development of the application, bearing in mind that it is still subject both to some improvements and minor graphic changes. It is constituted by two modules dedicated to segmentation and characterization.

In the segmentation module, the input is constituted by the original grey-level image. This can go through some pre-processing steps (histogram manipulation, mask creation) designed to highlight the structures to be identified. The segmentation itself is done through the application of a published algorithm [2], and regulated by a set of parameters that the operator can change. In the end, other than the visual results of the segmentation, a short statistical analysis of the network (areas, contour dynamics) is available to the user.

The results of this phase are the input for the second module, focused on characterization. A detailed statistical analysis is conducted for the parameters chosen to quantitatively describe the network (polygon neighbourhood, number of sides, dimensions, shape, orientations) [3][4]. Their spatial variation along a network can also be appreciated in maps showing the distribution of values.

The relevance of the different parameters and their interrelations can be evaluated through the realization of a PCA. Thus, a purpose-built module is also in development, eliminating the need for the use of any other statistical software.

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Poster 7

Automated detection of snowpatches in VHR images of Fildes Peninsula, King George Island, Maritime Antarctica

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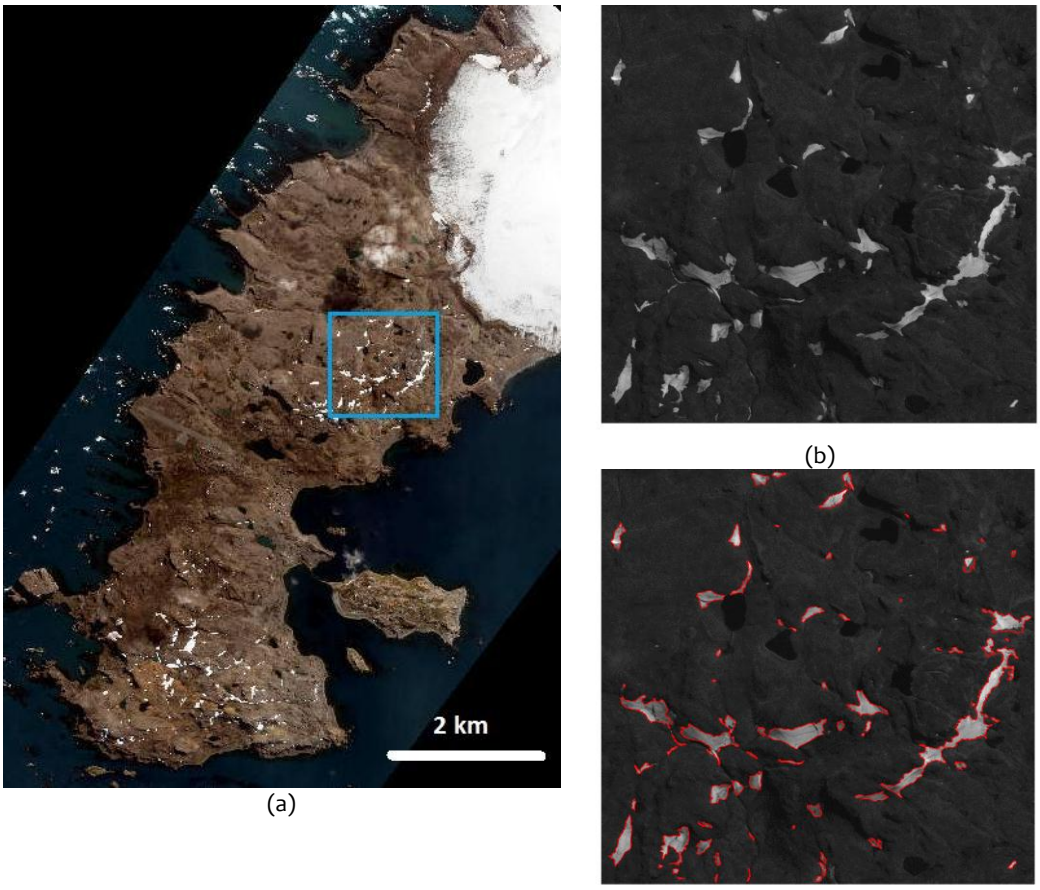
The detailed and complete mapping of ice-free areas in Antarctica is of great interest to periglacial and ecological studies and can be performed on a multi- temporal basis with the aid of remotely sensed images. Among the most appealing features of interest to monitor in these areas are snowpatches. These are important areas in the permafrost environment that influence its distribution at the discontinuous and sporadic permafrost zones, since they protect the ground from summer warming. Therefore an understanding of snowpatch properties and dynamics is essential to better model permafrost.

