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Large Scale Meteorological Pattern of Extreme Rainfall in Indonesia

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Extreme Weather Events (EWEs) cause negative impacts socially, economically, and environmentally. Considering these facts, forecasting EWEs is crucial work. Indonesia has been identified as being among the countries most vulnerable to the risk of natural disasters, such as floods, heat waves, and droughts. Current forecasting of extreme events in Indonesia is carried out by interpreting synoptic maps for several fields without taking into account the link between the observed events in the "target" area with remote conditions. This situation may cause misidentification of the event leading to an inaccurate prediction. Grotjahn and Faure (2008) compute composite maps from extreme events (including heat waves and intense rainfall) to help forecasters identify such events in model output. The composite maps show large scale meteorological patterns (LSMP) that occurred during historical EWEs. Some vital information about the EWEs can be acquired from studying such maps, in addition to providing forecaster guidance. Such maps have robust mid-latitude meteorological patterns (for Sacramento and California Central Valley, USA EWEs).

We study the performance of the composite approach for tropical weather condition such as Indonesia. Initially, the composite maps are developed to identify and forecast the extreme weather events in Indramayu district- West Java, the main producer of rice in Indonesia and contributes to about 60% of the national total rice production. Studying extreme weather events happening in Indramayu is important since EWEs there affect national agricultural and fisheries activities. During a recent EWE more than a thousand houses in Indramayu suffered from serious flooding with each home more than one meter underwater. The flood also destroyed a thousand hectares of rice plantings in 5 regencies.

Identifying the dates of extreme events is one of the most important steps and has to be carried out carefully. An approach has been applied to identify the dates involving observations from multiple sites (rain gauges). The approach combines the POT (Peaks Over Threshold) with 'declustering' of the data to approximate independence based on the autocorrelation structure of each rainfall series. The cross correlation among sites is considered also to develop the event's criteria yielding a rational choice of the extreme dates given the 'spotty' nature of the intense convection. Based on the identified dates, we are developing a supporting tool for forecasting extreme rainfall based on the corresponding large-scale meteorological patterns (LSMPs). The LSMPs methodology focuses on the larger-scale patterns that the model are better able to forecast, as those larger-scale patterns create the conditions fostering the local EWE. Bootstrap resampling method is applied to highlight the key features that statistically significant with the extreme events.

Grotjahn, R., and G. Faure. 2008: Composite Predictor Maps of Extraordinary Weather Events in the Sacramento California Region. Weather and Forecasting. 23: 313-335.