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PARAMOUR

EOS THE EXCELLENCE OF SCIENCE

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Modelling the basal hydrology under the Greenland Ice Sheet

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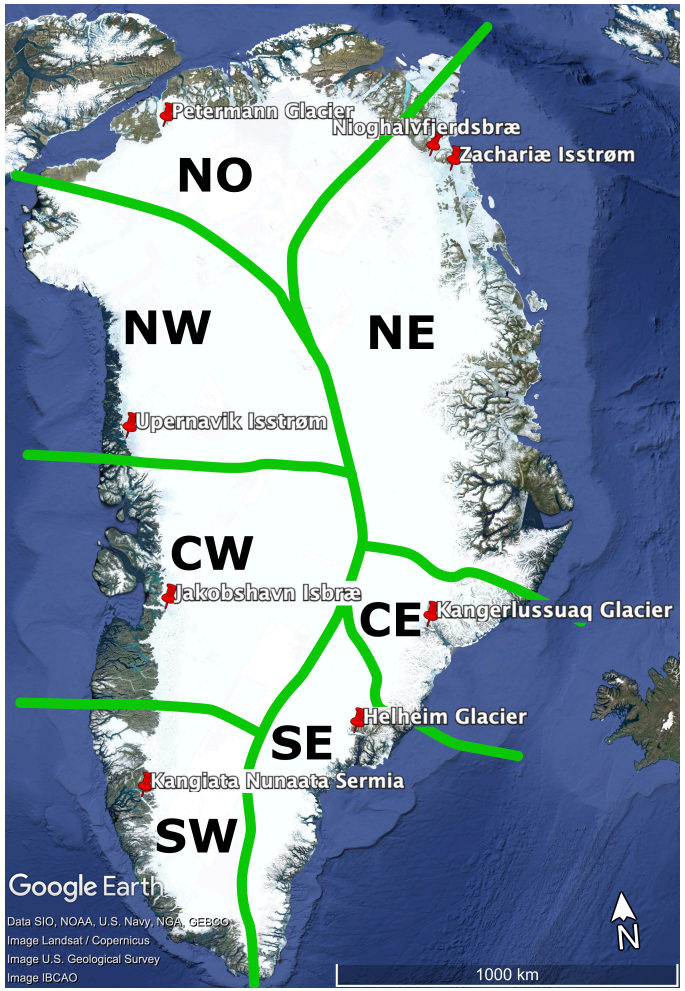
Outline

- Basal water routing is of significant importance
  - Basal processes (such as basal sliding)
  - Submarine melt at calving fronts
- Implemented an efficient model to route basal water
  - Based on the hydraulic potential $\phi = P_w + \rho_w g h$
- Sensitivity analysis
  - 1, 4 and 8 directional routing algorithms
  - Uncertainties in dataset
  - 500 m, 1 km and 5 km resolution
  - Different floatation factors affect routing
- Application
  - Construction of 1980-2018 timeseries of subglacial outflow for 8 important outlets (division per sector according to Slater et al., 2019)



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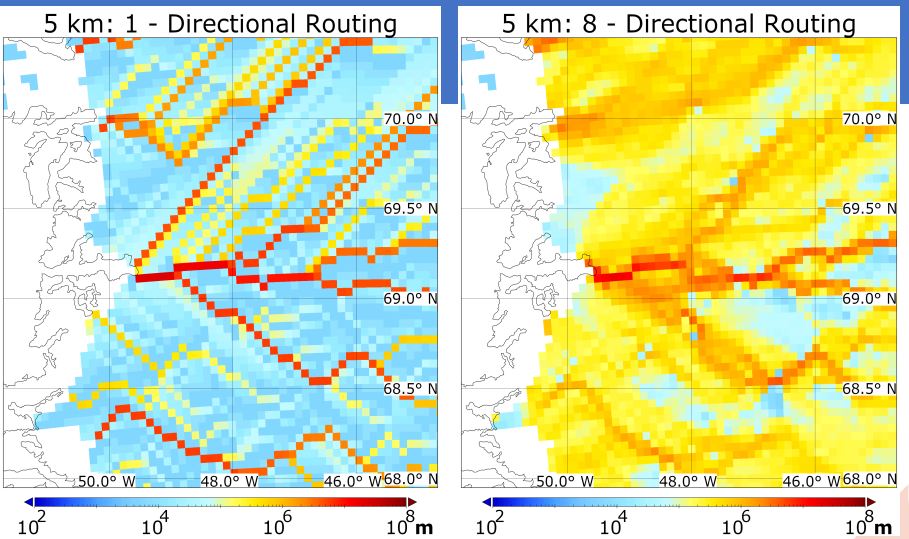
Many uncertainties



Specific catchment areas for the 1D and 8D routing algorithms near Jakobshavn Isbræ on a resolution of 5 km

- Water pressures are not uniform
- Water pressure ≠ ice overburden pressure
- Can affect routing

