Geomorphological mapping: testing NEXTMap against field mapping of glacial landforms and other remotely sensed data

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Introduction

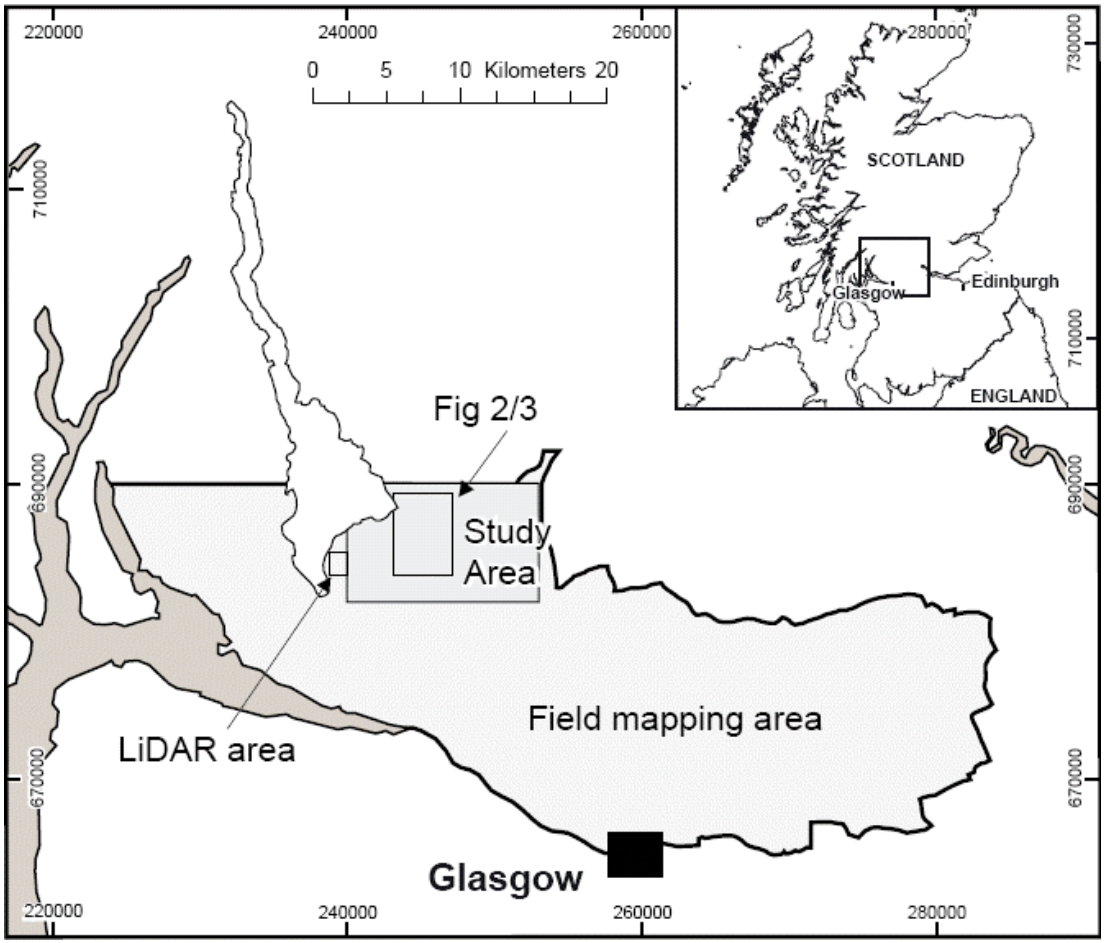
- Mapping is used extensively to determine the extent and distribution of glacial landforms
- Can include generalised summary mapping or detailed geomorphological mapping
- Originally (and often still) performed in the field
- Remote sensing mapping techniques include:
  - aerial photography
  - satellite imagery
  - digital elevation models (DEMs)

