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Winter time eastern North Atlantic climate variability during the late Holocene – changes in strength and spatial patterns of the westerlies

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Two records of Holocene July temperature and two records of glacier fluctuations from the west coast of Norway have been combined to express a south-north winter humidity index. Summer temperatures are inferred from transfer functions on pollen retrieved from lake sediment records. Continuous records of glacier fluctuations are reconstructed by the use of lake sediments from glacial-fed lakes. Through a multi-proxy approach, physical sediment variability is used to estimate former glacier size. The glaciers at the west coast of Norway are one of few proxies for winter time atmospheric circulation as the mass balance and thus glacier size are mainly controlled by the solid winter precipitation. It is earlier showed, by combining an independent proxy for summer temperature with reconstructed equilibrium-line altitudes (ELA) during the Holocene, how it is possible to reconstruct former winter precipitation. The two records of winter precipitation at the west coast of Norway indicate an anti-phasing between southern and northern Norway. As the distance between the two sites is 2000 km, they provide a robust signal of changes in the main track of the westerlies during the winter season. It is assumed that periods of increased winter precipitation along the coast of Norway are associated with strong westerlies. Differences in the winter precipitation distribution are assumed to reflect changes in the position of the westerlies. The largest precipitation anomalies occurred 2.8, 1.2 and 0.4 ka cal. yr BP. Based on the winter precipitation reconstructions, enhanced strength of the westerlies is inferred from 2.3 -0.9 ka cal. yr BP, and an increase in strength during the “Little Ice Age”.