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Spatial and temporal patterns of overland flow generation during a dry-to-wet season transition

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The seasonal shift from dry to wet season affects the hydrology of tropical rainforests in many ways. Our objectives were to identify the controls of the temporal and spatial frequency of overland flow (OF) occurrence and of hillslope-channel connectivity during such a shift. We installed 113 overland flow detectors (OFDs) and monitored stream discharge in nested subcatchments of the Lutz Creek catchment on Barro Colorado Island, Panamá. For each OFD location, we derived 50 terrain attributes as inputs into a Random Forest (RF) model. This approach was used to elucidate the variation in spatial frequency of OF occurrence, whereas a Generalized Linear Model (GLM) approach served to explain the temporal frequency of overland flow occurrence in terms of rainfall parameters. 87 % of the variation in temporal frequency of OF occurrence was explained by three explanatory variables: rainfall intensity, timing of an event within the transitional period and antecedent rainfall. The spatial variability of OF occurrence was best explained by microtopography and by measures of distance-to-channel, with the contribution of all other terrain attributes being marginal. Peak stormflows were strongly correlated with the temporal frequency of overland flow occurrence for catchment and the one subcatchment, while the second subcatchment remained virtually unconnected to the channel network, suggesting small-scale differences in thresholds of overland flow generation. Our study contributes to the understanding 1) of seasonal effects on overland flow generation, 2) of hillslope-channel connectivity in an overland flow-prone environment, and 3) of limitations of terrain

attributes for the spatially explicit prediction of overland flow occurrence.