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Research poster: Hydrological impacts of climate change on Colorado Basin

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Hydrological Impacts of Climate Change on Colorado Basin

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Introduction

The objective of this study is to apply an integrate hydrological model system (HMS) to study hydrological processes in response to past and future climate changes and human activities on Colorado Basin. Lots of work has been done by downscaling different predicted or purely hypothetical climate scenarios derived from different general circulation models (GCMs) to drive a hydrologic model which successfully provides a qualitative understanding of relationships between large-scale climate patterns and hydrologic variability. However, it still remains difficult to determine magnitude, changes in flood and drought frequency and intensity, as well as the portion of early snow melt and increase of winter rain in the components of increasing winter runoff. This study is an effort on this topic, which may provide a quantitative understanding of hydrologic response.

Background

The Colorado River is one of the most important river systems in the United States. It flows through some arid regions and serves as the sole source of water to extensive agriculture, increasing population and diverse ecosystem (Nash and Gleick, 1991). Previous studies indicates climate changes will dramatically impact on hydrological processes and water resources and probably aggravate some existed contested issues. Climate changes introduced by global warming, Pacific Decadal Oscillation (PDO) and the El Niño-southern Oscillation (ENSO) are key factors governing the supply of water in the river from one year or decade to the next (Kim et al., 2006). 100 years of usable recorded and long series of reconstructed stream flow are greatly helpful to calibrate the HMS, making it more confident to produce predictions.

Fig.1 Colorado River Basin

Models

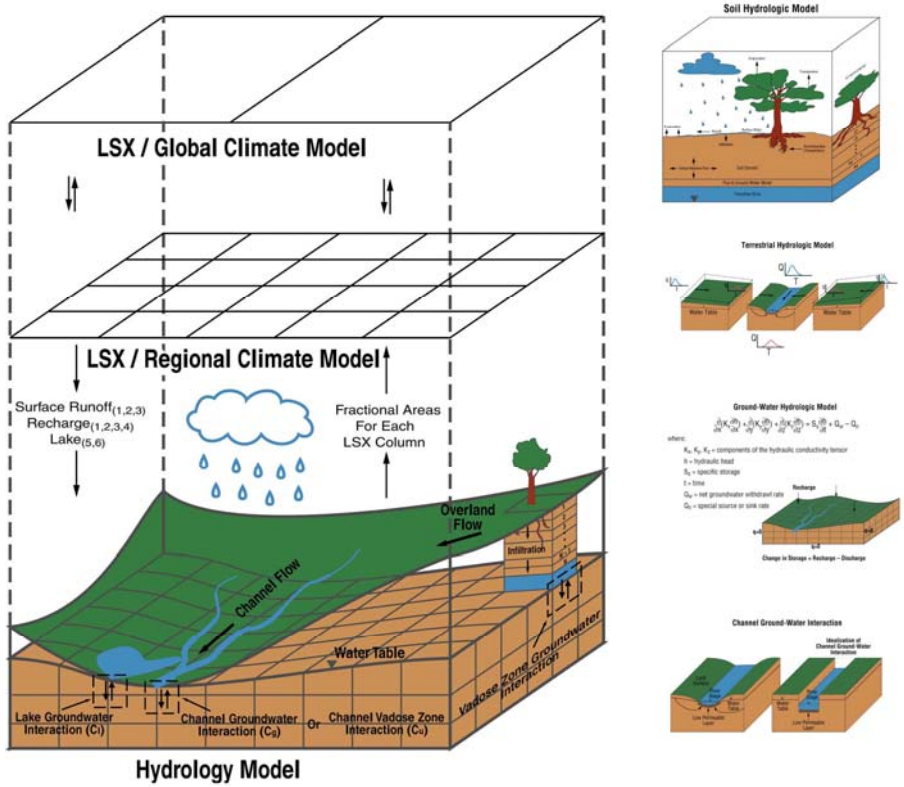

Fig.2 Hydrologic Model System

- Comprised of four component modules: Soil Hydrologic Model (SHM), Terrestrial Hydrologic Model (THM), Ground-Water Hydrologic Model (GHM), and Channel Ground-Water Interaction (CGI) (Yu et al., 1999a).
- Physically-based parameter-distributed, emphasis on interactions among climate, land surface, surface water, and ground water.
- Well coupled with a mesoscale meteorological model (MM)
- Implementing subgrid scale spatial variability in precipitation and hydraulic conductivity in the model system

Methods

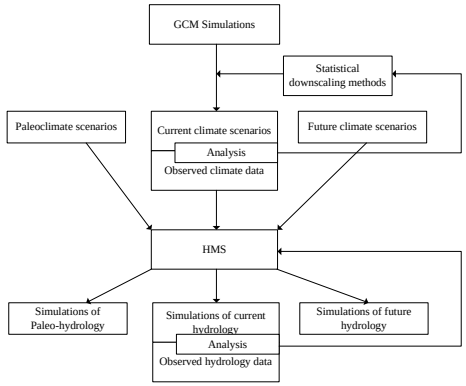

Fig.3 Frame of Proposed Study

Expected Results

A reliable statistical downscaling method could be chosen to the downscale the GCM simulations on Colorado Basin, which best represents the spatial and temporal distributions of climatic variables.

With about 100 years of usable recorded stream flow measurements of Colorado Basin. HMS can be well calibrated and capable of providing reliable simulations and predictions.

The simulated and predicted results could give us a quantitative understanding of how hydrological processes and water resources could be impacted by large scale climate change as well as human activites.

Personal Information

I am working with my mentor Zhongbo Yu in Climate Modeling Component. The Climate Modeling Component will conduct climate simulations of various atmospheric processes in response to climate change in western US and study the hydrological impacts of climate change in this region.

References

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