Physiographic data in AROME-Arctic

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Land surface parameters in the surface model are determined by physiographic datasets. The global datasets have inaccuracies in the northern areas. In order to proceed towards improvement of physiography in AROME-Arctic, we present some of the currently used data sets and introduce alternative data sets for glacier mask, cover types and soil texture for Svalbard. Remarkable differences between the data sets were found. This work suggests that a careful update of physiographic data on Svalbard is beneficial.
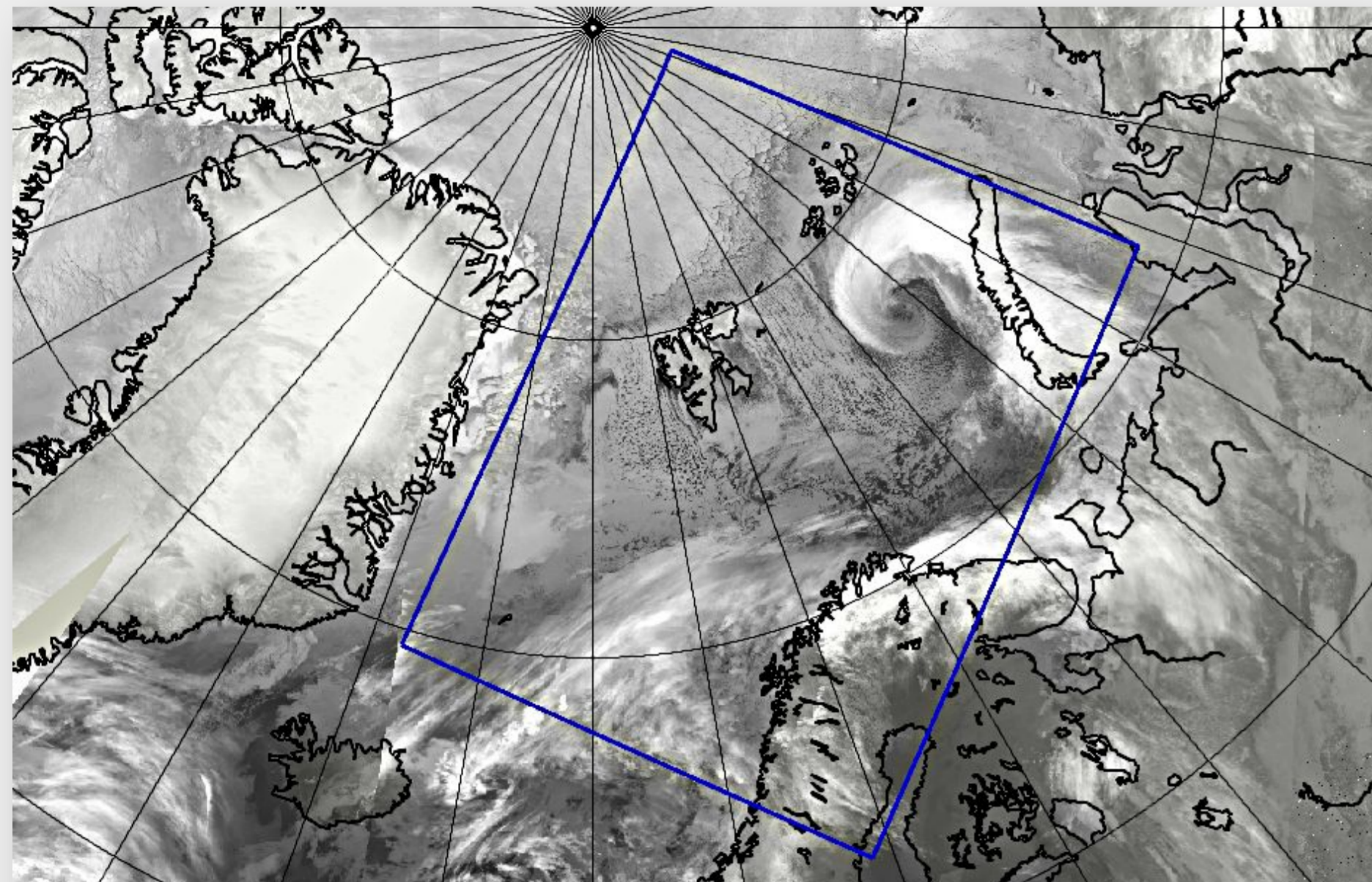
AROME-Arctic

AROME-Arctic is a regional short-range high-resolution forecasting system for the European Arctic with 2.5 km grid spacing and 65 vertical levels at MET Norway. The model system is based on the HARMONIE-AROME 40h1.1 configuration of the ALADIN-HIRLAM numerical weather prediction system. Surface processes and energy and water exchange between atmosphere and surface are treated by SURFEX v7.3. AROME-Arctic issues deterministic forecasts 4 times a day with a lead time of 66 hours.

