

An Intuitive Measure of Dependence Between Non-Stationary Hydrological Time-Series

Alexander Schnurr*, Andreas Schumann, Svenja Fischer, Herold Dehling
University Siegen, Mathematics, 57068 Siegen, Germany
(schnurr@mathematik.uni-siegen.de)

For 3 consecutive data points attaining different values, there are six possibilities how their values can be ordered. These possibilities are called ordinal patterns. Our first idea is simply to count how often we find the same pattern in both time series at the same time, and compare this with the theoretical case of independence. If we detect a lot of coincident patterns, this means that the up-and-down behavior is similar. Hence, our concept can be seen as a way to measure non-linear 'correlation'.

If more than 3 data points are considered, we often find 'almost similar' patterns. This term is made precise by introducing a distance function on the space of ordinal patterns.

There is strong evidence that one often finds positive ordinal pattern dependence in flood data of neighboring rivers. This effect is stronger than it is for classical empirical correlation. Ordinal pattern dependence seems to be a useful tool in analyzing non-stationary hydrological time series.