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Coupled land-sea Miocene climate changes from the Southern North Sea Basin, NW Europe

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A shallow marine palynological record from the SE Netherlands documents the marine and terrestrial climate evolution from the Late Burdigalian (˜17 Ma) through the Early Zanclean (˜4.5 Ma). To refine the biostratigraphical age assessments, regional third order sea-level reconstructions, derived from palynological indicators and physical properties, have been correlated to long-term obliquity-paced glacio-eustatic sea-level changes with highstands corresponding to long-term maxima in amplitude of obliquity in both cores. This integrated approach can significantly improve shallow marine chronologies and allows access to high resolution climatic timeseries.

Results show several coeval climate phases in both sea surface (percent cool organic-walled dinoflagellate cyst [SST-dino]) and terrestrial (relative index subtropical vs. cool temperate pollen) relative temperature proxies. Hence, marine and terestrial Miocene climates in NW European seem closely coupled.

SST-dino decreases broadly correlate to third-order sequence boundaries and correspond to isotope glacial events Mi-3 through 7. An additional strong SST-dino decrease occurs around ˜8.4 Ma, coincident with a strong reduction (regional extinction) in subtropical pollen. This cooling correlates to a long-term minimum amplitude obliquity and maximum eccentricity orbital configuration that is often associated with glacial stages and lowered sea levels, but it has not yet been described from deep sea records of Oxygen-isotope ratios.

Our record demonstrates that shallow marine palynological records are very valuable

for both palaeoclimatic and stratigraphical purposes, especially for improving the outdated zonation scheme of Neogene continental vegetation in NW Europe, and for understanding the exact coupling between marine and terrestrial systems.