

Notes for the “ICRC-CORDEX 2019 International Conference on Regional Climate”

Session C3

Theme: Implications for renewable energy

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Increasing energy demands on a global scale calls for an intensification of the energy production. As many types of traditional energy production are associated with strong negative environmental impacts there is a need for an extensive increase of renewable energy production. It is important that this expansion considers adaptation to future climate conditions. In this context, adequate regional climate information, such as that provided by CORDEX, can be of help to planners and decision makers.

In this session most presentations addressed changing conditions for wind-, solar- and hydropower. Examples from Africa, Asia and Europe were given. Here, we summarize commonalities before detailing findings from the individual studies:

- Some of the studies pointed to added value of the RCMs w.r.t. the underlying GCMs. It was also pointed out that the horizontal resolution of 50 km in most simulations is not adequate for all purposes including studying near-coast gradients in wind speed, precipitation conditions in steep topography etc.
- Several of the studies pointed to the lack of reference data for model evaluation. Observational data sets are often produced in a national context with different quality and it is clear that there is a need for more collaboration on a regional, international level to enhance observational data sets. In particular, it was noted that gridded products are often lacking. Data sets that do exist are often restricted to near surface temperature and precipitation and there is a urgent need also for other variables such as wind speed.
- As an alternative to gridded observational data sets, reanalysis data sets are often used. In some occasions it can be questioned whether this is a good approach as most reanalysis data sets are on coarser scale than the RCMs. Also, not all variables are assimilated implying that the reanalysis product also can have large biases w.r.t. the real climate.
- Bias correction was applied in some studies. Differences in methodologies and questionable quality of some reference data sets implies that care must be taken in interpreting results that are bias corrected.
- Most studies did not present results for model evaluation of ERA-Interim driven runs. This would be the natural starting points for studies on RCM-GCM simulations.
- A common problem for all conducted studies but one was that only few RCM-GCM combinations had been used implying that broad conclusions could not be drawn. An exception was the study presented by Victor Indasi on the African wind climate utilizing the relatively larger RCM-GCM matrix existing for Africa-CORDEX. Low number of simulations, poor availability of data and problems in downloading and handling data from simulations all contributed to this.
- Most studies had not involved any direct user interaction at this point although it was seen as an important next step. Participation from other sectors in a transdisciplinary way was discussed as a way of improving work on renewable energy, not least with respect to climate change adaptation.

Brief summary of presentations

Delei Li: Future projections of wind speed and wind power over CORDEX-East Asia

- A set of CORDEX simulations with one RCM downscaling four GCMs have been analysed.

- The study showed added value for wind in the RCM w.r.t. the underlying GCMs.
- The results indicate an increase in wind power density in some areas in East Asia (i.e. Eastern China) and wind energy output greater in the end of the 21st century than in the near future. In other areas, notably over some oceanic regions and in the tropics, there is a decrease.

Juan Pedro Montavez: Effect of aerosol radiation and aerosol cloud interactions in the simulation of photovoltaic and wind power using regional climate models

- A RCM has been used to include direct and indirect radiative effects of aerosols on climate change over Europe.
- It is found that aerosols can strongly influence the potential for renewable energy production.
- Direct and indirect effects of the aerosols can sometimes counteract each other.
- Inclusion of aerosol radiative effects in the RCM reduces the discrepancy between GCM and RCM projections.

John Nacpil: Characterising the historical and projected wind energy resource in the Philippines using CORDEX SEA simulations

- One RCM downscaling several GCMs have been analysed for the area of the Philippines.
- It is found that there are large wind biases over high terrain topography in the Philippines although this is w.r.t. reanalysis data.
- Results show that areas where wind power density increase with climate change, do not necessarily correspond to areas that have high wind speeds in the reference period.
- Some already planned wind farms are not in areas that are projected to see a larger wind power potential. However, they are foreseen to power more homes relative to current numbers.
- Results implies that small scale wind farms may be more beneficial for local communities.

Hyun Chin Lim and Suk-Ki Kong: A study on civic engagement into energy transition since Fukushima and its impact on renewable energy policy in South Korea

- The Fukushima disaster led to a rapid change in the perception of nuclear power and there is now a strong push for more renewable energy in South Korea.
- A strong change in the discourse is seen including involvement of new groups such as environmental activists, young mothers, etc.
- These “post-nuke” groups develop their specialty equipped with more scientific and reliable evidence to persuade others. In this context reliable regional climate information is of importance. It was stressed that participation of scientists is needed in order to guide the discourse in the larger public domain.

Hazrat Bilal: Sustainability of the hydropower generation capacity of Pakistan in changing climate conditions

- Results from one RCM downscaling several GCMs under the RCP4.5 and 8.5 scenarios have been analysed and used for a study on impacts on hydropower generation.
- Results show that increased snow melt and run off due to increasing temperature can increase hydroelectric power generation capacity in the area.
- Results also showed a shift of the season as accumulation and melt seasons are changing differently.

Victor Indasi: The future of Africa’s wind energy sector under 1.5 degree and 2 degree global warming

- A relatively large ensemble of RCM-GCM combinations was analysed w.r.t. changes in the wind speed potential for a number of major wind power facilities in Africa.
- Results show that for some of the studied countries in Africa, wind speeds are increasing under both RCP scenarios.
- Possible reasons behind the changes in wind speed touched upon include: Changing temperature gradients across coastal regions resulting from differential heating of oceans and

land, changes in the position and migration of the Intertropical convergence Zone and in the Hadley cell circulation as well as in the mid-latitude circulation.