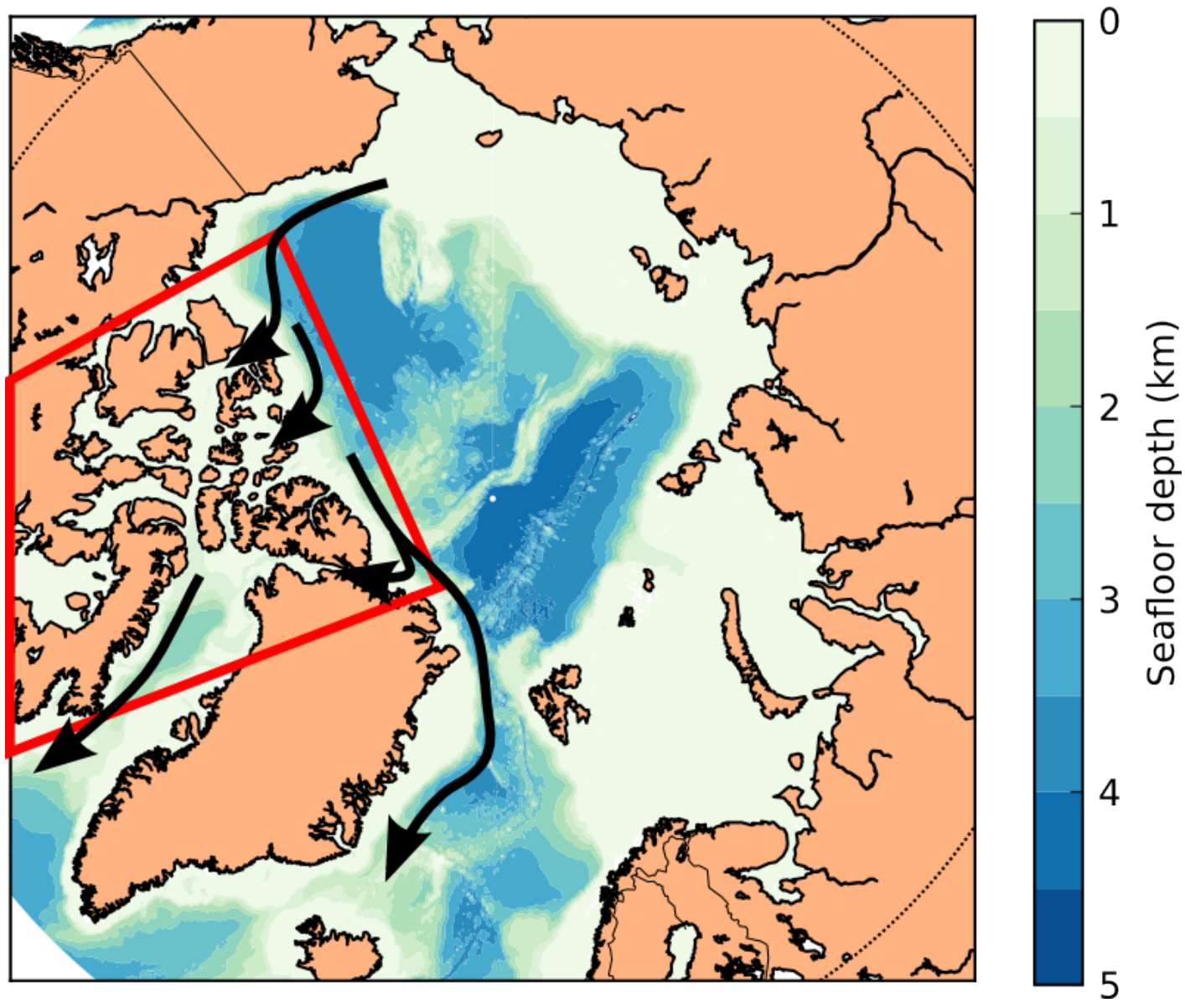
Mixing in the Canadian Arctic Archipelago

Ken Hughes[1]
Jody Klymak[1], Xianmin Hu[2], Paul Myers[2]

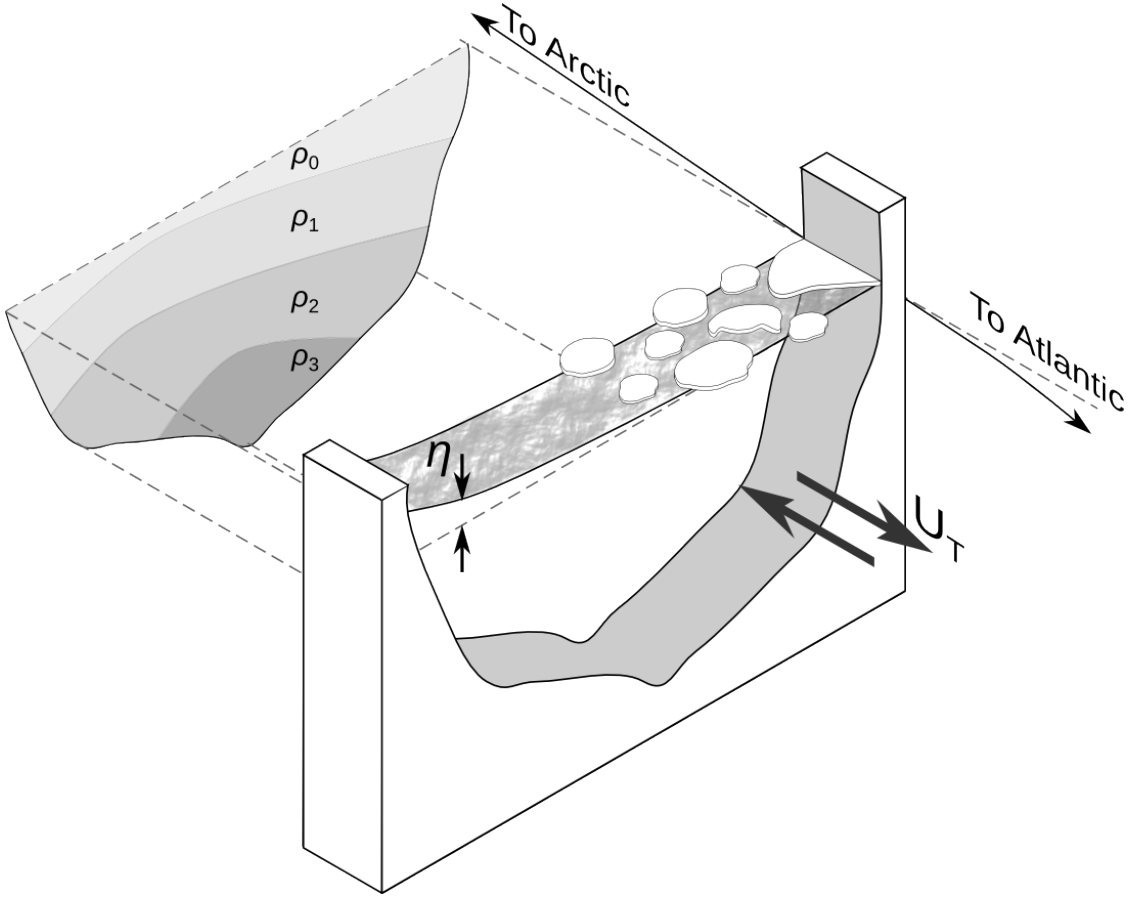
[1]University of Victoria, [2]University of Alberta

Location



Flow details

- Large u^3/H
- Both SSH and density differences important
- Ice cover
- Channels wide relative to internal Rossby radius



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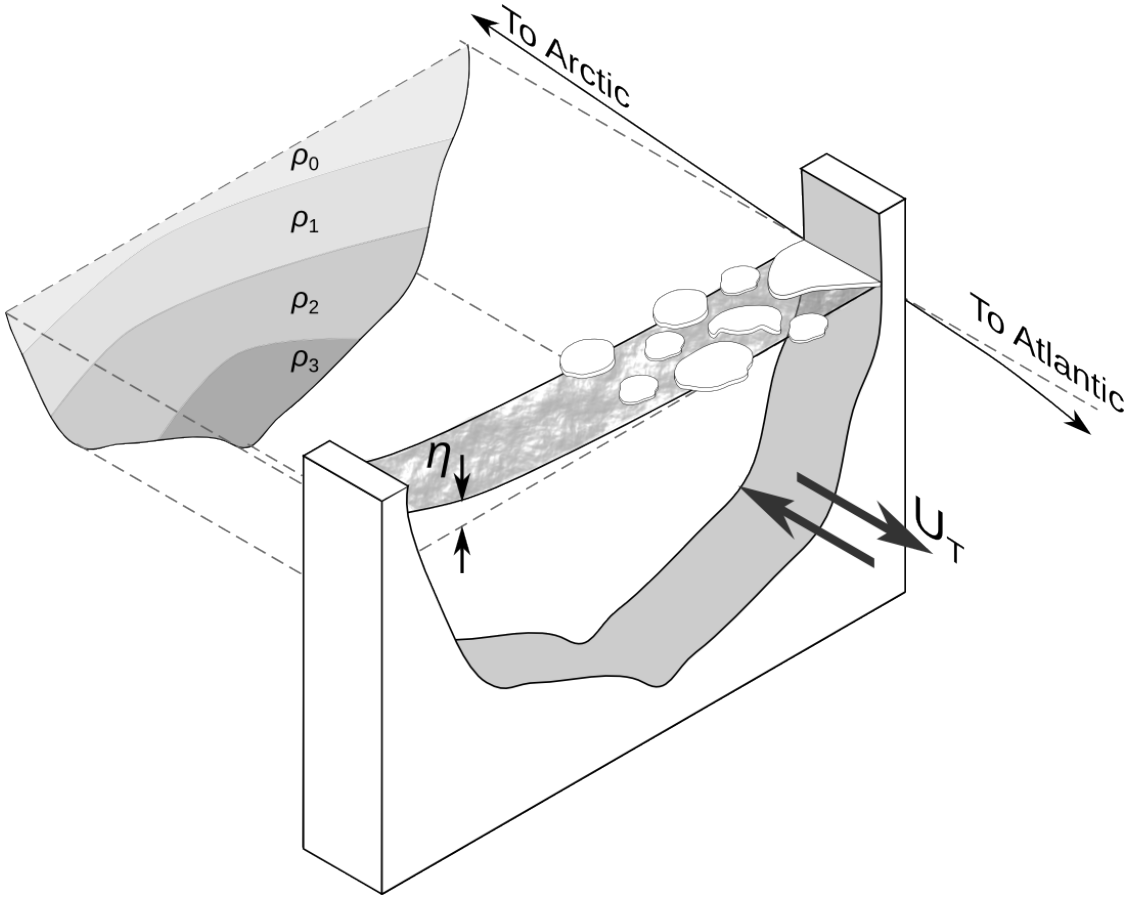

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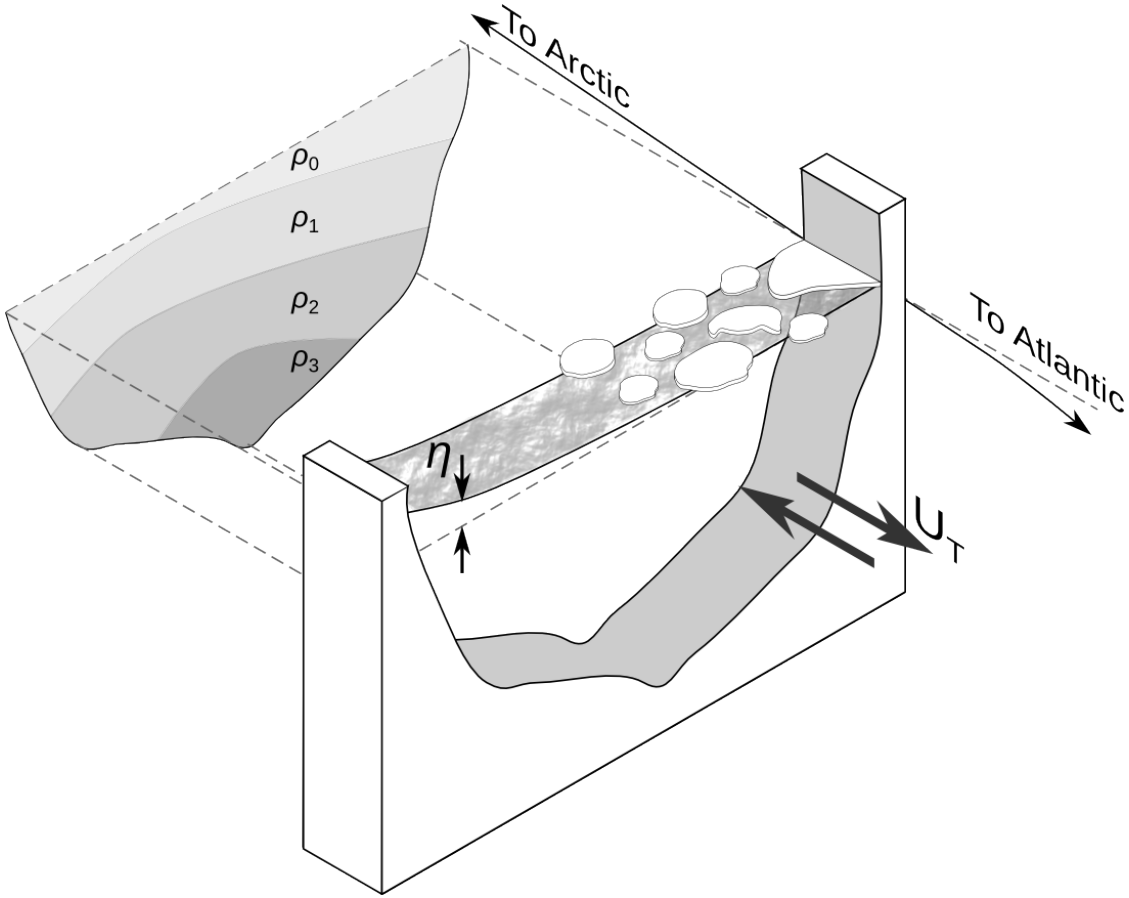

