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Jai Kumar
Centre for Geospatial Technologies, Vaugh Institute of Agricultural Engineering And Technology, Sam Higginbottom University of Agriculture Technology & Sciences, Prayagraj (Allahabad), Uttar Pradesh, India

Correspondence
Jai Kumar
Centre for Geospatial Technologies, Vaugh Institute of Agricultural Engineering And Technology, Sam Higginbottom University of Agriculture Technology & Sciences, Prayagraj (Allahabad), Uttar Pradesh, India

Review of literature of climate change on GCM, RCM, RCP scenarios

Jai Kumar

Abstract
The purpose of this review is to briefly discuss GCM, RCM, RCP scenarios in climate change. To provide information about them to help GCM, RCM, RCP scenarios in climate change to discuss the particular problem relate to the climate change. Scenarios have been changed and evaluated signification in recent years highlight the use of swat, GIS automatic calibration process allowing then capable of simulating watershed under given land use and climate effects.

Keywords: GCM, RCM, RCP, climate change

Introduction
General Circulation Models (GCMs) predict that increases in atmospheric greenhouse gas concentrations will raise surface temperatures. These changes will likely affect the hydrologic condition. Among the GCMs and emission scenarios used by the IPCC, temperatures in 2100 are expected to be between 1.1 and 6.4 _C higher than temperatures in 1900, accompanied by changes in rainfall intensity (IPCC, 2007) [4]. Possible changes in regional and seasonal patterns of temperature and precipitation and their implications for the hydrologic cycle are as yet poorly understood.

An increase of atmospheric CO2 will directly affect plant transpiration and growth which are inherently tied to the hydrologic cycle. Experimental evidence indicates that stomatal conductance of some plants will decline as atmospheric CO2 increases, resulting in a reduction of transpiration (e.g., Morison and Gifford, 1983; Morison, 1987; Hendry *et al*., 1993; Tyree and Alexander, 1993; Field *et al*., 1995; Saxe *et al*., 1998; Wand *et al*., 1999; Medlyn *et al*., 2001; Wullschleger *et al*., 2002) [7].

The increase in global temperature has caused higher evapo transpiration rates leading to changes in precipitation worldwide (Paparrizos *et al*., 2016; Urrutia and Vuille, 2009) [8, 9], significantly impacting hydrological processes and the occurrence frequency of hydrological events (i.e., floods and droughts).

The general circulation model (GCM) is a type of climate model which mathematically represents the general circulation of a planetary atmosphere or ocean. The impact of climate change has been widely studied using GCMs, which are considered one of the most effective tools for exploring the physical processes of the earth’s surface-atmosphere system.it can be provide very important information in regards to historical, current, present and future climate (Gonzalez *et al*., 2010; Jing *et al*., 2015) [2, 6].

Regional climates consistent with global changes are created by downscaling global climate model (GCM) results either by statistical or mathematically (regional climate model (RCM)) methods. Numerous studies based on statistical methods or algorithm for exploring impact of climate change at the watershed scale is summarized in the latest IPCC impacts report [IPCC, 2001b] [3].

General circulation models (GCMs) are the major tools that provide information about future climate change. Generally speaking, there are two steps to follow to quantify the hydrological impacts of climate change based on GCMs outputs: (1) GCM outputs (precipitation and temperatures) are first downscaled to a Watershed Characterization to obtain climate change projections at an appropriate scale; and (2) climate change projections are then input into hydrological models to simulate future hydrological conditions.

RCM

The nested regional climate modelling technique consists of using initial conditions, time-dependent lateral meteorological conditions and surface boundary conditions to drive high-resolution RCMs. The driving data is derived from GCMs and can include GHG and aerosol forcing. It can be analyses of observations. A variation of this technique is to also force the large-scale component or largest area of the RCM solution throughout the entire domain (e.g., Kida *et al*., 1991; Cocke and LaRow, 2000; von Storch *et al*., 2000)

This technique has been used only in one-way mode, i.e., with no feedback from the RCM simulation to the driving GCM. The basic or primary strategy is, thus, to use the global model to simulate the response of the global circulation to large-scale forcing and the RCM to (a) account for sub-GCM grid scale forcings (e.g., complex topographical features and land cover inhomogeneity or land use /land cover) in a physically-based way; and (b) enhance the simulation of atmospheric circulations and climatic variables at fine spatial (earth-places) scales.

