Geophysical Research Abstracts
Vol. 19, EGU2017-17825, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

Spatiotemporal assessment of historical skill and projected future changes in CORDEX South Asia ensemble simulation of precipitation and temperature for the Upper Indus Basin

Nathan Forsythe, Hayley Fowler, and David Pritchard

Newcastle University, School of Civil Engineering and Geosciences, Newcastle upon Tyne, United Kingdom (h.j.fowler@ncl.ac.uk)

High mountain Asia (HMA), including the Hindu Kush-Karakoram, Himalayas and Tibetan Plateau, constitutes one the key "water towers of the world", giving rise to river basins whose resources support hundreds of millions of people. This area is currently experiencing substantial demographic growth and socio-economic development. This evolution will likely continue for the next few decades and compound pressure on resource managements systems from inevitable climate change. In order to develop climate services to support water resources planning and facilitate adaptive capacity building, it is essential to critically characterise the skill and biases of the evaluation (reanalysis-driven) and control (historical period) components of presently available regional climate model (RCM) experiments. For mountain regions in particular, the ability of RCMs to reasonably reproduce the influence of complex topography, through lapse rates and orographic forcing, on sub-regional climate – notably temperature and precipitation – must be assessed in detail. This is vital because the spatiotemporal distribution of precipitation and temperature in mountains determine the seasonality of streamflow from the headwater reaches and of major river basins. Once the biases of individual GCM/RCM experiments have been identified methodologies can be developed for modulating (correcting) the projected patterns of change identified by comparing simulated climate sub-regional climate under specific emissions scenarios (e.g. RCP8.5) to historical representations by the same model (time-slice approach). Such methods could for example include calculating temperature change factors as a function elevation difference from present 0°C (freezing) isotherm rather than simply using the overlying RCM grid cell if for instance the RCM showed exacerbated temperature increase at snow line (i.e. albedo feedback in elevation dependent warming) but also showed a pronounced bias in the historical (vertical) position of the isotherm.

HMA falls within the South Asia domain of the Coordinated Regional Downscaling Experiment (CORDEX) initiative to which multiple international modelling centres have contributed RCM experiments. This work evaluates the present publically available CORDEX South Asia experiments including integrations of CCAM, RegCM4, $REMO_2009$ and RCA4. These have been driven by a range of GCMS including ACCESS1.0, CNRM-CM5, GFDL, LMDZ, MPI-ESM, and NorESM. This substantial multi-model ensemble provides a valuable opportunity to explore the spread in model skill at simulation of key characteristics of the present HMA climate. This study focuses geographically within the CORDEX South Asia domain on an orthogonal subdomain from 72E to 77E and 32.5N to 37.5N which covers the bulk of the Karakoram range and key headwaters tributaries of the Indus river basin upon which Pakistan is preponderantly dependent for agricultural water supply and hydro-electric power generation.