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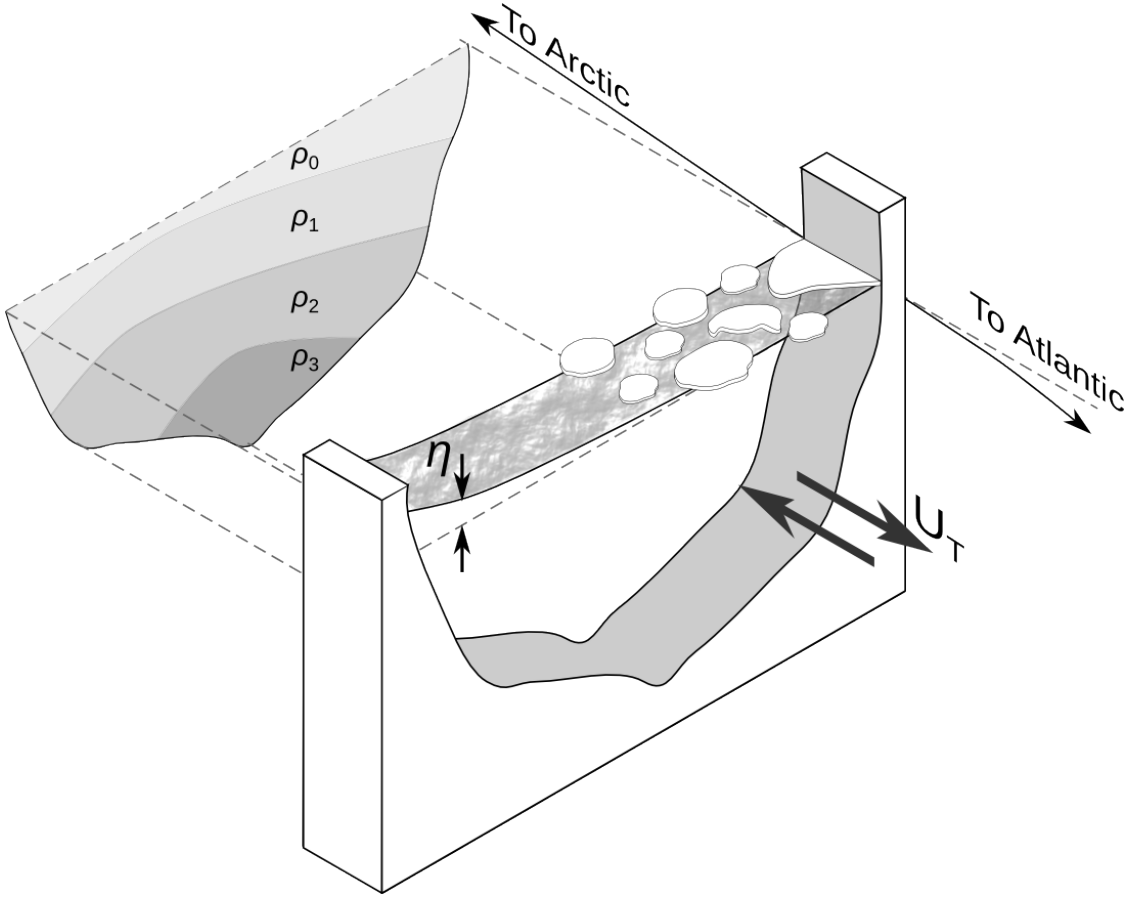


Penny Strait

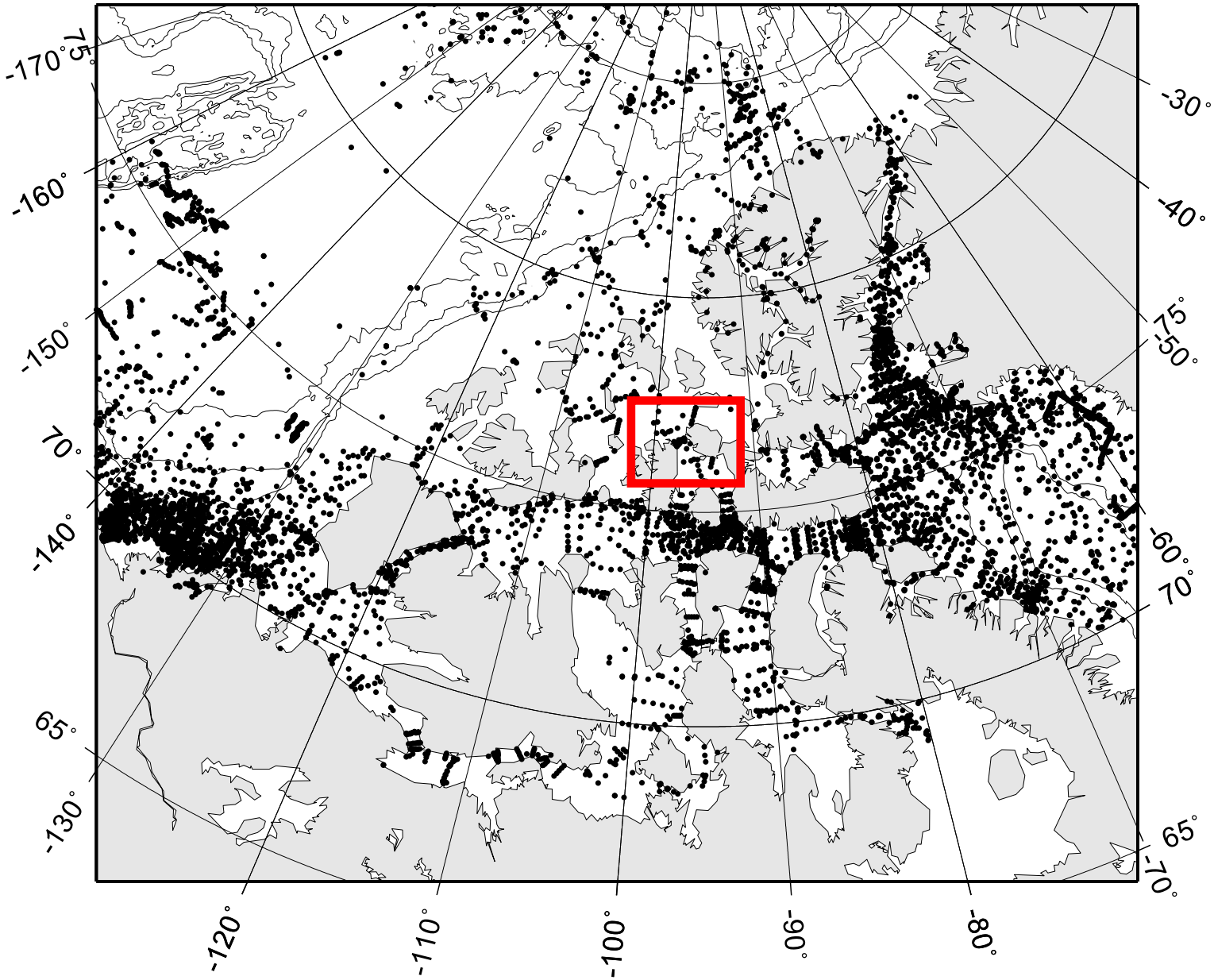
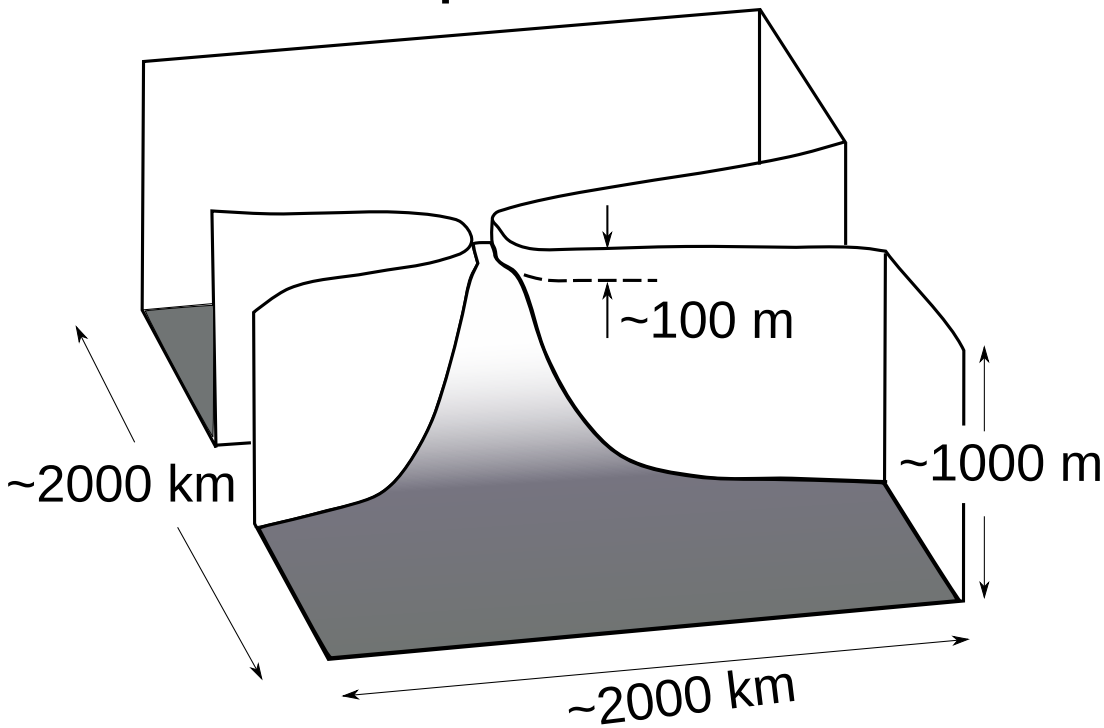


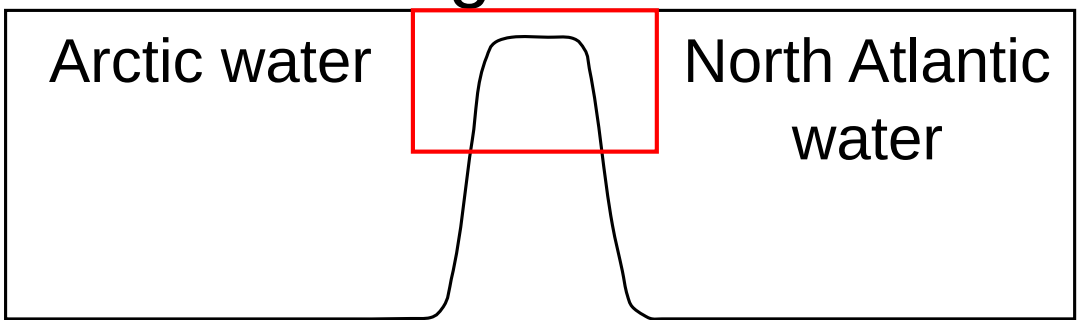
Figure from Kliem and Greenberg (2003)

