

Non-Parametric Paleo-Reconstruction of Lees Ferry Flows

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Abstract. Paleo reconstruction of streamflows using tree-ring chronologies for the Lees Ferry gage on the Colorado River was developed using a non-parametric algorithm that matched patterns in tree-ring chronologies for the period 1400-1905 with chronologies over the period 1906-2005. The period 1906-2005 is referred to as the overlap period over which both tree-ring chronologies and naturalized streamflow data at the Lees Ferry gage are available. The period, 1400-1905 is referred to as the paleo period. The non-parametric algorithm is based on finding neighbors, i.e. similarity of tree-ring patterns for the 1400-1905 chronologies from the overlap period chronologies. The pattern selection is developed in EOF (Empirical Orthogonal Function) space, and the output is a set of K similar years (nearest neighbors) from the overlap period to each of the paleo years. Once a set of K nearest neighbors have been identified, ensembles of streamflow are generated through weighted resampling. This algorithm is also cross-validated for the overlap period and reconstructed Lees Ferry flows from this algorithm are compared with published streamflow reconstructions. The non-parametric algorithm was found to provide robust reconstructions of Lees Ferry flows and provides an efficient approach to generating streamflow ensembles. In addition, because the method relies on pattern matching it can be used to reconstruct structured and even non-numerical data for use in water resources modeling.