



Spatial and Temporal influence of Redondo Peak headwaters in the East Fork Jemez River using Principal Component Analysis approach, Valles Caldera, New Mexico

Rodrigo Sanchez and Thomas Meixner

Hydrology and Water Resources, University of Arizona, Tucson, AZ, United States

The Valles Caldera is a volcanic collapse feature located in the Jemez Mountains in northern New Mexico, southwestern United States. This region is characterized by a bimodal precipitation pattern, i.e. spring snowmelt and summer monsoon rains. Two main streams flow through the Valles Caldera: San Antonio and East Fork Jemez. The junction of these two rivers form the Jemez River which is an important contributor to the Rio Grande that supplies water to cities located in southwestern U.S. Redondo Peak is located in the center of the Valles Caldera that has several springs that drain around all sides of the peak with different hydrologic responses. The main catchments (headwaters) identified in Redondo Peak are: La Jara, Upper Jaramillo, History Grove and Upper Redondo. The main questions that are going to be answered in this research are: Do these head waters affect the chemistry in East Fork Jemez river? and if so, how does this influence vary in space and time?

A Principal Component Analysis (PCA) was performed using analyzed water samples for water isotopes and major anions and cations. These samples were collected from the flumes located at each catchment in Redondo Peak, and at different locations along the East Fork Jemez. Samples from the most consistent analytes from 2011 to 2013 were used in this present work.

A first PCA was performed to assess how different the La Jara catchment is from Upper Redondo, Upper Jaramillo and History Grove based on the geochemistry of each basin. Prior the analysis the data needs to be normalized in order to avoid biasing towards extreme values. Since La Jara is the reference site for this analysis, its mean and standard deviation were used to normalized the data set of the other catchments. In order to simplify this analysis the two first principal components for each catchment were used to do the projections regardless how much of the variability can be explained. However future analyses are going to be performed with those principal components that explain at least 90% of the variability of the data set. This analysis showed that Upper Jaramillo and History Grove spaces plotted close to La Jara space, suggesting that these three catchment share one or several end members, whereas Upper Redondo space is more scatter therefore is more than likely speak of different source of water. In order to observe a temporal variability the Euclidian Distance from the mean of the reference site to the other sites was calculated. Throughout the year the catchments seem to be similar in composition early the year, spring time, whereas in summer a remarkable difference is noticed from one catchment to the other.

The proposed methodology is going to be applied using data from the East Fork Jemez river in different locations to evaluate what is going to be the influence of the these headwaters on these locations.