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A new concept for the paleoceanographic evolution of Heinrich event 1 in the North Atlantic

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New records of planktonic foraminiferal δ18O and lithic and foraminiferal counts from Eirik Drift are combined with published data from the Nordic Seas and the "Ice Rafted Debris (IRD) belt", to portray a sequence of events through Heinrich event 1 (H1). These events progressed from an onset of meltwater release at $\sim$19 ka BP, through the 'conventional' H1 IRD deposition phase in the IRD belt starting from $\sim$17.5 ka BP, to a final phase between 16.5 and $\sim$15 ka BP that was characterised by a pooling of fresh water in the Nordic Seas, which we suggest was hyperpycnally injected into that basin. After $\sim$15 ka BP, this fresh water was purged from the Nordic Seas into the North Atlantic, which preconditioned the Nordic Seas for convective deep-water formation. This allowed an abrupt re-start of North Atlantic Deep Water (NADW) formation in the Nordic Seas at the Bølling warming (14.6 ka BP). In contrast to previous estimates for the duration of H1 (i.e. 1000 years to only a century or two), the total, combined composite H1 signal presented here had a duration of over 4000 yrs ($\sim$19–14.6 ka BP), which spanned the entire period of NADW collapse. It appears that deep-water formation and climate are not simply controlled by the magnitude or rate of meltwater addition. Instead the location of meltwater injections may be more important, with NADW formation being particularly sensitive to surface freshening in the Arctic/Nordic Seas.