Data available: thredds.met.no

Glacier and land mask

AROME-Arctic utilises ECOCLIMAP-II for land surface parameters. A more realistic glacier information for Svalbard from the Norwegian Polar Institute[1] was implemented, and forecast sensitivity in the glacier-free areas was studied. Model experiments show that 2 m temperature and 10 m wind speed are sensitive to the cover type choice locally.
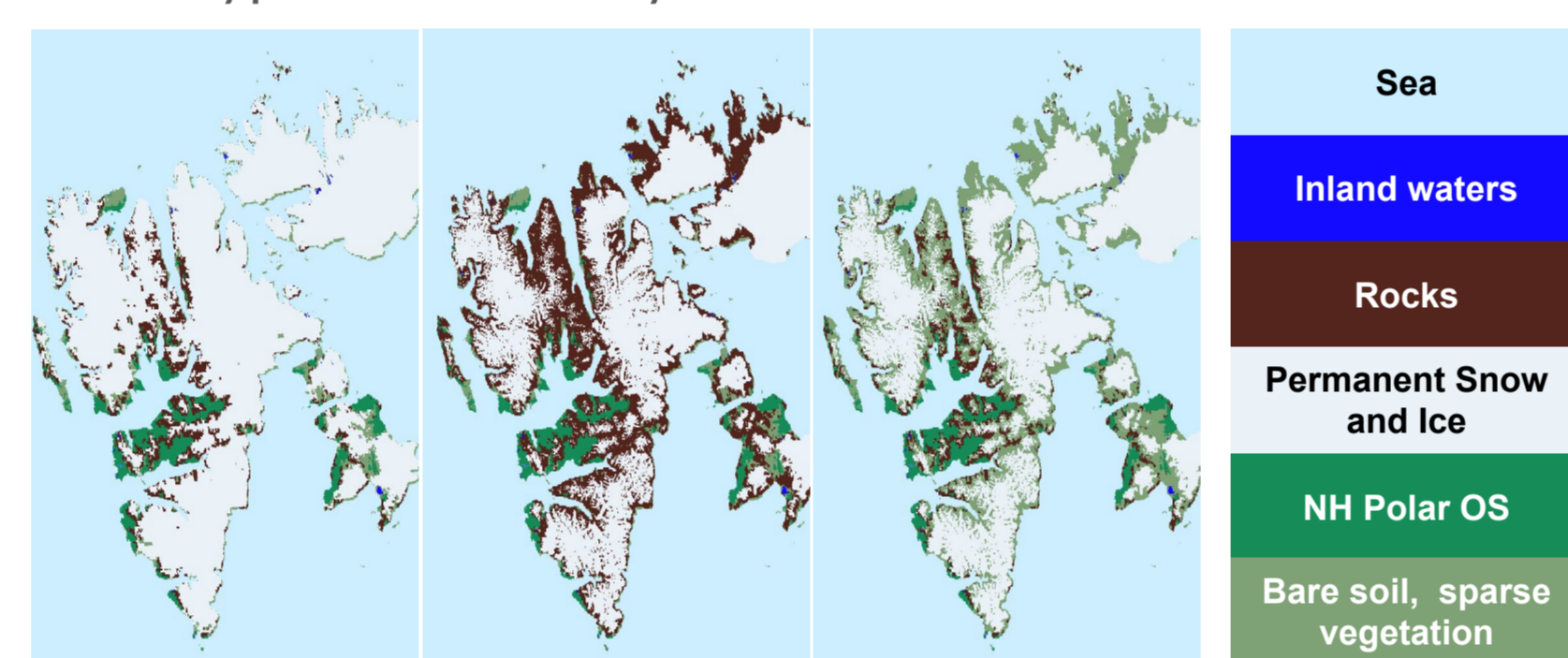
