

Journal of Climate

The JOURNAL OF CLIMATE (*JCLI*) publishes research that advances basic understanding of the dynamics and physics of the climate system on large spatial scales, including variability of the atmosphere, oceans, land surface, and cryosphere; past, present, and projected future changes in the climate system; and climate simulation and prediction.

ISLA SIMPSON

University Corporation for Atmospheric Research

Co-Chief Editors

DARRYN WAUGH

The Johns Hopkins University

Editors

QINGHUA DING
University of California, Santa Barbara

DIETMAR DOMMENGET
Monash University

MICHAEL N. EVANS
University of Maryland

ANDY HOELL
NOAA/Physical Sciences Laboratory

PANG-CHI HSU
Nanjing University of Science and
Technology

XIANGLEI HUANG
University of Michigan

ROBERT JNGLIN WILLS
University of Washington

JENNIFER E. KAY
University of Colorado, Boulder

DAEHYUN KIM
University of Washington

YU KOSAKA
University of Tokyo

CHARLES KOVEN
Lawrence Berkeley National Laboratory

BENJAMIN R. LINTNER
Rutgers, The State University of New Jersey

JIAN LU
Pacific Northwest National Laboratory

SHAWN MARSHALL
University of Calgary

SEUNG-KI MIN
Pohang University of Science
and Technology

JOEL NORRIS
University of California, San Diego

YUKO OKUMURA
The University of Texas at Austin

KEVIN REED
Stony Brook University

AGUS SANTOSO
University of New South Wales

TOMOKI TOZUKA
The University of Tokyo

HAILAN WANG
NOAA/Climate Prediction Center

SONG YANG
School of Atmospheric Sciences,
Sun Yat-sen University

STEPHEN YEAGER
UCAR

Associate Editors

RICHARD P. ALLAN
University of Reading

ALYSSA ATWOOD
Florida State University

ALEXIS BERG
Department of Geography, University of
Montreal

RUSSEL BLACKPORT
Environment and Climate Change
Canada

SUZANA CAMARGO
Lamont-Doherty Earth Observatory

ROBIN CHADWICK
Met Office and University of Exeter

ANDREW CHARLTON-PEREZ
University of Reading

RUYAN CHEN
South China Sea Institute of Oceanology, Chinese
Academy of Science

LAURA CIASTO
NOAA/NWS/NCEP/Climate Prediction Center

PETER CLARK
Oregon State University

KYLE CLEM
Victoria University of Wellington

BENJAMIN COOK
Lamont-Doherty Earth Observatory,
NASA Goddard Institute for Space Studies

FRANCES DAVENPORT
Colorado State University

TIMOTHY DELSOLE
George Mason University

AMATO T. EVAN
Scripps Institution of Oceanography,
University of California, San Diego

PAUL FIELD
Met Office

JASON C. FURTADO
University of Oklahoma

BOLAN GAN
Ocean University of China

CHAIM GARFINKEL
The Hebrew University of Jerusalem

PETER GENT
National Center for Atmospheric Research

DENNIS HARTMANN
University of Washington

MICHIYA HAYASHI
National Institute for Environmental Studies

TOMOKI IWAKIRI
Meteorological Research Institute, Japan

CHRIS JONES
Met Office Hadley Centre

BOR-TING JONG
Princeton University and NOAA/Geophysical
Fluid Dynamics Laboratory

