

Session: A3

Theme: Statistical Methods/Machine Learning techniques for regional climate modelling/downscaling

Day and time: Tuesday 26/09/23, 15:30-18:15

Chairs: Douglas Mauran and Jason Evans

Rapporteur: Komkoua Mbienda A J

Top Highlights

1. The lack of observational data is a major constraint for model development and evaluation.
2. RCM-emulators are powerful tools to create large ensembles of high resolution simulations.
3. Bias correction of RCM boundary conditions (done well) improves the simulated climate by reducing the GCM error impact on the RCM simulation.
4. No best performing model for all regions and metrics.
5. It is important to consider who are the stakeholders that will use the downscaled product and which climatic impact-drivers that are relevant for their need.

Additional Notes and Takeaways

Speaker 1: Andressa ANDRADE CARDOSO (A storyline approach to select the CMIP6 model ensemble to be downscaled for the South America domain)

- *Storylines have been shown to be useful tool to select the CMIP6 GCMs for dynamical downscaling;*
- *Storylines can answer one specific research question or a set of correlated questions;*
- *It is important to consider who are the stakeholders that will use the downscaled product and which are the climatic impact-drivers that are relevant for their need.*

Speaker 2: Maria Laura BETTOLLI (Convolutional neural networks for local climate downscaling: precipitation extremes in the FPS in Southeastern South America)

- *The lack of observational data is a major constraint for model development and evaluation;*
- *CNN showed promising results adding value and regional detail of the distinctive characteristics of daily precipitation extremes over SESA subregions;*
- *No single model performed best over all aspects evaluated, evidencing the need of coordinated experiments to better sample the uncertainties;*
- *The Bernoulli-Gamma distribution seems to have potential for capturing the different aspects of precipitation over SESA.*

Speaker 3: Antoine DOURY (RCM-emulators: A study of applicability to large GCM ensembles)

- *RCM-emulator are able to capture and reproduce the RCM downscaling function, but progress can be done for extremes;*
- *RCM-emulators are powerful tools to create large ensemble of high resolution simulation*

Speaker 4: Jason EVANS (Should we bias correct boundary conditions for regional climate models?)

- *Bias correction of RCM boundary conditions improves the simulated climate by reducing the GCM error impact on the RCM simulation;*
- *The bias correction method should be multivariate (physically consistent).*

Speaker 5: Jose GONZÁLEZ-ABAD (Introducing eXplainable Artificial Intelligence to assess Deep Learning Models for Statistical Downscaling)

- *Introducing explainable artificial intelligence to assess deep learning models for statistical downscaling led to better model information.*

Speaker 6: Neelesh RAMPAL (Can deep-learning models extrapolate to downscaling rainfall in future climates?)

- *GANs better capture the spatio-temporal variability of rainfall in comparison to regressive approaches;*
- *GANs can better resolve the extremes of precipitation (RX1Day, in particular)*

Speaker 7: Carla VIVACQUA (Design of Experiments and Machine Learning (DoE & ML)-based approach to better capture uncertainty in future climate projections)

- *Ongoing quest for adequate climate and weather modeling through ensemble experiments needs to be embedded in a statistical design and analysis framework that rigorously and efficiently compares different models against observed or reanalysis data;*

- When appropriately applied, statistically designed and analysed experiments can considerably contribute to reducing computational effort and advancing the knowledge regarding weather and climate modeling across different regions