Introduction

- Remote sensing offers the following benefits:
  - rapid
  - cheap
  - areal coverage
- The focus of this presentation is on **accuracy** of NEXTMap with respect to the high resolution field mapping, satellite imagery and DEMs
- Field mapping is based on access to detailed geomorphological field maps of over 750 km^2 of terrain

Study Area

- Study site located in an area of central Scotland last glaciated during the LGM and YD
- Detailed geomorphological mapping was recorded on 1:10,560 Ordnance Survey base maps, later transferred to 1:25,000 maps



- Assessed accuracy: vertical (<1m), horizontal (2m – 10 m depending on location)

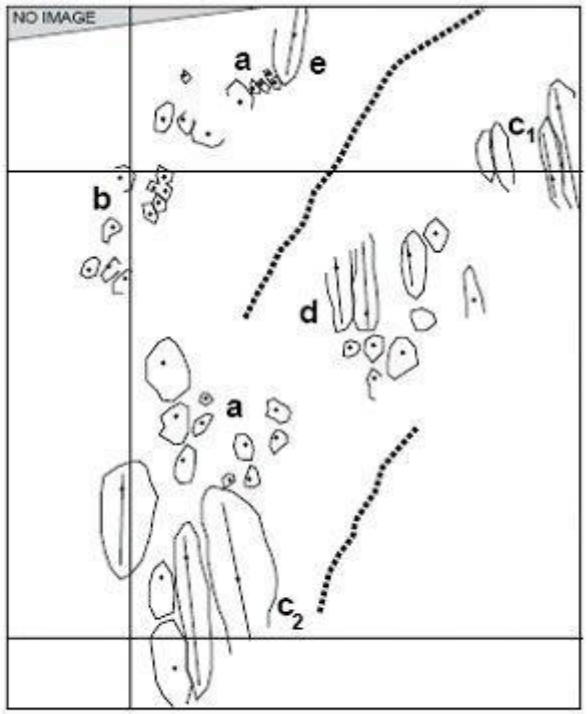
Quality of field mapping - a test against LiDAR

- Access to high quality LiDAR data (2 m spatial resolution) for a small area (1.5 km^2) enabled limited validation of the field mapping.

A LiDAR

0 120 240 480 Meters

B Field Mapping at 1:10,560 scale



C Digitized from LiDAR

Method

- Field mapping was then used as a reference data set against which to test different remotely sensed data products for a 100 km^2 subset.
- Data sets are national products

Data Sets

	Image Number	Nominal Resolution (m)	Relative Vertical Accuracy (m)	Acquisition Date
Field Mapping	3a	<1	1	1965-1970
Digital Elevation Models				
Shuttle Radar Topography Mission C-Band	3f	90	6	11/02/2000
Landmap	3e	25	20	1995-96
OS Panorama®	3d	50	5	Maintained until 2002
OS Profile®	3c	10	5	Maintained
NEXTMap	3b	5	1	2002-03
LiDAR	4	2	0.25	03/2003
Satellite Imagery				
Landsat Thematic Mapper	3g	30	-	23/10/1986

