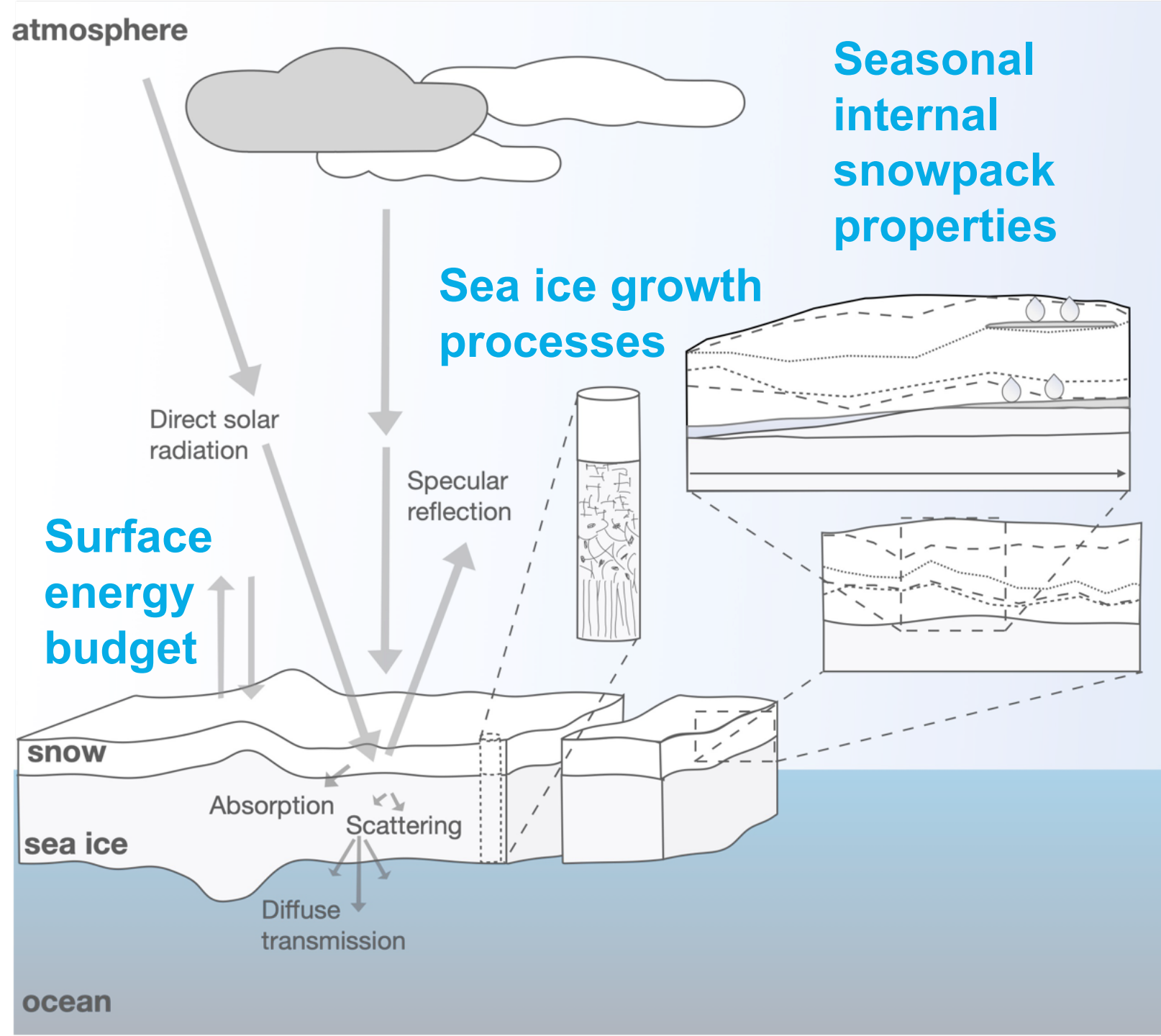




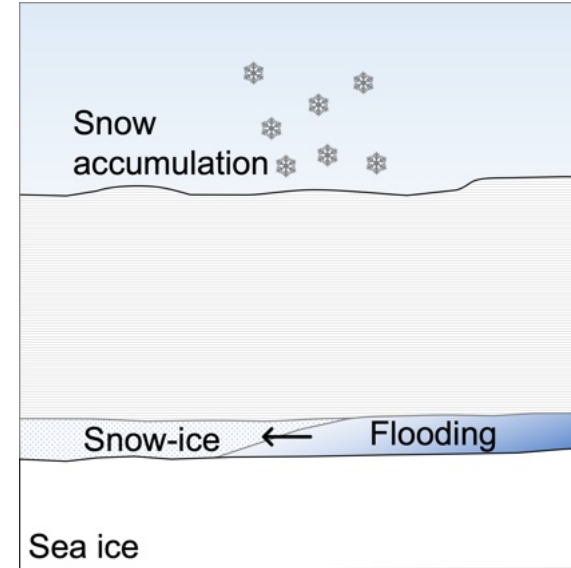
