CLIMAT AmSud

2022 call for proposal approved projects

A-DUST

Andean Dust from Sources to Sinks

B2IST

Biomass Burning and Impacts in the Southern Tropics

CESPA

Climate Emergence and Long-term Variability in the Southern Peruvian Andes

CLIMICRORES

Responses of aquatic Microinvertebrates to climate changederived stressors : contribution towards predicting the sensitivity to local impact

HighRes-AmSur

Continental-scale high-resolution climate modeling over South America in a future climate change scenario

TCPSUD

Thermal Comfort in Public Space for Urban Design

A-DUST
Andean Dust from Sources to Sinks

Atmospheric dust plays an important role in the global climate system and is now recognized as such by climate modelers. While the Northern Hemisphere dust sources and sinks have been well documented, less attention has been given to the Southern Hemisphere (SH). Previous studies have demonstrated that South America is a major SH dust source to both continents and oceans. However, the pathways from dust sources to sinks and their fluctuation over time are poorly understood.

We propose to study atmospheric dust in various compartments of the South American continent as well as in he remotest sink (Antarctica). Using an array of peat records (continental atmospheric archives) from the Andes as well as present-day dust collectors, we aim at:

1) Providing high-resolution continuous records of natural atmospheric dust using both direct measurements and the elemental and isotopic signatures over the last millennium,
2) Understand the trajectories of past and present dust from source (Andes) to sink (coastal South America and Antarctic Peninsula) by comparing peat records, dust traps and implementing transport models to ultimately
3) Assess the linkage between dust inputs and climate at two scales: the Holocene over the last 12 thousand years and modern times during the last few decades.

Our consortium is built up to answer those challenges by providing interdisciplinary expertise as well as the regional knowledge and support to carry out field campaigns and analyses.

Project coordinators

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B2IST

Biomass Burning and Impacts in the Southern Tropics

Various factors and species play an essential role in the climate system and influence climate change. Our project focuses on one of them affecting the chemical and radiation balance of the atmosphere from ground to stratosphere: aerosol.

Although it has an important role in the global climate system, the scientific community does not well know the processes controlling the amounts of the various families of this atmospheric component in the tropical UT-LS (Upper Troposphere-Lower Stratosphere). This is especially true in the Southern Hemisphere due to the low number of observation stations, in comparison with the Northern Hemisphere. The likely sources of carbonaceous aerosols in the UT-LS are from the major biomass burning events. The Southern American and Southern African regions are recognized to be significant primary sources of carbonaceous aerosols in the Southern Hemisphere through the biomass burning activity. Given the important impacts of biomass burning on climate and air quality, further vertically resolved observations of aerosol are absolutely obliged.

This project aims to investigate the impact of biomass burning activities on aerosol distributions over South America. The main goal of the project is to study optical characteristics and the physical processes behind transport of the biomass burning aerosol plumes, and to design automatic monitoring and forecasting tools for both long-range and regional scales. Both traditional atmosphere modeling (WRF, MIMOSA) and Artificial Intelligence modeling are expected to contribute to this study, bringing complementary information to help understand the spread and impact of this class of aerosols.

Project coordinators

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CESPA

Climate Emergence and Long-term Variability in the Southern Peruvian Andes

The Peruvian Andes are vulnerable to anthropogenic climate change but the current trajectory of Andean hydroclimate cannot be clearly assessed from the short instrumental record. Some scarce paleoclimate records suggest an aridification trend in the past 200 years that highlight the need for a detailed assessment of long-term climate variability and its relationship with external forcings.

This proposal is part of a broader project aimed at reconstructing decadal to millennial scale climate variability in the southern Peruvian Andes using multiple environmental indicators in lake sediment cores collected in 2021 along a transect from the western to the eastern side of the Andes. We focus here on the dynamics of vegetation and fire since the last glacial period in two key sites that yielded long and well dated sedimentary records from both sides of the Andes.

The new collaboration network proposed here is based on a complementarity of expertise that will contribute to an exhaustive understanding of the mechanisms of low frequency climatic and environmental changes, and to technical and knowledge transfer between partners. Our record of past climate and environmental changes will allow us (1) to evaluate the trend of anthropogenic climate change in parts of the Andes influenced by different climatic systems, (2) to estimate whether the current climate conditions have emerged from the natural climate variability, (3) to improve our understanding of the Andean climate sensitivity to external climate forcings during the last deglacial warming and during the Holocene, and (4) to evaluate climate model performance in simulating the Andean climate under different global conditions.

