

# Understanding and Prediction of Monsoon Weather and Climate

The Centre for Australian Weather and Climate Research (CAWCR), a partnership between [CSIRO](#) and the [Australian Bureau of Meteorology](#), will hold its sixth annual workshop, from 12-15 November 2012. The workshop will be held at the Bureau of Meteorology, 700 Collins Street, Melbourne.

The main focus of this year's workshop is on modelling (simulation and prediction) but will include observational studies of physical processes and variability that are pertinent to improving modelling capability (including improved understanding so as to guide model development)

## Key themes for the workshop:

- Observed monsoon Variability from Weather to Climate
- Physical Processes
- Monsoon NWP
- Intra-seasonal/Seasonal Prediction of the Monsoon
- Monsoon Decadal Prediction and Climate Change

## Keynote Presenters:

A number of prominent scientists and experts from overseas, Australian research agencies and universities will present at the meeting. Keynote presentations will be given by the following international experts:

- Gill Martin (MetOffice, UK)
- Akio Kitoh (MRI, Japan)
- Ken Sperber (PCMDI, LLNL, USA)
- Eric Maloney (Colorado State University, USA)
- William Boos (Yale, USA)
- Sean Milton (MetOffice, UK)
- Masayuki Nakagawa (JMA, Japan)
- Chidong Zhang (University of Miami, USA)



**Australian Government**  
Bureau of Meteorology

**The Centre for Australian Weather and Climate Research**  
A partnership between CSIRO and the Bureau of Meteorology



# Understanding and Prediction of Monsoon Weather and Climate - abstracts of the sixth CAWCR Workshop 12 November - 15 November 2012, Melbourne, Australia

**CAWCR Technical Report No. 056**

Keith A. Day (editor)

November 2012



[www.cawcr.gov.au](http://www.cawcr.gov.au)



Understanding and Prediction of Monsoon Weather  
and Climate - abstracts of the sixth CAWCR  
Workshop 12 November - 15 November 2012,  
Melbourne, Australia

*Keith A. Day (Editor)*

*Centre for Australian Weather and Climate Research,  
GPO Box 1289, Melbourne, VIC 3001, Australia*

**CAWCR Technical Report No. 056**

November 2012

National Library of Australia Cataloguing-in-Publication entry

Author: CAWCR 6<sup>th</sup> Annual Workshop; Understanding and Prediction of Monsoon Weather and Climate (2012: Melbourne, Victoria)

Title: Understanding and Prediction of Monsoon Weather and Climate - abstracts of the sixth CAWCR Workshop 12 November - 15 November 2012, Melbourne, Australia / Editor Keith. A. Day.

ISBN: 978-0-643-10959-9

Series: CAWCR technical report; No. 56

Notes: Includes index.

Subjects: Meteorology--Research--Congresses.

Enquiries should be addressed to:

Keith Day  
Centre for Australian Weather and Climate Research:  
A partnership between the Bureau of Meteorology and CSIRO  
GPO Box 1289  
Melbourne VIC 3001  
Australia

k.day@bom.gov.au  
Phone: 61 3 9669 8311  
Fax: 61 3 9669 4660

## Copyright and Disclaimer

© 2012 CSIRO and the Bureau of Meteorology. To the extent permitted by law, all rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of CSIRO and the Bureau of Meteorology.

CSIRO and the Bureau of Meteorology advise that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, CSIRO and the Bureau of Meteorology (including each of its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

All images reproduced in grayscale. A colour version of CAWCR Technical Report No.056 is available online: <http://www.cawcr.gov.au>

