Predictability Of Weather And Climate

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Mesoscale Meteorology and Forecasting John Wiley & Sons
Climate change can reasonably be expected to increase the frequency and intensity of a variety of potentially disruptive environmental events-slowly at first, but then more quickly. It is prudent to expect to be surprised by the way in which these events may cascade, or have far-reaching effects. During the coming decade, certain climate-related events will produce consequences that exceed the capacity of the affected societies or global systems to manage; these may have global security implications. Although focused on events outside the United States, Climate and Social Stress: Implications for Security Analysis recommends a range of research and policy actions to create a whole-of-government approach to increasing understanding of complex and contingent connections between climate and security, and to inform choices about adapting to and reducing vulnerability to climate change.
Predictability of Weather and Climate Cambridge University Press
This book examines the dynamical processes between high-impact weather and climate events, and between atmospheric and ocean phenomena.
Numerical Weather and Climate Prediction National Academies Press
In recent decades, science has experienced a revolutionary shift. The development and extensive application of computer modelling and simulation has transformed the knowledge-making practices of scientific fields as diverse as astro-physics, genetics, robotics and demography. This epistemic transformation has brought with it a simultaneous heightening of political relevance and a renewal of international policy agendas, raising crucial questions about the nature and application of simulation knowledges throughout public policy. Through a diverse range of case studies, spanning over a century of theoretical and practical developments in the atmospheric and environmental sciences, this book argues that computer modelling and simulation have substantially changed scientific and cultural practices and shaped the emergence of novel ‘cultures of prediction’. Making an innovative, interdisciplinary contribution to understanding the impact of computer modelling on research practice, institutional configurations and broader cultures, this volume will be essential reading for anyone interested in the past, present and future of climate change and the environmental sciences.
Completing the Forecast MDPI
This book, first published in 2006, is a history of weather forecasting for researchers, graduate students and professionals in numerical weather forecasting.
Next Generation Earth System Prediction National Academies Press
This book focuses on two major challenges in the climate sciences: 1) to describe the decadal-to-centennial variations in instrumental and proxy records; and 2) to distinguish between anthropogenic variations and natural variability. The National Taiwan University invited some of the world's leading experts across the areas of observational analysis, mathematical theory, and modeling to discuss these two issues. The outcome of the meeting is the 23 chapters in this book that review the state of the art in theoretical, observational and modeling research on internal,

unforced and externally forced climate variability. The main conclusion of this research is that internal climate variability on decadal and longer time scales is so large that sidestepping it may lead to false estimates of the climate's sensitivity to anthropogenic forcing. Contents:Attribution of Climate Change in the Presence of Internal Variability (John M Wallace, Clara Deser, Brian V Smoliak, and Adam S Phillips)A Mathematical Theory of Climate Sensitivity or, How to Deal With Both Anthropogenic Forcing and Natural Variability? (Michael Ghil)Fluctuation-dissipation Theorem with Application to Climate Change Studies with Seasonal Impact (Xiaoming Wang)Parametrization of Cross-scale Interaction in Multiscale Systems (Jeroen Wouters and Valerio Lucarini)Dynamics of Nonlinear Error Growth and the "Spring Predictability Barrier" for El Niño Predictions (Wansuo Duan and Mu Mu)An Adaptive Approach for Nonlinear and Nonstationary Data Analysis (Norden E Huang)Internal Southern Ocean Centennial Variability: Dynamics, Impacts and Implications for Global Warming (Mojib Latif, Torge Martin, Wonsun Park, and Mohammad H Bordbar)Atlantic Meridional Overturning Circulation and Climate (Rong Zhang)North Atlantic Multi-Decadal Variability — Mechanisms and Predictability (Noel S Keenlyside, Jin Ba, Jennifer Mecking, Nour-Eddine Omrani, Mojib Latif, Rong Zhang, and Rym Msadek)A Review of the Dynamics of Pacific Interdecadal Climate Variability (Zhengyu Liu)Global-Scale Decadal Hyper Modes (Dietmar Dommenget)Evidence for a Recurrent Multi-Decadal Oscillation in Global Temperature and Possible Impacts on 21st Century Climate Projections (Ka-Kit Tung and Jiansong Zhou)Variability of Sea Ice Extent Over Decadal and Longer Timescales (John E Walsh and William L Chapman)Multi-year Prediction and Predictability (Timothy DelSole, Michael K Tippett, and Liwei Jia)Decadal Hydroclimate Variability Across the Americas (Richard Seager)The Interhemispheric Pattern and Long-Term Variations in the Tropical Climate over the 20th and 21st Centuries (John C H Chiang)Climate of China in the Holocene (Wang Shaowu, Wen Xinyu, and Huang Jianbin)North Atlantic Hurricane Activity: Past, Present and Future (Rym Msadek, Gabriel A Vecchi, and Thomas R Knutson)Observed Variations of Western North Pacific Tropical Cyclone Activity on Decadal Time Scales and Longer (Johnny C L Chan)Record-Breaking Increase of Tropical Cyclone Heavy Rainfall in Taiwan in the First Decade of 21st Century (Chih-Pei Chang, Hung-Chi Kuo, and Chung-Hsiung Sui)Multi-Decadal Variability in Indian Summer Monsoon Rainfall Using Proxy Data (Bhupendra N Goswami, Ramesh H Kripalani, Hemant P Borgaonkar, and Bhaskar Preethi)The South-Flood North-Drought Pattern Over Eastern China and the Drying of the Gangetic Plain (Sumant Nigam, Yongjing Zhao, Alfredo Ruiz-Barradas, and Tianjun Zhou)Impacts of Aerosols on the Asian Monsoon — An Interim Assessment (William K M Lau and Kyu-Myong Kim) Readership: Graduate students, academics and researchers in atmospheric sciences, oceanography, mathematics, and climate change. Keywords:Climate Change;Multidecadal Variability;Climate Variability Asia-Pacific Weather