To obtain a detailed map of these structures, VHR (very high resolution) images (1 metre/pixel or better) are needed to detect the smallest patches and also to delineate more correctly their contours. The detection of a very high number of snowpatches in the free ice-regions and the frequent revisit of these areas in multi- temporal monitoring tasks may be greatly aided by an automated approach. Aiming at that purpose we developed an algorithm based on image analysis and mathematical morphology operators, whose robustness comes from the local analysis of the texture rather than the single intensity of the image pixels.

Our algorithm is organized into three main phases: 1) Filtering, through morphological connected operators; 2) Segmentation, based on the watershed transform and 3) Post-processing, to filter out false positives of small dimension and to better delineate the contours of the snowpatches. The testing of the approach is performed on QuickBird satellite datasets (Figure 1a) from Fildes Peninsula, King George Island, Maritime Antarctica (62oS) attaining a very high performance of detection of snow patches (Figures 1b and 1c).

This work was developed within the frame of project SNOWCHANGE and the Portuguese Antarctic Campaign 2011-2012 of PROPOLAR, The Portuguese Polar Program (http://www.propolar.org/a-campanha-2011-12.html).



(a) (b) (c)

Figure 1. (a) Global view of Fildes Peninsula in a QuickBird image (RGB composition); (b) Detail of Meseta Norte (panchromatic band) and (c) Results of automated detection of snowpatches.

Poster 8

Detailed geoecological mapping using multisource remote sensing imagery (Adventdalen, Svalbard)

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In the vicinity of Longyearbyen (Svalbard), Adventdalen shows a flat floor with a braided river system bordered by gently sloping terraces showing complex patterns of tundra polygons. These are mostly low-centered and can show orthogonal, as well as polygonal patterns generally with 5 to 6 neighbours. The study site is located at 78°10'42.8''N, 16°16'24.9''E.

In the framework of the project ANAPOLIS (PTDC/CTE-SPA/099041/2008) - Analysis of polygonal terrains on Earth as Mars analogues we aim at characterizing and classifying the spatial patterns of the tundra polygons in Adventdalen and at understanding the environmental causes for the different patterns. Our approach uses high resolution aerial imagery, as well as a detailed ground truthing surveys for characterizing the tundra polygons and to understand the environmental factors constraining them. Vegetation is highly sensitive to changes in hydrology, snow, dryness and salt in the ground. Therefore spatial patterns of vegetation communities can be used for defining an ecological zonation in the terraces where tundra polygons occur. In this poster we present the results of mapping of vegetation communities obtained by remote sensing methods and field data validation.

Vegetation communities were sampled in the field by means of developing a georeferenced test-set based on the dominant vegetation type. Communities with several species have been identified during field work and a GIS database has been implemented. Two types of high resolution aerial photos have been used and fused: a) high resolution VIS+NIR orthophotomaps from 2009 with ca. 20 cm spatial resolution (Norsk Polar Institutt), b) very high resolution VIS photo mosaic from 2009 with ca. 6 cm spatial resolution (Geokolibri). 7 bands from both sources have been fused and used for supervised classification. The training set was randomly selected using 50% of the sample pixels, while the other 50% has been used for evaluation of classification errors. Preliminary classification results have been checked in the field in 2011 in order to detect error sources in the classification. The final number of classes used in the training set results from a reclassification of original field classes in order to maximize the discriminative potential of the algorithm (see confusion matrix). The final map shows a regrouping of communities after classification, organized by dominant vegetation type.

The best mapping results were obtained by means of a supervised classification using the minimum distance mahalanobis method. Overall accuracies before and after reclassification show very high values (>77%, see below). Clear spatial patterns reflecting the ecological zonation in the polygon areas has been found (see map). This is especially evident before reclassification, but we don't show this results, since accuracy is slightly less (ca. 70%).

The good overall quality of the mapping results will allow for a detailed classification of the polygon according to vegetation types and hence contribute for the next step, which is to better understand morphometrical and topological differences between them.

Poster 9

Detailed Geomorphological Survey of the UNIS Ice-wedge Monitoring Site Area (Adventdalen, Svalbard)

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This study focusses on the tundra polygon area at the southern part of the Adventdalen valley floor that is being monitored for different types of geomorphic processes since several years by the teams of Hanne Christiansen and Norikazu Matsuoka. The study site is located at 78°10'42.8'' N, 16°16'24.9'' E. Ice wedge contraction cracking, frost heave, mud-boil dynamics, permafrost thermal state and active layer depth as well as their environmental controls are being studied by these authors.

