A short summary of glacier and climate changes in Iceland

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The current, main Icelandic ice caps are not remnants of the Ice Age ice sheet that covered Iceland during the Last Glacial Maximum around 18,000 years ago. During the warmest period of the Holocene (5000–8000 years ago), the large Ice Age ice sheet had disappeared and probably only small glaciers remained on the highest mountains. Cooler summers from ca. 5000 years ago led to expansion of glaciers in the highland. Tree logs found in the forefields of south-flowing outlet glaciers of Vatnajökull have been dated to about 2000 years ago, demonstrating that the corresponding valleys were ice-free at that time. Vatnajökull ice cap began to take on its modern form when glaciers from mountain ranges at elevations between 1200 and 2000 m coalesced. By the time of the settlement (around 874 CE), the glaciers had coalesced into a continuous ice cap, which was considerably smaller than at present. The other main ice caps probably formed around the same time.

Most Icelandic glaciers reached their maximum Holocene extent towards the end of the 19th century. Since then they have retreated and lost about 2100 km^2, or more than 15%, of their area. This retreat occurred primarily in two periods, during the mid-20th century warm period in the 1920's and 1930's, and again from 1995 to the present. In between these two periods, there was an interval when many outlet glaciers advanced, especially from the 1970's to the late 1980's. This temporary advance did not make up for the retreat during the two retreat periods, and from 2000 to the present, the area covered by the glaciers has been reduced by more than 750 km^2, or by ca. 40 km^2 per year on average.

The recent retreat of glaciers in Iceland has had considerable impact on water drainage from glaciers, with numerous lakes forming in front of retreating termini, and with glacier rivers changing course. The most notable example of the latter are the changes in drainage in the southern part of Vatnajökull where the glacier river Skeiðará changed its course in 2009 and now runs to the sea via the river Gígjukvísl, leaving the 880-m long Skeiðará-bridge covering mostly dry sand. A second much smaller bridge over the Morsá tributary has now replaced the older longer bridge. Changes in river discharge and river courses caused by glacier changes affect conditions for the operation of hydropower plants in Iceland, as well as for infrastructure such as roads, bridges and communication lines. Retreat and lowering of outlet glacier termini, furthermore, increases the danger for landslides from adjacent hillsides, which may cause dangerous tsunami waves in newly-formed terminus lakes and flash floods in rivers running from those lakes.

As glaciers thin and retreat, the underlying crust rebounds. The rate of uplift in Iceland is highest closest to the glacier margin where the greatest mass loss takes place and currently amounts to ca. 40 mm per year at the western margin of Vatnajökull ice cap. The removal of surface ice load may even lead to enhanced magma generation at depth and increased volcanic activity. How much ice loss is required to trigger such activity is not known at present.

Iceland has numerous glaciers and snow-clad mountains. Detailed mapping around the turn of the century found about 300 glaciers, but a repeat mapping in 2017 revealed that 56 of those did not exist anymore. Of these, the most prominent example is the Ok glacier in W-Iceland, but based on current trends, several other notable mountain glaciers are likely to vanish in the coming decades.

The likely future evolution of Iceland's glaciers and ice caps can be studied using scenarios of greenhouse gas emissions to make projections of climate change over Iceland. The climate projections are then used as input for glacier models to examine likely future changes in glacier mass balance. The results of such calculations indicate that the large ice caps may lose a considerable fraction of their current mass towards the end of the 21st century, with the Langjökull ice-cap losing up to 85% of its volume, but higher elevation ice-caps, such as Hofsjökull and much thicker and larger Vatnajökull losing up to 60%

and 30%, respectively. While such projections have considerable uncertainty, with continued warming, most glaciers in Iceland will not survive in the long term. In a business-as-usual emission scenario, Icelandic ice-caps will vanish in the coming centuries with the Vatnajökull ice cap (the largest one in Europe) surviving longest. In such a future climate, only snow fields and small glaciers may still survive on the highest mountain peaks.

More information:

www.vatnajokulsthjodgardur.is/en/areas/melting-glaciers

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