SUPPLEMENT

EXPLAINING EXTREME EVENTS OF 2016 FROM A CLIMATE PERSPECTIVE

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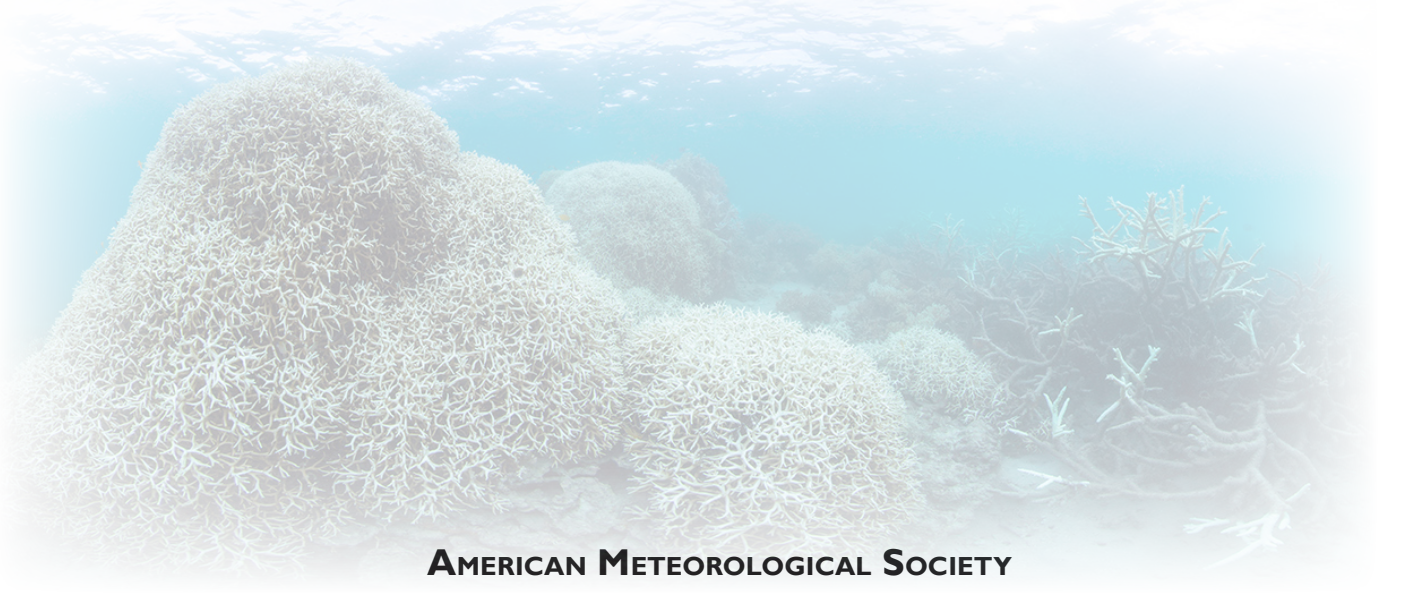
©The Ocean Agency / XL Catlin Seaview Survey / Chrisophe Bailhache—A panoramic image of coral bleaching at Lizard Island on the Great Barrier Reef, captured by The Ocean Agency / XL Catlin Seaview Survey / Christophe Bailhache in March 2016.



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ES27. NATURAL VARIABILITY NOT CLIMATE CHANGE DROVE THE RECORD WET WINTER IN SOUTHEAST AUSTRALIA

Andrew D. King

This document is a supplement to "Natural Variability Not Climate Change Drove the Record Wet Winter in Southeast Australia]," by Andrew D. King (*Bull. Amer. Meteor. Soc.*, **99** (1), S139–S143) • ©2018 American Meteorological Society • DOI:10.1175/BAMS-D-17-0087.2

Model evaluation details.

The CMIP5 models were evaluated based on the ability of the historical simulations to capture:

1. Observed variability in SEA JAS rainfall anomalies,
2. Observed variability in EIO SST anomalies in JAS, and
3. The observed relationship between EIO SST anomalies and SEA rainfall anomalies.

Tests 1 and 2 involved calculating Kolmogorov–Smirnov test statistics measuring the likelihood of whether the observed and model simulated anomalies were likely from the same overall population. Models with at least one-in-three historical simulations having statistically significant ($p < 0.05$) differences in the rainfall or SST distributions from observed were removed from further analysis.

There is a positive correlation between observed and detrended EIO SST anomalies and SEA rainfall anomalies in JAS (r = 0.3 over 1900–2016), but model ability to capture this relationship is variable. Test 3 removed models with at least one-third of historical runs simulating negative correlations between detrended EIO SSTs and SEA rainfall.

The results described in the study were compared with those derived from using the entire model ensemble. Based on all 16 climate models I find a stronger climate change role (at least 90% confidence of a decrease in the likelihood of very wet conditions) nd a weaker EIO effect (more than 80% increase in likelihood of very wet conditions in warm EIO periods). This difference in the simulated change in the wet tail of the rainfall distribution is accompanied by changes in the mean shift due to climate change and EIO between the model subensemble and the full ensemble.

Table ES27.1. The models and simulations used in this analysis. Models were evaluated based on their historical simulations and those that passed were used in the attribution analysis. Models in bold passed the evaluation tests. Details of which models failed which tests are shown with green representing a pass and red a fail.

