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Variable isochrones for estimating runoff based on digital stream networks

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Abstract Traditionally, isochrones are obtained by empirically drawing lines on to a topographic map where the flow velocity is assumed uniformly distributed across a given region. However, the spatial variability in topography and rainfall can greatly influence the flow velocity. Thus, a new method of variable isochrones is proposed in this paper. Variable isochrones are obtained from digital stream networks. The digital stream networks were extracted from a DEM. Rainfall was interpolated to each grid of the DEM to describe the spatial distribution of rainfall. The flow velocity of each grid is computed by a proposed formula. The proposed variable isochrones cannot only reflect the unevenness of the flow velocity over the topography of a watershed, but they also reflect the influence of rainfall spatial distribution on runoff. In the case study, this method is applied to the Sangyuan watershed in Fujian Province of China. The computational results show that the proposed variable isochrones method has potential application for the estimation of runoff, and particularly for ungauged basins.

Key words hydrological modelling; variable isochrones; digital stream networks; flow velocity