XI OPEN SCIENCE CONFERENCE

ABSTRACT BOOK

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PROLOGUE

At the Antarctic meeting of the International Council of Scientific Unions (ICSU), held in Stockholm (September 1957) it was agreed to create a committee to supervise scientific research in Antarctica. At that time there were 12 nations actively conducting Antarctic research, including Chile, and they appointed a delegate to be part of a Special Committee on Antarctic Research. The Committee held its first meeting in The Hague in February 1958, a date that is considered as the beginning of SCAR. Afterwards, during the Open Science Conference 2018 in Davos, Switzerland, we commemorate 60 years of developing quality science, promoting international collaboration, stimulating young researchers and providing independent and objective advice to the Antarctic Treaty, as well as to the United Nations Framework Convention on Climate Change (UNFCCC) and the IPCC (Intergovernmental Panel on Climate Change), in all matters relating to science in the Antarctic continent and its Southern Ocean.

As a founding member, Chile has supported SCAR's effort to incorporate science as one of the foundations that give meaning to the political and administrative decisions that nations make regarding Antarctica. Therefore, when the opportunity arose to apply for our country to host the XI SCAR Open Science Conference, as well as the Business Meetings and the SCAR Delegates Meeting, we did not hesitate, on the understanding that we are an Antarctic nation by human and natural history, in addition to the inalienable fact that our country´s destiny is linked to that of the white continent.

Today, Antarctica is considered the beating heart of the planet, which is surrounded by the most powerful marine current in the world, the Antarctic Circumpolar Current. This current extends and interacts with almost all seas of the world, regulating processes in the most remote regions of the planet. Today, we know that the atmosphere over Antarctica interacts in unexpected ways with distant regions of the globe such as Southeast Asia, the equatorial Pacific and other vast tropical regions. Thus, the phrase so energetically captured by the UN Secretary General during his recent visit to Antarctica with the President of Chile, Gabriel Boric, takes on greater relevance. The phrase was: “What happens in Antarctica, does not stay in Antarctica”.

Since the instrumental record has increased, supported by satellites, autonomous vehicles and remote automatic stations, in addition to the constant sacrifice of human beings listening to Antarctic signals, substantial climatic changes have been observed, such as atmospheric and oceanic warming, thinning of the continental ice sheet and anomalies in the sea ice. Although these changes, which exhibit strong zonal asymmetry, are partially influenced by increased greenhouse gas emissions and stratospheric ozone depletion, tropical-polar teleconnections are believed to play a relevant role.

Since the 2014 international SCAR Horizon Scan exercise, we have become aware of the need to close the gap due to limited observations and inherent model biases, which leads to uncertainties in understanding and assessing the importance of these teleconnections versus those arising from greenhouse gases, ozone recovery and internal variability. Sustained efforts throughout Antarctica to achieve long-term observations, as well as more realistic dynamics and parameterizations in high-resolution climate models, offer opportunities to reduce these uncertainties. This is why Chile has deployed, through the Chilean Antarctic Institute, a new network of automatic stations and autonomous sensors transmitting in real time, along a 2,100 km (about 1,300 miles) long distance, which have already begun their test transmissions. This year, the new icebreaker Oscar Viel, entirely built in Chile and focused on high quality scientific research in the Southern Ocean, will be added to this effort. The renovation of the Chilean base Carvajal within the Polar Circle in the coming years will allow intensified studies in regions that are actively evolving in response to climate change.

There is no longer any doubt that the landscape that makes up our mountain ice, southern ice fields and Antarctic ice fields has been changing. The high latitudes of our planet, including the polar and sub-polar regions, have been manifesting the effects of global warming with increasing intensity, a fact that is widely agreed upon by the scientific community. Greenhouse gases, especially carbon dioxide, have reached record levels, while the planet is experiencing average temperatures that the human species has never experienced in its 350,000 years of transit on Earth.

In short, the increase in greenhouse gases resulting from human activity since the beginning of the industrial revolution has increased the temperature of the planet so much that important features of our world, such as its “eternal” ice, will reach a point where they can no longer be recovered. Species intolerant of change are retreating inland from Antarctica, while those that tolerate it are beginning to compete with invasive species arriving from other latitudes. These changes are having far-reaching repercussions for both ecosystems and humans, threatening the livelihoods of millions of people, and will become more serious the further global warming progresses.

The last decade of Antarctic research has established that the Antarctic Peninsula experienced new episodes of extreme heat and record surface thaws during the summers, especially in the last three years, contributing to the alarming series of episodes over this region that show stronger warming compared to the rest of Antarctica. Intense atmospheric rivers brought anomalous heat and precipitation, while the intensification of the Foehn effect produced temperature increases to the northeast of the Antarctic Peninsula, causing record sea ice loss and violent weather episodes outside Antarctica, such as the intense precipitation in southern Brazil this 2024.

Given that the polar regions and high latitudes are experiencing the changes predicted by the IPCC most violently, and that Antarctica and its surrounding ocean are now recognized as crucial players in all the scenarios predicted by the IPCC, the Chile 2024 SCAR OSC will be key to updating the best available global science.

After 6 years without face-to-face Antarctic conferences, more than 1300 Antarctic scientists of 57 nationalities gathered in Pucón, a city surrounded by forests and wildlife, with species heir to Antarctica's long natural history, as well as volcanoes and lakes reminiscent of the green Antarctic landscapes of the remote past. This book of abstracts is the testimony of that enormous meeting, the largest since the beginning of SCAR, the most hopeful because of the enormous participation of young researchers, who augur that a new and larger cohort of scientists will find in Antarctica the reason to do science, but also with a greater and fairer female participation, inspired by the experience of hundreds of pioneer women who blazed the trail in the polar ice.

Marcelo Leppe Cartes
Vice-President SCAR
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PARALLEL SESSIONS

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Carbon flow web model for the inner and outer Beagle Channel (Sub-Antarctica) during springtime

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Abstract

The Beagle Channel (BC) constitutes a unique sub-Antarctic coastal ecosystem connecting the Pacific and Atlantic oceans at the southern tip of South America. It is also considered a spatially variable atmospheric CO_2 sink. The presence of sills in the BC originates micro-basins which favour the formation of particular biological niches in terms of nutrients, primary production and planktonic communities. Here we developed a mass-balanced carbon flow model for the pelagic ecosystem of BC for the spring season, focusing on two contrasting sites: the inner and outer channel to the west and east of the Mackinlay Strait, respectively. For this, we used a single model for both study sites since the structure of the pelagic community is similar in both sectors of the BC. In order to reflect the differences among sites, we parameterized the model according to each case, inner and outer, mostly considering empirical data gathered during the binational Argentine-Chilean campaign carried out in 2019. The model comprises ten compartments representing the key components of the pelagic community of the BC (e.g., phytoplankton, microzooplankton (67-200 µm), mesozooplankton (200-20000 µm), ichthyoplankton).

Our results show important quantitative differences in the carbon sources produced within the pelagic ecosystem (autochthonous), such as phytoplankton, and that imported (allochthonous), such as terrestrial input, between the inner and outer BC. Noteworthy, benthic resuspension provides as much carbon as the allochthonous source to the pelagic ecosystem in both sites. Overall, these preliminary results suggest a differential energy flow pattern during spring in the inner and outer BC pelagic ecosystems.

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