Method One: Modelling

3D representation



Long-section



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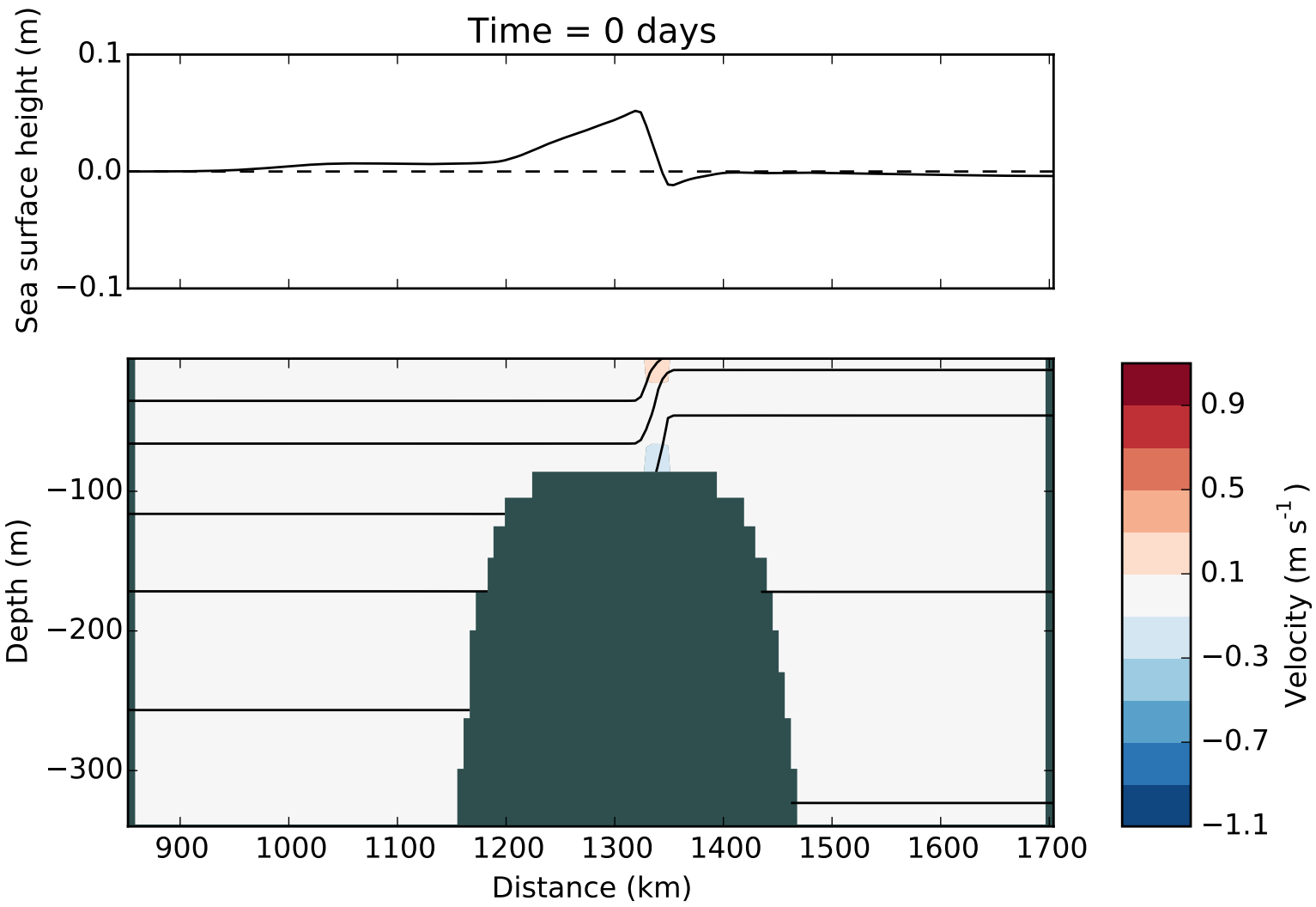

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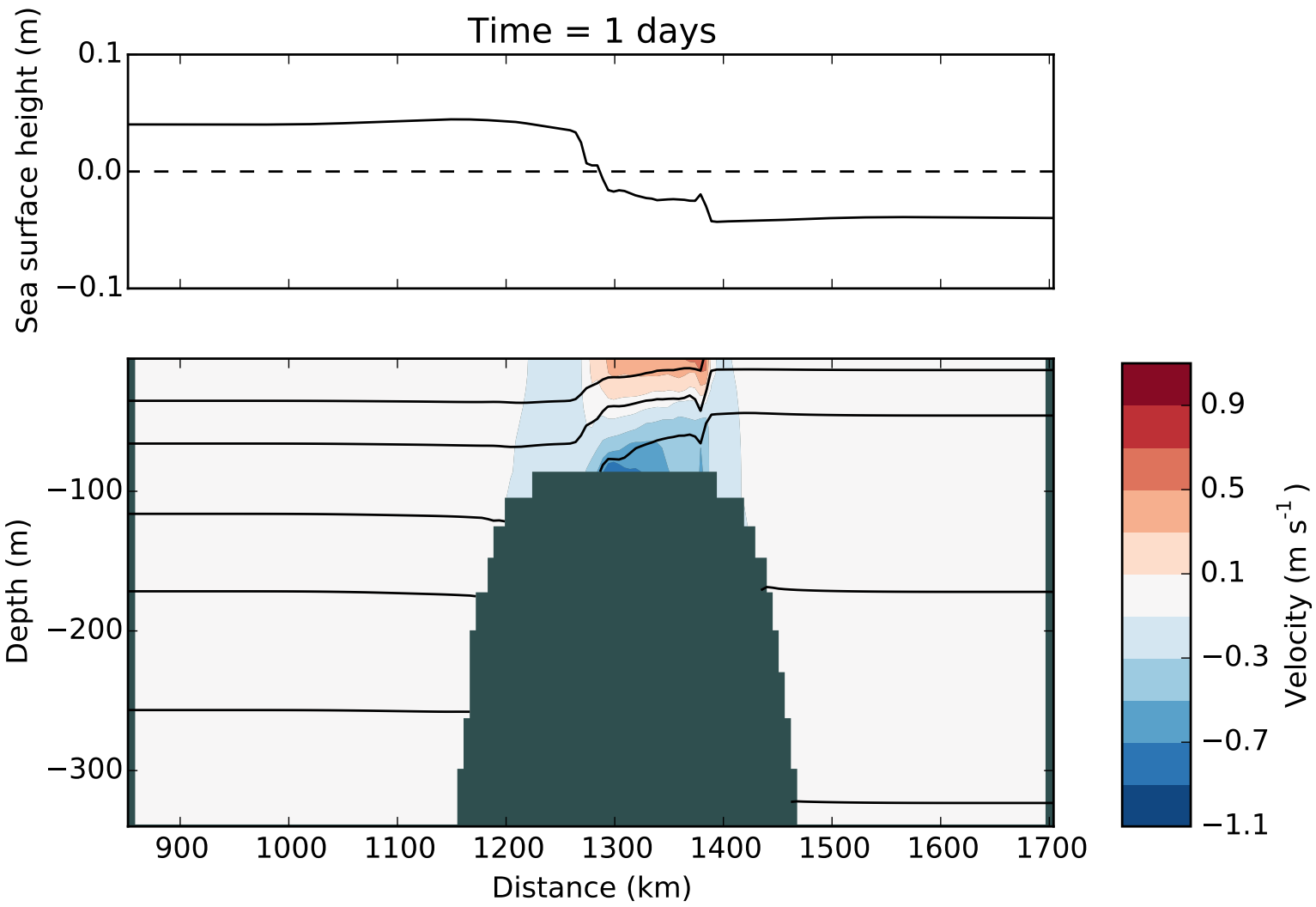

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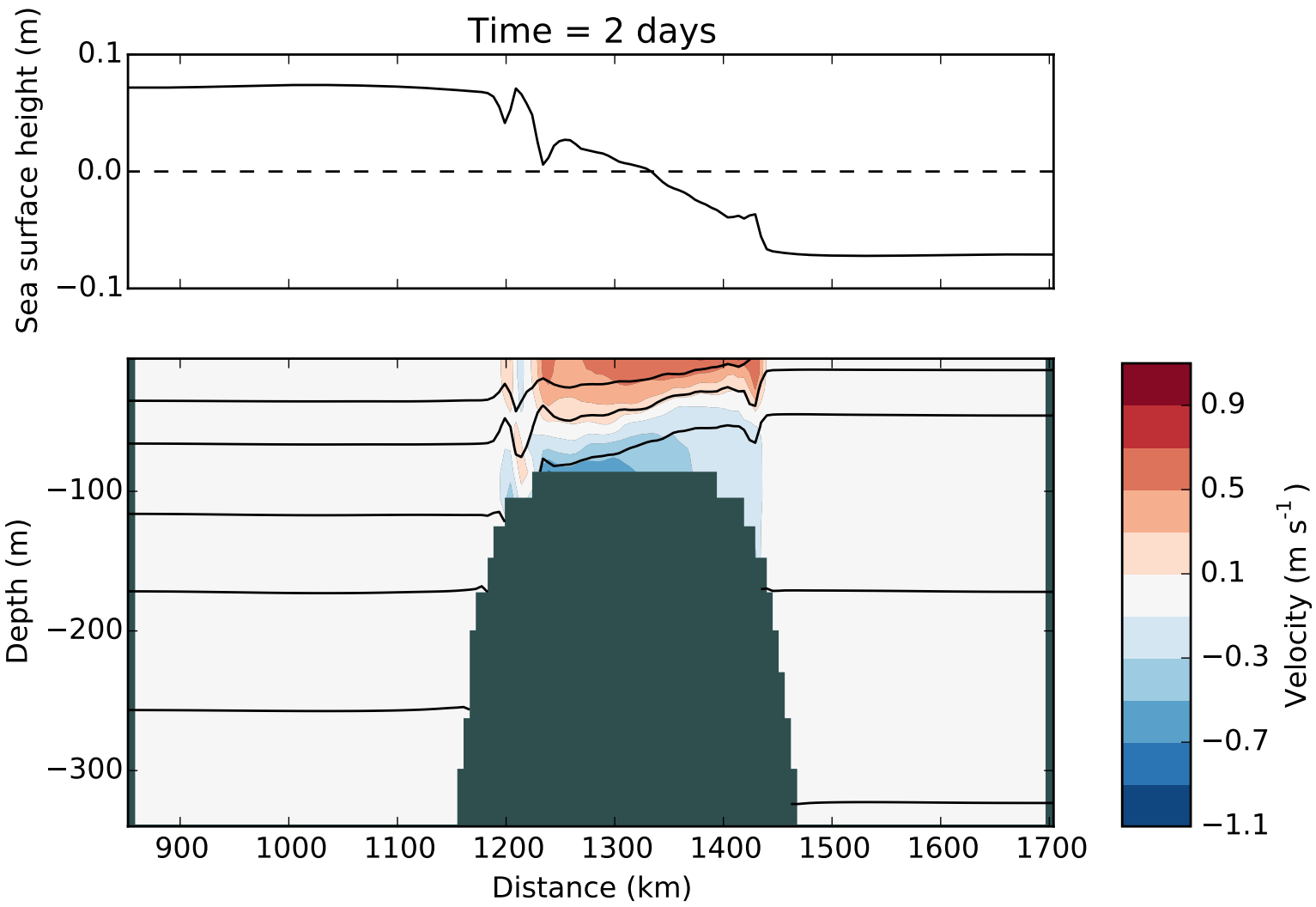

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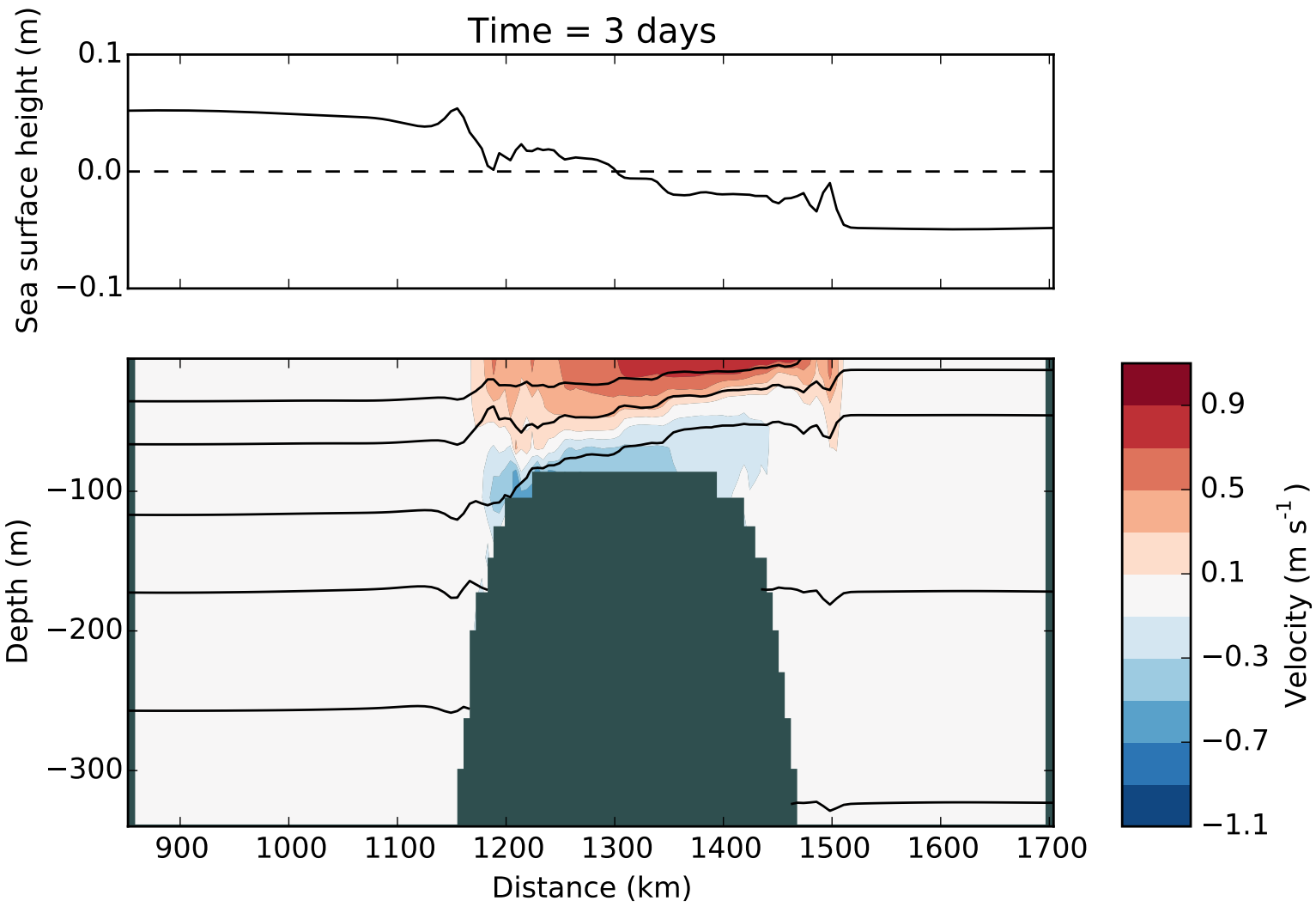

