

## **Complementary Temperature/Precipitation Patterns Accompanying Climate Cycles in the Gunnison River Basin & Effects of Climate Change and Land Use Modifications**

Margaret A. Matter<sup>1</sup>

Civil and Environmental Engineering Department, Colorado State University, Fort Collins

Luis A. Garcia and Darrell Fontane<sup>2</sup>

Civil and Environmental Engineering Department, Colorado State University, Fort Collins

**Abstract.** Increasing variability in the hydrologic/climate system is cited as a major cause in decreasing accuracy and lead time for water supply forecasts in the Colorado River Basin. This study strives to understand the underpinnings of the variability by applying quartile analysis and linear regression to determine climate cycle-related patterns in temperature and precipitation, and associated seasonal complementary temperature/precipitation patterns; as well as to determine effects of climate change and modifications in land use on climate cycles and related seasonal complementary patterns. The methods are applied to temperature, precipitation and streamflow data for Sept-Mar between 1910 and 2005 for the Gunnison River, a tributary of the Colorado River. Results of quartile analysis reveal cyclic variations in temperature and precipitation patterns corresponding to prevailing climate cycles, as well as temperature increases and shifts in precipitation over the twentieth century. Linear regression results show that complementary patterns in temperature and precipitation establish by fall, are detectable as early as September, and evolve between fall and early spring according to the prevailing climate cycles, but are also affected by increases in temperature and shifts in precipitation that are likely due to climate and land use changes over the 20<sup>th</sup> century. These results may be used to improve accuracy and lead time in water supply forecasting, and improve water resource management.

---

<sup>1</sup> Water Resource Planning and Management  
Civil & Environmental Engineering Department  
Colorado State University  
Fort Collins, CO 80523-1372  
Tel: (970) 491-7620  
e-mail: [Margaret.Matter@Colostate.edu](mailto:Margaret.Matter@Colostate.edu)

<sup>2</sup> Civil & Environmental Engineering Department  
Colorado State University  
Fort Collins, CO 80523-1372  
Tel: (970) 491-5049, 491-5248  
e-mail: [Luis.Garcia@Colostate.edu](mailto:Luis.Garcia@Colostate.edu), [Darrell.Fontane@Colostate.edu](mailto:Darrell.Fontane@Colostate.edu)