CORDEX-FPS-SA: "Extreme precipitation events in Southeastern South America: a proposal for a better understanding and modeling"

3rd Report - January 2020

The main aim of the CORDEX-Flagship Pilot Study in South America (FPS-SA) is to investigate multi-scale aspects, processes and interactions that result in extreme precipitation events by using dynamical models (high resolution, convection permitting and coupled models) and statistical models. To this end, this initiative also seeks to promote inter-institutional collaboration and further networking in the South America domain.

Status of the FPS Simulations

During 2019 the work was mainly focused on finalizing the simulations and analyzing results. The 2009-2010 warm season was selected for performing the downscaling exercises and three individual 3-day extreme events were chosen as case studies for analyzing specific regional processes and sensitivity to model configurations. The ESD models, RCMs, status of simulations and institutions contributing to the FPS-SESA are shown in Tables 1 and 2. RCM simulations were performed in two modes: Weather Like (WL) mode simulations (starting 24 hours before the onset of each of three selected extreme events and Climate Mode (CM) simulations (running continuously for a 6-month period starting October 2009).

Table 1 RCM and contributing institutions to the FPS-SESA. WL: Weather-like simulation, CM: Climate-mode simulation.

RCMs	Label (model name+spatial resolution+type of simulation)	Status of simulations	Institution
RegCM4	RegCM4.4WL	Finished	University of Sao Paulo - São Paulo State University
	RegCM4.20WL	Finished	
	RegCM4.4CM	Finished	
	RegCM4.20CM	Finished	
ETA	ETA.4WL	Finished	National Institute for Space Research-Brazil
	ETA.20WL	Finished	
	ETA.4CM	In progress	
	ETA.20CM	Finished	
WRF381	WRF381BI.4WL	Finished	University of Cantabria/CSIC
	WRF381BI.20WL	Finished	
	WRF381BI.4CM	Finished	
	WRF381BI.20CM	Finished	

WRF391	WRF.CIMA.4WL	Finished	CIMA-University of Buenos Aires-CONICET
	WRF.CIMA.20WL	Finished	
	WRF.CIMA.4CM	In progress	
	WRF.CIMA.20CM	In progress	

Table 2 ESD methods used in this study and contributing institutions to the FPS-SESA. GLM: generalized Linear Model, AN: Analog method. All ESD simulations are finished.

Method	Configuration	Predictor Variables	Institutions
GLM_pc	PCs (95% variance)	Z500, V850, Z1000, Q700, Q850, T700, T850	University of Cantabria/CSIC University of Buenos Aires/CONICET
GLM_pc.C	PCs Circulation Variables (95% variance)	Z500, V850, Z1000	
GLM_l4	Local predictor values in the four nearest grid boxes.	Z500, V850, Z1000, Q700, Q850, T700, T850	
GLM_ls	Combination of local and spatial predictors (PCs 90%Variance)	Local: Q850 Spatial: V850, Z500,Z1000	
AN_pc	Nearest neighbor, PCs (95% variance)	Z500, V850, Z1000, Q700, Q850, T700, T850	
AN_pc_C	Nearest neighbor, PCs Circulation Variables (95% variance)	Z500, V850, Z1000	
AN_l16	Nearest neighbor, Local predictor values in the four nearest grid boxes.	Z500, V850, Z1000, Q700, Q850, T700, T850	

Funding:

- "Statistical and dynamic modeling of daily extreme precipitation events in southeastern South America". This project is funded by the Argentine National Agency for Scientific and Technological Promotion to partially cover the objectives of the proposal. PI: Silvina Solman. Duration: 2019-2021.

- "Variability and regional climate change of extreme events in Southeastern South America: contribution to the CORDEX FPS-SESA initiative". This projects support visits and mobility among Spanish and South American scientists in order to promote scientific cooperation in the FPS-SA framework. It is granted by the Spanish National Council of Scientific Research (CSIC), Programme I-Coop+2018. Duration: 2019-2020.

- "INSIGNIA: Contribution to CORDEX Flagship Pilot Studies: regional climate downscaling and data publishing". This project is funded by the Spanish R&D program (CGL2016-79210-R) and partially covers the objectives of the proposal. PI: Jesús Fernández and Antonio Cofiño. Duration: 2017-2020

- The “Conference on Regional Climate Modeling and Extreme Events over South America: Results from the CORDEX-Flagship Pilot Study” will take place at the University of Buenos Aires, Argentina during 16 Nov 2020 - 20 Nov 2020 http://indico.ictp.it/event/9025/. This conference has already been approved as an ICTP activity (smr 3428) and will receive ICTP partial financial support.