[1] Norwegian Polar Institute (2014). Kartdata Svalbard 1:100 000 (S100 Kartdata) / Map Data. Norwegian Polar Institute. https://doi.org/10.21334/npolar.2014.645336c7
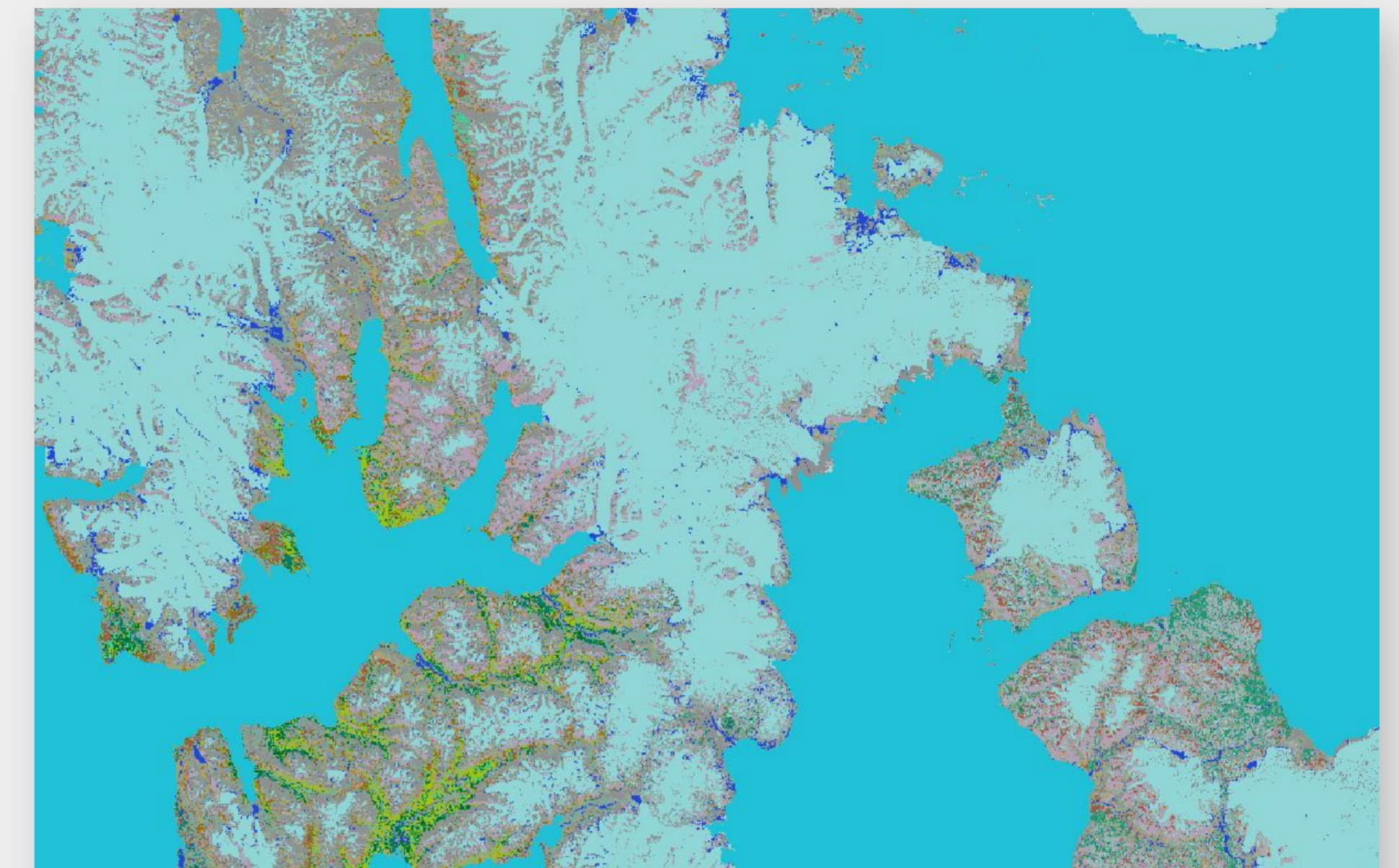
Cover types

A vegetation map for Svalbard from the Norwegian Polar Institute has been accessed.[2] The map is based on Landsat TM/ETM+ images. It contains 22 land cover types on a 30 m resolution. The map is used to update ECOCLIMAP-II in areas where glacier cover has been removed by studying the correlation between the vegetation map and ECOCLIMAP-II classes.

