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The impact of glacial fluctuations on the shallow proglacial groundwater systems of two SE Icelandic glaciers.

A. Levy (1), Z. Robinson (1), S. Krause (2), and R. Waller (1)

(1) Research Institute for the Environment, Physical Sciences and Applied Mathematics (EPSAM), Keele University, Keele, United Kingdom (a.levy@epsam.keele.ac.uk), (2) the University of Birmingham, Birmingham, United Kingdom

Groundwater represents a key component of the complex hydrological processes of glaciated basins, where models project significant changes in glacial extent and mass balance. Exchange fluxes between groundwater and surface water can significantly impact discharge and stream level dynamics, biogeochemical cycling and aquifer and river habitat conditions. Understanding the spatial patterns and temporal dynamics of groundwater – surface water exchange fluxes is important for effective water resources management, especially considering the increasing pressures on groundwater and surface water systems resulting from environmental changes.

This study investigates the shallow groundwater systems at two proglacial locations in SE Iceland. Impacted by the interaction between volcanic activity and glaciers, Skeiðarársandur is the world's largest active proglacial outwash plain (sandur). Skeiðarársandur contains an extensive unconfined aquifer whose thickness varies between 100-250m. Skaftafellsjökull, the second site of investigation, is a temperate valley glacier. This site is dominated by moraines and confined channels. Vegetation cover is higher than on the sandur. Groundwater seepage at both sites have potential impacts on eco-hydrological habitat conditions.

Automated groundwater monitoring took place between July - mid August 2011. Preliminary results suggest strong coupling between rivers and the aquifer. This was illustrated by an increase in groundwater level following high, episodic increases in the discharge of the river Súla, western Skeiðarársandur. Results from the Skaftafellsjökull margin also suggest high river-aquifer coupling. A strong diurnal signal was detected in a well located between a large groundwater-fed lake and the glacial-fed river Skaftafellsà. Fluctuations in groundwater level, temperature and EC suggest strong response of the aquifer to changes in river level. This was illustrated during a flood event, in which an increase in groundwater level was coupled with a strong reduction in temperature and EC, which suggests an infiltration of river water into the aquifer. Therefore, dynamic exchange patterns between rivers and the aquifer were detected at both sites. In order to increase the understanding of proglacial groundwater-surface water exchange patterns, further monitoring is planned for the summer of 2012. These experimentally-gained results will provide new improved mechanistic process understanding of hydrogeological responses to glacial retreat. Furthermore, these results will be used to parameterise the aquifer-river boundary conditions in a coupled numerical groundwater-surface water model for quantification of the impact of changes in catchment glaciation on river-aquifer exchange dynamics and in-stream habitat conditions.