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User friendly R-code for data extraction from GCM and RCM outputs

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Statement of the Problem: The trend in the climate parameters in the last decades and the climate change (CC) modeling projections indicate potential changes in climate and connected environmental parameters which are expected to create adverse impacts on Earth System. As CC related risks become more apparent relevant studies gain higher pace. Research on CC impacts significantly depend on availability of the data. Climate model outputs are commonly used in further numerical analyses and as inputs for successive modeling studies such as hydrologic models. The outputs of Global and Regional Climate Models (GCMs and RCMs) are generated in NetCDF file format and available online in this format for researchers' download and utilization in open-access databases of ESGF (Earth System Grid Federation), CORDEX (Coordinated Regional Downscaling Experiment) and similar. However, even for regional domains four dimensional data (spatial and time dimensions) of long horizon climate simulation outputs necessitate working with very large size files in NetCDF file format which is not suitable to be processed by other type of data processing and modeling programs. Hence, researchers are facing problems in extracting specific data for their temporal and spatial focus from these files. Although there are already some commercial and non-commercial software and computer programming codes to extract desired data from these datasets most of them necessitate familiarity with various computer languages, thus are not easy to use. Here, we developed a simple efficient R-code to extract data from GCM and RCM outputs.

Methodology: Based on the spatial and temporal characteristic of the NetCDF file, an R-code is developed. The "ncdf4" and "openxlsx" packages are used in the code.Outcomes: Using the developed R-code time series data of climate parameters can be obtained in Microsoft Excel format suitable to be used in further hydrological modeling by relevant software (e.g. HEC-HMS). Extracted data can also be used for further multimodel ensemble analysis of climate model outcomes for selected local focus area by the use of relevant data processing tools.

Conclusion & Significance: The user-friendly R-code code is public and provides timesaving for all end-user researchers from various fields that utilize the open-access data in ESGF and CORDEX databases. The structure of the developed R-code enables researchers to easily extract data from a series of NetCDF files in Microsoft Excel format. A video explaining "How to use the R-code" is prepared and shared together with the R-code.