Field Map

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NEXTMap

Field Map

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OS Profile

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Field Map

OS Panorama

Field Map

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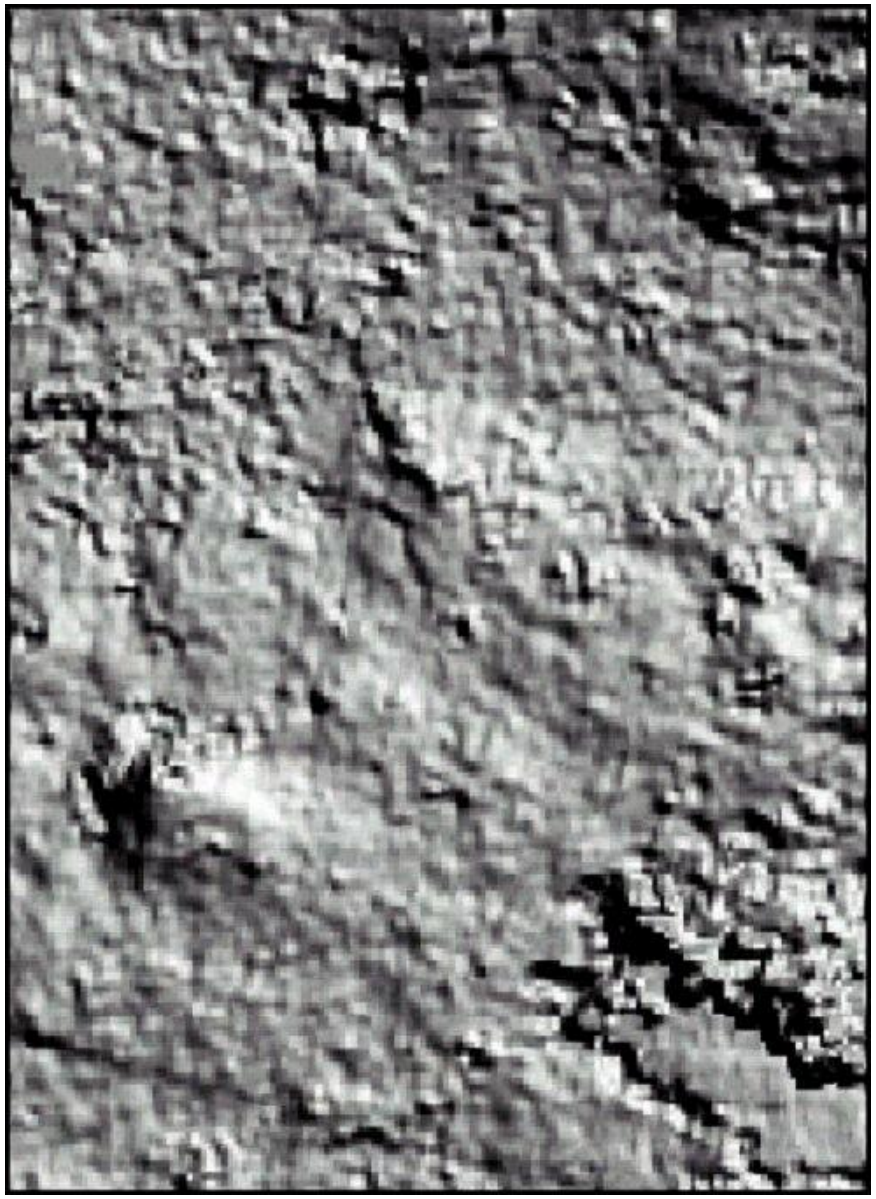
Landmap



