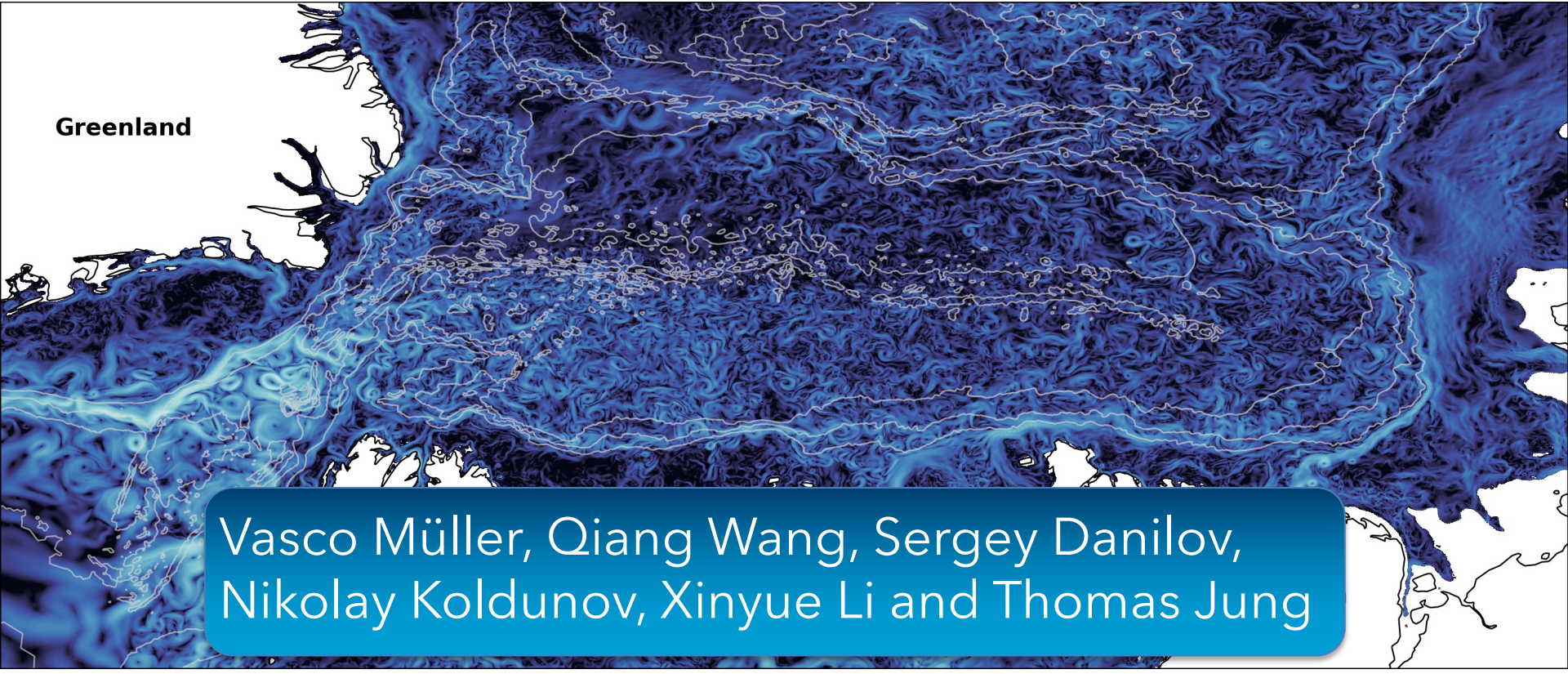
A high-resolution view on mesoscale eddy activity in the Eurasian Basin

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG



Vasco Müller, Qiang Wang, Sergey Danilov, Nikolay Koldunov, Xinyue Li and Thomas Jung

