WCRP CORDEX 17TH-20TH MAY 2016 STOCKHOLM, SWEDEN ICRC-CORDEX 2016

PARALLEL SESSION C: IMPACTS AND APPLICATIONS
C1: REPRESENTING & PROJECTING EXTREMES

Extreme precipitation in an ensemble of regional climate models

Raymond ARRITT

Iowa State University - USA

The north-central United States is one of the world's most productive agricultural regions and also is implicated in environmental issues such as the hypoxic "dead zone" in the Gulf of Mexico. During the late 20th century this region has seen a marked increase in the occurrence of extreme precipitation, which affects both agricultural production and its environmental consequences. We have performed an ensemble of simulations using RegCM4 to examine the ability to reproduce the observed trend in precipitation intensity and to project future changes through the 21st century. We created a matrix of simulations over the CORDEX North America domain for 1950-2099 by driving the regional model with two different global models (HadGEM2-ES and GFDL-ESM2M, both for RCP8.5), by performing simulations at both 50 km and 25 km grid spacing, and by using three different convective parameterizations. The result is a set of 12 simulations (two GCMs by two resolutions by three convective parameterizations) that can be used to systematically evaluate the influence of simulation design on predicted precipitation. The two global models were selected to bracket the range of climate sensitivity in the CMIP5 models: HadGEM2-ES has the highest ECS of the CMIP5 models, while GFDL-ESM2M has one of the lowest.

Trends in frequency of extreme precipitation (defined as amounts exceeding 76.2 mm/day) for most simulations are similar to the observed trend but with notable variations depending on RegCM4 configuration and on the driving GCM. This trend is predicted to continue and intensify through the 21st century, with the magnitude varying by model configuration. Most configurations also show a marked increase in the number of long runs of dry days. These results are tempered by complex interactions among resolution, choice of convective parameterization, and the driving GCM. As an example, the Emanuel scheme produced the smallest precipitation increase of the three convective parameterizations when used in simulations driven by HadGEM2-ES but the largest increase when driven by GFDL-ESM2M. These findings reiterate that large ensembles using multiple RCM configurations and driving GCMs are essential for projecting regional climate change.

This research was sponsored by the U.S. Department of Agriculture National Institute of Food and Agriculture.

Raymond Arritt[1], Ariele Daniel[1], Pavel Groisman[2]

[1]Iowa State University, [2]Hydrology Science and Services Corp