In the framework of the project ANAPOLIS - Analysis of polygonal terrains on Earth as Mars Analogues, we aim at characterizing and classifying the spatial patterns of the tundra polygons in Adventdalen and at understanding the environmental causes for the different patterns. Our approach includes using high resolution aerial imagery, as well as a detailed ground-based geomorphic survey. The UNIS tundra polygon monitoring site was chosen as a key site for our survey and to evaluate the potential of the multisource geomorphic mapping. This presentation shows the results of the mapping and discusses the implications of the findings for the tundra polygon patterns of Adventdalen.

The detailed geomorphological map of the UNIS Adventdalen tundra polygon monitoring site was prepared using the following techniques:

- High resolution aerial photography from the Norwegian Polar Institute flight of 2009, with a ground resolution of about 20 cm. The scenes were obtained in 4 spectral bands: visible (RGB) and near infra-red. The orthorectification was performed using selected ground control points inside the study area with coordinates obtained from a DGPS survey.
- Very high resolution aerial photography (visible – RGB) obtained with an Unmaned Aerial Vehicle by Kolibri in 2009, with a spatial resolution of ca. 6 cm. Orthorectification was conducted similarly to above.
- Field geomorphic surveying using DGPS with identification and georeferencing of geomorphic units at the submetric scale.
- Topographical surveing using DGPS in order to identify morphological variations at a decimeter vertical scale.

The final map was produced in a GIS environment by analysing the ground truthing obtained in the field with the DGPS together with aerial photo interpretation made at the two scales.

This research is part of the project ANAPOLIS - Analysis of polygonal terrains on Mars based on Earth analogues, funded by the FCT.

Poster 10

Geodetic research in the South Shetland Islands and the Antarctic Peninsula

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Since the first Spanish Antarctic Campaigns in 1987 the Laboratory of Astronomy, Geodesy and Cartography (LAGC) of the Cadiz University has been present in both Livingston and Deception Islands on the South Shetland Archipelago near the Antarctic Peninsula.
Supported by the Spanish Antarctic Stations logistics, in those two islands, and the Spanish Navy ships mobility, the Spanish Antarctic Geodetic Network (RGAE) was developed covering the South Shetland Archipelago and the Antarctic Peninsula. Furthermore, this network was densified in Deception Island, the most prominent active volcano and visited island in this region, establishing the Spanish Geodetic Network for Deception Island (REGID).
These geodetic benchmarks have been the support of various cartographic products made in collaboration with the Spanish Army Geographic Center and the Spanish Navy Hydrographical Institute. Besides, they are fundamental for ground deformation volcano-tectonic monitoring, gravity measurements and ocean tide observation. Consequent ocean tide prediction is crucial to every intertidal or underwater research project and for mobility purposes, moreover inside Deception inner bay, being another outcome of the Group's work.
In the last years an effort to accomplish near real-time multi-parametric volcano monitoring capability is being made. These observations, added to the seismicity, provide extra protection trough forewarning to those that visit Deception or research there. Also, the South Shetland Archipelago tectonic behaviour relative to the Antarctic Peninsula is investigated.
All these accomplishments are the outcome of several geodetic and geophysical investigation projects, whose main purpose is to elucidate about this tectonically complex region where two major plates converge, the South American and the Antarctic plates, and minor plates interact, the Scotia and the Phoenix plates, mostly responsible for the South Shetland volcanic arc block formation and the Bransfield back-arc basin undergoing volcanism.
This communication intends to present some of Group's work in Antarctica.

Poster 11

Geometric and topological characterization of periglacial polygonal networks in Adventdalen, Svalbard, Norway

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Polygonal terrain patterns commonly occur in periglacial regions of the Earth, where seasonal processes cause the soil to expand and contract, leading to the formation of cracks, later filled and enlarged by ice-wedges. However, the details of their evolution are not well understood, and demand in-depth studies of their characteristics.

We describe here the geometric and topological characteristics of a number of networks of ice-wedge polygons occurring in a coastal valley, the Adventdalen, on the Norwegian archipelago of Svalbard. The aim of the study is to try and find the similarities and differences between the networks and to relate them with factors such as soil characteristics and topographic location.

The focus is on the analysis of remotely sensed data: 53 images (four-band RGB+NIR and 0.2m/pixel of spatial resolution), acquired by the Norwegian Polar Institute in 2009 during their aerial photogrammetric campaign, were purchased and processed. The polygonal networks were identified and digitized into a GIS. They occupy a total area of almost 10 km^2.

