

Time Series Analysis of High-Frequency Fluorescence Spectroscopy Data Tracks Water Quality in Urban Water Systems

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Headwater streams act as natural filters for runoff, sediments, contaminants, and other particulate matter before they move downstream. Alvarado Creek is an urban headwater stream in San Diego, California that feeds into the San Diego River and is the current site for real-time water quality monitoring. Real-time water quality monitoring has been achieved through the deployment of an in-situ sensor platform equipped with a submersible fluorometer and a multi-parameter optical dissolved oxygen, specific conductivity, salinity, and temperature sensor, measuring at 10 minute increments. The presence of trends and sensor data artifacts in the data, due to occasional mechanical failures (e.g., wiper failure) and environmental complications (such as microbubble formation or movement of organisms) can both skew and distort time series data. The fluorometer is also prone to data drift due to biofilm build up on the lenses (biofouling), resulting in erroneous trends in the data that further obscure the signal. To correct real-time data for these issues, a full year (12 months) of water quality data was used to develop a library of functions and scripts in Matlab to remove anomalous spikes and sensor artifacts such that stationarity could be reasonably assumed. With this, we are able to reliably reconstruct the full waveform of the water quality parameters and observe the dynamics of pollutants in response to climate and environmental change. Our findings will help assess the level of pollution in Alvarado Creek .The Alvarado Creek project is just one of many efforts being made by San Diego State University and the San Diego River Conservancy to preserve urban waterways and ensure water quality in San Diego County. The techniques, scripts and functions developed for this urban headwater stream can be used for other sites and projects to monitor water quality changes and assess water contamination.