## Contents

Foreword by Dr Tom Keenan.....	1
<hr/>	
<i>May, P.</i> General overview on observation of Australian Monsoon.....	3
<hr/>	
<i>Berry, G.J., Reeder, M.J. and Jakob, C.</i> Coherent synoptic disturbances in the Australian monsoon.....	4
<hr/>	
<i>Lavender, S. and Abbs, D.</i> Contribution of Tropical Cyclones to North Australian Rainfall.....	12
<hr/>	
<i>Kumar, V.V., Protat, A., May, P.T., Penide, G. and Jakob, C.</i> Radar observations of Darwin monsoon convection.....	15
<hr/>	
<i>Fernon, J.</i> The initiation of Equatorial Rossby Waves in the Pacific during the North Australian Wet Season and their effect on the synoptic flow and the rainfall over the Australian tropics and adjoining waters.....	20
<hr/>	
<i>McBride, J.</i> The Meteorology of the Australian Monsoon Floods of 2010-2011.....	21
<hr/>	
<i>Frederiksen, J.S. and Frederiksen, C.S.</i> Tropical Modes of Variability.....	22
<hr/>	
<i>Woodward, E.</i> Indigenous seasonal understanding in monsoon Australia: examples from the Northern Territory and Western Australia.....	26
<hr/>	
<i>Boos, W.R. and Hurley, J.V.</i> A Convective Quasi-Equilibrium View of Observed Monsoon Interannual Variability.....	30
<hr/>	
<i>Davidson, N., Dietachmayer, G., Puri, K., Ebert, E., Hirst, T., Rikus, L., Steinle, P. and Tory, K.</i> Some Aspects of Prediction and Diagnosis of the Onset of the Australian Monsoon using ACCESS.....	38
<hr/>	
<i>Taschetto, A.S., Li, Y., Jourdain, N.C. and Gupta, A.S.</i> Modulation of monsoon activity by tropical Pacific variability and climate model fidelity Apologies.....	<b>Error! Bookmark not defined.</b>
<hr/>	
<i>Jourdain, N.C., Gupta, A.S., Taschetto, A.S., Ummenhofer, C.C., Moise, A.F. and Ashok, K.</i> Relationship between the Australian and Maritime Continent monsoon and the El Niño Southern Oscillation in reanalysis data and the CMIP3/CMIP5 simulations.....	44
<hr/>	
<i>Wheeler, M. and McBride, J.</i> Intraseasonal Variability of the Australasian Monsoon.....	48
<hr/>	
<i>Schubert, J., Hendon, H.H. and Jakob, C.</i> Variations of MJO Activity and the Australian Summer Monsoon in Observations and Simulations with ECHAM6.....	57
<hr/>	
<i>Feng, M., McPhaden, M., Xie, S-P. and Hafner, J.</i>	

An unprecedented intraseasonal Leeuwin Current warming event in February-March 2011.....	61
<i>Marshall, A.G. and Hendon, H.H.</i>	
Impact of the MJO on the WA Marine Environment during the Monsoon.....	62
<hr/>	
<i>Oliver, E.C.J. and Thompson, K.R.</i>	
Impact of the MJO on the Gulf of Carpentaria during the monsoon.....	67
<hr/>	
<b>Day 2</b>	
<i>Milton, S., Webster, S., Xavier, P., Martin, G., Willett, M., Shelly, A., Mulcahy, J. and Heming, J.</i>	
Asian-Australian Monsoon NWP with the MetUM.....	72
<hr/>	
<i>Nakagawa, M.</i>	
Recent activities of global model development at JMA for prediction of monsoons.....	80
<hr/>	
<i>Steinle, P. on behalf of the Earth System Modelling</i>	
Developments within the ACCESS NWP systems.....	84
<hr/>	
<i>Ebert, B.</i>	
ACCESS short-range rainfall prediction in the Australian tropics.....	86
<hr/>	
<i>Earl-Spurr, C.</i>	
Challenges in Monsoon Forecasting at Darwin.....	90
<hr/>	
<i>Martin, G.</i>	
Understanding and evaluation of monsoon processes in the MetUM.....	91
<hr/>	
<i>Rashid, H.</i>	
Simulation of Asian-Australian Monsoon by ACCESS Coupled Models.....	101
<hr/>	
<i>Ackerley, D., Berry, G., Jakob, C. and Reeder, M.</i>	
The representation of summer-time rainfall in north-west Australia by ACCESS1.3.....	103
<hr/>	
<i>Zhu, H., Hendon, H.H., Dix, M. and Sun, Z.</i>	
Intraseasonal moisture budget in ACCESS Model.....	107
<hr/>	
<i>Lane, T., Hassim, M. and Caine, S.</i>	
High-resolution simulations of convection over the maritime continent.....	108
<hr/>	
<b>Day 3</b>	
<i>Zhang, C.</i>	
Processes of MJO Initiation over the Indian Ocean.....	109
<hr/>	
<i>Maloney, E.</i>	
Linking Improved MJO Simulations to Theoretical Understanding.....	110
<hr/>	
<i>Marshall, A.G., Hudson, D., Wheeler, M.C., Hendon, H.H. and Alves, O.</i>	
Simulation and Prediction of the MJO and its Teleconnections using POAMA.....	113
<hr/>	
<i>Shelton, K., Charles, A., Hendon, H.H. and Kuleshov, Y.</i>	
Tropical Cyclones in POAMA.....	117
<hr/>	
<i>Lim, E-P., Hendon, H.H., Liu, G. and Young, G.</i>	