TAKAHITO KATAOKA
Japan Agency for Marine-Earth Science and
Technology

SHOICHIRO KIDO
Japan Agency for Marine-Earth Science and
Technology

ZACHARY LABE
Princeton University and NOAA/Geophysical
Fluid Dynamics Laboratory

JOHN LANZANTE
NOAA/Geophysical Fluid Dynamics Laboratory

SARAH LARSON
North Carolina State University

MATTHIEU LENGAIGNE
Institute for Research and Development

NATHAN LENNSEN
Colorado School of Mines

LAIFANG LI
The Pennsylvania State University

XICHEN LI
Institute of Atmospheric Physics, Chinese Academy
of Sciences

TAO LIAN
Second Institute of Oceanography, Ministry of
Natural Resources

FEI LIU
School of Atmospheric Sciences, Sun Yat-sen
University, China

PAUL LOIKITH
Portland State University

RIYU LU
LASG, Institute of Atmospheric Physics,
Chinese Academy of Sciences

JUSTIN S. MANKIN
Dartmouth College

ELINOR MARTIN
University of Oklahoma

DANIEL MCCOY
University of Wyoming

KAREN MCKINNON
University of California, Los Angeles

BRIAN MEDEIROS
University Corporation for Atmospheric Research

TIMOTHY MERLIS
Princeton University

OSAMU MIYAWAKI
National Center for Atmospheric Research

VINCENT MORORN
Department of Geography and Planning, Aix-Marseille
University

HIROYUKI MURAKAMI
NOAA/Geophysical Fluid Dynamics Laboratory

KATHY PEGION
University of Oklahoma

BING PU
University of Kansas

INGO RICHTER
Japan Agency for Marine-Earth Science and
Technology

JON ROBSON
National Centre for Atmospheric Science, University
of Reading

BENJAMIN SCHENKEL
National Severe Storms Laboratory, University
of Oklahoma

HYODAE SEO
Woods Hole Oceanographic Institution

JIA-RUI SHI
Woods Hole Oceanographic Institution

RYAN SRIVER
University of Illinois at Urbana-Champaign

LANTAO SUN
Colorado State University

KEN TAKAHASHI
Instituto Geofísico del Perú, Lima, Peru

IVY TAN
McGill University

NEIL TANDON
York University

GABRIELE VILLARINI
Department of Civil and Environmental Engineering and
High Meadows Environmental Institute,
Princeton University

HANS VON STORCH
GKSS Research Centre

CASEY WALL
University of Oslo

HUI WANG
NOAA/Climate Prediction Center

LEI WANG
Fudan University

LIN WANG
Institute of Atmospheric Physics, Chinese Academy
of Sciences

LU WANG
Nanjing University of Information Science & Technology

ZIOLAN WANG
School of Atmospheric Sciences, Sun Yat-sen University

YUNTAO WEI
Fudan University

RENGUANG WU
Zhejiang University

XIAN WU
Princeton University

YUTIAN WU
Lamont Doherty Earth Observatory of Columbia University

SHAOCHENG XIE
Lawrence Livermore National Laboratory

DA YANG
University of California, Davis

SANG-WOOK YEH
Hanyang University

YUJIA YOU
Geophysical Fluid Dynamics Laboratory

QING YUE
Jet Propulsion Laboratory, California Institute of
Technology

GAN ZHANG
University of Illinois at Urbana-Champaign

LEI ZHANG
South China Sea Institute of Oceanology, Chinese Academy
of Sciences

LIPING ZHANG
Geophysical Fluid Dynamics Laboratory

PENGFEI ZHANG
The Pennsylvania State University

RENHE ZHANG
Fudan University

YANG ZHANG
Nanjing University

HAIKUN ZHAO
Nanjing University of Information Science and Technology

CHENG ZHENG
Lamont-Doherty Earth Observatory

YOUTONG ZHENG
University of Houston

FRANCIS ZWIERS
Pacific Climate Impacts Consortium

AMS Lead Technical Editor for *Journal of Climate*
RICHARD R. BRANDT

AMS Lead Copy Editor for *Journal of Climate*
KRISTIN GILBERT

CRISTINA BARLETTA
(Assistant to Drs. Simpson and Waugh)
DJ ARRUDA
TIFFANY BISCHOFF

