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Vatnajökull meltwater discharge variability: a Holocene climate sensor in the Nordic Seas

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The Holocene glacial history of Vatnajökull and its many outlet glaciers is rather poorly known, even though it is one of the largest ice caps outside Antarctica and Greenland. Vatnajökull is positioned in the centre of the Nordic Seas, the region for North Atlantic Deep Water formation and it is influenced by humid-bearing cyclone systems from the southwest. Thus, it can be regarded as a sensor for a combination of different climatic driven processes.
Lake Lögurinn (53 km^2, 20 m a.s.l), situated northeast of Vatnajökull, is part of the drainage system of Eyjabakkajökull, one of the most conspicuous surging outlet glaciers of the ice cap. In addition to glacial meltwater, the lake also receives discharge from rivers that drain non-glaciated catchments. The mix of glacial and non-glacial suspension makes the sediments suitable for analyses of how the fluvial regime has varied over time and how this relates to meltwater discharge, fluvial discharge and general changes in climate and hydrology.
A total of 17.8 m of sediment was obtained from the central part of the northernmost sub-basin in Lake Lögurinn at water depths of 38 and 16 m, respectively. The sediments are laminated in most parts of the sequence. ^{137}Cs analyses of the surface core have confirmed that the laminated couplets are varves. Tephra horizons have been used as time markers throughout the sediments, and X-ray fluorescence and X-ray analyses as well as visual observations have been used in order to identify varves in the uppermost 3.8 m of the sequence. This section covers the time period AD 1262-2005.
The sediment contains 610 varves for the periods AD 1262-1476 and AD 1603-2005 (a total of 618 years). A significant change in sedimentation rate is observed between AD 1477-1602 (from 5.9 mm/yr to 1.2 mm/yr). For this period only 18 varves are found. This abrupt change is likely related to a lower discharge rate, or to more turbulent conditions in the lake.
The sedimentation rate of the suspension delivered by the glacier-fed river correlates well to changes in Fe intensity, to changes in magnetic susceptibility and to changes in biogenic silica. The proxies show a cyclic pattern for the time period AD 1262-2005, each cycle spanning about 30-40 years, which could be related to a cyclic behaviour of the Eyjabakkajökull glacier. Possible explanations could be repeated surges, or recurring drainages of Háöldulón, an ice-dammed, lateral, partly supraglacial lake. Since AD 1890 surges have occurred about every 30-40 years, while the history of the ice-dammed lake is less known.
The laminations and the cyclic pattern in the sediment parameters disappear gradually close to the H3 and H4 tephras and are not found below the H4 tephra. This implies that the current drainage system has been more or less stable for the past ca. 3000-4000 years, and that the sedimentation in Lake Lögurinn was less influenced by glacial meltwater during the early to mid-Holocene.