Statistical Downscaling And Bias Correction For

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National Climate Change Viewer (NCCV)
Julie studied Environmental Sciences at the University of East Anglia (UEA) in Norwich. She then obtained her PhD from the Climatic Research Unit (CRU) at UEA in 1998. Following a short postdoc in CRU ...

Dr Julie Jones
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A comprehensive and practical guide, providing technical background and user context for researchers, graduate students, practitioners and decision makers. This book presents the main approaches and describes their underlying assumptions, skill and limitations. Guidelines for the application of downscaling and the use of downscaled information in practice complete the volume.

Global Climate Models (GCMs) are the typical sources of future climate data required for impact assessments of climate change. However, GCM outputs are related to model-related uncertainties and involve a great deal of biases. Bias correction of model outputs is, therefore, necessary before their use in impact studies. The coarse resolution of GCM simulations is another hindrance to their direct use in fine-scale impact analysis of climate change. Although downscaling of GCM outputs can be performed by dynamical downscaling using Regional Climate Models (RCMs), it requires large computational capacity. When daily climate data from multiple GCMs are required to be downscaled, dynamical downscaling may not be a feasible option. Statistical downscaling, in contrast, can be efficiently used to downscale a large number of GCM outputs at a fine temporal and spatial scale. This study performs the bias correction and statistical downscaling of daily maximum and minimum temperature and daily precipitation data from six GCM and four RCM simulations for the northeast United Stated (US). The spatial resolution of the data set is 1/8Â°x 1/8Â° and it spans from 2046 to 2065. This fine-scale daily climate data set, which has been created using Bias Correction and Spatial Downscaling (BCSD) approach, can be directly used in regional impact studies for the northeast US. Using both raw and bias corrected daily precipitation data from two GCMs and two RCMs, one extreme precipitation index has been analyzed for the observed climate. The comparison between the results demonstrates that bias correction is important not only for GCM outputs, but also for RCM outputs. When the same analysis has been performed for future climate, bias correction has led to a larger level of agreements among the models in predicting the magnitude and capturing the spatial trend for the extreme precipitation index. Moreover, five extreme climate indices have been analyzed at 1/8Â° spatial resolution for future climate using the bias corrected and statically downscaled data from multiple GCMs and RCMs. The incorporation of dynamical downscaling as an intermediate step has not led to any considerable changes from the results of statistical downscaling. Statistical downscaling with bias correction has been sufficient to create a fine-scale daily climate data set to be directly used in impact studies. The future means of five extreme climate indices, which have been calculated from GCM and RCM ensembles, have been compared to their observed means. The decrease in total number of frost days because of the future warming will be similar over the entire northeast region. The earlier arrival of spring will lead to an extended growing season and the magnitude of the changes will be larger in the coastal area. The comparison of precipitation extreme indices indicates an increase in the heavy precipitation events in future climate for most of the region.

Global climate change is typically understood and modeled using global climate models (GCMs), but the outputs of these models in terms of hydrological variables are only available on coarse or large spatial and time scales, while finer spatial and temporal resolutions are needed to reliably assess the hydro-environmental impacts of climate change. To reliably obtain the required resolutions of hydrological variables, statistical downscaling is typically employed. Statistical Downscaling for Hydrological and Environmental Applications presents statistical downscaling techniques in a practical manner so that both students and practitioners can readily utilize them. Numerous methods are presented, and all are illustrated with practical examples. The book is written so that no prior background in statistics is needed, and it will be useful to graduate students, college faculty, and researchers in hydrology, hydroclimatology, agricultural and environmental sciences, and watershed management. It will also be of interest to environmental policymakers at the local, state, and national levels, as well as readers interested in climate change and its related hydrologic impacts. Features: Examines how to model hydrological events such as extreme rainfall, floods, and droughts at the local, watershed level. Explains how to properly correct for significant biases with the observational data normally found in current Global Climate Models (GCMs). Presents temporal downscaling from daily to hourly with a nonparametric approach. Discusses the myriad effects of climate change on hydrological processes.

Empirical-statistical downscaling (ESD) is a method for estimating how local climatic variables are affected by large-scale climatic conditions. ESD has been applied to local climate/weather studies for years, but there are few ? if any ? textbooks on the subject. It is also anticipated that ESD will become more important and commonplace in the future, as anthropogenic global warming proceeds. Thus, a textbook on ESD will be important for next-generation climate scientists.

This book presents select peer-reviewed papers presented at the International Conference on Numerical Optimization in Engineering and Sciences (NOIEAS) 2019. The book covers a wide variety of numerical optimization techniques across all major engineering disciplines like mechanical, manufacturing, civil, electrical, chemical, computer, and electronics engineering. The major focus is on innovative ideas, current methods and latest results involving advanced optimization techniques. The contents provide a good balance between numerical models and analytical results obtained for different engineering problems and challenges. This book will be useful for students, researchers, and professionals interested in engineering optimization techniques.

This book presents selected articles from the International Conference on Asian and Pacific Coasts (APAC 2019), an event intended to promote academic and technical exchange on coastal related studies, including coastal engineering and coastal environmental problems, among Asian and Pacific countries/regions. APAC is jointly supported by the Chinese Ocean Engineering Society (COES), the Coastal Engineering Committee of the Japan Society of Civil Engineers (JSCE), and the Korean Society of Coastal and Ocean Engineers (KSCOE). APAC is jointly supported by the Chinese Ocean Engineering Society (COES), the Coastal Engineering Committee of the Japan Society of Civil Engineers (JSCE), and the Korean Society of Coastal and Ocean Engineers (KSCOE).

New York City's water supply system is one of the oldest, largest, and most complex in the nation. It delivers more than 1.1 billion gallons of water each day from three upstate watersheds (Croton, Catskill, and Delaware) to meet the needs of more than eight million people in the City, one million people in Westchester, Putnam, Orange, and Ulster counties, and millions of commuters and tourists who visit the City throughout the year. The Catskill and Delaware portions, which make up about 90 percent of the supply, receive no filtration or treatment other than disinfection, except for rare instances of high turbidity when a coagulant is added to increase deposition of suspended solids. The remaining 10 percent of the supply comes from the Croton watershed and receives treatment via filtration. The drinking water supply is managed by the Bureau of Water Supply within the New York City Department of Environmental Protection (NYC DEP). To continue to avoid filtration of the Catskill/Delaware portion of the water supply, in 2007, NYC DEP reexamined its control of turbidity in the Catskill portion of the water supply, including both structural improvements to the system and operational changes. The Operations Support Tool (OST) was developed as part of these efforts. OST couples models of reservoir operations and water quality; it uses real-time data on streamflow, snow pack, water quality, reservoir levels, diversions, and releases; and it incorporates streamflow forecastsâ€"all in order to predict future reservoir levels, water delivery to customers, and water quality within the system. These predictions inform the system operators, who then make decisions based on the most current data and forecasts. This report reviews the use of OST in current and future reservoir operations. It considers potential ways in which the City can more effectively use OST, makes recommendations for additional performance measures, and reviews the potential effects of climate change on the City's water supply to help identify and enhance understanding of areas of potential future concern with regard to the use of OST.

This book gives an overview of various aspects of climate change by integrating global climate models, downscaling approaches, and hydrological models. It also covers themes that help in understanding climate change in a holistic manner. The book includes worked-out examples, revision questions, exercise problems, and case studies, making it relevant for use as a textbook in graduate courses and professional development programs. The book will serve well researchers, students, as well as professionals working in the area of hydroclimatology.