Routing algorithm

Bedrock topography

Water pressure

Resolution

Uncertainties in topography

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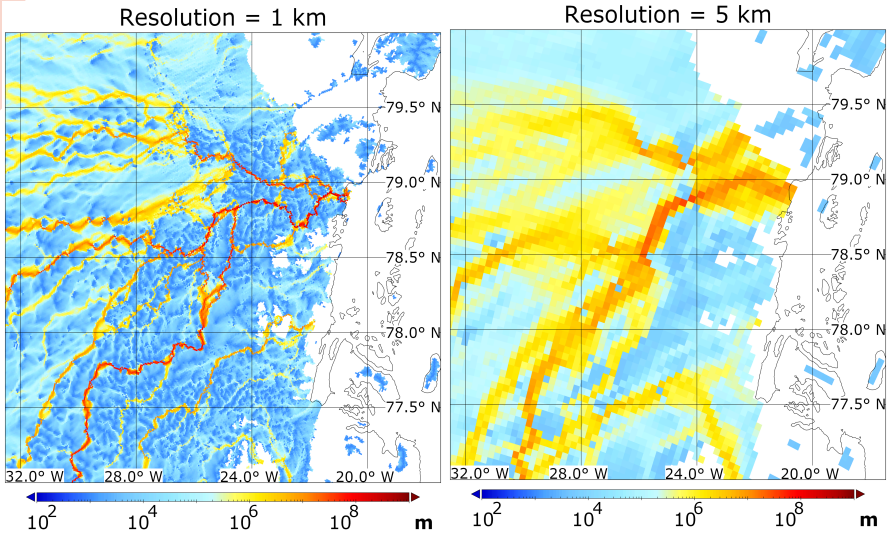
Uncertainties in routing

↓

Uncertainties in exit fluxes



Specific catchment areas on resolutions of 1 km and 5 km near the termini of the NEGIS (8D routing algorithm)

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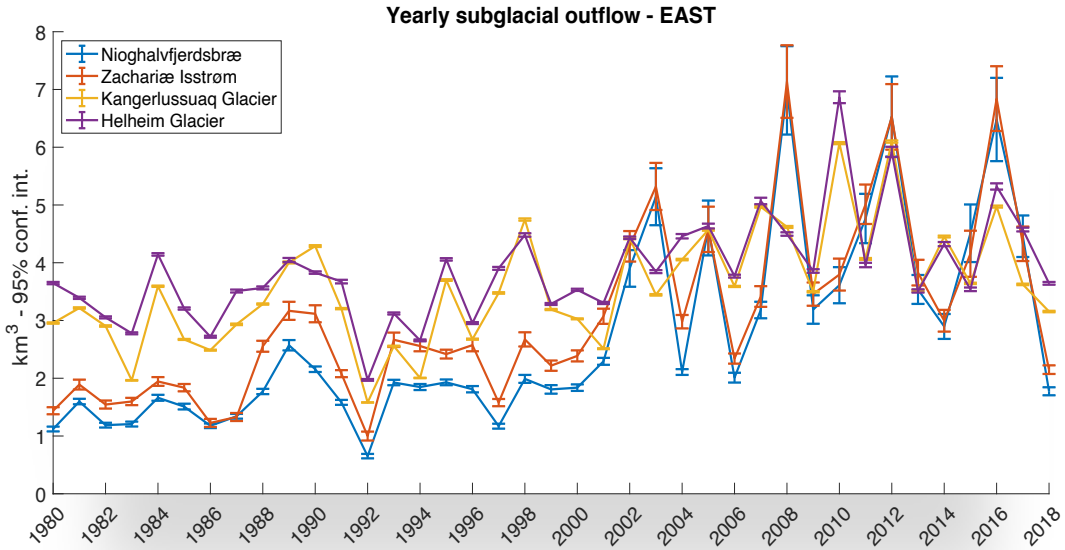
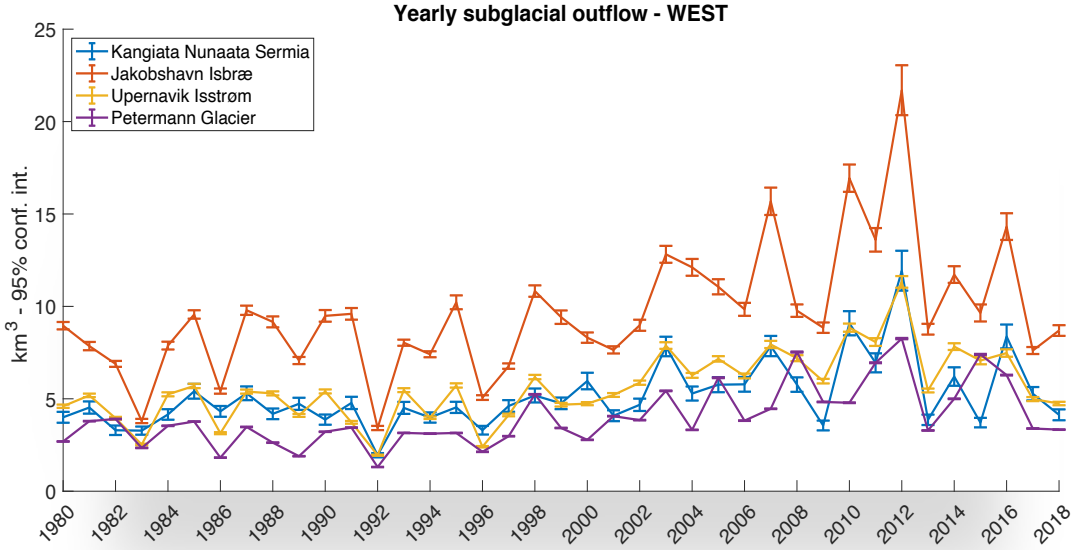
Application: timeseries

- Subglacial outflow of 8 important outlets
  - Runoff: ERA Interim forced by MAR v3.9
  - Basal melt rate: GISM-VUB
- Includes uncertainties due to
  - Bedrock / ice thickness data
  - Water pressure
  - 800 members in ensemble
- Uncertainties in the 95% confidence interval can be large during high-melt years
  - Nioghalvfjerdsbræ 7.0 km^3 ± 0.8 km^3 in 2008
  - Jakobshavn Isbræ 22 km^3 ± 1.4 km^3 in 2012