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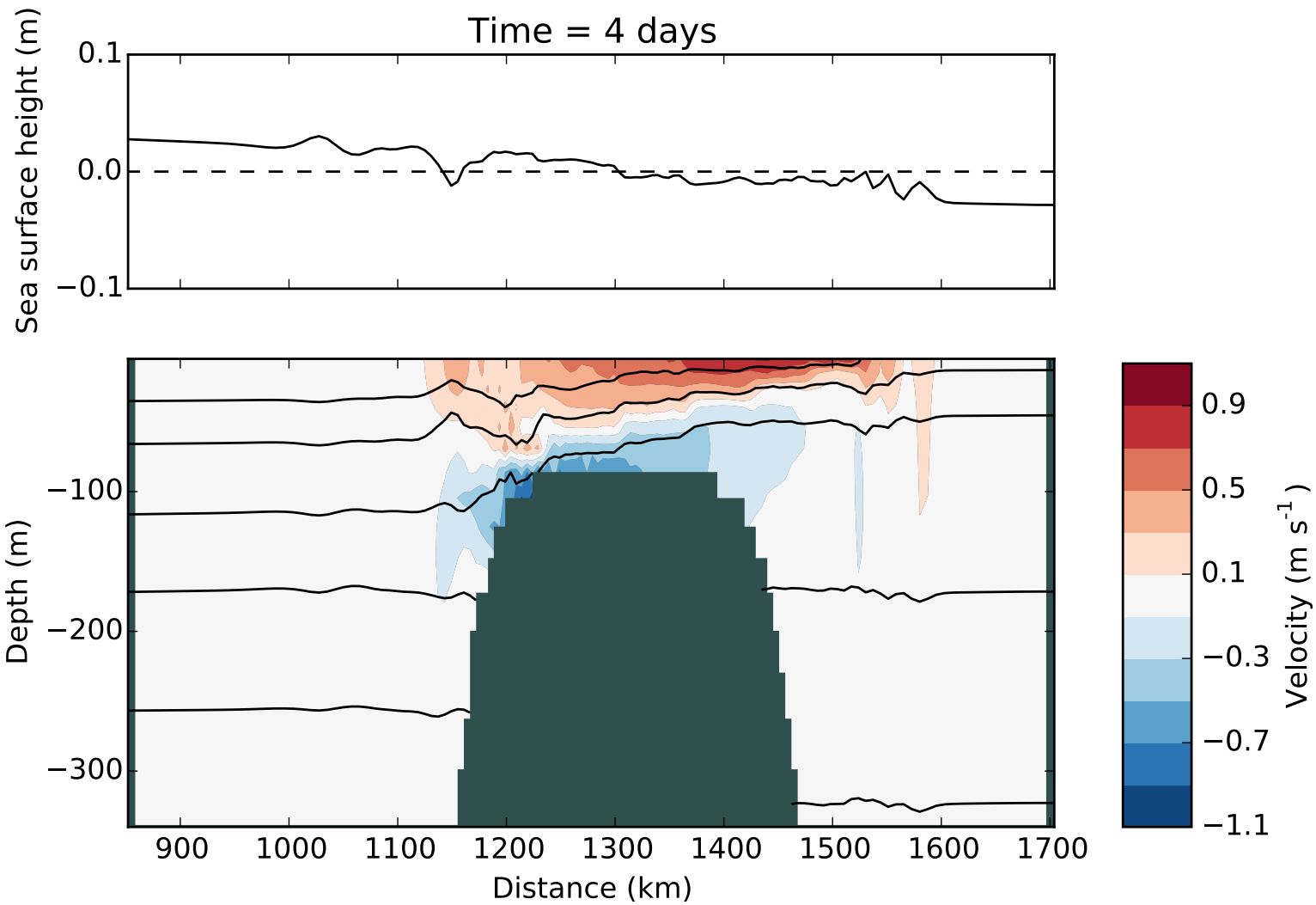

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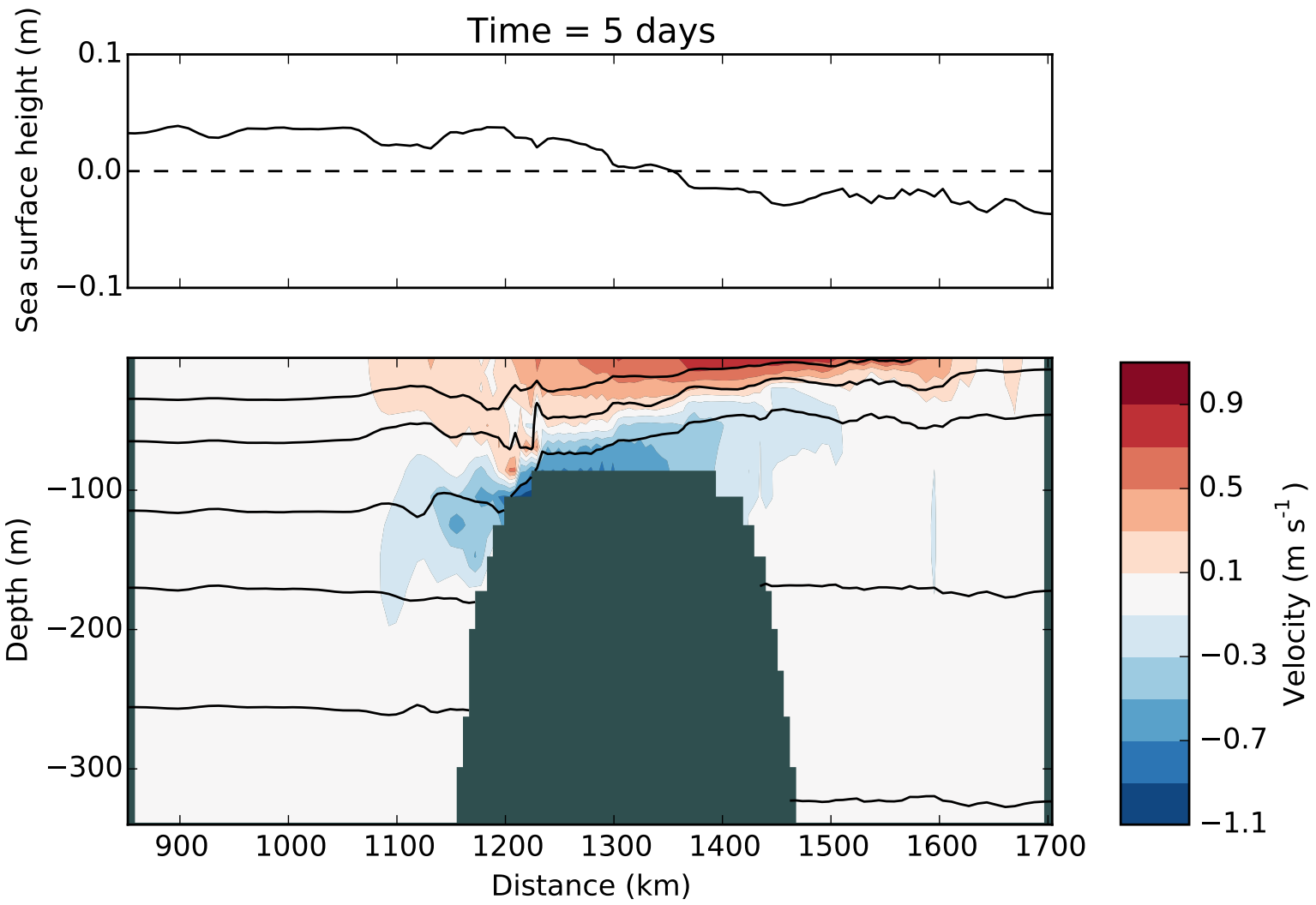

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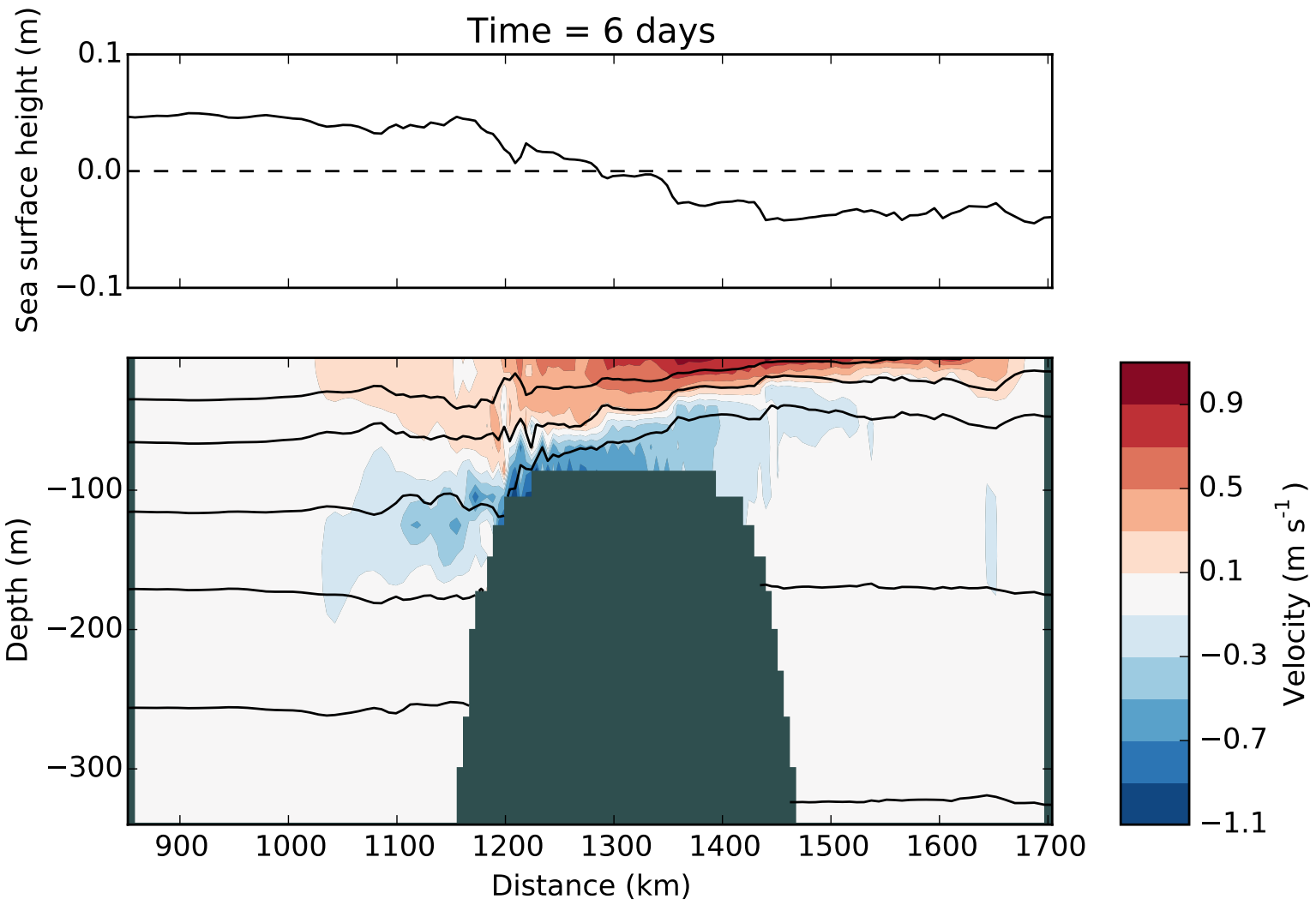

