MAPPING OF SOIL ORGANIC CARBON CONTENT IN THE GLACIER FORELAND OF MIDTRE LOVÉNBREEN, SPITSBERGEN IN NORTHERN NORWAY

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INTRODUCTION

Climate change is rapidly occurring in the Arctic region. Glacier retreat leads to formation of subglacial land, and in turn to proglacial ecosystem. In subglacial area, microorganisms and plants begin to be established, and soil development and soil organic carbon (SOC) accumulation are also initiated. Since space can be substituted with time in the glacier foreland, numerous studies have shown that SOC increases as soil age increase, and such results were drawn from line transect approaches (Hodkinson et al., 2003; Smittenberg et al., 2012). However, glacier foreland is not a simple ecosystem, and SOC accumulation is not only influenced by time. Many factors such as microtopography (altitude, slope, exposition, etc.), radiation, snow free days, runoff, etc, could affect the establishment of biota, and thus impact SOC. Therefore, we aimed to investigate SOC distribution in the glacier foreland with a consideration of many environmental parameters and produce a SOC stock map in the Midtre Lovénbreen.

MATERIAL & METHODS

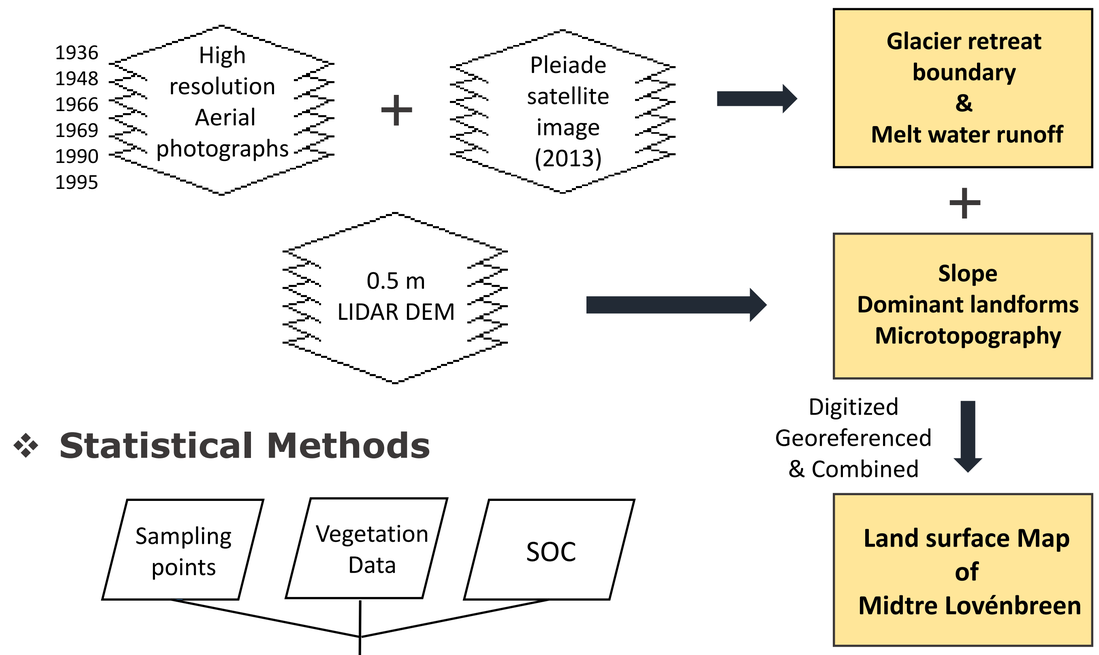
❖ Field Sampling

- Sampling points: 93 sites for vegetation & 34 sites for soil sampling in the foreland of Midtre Lovénbreen in July 2014.
- Soil sampling: 0-5, 5-10, 10-20, and 20-30 cm depths.

