

ABSTRACT

Coastal cliffs represent 80% of the world's coastlines and are subject to various transformation processes, of which erosion. Cliff erosion requires precise quantification measures in order to understand and apprehend the phenomenon. In this study, a combination of two methods, dendrogeomorphology and photogrammetry, is suggested to improve the accuracy of current erosion quantification methods. A total of 34 segments from 7 Aleppo Pine roots were microscopically analyzed, allowing to estimate the date of root exposition and consequently of erosion. Then, root/cliff distance measurements were performed using a depth gage and photogrammetry to determine erosion rates specific to each method. At Carry-le-Rouet, the mean erosion rates were valued between 1.34 cm y⁻¹ and 1.78 cm y⁻¹ using distance measurements from the depth gauge and photogrammetry respectively. The highest rates were observed in the western part of the study area, near the Anse du Rousset, where the deposits are composed of marly limestone (1.83-2.37 cm y⁻¹). In contrast, lower rates were observed in the eastern part of the study area, near le Port du Rouet, where deposits are mainly conglomeratic (0.26-0.46 cm y⁻¹). The comparison of erosion rates from the two types of measurements shows slight differences for most roots except for roots' segments in contact with the cliff (RA1.7 to RA1.15) and for complex areas such as zone 7 containing roots 11 and 12. The reliability of combining the two methods is demonstrated when comparing the erosion rates obtained in this study with other rates around the Mediterranean Sea and oceans. The present work highlights the necessity of providing clear guidelines for root sampling and root/cliff distance measurement done by photogrammetry. This study shows that within defined study conditions, the combination of dendrogeomorphology and photogrammetry provides accurate information on cliff erosion rate.