

## **Annual report 2022 for Flagship Pilot Study - Southeastern South America (SESA)**

### **Status and progress during the year including scientific highlights, end to end perspective and participants engaged in the project**

The focus of the extension of the CORDEX FPS-SESA (until June 2023) is the evaluation of the impacts of heavy precipitation events in different sectors (hydrology and agriculture). For this purpose, new simulations were designed in an extended spatial domain to include the full hydrological catchments and crop areas to be analyzed. Simulations cover the period June 2018-June 2021 to include the growing seasons and the Uruguay river hydrological cycle.

#### Status of the new RCM simulations:

- RegCM4, University of Sao Paulo – São Paulo State University, finished.
- RegCM5, ICTP, Italy, 2 simulations using different PBL, finished.
- ETA, National Institute for Space Research-Brazil, in progress due to computer difficulties.
- WRF, University of Cantabria/CSIC, finished.
- WRF, CIMA-University of Buenos Aires-CONICET, in progress due to computer difficulties
- WRF, NCAR, finished.

#### Status of the new ESD simulations:

- Different ESD models were used to simulate daily precipitation, maximum and minimum temperature over SESA. Some simulations using convolutional neural networks are still in progress.

#### Status of the impact model simulations:

- VIC hydrological simulations forced with dynamical models (RegCM4, WRF- University of Cantabria, WRF-NCAR) with old calibration are finished. New calibration is in progress.
- During 2022 we compared the simulations of the AgS model, a crop growth model, using as climate input data from NASAPOWER-GPM (gridded climate products), ERA5, and NCAR; for the Brazilian part of the CORDEX FPS-SESA domain. During 2023 we are going to run AgS with climate output from FPS-SESA RCM simulations.

#### Status of the observational data collection:

- Hourly data from different meteorological weather stations covering a large area of SESA (mainly southern Brazil, two provinces in Argentina and part of Uruguay) were collected from the national weather services and different local institutions (agriculture consortia and the Salto Hydropower plant). The quality control of the data is in progress.

The repository<sup>1</sup> for sharing data and simulations among the different groups involved in the FPS-SESA is hosted by the University of Cantabria.

Different specific studies of interest have been identified. The focus of these proposed analyses are on the added value of the convection-permitting simulations (compared with the ERA5 reanalyses); on assessing the capability of the simulations in capturing observed features such as the diurnal cycle of (extreme) precipitation regarding the observational uncertainty; the assessment of the capability of the models in capturing the urban-rural environment over selected cities within the domain and the analysis of the energy and water budgets.

Scientific Stays: 2 scientific stays were carried out at the Institute of Physics/University of Cantabria (IFCA/UCAN), Spain and were supported by the IFCA/UCAN and the University of Buenos Aires in the framework of the FPS-SA. The research visits were made by Rocio Balmaceda-Huarte (3-month stay)

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<sup>1</sup> <https://data.meteo.unican.es/thredds/catalog/cordex/fps/sesa/catalog.html>

and Maria Laura Bettolli (3-week stay). The objective of the stays was to advance in the statistical downscaling experiments for Southern South America including SESA, using convolutional neural networks.

**FPS SESA Meetings:**

- Several teleconferences are usually carried out in order to follow up the activities envisioned in the FPS-SESA
- A 3-day side meeting was carried out at Conference on Regional Climate Modeling and Extreme Events over South America: results from the CORDEX-Flagship Pilot Study, 4-6 September 2022 - Buenos Aires, Argentina. See some photos at the end of the report.

**Summary of each workshop/activity held during the year**

Title, date, short description, location, website, links	Responsible person/-s	Funder
<p>Conference on Regional Climate Modeling and Extreme Events over South America: results from the CORDEX-Flagship Pilot Study 4-6 September 2022 - Buenos Aires, Argentina &amp; Parallel CORDEX CAM/SAM lab-training activity 4-6 September 2022 - Buenos Aires, Argentina <a href="https://indico.ictp.it/event/9835/">https://indico.ictp.it/event/9835/</a> 38 in person attendees: Argentina (13), Bolivia (3), Brazil (11), Colombia (1), Italy (4), Peru (1), Spain (3), USA (2) + 12 remote attendees. See some photos at the end of the report.</p>	<p>Maria Laura Bettolli (University of Buenos Aires /CONICET), Tereza Cavazos (CICESE, Mexico), Rosmeri Porfirio da Rocha (IAG/USP), Marta Llopart (São Paulo State University (UNESP), Silvina Solman (University of Buenos Aires/CIMA-CONICET), Marcelo Barreiro (University of the Republic of Uruguay), ICTP Scientific Contact: Erika Coppola (ICTP)</p>	<p>SMHI, ICTP, University of Buenos Aires, University of Sao Paulo-FAPESP</p>

**Related publications during the year**

Title, journal and link to publication	Author/-s	Date
<p>Diurnal cycle of precipitation during extreme events in southeastern South America: evaluation of gridded observational data and convection permitting simulations. Submitted to JGR Atmospheres, November 2022</p>	<p>Rosmeri P. da Rocha, Marta Llopart, Michelle Reboita, Maria Bettolli, Silvina Solman, Jesus Fernandez, Josipa Milovac, Martín Feijoó, Erika Coppola</p>	<p>Submitted November 2022</p>
<p>On the use of convolutional neural networks for downscaling daily temperatures over southern South</p>	<p>Balmaceda-Huarte, R; Baño-Medina, J; Olmo, M; Bettolli, ML</p>	<p>Submitted November 2022</p>

