



Holocene glacier fluctuations at Fresvikbreen, western Norway, based on lacustrine sediments, quaternary geological mapping and historical observations

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Fresvikbreen is a small plateau glacier (c. 9 km², altitude c. 1642 to 1380 m) south of Sognefjorden, and about 100 km from the outer coastline in western Norway. Holocene glacier fluctuations are reconstructed based on two AMS radiocarbon dated lacustrine sediment cores from two proglacial lakes and quaternary geological mapping. Variations in the modern glacier magnitude have been reconstructed based on old maps, aerial photographs and satellite images from 1866 until 2014 AD, and show a rapid decreasing glacier during this time span. In accordance with the general deglaciation pattern in southern Norway, the retrieved cores show a high input of glacier-derived material during the deglaciation of the continental ice sheet. The glacier readvanced during the Erdalen Event (c. 10 cal ka BP), the Finse Event (8.2 cal ka BP) and had several small fluctuations from 7.3 cal ka BP until c. 6.2 cal ka BP). One of the studied lakes received glacier meltwater only when the glacier was in an advanced position beyond a local topographic threshold, and here a major glacier advance is recorded from c. 6.2-5.8 cal ka BP (400 years) before the glacier retreated behind the local threshold. Another major glacier advance beyond the threshold is dated to 4.5-3.8 cal ka BP before the glacier retreated again. This advance was followed by a period with minor and short-lived glacier fluctuations just beyond or behind the threshold. Two more distinct, but still minor advances, are dated to 1.56 cal ka BP and 1.12 cal ka BP followed by a retreat during the Medieval Warm Period. From then, an increase in glacial meltwater can be recorded in the sediment cores until the Little Ice Age glacier maximum was obtained about 1866 AD. The Fresvikbreen glacier was measured to be 28 ± 2 km² in 1866, 24 km² in 1911, 15.5 km² in 1945, 14.26 km² in 1964, 11.49 km² in 1983, 9.04 km² in 2006, and had its historical minimum extent in 2014 with the size of 8.89 km².