WCRP CORDEX

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CORDEX: Achievements, status and focus of future work

Summary of Parallel Session A, B and C

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With acknowledgements to all session chairs, rapporteurs

Parallel Session A: Advances in regional downscaling

A1: Uncertainties and added value

Chairs: Tereza Cavazos, Fredolin Tangang
Rapporteur: JC Peralta

Session Highlights:

- Downscaling increases model added value, by reducing the bias observed in GCMs in regions all over the world, with temperature better captured in general than the precipitation.
- Temperature projections point to warmer conditions in the future, but rainfall projections still have large spatial variability and is subject to contrasting intermodal signals.
- Model performance varies from season to season, and shows region dependence.

A1: Uncertainties and added value

Session Highlights (cont.):

- RCMs tend to inherit bias from the driving GCMs, even amplify biases of driving GCMs, especially for precipitation
- Where a climate signal is deemed robust, the model ensemble size does not matter.
- In complex region such as Southeast Asia and Maritime Continent, model biases may be improved by increasing model resolution to resolve complex topography and small islands.

A1: Uncertainties and added value

Takeaways

- Experiences from Mediterranean region are that the ensemble mean for EUR44 and AFR44 is consistent, but other metrics such as the median of annual dry spell maxima has considerable variability
- Variance decomposition indicates that domain choice has minimal effect compared to model variability
- The consistent cold bias for temperature can be improved due to better topography and albedo representation in eastern China
- Weighted ensemble increased added value by decreasing bias in Mainland SEA especially in JJASON, and drawing standard deviation closer to observed than the democratic (equal-weighted) ensemble
- Projected shifts in temperature distribution show latitude dependence over SEA
- Contrasting trends of GCM-RCM pairs were seen over west and central Africa, while south Africa has consistent GCM-RCM signals

A2: Convection permitting modelling

Chairs: Shiori Sugimoto, Belusic Danijel

Rapporteur: Dhirendra Kumar

Session Highlights:

- The convection permitting modeling (CPM) community is shifting towards process-based studies of present and future climate. Examples include:
  - classifying precipitation into different types (stratiform vs convective vs orographic; solid precipitation vs rain)
  - analyzing their change in the future climate and the associated effects of microphysics,
  - identifying large-scale constraints on CPM precipitation and precipitation change, challenging the link between CPM and high resolution, and
  - evaluating the sources of uncertainty in CPMs.
- Larger benefit is shown in CPM in simulating summer precipitation than in winter.
- There are indications that convection permitting modeling could be used even at coarser resolutions up to 50 km.

A2: Convection permitting modelling

Takeaways

- Observational uncertainty exists. It is important to carry out an intercomparison of CPM simulations with multiple datasets.
- CPM provides additional information over complex terrain.
- The representation of the low-level large scale convergence is dependent upon the way convection is captured in the models.

A3: Downscaling tools and methods

Chairs: Tannecia Stephenson, Koji Dairaku

Rapporteur: Abiodun Adeola

New/modified tools and methods and intercomparisons of dynamical and statistical downscaling techniques were presented.

Session highlights and Key Findings:

- New tools and methods and have been developed and tested over Europe and Asia. The Added values of those were presented. Some tools and data are publicly available. Those are expected to be used and evaluated by many potential users.
- The tools have great potential to significantly contribute to the CORDEX-CORE initiative.

A3: Downscaling tools and methods

Highlights and Key Findings(cont.):

- ✓ Quality of observation data is a major concern and a draw back to developing reliable regional climate information.

- ✓ Uncertainty in the regional climate information remains a big challenge, as various stakeholders have various needs/purposes and want simple/best information.

- ✓ There are great opportunities to improve the tools and methods through collaboration among scientists and stakeholders in the region (policy-relevance).

Parallel Session B: Coupled models

B1: Atmosphere-land interaction

Charis: Vimal Mishra , Hongbo Liu
Rapporteur: Richard Antonio

Session Highlights

- Land-use and land cover (LULC) are continuously changing due to environmental changes and anthropogenic activities. The regional climate simulation results show that LULC changes can exert different extent of influence on biogeographical characteristics and land-atmospheric feedbacks.
- Satellite based LULC data and soil data provide more realistic information for regional climate model simulations.
- The effects of land use or land change on climate is region, season, and variable dependent.
- RCM coupled terrestrial water cycle module show potential to predict near-term extreme events (e.g., drought and heatwave).
- Recently land cover change lead to significant cooling effect in Europe.

