



Major Reference Work

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Encyclopedia of Climate System Science

The Climate System is complex, consisting of myriad interactions and feedbacks within and across oceans, atmosphere, land surface, cryosphere, and biosphere, which lead to natural variability on timescales ranging from sub-seasonal to multidecadal. Superposed on the natural variations is Climate Change – a concern that has generated widespread interest in climate science.

The Encyclopedia of Climate System Science will provide authoritative, up-to-date information on the observing, functioning, modeling, and projected future states of the Climate System. It will highlight system interactions that play a leading role in shaping climate variability, their modulation by climate change, the multivariate structure of climate change in each subsystem, the extraction of this signal, and the robustness of climate projections. The Encyclopedia content will be a balanced blend of observational analysis, theory, and numerical modeling. The Encyclopedia will be a valuable go-to reference for students, citizen scientists, postdoctoral fellows, and disciplinary experts, and those interested in a discriminating understanding of climate variability and change.

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Editorial Team



Sumant Nigam (Editor-in-Chief): *Sumant is Professor and Chair of the Department of Atmospheric and Oceanic Science at the University of Maryland and Director of the Maryland Mesonet. His research interests are in climate dynamics, atmospheric general circulation and climate teleconnections, ocean-atmosphere interaction in the tropics and high latitudes, multidecadal climate variability, monsoons, and droughts and desertification. Unraveling natural variability and secular change in the recent steep warming of Northern Continents, Arctic Sea ice loss, and the warming of West Antarctica is a current focus. Sumant's lab issues seasonal forecasts of ENSO and the South Asian summer monsoon each spring, with the latter informing India's official monsoon forecast. Sumant chaired the American Meteorological Society's Climate Variations and Change Committee and NCAR's Climate & Global Dynamics Division's Advisory Panel until 2018. He led the drafting of the AMS Information Statement on Climate Change and has served as Editor of the Journal of Climate. Sumant was a member of the Climate Research Committee and the Board of Atmospheric Sciences and Climate from 2008-2012. He is a Fellow of the AMS and the Royal Meteorological Society. Sumant was a Jefferson Science Fellow of NAS and Senior Science Advisor to the U.S. State Department during 2016-17 and a 2020 Fulbright-Nehru Fellow. Sumant got his M.Sc. degree in Physics from the Indian Institute of Technology Kanpur in 1978; he received his alma mater's Distinguished Alumnus Award in 2013. Sumant received his Ph.D. in Geophysical Fluid Dynamics from Princeton University in 1984 and postdoctoral training at the Massachusetts Institute of Technology. Sumant has published over 100 papers and advised 19 Ph.Ds. He was featured on the cover of SCIENCE in May 2004 in connection with a report on foreign-born U.S. scientists titled "Brains & Borders: Many Origins, One Destination."*



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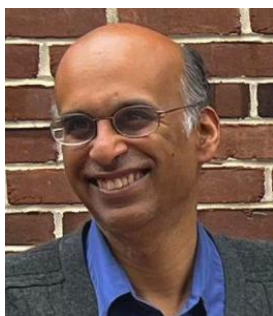
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James A. Carton (Editor, Oceans and Climate): *Jim is Professor of Atmospheric and Oceanic Science at the University of Maryland and a climate scientist interested in exploring the role of the global ocean/sea ice system in coupled climate variability and change. Jim joined the University of Maryland following undergraduate and graduate degrees from Princeton University and a postdoctoral Fellowship at Harvard University at an exciting time of rapidly expanding observations and increasingly sophisticated models. In the tropics, his work explores the coupled heat and momentum exchanges between ocean and atmosphere that underlie phenomena such as the Pacific El Nino. Sea ice complicates these exchanges at high latitudes by isolating the polar ocean and modulating its uptake of atmospheric heat and freshwater. In the past, when the sea ice cover was extensive, this isolation led to quiescent conditions in the central Arctic. However, as the sea ice cover retreats, the exchanges have increased with potentially large consequences for the earth's climate, biological systems, and local communities. Jim's recent work combines information from historical observations with computer numerical simulation models to document and explore these remarkable changes.*



Matthew (Mat) Collins (Editor, Climate Change, including Projections): *Mat is Professor in the Faculty of Environment, Science, and Economy, and Head of the Department of Mathematics and Statistics at the University of Exeter, where he also holds the Joint Met Office Chair in Climate Change. His research interests are in the physical aspects of climate change, with a focus on future projections. Specific interests include the impact of climate change on natural variability, especially the El Nino Southern Oscillation, changes in tropical rainfall, decadal climate variability and predictability, techniques for quantifying uncertainty in climate projections and feedbacks in the climate system. He has served twice as Coordinating Lead Author for the Intergovernmental Panel on Climate Change, on the Fifth Assessment Report of Working Group 1, and on the Special Report on Oceans and Cryosphere in a Changing Climate. He has led several UK-funded large projects on physical climate projections, including 'Emergence of Climate Hazards' and 'Robust Spatial Projections of Real-World Climate Change.' He is a past editor of the Journal of Climate and is currently the Field Chief Editor of Frontiers in Climate. He has published over 170 peer-reviewed journal articles. He is a member of the CLIVAR Scientific Steering Group and a past co-chair of the Climate Dynamics Panel.*



