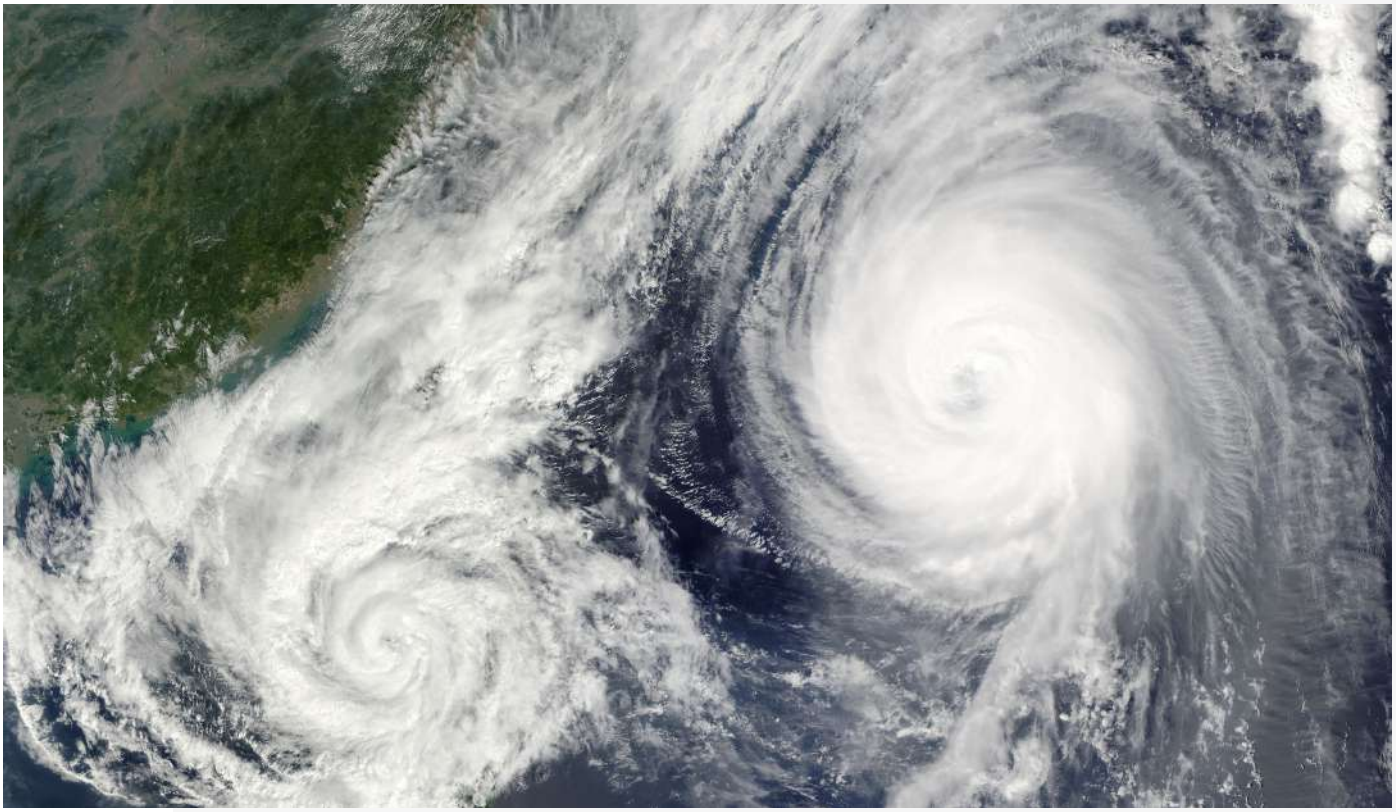
CLIMAT AMSUD SCIENTIFIC SEMINAR REPORT

29-30 NOV 2021

Intra-seasonal climate variability and prediction in South America



PRESENTATION OF THE MAIN RESULTS OF THE SEMINAR

ARGENTINA
BOLIVIA
BRASIL
CHILE
COLOMBIA
FRANCIA
PARAGUAY
PERÚ
URUGUAY

PRESENTATION OF THE REPORT

This report has been produced based on the interventions of 10 climate specialists from South America and France during the seminar CLIMAT AmSud. Its objective is to present the highlights of the seminar and to broaden the diffusion of results and tools presented among the scientific, political and generally among the civil society. It also suggests the next steps and potential for cooperation actions in South American that could be submitted in the framework of the CLIMAT AmSud program.