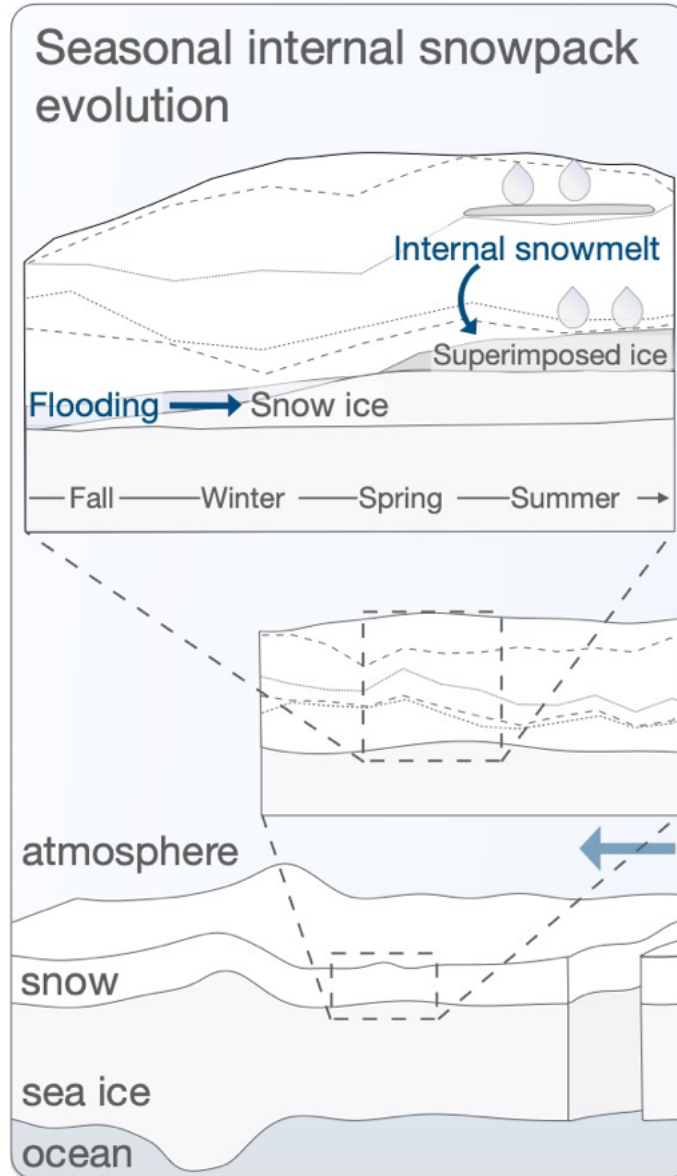
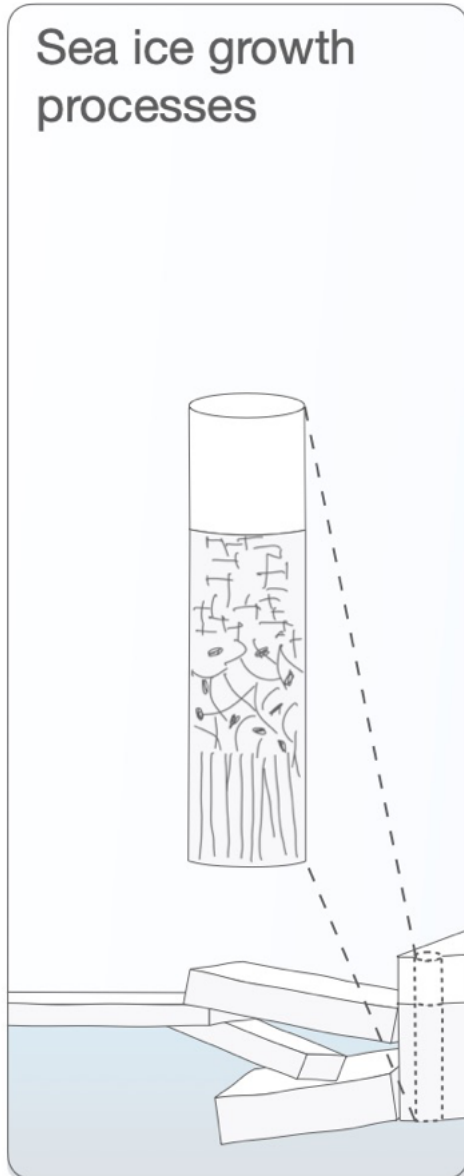
Snow rules!

