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Combining Landform Thematic Layer and Object-Oriented Image Analysis to Map the Surface Features of Mountainous Flood Plain Areas

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The Typhoon Morakot on August 2009 brought more than 2,000 mm of cumulative rainfall in southern Taiwan, the extreme rainfall event caused serious damage to the Kaoping River basin. The losses were mostly blamed on the landslides along sides of the river, and shifting of the watercourse even led to the failure of roads and bridges, as well as flooding and levees damage happened around the villages on flood bank and terraces. Alluvial fans resulted from debris flow of stream feeders blocked the main watercourse and debris dam was even formed and collapsed. These disasters have highlighted the importance of identification and map the watercourse alteration, surface features of flood plain area and artificial structures soon after the catastrophic typhoon event for natural hazard mitigation.

Interpretation of remote sensing images is an efficient approach to acquire spatial information for vast areas, therefore making it suitable for the differentiation of terrain and objects near the vast flood plain areas in a short term. The object-oriented image analysis program (Definiens Developer 7.0) and multi-band high resolution satellite images (QuickBird, DigitalGlobe) was utilized to interpret the flood plain features from Liouguei to Baolai of the the Kaoping River basin after Typhoon Morakot. Object-oriented image interpretation is the process of using homogenized image blocks as elements instead of pixels for different shapes, textures and the mutual relationships of adjacent elements, as well as categorized conditions and rules for semi-artificial interpretation of surface features. Digital terrain models (DTM) are also employed along with the above process to produce layers with specific “landform thematic layers”. These layers are especially helpful in differentiating some confusing categories in the spectrum analysis with improved accuracy, such as landslides and riverbeds, as well as terraces, riverbanks, which are of significant engineering importance in disaster mitigation.

In this study, an automatic and fast image interpretation process for eight surface features including main channel, secondary channel, sandbar, flood plain, river terrace, alluvial fan, landslide, and the nearby artificial structures in the mountainous flood plain is proposed. Images along timelines can even be compared in order to differentiate historical events such as village inundations, failure of roads, bridges and levees, as well as alternation of watercourse, and therefore can be used as references for safety evaluation of engineering structures near rivers, disaster prevention and mitigation, and even future land-use planning.

Keywords: Flood plain area, Remote sensing, Object-oriented, Surface feature interpretation, Terrain analysis, Thematic layer, Typhoon Morakot