The seminar was organized by the CLIMAT AmSud secretary composed of the French Embassy in Chile and the Chilean Innovation and Development National Agency (ANID), the Uruguayan Innovation and research Agency (ANII) and the French Ambassy in Uruguay. 150 participants attended this seminar, from 12 countries,

The organizers of the seminar thank Marcelo Barreiro, Serena Heckler, Martín Jacques-Coper, Thierry Caquet, Marisol Osman, Max Pasten, Jhan Carlo Espinoza Villar, Walter Baethgen, Victor Raul Chavez Mayta and Ramiro Pillco-Zóla who made this report possible and who contributed to the success of the seminar.

Climat AmSud is one of the three « AmSud » programmes, which support regional mobility projects between France and South America countries. It is funded by 14 structures, listed on the last page of the report. More information at **www.sticmathamsud.org**

Watch the seminar https://www.youtube.com/watch?v=UeprwULY1AM&t=2306s

TABLE OF CONTENT

SERENA HECKLER

UNESCO, SPECIALIST OF THE PROGRAM "ECOLOGY AND EARTH SCIENCE", COORDINATOR OF THE "MAN AND THE BIOSPHERE PROGRAM" FOR LATIN AMERICA AND THE CARIBBEAN

As the United Nations Scientific Organization, one of UNESCO's core mandates is to advance and promote science in the interests of peace, sustainable development, human security and well-being. UNESCO Montevideo, the Regional Bureau for the Sciences in Latin America and the Caribbean, fulfils this mandate through a number of programmes in the region. For instance, the Latin America and the Caribbean Open Science Forum (Foro CILAC) promotes debates and exchanges on the sciences, technology and innovation. The Intergovernmental Hydrological Programme (IHP-LAC) with its national committees has programs on hydrology, glaciers and large basins across South America. In the Organization's regional risk management program, the UNESCO regional Group of Experts on Disaster Risk Management (GERM) and UNDRR are developing a web platform on risk reduction and climate change which aims to be a clearinghouse of information for all local, national and regional institutions involved in the subject.

A priority challenge is linking local climate change impacts and actions with national and international response. UNESCO Global Geoparks, Biosphere Reserves and World Heritage Sites are dedicated to facilitating sustainability science and to supporting climate change mitigation and adaptation.[1] To more effectively support them in Latin America and the Caribbean, UNESCO Montevideo developed the LAC UNESCO Sites Climate Change, Risk and Resilience Platform.

Across Latin America and the Caribbean, more than 140 UNESCO Global Geoparks and Biosphere Reserves in 22 countries are confronting the impacts of climate change in innovative ways. The LAC UNESCO Sites CCRR Platform aims to build on their experiences; foster knowledge exchange with a wider scientific and policy community; and increase the visibility of local actions. Only by sharing knowledge through such platforms can we hope to fully understand and address the complex and interwoven impacts of climate change across all sectors and scales of society.

[1] See for instance the MAB Strategic Objectives 2015-25 (UNESCO 2017, pg. 17)

INTRASEASONAL CLIMATE PREDICTABILITY IN SOUTHEASTERN SOUTH AMERICA

MARCELO BARREIRO
DEPARTAMENTO DE CIENCIAS DE LA ATMÓSFERA, FACULTAD DE CIENCIAS UNIVERSIDAD DE LA REPÚBLICA, URUGUAY

Content of the presentation
The talk was structured into three parts. First, it presented an introduction on intraseasonal variability and the Madden-Julian Oscillation (MJO) as the dominant phenomenon in this time-scale.
Then, it showed the impact of the MJO on spring time rainfall extremes in southern Uruguay.
Finally, a novel methodology based on neural networks to predict the evolution of the MJO was presented.

These studies show the possibility of developing an early warning system for extreme precipitation events in southern Uruguay based on the evolution of the MJO.

Tools available and potential cooperation actions in the South American region about the thematic
As a highly populated area with an economy strongly influenced by weather conditions this information would be very helpful.

These results also benefit regional initiatives in southern South America (e.g. CRC-SAS Centro Regional del Clima para el Sur de América del Sur) that have been created to develop climate services in the region..

