e Tahoe Science Research Update: The Effects of Climate Change on Lake Tahoe and Implications for Design of Best Management Practices

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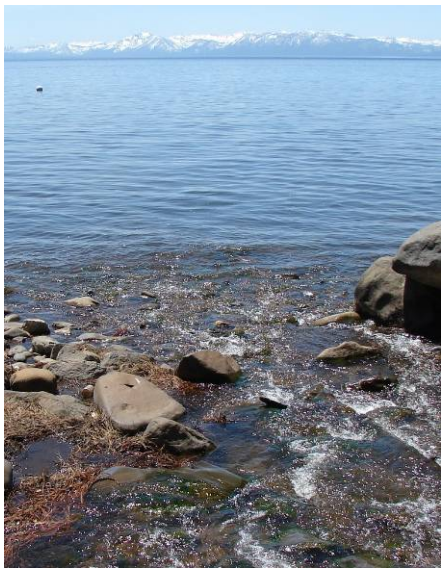

Fig. 1: Research is examining how climate change will affect discharge of water, sediment, and nutrients to Lake Tahoe. Photo taken at the mouth of Wood Creek by Jonathan Long.

Management Implications

Long-term planning for water quality restoration at Lake Tahoe requires an understanding of the possible influence(s) of climate change on runoff and pollutant loading. In particular, to restore lake clarity, pollution reduction infrastructure will need to accommodate increases in storm intensity and runoff volume from urban areas expected under climate change in the basin.

Background and Purpose

A UC Davis-led team is investigating the likely effects of climate change on Lake Tahoe, and assessing the implications of hydrologic changes associated with climate change for (1) changes in loads of sediment and nutrients to Lake Tahoe, (2) the design and effectiveness of Best Management Practices (BMPs) and (3) lake response to changes in loading.

Some of the questions that we hope to answer include:

- How will the discharge of water and loads of sediment and nutrients to the lake change as the climate warms, and how will those changes affect lake clarity?
- How does climate change affect the temperature and thermal stability of the lake?
- How would reduced mixing of the lake affect its clarity, primary productivity, and deep-water dissolved oxygen?

The project team also includes:

- Geoffrey Schladow, UC Davis Tahoe Environmental Research Center – lake modeling
- Michael Dettinger, U.S. Geological Survey and Climate Research Division/Scripps Institution of Oceanography – modeling of down-scaled climate input data
- John Riverson, Tetratech in Fairfax, VA – watershed modeling
- Goloka Sahoo, UC Davis, UC Davis, Tahoe Environmental Research Center – lake modeling
- Brent Wolfe, of Northwest Hydraulics Consulting (nhc) – stormwater/BMP modeling

Methods

The team is using the output of two General Circulation Models (GCMs) and two emissions scenarios, downscaled to a 12 km grid scale. The daily data (temperature, precipitation, wind, and radiation) will be used to drive an existing numerical lake clarity model (DLM), and (after "disaggregation" of daily to hourly values) to drive an existing watershed/loading model (LSPC) that will calculate runoff, sediment and nutrient loads. The latter output will then be used as input to the lake model. In addition, the Pollutant Load Reduction Model (PLRM) will be used to asses the effect of changes in hydrology on the design and operation of BMPs, such as retention basins.

Summary of Findings to Date

A key accomplishment of this project has been to calculate downscaled values of precipitation, and maximum and minimum temperature for the Tahoe basin based upon the two climate models and two emissions scenarios. Fig. 2 shows the results from the Geophysical Fluid Dynamics Laboratory model (GFDL) for the A2 emissions scenario, which assumes that present trends in land use and fossil fuel consumption continue. Brent Wolfe and Dave Hartley of nhc are currently working to produce more realistic distributions of seasonal and daily precipitation.

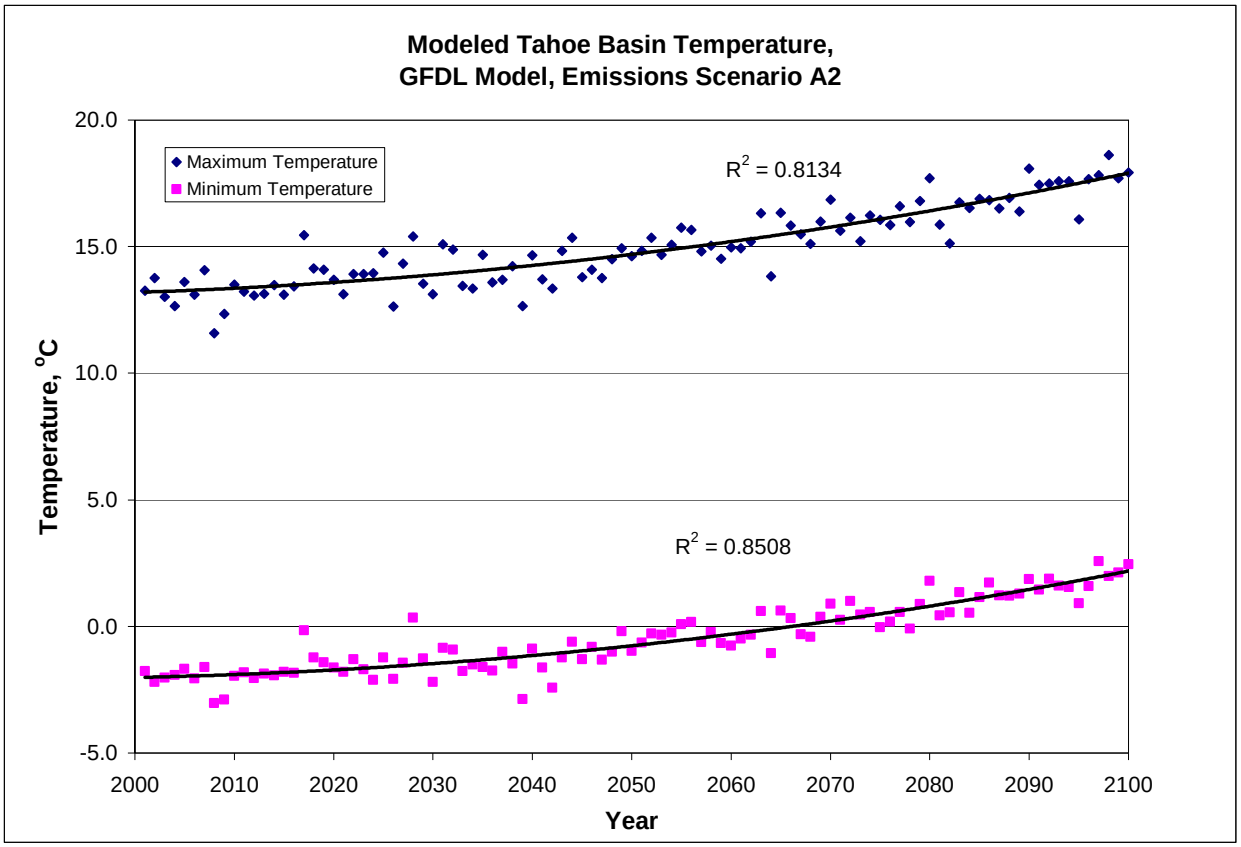

Fig. 2. Annual averages of maximum and minimum daily temperature, averaged over twelve 7.5' grid cells covering the Tahoe basin, derived from the Geophysical Fluid Dynamics Laboratory model (GFDL) with the A2 emissions scenario. Data were provided by Michael Dettinger of USGS/SIO.

For more information about this project, please visit this webpage:
http://www.fs.fed.us/psw/partnerships/tahoescience/bmp_climate_change.shtml

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