B1: Atmosphere-land interaction

Takeaways

- Land use is a suitable proxy of human forcing, needed to be integrated into RCMs to comprehensively quantify effects of human activities on climate
- Strength of the sensitivity to a specific change depend on the model configuration
- Groundwater processes may play a crucial role for climate and the evolution of heatwaves and droughts.
- Recent realistic land cover change causes cooling climate in Europe.
- Emphasis should be placed on the impact of land use changes on climate, special focus on precipitation and low-level humidity related properties.

B2: Ocean-ice-atmosphere

Chairs: Anette Rinke, Grigory Nikulin
Rapporteur: Andrea Lira Loarca

Session Highlights

- Coupled RCMs improve the simulation of major spatio-temporal variability of monsoon characterization, wind fields and local physical processes
- Coupled RCMs could increase decadal SST predictability
- Coupled RCMs allow for better characterization of local dynamic processes and extreme events, such as tropical cyclones, typhoon frequency, trends in river discharges, impacts on vegetations, extreme rainfall at decadal, extreme significant wave heights
- Efforts should put to better assess the regional and local processes, which require high-resolution observations for validation and comparison.

B2: Ocean-ice-atmosphere

Takeaways:

- The regional coupled model intercomparison project is esteemed necessary.
- Continuous effort to absorb or include more components into the current atmosphere-ocean coupled modeling system and developing RESM is required.

B3: Biogeochemical processes

Chairs: William Gutowski

Rapporteur: Mohan Kumar Das

- Applying the Regional Earth System Model RegCM-ES, which contains regional ocean circulation, marine biogeochemical process, shows improvement for the climate simulation and provides marine biogeochemistry over the highly populated coastal zone of the Mediterranean region, by minimizing the errors in rainfall, evaporation.
- The effects of aerosols on the radiative forcing efficiency of heating rate have distinctive annual and seasonal features, as well as regional characters.

Parallel Session C: Climate change impacts

C1: High impact regional phenomena

Chairs: Faye Cruz, Izidine Pinto

Rapporteur: Adnan Arshad

Session Highlights

- The risks of extreme events, such as heat stress, drought, and floods, will likely increase in the future as projected by GCMs and RCMs (e.g. from CORDEX sources) under future scenarios. Future changes in the frequency of tropical cyclones differ in sign depending on the region.
- Future changes in extremes (e.g. significant increase in 1-in-50-year extreme flooding and high winds in southeast US, projected increase in the hydrological cycle over La Plata Basin) require appropriate adaptation strategies for sectors, such as infrastructure and agriculture.
- Climate extremes impose the increase level of frequency, intensity, duration and occurrence of health risks in regions of sub-Sahara.

C1: High impact regional phenomena

Takeaways

- Model estimations are expected to improve using improved and/or optimized parameterization schemes (e.g. aging parameterization, choice of best physics options).
- There is a need to consider how best to co-generate climate information for decision-makers/policymakers to minimize the knowledge gap
- Effective forecast and warning systems can play an important role in reducing the harm caused by these events. The way forward is to communicating high impact climate and weather improving warnings and decision-making processes.
- Capacity building of climate and met scientist and building bridges among the scientists-process-results-translation-delivery to end users “climate services and providers”

C2: High mountain environments

Chairs: Jason Evans Mandira Singh Shrestha

Rapporteur: Anubhav Choudhary

Session Highlights

- High mountain regions are challenging to observe as well as model. There are various fine scale processes that needs to be studied. Future changes in climate are often enhanced in up slopes and over mountain regions.
- Some of the talks showed that there are existing projects that are trying to address observational and modeling uncertainties (e.g. TPE, ANDEX, CORDEX Alps FPS, HyMEX, …) in various mountainous regions of the world
- We need to represent some important processes in models which are currently missing or poorly represented such as, soil freezing/thawing, glaciers, topography, snow processes including snow packs etc.

C3: Implications for renewable energy

Chairs: Juan Pedro Montavez, Erik Kjellström

Rapporteur: Richard Antonio

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Thank you!