HEAT WAVES IN SOUTHERN SOUTH AMERICA: MECHANISMS, PRECURSORS AND IMPACTS

MARTÍN JACQUES-COPER
DEPARTAMENTO DE GEOFÍSICA, UNIVERSIDAD DE CONCEPCIÓN, CHILE

Content of the presentation

We showed teleconnections that are related with summer heat waves in central Chile (Jacques-Coper et al.,2021).. Based on that, we specifically presented two precursors that might deliver guidance on the occurrence of some of these events with ~2 weeks lead time. These are the Madden-Julian Oscilation index (tropical variability) and the standardized Extra-Tropical Index (sETI, an original contribution).

Tools available

We have recently launched a web platform that allows the monitoring of GEFS-based sETI forecasts, the MJO evolution, and serves as a repository of further relevant information. **https://www2.dgeo.udec.cl/shiny/hw-monitor/**

Next steps and potential cooperation actions in the South American region about the thematic

We are investigating on impacts of heat waves in central Chile (e.g. wildfires, snow melt, harmful algal blooms). We have been exploring the predictability of these events in real time this summer 2021/2022. We have been able to indicate the genesis of 2 major events 2-3 weeks before their occurrence.

Our approach and results offer great potential to risk mitigation in further regions in South America. Our aim is to strengthen the communication with national agencies and collaboration with researchers working on similar topics.

COPING WITH CLIMATE VARIABILITY IN AGRICULTURE: COMBINING CLIMATE SERVICES AND AGRO ECOLOGICAL PRACTICES

THIERRY CAQUET
SCIENTIFIC DIRECTOR ENVIRONMENT, INRAE, FRANCE

Content of the presentation
Agriculture is increasingly exposed to risks associated with increased climate variability, with consequences on yield and quality. In parallel, agroecological practices may increase the resilience of agriculture to climate shocks but their implementation requires detailed knowledge on local climate. Improved climate information and services are now available to foster the success of the agroecological transition of agriculture.

Tools available
INRAE has developed online indicators platforms (AgroMetInfo or Getari). CSTools, a R package to support the implementation of climate service has been produced in the frame of MEDSCOPE EU-funded project.

Next steps and potential cooperation actions in the South American region about the thematic
Seasonal (or decadal) forecasts will be crucial to foster agriculture adaptation through a support to farmers decisions. Significant progress have been made in the implementation of operational services co-constructed with end-users. Continuous dialogue and capacity building will be key issues to foster continuous improvement and dissemination.

Share of experience on indicators and climate services developed in France and South America may greatly enhance their reliability and usefulness in support to agroecology up- and outscaling.

EFFORTS AND CHALLENGES TO ADVANCE IN THE PREDICTION OF CLIMATE VARIABILITY IN SOUTH AMERICA ON SUBSEASONAL TIMESCALES

MARISOL OSMAN
CENTRO DE INVESTIGACIÓN DEL MAR Y LA ATMÓSFERA, CONICET, ARGENTINA

Content of the presentation
The presentation discusses the strategy adopted by the DiVar group at CIMA (Centro de Investigación del Mar y la Atmósfera) to address the prediction of subseasonal climate variability in Southern South America. This strategy has allowed researchers to effectively develop monitoring and prediction tools of the main variables that are relevant for sectors such as agriculture.

Tools available
The main results are compiled in the website **www.climar.cima.fcen.uba.ar** which includes not only the tools developed, but also a guidance on how to use and interpret the observed information. This tool is useful not only for members of national agencies such as the Weather Service but also for experienced stakeholders. In addition, the website helps scientists to showcase their research to address funding agencies and foster new collaborations.

Next steps and potential cooperation actions in the South American region about the thematic
Challenges ahead include a comprehensive assessment of the role of climate drivers, such as the Madden Julian Oscillation, the Southern Annular Mode and others, in the observed levels of predictability depicted by forecasting tools, a thorough study of the sources of error in forecasts by the current models and an identification of windows of opportunity for forecast in this timescale. In addition, there are some challenges associated with the visualization, communication and interpretation of forecasts by societal actors which would need to be addressed by interdisciplinary studies.

