Synchronization and Recurrence: Are Nonlinear Approaches Useful in Geophysical Time Series Analysis?

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Various approaches in nonlinear time series analysis have enabled substantially new insights into complex processes in many fields ranging from lasers via electrochemistry to earth sciences and even economy. However, they are often basing on strong restrictions; their violation may lead to pitfalls and misinterpretations.

Here, we discuss two general concepts of nonlinear dynamics, synchronization and recurrence and discuss how to use them for data analysis. We show that corresponding methods for time series analysis can be applied even to rather short and somewhat non-stationary data.

Finally applications are presented to study dynamic teleconnections, such as El Nino – Monsoon interactions.