Field Map

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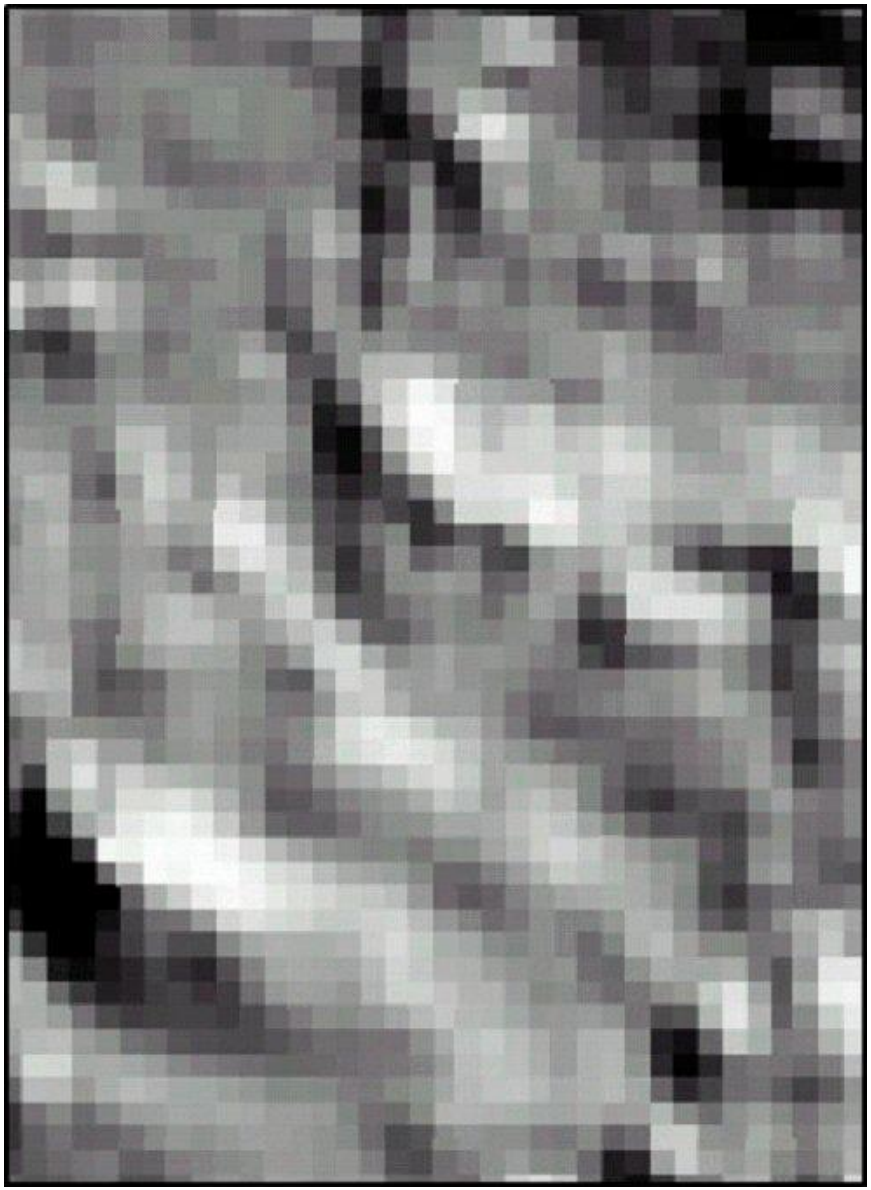
SRTM