Dynamics and Predictability of Large-Scale, High-Impact Weather and Climate Events World Scientific

This open access book showcases the burgeoning area of applied research at the intersection between weather and climate science and the energy industry. It illustrates how better communication between science and industry can help both sides. By opening a dialogue, scientists can understand the broader context for their work and the energy industry is able to keep track of and implement the latest scientific advances for more efficient and sustainable energy systems. Weather & Climate Services for the Energy Industry considers the lessons learned in establishing an ongoing discussion between the energy industry and the meteorological community and how its principles and practises can be applied elsewhere. This book will be a useful guiding resource for research and early career practitioners concerned with the energy industry and the new field of research known as energy meteorology.

The Emergence of Numerical Weather Prediction: Richardson's Dream Cambridge University Press

This textbook provides a comprehensive yet accessible treatment of weather and climate prediction, for graduate students, researchers and professionals. It teaches the strengths, weaknesses and best practices for the use of atmospheric models. It is ideal for the many scientists who use such models across a wide variety of applications. The book describes the different numerical methods, data assimilation, ensemble methods, predictability, land-surface modeling, climate modeling and downscaling, computational fluid-dynamics models, experimental designs in model-based research, verification methods, operational prediction, and special applications such as air-quality modeling and flood prediction. This volume will satisfy everyone who needs to know about atmospheric modeling for use in research or operations. It is ideal both as a textbook for a course on weather and climate prediction and as a reference text for researchers and professionals from a range of backgrounds: atmospheric science, meteorology, climatology, environmental science, geography, and geophysical fluid mechanics/dynamics.

Climate Analysis Taylor & Francis

In this study, the committee explores ways the National Weather Service (NWS) can take advantage of continuing advances in science and technology to meet the challenges of the future. The predictions are focused on the target year 2025. Because specific predictions about the state of science and technology or the NWS more than 25 years in the future will not be entirely accurate, the goal of this report is to identify and highlight trends that are most likely to influence change. The Panel on the Road Map for the Future National Weather Service developed an optimistic vision for 2025 based on advances in science and technology.

Seamless Prediction of the Earth System National Academies Press

Natural decadal climate variability (DCV) and its interactions with anthropogenic climate change (ACC) are vitally important to understand to predict the future of the Earth's climate. This book, after familiarizing readers with the importance of understanding and predicting DCV phenomena and its distinction from ACC phenomena, comprehensively explains the physics of DCV, integrating paleoclimate proxy and modern instrument-based data and simulations with climate models. Features of this book: Uniquely focuses on natural DCV, its physics, and its predictability Presents an integrated view of DCV phenomena based on approximately 700 peer-reviewed publications cited in the book Includes research on influences of decadal variability in solar emissions on the Earth's climate, with a historical perspective going back several centuries Describes progress in decadal climate predictability and prediction research, with a historical perspective on weather and climate predictability research This book is an excellent resource for graduate students, faculty members and other teachers and researchers, and anyone who is interested in learning about a very important component of the puzzle of the changing climate. "This book provides a comprehensive review.... Highlighted throughout the book are potential links between DCV and solar variability, a fascinating topic that has engaged our minds for centuries. Written by an expert with more than 30 years' experience, this book should be an invaluable resource for students and researchers interested in how our climate will evolve over the coming decades." Doug Smith, Decadal Climate Prediction Leader, Meteorological Office Hadley Centre, UK "This book is a tour de force by the author who has spent his career studying decadal climate variability. He brings new insights to the vast scope of this topic, providing clearly understandable descriptions of the various aspects." Gerald Meehl, Senior Scientist, National Center for Atmospheric Research, Colorado, USA

