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Mathematics of Sea Ice, Ice Sheets and Ice Shelves

Computational Fluid Dynamics

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ABSTRACT

Ice sheets and sea ice have been melting at an increasing pace in recent years in response to climate change. This does not only affect the polar regions but also the global climate system, e.g. through sea-level rise. Modeling and simulation of this system presents numerous mathematical challenges.

Both the ice sheets and sea ice are governed by a variety of small-scale processes that affect large-scale dynamics of the system. The representation of these processes in models as well as the evaluation of these models is a major challenge due to the scarcity of available observations.

At increasing spatial resolution, the simulation of nonlinear coupled multidimensional system can lead to a more realistic representation of these processes but the numerical approximation and the simulation becomes more difficult and computationally expensive. New concepts and techniques are required to address this issue. Recently a number of new approaches have been developed including new rheologies, particle models and machine learning techniques to model nonlinear relationships.

The mini-symposium aims to bring together researchers who are experts in the mathematical modeling of ice sheets and sea ice, discussing similarities and differences in approaches to represent these two parts of the cryosphere in numerical models.

List of prospective speakers

1. E. Olason, *"Modelling sea ice with damage mechanics and a Bingham-Maxwell rheological model"*, University of Bergen, Norway

2. Dorothée Vallot. *"Modeling the ocean-ice interface of Thwaites glacier by coupling a continuum ice and a particle model",* Swedish Meteorological and Hydrological Institute, Sweden

3. Cruz Garcia Molina, *"Modeling calving on a large-scale with a finite element ice model",* Institut des Géosciences de l'Environnement, France

4. Carina Schwarz, *"Simulating sea ice drift with LSFEM incorporating field data",* University Duisburg-Essen, Germany

5. Chris Horvat, *"A hybrid machine-learning-based parameterization of Wave-Induced sea-ice Floe Fracture",* Brown University, USA

6. Tobias Finn, *"Using machine learning techniques to assimilate data for sea ice models",* École des Ponts ParisTech, France