Model	Historical	Histori-calNat	RCP8.5	Did the model pass?		
				Test 1	Test 2	Test 3
ACCESS1.3	**1,2,3**	**1**	**1**			
Bcc-csm1.1	**1,2,3**	**1**	**1**			
CanESM2	**1,2,3,4,5**	**1,2,3,4,5**	**1,2,3,4,5**			
CCSM4	**1,2,3,4,5,6**	**1,2,4,6**	**1,2,4,6**			
CESM1-CAM5	**1,2,3**	**1,2,3**	**1,2,3**			
CNRM-CM5	**1,2,3,4,5, 6,7,8,9,10**	**1,2,4**	**1,2,4**			
CSIRO-Mk3.6.0	1,2,3,4,5, 6,7,8,9,10	1,2,3,4,5	1,2,3,4,5			
GFDL-CM3	**1,2,3,4,5**	**1**	**1**			
GISS-E2-H	1,2,3,4,5	1,2	1,2			
GISS-E2-R	1,2,3	1,2	1,2			
HadGEM2-ES	1,2,3,4,5	1,2,3,4	1,2,3,4			
IPSL-CM5A-LR	1,2,3,4,5,6	1,2,3	1,2,3			
IPSL-CM5A-MR	1,2,3	1	1			
MIROC-ESM	1,2,3	1,2,3	1			
MRI-CGCM3	**1,2,3**	**1**	**1**			
NorESM1-M	**1,2,3**	**1**	**1**			

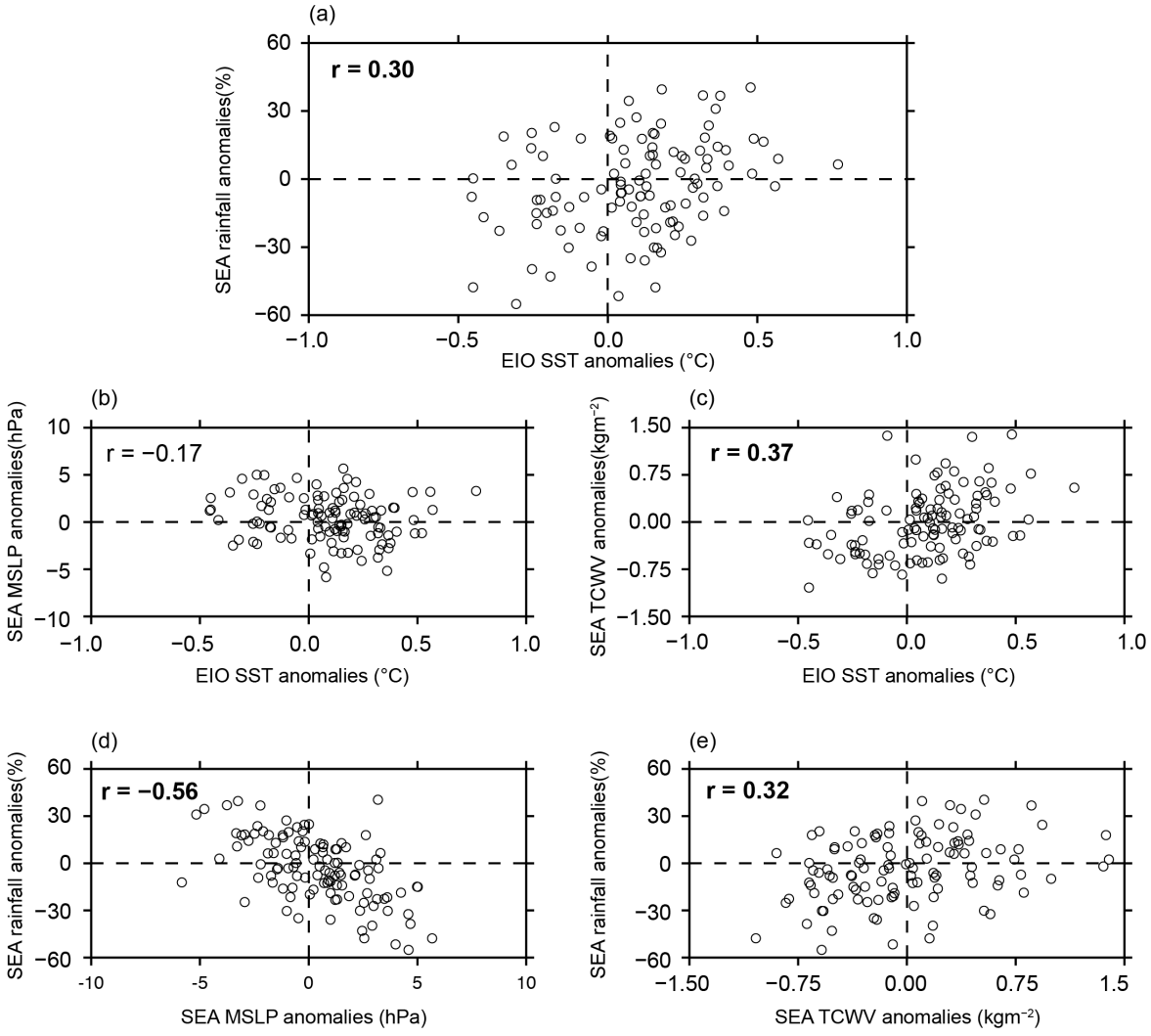

Fig. ES27.1. Scatter plots showing the relationships between (a) EIO SST anomalies (°C) and SEA rainfall anomalies (%), (b) EIO SST anomalies (°C) and SEA MSLP anomalies (hPa), (c) EIO SST anomalies (°C) and SEA TCWV anomalies (kg m^{-2}), (d) SEA MSLP anomalies (hPa) and SEA rainfall anomalies (%), and (e) SEA TCWV anomalies (kg m^{-2}) and SEA rainfall anomalies (%). All time series are detrended and anomalies calculated w.r.t. 1961–90. Spearman rank correlation coefficients are shown with bold typeface used when these are significant at the 5% level.