[2] Johansen, B., Karlsen, S., & Tømmervik, H. (2012). Vegetation mapping of Svalbard utilising Landsat TM/ET281360004M data. Polar Record, 48(1), 47-63. doi:10.1017/S0032247411000647

Soil texture

The Food and Agriculture Organization (FAO) data set for soil texture is currently used in AROME-Arctic. The data set has a constant value of 0.33 for sand and clay fractions for Svalbard. Sand and clay fractions derived from SoilGrids250m[3] show more detailed soil texture.
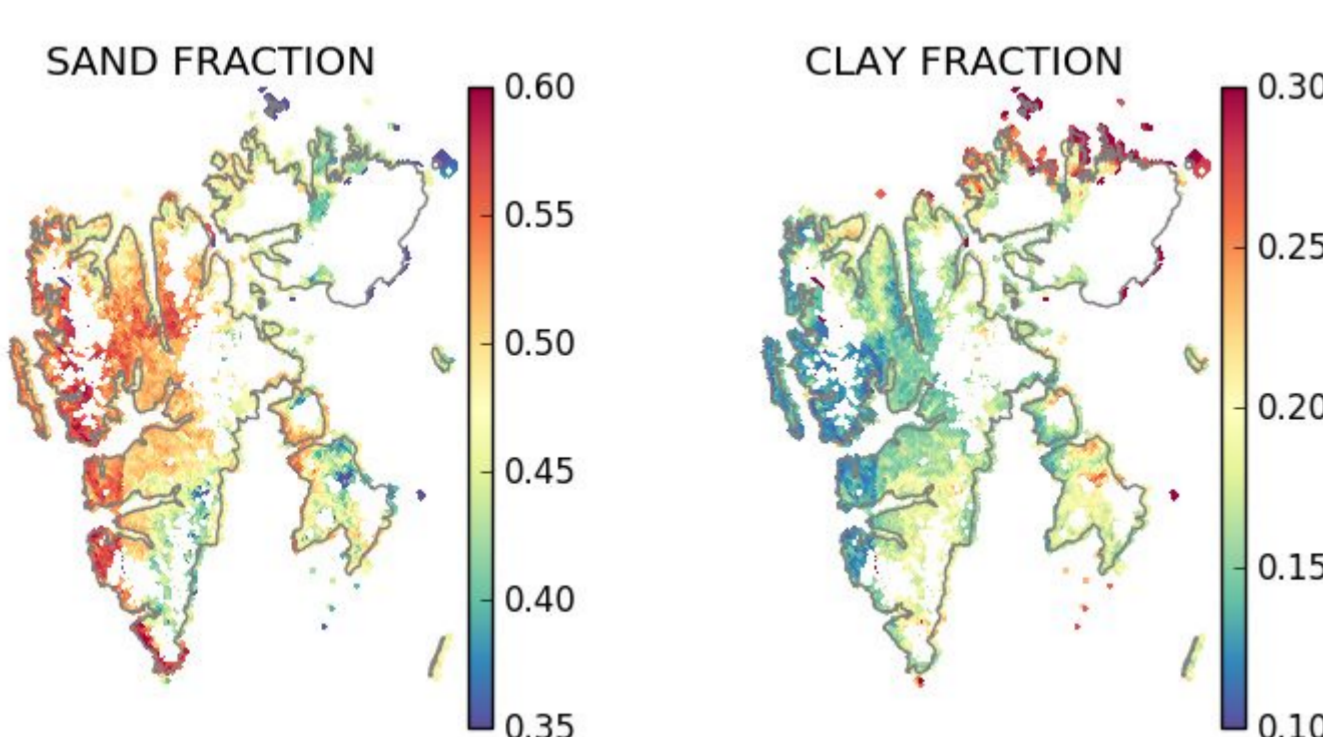
[3] Hengl T, Mendes de Jesus J, Heuvelink GBM, Ruiperez Gonzalez M, Kilibarda M, Blagotić A, et al. (2017) SoilGrids250m: Global gridded soil information based on machine learning. PLoS ONE 12(2): e0169748. https://doi.org/10.1371/journal.pone.0169748
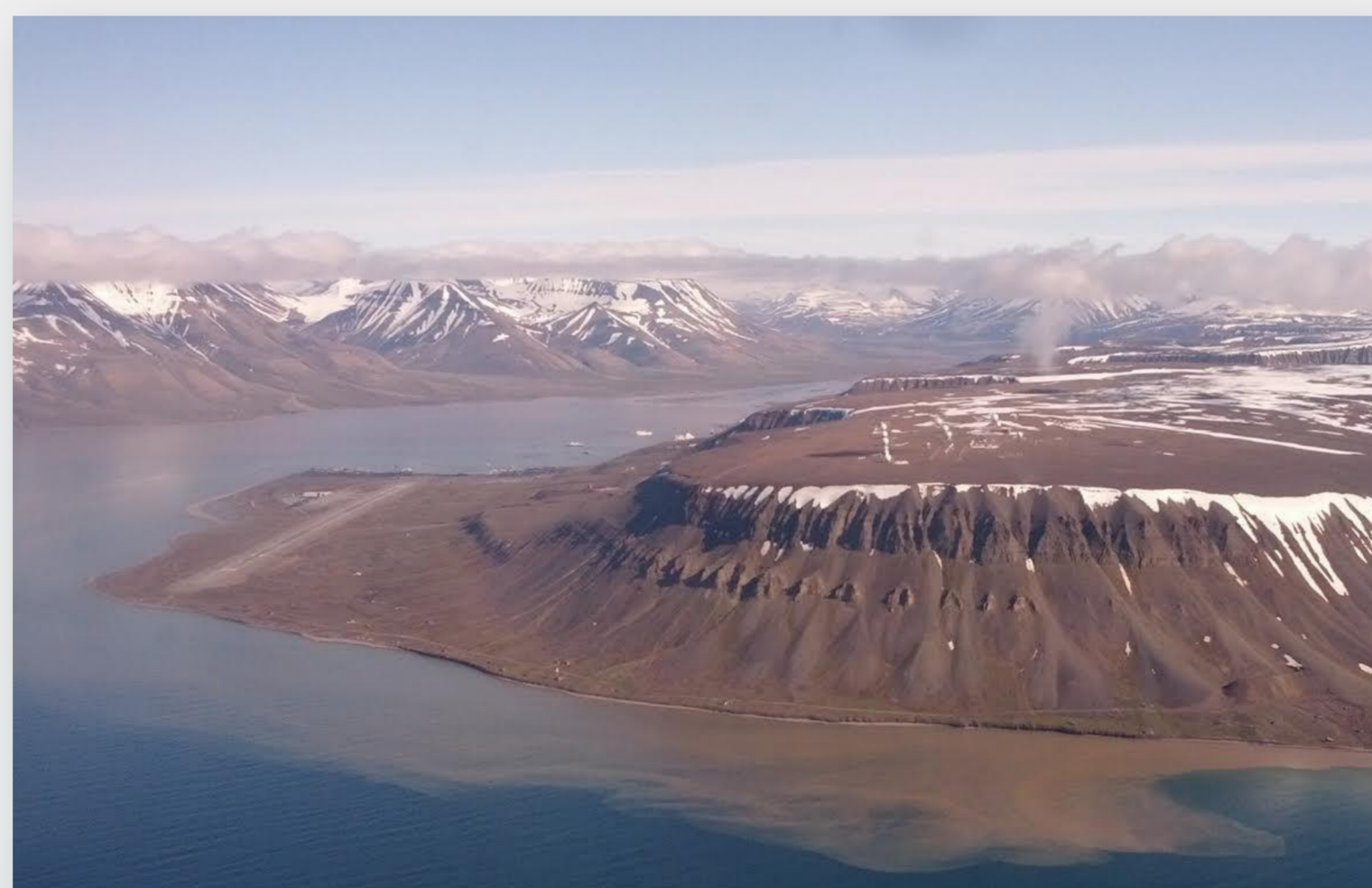
Topography

