

Groundwater – meltwater coupling in an active proglacial sandur aquifer in southeast Iceland

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Abstract

The sandur proglacial to Virkisjokull, a rapidly retreating glacier in southeast Iceland, forms a thick (at least 50-100m), high permeability, high storage aquifer that is actively coupled with the meltwater river. The sandur aquifer has been characterised by a combination of piezometer drilling, permeability testing and geophysics, and groundwater-meltwater coupling has been investigated by regular monitoring of hydrochemistry, stable isotopes and dissolved gases and by continuous monitoring of groundwater levels and river stage over two years. The study has demonstrated that active rainfall recharge occurs across the sparsely vegetated sandur, and there is significant river influence on groundwater within at least 50-150m of the river channel, particularly proximal to the glacier. In this zone the river loses to the sandur aquifer throughout most of the year, with high meltwater river flows maintaining high groundwater levels in summer. At ~300-400m distance from the river, there is no significant river influence on groundwater: here, groundwater recharge and levels are controlled by the timing and volume of precipitation; groundwater level fluctuations are larger than in the zone near the river; and summer groundwater levels are lower than winter levels. There is significant down-gradient groundwater flow in the sandur aquifer, and from ~3km down-gradient from the upper edge of the sandur there is extensive groundwater discharge via springs that provides baseflow to the river throughout much of the year. This study highlights the important role that groundwater storage will play in regulating meltwater river flows as glaciers retreat globally.