EXPLAINING EXTREME EVENTS OF 2016 FROM A CLIMATE PERSPECTIVE

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ES25. THE HOT AND DRY APRIL OF 2016 
IN THAILAND

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This document is a supplement to “The Hot and Dry April of 2016 In Thailand],” by Nikolaos Christidis, Kasemsan Manomaiphiboon, Andrew Ciavarella, and Peter A. Stott (Bull. Amer. Meteor. Soc., 99 (1), S128–S132) • ©2018 American Meteorological Society • DOI:10.1175/BAMS-D-17-0071.2

Streamflow stations. Thailand and its vicinity.

Fig. ES25.1. Chao Phraya (blue shading) and Mun-Chi (yellow shading) River basins and their tributaries (gray lines). Black triangles mark the streamflow stations that provided data for this study. There are two major dams upstream of each station (i.e., four in total), expected to have an effect on the downstream flow. However, time-averaging in the calculation of the 1-year running streamflows presented in our study helps reduce the impact of dam regulation.
Evaluation.

The modelled distribution of temperature and rainfall in the region of Thailand over the period 1960–2013 is evaluated against observational data (Figs. ES25.2a,b). Two-sided Kolmogorov–Smirnov (KS) tests assess whether the modelled data are significantly different from the observations and yield p-values greater than 0.1, which indicates no significant difference. The model’s representation of very hot and dry events is assessed from probabilities estimated over a range of high temperature and low rainfall thresholds. The corresponding return times are shown in Figs. ES25.2c,d. Extreme probabilities are estimated with the Generalised Pareto Distribution and their uncertainty with Monte Carlo bootstrapping. The likelihood of low rainfall events is consistent with observational estimates. The probability of high temperature events is somewhat underestimated by the model for moderate extremes, but there is better consistency for rarer events. The hot event considered in this study has an estimated return time of hundreds to thousands of years in the present-day climate (main text Fig. 25.2f) and although our observations are not long enough to evaluate such rare events, we conclude, on the basis of our simple evaluation, that the model is able to provide a reasonable attribution assessment. Power spectra produced with modelled and observational data over the period 1960–2013 (Figs. ES25.2e,f) show that the modelled variability is generally consistent with the observations. Finally, histograms similar to main text Figs. 25.1e,f were produced with modelled data (Figs. ES25.2g,h), which demonstrate the model reproduces well the ENSO effect in the region.
Fig. ES25.2. (a),(b) Normalised distributions of the April mean temperature (°C) and rainfall (mm) in the region of Thailand in 1960–2013 estimated from HadGEM3-A simulations with historical forcings (red lines) and observations (gray histograms). KS tests assess whether the modelled data are significantly different from the observations. (c),(d) Return time of high temperature (°C) and low rainfall (mm) events estimated over a range of thresholds with HadGEM3-A (red) and observational (black) data. Thick lines represent the best estimate (50th percentile) and thin lines the 5%–95% uncertainty range. (e),(f) Power spectra for April anomalies for temperature and rainfall, respectively, during 1960–2013 constructed with model (orange) and observational (black) data. (g),(h) Histograms demonstrating the dependence of temperature (°C) and rainfall (mm mo\(^{-1}\)) on ENSO (as in main text Fig. 25.1e,f). All anomalies are relative to 1961–90.