Anand Gnanadesikan (Editor, Biogeochemical/Carbon Cycles): *Anand is the Morton K. Blaustein Chair and Professor in the Department of Earth and Planetary Sciences at Johns Hopkins University. His interests center on understanding the interactions between different parts of the Earth System. Trained as an oceanographer, his primary expertise is in how the ocean circulates and influences marine life, climate, and atmospheric chemistry. He received a Ph.D. from the MIT/Woods Hole Joint Program in Physical Oceanography in 1994 and spent over fifteen years at Princeton University and NOAA's Geophysical Fluid Dynamics Laboratory where he helped lead the development and diagnosis of Earth System Models. Among the major questions he studies are the following: What are the implications of better representing mixing within the ocean for our ability to simulate the Earth System? Key accomplishments in this area include developing a simple theory for how vertical and lateral mixing combine to set the magnitude and stability of the ocean overturning, highlighting the impact of ocean mixing on hypoxia and anthropogenic carbon uptake, and helping to develop some of the first coupled ocean ice-sheet models. How do ocean circulation and biological cycling combine to determine ocean habitats and chemical distributions, and how can we represent the relevant processes in models? Key accomplishments in this area include collaborative work on identifying the key role of the Southern Ocean in the carbon and oxygen cycles, developing simple models of ocean biogeochemical cycling, and identifying responses of oceanic biology to ocean acidification*



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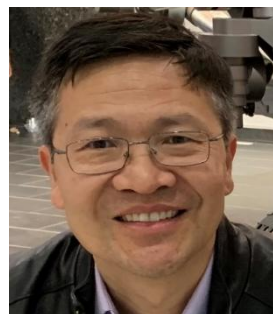
Bin Guan (Editor, Hydroclimate Variability and Change): *Bin is a Researcher (Full Professor equivalent) at the Joint Institute for Regional Earth System Science and Engineering, University of California, Los Angeles (UCLA). His research focuses on high-impact weather and climate events and their interdisciplinary implications. He has served on the American Meteorological Society's (AMS) Committee on Climate Variability and Change, its membership subcommittee, and the drafting committee for updating the AMS Statement on Weather Analysis and Forecasting. He received the 2018 Climate Science Service Award from the California Department of Water Resources and was named Outstanding Reviewer of 2019 by the American Geophysical Union. He has authored more than 80 peer-reviewed publications and was the editor of the 2024 book "[Atmospheric Oscillations: Sources of Subseasonal-to-Seasonal Variability and Predictability](#)". He earned his BS degree from Nanjing University, MPhil from the City University of Hong Kong, and PhD from the University of Maryland, College Park. He was a postdoctoral scholar at the Jet Propulsion Laboratory, California Institute of Technology before joining UCLA.*



Shawn Marshall (Editor, Cryosphere and Paleoclimate): *Shawn is a Professor of Geography at the University of Calgary, currently seconded to the Government of Canada as the Departmental Science Advisor at Environment and Climate Change Canada. Dr. Marshall completed an undergraduate degree in Engineering Physics at the University of Toronto (1991), followed by a Ph.D. in Geophysics at UBC (1996) and postdoctoral research in the UBC Department of Earth and Ocean Sciences (1997-1999). He joined the University of Calgary in 2000, where he held the Canada Research Chair in Climate Change from 2007-2017. His research combines field studies and numerical modeling to examine glacier-climate processes and the role of glaciers and ice sheets in the climate system, spanning timescales from Ice Age climate dynamics to recent and future climate change. Dr. Marshall was a Fellow of the Canadian Institute for Advanced Research (CIFAR) Earth System Evolution Program from 2001-2015 and is the author of the book 'The Cryosphere,' as part of the Princeton University Press series Primers in Climate Science. He has served as an Editor for Geophysical Research Letters, The Cryosphere, and Journal of Climate and is the current Chair of the International Arctic Science Committee Cryosphere Working Group.*



Isla Simpson (Editor, Climate Simulation, including Assessments): *Isla is a Research Scientist in the Climate and Global Dynamics Laboratory of the National Center for Atmospheric Research (NCAR). She obtained her Ph.D. in 2009 from Imperial College London. She was a postdoctoral fellow at the University of Toronto and Lamont-Doherty Earth Observatory of Columbia University before moving to NCAR in 2015. Her research interests lie in large-scale atmospheric dynamics, climate variability and change, regional hydroclimate, seasonal to decadal predictability, and Earth System Modelling of historical and future projected climate changes.*



Zong-Liang Yang (Editor, Water Cycles and Land-Atmosphere Interactions): *Liang is a Professor in the Department of Earth and Planetary Sciences at the Jackson School of Geosciences, University of Texas at Austin, where he holds the John A. and Katherine G. Jackson Chair in Earth System Sciences. He is also the Founding Director of the Center for Integrated Earth System Science. Dr. Yang earned his B.Sc. in Meteorology from Nanjing University of Information Science and Technology, an M.S. in Meteorology from the University of Melbourne, and his Ph.D. in Atmospheric Sciences from Macquarie University, Australia. His research focuses on understanding land-atmosphere exchanges of energy and water, with applications in predicting hydrological extremes such as floods and droughts. He has authored over 220 peer-reviewed journal articles and teaches physical climatology, hydroclimatology, and climate change courses. Dr. Yang's terrestrial hydrological parameterizations and land surface models are utilized by major modeling centers worldwide and have been instrumental in accurately forecasting extreme weather events. He has been honored for his contributions to Earth System Science. He serves as Editor-in-Chief for the Water and Climate section of the Water Journal, Editor for the Journal of Meteorological Research, Editor for Advances in Atmospheric Sciences, and Associate Editor for the Journal of Geophysical Research: Atmospheres.*