

The impact of Vatnajökull ice cap on mesoscale atmospheric flow

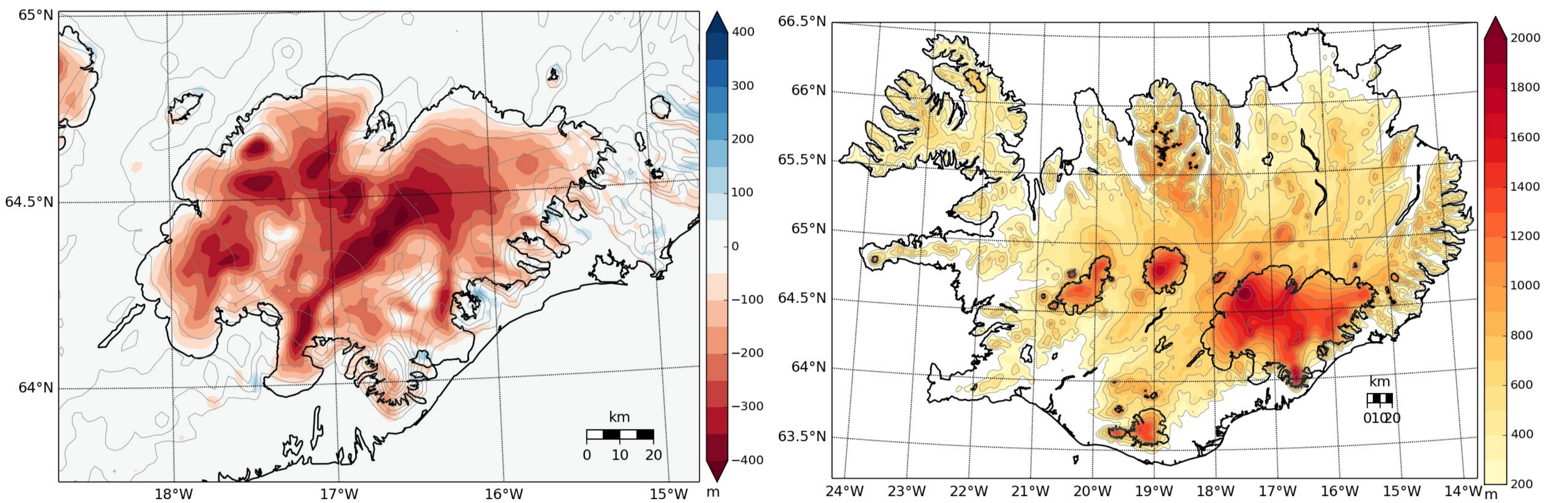
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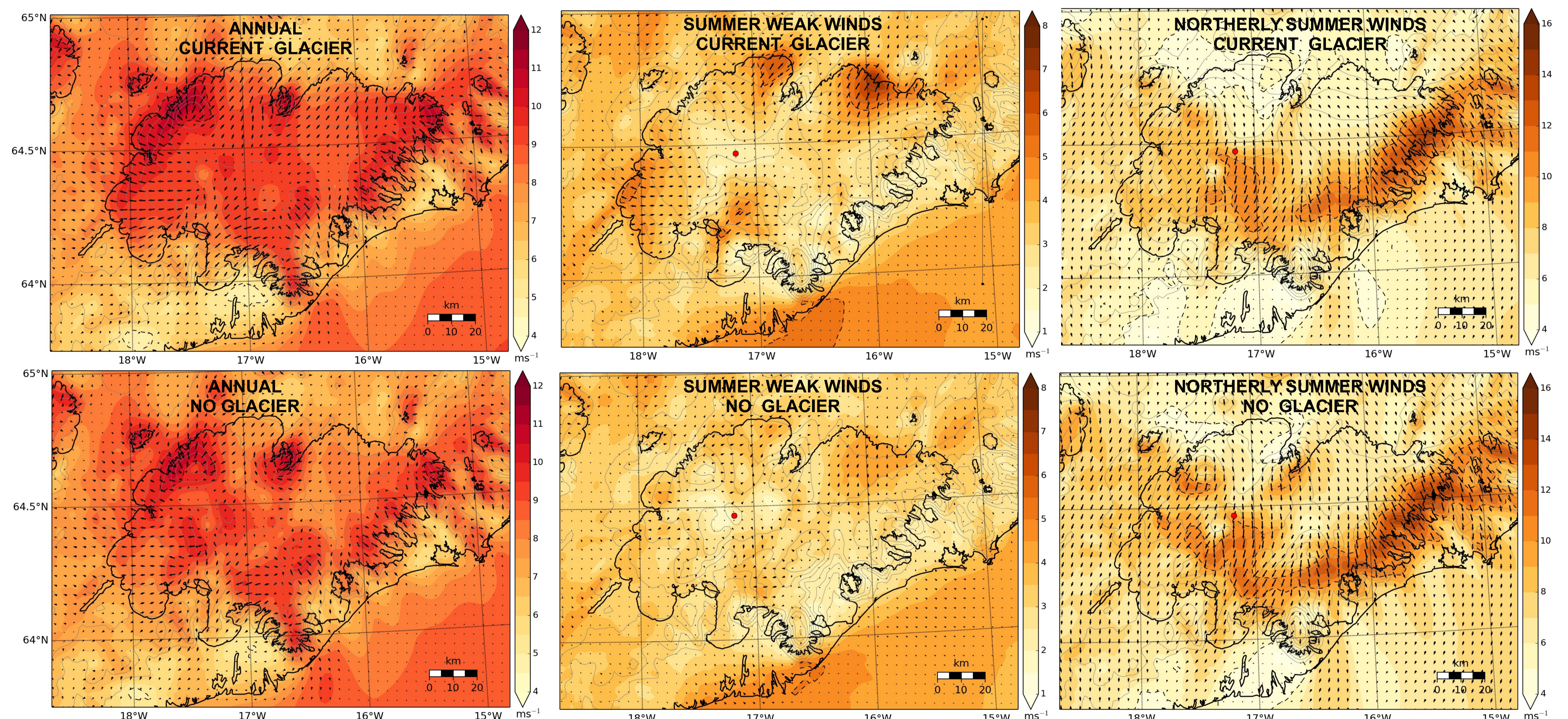
The large Icelandic ice caps have a significant effect on the mesoscale atmospheric flow in Iceland. To name a few; atmospheric blockings, downslope windstorms, extreme gust events at the south coast are all associated with orographically affected flow in and near the high topography of the ice caps.