Field Map

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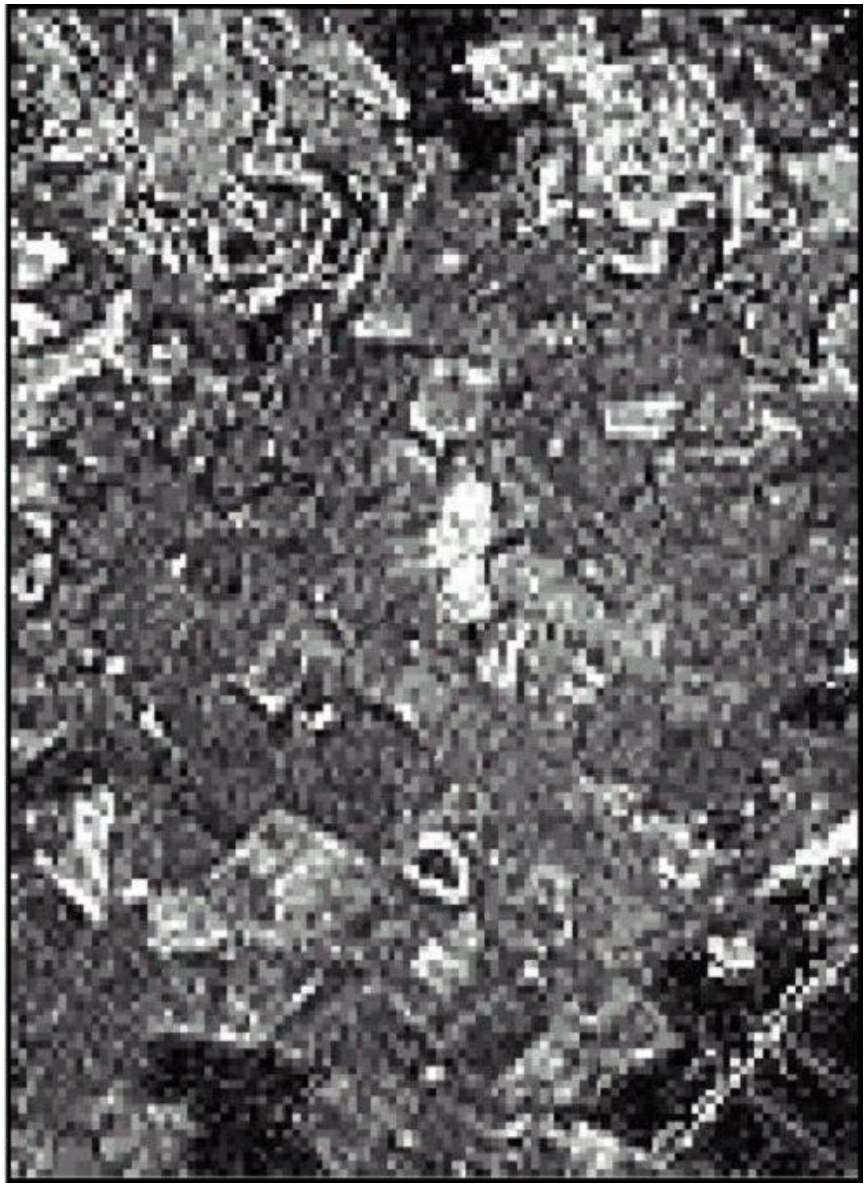
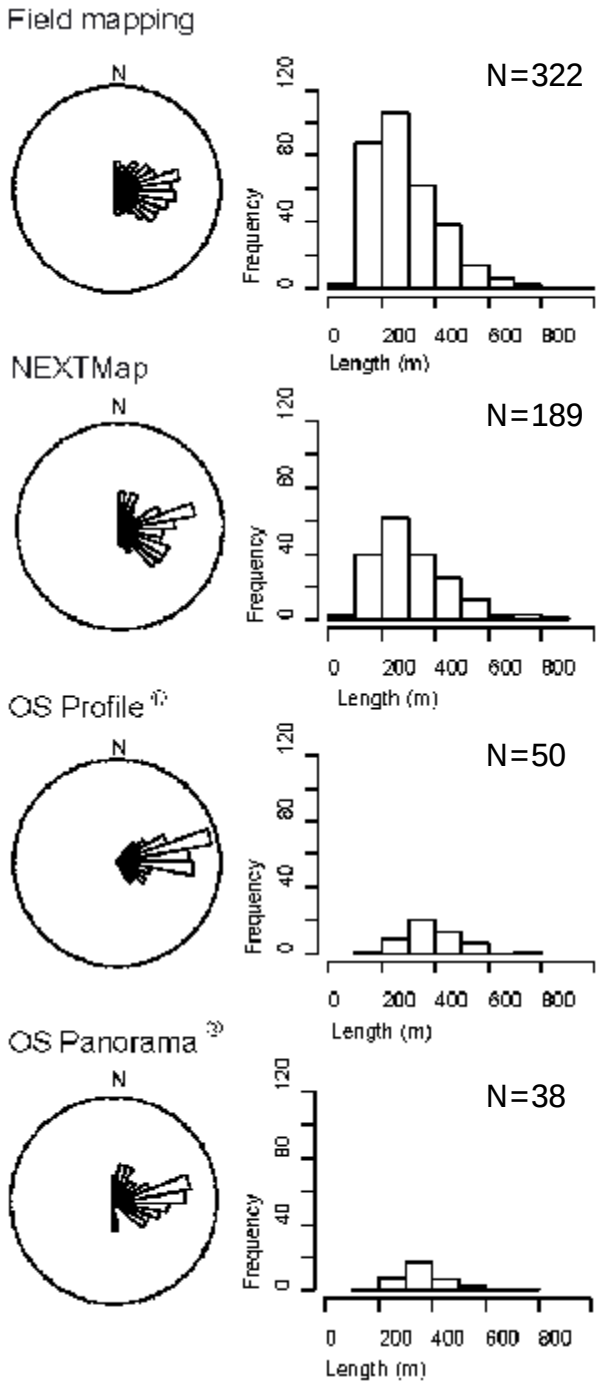
Landsat TM