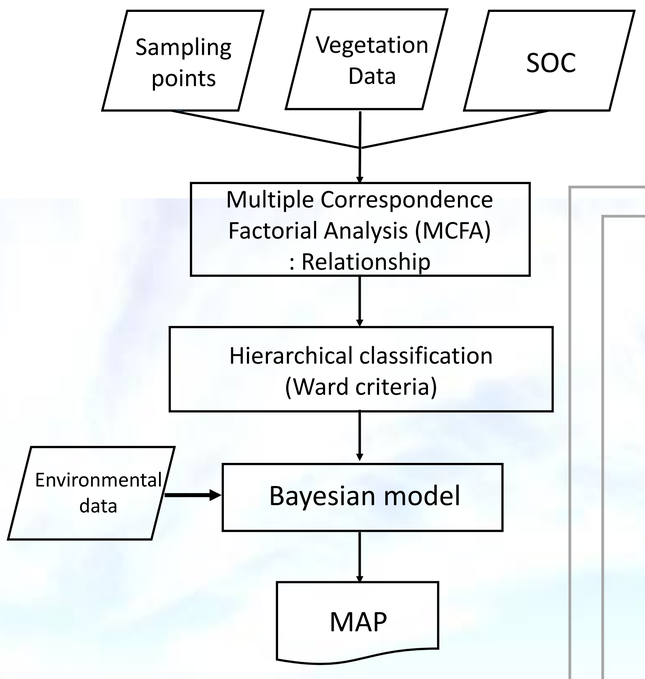
❖ Soil analysis

- SOC & TN content : combustion method at 950 ℃ after removing total inorganic carbon
- Bulk density : Estimated by soil texture using SPAW software (Soil water characteristics Version 6.02.74; Saxton and Rawls, 2006).
- SOC stock : SOC content (Mg C/Mg soil) x bulk density (Mg soil/m^3 soil) x Soil depth (m).