The areas covered by the individual networks range between 4x103 and 106 m^2. Individual polygon sizes vary widely, from 6 to 7x103 m^2, with an average of 300 m^2. The variation is less pronounced for the networks that are most clearly traceable on the images (large spurious polygons occupying the area of several true smaller ones can result from failing to notice troughs on the images).

For each polygon of the full set of networks studied, topological parameters such as number of neighbours and valences of the vertexes were obtained, using an automated process previously developed by this team for the analysis of networks that occur on Mars [1,2]. Shape descriptors like area, circularity, compactness and elongation were also calculated. These multivariate data will be analysed with the goal of determining what, if any, are the relations between terrain morphology and network presence, and its influence on polygon geometry.

Polygons seem to be favoured by flat terrains with water accumulation zones, although they can be found in slopes with slopes up to 25o. It is commonly accepted that larger polygons are older, and that, after repeated seasonal cycles, new and thinner cracks form inside the early polygons, dividing them into smaller ones. This sequence can be retraced by a careful consideration of the relations between polygon troughs (which reflect the positions of ice-wedges).

Acknowledgments
Work developed within project ANAPOLIS, funded by FCT

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Poster 12

Ice-wedge Polygonal Networks and Depth of Active Layer Thaw, a case study in Svalbard, Norway

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Polygonal networks are geomorphologic features generally indicative of the presence of permafrost. In winter, cold temperatures cause the soil to contract until it cracks; during the thawing season, water can infiltrate into the crack and later freeze there, causing it to expand; this seasonal cycle repeats through the years. Cracks expand vertically and horizontally; as they cross each other they can stop or even change direction, developing complex networks of polygonal patterns on the ground.

The active layer is the zone above the permafrost that experiences seasonal freezing and thawing. Its thickness varies annually in response to air and surface temperature, and generally decreases poleward. Substantially less is known about thaw depth variability across small lateral distances in response to topography, soil, vegetation, and subsurface hydrology. A recent study [1] (Gomersall & Hinkel, 2001), showed that spatial variation in thaw depth followed a different pattern in foothills and coastal plain sites. In the first case it varies between 0 and 3 meters, but in contrast, thaw variation at coastal plain sites occurs at substantially larger distances.

In the framework of research project ANAPOLIS [2], 120 clusters of polygons were identified on aerial images of the Adventdalen (Svalbard) acquired by the Norwegian Polar Institute, with a spatial resolution of 20 cm/pixel; the polygons constituting those networks were digitized, numbering around 10 000 in total. Analysis of these data points to the occurrence of rather regular networks in lower and flatter terrain. Further into the valley, polygons spread to foothills at higher altitudes, and in these networks the sizes seem to vary widely, even between close neighbours.

To test an eventual significant relation between the depth of active layer thaw and polygon size, a field campaign was conducted in the area on August 2012. The aim was to obtain measurements of thaw depth along several transects on a network with a range of different polygon sizes, and to obtain by kriging (a geostatistical interpolation method) a global model of the active layer depth under this network.

Diverse data were collected on this network, since several factors may contribute to the active layer thickness. A topographic survey was obtained with a differential GPS; 1000 coordinated points collected over a network with an area of 150 000 m^2 and 700 polygons resulted in a Digital Terrain Model with a resolution of 2 m/pixel. Regarding vegetation cover and geomorphologic features on the network, a GPS/GNSS-RTK survey was also conducted to define training areas for the application on supervised image classification techniques.

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Poster 13

Late Holocene development of ice-wedge polygon terrain in Adventalen valley (Svalbard)

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In the framework of the ANAPOLIS project we have studied the sedimentological characteristics in two areas of the Adventalen valley (Svalbard) where ice-wedge polygons are widespread. The two studied areas correspond to: (1) a glacio-fluvial terrace on the northern bank of the Advent river, and (2) the lowest part of the Todalen alluvial fan, in the southern bank of the Advent river.

With the purpose of understanding the role of the soils and sediments in the formation and development of ice-wedge networks, tens of pits and sections along longitudinal and transversal transects were opened in order to examine the sedimentary record in these areas where polygons are present. The thickness of the active layer at the end of summer (50-110 cm) determined the depth down to which sections were examined. Moreover, in the cliffs of the Advent river we excavated exposures up to 2 m depth to better analyze the sedimentary sequence. Samples were collected from the different lithostratigraphic units for standard laboratory analyses (grain size, organic matter content, XRF). Ten samples were processed for AMS C^{14} dating to establish the chronological framework of the environmental evolution inferred from the key sections.

