On the Determination of Triggering Factors of Coastal Chalk Cliff Collapses in Upper Normandy

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INTRODUCTION

The coastline of Upper Normandy (France) is made up of a 130-km long chalk cliff in the central and the oriental parts of the English Channel shoreline (Figure 1). Spatial variability of cliff recession occurs due to layer variations in local lithology (Figures 2 and 3) and the influence of natural and man-made obstacles to the longshore drift. Such cliff retreat is locally different and its rate can reach up to one meter per year.

To determine triggering factors, we applied a principal component analysis (PCA) over a 10-day period. Through the role of rainfall, tidal range, and wind seem to be preponderant, the factor analysis points to the high complexity of the process of collapse triggering (Figure 10).

The index in a wet context (Figure 12) is a good indicator of coastal collapses. Higher index coefficients correspond with greater numbers of collapses. Some of these seem to be linked to runoff (Figure 13).

This index allows us to identify 10-day periods that are conducive to coastal collapse in order to improve risk prevention.

RESULTS

The analysis deals with the statistical definition of the relationships between processes and the collapse (Figure 9).

REFERENCES


CONCLUSIONS

It is difficult to classify the processes that trigger coastal chalk cliff collapses. Indeed, numerous combinations of factors, and the phenomena of process shifts, or even hysteresis effects, draw a more complex link between triggering agents and coastal cliff falls. However, we have identified periods of high probability of triggering due to main continental factors. This index will prove to be a useful tool in warning and protecting the human population.