Geophysical Research Abstracts
Vol. 15, EGU2013-5196, 2013
EGU General Assembly 2013

Towards a LiDAR based geomorphological database of Sweden

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Geomorphological maps can be important for both societal development and scientific research especially with the use of new technology and consideration for the end user's needs. Since 2009, the Swedish mapping agency (Lantmäteriet) has been using airborne light detection and ranging (LiDAR) to create a detailed "bare earth" digital elevation model (DEM) of Sweden. Presently, a LiDAR derived DEM with 2 m horizontal and 0.25 m vertical resolution exist for about half of the country. This data set enables viewing of the landscape in a new more detailed way; landforms never before seen can now be delineated easily in a desktop environment. We are using this DEM to map the geomorphology, bringing into existence a highly detailed, digitial, geomorphologic database and map.

While prior geomorphological maps exist for Sweden, the new map being compiled by the Geological Survey of Sweden (SGU) will be the first one to be derived from and presented in an entirely digital format. With the use of GIS technology, it is possible to present a map with different layers and symbology depending on the scale of the area of interest. For example, when looking at a map at a small scale, every moraine within a moraine complex is visible, but when viewed at a larger scale the moraine complex is presented as a single object. The digital presentation allows users to select scale-appropriate geomorphological data to their needs. By coupling other SGU or external databases with the geomorphological database it is possible to produce a wide range of products suitable for a wide range of uses. For example, by adding bedrock or geochemical data to landforms indicative of ice flow direction, a product useful for mineral prospecting is created. Other derivative applications may include groundwater studies or evaluation of geoheritage areas.

Regarding scientific applications, the new LiDAR data have enabled mapping of geomorphic landforms in greater detail than previous Swedish maps. In addition to refining the locations and dimensions of previously mapped landforms, features never described before have been brought to light. These features include terminal moraines and cross-cutting glacial lineations. At small scales, these newly mapped landforms show signs of a complex glacial history. On a larger scale, landforms indicative of ice flow direction can be used to create a gridded map of ice flow directions useful for glaciological modelling.