Mountain glacier flow modelling : a comparison of different models from the Shallow Ice Approximation to the Full-Stokes solution

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Different glacier flow models are compared for different synthetic glacier geometries. Two models based on the Shallow-Ice Approximation (SIA, zeroth-order, Le Meur and Vincent (2003), Pattyn (2003)), a higher-order model (Pattyn (2003)) and a Full-Stokes finite element model (Elmer, http:\\www.csc.fi\elmer) are used.

The roles of deformation, basal sliding and mass balance are investigated separately in the different models in order to assess the importance of a more precise treatment as in the higher-order or the Full-Stokes models. Moreover, by changing the geometry of a given synthetic shape, especially regarding the aspect ratio, the deviation of SIA results can be examined.

Criteria for comparing the models are surface velocities, velocity profiles and surface geometry.
Another important aspect is CPU-time and the trade-off between gain in accuracy and cost in CPU-time when switching from one model to another.

Finally, attempts of similar comparisons on the real case of the Glacier of Saint-Sorlin (France) will be performed.