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Generalizing roughness: experiments with flow-oriented roughness

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Surface texture analysis applied to High Resolution Digital Terrain Models (HRDTMs) improves the capability to characterize fine-scale morphology and permits the derivation of useful morphometric indexes. An important indicator to be taken into account in surface texture analysis is surface roughness, which can have a discriminant role in the detection of different geomorphic processes and factors. The evaluation of surface roughness is generally performed considering it as an isotropic surface parameter (e.g., Cavalli, 2008; Grohmann, 2011). However, surface texture has often an anisotropic character, which means that surface roughness could change according to the considered direction. In some applications, for example involving surface flow processes, the anisotropy of roughness should be taken into account (e.g., Trevisani, 2012; Smith, 2014). Accordingly, we test the application of a flow-oriented directional measure of roughness, computed considering surface gravity-driven flow. For the calculation of flow-oriented roughness we use both classical variogram-based roughness (e.g., Herzfeld,1996; Atkinson, 2000) as well as an ad-hoc developed robust modification of variogram (i.e. MAD, Trevisani, 2014). The presented approach, based on a D8 algorithm, shows the potential impact of considering directionality in the calculation of roughness indexes. The use of flow-oriented roughness could improve the definition of effective proxies of impedance to flow. Preliminary results on the integration of directional roughness operators with morphometric-based models, are promising and can be extended to more complex approaches.

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