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Changes in precipitation patterns associated with retreating glaciers in Iceland

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The large Icelandic glaciers have a significant effect on the mesoscale atmpospheric flow in Iceland. Their impact on the spatial distribution of precipitation is clearly indicated in the annual maxima observed near the ice caps at the south coast of Iceland. This maxima is associated with the high and broad orographic features and with the frequent passage of atmospheric lows and fronts.

To quantify the effect of the glaciers on the flow, two sets of high-resolution atmospheric simulations have been performed. The control simulation uses the current land height and glacial cover while in the sensitivity run the glaciers have been removed and the bottom topography of the glaciers used instead of the glacial surface as land height. The simulations are done at 8 and 2 km horizontal resolution and are forced with the Interim re-analysis of the ECMWF for two consecutive years 2004-2006.

The key results for Vatnajökull ice cap in Southeast-Iceland indicate up to 25% decrease in annual precipitation on large parts of the ice cap and an overall decrease close to 15% when the glacial cover is removed. There is furthermore greater spillover of precipitation in regions near the west and north edge of the ice cap but little changes further in the lee of the ice cap. The results of this study are of relevance for planning of hydropower availability and harnessing in a warming climate.