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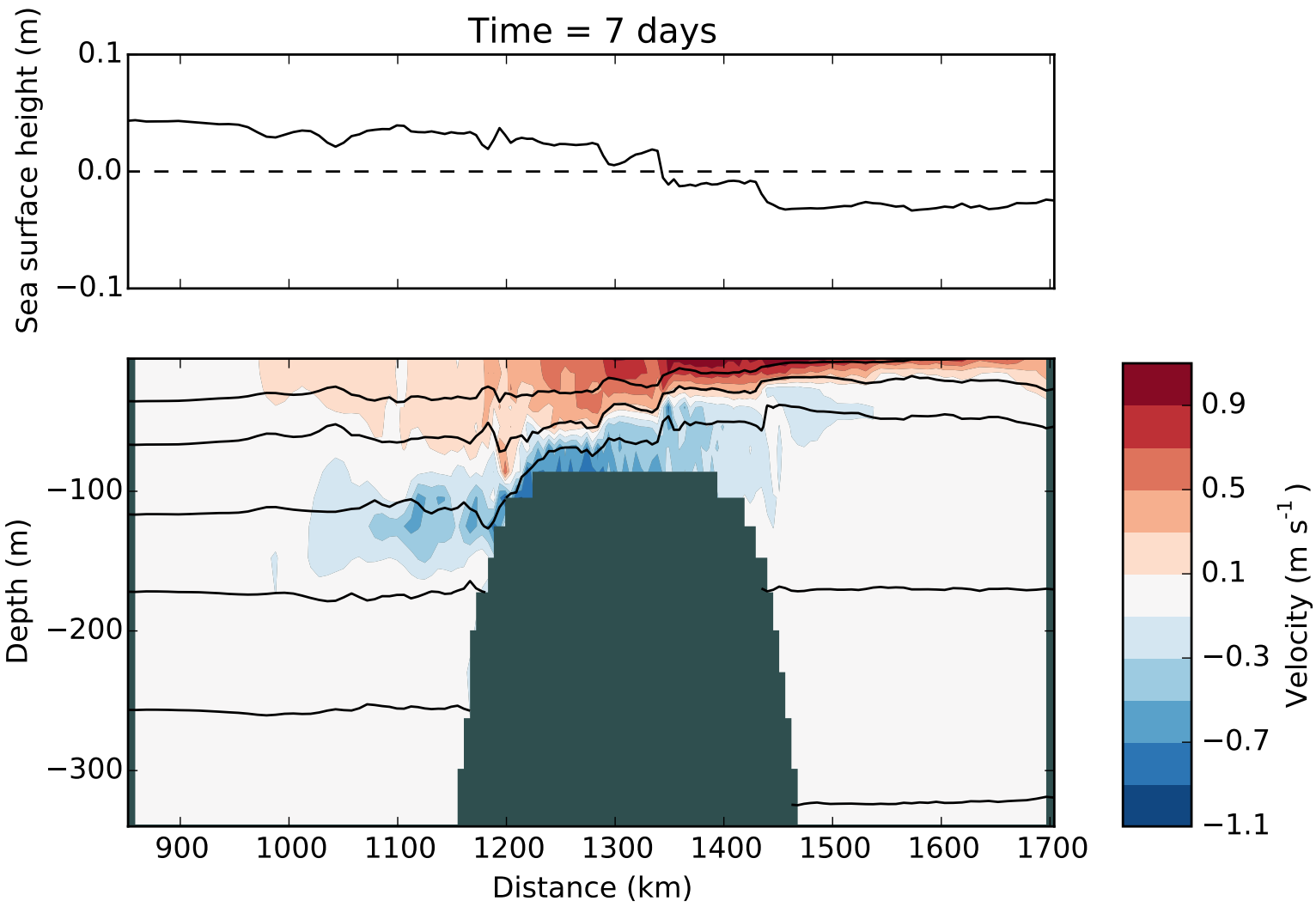

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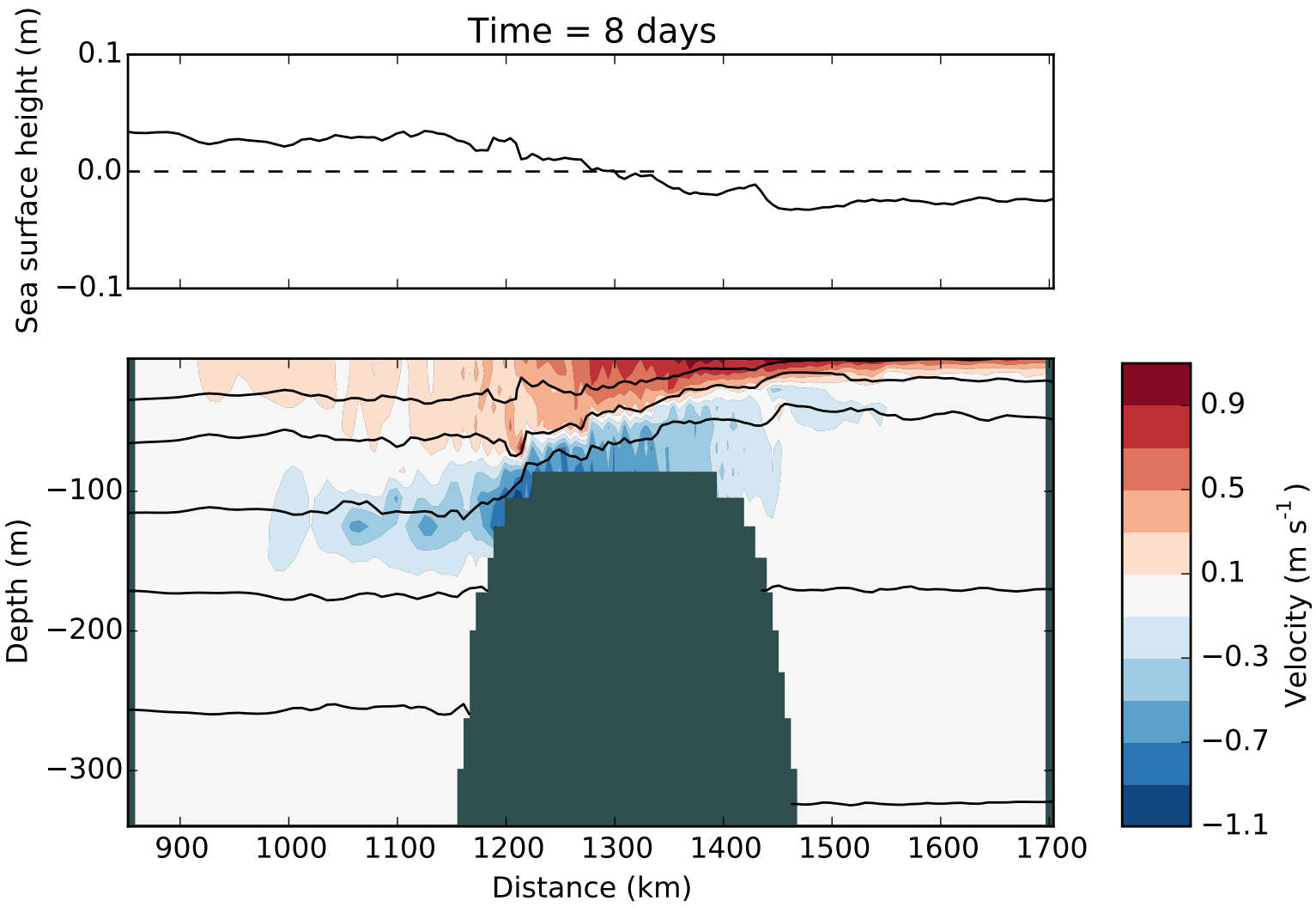

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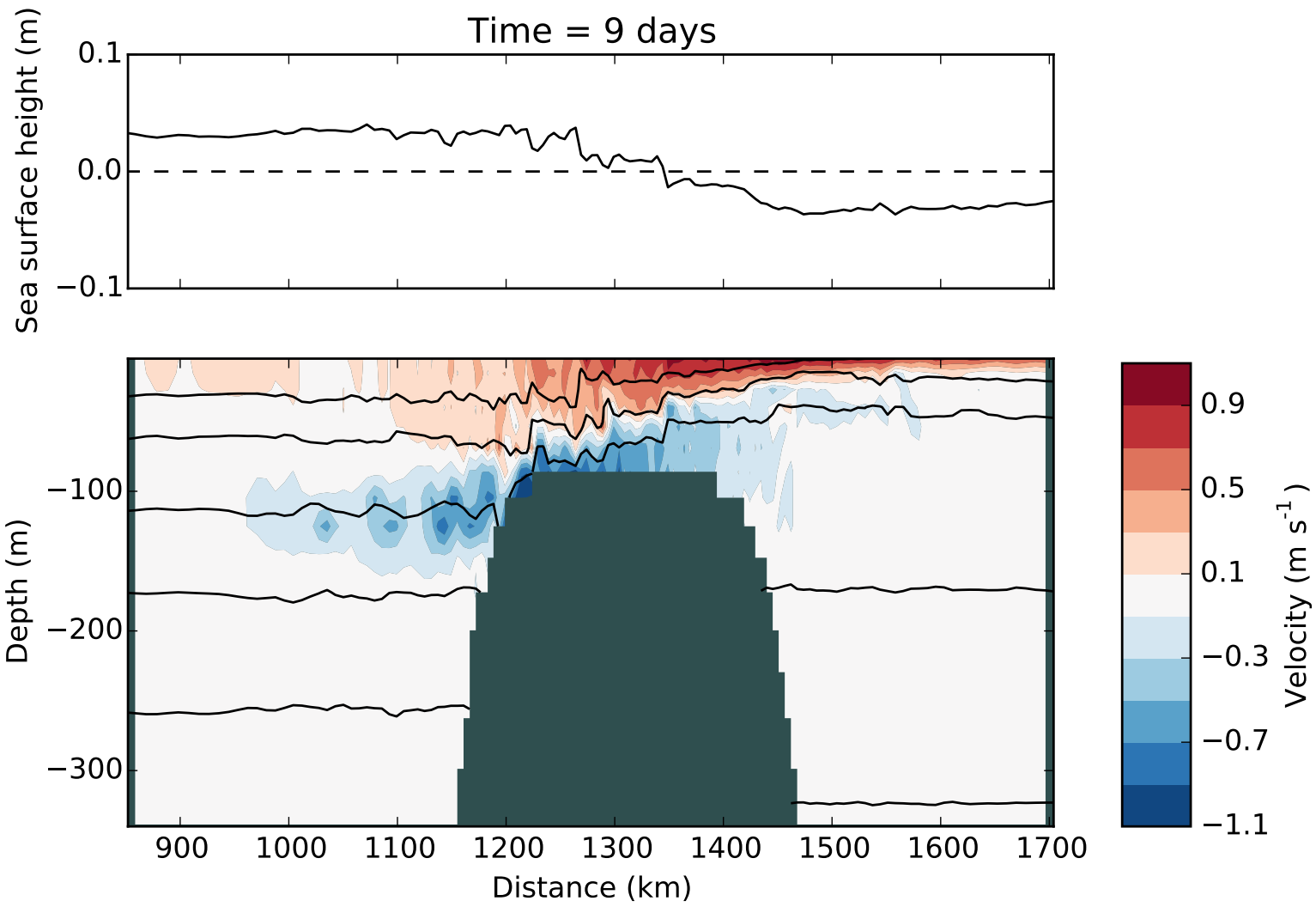

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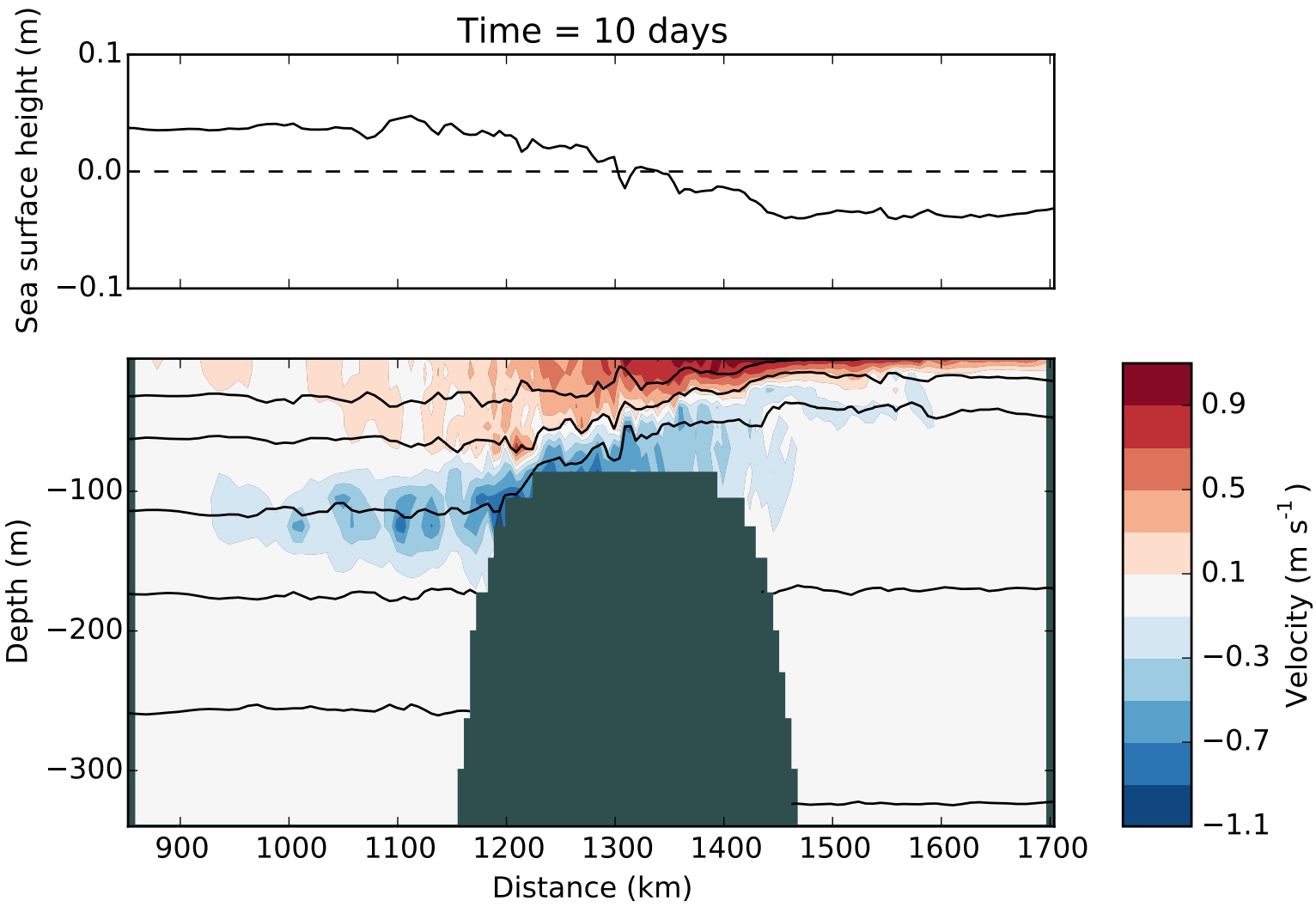