Field work and preliminary laboratory data points to significant landscape changes in the area over the Late Holocene. The peat layer detected in the basal layer of the northern section is found widespread across the valley and it has been dated back to 3.4-2.8 ka BP. Therefore, the alternation of organic-rich layers and aeolian layers existing in the upper part of the section developed during the Late Holocene. A more intense wind deposition is likely to have occurred in the southern bank of the river, where the peat layer has not been found in the upper 2 m thick exposure. This section is more homogeneous, with silty-sandy aeolian units alternating with organic silty layers in the bottom of the section. Therefore, the ANAPOLIS project provides a better understanding of the environmental conditions (and climate) more favorable for the development of ice-wedge polygons in this arid Arctic environment during the Late Holocene.

Poster 14

Mineral Chemistry of Effusive Rocks from Deception Island, Antarctica

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This abstract presents the results of mineral chemistry data of Quaternary volcanic rocks from Deception Island. This island is a small and young (< 780 thousand years old) active volcano located in the south-western part of Bransfield Strait, between the Antarctic Peninsula and the South Shetland Archipelago. The studied effusive rocks include basalts, basaltic andesites and andesites that represent the pre-caldera (Fumarole Bay and Basaltic Shield formations) and post-caldera (Pendulum Cove) phases of the island. The rocks textures observed under the microscope are porphyritic, intergranular, trachytic, pilotaxitic, intersertal and hialophitic. The primary mineralogy is composed of plagioclase, augite, olivine and opaque minerals. Glomeroporphyritic clusters are present in some samples and consist of plagioclase, augite and Ti-magnetite phenocrysts or just plagioclase. The mineral chemistry data show that the plagioclase phenocrysts are mostly bytownite type. The plagioclase grains of matrix vary from bytownite to andesine types. The main pyroxene found in all studied rocks is augite. Rare pyroxene grains of matrix are classified as pigeonite. The chemical analyses of olivine grains indicate that this mineral is of forsterite

The oxide phase belongs to the FeO-Fe_2O_3-TiO_2 system and is represented by Ti- magnetite and ilmenite. The evaluation of whole-rock geochemistry and mineral chemistry supports the hypothesis of fractional crystallization of Ti-magnetite, olivine, clinopyroxene and calcic plagioclase for chemical evolution of Deception rocks.

Poster 15

New permafrost monitoring boreholes in the Western Antarctic Peninsula Region: Amsler Island, Palmer Archipelago and Cierva Cove

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The Western Antarctic Peninsula has been one of the Earth's regions with a strongest atmospheric warming since 1950. The impacts of this warming on glaciers, sea-ice and ice-shelves are relatively well-known, but very little is know of its effects on permafrost. Permafrost monitoring boreholes have been recently installed in the South Shetlands and in Adelaide Island, but between these two regions, barely anything is known on the thermal state of permafrost. In the framework of a collaboration between an FCT and a NSF funded project, two new boreholes (14 an 16m deep) have been installed in February-March 2012, respectively in Amsler Island (near Palmer Station) and Cierva Cove (near Primavera Station). The later is the first permafrost borehole to be drilled in the Antarctic Peninsula. Despite having only preliminary results, since stable data will only be gathered in 2013, the observations show that permafrost is absent in most of Amsler Island and near Palmer Station, with a posibility for near 0°C permafrost at the borehole located at ca. 70 m asl. Comparison of the results with the literature suggests that permafrost has been warming and degrading in the las two decades in the Palmer region. At Cierva Cove, at 180 m asl, preliminary data shows a permafrost temperature of -1.7°C. The poster describes the drilling activities and first results obtained during last campaign.
This research was supported by the U.S.A. National Science Foundation, Office of Polar Programs, Antarctic Sciences, grant OPP-0943799, Portuguese Foundation for Science and Technology project PERMANTAR-2 (PTDC/AAC-CLI/098885/2008) and by a grant of the Gulbenkian-Ambiente Program.
The project is integrated in the Portuguese Polar Program.

Poster 16

Preliminary results of a resistivity motorization in the Crater Lake – Deception Island

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Electrical methods allow us to have a good idea of the evolution of a permafrost due to its sensibility to detect the changes in the water and ice content in the subsurface.
This case study is part of the project PERMANTAR-2 – Permafrost and Climate Change in the Maritime Antarctic and it consists on the study of the evolution of the motorization using the resistivity method for the period of February 2010 to January 2011. The profile was set in the remote area of Crater Lake (Deception Island), with a length of 10 meters and with an electrode separation of 0.5 meters, where a measurement was registered every 4 hours. A borehole placed close to the profile gave us complementary information about the variation of the temperature with the depth.
The preliminary results show us a good correlation between the resistivity change and with the subsurface temperature.