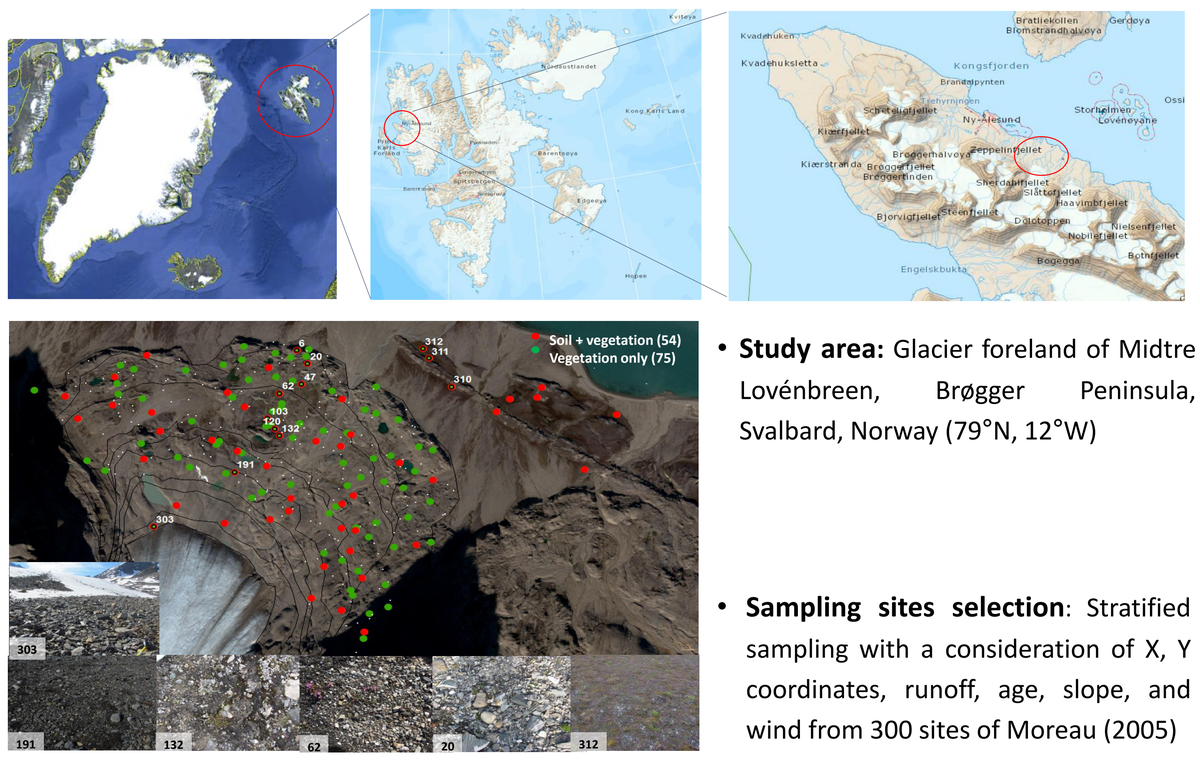
❖ Remote sensed data



❖ Statistical Methods

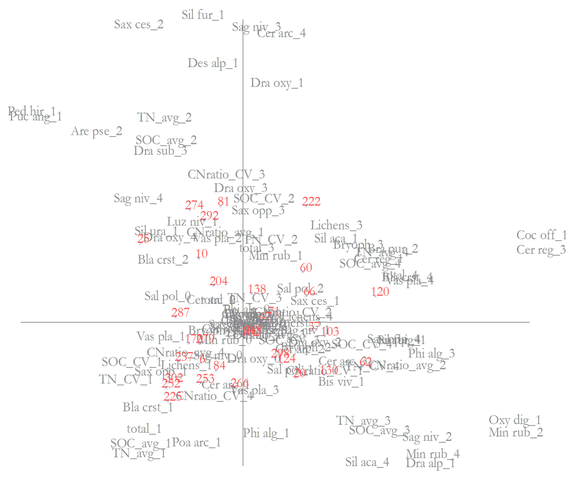


STUDY AREA

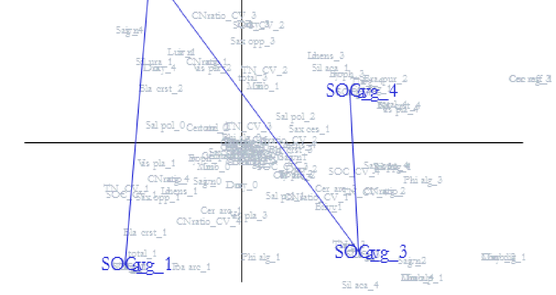


- **Study area:** Glacier foreland of Midtre Lovénbreen, Brøgger Peninsula, Svalbard, Norway (79°N, 12°W)
- **Sampling sites selection**: Stratified sampling with a consideration of X, Y coordinates, runoff, age, slope, and wind from 300 sites of Moreau (2005)

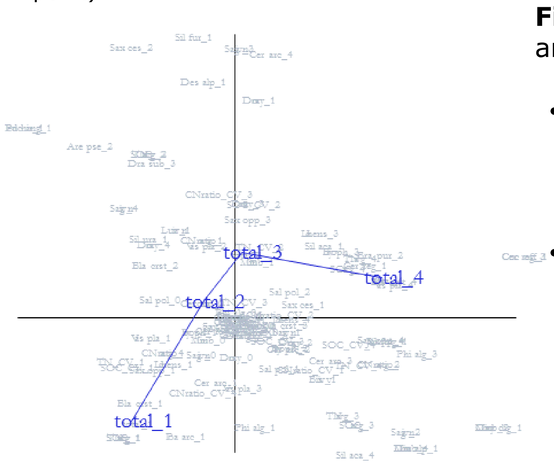
RESULTS & DISCUSSION



(a) Factorial space with all data used in this analysis (black : modalitties of variable ; red : sample field point)



(b) Gradation of SOC distribution along the first and second factorial axis



(c) Gradation of total number of plants distribution along the first and second factorial axis

Fig 1. Results of multiple correspondence factorial analysis (MCFA)

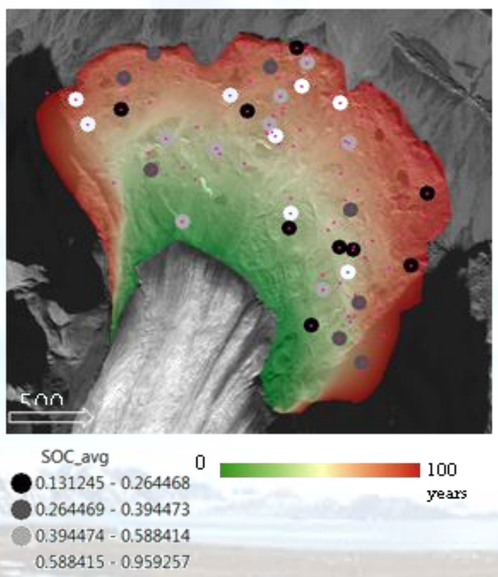


Fig 2. Measured soil organic carbon concentration within 0-5 cm depth

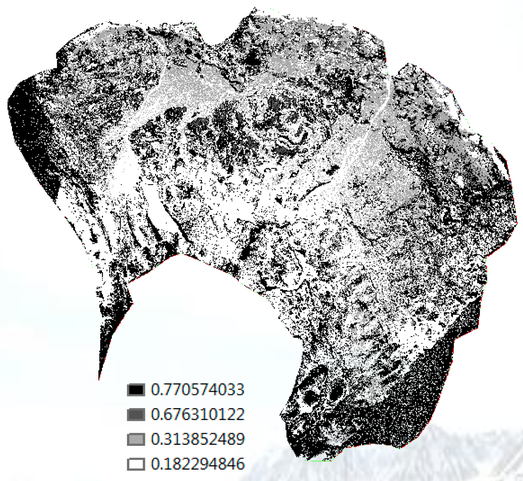


Fig 3. Modelling the probability of soil organic carbon (SOC) concentration for 0-5 cm depth in the glacier foreland of Midtre Lovénbreen

- The SOC concentration generally tended to increase as soil age increased but did not always coincide with soil age.
- The active runoff sites showed low concentration of SOC. Glacier/snow meltwater wash out previously established vegetation and accumulated SOC.
- With the same soil age, SOC concentrations were different, this could be due to vegetation establishment affected by microtopography, parent material, climate, living organisms, topography, or time.
- Besides above mentioned factors, we are currently scrutinizing the relationship between SOC and other environmental parameters.
- Through understanding the relationship between SOC concentration/stock and environmental parameters, there is a possibility to quantify and predict SOC distribution by observing vegetation distribution and extracting specific environmental factors.

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