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Aeolian activity in the central coast of Portugal since the LGM and major atmospheric circulation shifts

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Along the Portuguese coast, transgressive dunefields represent relict features originated by intense and frequent westerly winds that largely contrast with present windfield regimes and coastal sediment budgets. The first is clearly dominated by weaker northwesterly winds while the second shows evident symptoms of sediment deficit represented by severe problems of erosion and land loss. Optical dating luminescence (OSL) and subsurface (GPR) stratigraphy document three age clusters indicating main episodes of dune mobilization during: last termination (20-11.6 ka), Middle Holocene (5.6 ka), and Late Holocene (1.2-0.98 and 0.4-0.15 ka).
We find reconstructed windfields to be analogous during all episodes and dominated by strong westerlies. Yet, larger grain size diameters, dune volumes, and longer travelled distances by the dunes formed during the last termination support amplified patterns during the deglaciation compatible with a southward shift and intensification of the North Atlantic westerlies during winters, accompanying the equatorward migration of the polar front. Conversely, dunes deposited after the Middle Holocene are compatible with more variable windfields and weakened patterns controlled by interannual shifts towards low values of the North Atlantic Oscillation (NAO) and relative blocking.
This work demonstrates that present windfield regimes in Southern Europe are not compatible with past aeolian activity. Indeed, present day analogs indicate that wind intensities compatible with past aeolian activity are rare at present, but can occur if the jet stream is diverted to the south (i.e. 30N with very low NAO index) or if very deep cyclones anchor around 50N, extending their influence to the western Portuguese coast (relatively low NAO index). However, these conditions represent temporary conditions lasting around one day, while the identified episodes of aeolian activity may represent semi-permanent conditions.