Poster 17
Quantitative comparison of Svalbard and Mars polygonal terrains

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The comparison of Martian polygonal networks with terrestrial analogues has been often performed on a qualitative analysis basis, normally based on the diameter of the polygons. Extensive quantitative analysis of this kind of Martian patterned ground based on geometric and topological features [1, 2] and comparison with terrestrial analogues through a spatial point pattern analysis are much more promising as they permit to make objective comparisons between networks in order to better understand the origin and the processes involved in their evolution. We present some results to verify where terrestrial analogues networks of Adventdalen, Svalbard (Norway) stand in relation to quantitatively characterized polygonal networks on Mars.

Two recent sets of aerial imagery with very high spatial resolution of the Adventdalen Valley were acquired: one with a spatial resolution of about 20 cm/pixel in true-colour and near-infrared modes recorded by the Norsk Polarinstitutt, and the other with 4-6 cm/pixel in spatial resolution in true-colour mode photos captured by Kolibri GeoServices.

From the analysis of the remotely sensed images, a total of 120 polygonal networks with clusters of at least 10 polygons were identified. All these networks were segmented and 17 networks that contain more than 20 polygons in their third-inner layer were selected. Within these networks 6,226 polygons were analyzed, whereas 2,850 of them are completely surrounded and used to compute their characteristics. Some geometric (area, diameter, shape, among others) and topological features (number of neighbors) were thus obtained for each and every individual polygon of the network. In addition, three classic laws (Lewis, Desch and Aboav-Weaire) derived from the combination of those geometric and topologic features were verified for the global network [3]. In order to confirm the accuracy of these measurements collected remotely, field surveys have been conducted since 2010 in 4 of these polygonal networks to gather ground-truth data. Finally, the relations obtained for the terrestrial networks are compared with the ones extracted from 33 Martian networks with 52,000 polygons, and the presence of clusters or trends is analyzed.

Acknowledgements: This research is supported by FCT, the Portuguese Science Foundation, under the project ANAPOLIS (PTDC/CTE-SPA/99041/2008).

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Poster 18

Remote sensing of snow cover on Hurd Peninsula (Livingston Island, Antarctic) through Landsat imagery processing

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Snow is an essential part of the cryosphere and has an important role on the soil thermal regime. The snow low thermal conductivity reduces heat loss from the soil to the atmosphere during the winter and limits soil warming during spring and summer (Zhang, 2005, Rees, 2006). Snow has been used as a conditioning factor in modeling and prediction studies of permafrost and identifying its seasonal distribution is essential to the understanding of the soil thermal regime.

The knowledge about the snow cover regime in Maritime Antarctica is still scarce, mainly due to its remote access, high cloudiness and problems in validating snow detection algorithms in rough terrain regions. Satellite imagery processing allows filling this gap. In this poster we use 7 Landsat scenes from 1986 to 2004 . Methods such as the Normalized Difference Snow Index (NDSI), Normalised Difference Snow and Ice Index (NDSII), R35 and R45 were used for extracting the snow cover area. The results contribute to increasing the knowledge on the spatial distribution of snow, but also allow the identification of the late-lying snow areas in Hurd Peninsula. These are thought to show a significant control on permafrost distribution in the discontinuous permafrost zone.

Visual and areal comparisons were made to evaluate the accuracy of the indexes. The most precise method was the NDSI, witch is also the index more frequently used to extract snow cover. NDSII showed good results also but it underestimates snow cover were it appears to be thinner, and, in some cases snow small accumulations are better limited by this index. R45 in general, underestimates snow cover but is more useful to map glaciers because of its better sensitivity to distinguish between ice/snow and water. R35 index overestimates snow cover distribution and has a very poor capacity of separating ice/snow from water bodies.

The snow melting pattern analysis showed that fusion occurs first in the more steep slopes exposed to the North (more solar radiation) and convex areas were snow transport by wind is very strong. Then fusion occurs in coastal areas more exposed to solar radiation and less steep slopes. Throughout the summer, snow melting appears to ascend the slopes. Snow remains in the soil longer in concave and plane areas and with South exposure.

