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Saturated contributing areas and connectivity in semi-arid and humid environments

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During storms, both humid and semi-arid areas show patchy saturation and incomplete connectivity with channelways, but through very different mechanisms. Furthermore many Mediterranean areas, for example, show characteristics that vary seasonally and in response to storm sequences. Idealised semi-arid areas generate infiltration excess overland flow, produced in parallel at every point through 1-D partition of rainfall, infiltration and evapotranspiration. Overland flow generally occurs only during brief bursts of intense rainfall within longer storms from patches with low infiltration, and rarely travels the full length of the slope before re-infiltration when rainfall intensity decreases. Channels therefore generally receive flood flow only from some patches close to the stream. Connectivity between points is re-established only during rare widespread overland flow.

Humid areas generally show good connectivity through continuous sub-surface flow, but connectivity of overland flow is broken where saturated zones drain into areas that are not fully saturated. Although saturation levels may increase monotonically downslope in ideal ‘mature’ landscapes, many real landscapes diverge from this, so that not all saturated areas are connected. Connected saturated areas are concentrated near channels, as in semi-arid areas, but the dynamics of the relationships between storm characteristics and saturated contributing areas are very different.

The paper sketches possible model for semi-arid response, at a comparable level of complexity to TOPmodel for humid areas.