Overland Flow Network delineation allowing for flow divergence

**Keywords:** Digital Elevation Model, flow momentum and divergence, overland flow network, raster analysis

**Overland flow models require good 1D overland flow representation!**
High-intensity rainfall events can generate flooding in urban areas, which in turn cause serious social (e.g. injuries), economical and infrastructural damages. It is therefore desirable to have accurate flood predictions (flood extent and water depth).
Current research in urban flood modeling is generally focused into the area of 1D/2D modeling: the coupling of one-dimensional (1D) hydrodynamic models of the sewer system with two-dimensional (2D) overland flow models. While 1D/2D models generate more accurate flood predictions, they come at the cost of a computation time when compared to the alternative 1D/1D flood model - a prohibitive price for Swiss engineering companies. One of the main strengths of 2D overland flow models over current 1D overland flow models is the faithful representation of diverging flow paths, a task that is currently impossible for 1D models due to the complexity of delineating flow paths over a DEM.

**Objectives**
The main goal of this thesis is to develop a novel 1D overland flow path delineation method able to take into account flow divergence. The new method should be based on the *aspect driven kinematic routing algorithm* presented by Lea (1992). This algorithm, also known as the “rolling ball algorithm”, uses the aspect raster to delineate flow paths. Flow paths delineated using the new method should be compared and assessed towards the results obtained using other available 1D overland flow network generators (see Wilson *et al.* (2008) for different 1D overland flow network generation algorithms). The new method should delineate preferential flow paths as well as secondary flow paths that only appear at higher flow regimes. The method should represent divergent flow in a way that is compatible with the EPA StormWater Management Model (SWMM) (Rossman, 2007).

**Suggested tasks**
1. Literature review on overland flow, urban drainage modelling, and input data requirements;
2. Development of a novel method to generate 1D overland flow networks that takes into account flow divergence (and flow momentum);
3. Comparison of the obtained overland network using the proposed method with networks obtained using other algorithms, on the basis of a field test, e.g. in Adliswil;
4. Discussion of the obtained results, with a special focus on usability of the proposed method to improve 1D overland flow/ flood modelling in urban areas.
Requirements
- Interest in urban hydrology and hydrodynamic modelling;
- Computer programming skills;
- Good knowledge of English;
- Basic knowledge of GIS is an asset;
- A good amount of motivation and initiative

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References
