

# Ed Bueler's research in 3 slides

Department of Mathematics & Statistics  
University of Alaska Fairbanks

August 2024



UNIVERSITY  
*of* ALASKA

*Many Traditions One Alaska*

# thread 1: numerical models of glaciers and ice sheets

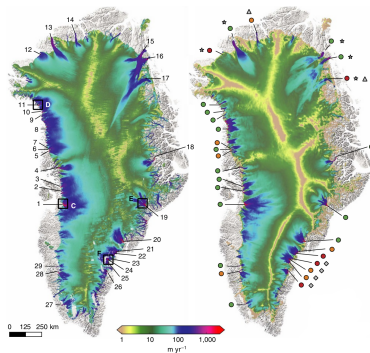
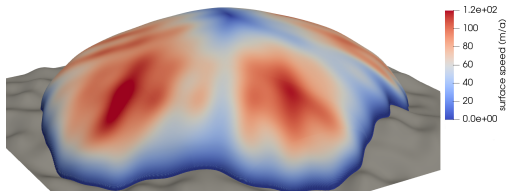
- I work on **numerical models of glaciers and ice sheets**

- mathematical and computational aspects

- **results:**

- 1 2023 paper on ice sheet model performance scaling
- 2 I was a lead author of


the **PISIM**  
PARALLEL ICE SHEET MODEL

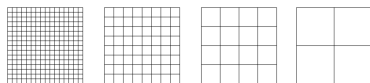
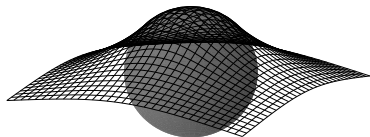


2023 paper →



## thread 2: multigrid solvers for free-boundary problems

- I work on **free-boundary problems**, which are partial differential equations (PDEs) wherein boundary conditions apply at locations only known after you solve the problem
  - rephrase as variational inequalities or complementarity problems
- **result:** a new **multigrid solver** for variational inequalities
  - joint work with P. Farrell (Oxford)
  - implemented in the  *Fire Drake* finite element library (Python)

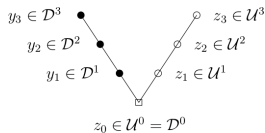


$\Omega^3$

$\Omega^2$


$\Omega^1$

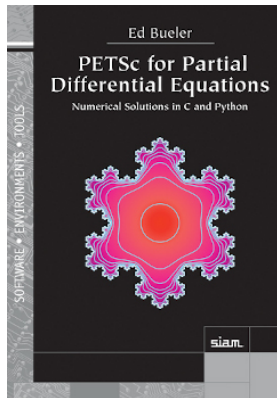
$\Omega^0$



2024 paper →



- I teach numerical analysis, numerical linear algebra, differential equations, and optimization at the MS level
- students (and researchers) in these areas have few resources for tackling the 21st century:
  - **mathematical solver concepts** based on matrices and function spaces
  - **high performance computing libraries** in performant languages like C
- **result:** published **new book** on solving PDE problems using the  **PETSc** solver library



2021 book →