Modelling Plans

- Apply realistic bathymetry
- Ramp up resolution
- Impose tides

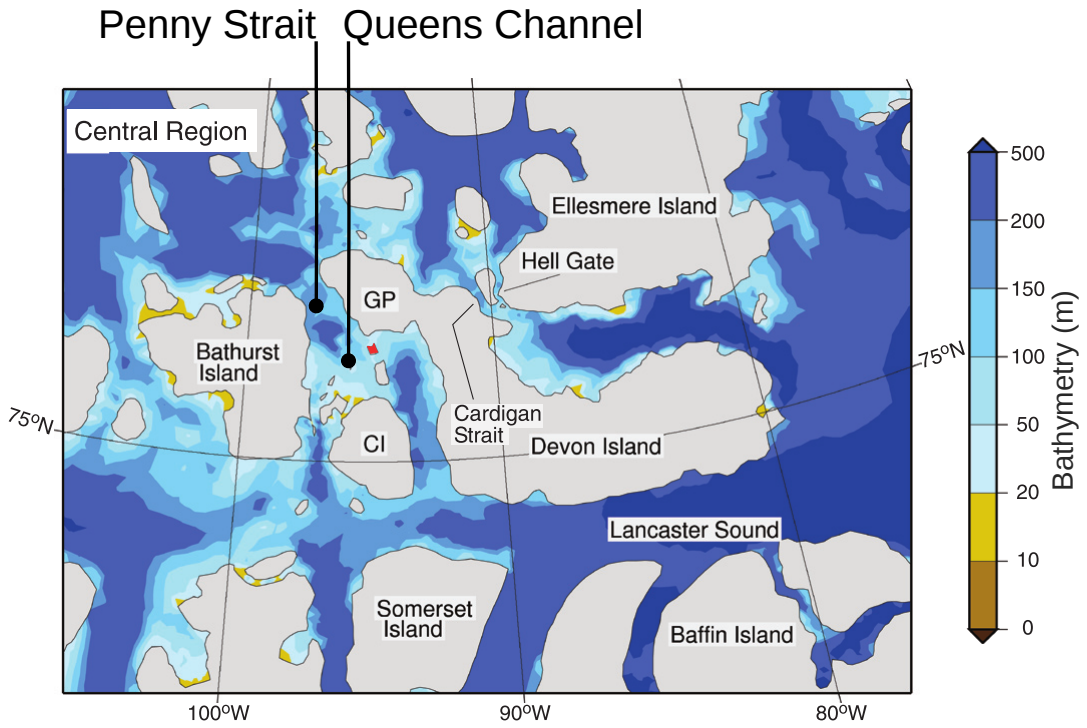

Figure from Hannah et al. (2009)

Similar studies

- Strait of Gibraltar: e.g. (Sánchez-Garrido et al., 2011)
- Luzon Strait: e.g. (Alford et al., 2015)
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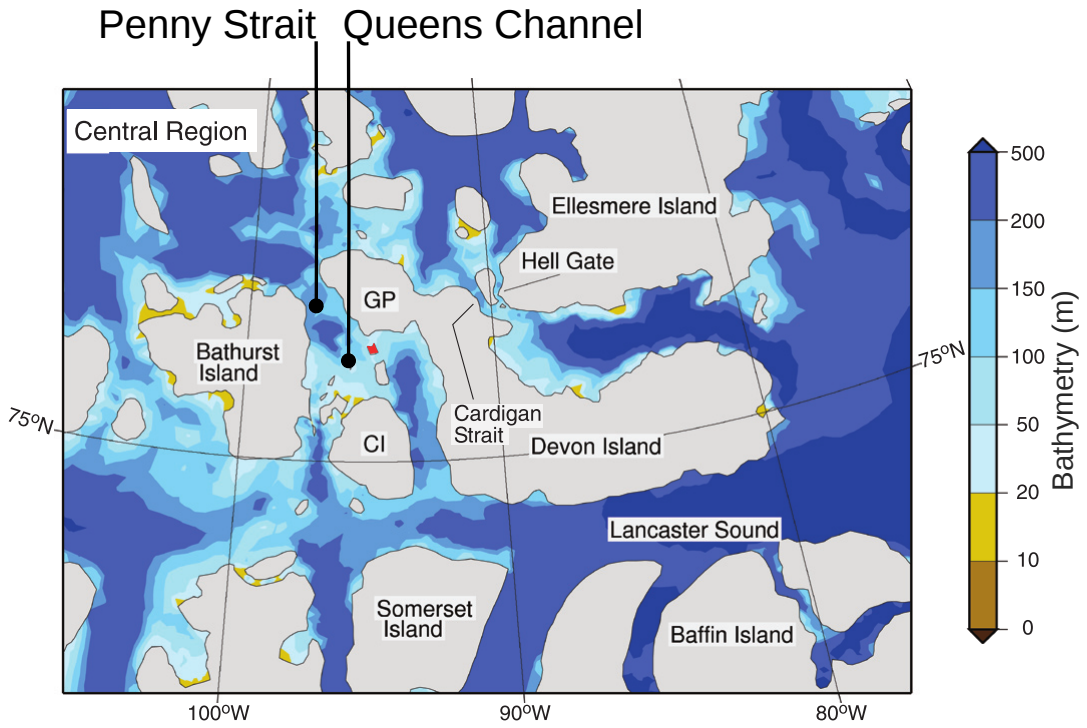

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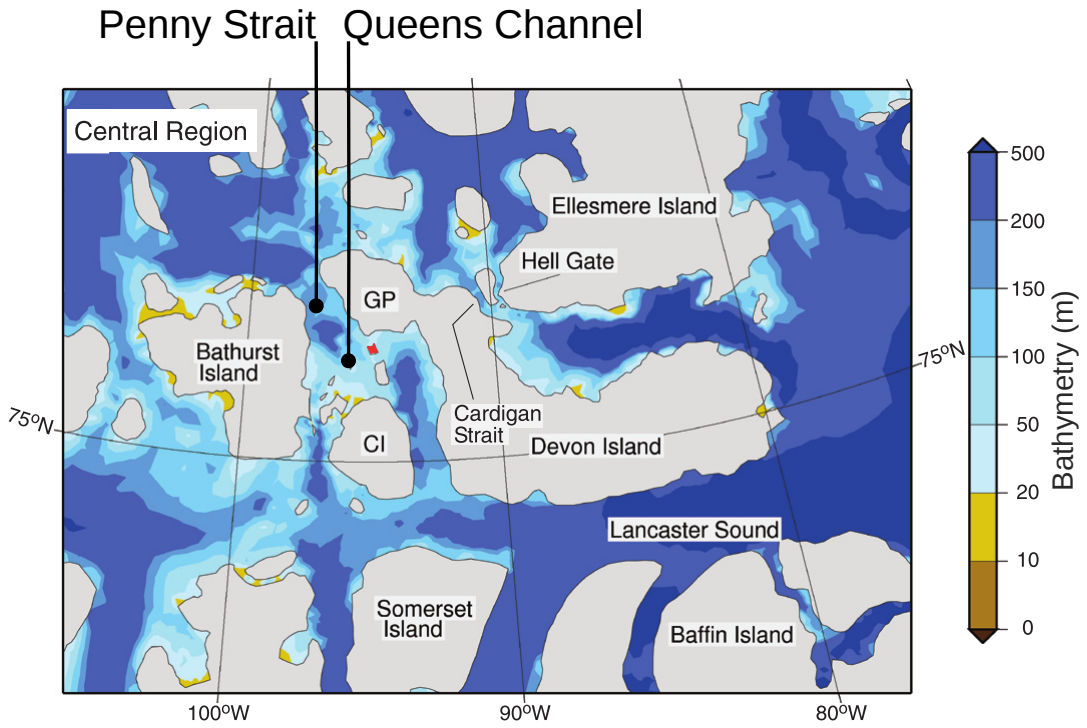

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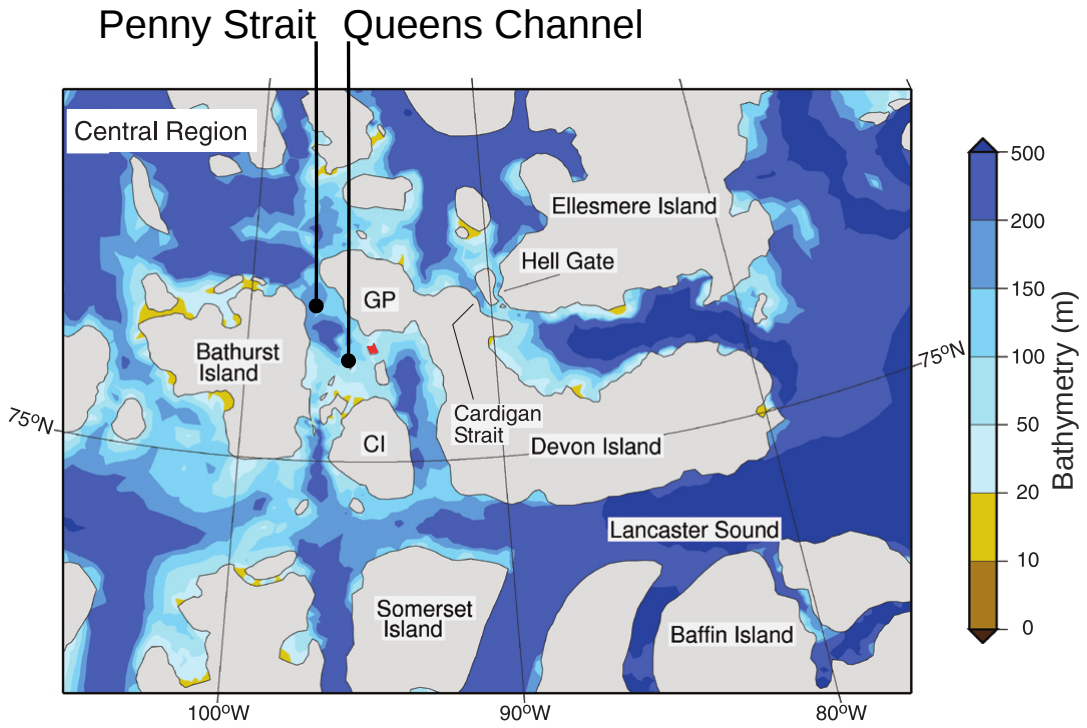

