AI4IS – Building a multivariate datacube for ice shelf calving prediction

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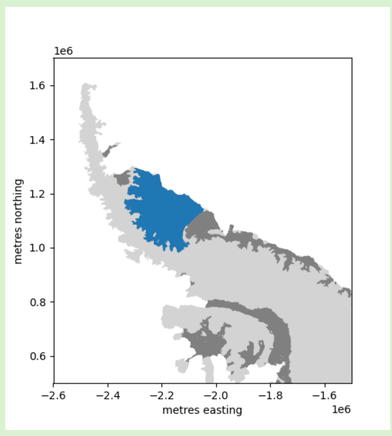
AI forecasting for ice shelf calving

AI4IS is an ESA-funded project to develop **AI-based forecasting for calving of Antarctic ice shelves**. A variety of datasets covering the ice shelf surface are brought onto a shared grid using **Gaussian random field (GRF)** representations. The stack of datasets on the shared grid – the **datacube** - is then similar to a pixel image, allowing **scene classifying AI** techniques to be effectively employed. The AI will be trained on a set of calving events determined from a time series of calving front location.

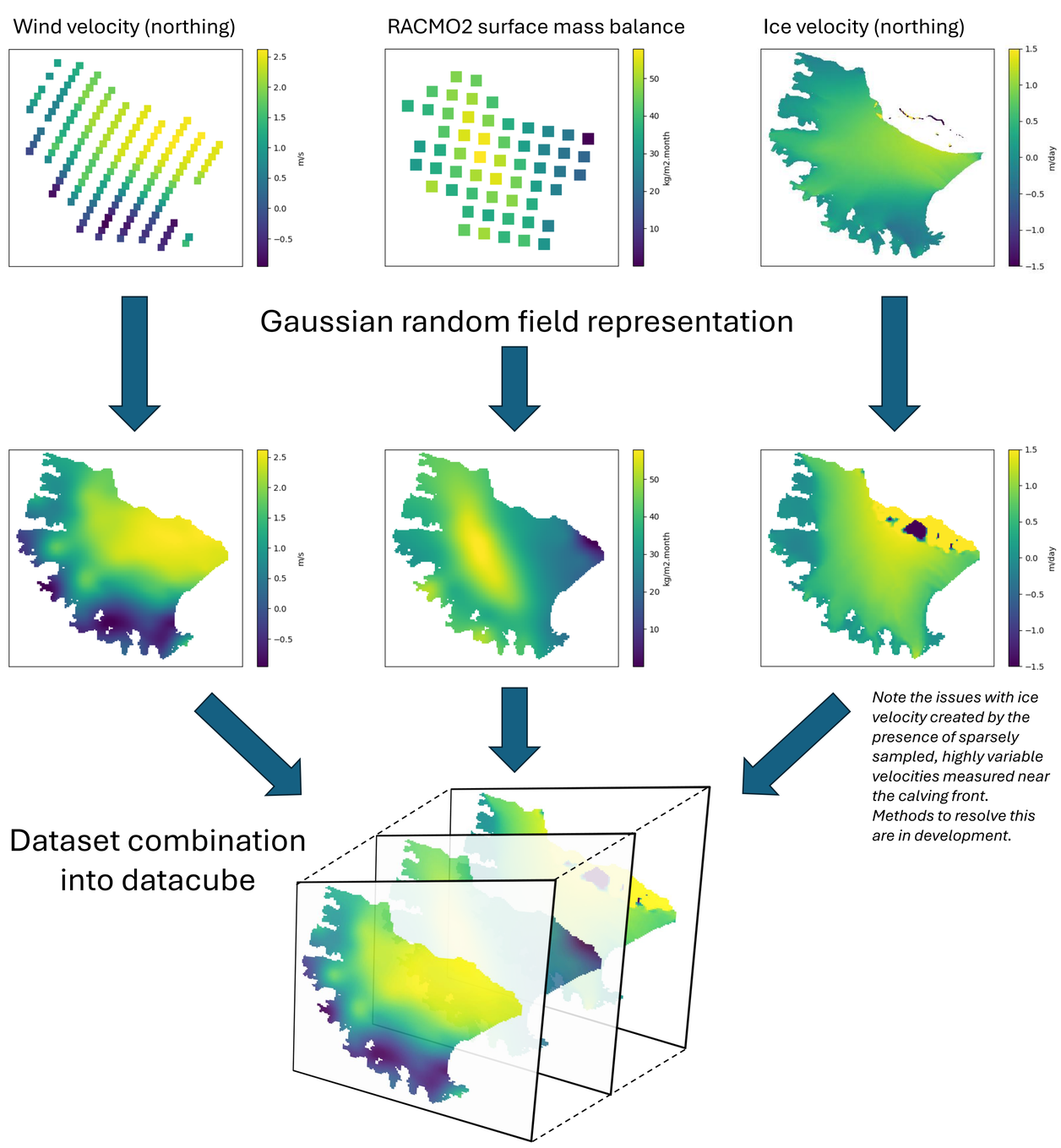
Study site 1: Larsen C Ice Shelf

The Larsen C ice shelf is the study site for the first phase of AI4IS. The Antarctic Peninsula is of particular interest for **ice shelf stability** and calving events due to its relatively warmer climate and collapse of the Larsen A and B ice shelves. Prediction of calving in this area



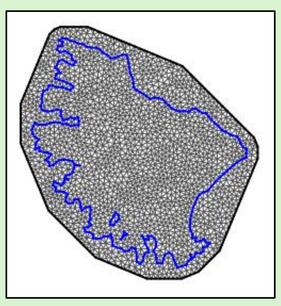
Larsen C Ice Shelf, in blue, shown on the outline of the Antarctic Peninsula (light grey), with the location of other ice shelves in dark grey.

Datacube construction



Datacube construction

A **GRF** representation of each **monthly timestep** for each dataset is generated. Using the **R-INLA package** values for an GRF fitting each input dataset are estimated at the vertices of a mesh covering the study area. These values are regressed to a uniform grid to create a datacube analogous to a pixel image.



The vertex mesh created for the generation of GRF representations. Consisting of ~2000 vertices, it covers the outline of Larsen C (in blue) plus a 'convex hull' surrounding it. These additional vertices outside the domain are necessary to reduce artefacts at the edges, especially where the domain boundary is complex.

Data Sources

In addition to **wind speed**, **surface mass balance**, and **ice velocity**, (centre panel), we incorporate **surface elevation**, **surface melt**, **supraglacial lakes**, and other currently available datasets. In later stages we will include novel datasets for **ice shelf damage** and **strain rate** developed as part of the project.

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