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Methodology for the predictive mapping of flat terrains within a catchment, by semi-automatic analysis of the Digital Elevation Model

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Abstract

The knowledge of surface geological formations over the metropolitan French territory is very much heterogeneous: sometimes well represented for their contours and descriptions, sometimes absolutely absent when they can be observed on the field. The implementation of systematic and continuous acquisitions programs at appropriate scales all over the territory cannot be intended considering vastness of the country. Therefore, finding solutions to help the mapping of subsurface geological objects in order to increase the knowledge is likely to be a relevant strategy in which the BRGM has been committed for some years.

One of the research approach consists in defining methodologies for predictive mapping by image processing and analysis with validation through field feedbacks. As part of the cartographic identification of alluvial formations, we developed a methodology based on the Digital Elevation Model (25m precision from IGN (French geographical service)) and its declinations (curvature, slope, its difference with base level etc.). The implemented workflow provides a predictive map representation of morphological terrace levels as well as the colluvium from the valley bottom or lower hillside.

We developed this methodology of semi-automatic mapping by topography analysis on a selected test area in the Pyrenean foothills (sub-watershed of the Gave de Pau). A field campaign on the basins of Baïse and Ousse rivers allowed us to compare the results of the predictive cartography and the geological reality. The first results show that the proposed analysis is relevant at the scale of a multi-kilometer catchment, not affected by faults. The methodology provides valuable support for the mapping of these superficial formations, in particular by significantly saving time when drawing the map. It was noted that the estimation of the alluvial system base level was a key point in our modeling, then several interpolation methods were compared.

The development of a graphical interface allowing all the catchment analysis to be carried out in a single application will make it possible to produce predictive maps quickly and to help with the cartographic identification of alluvial stepped formations