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A multi-scale investigation of geometrically derived z0 from Hintereisferner, Austrian Alps

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Spatially and temporally distributed values of glacier aerodynamic roughness (z_0) are required to improve estimates of glacier melt. z_0, representing the topographically-controlled height above the surface where wind speed reaches zero, is shown by empirical studies to be spatially and temporally dynamic, yet, z_0 is commonly overlooked as a tuning parameter in models or generalised between surfaces and over time. Indirect estimates of z_0 made from microtopographic measurements allow for rapid data collection over large areas but are sensitive to measurement scale, data resolution and detrending technique. The recent proliferation of remotely sensed topographic data from airborne and satellite sources has created a wealth of resources, as yet untapped in this particular field. We present a multi-scale analysis using data collected from Hintereisferner, Austria, with a view to upscaling current methods for estimating 3D microtopographic z_0 so that coarser resolution, broader scale data can be used to estimate z_0 at the glacier scale. Our extensive dataset covers a spectrum of scales from 5 x 5 m plots (at sub-cm resolution) to scans of almost the whole glacier surface from an in-situ terrestrial laser scanner.

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