CHANGES IN ATMOSPHERIC CIRCULATION PATTERNS IN TROPICAL SOUTH AMERICA: IMPACTS ON THE ONSET OF THE RAINY SEASON AND FIRES IN THE AMAZON REGION

JHAN CARLO ESPINOZA VILLAR
IRD FRANCE, IGE UNIVERSITY GRENOBALE ALPES, CNRS

Content of the presentation

Recent studies documented major biophysical transition in Amazonia, involving deforestation and hydroclimate changes. At large scale, Amazon deforestation may be related to alterations in the regional Hadley and Walker cells. High-resolution climate simulation (WRF model, 1km-1h), show that precipitation in the Amazon-Andes transition valleys is highly dependent of the Amazon deforestation, which reduce precipitation in these valleys in 20%-30%.

Tools available

- Scientific assessment of the state of the Amazon's ecosystems https://www.theamazonwewant.org/
- Espinoza JC., Arias PA., Moron V., Junquas C., Segura H., Sierra-Perez J., Wongchuig S., Condom T. 2021. Recent changes in the atmospheric circulation patterns during the dry-to-wet transition season in south tropical South America (1979-2020): Impacts on precipitation and fire season. Journal of Climate. https://doi.org/10.1175/JCLI-D-21-0303.1
- Sierra, J.P., Junquas, C., Espinoza, J.C., Segura, H., Condom, T., Andrade, M., Molina-Carpio, J., Ticona, L., Mardoñez, V., Blacutt, L., Polcher, J., Rabatel, A., Sicart, J. E. 2021. Deforestation Impacts on Amazon-Andes Hydroclimatic Connectivity. Climate Dynamics. https://doi.org/10.1007/s00382-021-06025-y.

Next steps and potential cooperation actions in the South American region about the thematic

The Amazon-Andes hydroclimatic connectivity is an excellent case of study for improving our understanding of the coupled dynamics between the water and energy cycles. Reduced uncertainties in future projections of water availability and extreme events is a key topic under the ongoing context of climate and land use changes.

This study is conducted in the context of several regional projects: AMANECER-MOPGA; RHP-ANDEX/GEWEX, ClimatAmSud (ACE-Amazon project) and ECOS-Nord.

SUBSEASONAL CLIMATE FORECASTS FOR THE AGRICULTURAL SECTOR

WALTER E. BAETHGEN

IRI, THE CLIMATE SCHOOL, COLUMBIA UNIVERSITY, NEW YORK

Content of the presentation

The presentation described the types of decisions in agriculture that can be informed with subseasonal climate forecasts. That type of information is especially useful and actionable if it is integrated with seasonal forecasts, and with information of other factors that affect actual decisions. For example, information on prices, production cost, policies in place, insurance, available credit, etc.

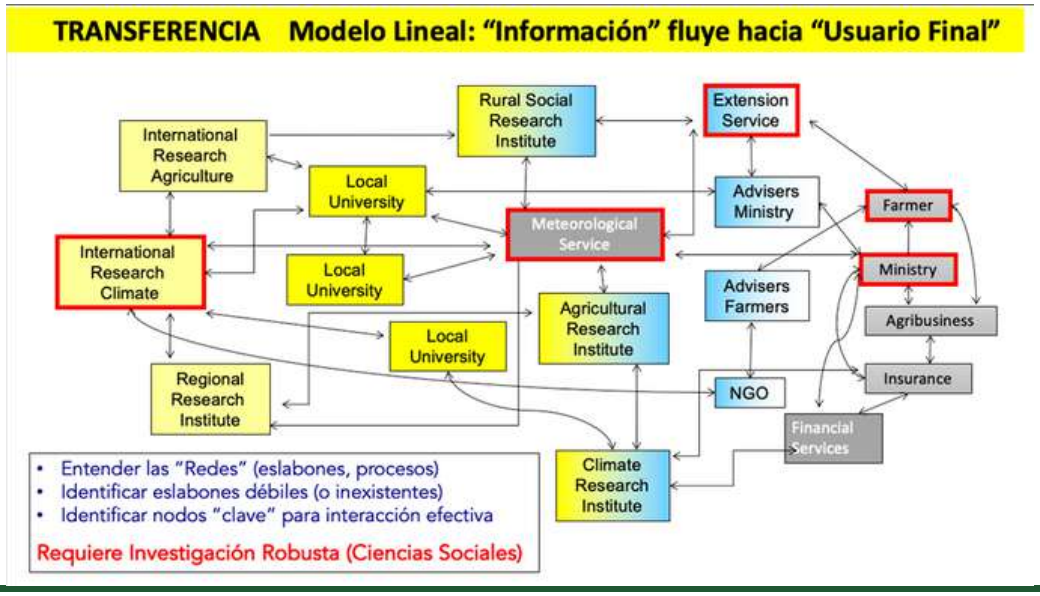
In order to increase the chances of incorporating subseasonal forecasts (as well as other information) to support concrete decisions and plans, we need research to understand and characterize the current decision systems in place. This includes mapping the networks of institutions and stakeholders involved, understanding how the different "nodes" interact, and creating flowcharts of decisions.

