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Numerical simulations of major ice streams in western Dronning Maud Land, Antarctica, under wet and dry basal conditions

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The evolution of the Antarctic ice sheet is highly affected by small scale topographic features that arise at the ice sheet margin where the ice flow towards the ocean ice channelized into ice streams and outlet glaciers. In general the ice sheet margin is characterized by pronounced basal relief and velocity gradients that require the consideration of both longitudinal and transverse stress gradients, as well as bridging effects in the force balance equation (Stokes equation). Furthermore, the widely temperate base of the ice sheet demands a reasonable law for basal sliding consequently also transport of basal melt water.

We present numerical simulations of the present day ice flow using the three-dimensional thermo-coupled full-Stokes model TIM-FD3 on a 2.5 km horizontal grid in the area of the western Dronning Maud Land, Antarctica, including the three ice streams Stancomb-Wills, Veststraumen and Plogbreen and the adjacent Brunt and Riiser-Larsen ice shelves. We estimate the distribution of subglacial water based on flux routing methods. Since very little is known about the basal conditions in that area, we study the effect of different sliding laws for wet and dry conditions at the ice base on the overall flow field.