Impact of atmospheric circulation patterns on coastal dune dynamics, NW Spain

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1. Introduction

Aeolian dunes are the result of complex histories of alternating events of sand drift and dune stabilization. Natural dune stability and mobility are influenced by three major factors: climatic variables (i.e. wind, precipitation, moisture), sediment characteristics (i.e. availability, grain size) and vegetation cover (Klijn, 1990; Pye, 1993). Episodes of aeolian activity have been linked repeatedly to an increase of sediment supply (Davidson-Arnott and Law, 1996; Aagaard et al., 2004) and changes in climate conditions (Gaylord and Stetler, 1994; Tsoar et al., 2009). On the European coasts, enhanced storminess has often been invoked as a major causal factor for the initiation of dune activity (Clemmensen et al., 1996; Wilson and Braley, 1997; Wilson et al., 2001; Clarke et al., 2002; Clarke and Rendell, 2009; Costas et al., 2012). However, the actual mechanism responsible for the reactivation of aeolian activity in coastal systems remains poorly understood (Bailey and Bristow, 2004; Buynevich et al., 2007; Girardi and Davis, 2010).

Currently, most European coastal dunes have undergone a progressive stabilization as vegetation cover expanded, but the causes behind such a landscape shift remain under debate (Bailey and Bristow, 2004; Costas and Alejo, 2007; Arens et al., 2008; Jackson and Cooper, 2011). Several factors have frequently been inferred as possible causes for the growth of vegetation in coastal dunes, including anthropogenic pressure (i.e. changes in land use, landscape fixation, introduction of non-native species); semi-natural factors (i.e. crashing rabbit populations, eutrophication) or climatic-derived changes (i.e. enhanced CO2 concentration and temperature, diminished wind and storminess); see Provoost et al. (2011) for a review.

From a climate variability perspective, increased emphasis has been put on the role played by the most important large-scale mode of atmospheric circulation in the North Atlantic. The climate of Galicia, located in the northwestern corner of the Iberian Peninsula has been reviewed in detail in a recent special issue (Gimeno et al., 2011). It has been noticed that a relatively small number of these modes are responsible for a large fraction of the wind and precipitation

Footnotes:

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