Peer Review Staff

HALEY CHARNEY
JANE FOLEY
TOM JUSTICE
ROBBIE MATLOCK

AMS Scientific and Technical Journals Staff

Director of Publications
GWENDOLYN WHITTAKER

Publications Billing and
AMS Office Manager
CAITLIN GARRISON

Senior Production Assistants
DANIELLE M. JOYCE
ABBY WOODWARD

Managing Copy Editor
JESSICA A. LAPOINTE

Associate Director—Publishing
Technology
MICHAEL A. FRIEDMAN

Production Manager
SHEILA F. GAFVERT

Production Assistant
ADRIANNA CROWELL

Managing Technical Editor
MARK E. FERNAU

Senior Copy Editors

Peer Review Support Manager
ANDREA HERBST

Production Team Coordinator
LIZ WRIGHT

Senior Technical Editors
HOLLIS E. BAGUSKAS
RICHARD R. BRANDT

KRISTIN GILBERT
RAMESH PILLAY
NICOLE E. RIETMANN
ANDREA L. SCHEIN

© Copyright 2024 American Meteorological Society (AMS). For permission to reuse any portion of this work, please contact permissions@ametsoc.org. Any use of material in this work that is determined to be “fair use” under Section 107 of the U.S. Copyright Act (17 U.S. Code § 107) or that satisfies the conditions specified in Section 108 of the U.S. Copyright Act (17 USC § 108) does not require AMS’s permission. Reproduction, systematic reproduction, posting in electronic form, such as on a website or in a searchable database, or other uses of this material, except as exempted by the above statement, require written permission or a license from AMS. All AMS journals and monograph publications are registered with the Copyright Clearance Center (<https://www.copyright.com>). Additional details are provided in the AMS Copyright Policy statement, available on the AMS website (<https://www.ametsoc.org/PUBSCopyrightPolicy>).

The JOURNAL OF CLIMATE (ISSN 0894-8755) is published semimonthly by the American Meteorological Society at 45 Beacon Street, Boston, MA 02108-3693. Subscription rates for this and other AMS titles are available online at <https://www.ametsoc.org/index.cfm/ams/publications/subscription-information>. For information on becoming an AMS member and/or subscribing to the Society’s journals, visit the AMS website: <https://www.ametsoc.org>. Subscription orders, claims for missing numbers, changes of address, and other business correspondence should be sent to amsinfo@ametsoc.org (or to the American Meteorological Society, 45 Beacon Street, Boston, MA 02108-3693). Periodical postage paid at Boston, MA, and at additional mailing offices. POSTMASTER: Send address changes to the JOURNAL OF CLIMATE, American Meteorological Society, 45 Beacon Street, Boston, MA 02108-3693.

INFORMATION FOR CONTRIBUTORS

Submissions Manuscripts for *Journal of Climate* should be submitted to <https://www.editorialmanager.com/jcli>. General questions about *Journal of Climate* should be sent to jcli@ametsoc.org. Detailed information about the journal is available in the Journals section of the AMS Publications website. Authors are advised to check the AMS author information web pages for the most current information on the preparation and submission of manuscripts.

Copyright Policy The American Meteorological Society’s mission to disseminate knowledge in the atmospheric and related oceanic and hydrologic sciences is best served by promoting wide access to AMS publications while ensuring that this dissemination preserves the integrity of the originally published works. The copyrights to the materials published in AMS journals, monographs, and other publications are transferred from the authors to AMS at the time the materials are accepted for publication, allowing AMS to act as the steward for the intellectual property contained in the published works. It also allows AMS to protect the value of the materials in order to generate revenue for AMS to support the peer-review publication process so crucial to the scholarly scientific endeavor.

Use of AMS Copyrighted Materials Figures, tables, and brief excerpts from AMS primary journals (*Bulletin of the American*

Meteorological Society; Artificial Intelligence for the Earth Systems; Journal of the Atmospheric Sciences; Journal of Applied Meteorology and Climatology; Journal of Physical Oceanography; Monthly Weather Review; Journal of Atmospheric and Oceanic Technology; Weather and Forecasting; Journal of Hydrometeorology; Journal of Climate; Weather, Climate, and Society) and Meteorological Monographs may be used in scientific educational works provided the original source is acknowledged. This policy also applies to earlier issues in which the copyright notice may have stated a different policy. Restrictions on other uses of material from the abovementioned primary publications, including republication and copying of articles, are stated in the copyright notice near the front of each issue and discussed in more detail in the AMS Copyright Policy available in the Author Resources section of the AMS website. It is emphasized that the policy stated in the opening sentence above applies only to primary publications listed there. For policy on copying and other uses of materials from *Meteorological and Geostrophysical Abstracts*, the *Glossary of Meteorology*, and all other AMS publications and books, please consult the copyright notice in each.

Publication Charges Authors’ institutions or sponsors are requested to pay the publication charges. Information on current publication charges is available on the AMS website.