Poster 19

Toposcale snowpatch detection using TerraSAR-X imagery (Fildes Peninsula, King George Island, Antarctica)

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Snowpatches are important phenomena in the marginal permafrost environment, since they maintain the ground insulated from summer heat fluxes, allowing for the maintenance of permafrost in otherwise warmer terrain. They are also a continuous source of melt water and are well known to promote the occurrence of a set of geomorphic processes framed within the concept of nivation. In order to evaluate the use of high resolution (ca. 1 m) X-band imagery for the identification and mapping of snowpatches at a detailed toposcale, two TerraSAR-X Spotlight mode scenes have been acquired in January 2012 for the Meseta Norte area in Fildes Peninsula, King George Island. At the same time miniloggers were installed in 12 snowpatches with different aspects to measure snow temperature, an important factor due to dependence of radar backscattering on the water content of snow. Snowpits were dug in thes nowpatches in order to characterize snow stratigraphy, with a focus on grain size and type and snow density. A DGPS system was used to map snowpatch borders, as well as other water surfaces, such aslakes. Differenttypes of terrain units were also mapped in order to better characterize the descriminating capacity of the radar signal.

Results show that TerraSAR-X Spotlight scenes show a very good capacity for snow patch mapping in the maritime Antarctic enviroments, even at very detailed scales. The preliminary results, with wet snow on the snow patches, as shown by the near 0°C temperatures, show that the HH Polarisation scene has better potential for descriminating snow patches than the VV scene. TerraSAR-X is therefore an excellent source of imagery for detailed scale snowpatch mapping, especially when compared to other sources such as C-band sensors that have shown a complex response signal.

This research has been funded by the Portuguese Polar Programme and the FCT, through projects SNOWCHANGE and PERMANTAR-2.

Imagery was obtained through the DLR TerraSAR-X project LAN1276.

Poster 20

Understanding present and past interactions between permafrost and climate in the Maritime Antarctica. The HOLOANTAR project

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HOLOANTAR is a multidisciplinary project funded by the Fundação para a Ciência e a Tecnologia of Portugal for conducting research activities in the Maritime Antarctic between 2012 and 2015. Following former projects focused on permafrost topics (PERMANTAR, PERMANTAR-2), HOLOANTAR project will focus on the South Shetland Islands. Up to 16 researchers from different international institutions (Portugal, Spain, Brazil and Uruguay) will participate in the HOLOANTAR project.

The project is led by the Institute of Geography and Spatial Planning - Centre for Geographical Studies of the University of Lisbon through the research group Antarctic Environments and Climate Change Research Group (ANTECC). Results of HOLOANTAR project will contribute to the understanding of the landscape evolution and climate changes in the South Shetlands Islands (SSI) following Holocene environmental evolution in Byers Peninsula (Livingston, Antarctica, the largest ice-free area in the SSI.

The SSI are located in the northwestern tip of the Antarctic Peninsula, one of the Earth's regions that have experienced a stronger warming signal during the second half of the 20th century. In the ice-free areas of this archipelago islands the terrestrial ecosystem is supported by permafrost, one of the key components of the cryosphere as recently defined by the World Climate Research Programme, though its reaction to climate change is still poorly known. HOLOANTAR is based on two main hypotheses:

a) A multi-proxy analysis of lake sediments will allow reconstructing the palaeoecological evolution in the Maritime Antarctic and the role played in it by permafrost and active layer dynamics,

b) The detection of activity rates, spatial patterns and geographical controls of contemporary key-geomorphic processes and permafrost distribution, will allow defining their limiting climatic conditions that will be used to interpret the sedimentary record.

The main purpose of HOLOANTAR is to reconstruct the Holocene environmental evolution and climate variability in Byers by executing five main tasks: (1) Geomorphological mapping, (2) Monitoring of geomorphological processes and permafrost regime/distribution, (3) Sedimentological field work, (4) Laboratory analyses, and (5) Palaeoenvironmental reconstruction based on all the data.

By comparison with present-day geomorphological processes, we shall derive the role played by permafrost and active layer dynamics in the last millennia controlling the environmental evolution in the area. Results will be published in international journals and widely spread in conferences. Several outreach activities will be conducted in order to collaborate in making aware the people of the uniqueness and the necessity to preserve and protect the Antarctic environment.

Poster 21

COOPANTAR - Dynamics of Cooperation in Antarctica

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In Portugal, Antarctica has not been deeply investigated in Social Sciences field and the available bibliography on the subject is rare, despite historical evidence pointing to the Portuguese presence in the frozen continent before its official discovery. There are some contributions on the analysis of territorial claims and natural resources, however academic research has focused primarily on natural sciences and there is almost no doctoral research on geopolitics in Antarctica.

