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Spurious links in spatial networks and their implications for global rainfall synchronization patterns

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Functional networks have been successfully applied to reveal and investigate the dependency structure of various climatic observables on global [1,2] and regional [3,4] scales. Such approaches are — just as any data-driven dependency analysis in large sets of time series — biased due to the multiple-comparisons issue [5]. This statistical problem leads to spurious network links that do not represent any physical couplings, but are instead caused by randomly similar behaviour between different time series.
In this talk, we first discuss the relevance of this problem focussing on synthetical examples embedded in two- or three-dimensional space, where the physical couplings are assumed to be known a priori. We then propose a technique to correct for the multiple comparison bias in spatially embedded functional networks, which is based on testing the significance of the spatial bundelling of network links. We exemplify this approach with an analysis of high-resolution rainfall data and thereby reveal the global synchronization pattern of rainfall events [5].

References

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