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A unique preservation window capturing coastal-marine landscape evolution across the MIS5-4 cooling event (Late Pleistocene, North Sea Basin)

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The Late Pleistocene MIS5 - MIS4 transition (ca. 80-70 ka) is globally known to correspond to a major cooling event accompanied by a large decline in eustatic sea level. This transition must have radically changed coastal landscapes worldwide, affecting basin shape, salinity regimes, river courses, as well as biota. Most existing records are from either local lacustrine, ice core or distal oceanic records, while dated and continuous records from coastal environments are lacking. Within the southern North Sea Basin a unique record of coupled terrestrial-marine signals exists in the deposits of the Brown Bank Formation, covering the MIS5-MIS4 transition. Here, we target the Brown Bank Formation to produce a new integrated palaeoenvironment and -climate framework for the MIS5-4 transition and show biotic and abiotic environmental response to rapid cooling in a coastal area.

Multi-proxy records of lipid biomarkers, pollen, mollusk and diatom assemblages for the MIS5-4 transition in the center of the southern North Sea are combined with seismic facies determinations. The Brown Bank Formation consists of multiple facies representing multiple depositional phases around the MIS5-4 transition, and provides insights into the cooling of the terrestrial and shallow marine environments. On land, the vegetation changed from boreal forests to more open, grassland vegetation, combined with an increase in soil erosion. At the same time the shallow marine environment of the southern North Sea experienced subarctic to arctic marine conditions with a high input of soil material. These continued cool marine conditions have not been described earlier for this region and show that sea level remained high and lagged local cooling, as inferred from lipid-biomarker palaeothermometry. Assuming that this lag between sea-level and temperature change is common during cooling events, it is a potential mechanism creating sediment preservation windows during the onset of glacial intervals in shallow marine environments. Preserved records like the one presented here are valuable because they capture both the unique changes in cold marine environments, as well as informative terrestrial signals that are rarely preserved onshore.