STREAM MORPHOLOGICAL ANALYSIS BY AIRBORNE LASER ALTIMETRY AND FRACTAL DIMENSION

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ABSTRACT

The stream morphology may present different stages of fluvial processes by characteristics and sediments of various stream flow conditions; it played an important role for the stream cumulative stress. The stream morphology is being adjusted by the incoming stream flows as well as the sediments been carried. In Taiwan, streams are showing a very complicate topography due to the high eroding capability caused by secondary disasters such as landslides and debris flows after heavy rain or typhoon. Nevertheless, to understand the balancing characteristics between incoming flow and sediment regime is an important task for disaster prevention.

Quantifying the morphology along a river channel has been proven difficult; till the airborne laser altimetry technology was implemented in the survey. In this study, the remote sensing techniques are employed to assist the studies on stream roughness distribution and morphological investigation. The results are proven to be valuable for hydrological and engineering applications.

The stream roughness was derived from Light Detection and Ranging (LiDAR) records of Airborne Laser Altimeter. Data of the pre-disaster and the post-disaster were compared to determine the variability of stream morphology. Even the stream sediment grain size cannot be determined by high accuracy and high resolution LiDAR, topographic data can still be described as self-affined random fractals; namely, allowing fractal dimension to be implemented to understand the topographic roughness. In general, the greater the fractal dimension of the surface has, the rougher the surface is. In this study, fractal dimension are employed to evaluate the stream morphology. The results showed that the upper-reaches demonstrate higher roughness values than the lower-reaches; the materials from debris flow and landslides also influence the incoming flow and sediment carrying capacities.

Keyword: Fractal Dimension, LiDAR, Stream Morphology, Debris flow, Landslides