



ICG2022-545, updated on 05 Jun 2023

<https://doi.org/10.5194/icg2022-545>

10th International Conference on Geomorphology

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Earth Observation for Permafrost dominated Arctic Coasts – consistent coastal erosion mapping as relevant for permafrost carbon and coastal communities

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The multifaceted impacts of coastal environmental change on local communities, ecosystem services, and socio-economic dynamics have not yet been quantified in an integrated framework at the circum-Arctic scale. Maps need to be developed that delineate areas at risk of permafrost degradation and coastal erosion, to produce vulnerability maps for determining safe building locations, and to provide information where mitigation efforts should be focused to protect Arctic coastal areas.

The following Earth Observation (EO)-guided activities have been identified feasible in order to address these issues with the possibilities offered by remote sensing:

- Creation of the first circumpolar consistent dataset of coastal erosion trends. The retrieval of coastal erosion will be based on Landsat-data for the last 20 years. The long observation period allows the detection of erosion rates larger than 2m/year despite of the comparably low spatial resolution of Landsat (30m).
- Creation of the first circumpolar consistent dataset of infrastructure at risk along the coasts. Detection of infrastructure potentially at risk has recently been shown feasible for 10m datasets from Sentinel-1/2 using machine learning (AI) methodology.
- Validation of the circumpolar datasets of (1) and (2) as well as permafrost time series which are already available through permafrost_cci

Results will significantly enhance the current Arctic Coastal Dynamics database (ACD) through ingestion of results from (1), (2), (3) and Permafrost_cci for full coastal environment characterization. They form the basis for the development of a roadmap for future EO based updates of the ACD. We will present our strategy for the entire initiative and will specifically discuss validation and calibration steps.

The work is funded primarily through the European Space Agency Polar Science Cluster Program (project EO4PAC). Further funding was received from ESA's Climate Change Initiative (Permafrost_cci), the European Union's Horizon 2020 Research and Innovation

