Arctic sea ice thickness variability and change

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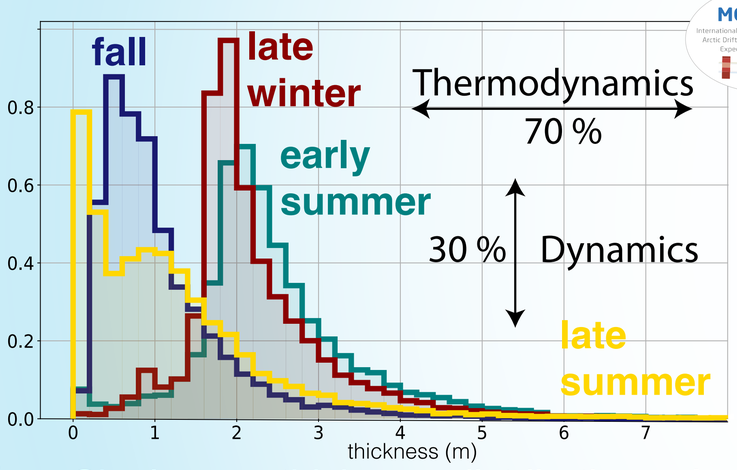
Because of the ongoing thinning of (multi-year) sea ice, the Arctic will likely be dominated by seasonal ice in the future, reshaping many ocean-ice-air interactions and biogeochemical processes. With comprehensive observations and modeling experiments, we aim at understanding the drivers and consequences of the current sea-ice thinning.

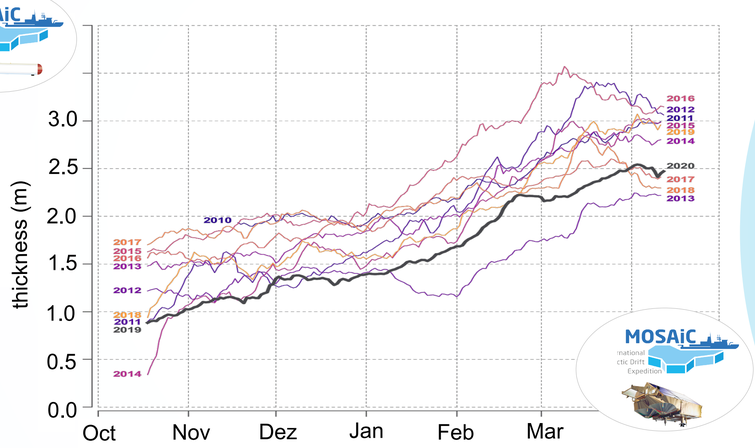
TOPIC 2
OCEAN AND CRYOSPHERE

PoF IV, Topic 2, Subtopic 1

Seasonal and spatial variability



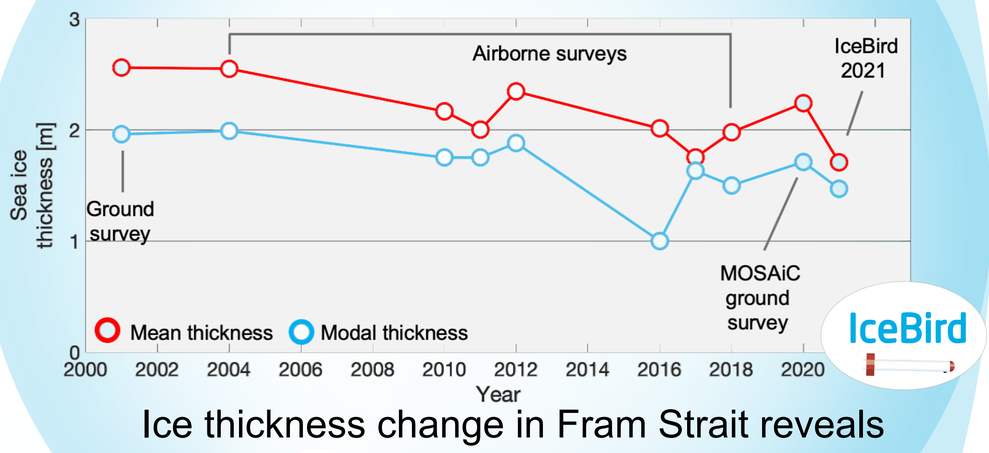
Single-year thickness distributions along the Transpolar Drift display strong variability induced by thermodynamic and dynamic processes. *von Albedyll et al., in review*



CryoSat-2/SMOS satellite winter ice thickness data shows strong seasonal variability and a small negative trend.