Dynamical prediction of extreme Australian monsoon in 2010-11 .....	123
<i>Drosowsky, W. and Wheeler, M.</i>	
Prediction of North Australian Wet Season Onset and Intra-seasonal Variability in POAMA. ....	124
<hr/>	
<i>Griesser, A.</i>	
POAMA Sea Surface Temperature Forecast Skill in the Western Tropical Pacific Ocean .....	128
<hr/>	
<i>Stone, R.C., Everingham, Y. and Marcussen, T.</i>	
Application of Seasonal Prediction on Sugar Cane .....	132
<hr/>	
<i>Nakaegawa, T.</i>	
Dynamical seasonal typhoon prediction with the JMA/MRI-CGCM and its linkage of Asian Monsoon prediction .....	135
<hr/>	
<i>Cowan, T. and Cai, W.</i>	
Impact of Asian and non-Asian anthropogenic aerosols on 20th century Asian summer monsoon .....	136
<hr/>	
<i>Li, Y.</i>	
Remote influence of the tropical Atlantic on the variability and trend in North West Australia summer rainfall .....	140
<hr/>	
<i>Zhang, H., Moise, A., Liang, P. and Hanson, L.</i>	
Puzzling Puzzles: Potential Changes in Monsoon Onset/Intensity in the Australia-Asian Region in Future Climate .....	141
<hr/>	
<i>Smith, I.</i>	
Western Pacific Monsoon and Climate Change .....	144
<hr/>	
<b>Day 4</b>	
<hr/>	
<i>Kitoh, A.</i>	
High-Resolution Projection of Asian/Australian Monsoon System .....	145
<hr/>	
<i>Rotstayn, L., Jeffrey, S., Syktus, J., Collier, M.A., Wong, K., Hirst, T. and Dravitzki, S.</i>	
Historical and projected Australian monsoon rainfall under different forcing assumptions .....	152
<hr/>	
<i>Katzfey, J.</i>	
Climate change and the Southeast Asian Monsoon using downscaled simulations .....	154
<hr/>	
<i>Power, S., Delage, F., Chung, C., Colman, R., Arblaster, J., Moise, A., Roff, G. and Rashid, H.</i>	
21 <sup>st</sup> century rainfall projections in climate models and the role of ENSO .....	159
<hr/>	
<i>Brown, J.R., Moise, A.F. and Colman, R.A.</i>	
Interactions between the South Pacific Convergence Zone and the Australian summer monsoon .....	162
<hr/>	
<i>Arblaster, J. and Meehl, J.</i>	
Decadal variability in TBO-ENSO-monsoon relationships .....	164
<hr/>	
<i>Moise, A.F., Colman, R. and Brown, J.</i>	
CMIP5 Evaluation of Australian Monsoon Using Regime-Sorting of Rainfall .....	166
<hr/>	
<i>Anderson, J.</i>	

Zonal Asymmetries in the Widening of the Tropics Under Climate Change.....	168
<i>Nguyen, H.</i>	
Hadley cell under warming climate.....	169
<hr/>	
<i>Sperber, K.R., Annamalai, H., Kang, I-S., Kitoh, A., Moise, A., Turner, A., Wang, B. and Zhou, T.</i>	
The Asian Summer Monsoon: An Intercomparison of CMIP5 vs. CMIP3 Simulations of the Late 20 <sup>th</sup> Century.....	170
<hr/>	
<i>Catto, J.L., Jakob, C. and Nicholls, N.</i>	
The influence of changes in synoptic regimes on north Australian wet season rainfall trends.	180
<hr/>	
<i>Suppiah, R., Moise, A., Hanson, L. and Colman, R.</i>	
Circulation of anomalous wet and dry Australian monsoon seasons and future changes from CMIP3 Simulations .....	182
<hr/>	
<i>Watterson, I.</i>	
Large-scale influences on changes in Australian monsoonal rainfall and circulation under global warming.....	185