Stefanie Arndt, Marcel Nicolaus,
Christian Haas, and many more!

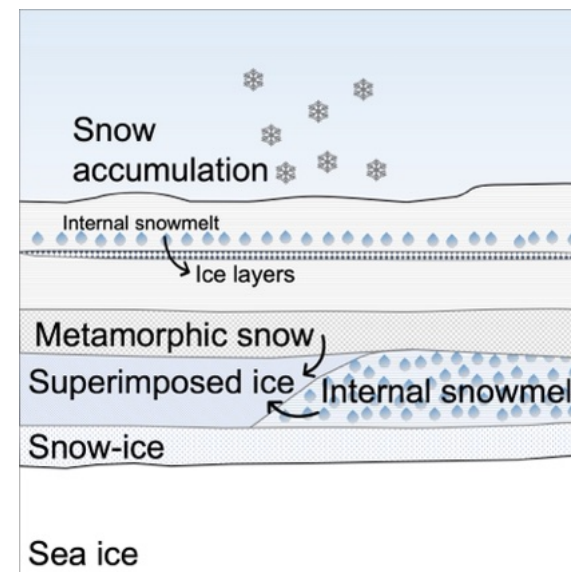
Snow – one of the most important but least studied components in the sea ice system



Snow-to-ice conversion processes



- Flooding
- Flood-freeze cycle
- **Snow ice formation**

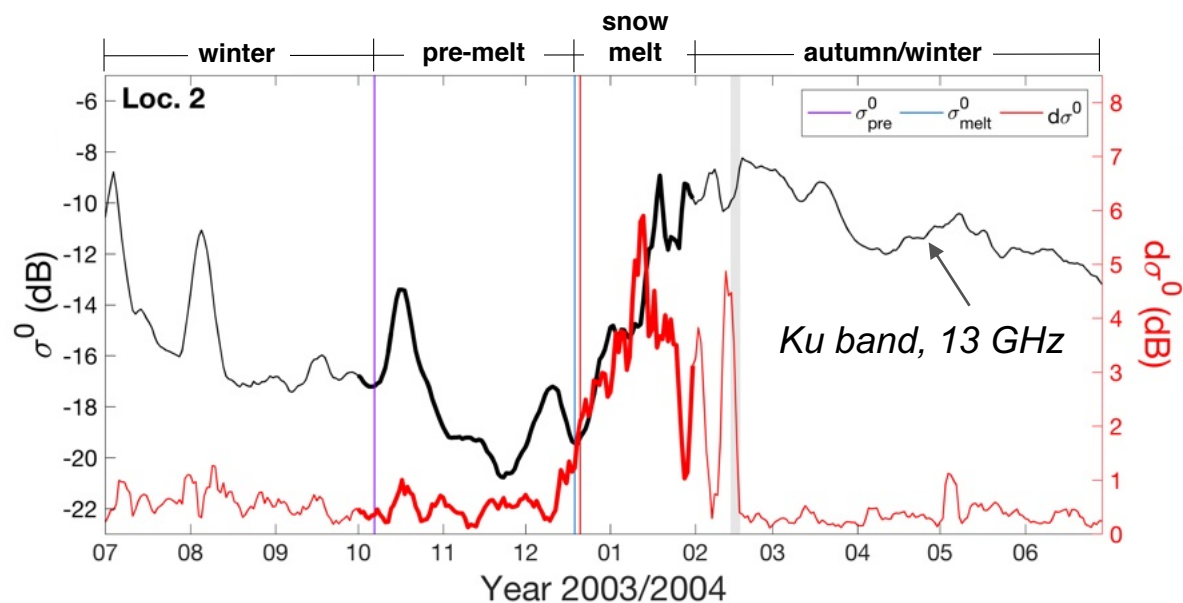


- Snow metamorphism
- Thaw-refreeze cycle