Intraseasonal Variability in the Atmosphere-Ocean Climate System National Academies Press

"This book collects together White Papers that have been written to describe the state of the science and to discuss the major challenges for making further advances. The authors of each chapter have attempted to draw together key aspects of the science that was presented at WWOSC-2014. The overarching theme of this book and of WWOSC-2014 is 'Seamless Prediction of the Earth System: from minutes to months'. The book is structured with chapters that address topics regarding: Observations and Data Assimilation; Predictability and Processes; Numerical Prediction of the Earth System; Weather-related Hazards and Impacts. This book marks a point in time and the knowledge that has been accumulating on weather science. It aims to point the way to future developments"--Preface.

Decade-to-Century-Scale Climate Variability and Change Springer

This book is a collection of selected lectures presented at the 'Intensive Course on Mesoscale Meteorology and Forecasting' in Boulder, USA, in 1984. It includes mesoscale classifications, observing techniques and systems, internally generated circulations, mesoscale convective systems, externally forced circulations, modeling and short-range forecasting techniques. This is a highly illustrated book and comprehensive work, including extensive bibliographic references. It is aimed at graduates in meteorology and for professionals working in the field.

A Vision for the National Weather Service Cambridge University Press

El Nino has been with us for centuries, but now we can forcast it, and thus can prepare far in advance for the extreme climatic events it brings. The emerging ability to forecast climate may be of tremendous value to humanity if we learn how to use the information well. How does society cope with seasonal-to-interannual climatic variations? How have climate forecasts been used--and how useful have they been? What kinds of forecast information are needed? Who is likely to benefit from forecasting skill? What are the benefits of better forecasting? This book reviews what we know about these and other questions and identifies research directions toward more useful seasonal-to-interannual climate forecasts. In approaching their recommendations, the panel explores: Vulnerability of human activities to climate. State of the science of climate forecasting. How societies coevolved with their climates and cope with variations in climate. How climate information should be disseminated to achieve the best response. How we can use forecasting to better manage the human consequences of climate change.

Atmosphere, Clouds, and Climate Cambridge University Press

Uncertainties in Numerical Weather Prediction is a comprehensive work on the most current understandings of uncertainties and predictability in numerical simulations of the atmosphere. It provides general knowledge on all aspects of uncertainties in the weather prediction models in a single, easy to use reference. The book illustrates particular uncertainties in observations and data assimilation, as well as the errors associated with numerical integration methods. Stochastic methods in parameterization of subgrid processes are also assessed, as are uncertainties associated with surface-atmosphere exchange, orographic flows and processes in the atmospheric boundary layer. Through a better understanding of the uncertainties to watch for, readers will be able to produce more precise and accurate forecasts. This is an essential work for anyone who wants to improve the accuracy of weather and climate forecasting and interested parties developing tools to enhance the quality of such forecasts. Provides a comprehensive overview of the state of numerical weather prediction at spatial scales, from hundreds of meters, to thousands of kilometers Focuses on short-term 1-15 day atmospheric predictions, with some coverage appropriate for longer-term forecasts Includes references to climate prediction models to allow applications of these techniques for climate simulations

30-Second Weather National Academies Press

It is now widely recognized that the climate system is governed by nonlinear, multi-scale processes, whereby memory effects and stochastic forcing by fast processes, such as weather and convective systems, can induce regime behavior. Motivated by present difficulties in understanding the climate system and to aid the improvement of numerical weather and climate models, this book gathers contributions from mathematics, physics and climate science to highlight the latest developments and current research questions in nonlinear and stochastic climate dynamics. Leading researchers discuss some of the most challenging and exciting areas of research in the mathematical geosciences, such as the theory of tipping points and of extreme events including spatial extremes, climate networks, data assimilation and dynamical systems. This book provides graduate students and researchers with a broad overview of the physical climate system and introduces powerful data analysis and modeling methods for climate scientists and applied mathematicians.

Weather & Climate Services for the Energy Industry Cambridge University Press

Numerical models have become essential tools in environmental science, particularly in weather forecasting and climate prediction. This book provides a comprehensive overview of the techniques used in these fields, with emphasis on the design of the most recent numerical models of the atmosphere. It presents a short history of numerical weather prediction and its evolution, before describing the various model equations and how to solve them numerically. It outlines the main elements of a meteorological forecast suite, and the theory is illustrated throughout with practical examples of operational models and parameterizations of physical processes. This book is founded on the author's many years of experience, as a scientist at Météo-France and teaching university-level courses. It is a practical and accessible textbook for graduate courses and a handy resource for researchers and professionals in atmospheric physics, meteorology and climatology, as well as the related disciplines of fluid dynamics, hydrology and oceanography.

