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Session: A1
Theme: Uncertainties and added value
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Chair(s): Fredolin Tangang and Tereza Cavazos
Rapporteur: JC Albert Peralta

Session A1 of the CORDEX International Conference on Regional Climate (ICRC-CORDEX 2019) showcased the work of climate scientists around the world in assessing how current regional climate models (RCMs) reproduce observed climate. Throughout the presentations and discussions, a common theme is that downscaling tends to increase model added value by reducing the global climate models biases present in many regions.

The regional climate modelling community has shown that downscaling has advanced with considerable improvements in recent years. Among the studies presented, there is a consensus that temperature is better captured than rainfall. There is also evidence that winter season is better captured than the summer season. In a downscaling experiment led by ICTP over 9 CORDEX domains using RegCM4.7 forced by several general circulation models (GCMs), the bias for temperature is reasonably low for all domains. For rainfall, there are evident dry biases in the Amazon region and wet biases in Africa, and over the summer monsoon in India and Southeast Asia (SEA). Extreme events are better captured by the regional model in these experiments than the GCMs (Erika Coppola). For topographically-complex regions such as in Southeast Asia and its Maritime Continent, model ensemble adequately simulates the low level circulation, divergence, and the annual cycle of rainfall, but there is considerable model spatial variation (Fredolin Tangang).

On the other hand, recent downscaling projects have identified key weaknesses in RCMs which still need to be addressed. There is substantial seasonal dependence in the performance of downscaled models, which varies per region. RCMs also tend to inherit the bias present in the driving GCM in simulations over East Asia (Xuejie Gao) and south Africa, while contrasting trends of GCM-RCM pairs were seen over west and central Africa (Grigory Nikulin). Moreover, the resulting projections from RCMs, especially for rainfall and during the summer season, contain large spatial variability and is subject to contrasting intermodel signals. For example, the time of emergence (TOE) of long-term change in future temperature from RCMs occur earlier than GCMs, while trends diverge and shows high spatial variability for precipitation (Thanh Ngo Duc).

Novel techniques were also proposed to improve certain aspects of how RCM output are analyzed. A comparison of downscaling projects in overlapping domains, e.g. the Mediterranean region in EUR44 and AFR44, show that ensemble means are consistent but other metrics pertaining to extremes have considerable variability (Mikael Legasa). Weighted ensembles tend to increase added value compared to equal-weighted ensembles (Gemma Narisma). A new method to calculate added value using the sum of differences between GCM and RCM distributions was also proposed (James Ciarlo). Precise definitions of ensemble significance and robustness also show that ensemble size does not matter if the climate signal is robust across all models (Chris Lennard).

Lastly, the downscaling community shared some challenges and future directions in the field. Running RCM ensembles require huge computational power and large data storage facilities. Also, finer (<25 km) regional model resolution is needed to reduce biases and intermodel variations, especially in topographically-complex regions. However, it is important to notice that RCMs can reduce or amplify climate signals, thus supporting the need to revise both GCMs and RCMs for uncertainties and added value. There were also discussions on how the modelling community can help climate services to better communicate model uncertainties to end-users.