

Annual report 2023 for Flagship Pilot Study Dynamical downscaling experiments and hydrological modelling for Canada and Mexico.

Status and progress during the year including scientific highlights (and images if possible), end to end perspective and participants engaged in the project

Progress.

1. The updated website of the project is available at: <http://cordex.imta.mx/>
2. During September and October 2023, José Antonio Salinas visited ICTP (International Centre for Theoretical Physics, Trieste, Italy) as Senior Associate increasing collaboration with the group that developed the RegCM5 model, receiving ten years of simulations of the Caribbean and Gulf of Mexico carried out at the ICTP, for evaluation, contributing to applying the best configuration of the RegCM5 model.
3. The first two papers related to statistical downscaling tests were published: i) Historical and Projected Trends of the Mean Surface Temperature in South-Southeast Mexico Using ERA5 and CMIP6. *Climate* 2023, 11(5), 111; and ii) Statistical Downscaling of Precipitation in the South and Southeast of Mexico. *Climate* 2023, 11(9), 186.
4. Currently, two basins have been modeled, one in Mexico and one in Quebec to analyze the hydrological model and the impact of Climate Change according to the CORDEX model.

Activities 2023.

- ✓ Selection of the best configuration in RegCM and WRF models considering the numerical simulations at high resolutions: 3, 4, 5 and 10 km in a nested grid structure, using MPI-ESM1-2-HR model.
- ✓ The statistical downscaling component of the Climatology group within the project conducted two scenario analyses for the study area in Mexico. The first study focused on generating climate change scenarios for the temperature variable using the statistical downscaling technique with delta bias correction. The analysis was based on the future projection periods defined by the IPCC: 2021-2040 (near), 2041-2060 (medium), and 2081-2100 (far). Scenarios from the CMIP6 models, namely SSP2-4.5, SSP4-6.0, and SSP5-8.5, were utilized. The results suggest that for the southern-southeastern region of Mexico, including the study area, the most probable scenario is SSP4-6.0 for the near and medium projection periods.
- ✓ In the second study, the same region underwent the quantile mapping bias correction technique to determine the best model for the precipitation variable during the historical period. The models employed included CNRM-ESM2-1, IPSL-CM6A-LR, MIROC6, and MRI-ESM2-0. Based on statistical metrics (rmsd and NSD) and Taylor diagram, CNRM-ESM2-1 was selected as the optimal model.
- ✓ Two doctoral students are currently engaged in projects related to statistical downscaling. M.S. Alejandro Ordoñez is working on the project titled "Differences in Projections of Climate Extremes Indices between CMIP5 and CMIP6 in Mexico," with a progress of 25%. Meanwhile, M.S. Sergio Rodríguez will undertake the thesis titled "Evaluation of the Added Value of Multiple Statistical Downscaling Techniques in Two Hydrological Regions of Mexico" starting in 2024.
- ✓ Selection of two basins with similar characteristics in Mexico and Canada.
- ✓ Geomorphological analysis of the basin
- ✓ Hydrological modeling of two basins

Generate Milestones.

- Hydrological analysis and impact of Climate Change of a basin in Mexico and one in Quebec.

Summary of each workshop/activity held during the year

Title, date, short description, location, website, links	Responsible person/-s	Funder
The International Conference on Regional Climate-CORDEX 2023 (ICRC-CORDEX 2023). Trieste, Italy.	Daniela Jacob	CORDEX
11th Workshop on the Theory and Use of Regional Climate Models. Trieste, Italy.	Erika Coppola	ICTP

Related publications during the year

Title, journal and link to publication	Author/-s	Date
Statistical Downscaling of Precipitation in the South and Southeast of Mexico. <i>Climate</i> 2023, 11(9), 186. Available from: https://www.mdpi.com/2225-1154/11/9/186 https://doi.org/10.3390/cli11090186	Andrade-Velázquez M, Montero-Martínez M.J.	2023 September 08
Historical and Projected Trends of the Mean Surface Temperature in South-Southeast Mexico Using ERA5 and CMIP6. <i>Climate</i> 2023, 11(5), 111. Available from: https://www.mdpi.com/2225-1154/11/5/111 https://doi.org/10.3390/cli11050111	Andrade-Velázquez M, Montero-Martínez M.J.	2023 May 18

Planned activities for next year

The statistical downscaling component of the Climatology group within the project plans to generate climate change scenarios for the study area in Mexico for the future projection periods of 2021-2040, 2041-2060, and 2081-2100.

In addition, the group plans to employ various statistical downscaling methods using the Climate4R software developed by the Santander Meteorological Group.

Universidad Veracruzana will accept some students to work on the project (thesis).

Hydrologically model other basins in Mexico and Quebec to evaluate the impact of Climate Change. Calibrate and validate the models created with at least two hydrological models.

Any other positive news or stories within your FPS during the year

Contact person/-s

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Please remember to inform IPOC about news, calls, activities or other information that can be shared with the community during the year! We want to show your work at the website and on social media.

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

The report is due the 15th of February each year and should be sent to ipoc@cordex.org.