EGU General Assembly 2023

Müller et al. 2023, submitted

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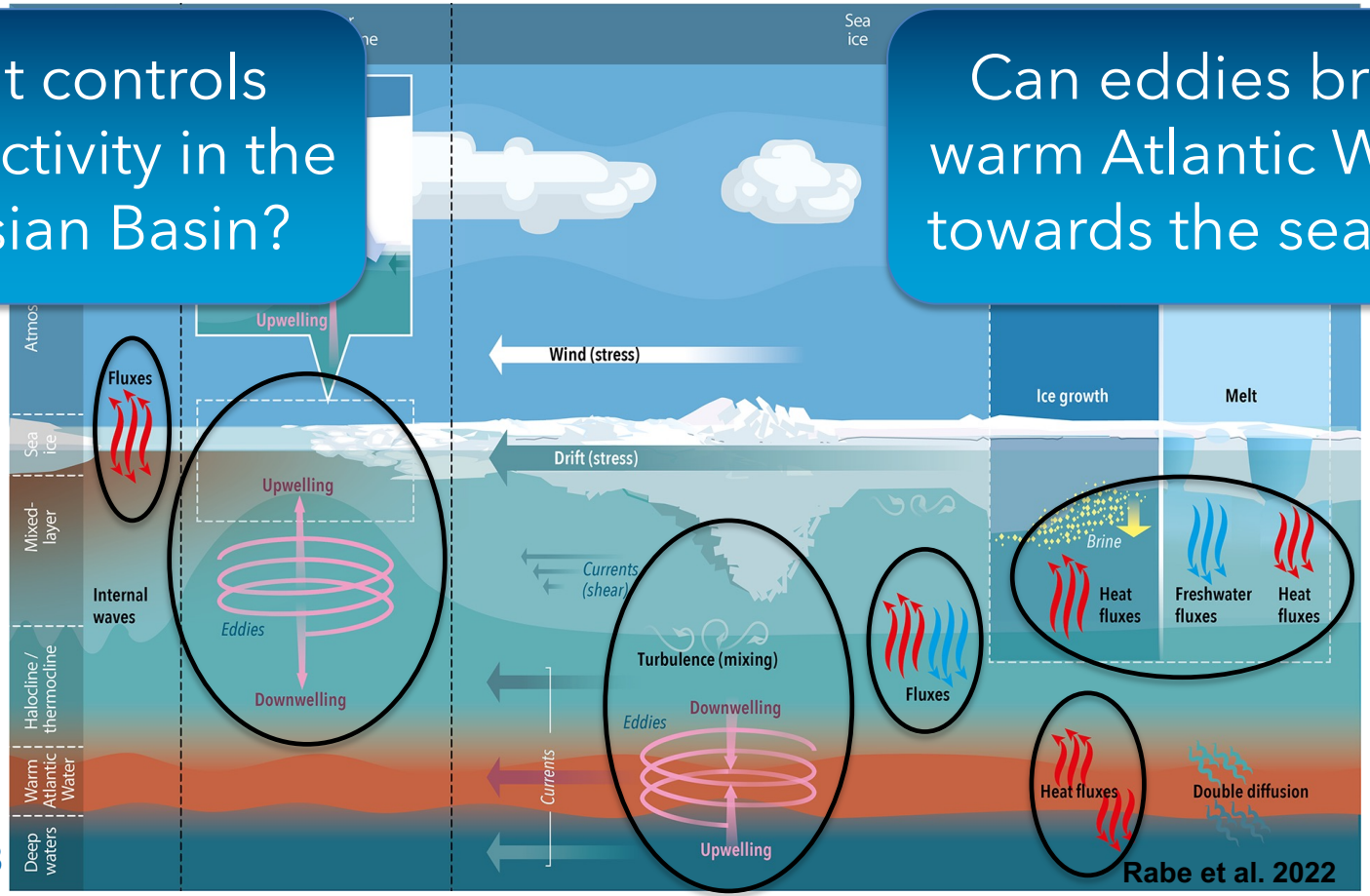
Motivation & Questions

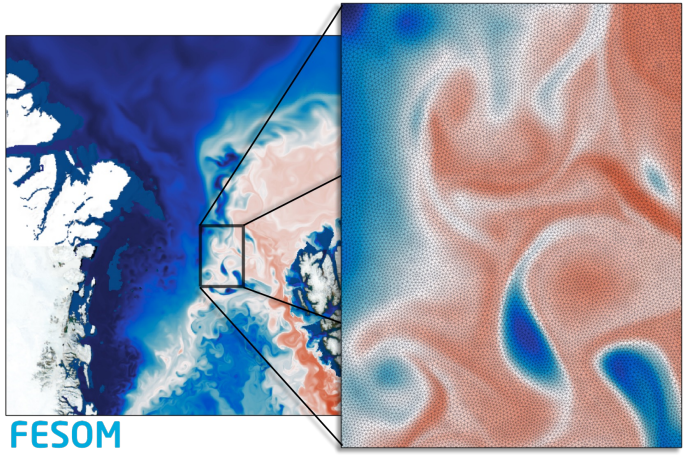
What controls eddy activity in the Eurasian Basin?

