Notes for the "ICRC-CORDEX 2019 International Conference On Regional Climate"

Session (e.g., A1, B2, etc.)**: A2**
Theme (e.g., Uncertainties and Added Value; Ocean-ice-atmosphere, etc)**: Convection permitting modelling**
Day and time: Oct. 16, 2019, 0800-1130
Chair(s): Shiori Sugimoto and Danijel Belusic
Rapporteur: Dhirendra Kumar

With the advances in convection permitting models (CPM) in the recent decades, the dedicated session in ICRC-CORDEX 2019 provided useful insights regarding the progress in the field. The session indicated that the CPM community is shifting towards process-based studies of present and future climate. Such observation is based on several studies discussing a range of processes e.g. classifying precipitation into different types (stratiform vs convective vs orographic, solid precipitation vs rain etc.) and their change in the future climate. Distinct seasonal signatures of these changes with different underlying mechanisms were reported and discussed. The speakers also emphasized the associated effects of microphysics parametrizations, identification of 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.

The CPM simulations for climate change experiments indicated an increase in the intensity of heavy precipitation events while the number of events were found to decrease in future. The climate change favors the conditions for stronger deep convection and the associated heavy precipitation. In addition, high-resolution simulations were shown to add value in representation of heavy precipitation as well as hourly extremes through different climate change signals [5 (10) % change per degree temperature change in case of coarse (high) resolution]. The benefit of CPM simulation in obtaining additional details over complex terrain was demonstrated in different experiments. Advantages of CPM simulations in representing the lifetime, size, maximum intensity, time evolution and duration of heavy precipitation events were also highlighted. Uncertainties in the available observations were reported and it was shown that it is important to perform an inter-comparison of CPM simulation with multiple datasets. Apart of the observational uncertainty, the uncertainty in simulating synoptic conditions using CPMs were found to be related with the physical parameterization as well as the internal variability. For the simulation of atmospheric circulation variables, the experiments using a range of different physics parameterizations have a comparable contribution to the overall uncertainty as the model's internal variability, while closer to the surface, the multi-physics approach has a larger contribution. Further, while exploring the importance of physical parameterizations under CPM framework, it was found that the choice of appropriate microphysics parameterization (MP) is important for the simulation of frequency and intensity of heavy and torrential precipitation. Interestingly, the large-scale circulation during East Asian monsoon season was found to be insensitive to the choice of MP. Nevertheless, the importance of bias correction in the lateral forcing (sea surface temperature) was reported to improve the simulated precipitation statistics for its mean and the variability over the Arabian Gulf region. The importance of resolution under the framework of CPM was also discussed and it was shown that the deep convection parameterization might not be required for climate simulations with grid spacing < 50 km. Further, a process-based approach was presented to highlight the impact of Trade Wind Inversion over Hawaii. It was shown that the response of Hawaii climate might be different from other places in the world. Moreover, it was shown that even at higher resolutions (3 km) the simulations over complex terrain such as the Himalayas need to consider using the orographic drag parametrization for achieving better results.

Apart from the general notion of improvement in the characteristics of convective precipitation, CPMs may provide benefits in studying the more general changes in the kinematics and dynamics. For instance, the low-level large-scale convergence over the mountainous region in South America was found to depend upon the way convection is captured in the CPM simulations.