Topography in AROME-Arctic is described by Global Multi-resolution Terrain Elevation Data 2010 (GMTED2010). The data set shows a good accuracy for Svalbard and it is used for model simulations with 0.5 km horizontal grid spacing.[4]
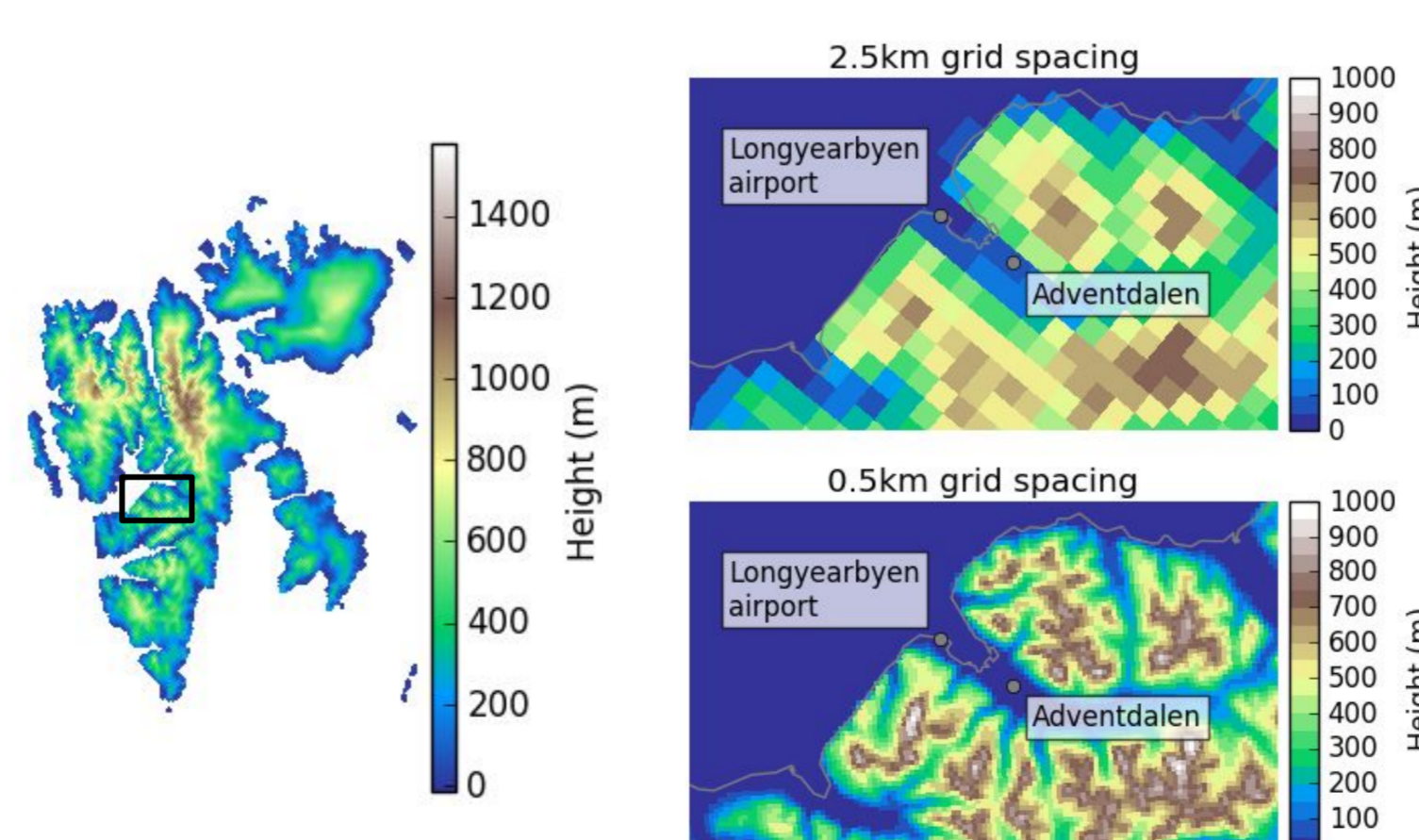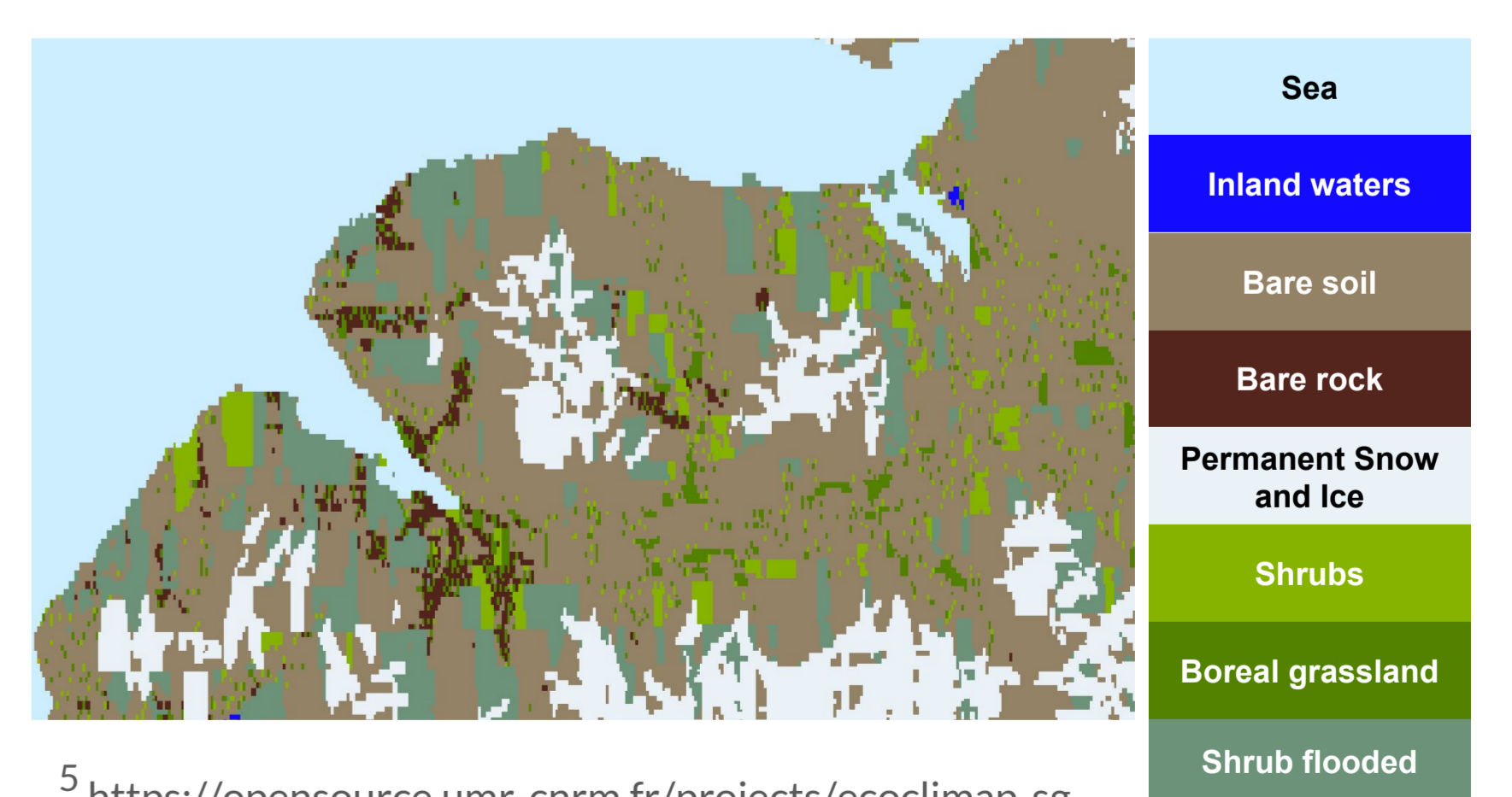
[4] Yurii Batrak (yuriib@met.no), personal communication.

Future work

Upcoming SURFEX versions beyond 8.1, which is currently under testing, will utilize the ECOCLIMAP Second Generation[5]. Correction of glacier information and cover type in ECOCLIMAP-SG is planned for in future work. In addition, investigations on leaf-area-index (LAI) and albedo are possible.

[5] https://opensource.umr-cnrm.fr/projects/ecoclimap-sg

Norwegian Meteorological Institute