- **Superimposed ice formation**

Snow-to-ice conversion processes

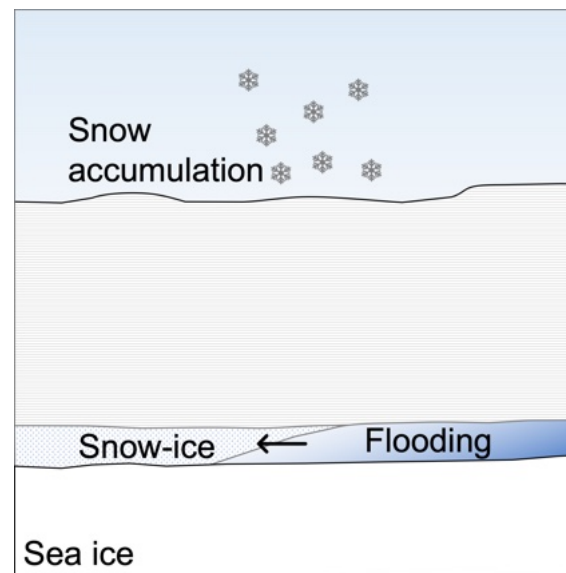
Flooding

- = decreasing microwave volume and surface scattering
- = low radar backscatter

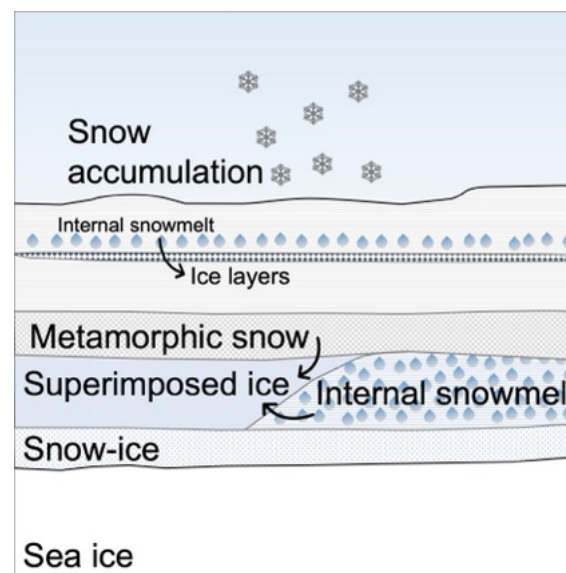


Superimposed ice formation

- = increasing microwave volume and surface scattering
- = high radar backscatter



