Lead Author e-mail: *agnieszka.m.piechota@us.edu.pl*

Title: *Subglacial drainage of Werenskioldbreen (SW Spitsbergen) based on numerical modelling.*

Agnieszka M. Piechota[1], Sławomir S. Sitek[2], Dariusz Ignatiuk[3], Jan A. Piotrowski[4]
[1]***University of Silesia, Department of Geomorphology, e-mail: agnieszka.m.piechota@us.edu.pl***
[2]*University of Silesia, Department of Hydrogeology and Engineering Geology, e–mail: slawomir.s.sitek@us.edu.pl*
[3]*University of Silesia, Department of Geomorphology, e–mail: dignatiuk@gmail.com*
[4] *Aarhus University, Department of Geoscience, e-mail: jan.piotrowski@geo.au.dk*

Our research attempts to describe subglacial drainage of the Werenskioldbreen glacier (SW Spitsbergen) based on numerical modelling using finite elements method (FEFLOW).

Numerical modelling was preceded by field research carried out on Werenskioldbreen during the summer periods of 2009 - 2011. The 3D model covers 36.2 km^2 of a polythermal glacier basin, 75% of which is filled with ice (27.1 km^2). The steady-state model illustrates the subglacial drainage in a till layer and the top of the bedrock. In the model, presence of permafrost and active layer of a maximum thickness up to 2 m under the glacier snout and in its forefield are prescribed. The main aim of this study was to obtain the subglacial groundwater flow field and the spatial distribution of hydraulic pressures beneath the glacier and in its forefield. The spatial distribution of hydraulic pressure and groundwater flow paths beneath the glacier are controlled by its geometry (thickness), thermal conditions, recharge estimated and calibrated from the ablation and precipitation, and the hydrogeological parameters of the modelling layers.

The subglacial groundwater budget shows that over 98% of this water (4542 m^3/day) is discharged by rivers (65% of which is the Kvisla river drainage). Less than 2% discharges directly to the sea. The assumption of permafrost under the snout of the glacier profoundly modifies water flowlines in the area and contributes to the formation of three preferential drainage paths (northern, southern and middle).

Studies were supported by Research Project NN 306179737 “Model of drainage in- and subglacial system changes of polythermal glaciers on Svalbard (Werenskioldbreen case study)” (Polish Ministry of Science and Higher Education). The last part of studies was supported by project BS/KG/2012 – „Recognition of hydrological, geomorphological and cryogenic contemporary processes in karst and glaciated areas using remote sensing, GIS and quantitative research methods”.