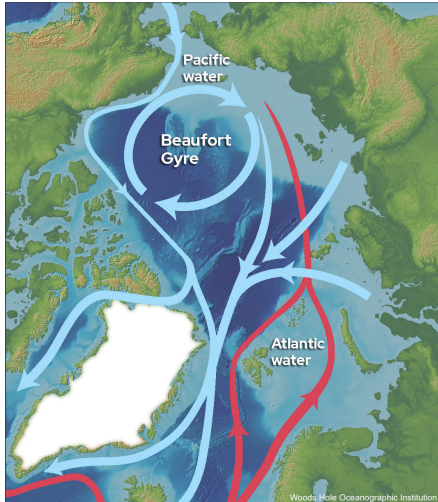# Air-Sea, Ice-Sea, and Effective Wind Forcing of the Beaufort Gyre

Elizabeth Webb
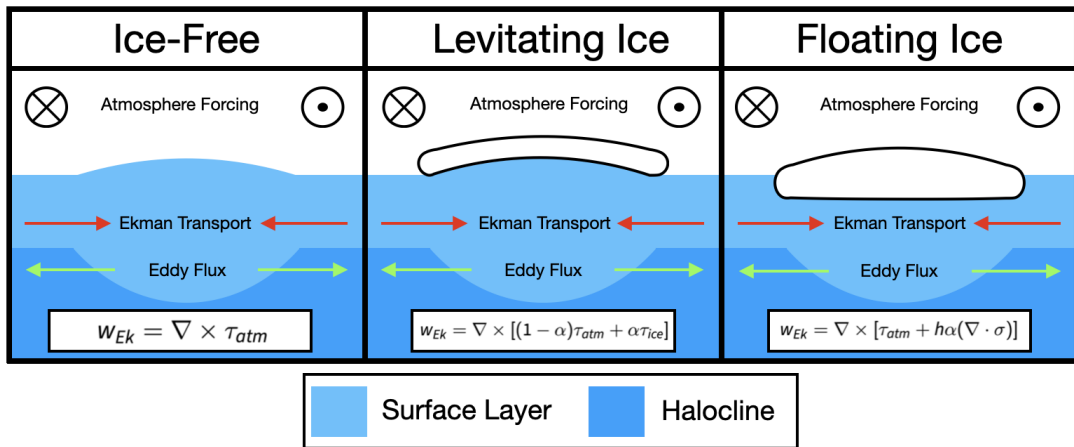Supervised by David Straub,
and Bruno Tremblay

The Beaufort Gyre (BG): Location

- ▶ Dominant circulation in the Canadian Arctic Basin
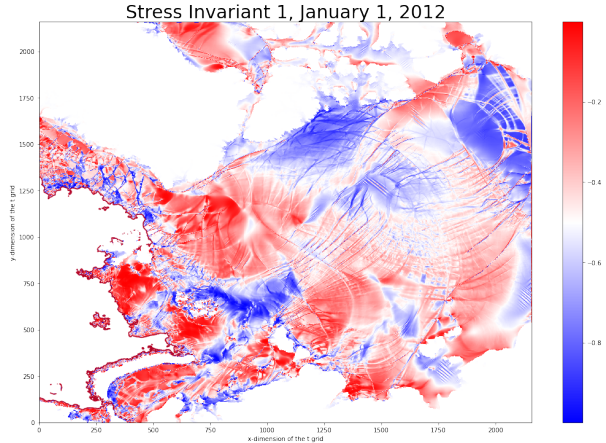- ▶ Collecting fresh water in surface layer

Reformulation with Floating Ice

► We have reformulated the equation to implicitly include the ice-ocean forcing

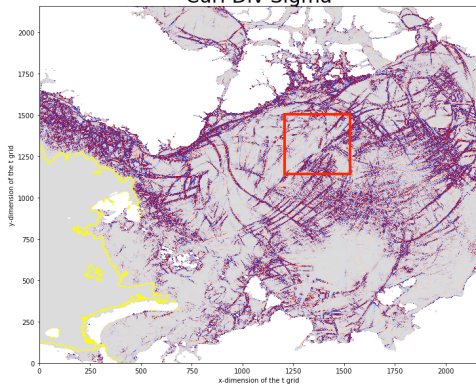| Ice-Free	Levitating Ice	Floating Ice
Atmosphere Forcing	Atmosphere Forcing	Atmosphere Forcing
Ekman Transport	Ekman Transport	Ekman Transport
Eddy Flux	Eddy Flux	Eddy Flux
$w_{Ek} = \nabla \times \tau_{atm}$	$w_{Ek} = \nabla \times [(1-\alpha)\tau_{atm} + \alpha\tau_{ice}]$	$w_{Ek} = \nabla \times [\tau_{atm} + h\alpha(\nabla \cdot \sigma)]$

Surface Layer   Halocline

Calculating Stress

$$\sigma_{ij} = 2\eta\dot{\epsilon}_{ij} + [\zeta - \eta]\dot{\epsilon}_{kk}\delta_{ij} - \frac{P}{2}\delta_{ij}$$

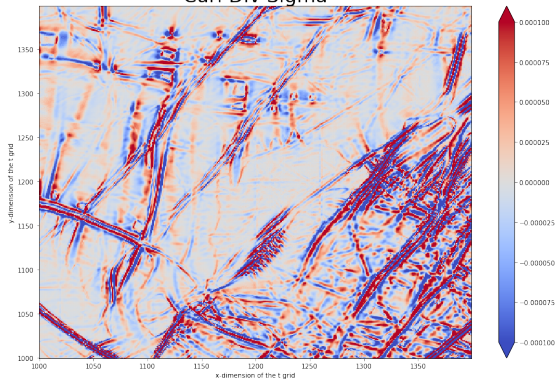$$I_1 = \frac{\sigma_{11} + \sigma_{22}}{2P}$$

Stress Invariant 1, January 1, 2012

$$\text{Recall, } w_{Ek} = \nabla \times \left(\tau_{atm} + h\alpha(\nabla \cdot \sigma) \right)$$

Curl Div Sigma

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Some take aways:

1. The reformulated method accounts for the transport of ice mass
2. By accounting for sea-ice rheology, we include small scale features, which contradicts Ekman theory
3. If you are working with ECCO LLC models, I would be very interested in chatting!

Thank you!