Tools available

Seasonal and subseasonal climate forecasts, data on decisions made / policy elaborated, a range of decision support systems for agriculture and water management.

Next steps and potential cooperation actions in the South American region about the thematic

There is a need to establish transdisciplinary research on characterizing decision systems, mapping institutions involved, establishing flowcharts of decisions (who informs who, how, when, using what), in order to increase the real use of climate information to support real-world decisions and policies.



INTRA-SEASONAL VARIABILITY IN THE TROPICAL AND SUBTROPICAL REGION OF SOUTH AMERICA

VICTOR RAUL CHAVEZ MAYTA
DEPARTMENT OF CLIMATE AND SPACE SCIENCE AND ENGINEERING, UNIVERSITY OF MICHIGAN, INSTITUTO GEOFÍSICO DEL PERÚ (IGP)

Content of the presentation

The presentation showed how the Equatorial waves (e.g., Madden-Julian Oscillations, Kelvin Waves, Rossby waves) impact precipitation over the tropical and subtropical South America region. Despite a large fraction of the intraseasonal rainfall variability is mainly associated with the eastward-propagating Madden-Julian Oscillation, there are other systems such as the Rossby-like wave which also play an important role in organizing convection. Our studies also highlighted that we need move forward with more sophisticated theory and statistical techniques that accounts for the complex interaction of the different systems in the intraseasonal time-scale.

Tools available

- Assessing the skill of all-season diverse Madden–Julian oscillation indices for the intraseasonal Amazon precipitation, Victor C. Mayta, Natalia P. Silva, Tercio Ambrizzi, Pedro L. Silva Dias & Jhan Carlo Espinoza
- The role of the Madden–Julian oscillation on the Amazon Basin intraseasonal rainfall variability, Victor C. Mayta, Tércio Ambrizzi,Jhan Carlo Espinoza,Pedro L. Silva Dias, https://doi.org/10.1002/joc.5810
- ·Westward-propagating Moisture Mode over the Tropical Western Hemisphere. VC Mayta, ÁF Adames-Corraliza, F Ahmed – 2022. doi: 10.1002/essoar.10510210.1

LAKE TITICACA WATER EVAPORATION FORECASTS FOR CLIMATE CHANGE SCENARIOS

RAMIRO PILLCO-ZOLÁ
INSTITUTO DE HIDRÁULICA E HIDROLOGÍA, UNIVERSIDAD MAYOR DE SAN ANDRÉS, BOLIVIA

Content of the presentation

Lake Titicaca is the largest lake in South America, the highest navigable lake in the world and the most important water source within the Altiplano. General circulation models (GCMs) predict significant impacts of climate change in the lake basin. Since precipitation and water evaporation are the main variables of the Titicaca water balance, it is essential to understand the impacts of climate change on them. We use validated MGC results for the A2 and B2 climate change scenarios, through the HadCM3 specific climate prediction model and the Penman approach to simulate evaporation from the lake for the period 1970-2095. To identify trends in evaporation, the Mann-Kendall test was used. For both scenarios we found a significantly increasing evaporation trend in the austral summer (DEFM) and winter (AMJJ), including an abrupt acceleration of evaporation losses since the late 2030s, coinciding with the acceleration of air temperature increase, while for the spring (ASON) a drop was found due to decreasing sunshine hours (SH) and instability of the net radiation balance (NR). The GCM results predicted an increase in minimum (TN) and maximum (TX) air temperatures in the lake area. Increasing TN will result in warmer springs with warmer nights, while increasing TX will result in warmer summers, autumns and, to some extent, winters. A general decreasing trend in precipitation was observed in the northwest of the lake basin, presumably due to the weakening of the South American lower jet, which causes instability in the upper atmosphere during the austral summer. This precipitation is crucial for lake recharge, but the coming years are predicted to be drier and with increased evaporation from the lake, which threatens to reduce Lake Titicaca's water storage.

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The seminar was organized by:

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