Fjord Circulation and Thermal Forcing in the Ice-Proximal Region

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RASM Project Meeting
warmer ocean --> more melt-->decrease buttressing -->higher longitudinal stretching (faster flow)
locs of tidewater glacs
red: > 0.5 km/yr
orange/orange-red:0.2–0.1 km/yr// 0.5–0.2 km/yr
yellow:0.1–0.025 km/yr
J drains 8% of ice sheet area
H ‘ ‘ 4% -----rignot and Kanagaratnam 2006
K ‘ ‘ 4%

discharge rates: – all three ~ 28 km$^3$/yr

irminger current: brings gulf streem water – salty and warm
bifurcates into egc – a bouyancy current trapped against teh shelf break
egc brings in a lot of ice bergs from arctic ~90 pc
INTERMEDIATE DEPTHS (150–400) VERY DENSE AND WARM ATLANTIC WATERS
• **Purpose:** account for oceanic thermal forcing on marine terminating glaciers

Ocean thermal forcing may play a key role on the dynamics of outlet glaciers in Greenland. A parameterization of fjord processes will be accounted for in the ocean and land ice components of RASM. Water column properties adjacent to the ice edge will be estimated from a fjord model shown schematically in the diagram below. Sensitivity studies from this model will provide the basis for the parameterization of melt rate at the glacier terminus and resulting freshwater flux to the open ocean.
Examines the sensitivity of melt rate (until initial buoyancy due to subglacial forcing is lost) on subglacial flux, geometry, and thermal forcing.

\[ \dot{m} = \left(1 + 0.2 \frac{X}{L} \right) A_0 U T_0 M_0 (g D X_0 U X_0 \Delta \rho_i)^{1/3} (T_a - T_{af}) X_0 \]

- Melt rate is proportional to the cube root of the subglacial flux.
- Melt rate has a linear (when subglacial forcing dominates) dependence on ambient temperature but a non-linear (quadratic) dependence when melting dominates the plume’s buoyancy.

Colors denote various subglacial discharge fluxes.