

Coastal landscape transformation as a factor changing High Arctic geography

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The objective of this short statement is paying attention to the biggest changes in the coastal landscape and High Arctic geography (and thus in maps).

Global change – defined as a sum and synthesis of all environmental changes caused by global climate warming after the Little Ice Age – has been very well exemplified in the Arctic coasts, especially under the so-called polar amplification since the end of the 20th century.

An abundance of the literature on the subject (impossible to quote in this abstract) give a wide picture of geographical changes in the High Arctic coasts.

They are more and more sensitive to climate warming, especially these covered with glaciers or built of permafrost containing a lot of ice.

Coastal and tidewater glaciers undergo quick recession. Their melting and decline of their lower parts create new marine straits (i.e. new seaways) in open bedrock depressions (filled with ice before), enabling appearance of new islands. From the AD 1960s–1970s to AD 2021, 44 new islands appeared in the High Arctic: 33 in Greenland, 2 in Svalbard, 3 in Franz Joseph Land, 4 in Novaya Zemlya, and 2 in Severnaya Zemlya. The next new straits and islands are in the state of forming (Ziaja and Ostafin 2019a, 2019b; Ziaja and Haska 2023).

This is the biggest change in geography.

Smaller but much more often geographical changes are caused by retreat of tidewater glaciers and then transformation of their valleys into new sea bays, including fjords formed from long valleys. E.g., the SE Spitsbergen coast, spanning almost two degrees of latitude, with 10 huge tidewater glaciers protruding into the Barents Sea in AD 1900, was changed into the coast with 10 big fjords or other bays afterwards. Only one of the transformations from a glacier into a fjord was described there (Cygankiewicz-Truś and Ziaja 2021).

The coasts built of permafrost with a lot of ice undergo a quick retreat due to thermal erosion (caused by climate warming) which intensify marine erosion (very limited before). Apart from the aforementioned phenomena, marine geomorphological processes (both erosion and accumulation) have been greatly intensified by shortening the sea ice seasons outside the majority of the High Arctic coasts.

All these landscape changes are interconnected on some coasts what can create positive feedback effects changing the local geography, such as on the NE Sørkapp Land coast, SE Spitsbergen (Ziaja et al. 2023).

To sum up, the High Arctic geography has changed and will change unless climate cooling occurs in the near future.

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