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Quantifying glacier area changes using object-based image analysis in Google Earth Engine

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Glaciers are an important component of the cryosphere and are key indicators of climate change. Observations of temporal changes in glacier extent are essential for understanding the impacts of climate change, but these observations are not widely available in many parts of the world. Research indicates that climate change has had a significant impact on glacier recession, particularly in the Arctic, where glacier meltwater is an important contributor to global sea-level rise. Therefore, it is important to accurately quantify glacier recession within this sensitive region. In this study, we mapped 480 glaciers in Russian Arctic, Novaya Zemlya, using object-based image analysis (OBIA) applied to multispectral Landsat satellite imagery in Google Earth Engine (GEE) to quantify the area changes between 1986-89 to 2019-21. Our results confirm that in 1986-89, the total glacierized area was 22958.98 km² and by 2019-21 there was an 5.56% reduction in glacier area to 21680.63 km². Comparison between manually corrected glacier outlines taken from the Randolph Glacier Inventory (RGI) and the mapped glacier outlines derived using the OBIA method shows there is a 90.26% similarity between both datasets. This confirms that OBIA, combined with the GEE platform, is a promising method for accurately mapping glaciers, reduces the time required for manual correction, and can be applied in other glacierized regions for rapid assessment of glacier change.