Natural Decadal Climate Variability National Academies Press

Weather 2e is a concise, affordable introductory text covering the processes of weather. Now with updated coverage, questions and exercises.

Sub-seasonal to Seasonal Prediction Cambridge University Press

More accurate forecasts of climate conditions over time periods of weeks to a few years could help people plan agricultural activities, mitigate drought, and manage energy resources, amongst other activities; however, current forecast systems have limited ability on these time- scales. Models for such climate forecasts must take into account complex interactions among the ocean, atmosphere, and land surface. Such processes can be difficult to represent realistically. To improve the quality of forecasts, this book makes recommendations about the development of the tools used in forecasting and about specific research goals for improving understanding of sources of predictability. To improve the accessibility of these forecasts to decision-makers and researchers, this book also suggests best practices to improve how forecasts are made and disseminated.

Operational Weather Forecasting Cambridge University Press

This book offers a complete primer, covering the end-to-endprocess of forecast production, and bringing together a descriptionof all the relevant aspects together in a single volume; withplenty of explanation of some of the more complex issues andexamples of current, state-of-the-art practices. Operational Weather Forecasting covers the whole processof forecast production, from understanding the nature of theforecasting problem, gathering the observational data with which toinitialise and verify forecasts, designing and building a model (ormodels) to advance those initial conditions forwards in time andthen interpreting the model output and putting it into a form whichis relevant to customers of weather forecasts. Included is thegeneration of forecasts on the monthly-to-seasonal timescales,often excluded in text-books despite this type of forecastinghaving been undertaken for several years. This is a rapidly developing field, with a lot of variations inpractices between different forecasting centres. Thus theauthors have tried to be as generic as possible when describingaspects of numerical model design and formulation. Despitethe reliance on NWP, the human forecaster still has a big part toplay in producing weather forecasts and this is described, alongwith the issue of forecast verification – how forecastcentres measure their own performance and improve upon it. Advanced undergraduates and postgraduate students will use thisbook to understand how the theory comes together in the day-to-dayapplications of weather forecast production. In addition,professional weather forecasting practitioners, professional usersof weather forecasts and trainers will all find this new member ofthe RMetS Advancing Weather and Climate series avaluable tool. Provides an end-to-end description of the weather forecastingprocess Clearly structured and pitched at an accessible level, the bookdiscusses the practical choices that operational forecastingcentres have to make in terms of what numerical models they use andwhen they are run. Takes a very practical approach, using real life case-studiesto contextualize information Discusses the latest advances in the area, including ensemblemethods, monthly to seasonal range prediction and use of‘nowcasting’ tools such as radar and satelliteimagery Full colour throughout Written by a highly respected team of authors with experiencein both academia and practice. Part of the RMetS book series ‘Advancing Weather andClimate’

Making Climate Forecasts Matter Cambridge University Press

This is the first book to promote the use of stochastic, or random, processes to understand, model and predict our climate system. One of the most important applications of this technique is in the representation of comprehensive climate models of processes which, although crucial, are too small or fast to be explicitly modeled. The book shows how stochastic methods can lead to improvements in climate simulation and prediction, compared with more conventional bulk-formula parameterization procedures. Beginning with expositions of the relevant mathematical theory, the book moves on to describe numerous practical applications. It covers the complete range of time scales of climate variability, from seasonal to decadal, centennial, and millennial. With contributions from leading experts in climate physics, this book is invaluable to anyone working on climate models, including graduate students and researchers in the atmospheric and oceanic sciences, numerical weather forecasting, climate prediction, climate modeling, and climate change.

Nonlinear and Stochastic Climate Dynamics National Academies Press

The topic of predictability in weather and climate has advanced significantly in recent years, both in understanding the phenomena that affect weather and climate and in techniques used to model and forecast them. This book, first published in 2006, brings together some of the world's leading experts on predicting weather and climate. It addresses predictability from the theoretical to the practical, on timescales from days to decades. Topics such as the predictability of weather phenomena, coupled ocean-atmosphere systems and anthropogenic climate change are among those included. Ensemble systems for forecasting predictability are discussed extensively. Ed Lorenz, father of chaos theory, makes a contribution to theoretical analysis with a previously unpublished paper. This well-balanced volume will be a valuable resource for many years. High-calibre chapter authors and extensive subject coverage make it valuable to people with an interest in weather and climate forecasting and environmental science, from graduate students to researchers.