

# A Complex Networks Perspective on Global Climate, Commerce and Environment

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## 1 Abstract

Climate change is a pressing focus of research, social and economic concern, and political attention. According to the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC), the increased frequency of extreme events will only intensify the occurrence of natural hazards, affecting global population, health, and economies. Such extreme events are accompanied with degrees of uncertainty at local, regional and global scales. Moreover, the influx of massive volumes of observed and simulated data also requires scalable methods relying on parallel architectures or cloud computing. Thus, climate data presents a series of exciting challenges for data mining community — from learning to mining to discovery to insight.

To that end, we propose complex networks based methodologies for modeling the multi-variate spatial relationships, long range teleconnections, and dependence structures in climate variables. Taking a data-centric approach, we have developed a unified framework for characterizing observed data as well as for developing predictive insights. We show that structural properties of climate networks have useful interpretations within the domain, and we extract patterns from the networks and use them to develop ocean climate indices for prediction of climatic variables over land. Moreover, complex networks enable us to study the stability and/or changes in climate by observing the network dynamics over time. We also evaluate the impact of climate change on commerce and ecology of regions, and the relationships therein.