Geophysical Research Abstracts
Vol. 21, EGU2019-4904, 2019
EGU General Assembly 2019

High-resolution monitoring of the “Vaches Noires” cliffs by multi-method analysis: characterization of hydrogravity processes and induced dynamics (Normandy, France)

Thomas Roulland (1), Olivier Maquaire (1), Stéphane Costa (1), Robert Davidson (1), Vincent Compain (1), Augustin Sallent (1), Mohand Medjkane (1), Cyrille Fauchard (2), and Raphael Antoine (2)

(1) Normandie Univ, UNICAEN, CNRS, LETG-Caen, 14000 Caen, France, (2) Cerema, ENDSUM, Le Grand Quevilly, France

Located at the northwestern edge of the « Pays d’Auge » plateau (Normandy, France), the « Vaches Noires » cliffs are unique on the French coast. With a height around 120m, they are characterized by a badlands morphology. These 4.5 km long cliffs are composed of Jurassic clayey-marly and limestone benchs, topped by a thick chalky series of the Upper Cretaceous. Each evolve under the combined action of subaerial and marine processes.

In detail, evolution of these coastal slope profile evolves, in the upper part, by slides and falls of limestone/chalky blocks. Middle and basal part of cliffs are affected by active mudslides with various modalities of evolution, forming a chaotic morphology. Cliff’s foot is marked by a scarp of metric to multi-metric amplitude (defined as coastline for our study) which is undermined by swells. This scarp alternates between erosion phases and accumulation phases through input of materials from the upstream coastal slope. The non-linear functioning in time and space are the result of relays and combinations of processes that we want to quantify. Thus, a study at different spatial and temporal scales is carried out:

- An analysis of the whole cliffs (4.5 km) at historical (257 years) and recent (69 years) scale with three morphological indicators: main upstream scarp, secondary scarp and basal scarp;

- Since September 2014, a high-resolution spatial and temporal monitoring has been carried out in an active sector. Purposes are to determine spatial distribution of cliffs evolution, to estimate cubature and agents/processes responsible of gravitational movements triggering. To this end, photogrammetric surveys (using “Structure from Motion” methodology) and terrestrial laser scanner were used at high resolution and frequency (terrestrial photogrammetry: 7-8 surveys/year; UAV photogrammetry: 2-3 surveys/year; TLS: 3-4 surveys/year). 3D models created are associated with surface displacements values measured with nine single-frequency GPS (“geocube sensors”), as well as the main factors responsible for hydrogravity movements (measured with six piezometers, one rain gauge).

On one hand, This work presents rates (decimetric to multi-decimetric) and periodicity of evolution of the chosen morphological indicators. On the other hand, thresholds of rainfall, groundwater table and swells favourable to the hydrogravitational movement triggering affecting the “Vaches Noires” cliffs are estimate. In a context of global change, this study can provide keys of understanding to the different actors or territory managers of these coastal areas.