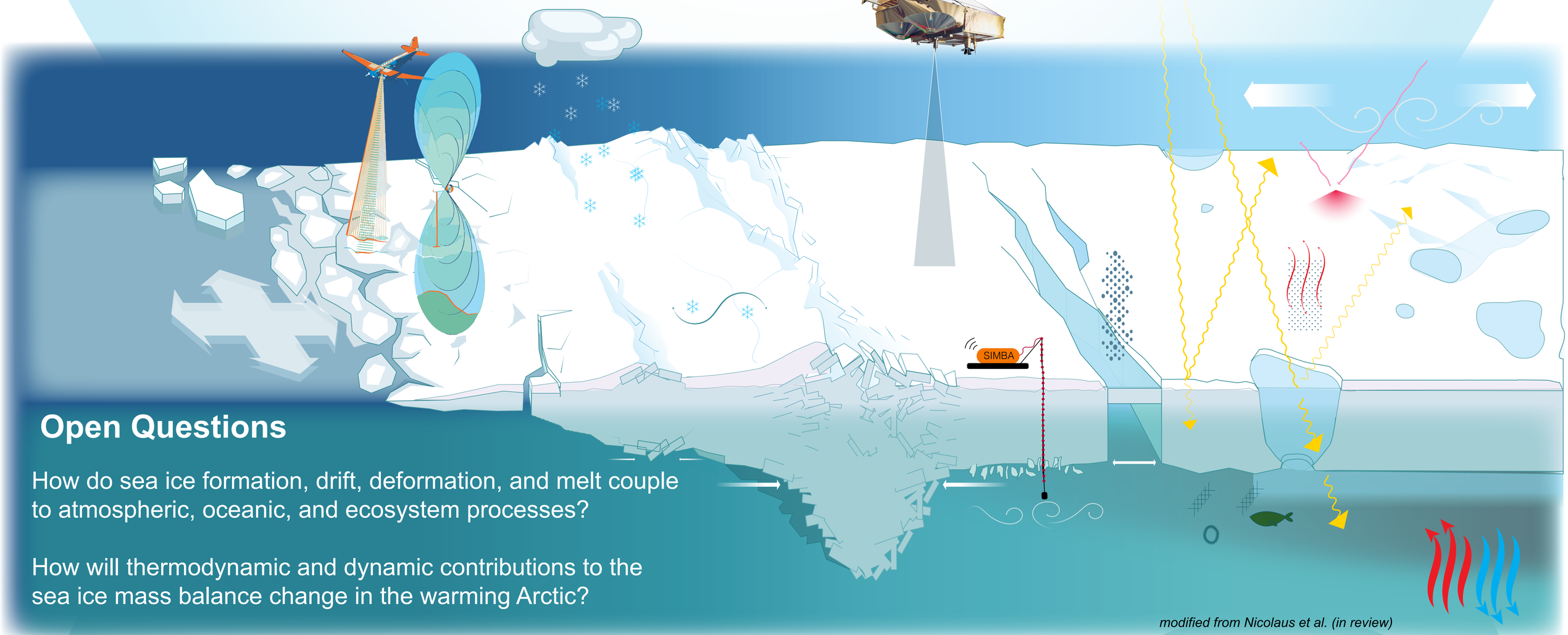
Krumpen et al., 2021

Thickness changes



Ice thickness change in Fram Strait reveals interannual variability and negative trends in mean and modal sea ice thickness.

updated, Belter et al., 2021



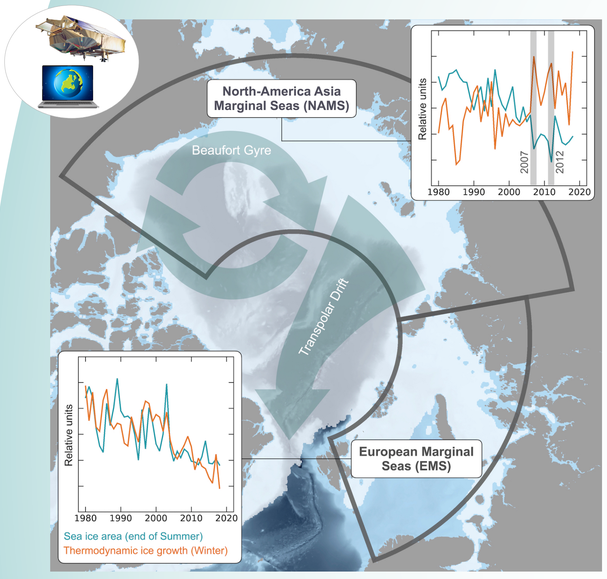
Open Questions

How do sea ice formation, drift, deformation, and melt couple to atmospheric, oceanic, and ecosystem processes?

How will thermodynamic and dynamic contributions to the sea ice mass balance change in the warming Arctic?