Therefore, this PhD research entitled "*Antarctica in Southern Atlantic Ocean Geopolitics*" aims to bridge the near absence of research outside the "Natural Sciences". COOPANTAR is the practical research of this PhD. It was conducted in January 2012 at the Uruguayan station of Artigas, King George Island, South Shetlands.

In a continent where cooperation has a major role on the lives of station staffs, COOPANTAR suggests a new approach to Antarctic sciences by following the daily routine at Artigas (a permanent station) and several scientists working in the field at the time. It was also possible to visit nearby stations and to witness day-to-day cooperation.

Staying at Artigas was important to understand the routine and difficulties of those who stay in Antarctica for just a few days or for a whole year. Climate conditions are extreme (the weather is very unstable, specially on winter) and the chance of something going wrong is very high.

At the Uruguayan station, it was also possible to witness a high level bilateral cooperation event. President José Mujica (Uruguay), President Sebastián Piñera (Chile) and their respective delegations visited Artigas and Chilean stations to know both Antarctic programs and to strengthen cooperation in Antarctica.

Concerning scientific research, it was possible to verify the presence of scientists of different nationalities at Chilean and Uruguayan stations, with prevalence of national scientists in each one. Giving the example of Artigas, in ten scientists (who stayed for a week) only one was a non Uruguayan: a Mexican researcher.

Therefore, COOPANTAR was an important asset to this PhD research once it allowed to understand not only the dynamics of cooperation (the main goal) but also the political aspirations and difficulties of those who stay the entire year in one of the most crowded regions of the Antarctic continent.

Last but not least, COOPANTAR was not possible without the support of the Portuguese Polar Program, tireless in contacting FCT (Science and Technology Foundation), Chilean Antarctic Program (INACH) and Uruguayan Antarctic Program (IAU).

Poster 22

APECS in a non polar country: a study case on how education and outreach stimulated polar science during IPY and beyond!

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The Association of Polar Early Career Scientists (APECS), created in 2007, was considered by the Joint Committee for the International Polar Year (IPY) as a major legacy of IPY. APECS is a worldwide association of early career scientists interested in the polar regions and the cryosphere generally. Its mission is to raise the profile of polar scientists by providing a continuum of leadership that is both internationally and interdisciplinarily focused, and to stimulate collaborative projects.
Within 3 years, APECS became a highly polar respected association, providing a strong voice for young researchers in polar research issues while enable information sharing between early career scientists, promoting and organizing science, education and outreach events, and having an active involvement within other polar organizations. This presentation aims to show how APECS played an important role in Portugal, how it became established within IPY, provide examples of interdisciplinary research and educational innovative activities/events nationally and internationally, within the national educational program LATITUDE60!, and how actively played an important role in promoting Portuguese Polar science beyond IPY in connection with the teaching community and politicians by addressing key polar issues important to society. This presentation will also aim to look to the future and identify new directions on how polar science should be addressed by early career scientists in order to shape the future of polar research and outreach.

Poster 23

Project PENGUIN – EDUCATION: How to study penguins?

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Antarctic Peninsula is one of the regions in the world that has been most affected by climate change. In the last 50 years, the air temperature has risen by 2-3° C, with ocean temperatures increasing by 1 ° C. The impact of such changes must be noted in the large scale and on the dynamic of biological systems, including on the populations of top predators, such as penguins. To inform and engage the general public, it is highly desirable that polar scientists engage on science communication to provide reliable, informative and simple information about "why should we conduct polar science?", "why should Portugal be engaged in carrying out polar science?", "what are the major science results coming out?" and "what can I do about it?". It is also important to show the passion and enthusiasm that most polar research possess of doing polar science. The members of the project international and interdisciplinary PENGUIN, within the national program PROPOLAR, and with collaborators from Bulgaria, Spain, Brazil, USA and UK, were highly engaged in education and outreach, with the contribution of the Association of Polar Early Career Scientists (APECS) APECS Portugal, the Capacity Building, Education and Training advisory group of the Scientific Committee on Antarctic Research (SCAR-CBET) and the Museum of Science of the University of Coimbra. The scientists of PENGUIN provided articles to 2 blogs, 2 websites, gave radio interviews from Antarctica (n= 4), interacted with schools from Portugal and Brazil (replying to questions on Antarctic Science) and also planned talks before and after the expedition (with a flag of a school was given to the science team and taken to the Antarctic, and returned to the school, fully signed by the majority of the scientists in the field from more than 10 countries). Schools also prepared exhibitions, discussion groups, music songs and theatre plays about the PENGUIN expedition.