- Taking advantage of this meeting, a capacity building activity for CORDEX-SAM and CAM participants will be held as a side/parallel activity of the 3-day conference. This activity will receive partial financial support from WRCP-CORDEX.

Scientific Stays

- A 3-month doctoral stay at CIMA/University of Buenos Aires was completed by MSc Alvaro Lavín Gullón from the University of Cantabria, Spain. The work focused on the assessment of the synoptic forcing associated with extreme precipitation events as depicted by RCMs at convective permitting resolution of the FPS-SESA.
- In the framework of the I-Coop+2018 CSIC Project, two scientific stays at the Institute of Physics/University of Cantabria (IFCA/UCAN) were carried out during November 2019 with the aim to discuss results of the FPS-SESA and coordinate scientific publications. The research visits were made by Rosmeri Porfirio da Rocha from University of São Paulo and Maria Laura Bettolli from University of Buenos Aires. During 2020, two additional stays at IFCA/UCAN and two at the University of Buenos Aires are planned.

Publications

- Bettolli ML, Solman S, da Rocha RP, Llopart M, Gutierrez JM, Fernández J, Olmo M, Lavín-Gullón A, Chou SC, Carneiro Rodrigues D, Coppola E, Balmaceda Huarte R, Barreiro M, Blázquez J, Doyle M, Feijoó M, Huth R, Machado L, Vianna Cuadra S. 2020. The CORDEX Flagship Pilot Study in Southeastern South America: a comparative study of statistical and dynamical downscaling models in simulating daily extreme precipitation events. Submitted to Climate Dynamics, December 2019.

This work is the first of a series of papers where the results of the FPS-SESA initiative are presented. Three other papers are under preparation.

Publications in Scientific Conferences

- Solman S, Feijoó M , Lavín-Gullón A , Fernández J , da Rocha RP, Llopart M , Chou S, Bettolli ML, Doyle M, Coppola E , Gutiérrez JM. 2019. Assessment of the synoptic forcing associated with extreme precipitation events over South- eastern South America as depicted by RCMs at convective permitting resolution performed within a CORDEX FPS. ICRC-CORDEX 2019, 14-18 October 2019, Beijing, China.
- da Rocha, RP, M Llopart, ML Bettolli, J Fernandez, S Chou, E Coppola, M Doyle, M Feijoo, JM Gutierrez., A Lavin-Gullon, S Solman, 2019. Performance of RegCM4 convective permitting version in precipitation extremes over southeastern South America: preliminary results. Paper-writing workshop on the Analysis of CORDEX-CORE Climate Projections, 6-10 May 2019, Trieste, Italy.
- da Rocha, RP, Marta Llopart, Jesus Fernandez, Maria Laura Bertolli, Sin Chan Chou, Erika Coppola, Moira Doyle, Martin Feijoo, José Manuel Gutierrez, A. Lavin-Gullon, Silvina Solman. 2019. Initial

results of the CORDEX FPS on extreme precipitation events in Southeastern South America: dynamical downscaling at convection-permitting resolution. ICRC-CORDEX 2019, 14-18 October 2019, Beijing, China.

- Bettolli ML, Gutiérrez JM, Iturbide M, Baño-Medina J, Huth R, Solman S, Fernandez J, da Rocha R.P., Llopart M, Lavíin-Gullóon A., Coppola E., Chou S., Doyle M., Feijoo M., Barreiro M., Carneiro Rodrigues D., Vianna Cuadra S., Machado Luiz A., Farneti R. 2019. A comparison of statistical downscaling techniques for daily precipitation: results from the CORDEX Flagship Pilot Study in South America. ICRC-CORDEX 2019, 14-18 October 2019, Beijing, China.
- Bettolli M.L., Solman S., da Rocha R. P., Gutiérrez J.M., Llopart M., Fernandez J., Lavin- Gullon A., Coppola E, Chou S., Doyle M., Feijoo M., Huth R., Barreiro M., Olmo M., Vianna Cuadra S., Machado Luiz A., Farneti R., Carneiro Rodrigues D. 2019. The CORDEX-FPS in Southeastern South America: a comparative study of statistical and dynamical downscaling models in simulating daily extreme precipitation events. ICRC-CORDEX 2019, 14-18 October 2019, Beijing, China.

Upcoming Activities

Future activities will focus on:

- Finalizing the analysis of results and inter-comparisons according with different scientific aims. Papers submissions.
- Preparation and use of ESD and RCM simulations for modelling streamflow of the Uruguay river and crop models over the region.
- Building a website and repository for data and simulations.
- Organizing the FPS-SESA Conference and Capacity building activity in November 2020 in Buenos Aires, Argentina.

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