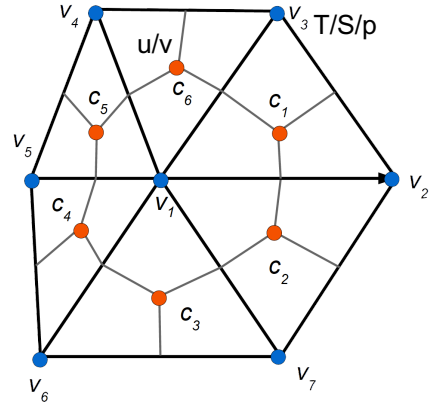
Can eddies bring warm Atlantic Water towards the sea ice?

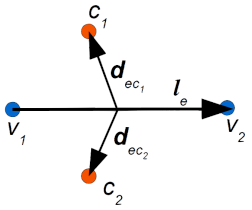


The Model: FESOM2 with a 1-km Arctic

- unstructured mesh → variable resolution
- 1km Arctic resolution, 30km global resolution
  → 11.5M "nodes" (10.9M north of 65N)
  → 22.9M "elements"
- 70 vertical z*-levels
- atmospheric forcing: ERA5
- initial conditions: PHC3 climatology
- 11 year run from 2010 to 2020
- starting 2015 for analysis (i.e. five years spin-up)
- monthly EKE and w'b'