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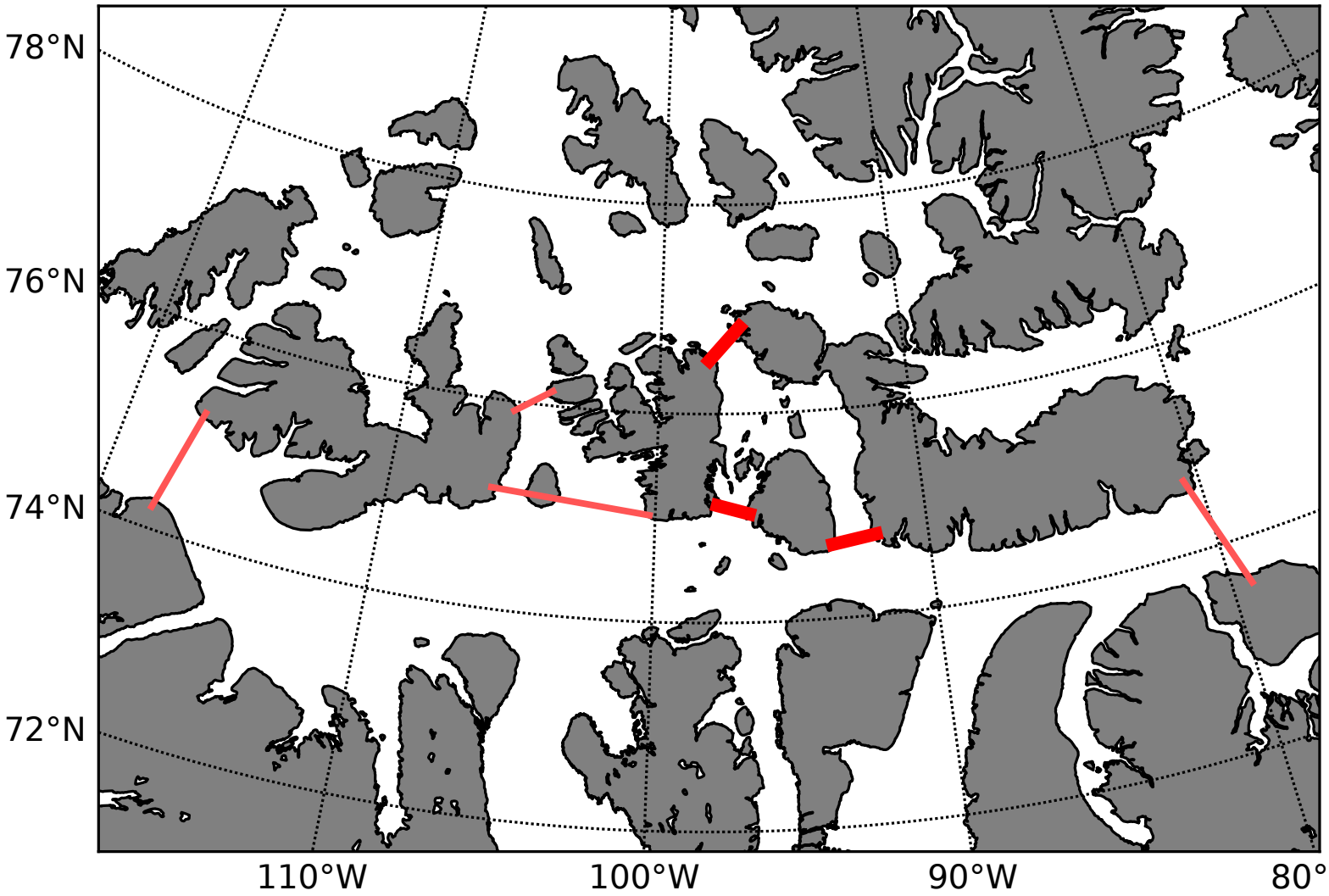
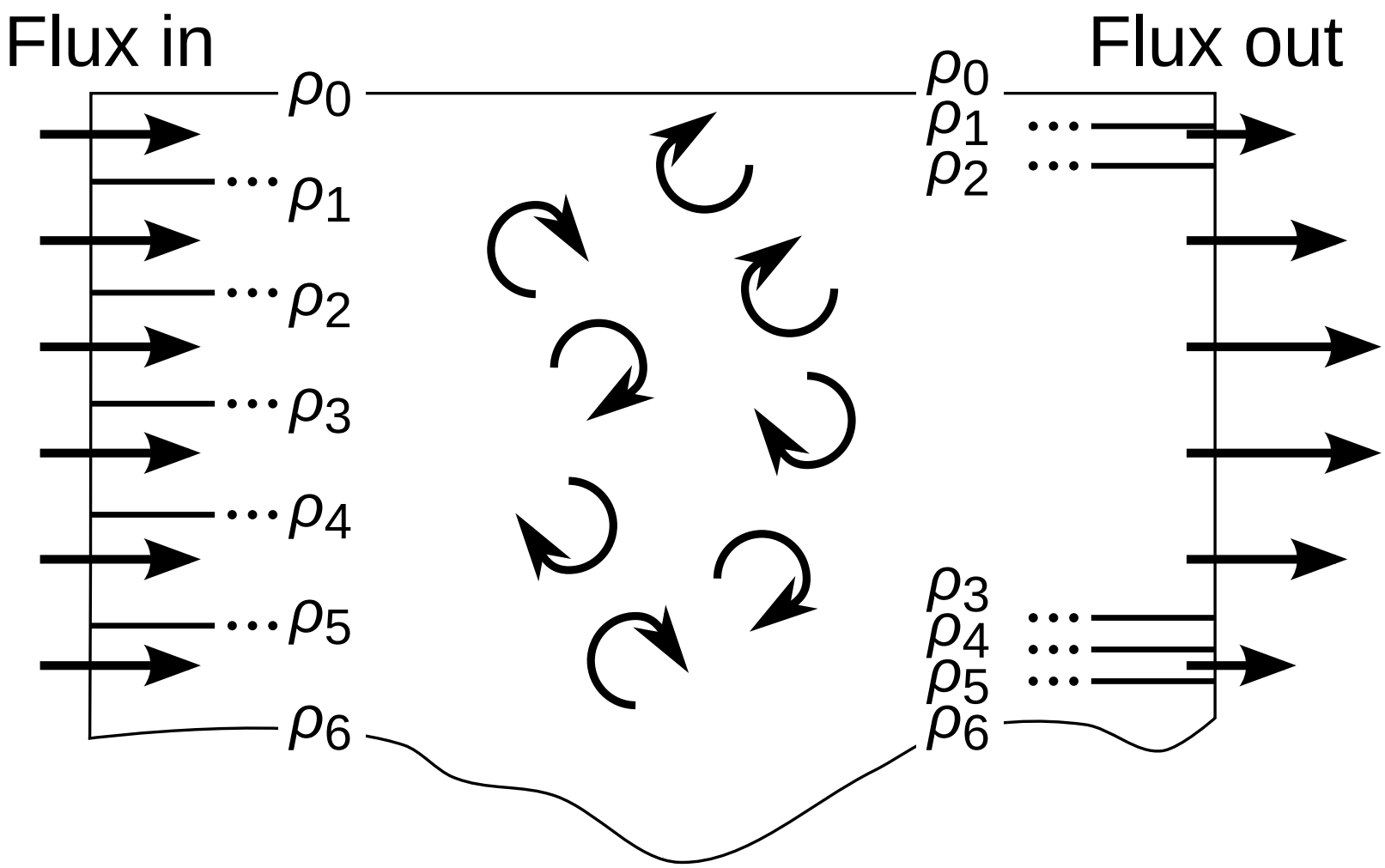
ANHA12

Arctic and Northern Hemisphere Atlantic, 1/12 degree resolution



Output courtesy of Xianmin Hu and Paul Myers

Transport and mixing



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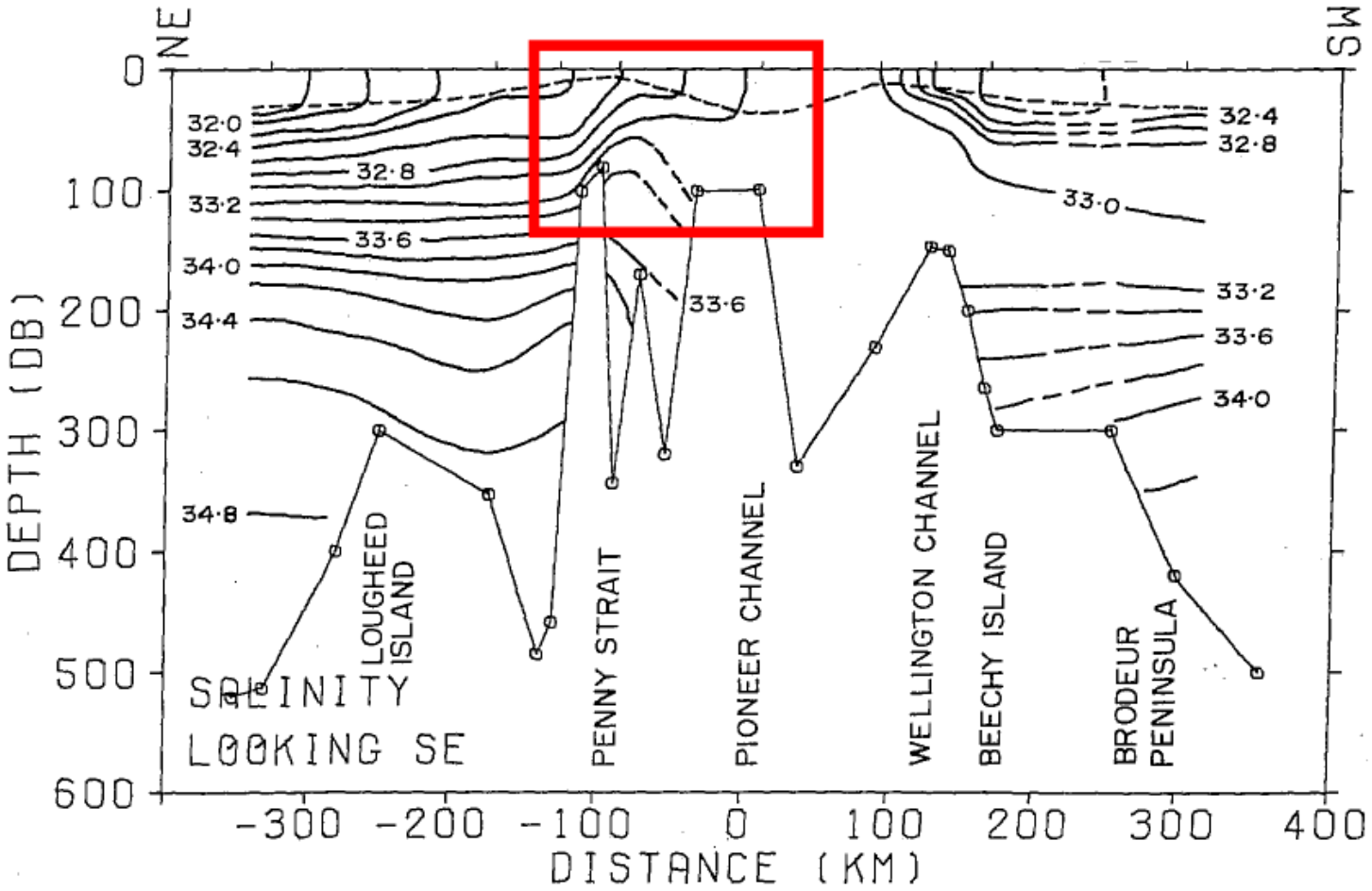
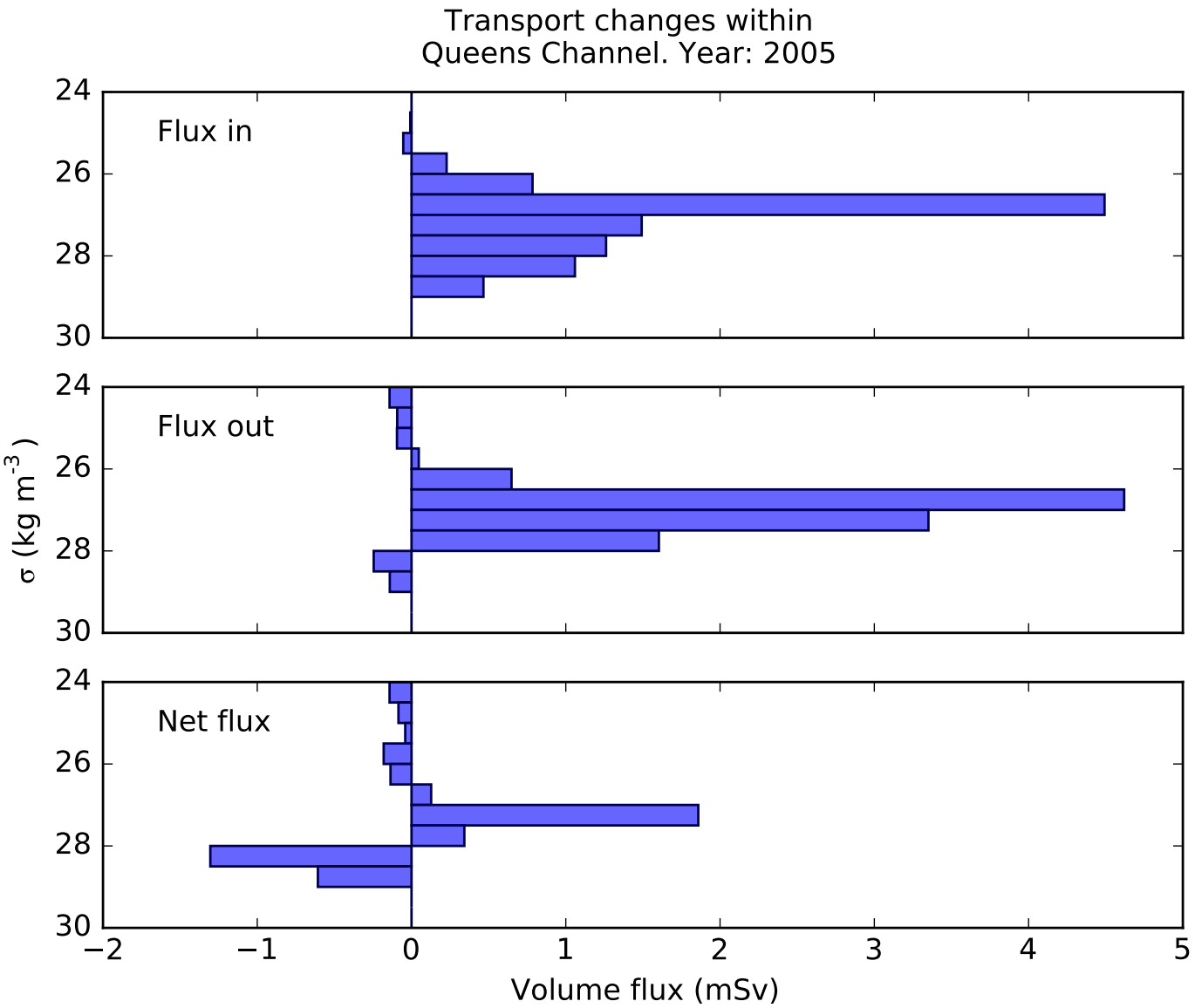


