NATIONAL SCALE MODELING TO EVALUATE IMPACTS OF CLIMATE CHANGE ON HYDROLOGY AND WATER QUALITY

EPA is evaluating the sensitivity of streamflow and stream water quality to potential future changes in climate and urbanization in 20 large river basins throughout the United States. Study areas cover nearly every ecoregion in the country and a range of hydroclimatic conditions.

The study uses the watershed models HSPF and SWAT to simulate the watershed response to a range of mid- 21st century climate and land-use change scenarios. Climate change scenarios were acquired from the North American Regional Climate Change Assessment Program (NARCCAP), run out of the National Center for Atmospheric Research (NCAR), supplemented by scenarios for same time period from the archive of statistically downscaled temperature and precipitation developed by Bureau of Reclamation/Santa Clara University/Lawrence Livermore. A set of 6 dynamically downscaled scenarios from the NARCCAP data set were evaluated in all 20 watersheds using the SWAT model. In addition, in 5 of the study watersheds referred to as "pilot" sites, additional scenarios were

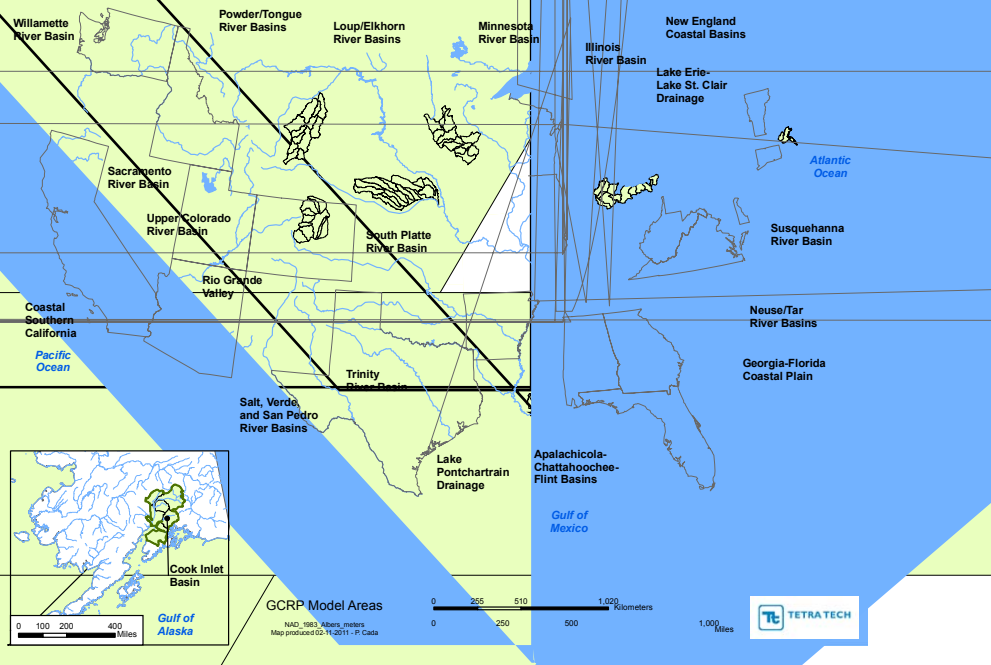

Figure 1. The watersheds chosen as part of the 20 Watersheds study.

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GLOBAL **CHANGE** IMPACTS AND ADAPTATION

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run to evaluate hydroclimatic sensitivity to different methods of downscaling climate data. In these 5 watersheds, 4 statistically downscaled scenarios from the Reclamation/Santa Clara/Livermore data set were evaluated, together with 4 scenarios based directly on GCM data (i.e., not downscaled). Simulations were also run in pilot watersheds using a second watershed model, HSPF, in addition to SWAT. All climate change scenarios assume the SRES A2 emissions storyline, and are for the future period 2040-2070. Land-use change scenarios reflecting mid- 21st century changes in developed land were acquired from EPA's Integrated Climate and Land Use Scenarios dataset (ICLUS). Model simulations include evaluation of watershed response to climate change alone, land use change alone, and the combined effects of climate and land use change scenarios. A range of hydrologic and water quality endpoints were evaluated for each simulation. Endpoints include mean monthly and mean annual stream flow, extreme flood and low flow events, the date of annual runoff center of mass, and mean monthly and mean annual nitrogen, phosphorus, and sediment loads. Watershed models for each basin were calibrated and validated prior to simulations. Results provide insights concerning the general hydrologic and water quality response to climate change, geographic differences in response, and the sensitivities of different streamflow and water quality endpoints to these changes. Results also help provide a plausible range of future effects in each region. Study results in pilot watersheds illustrate the influence of different methodological choices in the conduct of climate change impacts assessments, e.g. the influence of different techniques for downscaling climate data on the watershed simulation results, the influence of using different watershed models on simulation results, and the interaction of these with other forcing factors such as changes in atmospheric CO2 concentrations.

REFERENCES

GCRP Web site:
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