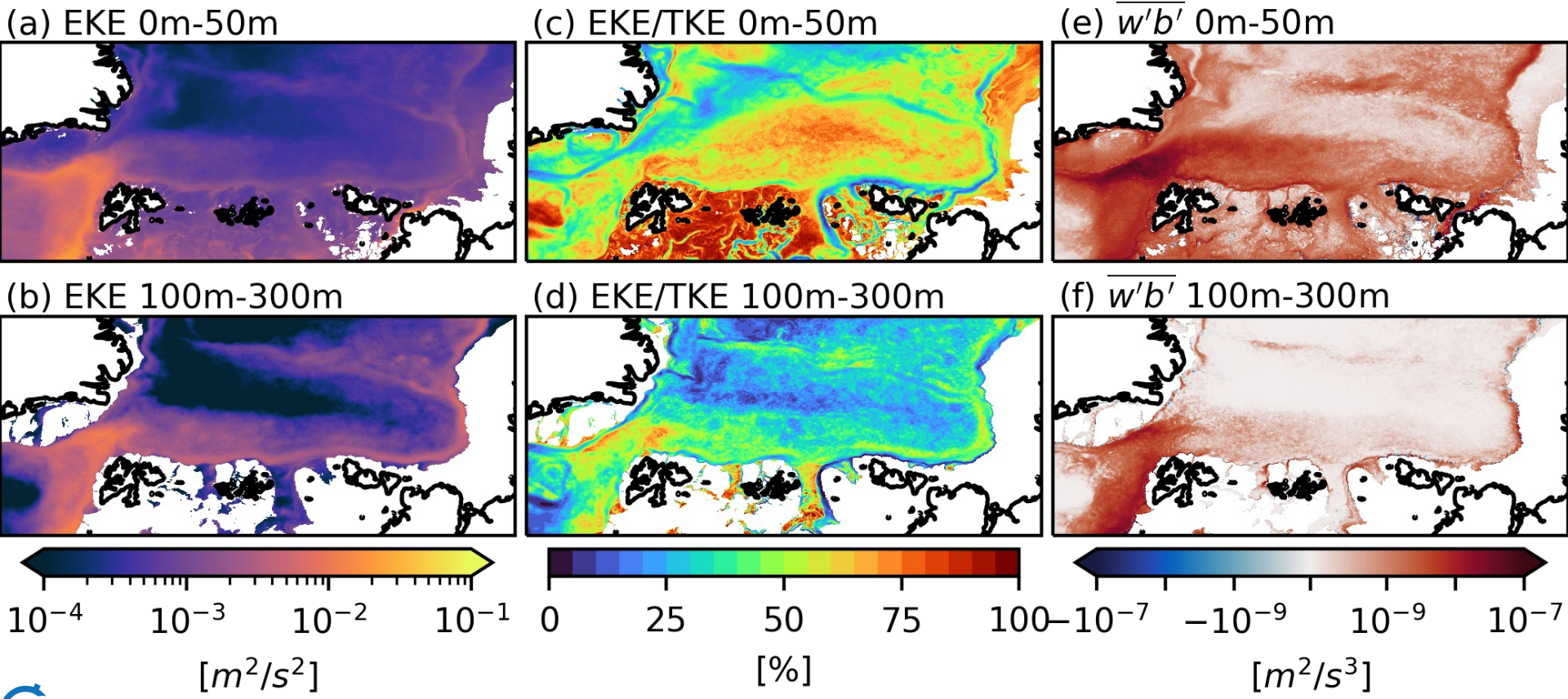






Danilov et al. 2017

EKE and baroclinic energy conversion



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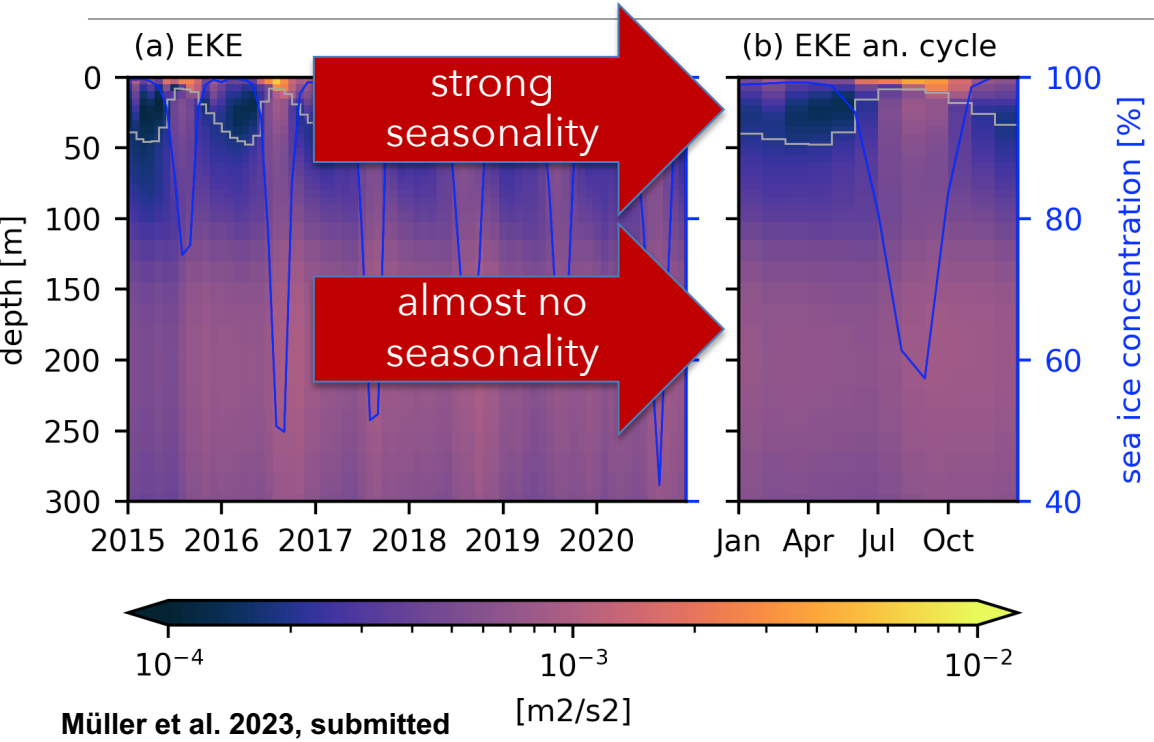
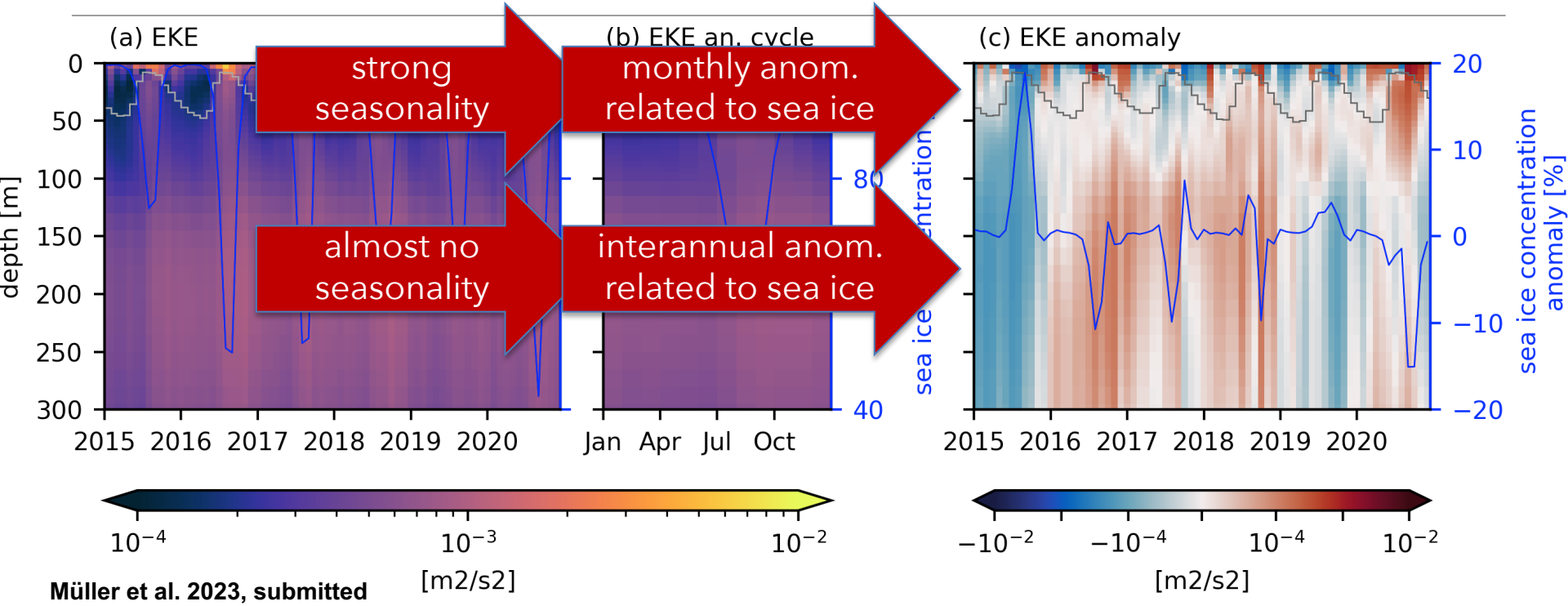
EKE in the Eurasian Basin over time



