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Effect of DEM resolution and comparison between different weighting factors for hydrologic connectivity index

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The emerging concept of hydrological connectivity is difficult to quantify. Some indices have been proposed. The most cited is Borselli's one. It mainly uses the DEM as input. The pixel size may strongly impacts the result of the calculation. It has not been studied yet in silty areas. Another important aspect is the choice of the weighting factor which strongly influences the index value. The objective of this poster is so to compare 8 different DEM's resolutions (12, 24, 48, 72, 96, 204, 504 and 996cm) and 3 different weighting factors (factor C of Wischmeier, Manning's factor and rugosity index) in the Borselli's index calculation. The IC was calculated in a 124ha catchment (Hevillers), in the loess belt, in Belgium. The DEM used is coming from a UAV with a maximum resolution of 12 cm. Permanent covered surfaces are not considered in order to avoid artefact due to the vegetation (2% of the surface).

Regarding the DEM pixel size, the IC increases for a given pixel when the pixel size decreases. That confirms some results observed in the Alpine region by Cavalli (2014). The mean difference between 12 cm and 10 m resolution is 35% with higher values up to 100% for higher connectivity zones (flow paths). Another result is the lower impact of connections in the watershed (grass strips...) at lower pixel sizes. This is linked to the small width of some connections which are sometimes comparing to cell size. Furthermore, a great loss of precision is observed from the 500 cm pixel size and upper. That remark is quite intuitive. Finally, some very well disconnected zones appear for the highest resolutions.

Regarding the weighting factor, IC values calculated using C factor are lower than with the rugosity index which is only a topographic factor. With very high resolution DEM, it permits to represent the fine topography. For the C factor, the zones up to very well disconnected areas (grass strips, wood...) are well represented with lower index values than downstream zones. On the contrary, areas up to very well connected zones (roads, paths...) are higher and much more connected than downstream areas. For the Manning's factor, the values are very low and not very well contrasted. This factor is not enough discriminant for this study.

In conclusion, high resolution DEM (1 meter or higher) is needed for the IC calculation (precison, impact of connections...). Very high resolution permits to identify very well disconnected areas but it multiplies the calculation time. For the weighting factor, rugosity index and C factor have each some advantages. It is planned to test other approaches for the IC calculation.

Key-words: hydrological connectivity index, DEM, resolution, weighting factor, comparison