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Sub-aerial and sub-glacial stream flow.

The evolution of river channels and hillslope topography is described by Smith-Bretherton theory, consisting of two coupled partial differential equations for ground surface elevation s and water flow depth h. Asymptotic reduction of the model leads to a single degenerate non-linear reaction-diffusion equation for h, coupled with an integral constraint. Solutions immediately become of finite support and reach a stable steady state, representing a stream channel of self-determined width. A similar theory describes subglacial water flow beneath ice streams, with the added complication that the glacial ice also moulds the subglacial topography. (Received September 23, 2012)