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Quantifying coastal erosion rates using anatomical change in exposed tree roots at Porquerolles Island (Var, France).

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Rocky coasts are the most common type of ocean–land contacts and can be found in all types of morphogenetic environments. Most work on rocky environments focused on the impacts of modern sea level rise on cliff stability derived from sequential surveys, direct measurements or erosional features in anthropogenic structures. Studies mainly focused on rapid erosion so that little is known about erosion rates of the French Mediterranean coastal area.

Using anatomical reactions in roots, has been successfully used in various environments in the past to quantify continuous denudation rates, mostly in relation with gullying processes (Vandekerckhove, 2001; Malik, 2008), aerial (or sheet) (Bodoque et al., 2005; Lopez Saez et al., 2011; Lucia et al., 2011), river bank (Malik, 2006; Hitz et al., 2008a; Stoffel et al., 2012), or lake shore (Fantucci, 2007) erosion, but never so far on coastal cliffs environment.

This study aims at exploring the potential of dendrogeomorphic approach to quantify multidecadal changes in coastal environments on Porquerolles Island (Var, France). We sampled 56 discs from Pinus halepensis Mill. roots on former alluvial deposits eroded by present day sea level (escarpments of a few meter in height) and on sandy-gravelly cliffs. We were able to dates erosion pulses as well as changes in cliff geometry with annual resolution over 30-40 years showing an average erosion rate of 2.1 cm yr-1. Our results are consistent with those found in the study of Giuliano (2015) on Mediterranean coastal environment.

This contribution therefore demonstrates that dendrogeomorphic analyses of roots clearly have significant potential and are a powerful tool for the quantification of multidecadal cliff retreats rates in areas where measurements of past erosion is lacking.

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