Plan Overview

A Data Management Plan created using DMPonline

Title: Antarctic surface hydrology and sea-level rise

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Project abstract:

As the climate warms, the ice sheets are shrinking, driving sea-level rise and threatening coastal communities around the world. Accurate sea-level projections are essential for defending against the impacts of sea-level rise. Unfortunately, due to poor understanding of the ice sheets, current projections are highly uncertain. Many factors affect ice-sheet response to climate warming. One factor currently usually neglected in projections is water flow across Antarctica's surface. My work has revealed the importance of Antarctic surface hydrology for moving water into locations where it could damage the ice sheets by expanding surface fractures. As the climate warms, we expect drainage systems to expand and accelerate ice-sheet loss. However, fundamental unanswered questions about how surface drainage operates prevent us from predicting this expansion and its implications in detail. These phenomena are important for the future of Antarctica, but they are also scientifically fascinating and produce beautiful, complex structure, largely hidden from public view at the extremes of our planet. These are some of the reasons I chose to study them. This fellowship will launch a new interdisciplinary research programme to study Antarctic surface hydrology in the field, from space, and with models. We will observe processes, leverage insights from observations to build drainage-system models, and incorporate simplifications of these models into ice-sheet models. We will train a new cohort of highly trained polar scientists, establish a pool of state-of-the-art field instrumentation, provide career-changing field experiences to students, and transform our understanding of this fascinating and important part of the Earth system.

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Antarctic surface hydrology and sea-level rise

Administrative details

Project Name/Title

Antarctic surface hydrology and sea-level rise
Also known as Subglacial Hydrology of Antarctic Ice Shelves (SHANTI)

Principle Investigator/Researcher

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Project Description

As the climate warms, shrinking ice sheets are driving sea-level rise, yet projections remain highly uncertain due to poorly understood processes — including Antarctic surface hydrology, a factor currently neglected despite its importance for the future of the ice sheet. This fellowship will launch an interdisciplinary programme to study Antarctic surface drainage through fieldwork, remote sensing, and modelling, building from observations to drainage-system models and ultimately incorporating these into ice-sheet projections. In doing so, we will train a new generation of polar scientists, establish state-of-the-art field instrumentation, and transform understanding of a scientifically fascinating and consequential part of the Earth system.

Data Collection

What types of data will you collect or create?

The project will collect field observations from in-situ instruments including flow meters, GPS receivers, and ice-penetrating radar, alongside UAV-derived surface topography data. We will also use high-resolution digital elevation models from existing remote sensing sources, though these will not be produced by the project. A major component of the project involves the development of research software, including new mathematical models of Antarctic surface drainage and improvements to existing large-scale numerical ice-sheet models.

What file formats will be used?

Raw field data will be collected in CSV and ASCII formats, along with proprietary formats from GNSS and ice-penetrating radar instruments, and GeoTIFF imagery from UAVs. These data will be processed and collated into netcdfs and cloud-optimized formats including Zarr for efficient analysis and storage. Model code will be developed primarily in Python and Julia, with all software developed openly and made available throughout the project.

What quality assurance processes will be adopted?

Field data quality will be ensured through repeat measurements and multiple independent measurement approaches — for example, surface topography will be derived from several remote sensing sources including IceSAT2 and the Reference Elevation Model of Antarctica, as well as our own UAV observations. Model outputs will be rigorously tested using continuous integration approaches to catch errors early and ensure code quality throughout development.

Ethics and Legal Responsibilities

Does your research involve human participants?

- No

Will you be processing/collecting personal data?

- No

Will you be processing/collecting special categories of personal data (please select all that apply)?

- None of the above

Have you completed Imperial's Data Asset Registration Tool (DART)?

- Not yet, but I intend to

Are there any IP or copyright restrictions which might influence your use or sharing of the data?

- No

Data Storage and Security

How much data do you expect to generate?

- 1-10 TB

How will you store and back-up your data during the project?

Field data will be stored on hard drives with multiple copies created immediately in the field. Upon return, all field data and remote sensing datasets will be backed up across both institutional storage (e.g., Sharepoint or Imperial's Research Data Store) and commercial cloud infrastructure for redundancy. Model code will be version-controlled on GitHub with local copies maintained throughout the project.

How will you manage access and security?

The project prioritises radical openness and maximum accessibility rather than restrictive security measures. Field data and remote sensing datasets will be published in Analysis Ready Cloud Optimized (ARCO) formats, enabling not just download but direct cloud-based processing by external users. Code will be openly available on GitHub from the outset. No encryption or password controls will be implemented, as the data is non-sensitive and open access is a core project principle.

Data Documentation and Metadata

How will the data be documented to ensure it can be understood?

All datasets will be accompanied by comprehensive READMEs and detailed metadata to ensure clarity on data origin, processing, and conditions, facilitating both reproducibility and reuse by external users accessing the data in cloud-optimized formats. Model code will be fully open-sourced with complete documentation including usage instructions and dependencies, making it accessible and usable to the research community.

Will you be using any domain specific or widely used metadata standards to describe your data?

- Yes (please give details below)

Where applicable, we will adopt established domain standards such as CF (Climate and Forecast) conventions for climate and model outputs to ensure interoperability and discoverability.

Data Preservation and Sharing

What are your plans for long-term preservation of the data?

All data will be preserved long-term in the UK Polar Data Centre, the primary repository for polar research data where they will be assigned persistent identifiers in the form of DOIs. Additionally, data will be archived in cloud-optimized formats on commercial cloud infrastructure to improve discoverability and accessibility alongside the official long-term archive. Model code will be archived on GitHub and zenodo. Zenodo will also provide DOIs

How will you share the data?

All data will be shared openly and unconditionally throughout the project, released as soon as possible after collection. Code will be developed openly on GitHub and assigned a DOI via Zenodo upon archival. Datasets will be archived long-term in the UK Polar Data Centre and made discoverable through cloud-optimized formats enabling direct access and processing by external users.

Will there be any restrictions on accessing the data?

- No

How will potential users find out about your data?

All published papers will include a data access statement providing details of where the dataset can be found and under what conditions it can be accessed.

Responsibilities and Resources

Who is responsible for implementing this plan?

Along with the PI, members of the project team will have responsibility for study-wide data management, metadata creation, data security and quality assurance of data.

Will you require any additional resources to deliver this plan?

We have costed in time and effort within the grant to prepare the data for sharing / preservation. We have sufficient storage and equipment to undertake these tasks.