Regional Patterns of Snow Water Equivalent in the Colorado River Basin Using Snowpack Telemetry (SNOTEL) Data

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Abstract. Typically the grouping of station measuring snow properties is based on spatial proximity or has been restricted due to the temporal resolution, in particular the monthly sampling of snow course data. This investigation utilizes daily data from 216 snowpack telemetry (SNOTEL) stations located in and around the Colorado River Basin for a 15-year period (1991-2005) to group stations. The grouping or clustering identifies regions of homogeneity based on their patterns and variability. To achieve this, data were submitted to a self-organizing map (SOM), a particular application of artificial neural networks. This methodology represents a learning algorithm that is non-linear, non-parametric, unsupervised, and learns through an iterative training process. The number of clusters can be specified to the SOM based on the level of generalization desired. A SOM consisting of a four, six, nine, and sixteen-cluster were constructed as well as a six-cluster derived from snow pack descriptor variables (peak SWE, length of snow season, etc.) and physical variables (elevation, aspect, distance to moisture source, etc.) for each station.

Results show an unbiased clustering of stations defined not by geographic location, but by each station's particular SWE variability. The established snow climatologies show some general homogenous course-scale clusters, particularly in Wyoming and Arizona, but overall there are no definite spatial patterns to the climatologies, indicating that local topographic variables dominate SWE processes. The descriptor variables that best represent daily time-step classifications are peak SWE, April 1st SWE, and physical variables.