The nested regional modelling technique essentially originated from numerical weather prediction / temperatures, and the use of RCMs for climate application was pioneered by Dickinson *et al*. (1989) and Giorgi (1990). RCMs are now used in a wide range of climate applications, from palaeo climate (Hostetler *et al*., 1994, 2000) to anthropogenic climate change studies (Section 10.5). They can provide high resolution (up to 10 to 20 km or less) and multi-decadal simulations and are capable of describing climate feedback mechanisms acting at the regional scale. A number of widely used limited area modelling systems have been adapted to, or developed for, climate application or environmental conditions More recently, RCMs have begun to couple atmospheric models with other climate process models, such as hydrology, ocean, sea-ice, chemistry/aerosol and land-biosphere models.

Two main theoretical limitations of this technique are the effects or some error s in the driving fields provided by global models; and lack of two-way interactions between regional and global climate (with the caveats discussed in Section 10.2.2 for variable resolution models). Practically, for a given application, consideration needs to be given to the choice of physics parametrizations, model domain size and resolution, technique for assimilation of large-scale meteorological conditions, and internal variability due to non-linear dynamics not associated with the boundary forcing (e.g., Giorgi and Mearns, 1991, 1999; Ji and Vernekar 1997). Depending on the domain size and resolution, RCM simulations can be computationally demanding, which has limited the length of many experiments to date. Finally, GCM fields are not routinely stored at high temporal frequency (6-hourly or higher), as required for RCM boundary conditions, and thus careful co-ordination between global and regional modellers is needed in order to perform RCM experiments.

RCP

Four RCPs were selected and defined by their total radiative forcing (cumulative measure of human emissions of GHGs from all sources expressed in Watts per square meter) pathway and level by 2100. The RCPs were chosen to represent a broad range or broad scaling of climate or environmental outcomes, based on a literature review, and are neither weather forecasts nor policy recommendations.

Uses and Limits of the RCPS

While each single RCP is based on an internally consistent set of socio-economic assumptions or predication for climate change, the four RCPs together cannot be treated as a set with consistent internal socioeconomic logic. For example, RCP8.5 cannot be used as a no-climate-policy for socioeconomic reference scenario for the other RCPs because RCP8.5's socioeconomic, science, technology, and biophysical, Agro meteorology, environmental science, natural resources assumptions differ from those of the other RCPs.

Each RCP could out comes from different combinations of economic, technological, demographic, policy, and institutional futures. For example, the second to lowest RCP could be considered as a moderate mitigation scenario. However, it is also consistent with a baseline scenario that assumes a global development that focuses on modern technological improvements or development and a shift to service industries but does not aim to reduce greenhouse gas emissions as a goal in itself.

Research Gaps

Identification of appropriate predictors for downscaling in various parts of the world Challenges. Understanding governing physical and chemical processes. Developing or creation of model effective multi-site multivariate downscaling models Challenges in modelling. Cross-correlations between time series or periods of a predict and or try to mention accuracy for all possible pairs of sites. Cross correlations between time series of different predict and at each site and for all possible pairs of sites Developing methods or creation of new models to address uncertainty in choice of Reanalysis data and spatial with temporal concept domain of predictors GCM and Climate change scenarios Method for re-gridding (GCM-to-Reanalysis) –(Inverse square distance; bilinear. Downscaling method, Hydrological model SWAT, HEC, VIC, MODFLOW). Relaxing assumption of stationarity in predictors -predictand relationship. Developing method or new models to arrive at realistic future projections of extreme hydrologic or drainage system flood model/ droughts Challenges. No proper strategy even in stationary scenario.

Conclusion

In this research out comes is Scenarios have been changed and evaluated signification in recent years highlight the use of swat with GIS, HEC, VIC, MODFLOW calibration process allowed better result and its effects.

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