

## STATISTICAL ANALYSIS AND DATA MINING

Research Article

**Complex networks as a unified framework for descriptive analysis and predictive modeling in climate science**Karsten Steinhäuser, Nitesh V. Chawla , Auroop R. Ganguly

First published: 16 December 2010

<https://doi.org/10.1002/sam.10100>

Cited by: 47



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## Abstract

The analysis of climate data has relied heavily on hypothesis - driven statistical methods, while projections of future climate are based primarily on physics - based computational models. However, in recent years a wealth of new datasets has become available. Therefore, we take a more data - centric approach and propose a unified framework for studying climate, with an aim toward characterizing observed phenomena as well as discovering new knowledge in climate science. Specifically, we posit that complex networks are well suited for both descriptive analysis and predictive modeling tasks. We show that the structural properties of 'climate networks' have useful interpretation within the domain. Further, we extract clusters from these networks and demonstrate their predictive power as climate indices. Our experimental results establish that the network clusters are statistically significantly better predictors than clusters derived using a more traditional clustering approach. Using complex networks as data representation thus enables the unique opportunity for descriptive and predictive modeling to inform each other. © 2011 Wiley Periodicals, Inc. Statistical Analysis and Data Mining 4: 497–511, 2011

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