3D numerical modelling of Priestley Glacier (East Antarctica)

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Priestley Glacier is one of the biggest Antarctic glaciers. It starts from Victoria Land
Plateau and flows into Nansen Ice Sheet; it is about 96 km long and flows into a narrow
valley which is about 7 km wide. In this work the dynamic of a portion of Priestley
Glacier is studied with a fully three-dimensional numerical model. The model is based
on the three-dimensional Stokes equations for the description of pressure and veloc-
ity fields, on the Saint Venant equation for the description of the free surface time
evolution and on a constitutive law derived from Glen's law for the description of
ice viscosity. The model computes the complete pressure field by considering both
the hydrostatic and hydrodynamic pressure components; it is time evolutive and uses
high-order numerical approximation for equations and boundary conditions. Differ-
ent sliding conditions and different space discretizations are considered in the mod-
elling procedure. The smallest errors between measured and computed velocity in a
reference point are less then 5% and can be obtained considering viscous sliding con-
ditions. All results show the importance of using a three-dimensional approach and
the important role played by the hydrodynamic pressure in the determination of the
motion filed.