A new glacier inventory on southern Baffin Island, Canada, from ASTER data: II. Data analysis, glacier change and applications

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In part II of the paper we discuss the results obtained with the methods presented in part I. The analysis is separated in three sections: (1) a statistical analysis of the glacier inventory data (year 2000) and their mutual dependencies derived from the ASTER scene, (2) change assessment between the mapped LIA glacier extent and glacier outlines from 1975 and 2000, and (3) application of both data sets to derive further quantities (like volume change). The statistical analysis includes 664 glaciers and icecaps ranging in size from 0.02 to 125 km^2. The frequency distribution of the count and area per size class reveals that glaciers from 1-10 (count: 239), 10-50 (36) and >50 km^2 (8) cover each one third of the total area (2416 km^2), while the 381 glaciers < 1 km^2 account only for 5%. There is a slight aspect dependency of the area covered towards the northern sectors (W-N-E). The mean elevation is 992 m (+/- 199 m) with a slight dependence on aspect (200 m lower for north facing glaciers), minimum and maximum elevation do strongly depend on glacier size, and mean slope is 18 (increasing towards smaller glaciers).

For a sample of 264 glaciers area changes between LIA-1975-2000 have been calculated. The relative area change since the LIA (around 1920) is -7.3% to 1975 and -12.5% to 2000, which gives a slight increase in the rate of area loss for the latter period. Length changes reach up to 3.3 km from LIA to 2000 and show a high correlation with original glacier length (r=0.8). Mean glacier elevation has increased by 50 m which is about one half of what is expected due to the temperature increase since the 1920s and indicate that glacier geometries are not yet in balance with the current climate. Neglecting that glaciers might not be in a steady-state yet, we calculated for a sample of 194 glaciers the mean mass loss by combining the calculated cumulative length changes with the topographic glacier parameters from the inventory, yielding a mean mass balance of about -0.11 m w.e. per year.