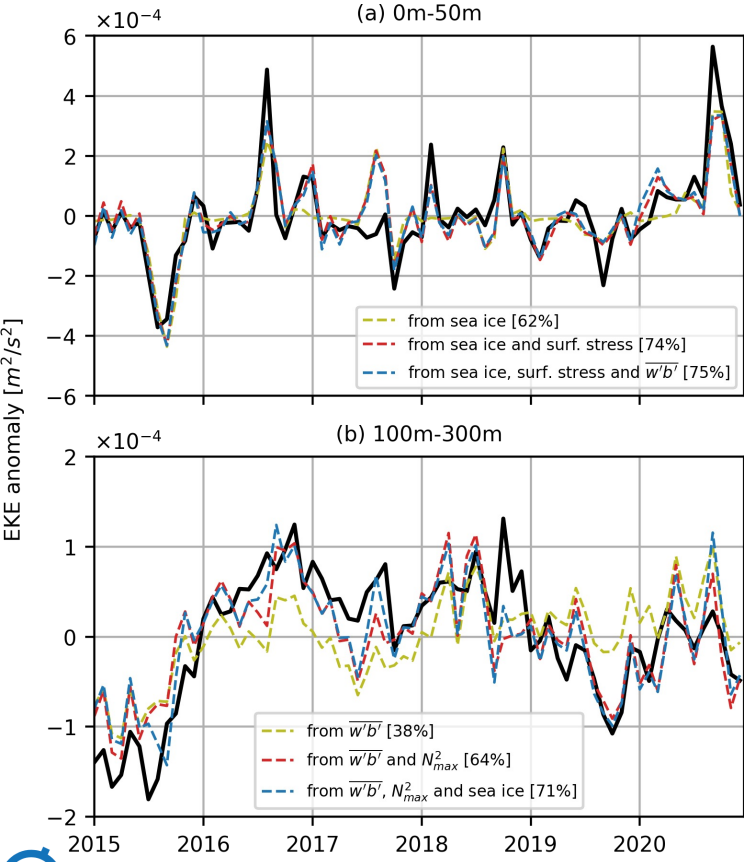
Müller et al. 2023, submitted

EKE in the Eurasian Basin over time



Müller et al. 2023, submitted

Linear Regression of EKE in the Eurasian Basin



surface layer:

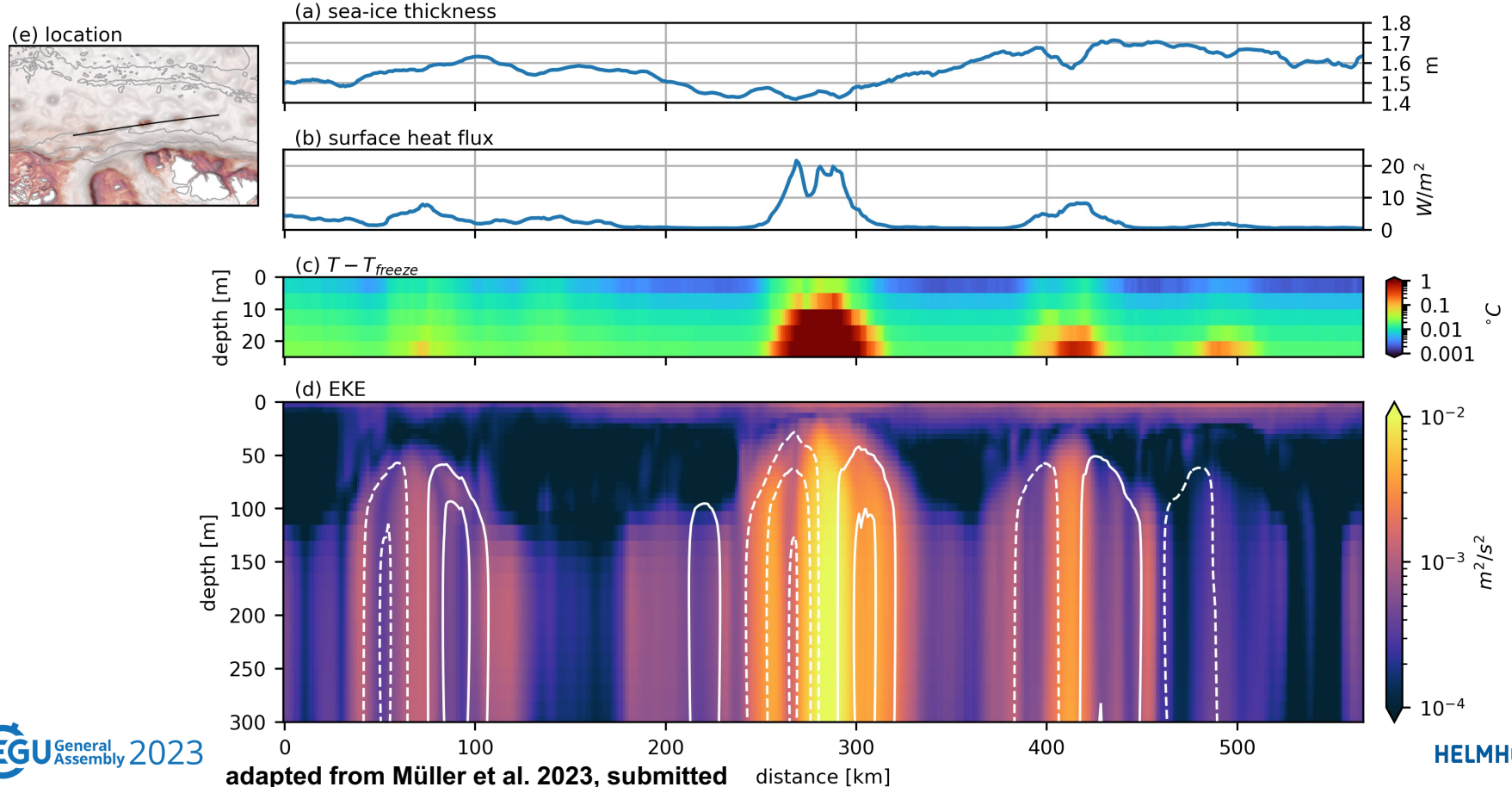
- strong dampening effect of sea ice friction
- energy input by surface stress
- almost no local effect of $\overline{w'b'}$ → instabilities are immediately dampened by sea ice friction

intermediate layer

- variability driven by mostly by local $\overline{w'b'}$
- stratification shields from sea ice friction

Müller et al. 2023, submitted

Eddies “pumping” heat



adapted from Müller et al. 2023, submitted

Summary

What controls eddy activity in the Eurasian Basin?

Can eddies bring warm Atlantic Water towards the sea ice?

seasonality and **interannual** variability dominated by sea ice

monthly anomalies driven by
- sea ice (surface layer)
- baroclinic energy conversion (intermediate layer)

YES

↓

eddy – heat-flux – sea ice feedback