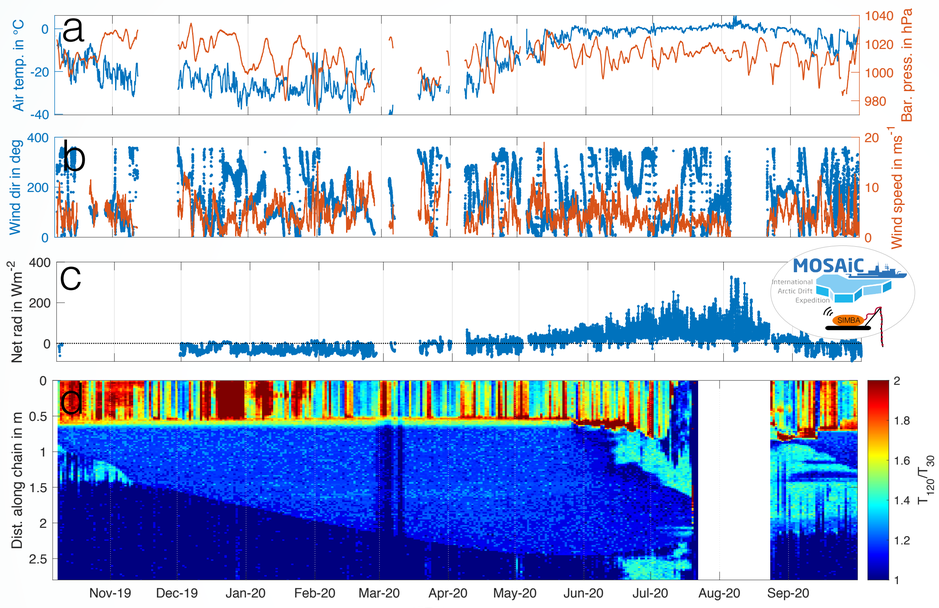
modified from Nicolaus et al. (in review)

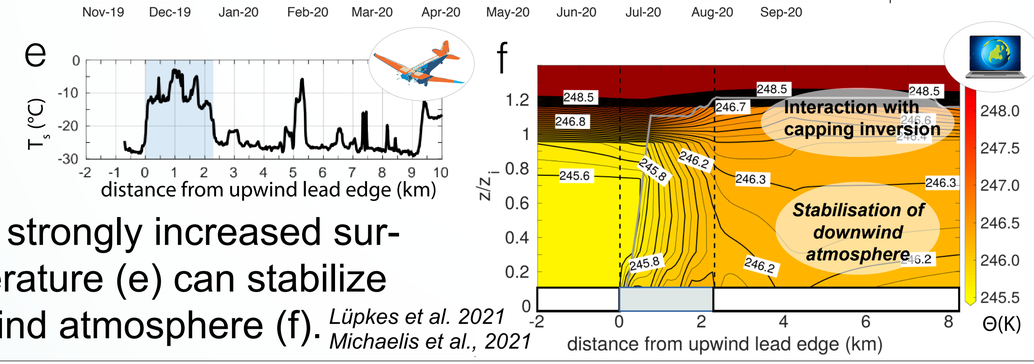
Causes: ocean - ice - atmosphere heat fluxes



Increased ocean heat flux outweighs the negative ice-growth feedback in response to summer melt in the European Marginal Seas.

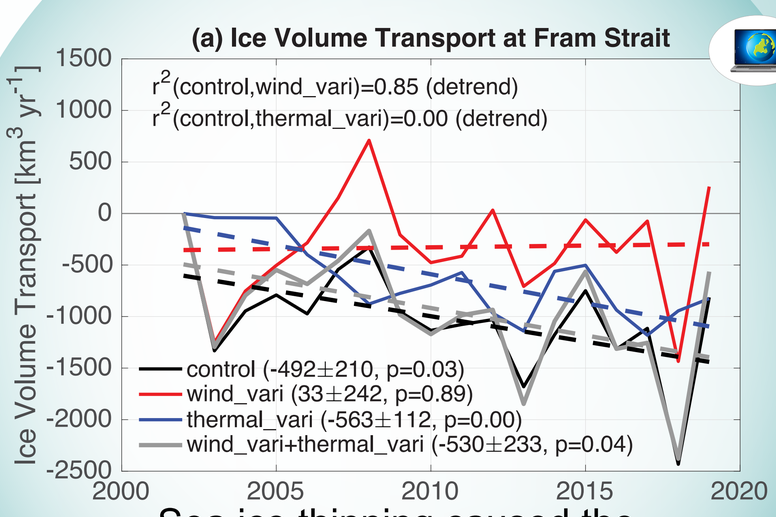
Ricker et al., 2021





Leads with strongly increased surface temperature (e) can stabilize the downwind atmosphere (f). *Lüpkes et al. 2021, Michaelis et al., 2021*

Consequences



Sea ice thinning caused the negative trend of the ice volume flux, while wind forcing caused the variability.

Wang et al. 2021

Oceanic and atmospheric conditions (a-c) precondition the thermodynamic level ice growth (d).

M Hoppmann

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