Calving Front Location Extraction of Antarctic Peninsula from TanDEM-X DEM Products

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I Abstract

As one important parameter of ice dynamics, the calving front location (CFL) of outlet glaciers and ice-shelf reveals the dynamic response of the glaciers or ice shelves to the changing ocean circulation or warming climate as well as the structural conditions.

It is very challenging to automatically extract CFLs from the optical and SAR remote sensing images especially along complex coastlines like on Antarctic Peninsula (AP). The major difficulty lies in distinguishing different surface types with similar optical spectral or radar backscattering characteristics. Our proposed method is an attempt to replace the manual delineation of CFL still used to derive such geophysical products e.g for the Antarctic Digital Database (ADD) coastline.

Our research work includes the following:

- As data source for automatic CFL extraction we used high-resolution DEM;
- We generate a novel feature image based on DEM roughness and elevation;
- The path propagation method is applied to the feature image for automatic CFL extraction;
- Validation of the extracted CFL with the ADD coastline.

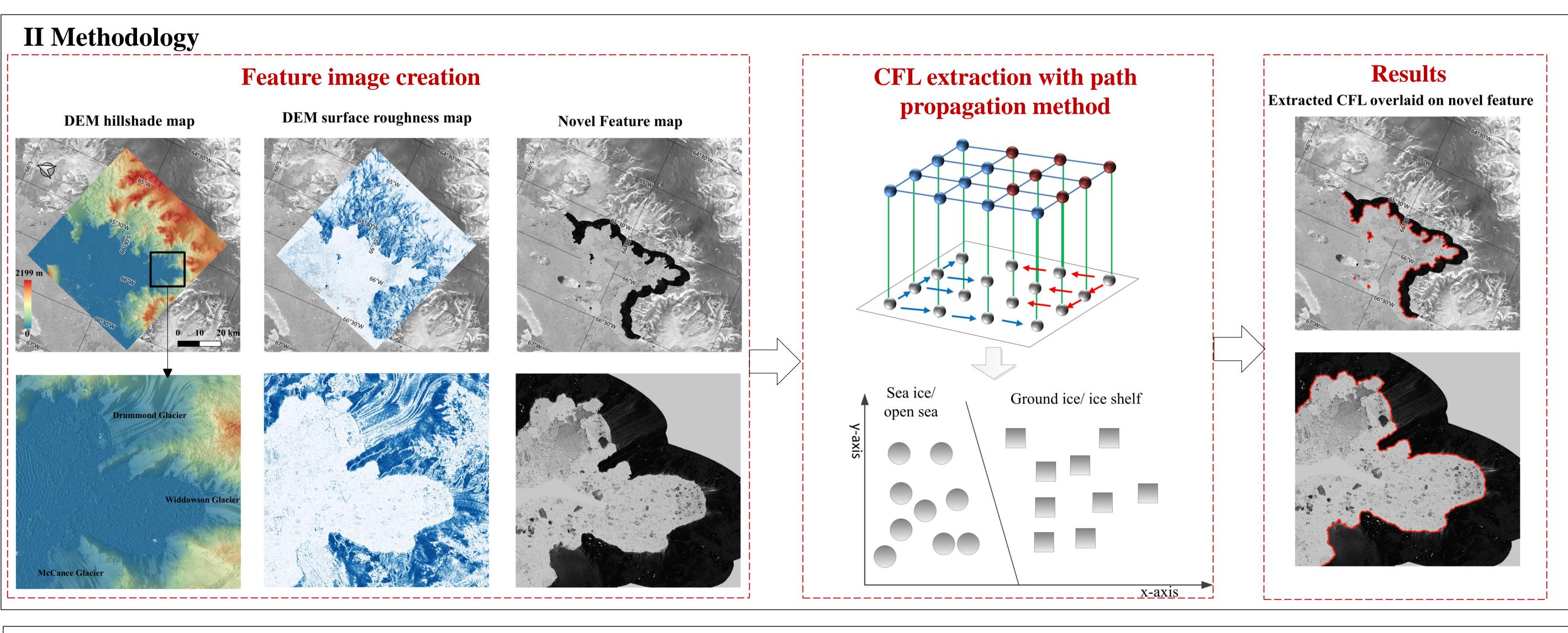The TanDEM-X global DEM with 12 m posting is used as experimental data in the Darbel Bay located on the western coast of AP (Figure 1). In the future the proposed method will be tested on the whole AP coast with the 12 m TanDEM-X global DEM as well as with time series of TanDEM-X DEMs.
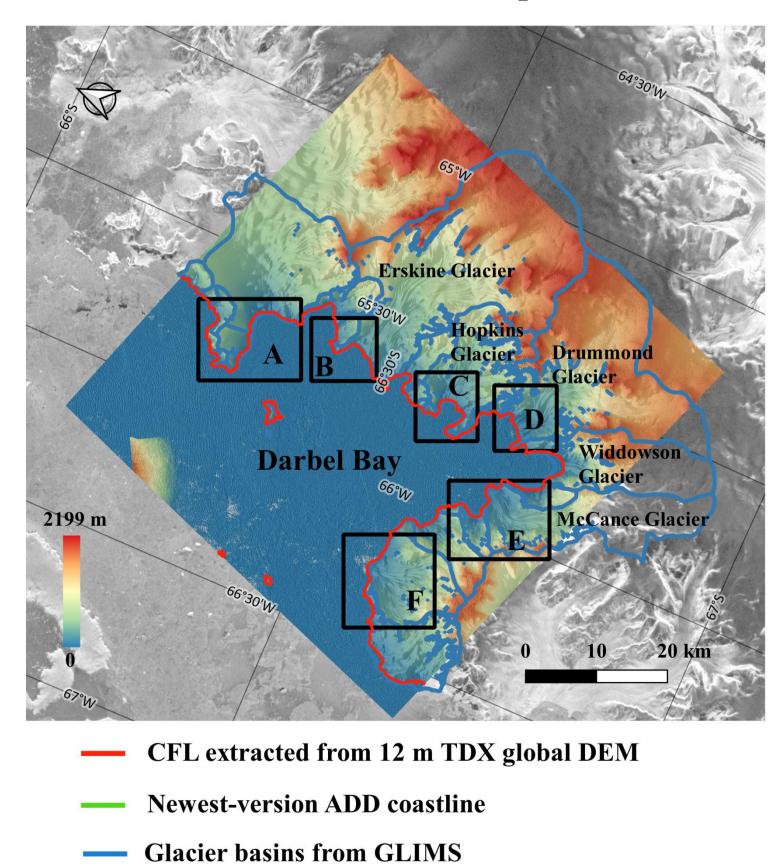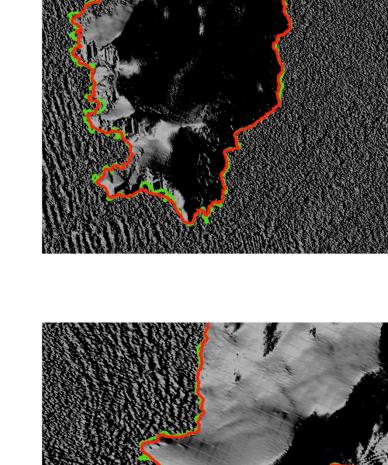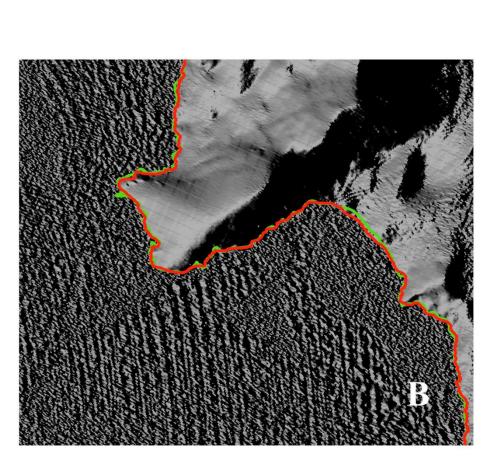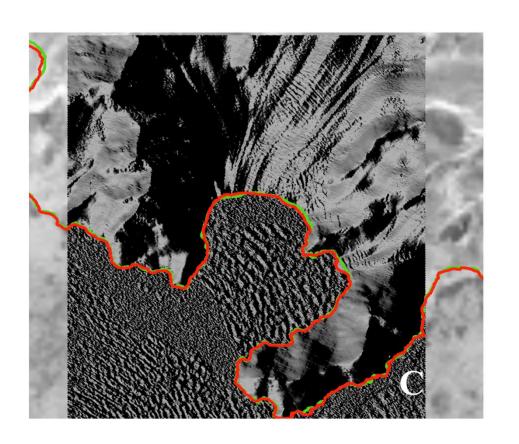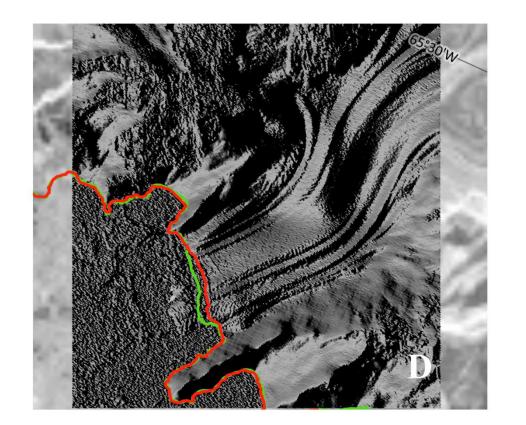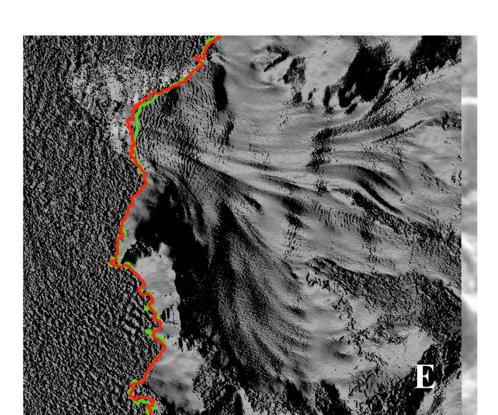
Figure 1 DEM hillshade map of Antarctic Peninsula (AP). The blue rectangle marks the experimental area used in this poster.

II Methodology

Feature image creation

DEM hillshade map · DEM surface roughness map · Novel Feature map

CFL extraction with path propagation method

Sea ice/ open sea · Ground ice/ ice shelf · y-axis · x-axis

Results

Extracted CFL overlaid on novel feature

III Experimental results

DEM hillshade map

Erskine Glacier · Hopkins Glacier · Drummond Glacier · Widdowson Glacier · McCance Glacier · Darbel Bay

2199 m · 0 · 0 10 20 km

— CFL extracted from 12 m TDX global DEM
— Newest-version ADD coastline
— Glacier basins from GLIMS

Extracted CFL and ADD coastline overlaid on DEM hillshade map

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