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A new Shallow Ice Scheme for Alpine Glaciers

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We present a new 2-D finite volume discretization scheme of the shallow ice equations targeted for Alpine glacier models. Alpine regions are characterized by steep slopes and mostly non-smooth landscape which creates problems with most known discretization schemes. Conservation of mass becomes the main problem in such a setting because most discretization schemes create mass on steep, ice-free slopes with glaciated landscape below. Including mass balance creates further complications at already problematic locations within a model and can lead to continuous mass creation. We have created a benchmark experiment to test existing discretization schemes, including our new scheme, for mass conservation in an Alpine setting. We further test our new scheme against well known similarity solutions in 2D and our own analytical solutions in 1D.