The roles of climate change and El Niño in the record low rainfall in October 2015 in Tasmania, Australia

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Reference: Karoly et al. (2016) BAMS EEE Suppl., S127-130





MSLP anomalies for Oct 2015, with record values bounded by grey contours. Strong PSA pattern with high MSLP over Tasmania

b. NCEP1 MSLP anomaly, Oct 2015 (baseline 1948-2015)



Attribution of extreme rainfall

- Consider role of El Niño and climate change using:
- Analysis of observational data:
 - small but sig correlation with El Niño, -26 ± 10 mm for Oct 15
 - -Very small and not significant declining trend in Oct rainfall
- Tasmania rainfall from 12 CMIP5 models for Hist and HistNat simulations and RCP8.5 for 2006-2035
- Tasmanian rainfall from large ensembles of weather@home ANZ regional climate simulations for
 2015 ALL (>2,000) and NAT (>5,000) simulations and

– composite El Niño ALL and NAT simulations





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Weather@home ANZ experiment

- Partnership between ARC Centre of Excellence for Climate System Science, Oxford University and NIWA (NZ) to run Australia-New Zealand domain
- Uses CORDEX Australasia domain (0.44° resol, 216x145)
- Simulations for 2013 with specified SSTs initially
- Remove human-caused SST and ghg changes for natural runs
- Perturbed initial conditions, different forcings
- Launched 26 Mar 2014,
 >40,000 runs distributed,
 >30,000 years daily data





Attribution of extreme events

- Evaluate the performance of a climate model in simulating the observed variability of the type of event
- Determine the likelihood of exceeding a threshold under different forcing conditions
- Determine the Fractional Attributable Risk, FAR = $1 - P_0/P_1$ where P_0 is the probability of exceeding the threshold in the "control" climate, and P₁ is the probability of exceeding the threshold in the perturbed climate





Evaluation of simulated rainfall



Attribution results

Anthropogenic forcing increased likelihood of low rainfall W@H 2015 > 39% (median 75%) W@H El Niño > 18% (median 59%) CMIP5 -12% < likelihood < 82%, (median 25%) El Niño increased likelihood of low rainfall > 18% (median 59%)



Summary

- Tasmania experienced record low rainfall in October 2015
- Anthropogenic climate change and El Niño made small but significant contributions to increasing the likelihood of this record low rainfall
- Atmospheric variability was the main contributor
- In contrast, 2016 brought record high rainfall to Tasmania for April-Nov (wet season)



