DRAFT PROPOSAL
Impacts of Climate Change on Water Supply in California

Introduction:
The availability of fresh water is now recognized as one of the major challenges of the 21st Century. Addressing this challenge, at state and local levels, requires the ability to develop and implement sound and sustainable water resources management practices and policies. Clearly, the challenge is great, and it is further compounded by population growth, and the potential impacts of climate change on the hydrologic cycle.

In contrast with the straight foreword relationship between population growth and increased demand for fresh water, the impacts of climate change on water resources are less direct. As air temperature increases, the water holding capacity of the atmosphere increases due to higher saturation vapor pressure, which in turn influences moisture circulation at global and regional scales. Arguably, there is a potential for more intense precipitation, which causes floods, as well as for extended periods of dryer conditions due to longer residence time and to changes in recycling ratio. In California, temperature changes are likely to influence the onset of snow-melt and reduce the number of freezing days. For water supply systems that depend on seasonal snowmelt, such as California's, a 50% decline in snow accumulation can result by the end of the 21st century under given climate change scenarios (Miller et. al., 2003). This is further complicated by the relatively low annual storage volume in the state (105% of average annual streamflow), which indicates the state's vulnerability to prolonged droughts when compared with other systems such as the Colorado River Basin, where the storage capacity equals 375% of the average annual flow.

In general, predicting the impacts of climate change on the hydrologic cycle first requires the ability to model the long-term climate change for the entire planet under various scenarios. Despite of significant progress in understanding fundamental processes, there remain large ranges of uncertainties in model predictions of future climate (Figure 1) between models as well as between possible scenarios. Greater uncertainties would be expected at local scales, and more significantly in predicting changes in precipitation characteristics (intensity, solid-liquid distribution, event duration, recurrence) at an event scale (Trenberth et al., 2003, and Brekke et. all, 2004).

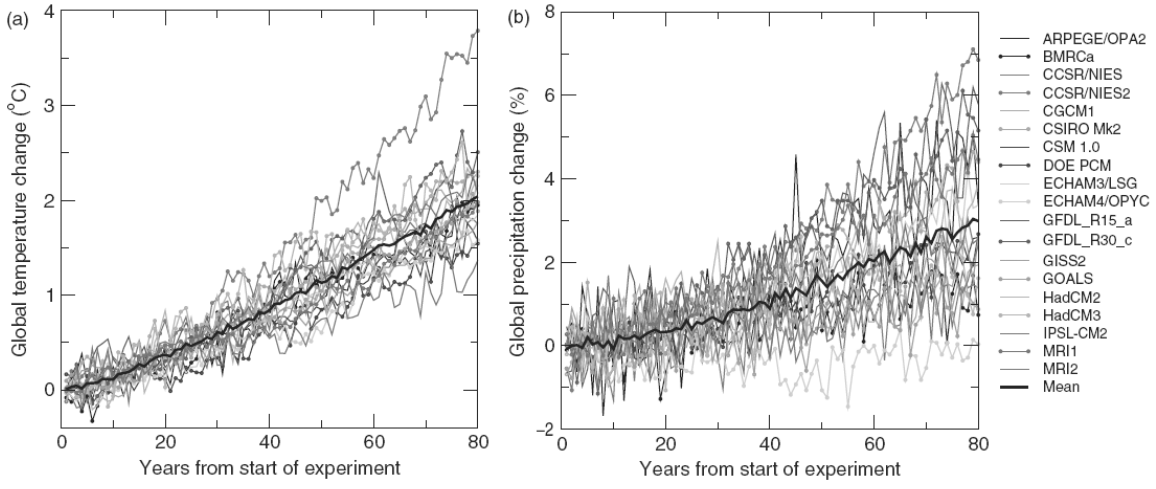

Figure 7. Uncertainties in model climate mode predictions of precipitation and temperature under double CO2 scenario. Source IPCC-2001

Outline of Proposed Activities:
In preparation for its fourth assessment report, the Intergovernmental Panel on Climate Change (IPCC) is compiling a substantial amount of global model output for multiple CO2 and developmental scenarios. These model outputs, which represent state of the art in climate modeling efforts, will be made available to researchers interested in regional and local assessment. We propose to establish the framework necessary to utilize these models' outputs in enhancing our understanding of the impacts of climate change scenarios on water supplies in the state, and more specifically in Southern California.

The proposal involves the following major elements:

1. Compilation and synthesis of current understanding of the potential impacts of climate change on water resources in the state.

2. Consulting with water resources management agencies and interest groups to identify and characterize key water resources management issues that can be impacted by climate change with emphasis on the State's Water Plan.

3. Preparing a hydrologic modeling infrastructure that is capable of addressing both seasonal water supply issues (i.e., snow model and reservoir management) and flood issues (i.e., hydrologic-hydraulic models). These must include both operational models used by state and federal agencies (e.g. CALSIM, HEC, NWSRFS) as well as research models.

4. Assembling base-line historical data set for target watersheds and conducting model validation and calibration studies relevant to the above-mentioned modeling framework.

5. Acquiring and downscaling global model output for the selected basins.

6. Conducting modeling studies for selected scenarios with emphasis on

    a. Variability of reservoir storage
    b. Drought frequency
    c. Flood magnitude and frequency

This proposal leverages on ongoing and planned activities. For example, CHRS currently produces satellite-based high resolution precipitation products which will be included in the baseline data. Additionally, a NASA funded project with the University of Washington will address the development of water supply forecasting system for Northern California. The system includes both hydrologic model and the state's reservoir management model (CALSIM).