Quantitative methods testing accuracy

- number of landforms mapped
- similarity of drumlin length, width and elongation ratio
- orientation
- positional accuracy



Fine resolution problems

- Remotely sensed data fails to recognise the textural differences of small features.
- Sedimentary evidence may be necessary in order to interpret landform genesis

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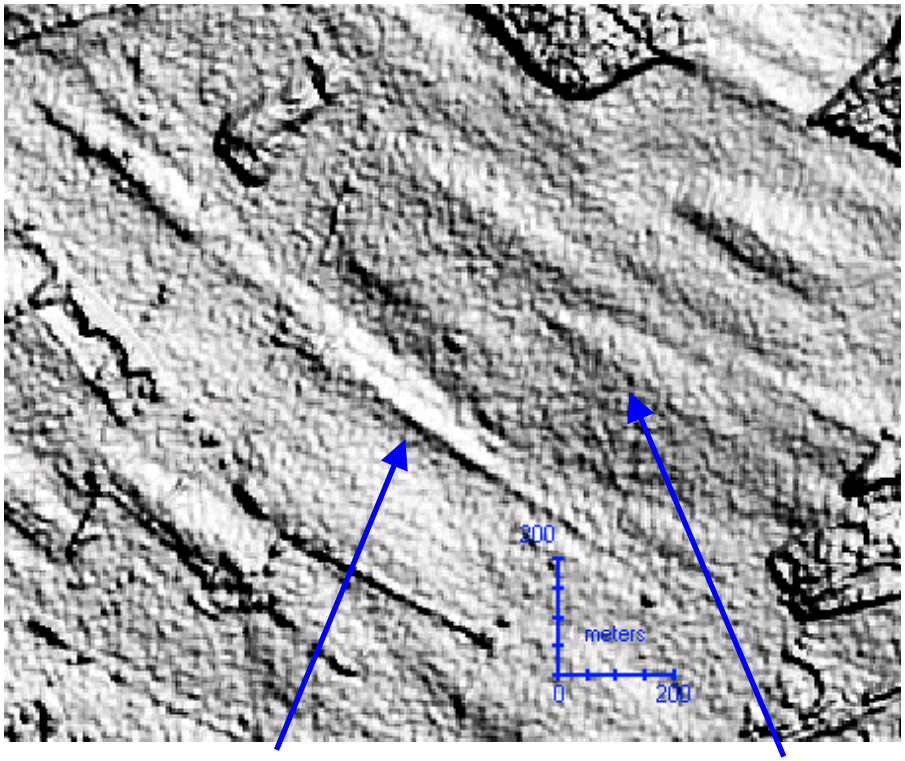

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drumlin

Conclusions

- NEXTMap (5m) produces the “best estimate” of ground truth of any remote sensing method except LiDAR
- OS Panorama (50m), OS Profile (10m) give poor estimation
- SRTM (90m), Landmap (25m) give virtually no information
- Landsat TM (30m) gives no information

Conclusions continued

- Significant numbers of landforms are still mis-represented with NEXTMap, however the mapping remains meaningful.

- Affordable satellite imagery is unsuitable for high quality geomorphological mapping.

- Sedimentary, *as well as* morphological, evidence may be required otherwise misinterpretation can occur