Technical Developments for the Geomorphological Reconstruction of Palaeo Ice Sheets from Remotely Sensed Data

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Title:

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Summary:

Ice sheet reconstructions are concerned with an understanding of the dynamics of palaeo ice sheets through time. This involves ascertaining the configuration of ice domes and flow patterns, as well as the evolution of glaciation and deglaciation. The use of remotely sensed data (radar and visual/near infra-red imagery) has been a key development in these studies, allowing the rapid mapping of individual landforms over large areas. These data sources record electro-magnetic reflectance of an illuminated landscape which leads to the introduction of random and systematic bias'. This research explores the propagation of these bias' and recommends that, in order to obtain optimum imagery, sensor spatial resolution is <30m and solar elevation is <20º at acquisition. More problematic is the selective bias introduced by the solar azimuth in relation to the orientation of linear landforms. This cannot be removed and requires a good knowledge of the study area or an additional primary data source (e.g. radar or digital elevation model).

DEMs are rapidly supplementing, and in many cases replacing, satellite imagery in landform mapping. However as they record surface elevation, rather than surface reflectance, they should be able to provide a bias-free data source for landform mapping. Methods by which the landscape can be visualised are explored with the purpose of providing a bias free method, although no single visualisation was found to be satisfactory. A suitable mapping strategy was developed through the application of these methods to the mapping of glacial landforms from a DEM of the Lake District.

Once landform mapping has been completed it is common for mapped landform data to be generalised in order to reduce their complexity and so aid interpretation. This is usually a manual technique that involves reducing several thousand individual lineaments to summary lines. The thesis concludes with the development of a set of tools to help with this manual process, as well as provide quantitative verification. This is then applied to the landforms mapped from the Lake District in the previous chapter. A method for the automation of this procedure is also suggested.

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