America in a climate change scenario. Submitted to Climate Dynamics, November 2022		
Multi-model ensemble of statistically downscaled GCMs over southeastern South America: historical evaluation and future projections of daily precipitation with focus on extremes. Clim Dyn 59, 3051–3068 (2022). <a href="https://doi.org/10.1007/s00382-022-06236-x">https://doi.org/10.1007/s00382-022-06236-x</a>	Olmo, ME, Balmaceda-Huarte, R, Bettolli, ML.	April 2022
Assessing statistical downscaling in Argentina: Daily maximum and minimum temperatures. Int. J Climatol. <a href="https://doi.org/10.1002/joc.7733">https://doi.org/10.1002/joc.7733</a>	Balmaceda-Huarte R, Bettolli ML	May 2022
Diurnal cycles of one season with precipitation extremes in southeastern South America: comparison between models, resolution and observational datasets <a href="https://ui.adsabs.harvard.edu/abs/2022EGUGA..24.6672P/abstract">https://ui.adsabs.harvard.edu/abs/2022EGUGA..24.6672P/abstract</a>	R. P. da Rocha, M. Llopart, Maria Bettolli, Silvina Solman, Jesus Fernandez, Alvaro Lavin-Gullon, Josipa Milovac, Martín Feijoó, Michelle Reboita,	EGU - May 2022
First assessment of long-term RegCM4 convection permitting simulations over the center-southeast of South America <a href="http://www.cima.fcen.uba.ar/cpcm2022/IndivAbstracts/P8-3_RosmeriPorfiriodaRocha.pdf">http://www.cima.fcen.uba.ar/cpcm2022/IndivAbstracts/P8-3_RosmeriPorfiriodaRocha.pdf</a>	Rosmeri Porfirio da Rocha, M. Llopart, María Laura Bettolli and S. Solman	vi Convection-Permitting Climate Modelling Workshop, 7-9 September 2022, Buenos Aires, Argentina
Impact of using precipitation from convection permitting models on the simulated Uruguay River streamflow <a href="http://www.cima.fcen.uba.ar/cpcm2022/IndivAbstracts/O2-5_MoiraDoyle.pdf">http://www.cima.fcen.uba.ar/cpcm2022/IndivAbstracts/O2-5_MoiraDoyle.pdf</a>	Moira Doyle, Gonzalo Díaz, María Laura Bettolli, Silvina A. Solman, Laura Chavez, Rocío Balmaceda Huarte, Josefina Blazquez, Rosmeri Porfirio da Rocha, Marta Llopart and J. Milovac	vi Convection-Permitting Climate Modelling Workshop, 7-9 September 2022, Buenos Aires, Argentina
Analysis of extreme hydrological events in the Uruguay River basin <a href="http://www.cima.fcen.uba.ar/cpcm2022/IndivAbstracts/P7-3_MoiraDoyle.pdf">http://www.cima.fcen.uba.ar/cpcm2022/IndivAbstracts/P7-3_MoiraDoyle.pdf</a>	Moira Doyle, Gonzalo Díaz, María Laura Bettolli, Silvina A. Solman, Rosmeri Porfirio da Rocha, Marta Llopart, J. M. Gutierrez, Rocío Balmaceda Huarte, L Chavez and Josefina Blazquez	vi Convection-Permitting Climate Modelling Workshop, 7-9 September 2022, Buenos Aires, Argentina
The CORDEX FPS-SESA Ensemble convection-permitting simulations: Achievements, challenges and future developments	Silvina A. Solman, María Laura Bettolli, D. Carneiro-Rodrigues, M. Doyle, Martin	vi Convection-Permitting Climate Modelling Workshop, 7-9 September 2022,

<a href="http://www.cima.fcen.uba.ar/cpcm2022/IndivAbstracts/P4-9_SilvinaA.Solman.pdf">http://www.cima.fcen.uba.ar/cpcm2022/IndivAbstracts/P4-9_SilvinaA.Solman.pdf</a>	Feijoó, Jesús Fernández, M. Llopart, J. Milovac, Rosmeri Porfirio da Rocha and S. Vianna-Cuadra	Buenos Aires, Argentina
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### Planned activities for next year

Planned scientific activities for 2023:

- To finalize ESD and RCM simulations in progress.
- To advance in the designed studies using RCM, ESD and different observational datasets.
- To analyze simulations of streamflow of the Uruguay river and crop yield in Southern Brazil.
- To summarize results in manuscripts.
- To present the results of this collaborative experience at EGU 2023, WCRP Open Conference 2023 and the CORDEX-ICRC 2023.
- To build a repository to make data and simulations available after the end of the FPS in June 2023.

### Additional relevant information

The 6th edition of the Convection-Permitting Climate Modeling Workshop took place at Buenos Aires city, Argentina on September 7-9th 2022 (<http://www.cima.fcen.uba.ar/cpcm2022/>).

The workshop was an open forum to discuss the benefits and added value of using the regional and global convection-permitting resolution for weather and climate studies using multiple approaches. South American regional initiatives such as ANDEX-GEWEX, the field campaign RELAMPAGO CACTI and the NCAR South America Affinity Group (<https://ral.ucar.edu/projects/south-america>) were presented at the workshop together with the CORDEX-FPS-SESA initiative. Workshop Organizers: Lluís Fita, Maria Laura Bettolli, Roy Rasmussen and Andreas Prein.

The '1st Convection-Permitting Climate Modeling Winter School' (<http://www.cima.fcen.uba.ar/cpCMSchool2022>) took place on Saturday, September 10th (after the end of Workshop). School Director: Marta Llopart.

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### Contact person/-s

If more space is needed just add rows in the table.

The report is due the 15<sup>th</sup> of February each year and should be sent to [ipoc@cordex.org](mailto:ipoc@cordex.org).

Photos of the FPS-SESA related meetings and activities during 4-6 September 2022 in Buenos Aires, Argentina.







