Correlation of Climate Variability with Water Quality in the High Plains Aquifer

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With nearly one-third of all ground-water pumpage in the United States occurring in the High Plains aquifer, characterization of the effects of climate variability on this important national resource is needed to better delineate the changes in water quality for surface water and ground water. Natural climatic cycles can augment or diminish anthropogenic stresses on ground-water and surface-water resources that in turn affect water availability and water quality. Significant changes in the surface-water and ground-water systems can occur when climate cycles of different periodicity occur at the same time. Spectral time-series analysis was used to systematically evaluate the effect of overlapping climatic cycles on precipitation, temperature, tree-ring widths, streamflow, spring flow, ground-water levels and pumpage, and selected water-quality parameters throughout the High Plains aquifer region. Preliminary analysis indicates that cyclical changes occur in all the evaluated time series. In particular, cycles that are partially coincident with the El Nino-Southern Oscillation (ENSO), North American Monsoon System (NAMS), and the Pacific Decadal Oscillation (PDO) occur in the hydrologic and water-quality time series for the High Plains aquifer. In particular, cyclic variability similar to known climate cycles occurs in specific conductance, temperature, and chloride concentrations for selected stream reaches and wells. An understanding of these variations may help guide water-resource management policies, such as the establishment of thresholds for total maximum daily loads in streamflow that are aligned with climate variability.