Trafficability assessment for flood hazards management in tropical regions using Virtual Globes imagery

Raphael KOURDIAN

Ecole des Mines de Paris
60 Bld Saint Michel – 75006 Paris – France
raphael.kourdian@ensmp.fr

Gilles LEROUGE
Thierry ROUSSELIN

Géo212
3 Square de Chatillon – 75014 Paris - France
gilles.lerouge@geo212.com

Trafficability forecast of land paths in tropical countries is a major issue which governs the set up of humanitarian and logistical responses to natural geohazards. This need must be addressed during pre-emptive phases as well as real time operations, in order to constrain itineraries during emergency hands-off. To integrate those diagnostics in operational systems and spread them over large territories, their cost must be minimal. Finally, they must be reliable over various climatic regions and landscapes.

The actual situation is characterized by the inability to provide a reliable trafficability forecast without in-situ measurements. When geotechnical tools are used (penetrometric, scissometric, vibrating table), terrain characterization diagnostics face many problem to widen these measurements to adjacent surfaces. Aerial geophysical survey provides an adequate answer, but flights are costly and not always easy over remote areas. Consequently, various approaches have been tested using satellite imagery (optical and radar) but they are so far inadequate to offer generic and reliable results.

Our approach relies on a new positive background of satellite sensors technological maturation (all-resources and all-resolutions), opening some new ways of researches once blocked by a lack of potential suitable resources, and upon the online geographical open sources democratization. Our objective is to provide trafficability diagnostics fitted to tropical areas, based upon satellite imagery.

We are drawing on open sources data (data mining algorithms, daily low resolution imagery and high resolution virtual globe imagery), whose integration supply some semantic information allowing to lead project specific imagery interpretation (and reduce its need and associated cost).

Because open resources reliability is still on debate, institutions and companies hesitate to include those kinds of sources in operational workflows. Hence, a part of our work has led to validate the relevance of these resources options. It is suggested to compare the quality of land use/land cover extraction (and its associated risk during flooding) produced from a single multispectral Quickbird image, and from its colour composite available on Google Earth. Land use extraction is obtained from two classification methods (Support Vector Machine and Object Oriented algorithms), and compared to a photographical interpretation made by a thematic image analyst. The reliability of the Google Earth image interpretation is confirmed if spectral properties and objects shapes (continuity, homogeneity and geometry) are maintained.

We are concretely focusing this approach over Chad, where floods and floods risks reduce mobility over the southern half of the country during the rainy season. Assessing the risks gives a chance to optimize the logistical operations and to allow controlling flood related hazards.

On these landscapes, our tests are showing that colour composites available on virtual globes like Google Earth, turn out to be a profitable option in replacement of genuine Very High Resolution Imagery because it allows a relevant quality of thematic interpretation.