To quantify the effect of the ice caps 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 ice caps have been removed and their bottom topography used instead of their 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.

Some of the key results for Vatnajökull ice cap in Southeast-Iceland include an increase in the annual mean wind near the ice cap due to the reduced topography height and weaker atmospheric blocking. Mean winds on the ice cap decrease, due to increased surface roughness and lower topography. Frequency of strong wind events near the ice cap decreases and patterns of diurnal winds near the ice edge change significantly.



Left: Thickness of Vatnajökull ice cap, i.e. difference in height of current glacial surface and the bedrock used as model surface in the sensitivity simulation. Right: Model topography at 2 km horizontal resolution in the control simulations, i.e. with current glacial surfaces.



Control run in upper row (current glacier) and sensitivity run in lower row (no glacier). Left: Mean annual wind speed and direction. Centre: Mean wind speed and direction during summer when the wind speed at the centre of the ice cap (red dot) is below 3 m/s. Right: Mean northerly wind speed during summer and with northerly winds at centre of ice cap (red dot).

Below: Difference in mean annual wind speed in sensitivity run (no glacier) and control run (current glacier).

Centre right: Mean wind speed (above) and relative frequency (below) of northerly winds during summer at Skeiðarárjökull, indicated with X in figure below.

Far right: Wind speed distributions during summer (above) and winter (below) at Skeiðarárjökull, indicated with X in figure below. Black bars show differences between sensitivity run (no glacier) and control run (current glacier)

