From paddock to catchment: adaptive flow modelling with D-Flow

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Abstract: D-Flow is a new adaptive algorithm for the calculation of flow lines and contributing upslope areas from a digital elevation model (DEM). The algorithm is an adaptation of an image-processing technique based on mathematical morphology. The technique dilates a connected group of pixels incrementally in the direction determined by the elevation of the pixels that envelop the connected pixels. The connectivity of the pixels is determined by a parameter known as the "structuring element." This parameter provides the option to control how the flow is proportioned, and to constrain the degree of flow dispersion and grid bias. As such, the algorithm can be regarded as a generalised method where the D-8 and D-Infinity algorithms are special cases. The region-growing approach in the algorithm makes it robust to saddles, steep slopes, and flat areas.

D-Flow is part of the Catchment Management Framework (Eigenraam, et al). CMF is an integrated toolkit consisting of several biophysical and regression models that incorporate climatic and soil conditions, surface runoff, recharge, vegetation types, plant growth, nutrients, and many others. These models can be used to influence the structuring element in D-Flow on a per-pixel basis, and adjust the local dispersion and direction of flow adaptively during simulation. The integrated and multi-scale approach in CMF is designed to inform the assessment of local paddock-scale changes in land use, in relation to the catchment-scale environmental impacts of those changes.

Keywords: deterministic flow, D-Flow, digital elevation model

Abstract only