

Landform Behaviors in Kaffiøyra Under Climate Change Conditions Using Remote Sensing and GIS Approach

Presenter: Vo Hong Son

Advisor: Prof. Chuen-Fa Ni

Date: 2023/11/10

Abstract

Polar regions are undergoing significant transformations attributed to global climate change. This study focuses on understanding these changes, particularly in Kaffiøyra, Svalbard, over a 38-year period, with a specific emphasis on shorelines, glaciers, and outwash landforms. Methodologically, remote sensing integrated with GIS technique are employed to quantify the changes in these landforms. Landsat imagery spanning from 1985 to 2023 is utilized to detect boundaries between land and sea, land and glaciers, and land and outwash. The results of the shoreline change analysis reveal distinct patterns: relatively stable shorelines in zones 1, 3, and 5, the linear regression rates (LRR) ranging from -2 m/yr to +3 m/yr, and significantly eroded shorelines in zones 2 and 4 (glaciers on the sea), with LRR ranging from -65 m/yr to +10 m/yr. This means that in some places the glacier retreated ~2.5 km in 38 years. Furthermore, the calculations of area changes are conducted for seven glaciers and three outwash areas. Notably, Aavatsmark, Elise, and Andreas glaciers, possessing the largest areas, have experienced losses - 63.1%, 35.1%, and 54.6% of their respective areas over 38 years. Conversely, the area changes in outwash regions display a tendency to increase, but not significantly, remaining below 10%. In addition to these findings, ongoing research involves the acquisition of remote sensing images from ASTER, ICESat, and ICESat-2 satellite to generate a multi-temporal Digital Elevation Model (DEM). This approach facilitates a comprehensive assessment of glacier volume loss in both vertical and horizontal directions. Eventually, the results emphasized the relative stability of shoreline changes over the 38-year period, little increases in outwash areas, and, notably, significant changes in glacier areas - particularly those glaciers on the sea, dramatically inland retreat. For future work, the study expect to quantify the volume loss of the glaciers in the vertical and horizontal directions to further consolidate the existing results.

Keywords: Climate change, Landsat images, Shoreline changes, Glaciers, Outwash