## FOREWORD

The Centre for Australian Weather and Climate Research (CAWCR) is a partnership between Australia's leading atmosphere and ocean research agencies – CSIRO) and the Bureau of Meteorology. CAWCR, established in 2007, jointly manages the science capability within the Bureau and CMAR providing a single centre of research excellence. This year's CAWCR Workshop, *"Understanding and Prediction of Monsoon Weather and Climate"* is the sixth Annual Workshop under the auspices of the Centre, continuing the series originating within the Bureau of Meteorology Research Centre.

The focus of the workshop on monsoons is motivated by the primary role that the Australian-Asian monsoon plays in the climate of Australia and the need to better predict and simulate monsoon weather and climate in order to provide more useful advice on weather and climate variability and change to society. However, monsoons are fundamental to many other regions of the world; hence the focus of the workshop is not limited to the Australian-Asian monsoon.

The aims of the meeting are to:

- 1) Review and assess the current understanding of the processes involved in monsoon climate (especially for Australia) on time scales from weather to seasonal to climate;
- 2) Identify major challenges in simulating the monsoon in the Australasian region and globally at these time scales; and
- 3) Provide a forum for monsoon researchers from different disciplines (weather, seasonal prediction, climate and climate change) to share ideas, enhance collaboration and develop a coordinated approach to address challenges in monsoon prediction and simulation in Australasia.

The key themes covered in this year's workshop are:

- (i) Observed monsoon Variability from Weather to Climate;
- (ii) Prediction of monsoon weather;
- (iii) Representing monsoons in weather and climate models;
- (iv) Intra-seasonal/Seasonal Prediction of the Monsoon;
- (v) Monsoon Decadal Prediction and Climate Change

A number of prominent scientists and experts from overseas, Australian research agencies and universities have been invited to give presentations. Keynote speakers include Dr Gareth Berry (Monash University, Australia), Dr William Boos (Yale University, USA), Dr Akio Kitoh (Climate Research Department, Meteorological Research Institute, Tsukuba, Japan), Dr Eric Maloney (Department of Atmospheric Science, Colorado State University, USA), Dr Gill Martin (Met Office, Exeter, UK), Dr Peter May (CAWCR, Bureau of Meteorology, Australia), Dr Sean Milton (Global Model Evaluation and Development, Met Office, Exeter, UK), Dr Masayuki Nakagawa (Numerical Prediction Division, Japan Meteorological Agency, Tokyo, Japan), Dr Leon Rotstayn (CAWCR, CSIRO Marine and Atmospheric Research, Australia), Dr Kenneth Sperber (Program for Climate Model Diagnosis and Intercomparison, Lawrence Livermore National Laboratory, USA), Dr Matt Wheeler (CAWCR, Bureau of Meteorology, Australia), and Dr Chidong Zhang (Division of Meteorology and Physical Oceanography, University of Miami, Miami, USA),

The Workshop also includes two panel sessions aimed to address important questions in the field of seasonal prediction of monsoon and monsoon under climate change. We are grateful for these expert contributions and to all the participants' contributions to the debate and discussions.

This workshop is sponsored by the Bureau of Meteorology, the Australian Climate Change Science Program (ACCSP), the Pacific-Australian Climate Change Science and Adaptation Planning Program (PACCSAP), and CSIRO (Climate Adaptation Flagship, CMAR and the Climate and Atmosphere

Theme). We are also particularly grateful to Fujitsu and Intel for their generous support of this workshop.

Finally, we would like to thank the members of the organising committee for their efforts, comprising: Aurel Moise (Chair), Harry Hendon, Christian Jakob, Shoni Maguire, Leon Rotstayn, and John McBride. Meryl Wiseman, Val Jemmeson, Mark Bervanakis, Anu Arora and Julie Sortino provided excellent administrative support.

***Tom Keenan***

Director

Centre for Australian Weather and Climate Research:

A partnership between the Australian Bureau of Meteorology and CSIRO

November 2012



The Centre for Australian Weather and  
Climate Research is a partnership between  
CSIRO and the Bureau of Meteorology.