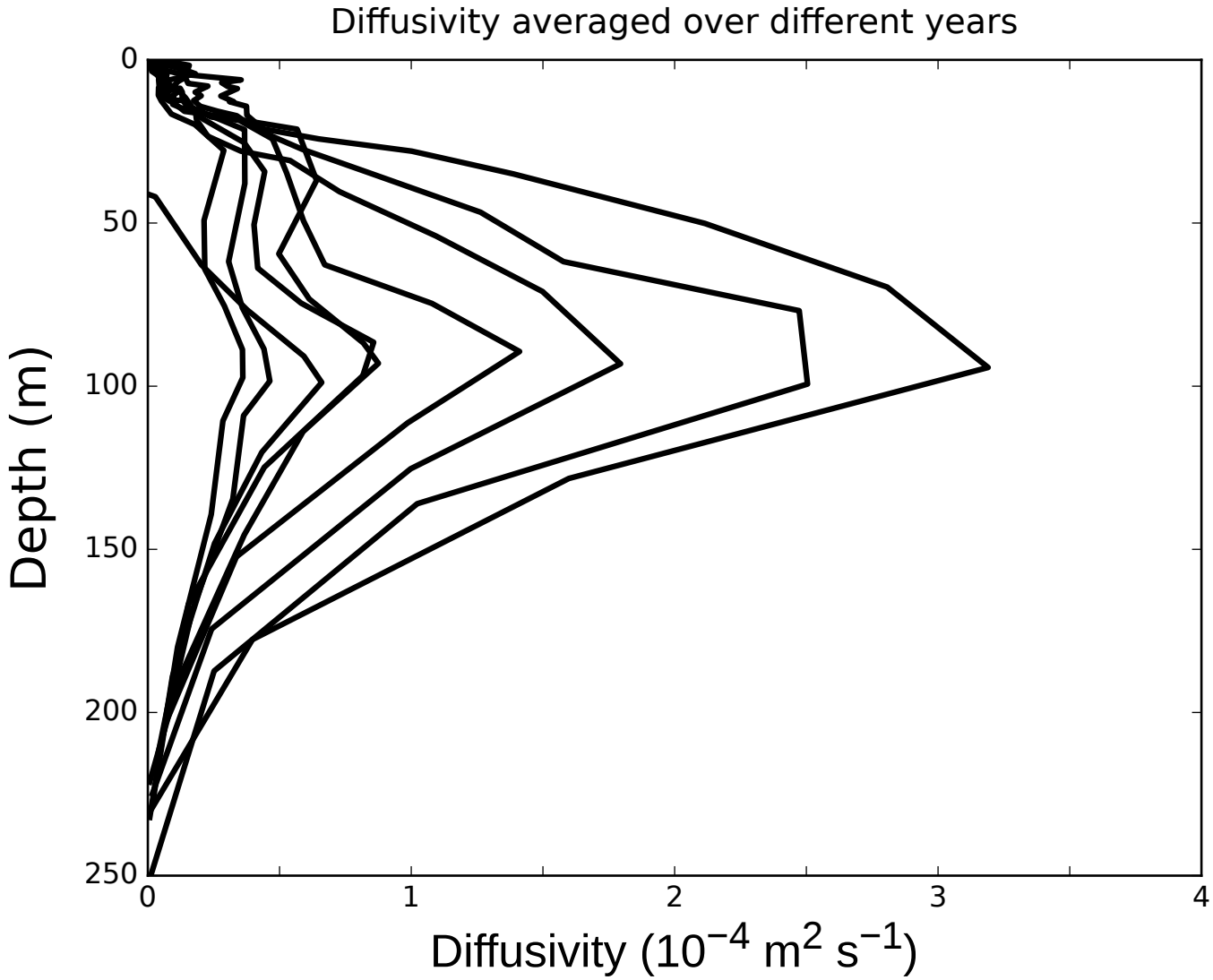
Figure from de Lange Boom et al. (1987)

Water mass changes



Average diffusivity

$$\int_V \mathbf{u} \cdot \nabla \rho \, \mathrm{d}V = \int_V \kappa \nabla^2 \rho \, \mathrm{d}V$$



Diffusivity over one year

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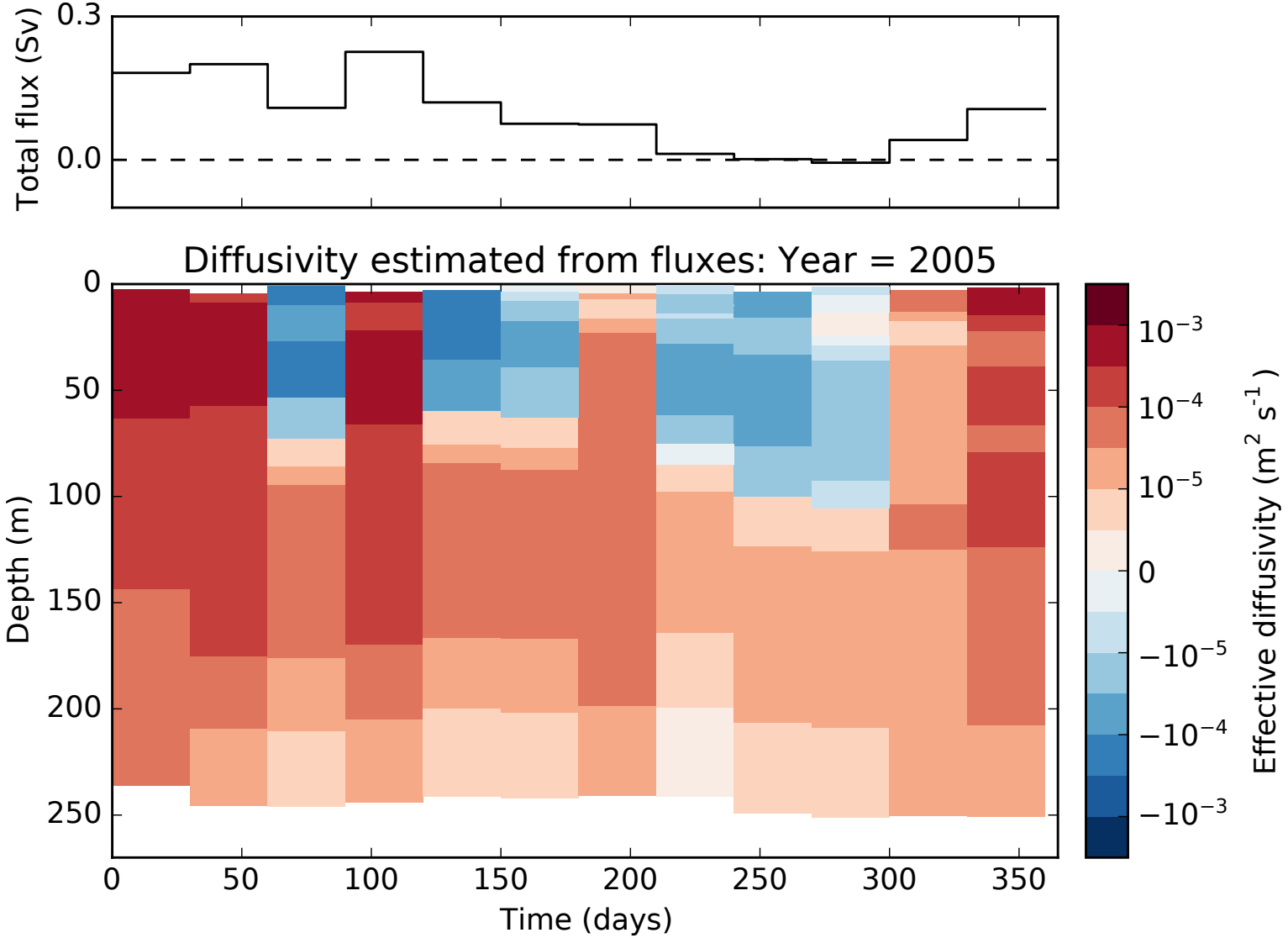

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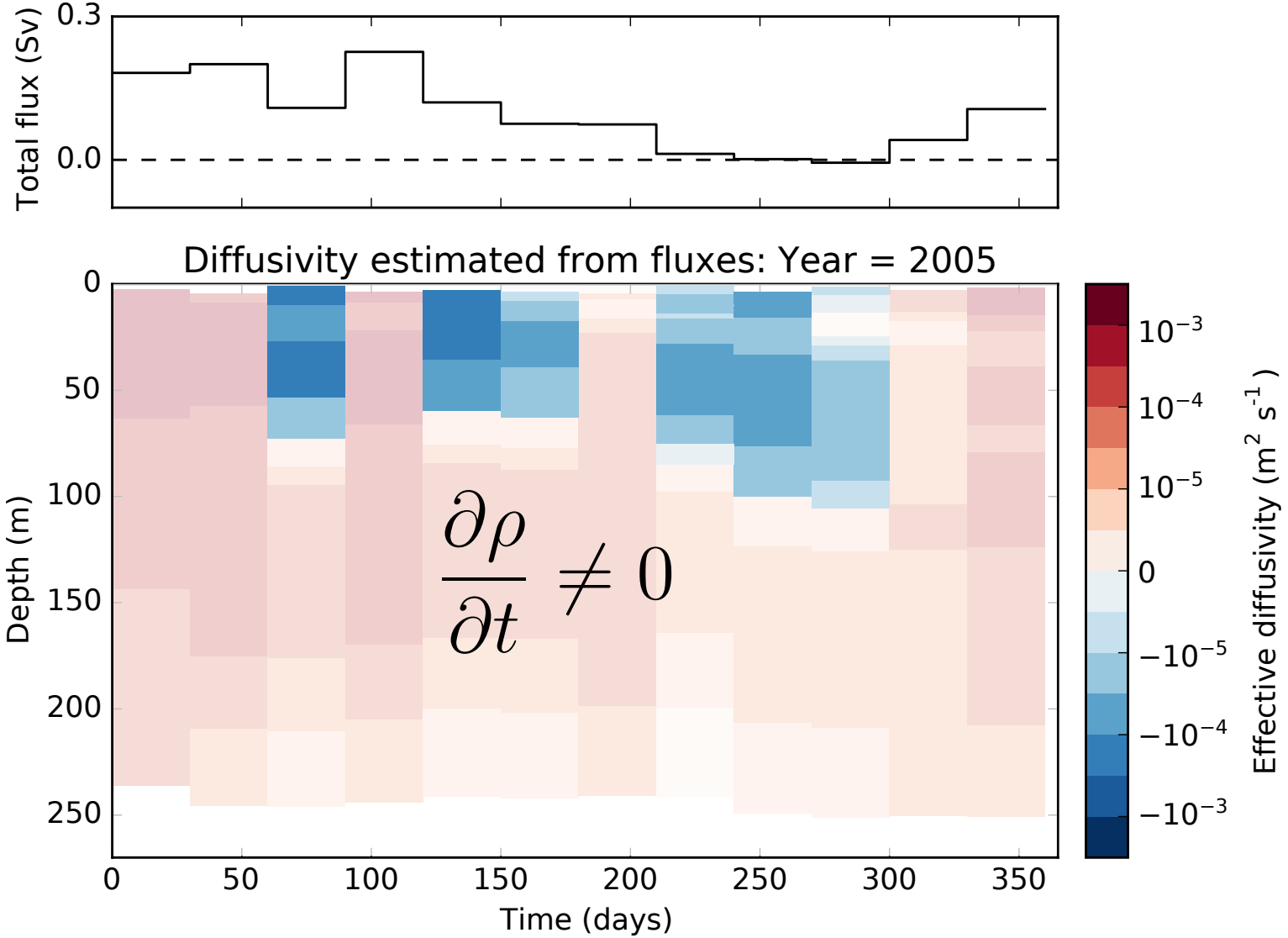

Method Two: Measurements

- Four days in late September
- Amundsen Arctic cruise
- Repeat sampling with MVP along Penny Strait

Photo: Tatiana Pichugina

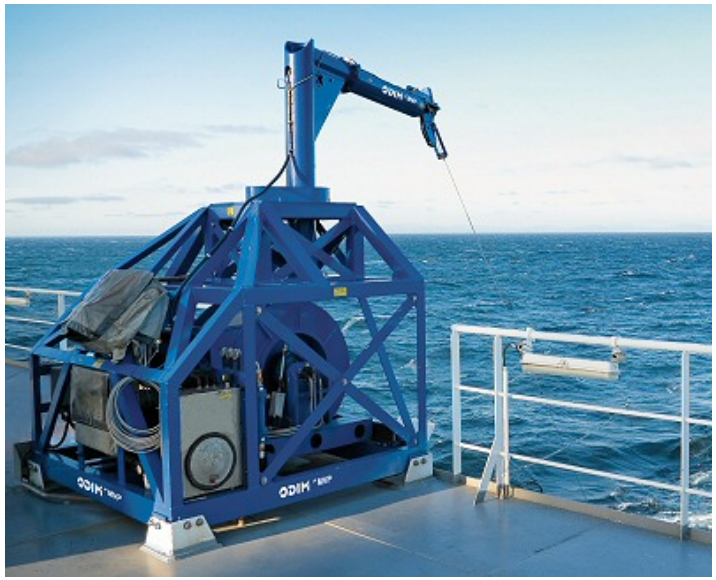

Photo: brooke-ocean.com

Questions to Answer

- Effects of so many straits
- Controls on flow in Archipelago
- Mixing hotspots and their magnitude

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References

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