Project coordinators

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CLIMICRORES

Responses of aquatic Microinvertebrates to climate changederived stressors : contribution towards predicting the sensitivity to local impact

Temperature and salinity patterns are expected to change in many aquatic ecosystems as result of climate change, imposing the risk of exceeding vital thresholds for the aquatic biota, and hence their survival with ecosystem implications. Changes in temperature or salinity can modify harmful impact of the current multiple pollution of aquatic ecosystems. Microinvertebrates are key components in the aquatic systems, which connect primary production or recycling of detritus material to consumer foodwebs. Thus, understanding their response to climate change-associated stressors is crucial to predict the impacts at the ecosystem level. Integrative studies combining different scales of analysis, from biochemical to life history patterns enable a better understanding of their responses and the underlying mechanisms in which the specific stressors affect microinvertebrates. Moreover, given that climate change is expected to alter the bioavailability and biological effects of other anthropogenic stressors such as pollutants, the development of analytical 3 techniques to detect early responses will allow anticipating drastic changes in impacted systems.

This project aims to elucidate how the two major global factors associated with climate change in aquatic systems -salinity and temperature increase- will affect microinvertebrates performance and response to other anthropogenic stressors at different scales of analysis, from molecular to life history patterns. Several manipulative experiments will be carried out with different test species belonging to different biogeographic regions including anostracans, cladocerans, and rotifers. Antioxidant and oxidative damage responses, activity of the electron transport system, changes in energy reserves, metabolomic changes, activity of Na/K-ATPase and life history patterns, including transgenerational effects will be analyzed and integrated in predictive models on the potential impacts of climate change on aquatic microinvertebtrates.

Project coordinators

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HighRes-AmSur

Continental-scale high-resolution climate modeling over South America in a future climate change scenario

The South American climate system encompasses complex interactions between contrasting climate and small scale processes related to complex land-atmosphere interactions like mountain topography across the Andes, that are challenging for numerical climate models to simulate. Many aspects of the South American regional responses to anthropogenic forcing are still not well understood, due to the coarse resolution and lack of local processes in current global climate models. The main goal of the HighRes-AmSur project is to coordinate ongoing efforts to simulate and analyze the South American climate at high-resolution with the Regional Earth System model RegIPSL (WRF-ORCHIDEE coupling).

The use of high-resolution is essential to represent key variables of the hydrological cycle in their means and extremes, mountain climate and land-atmosphere interactions. It also provides key climate information for adaptation actions for the entire continent, impact studies and decision making. This project brings together the skills of French and South American research teams combining their experiences in performing and analyzing high resolution climate modelling of various parts of the South American continent.

The project also includes impact studies that will use the atmospheric high-resolution variables as forcing for models of climatic and geodynamic risks.

This collaboration will build on active projects, two network programs: the IRN ANDES-C2H and the ANDEX regional hydro-climatic program, and a French national HPC project DARI-11. The future generation of the so called “convection-permitting” high-resolution climate simulations at 4km will be prepared within the project and submitted to the European HPC PRACE call and to national or international agencies to provide continuity to our research network. The HighRes-AmSur project will help the researchers to organize modeling strategies and network activities between French and South American teams.

Project coordinators

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TCPSUD

Thermal Comfort in Public Space for Urban Design

Heatwave is a phenomenon of climate change that affect on peoples to death due to thermal stress on cities.Thermal comfort is normally calculated using air temperature and humidity. However, there are other relevant variables such as mean radiant temperature (Tmrt) and wind (Ws) to estimate the human thermal comfort in a more comprehensive way. Measurements in situ, 2 modeling and calibration of both will be carried out in the public space of a city with a Mediterranean climate: Santiago de Chile.

The purpose is to analyze thermal comfort, wind comfort, and correlating with liveability. Territorial Planning Instruments (IPT) and architectural codes are prescriptive means be able to ameliorate thermal stress on cities because they modify Tmrt and Ws through the urban form. GIS, 3D-2D and Modelling, as RayMan are tools used to simulate thermal performance and give suggestions for urban design practices.

Project coordinators

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