- Flooding
- Flood-freeze cycle
- **Snow ice formation**



- Snow metamorphism
- Thaw-refreeze cycle
- **Superimposed ice formation**

Influence of snow metamorphism on its thermal conductivity



Conductive heat flux through snow

$$F_{C,S} = -k_s \frac{dT_s}{h_s} = -k_s \frac{T_{top} - T_{bot}}{h_s}$$

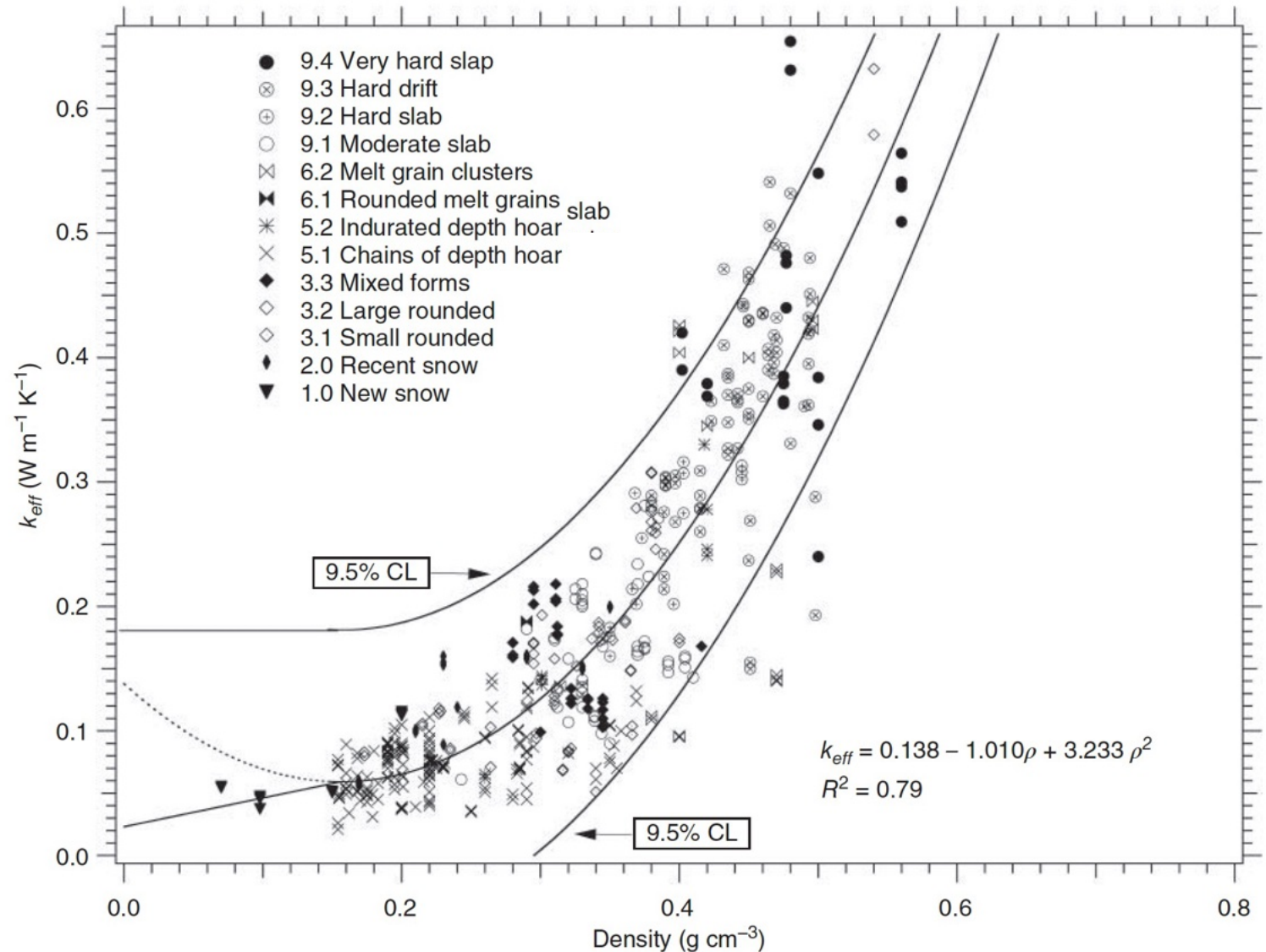
... is a function of the **thermal conductivity** of snow (k_s)



... is a function of **snow density**



... is a function of **grain type**



Influence of snow metamorphism on its thermal conductivity



Conductive heat flux through snow

$$F_{C,s} = -k_s \frac{dT_s}{h_s} = -k_s \frac{T_{top} - T_{bot}}{h_s}$$

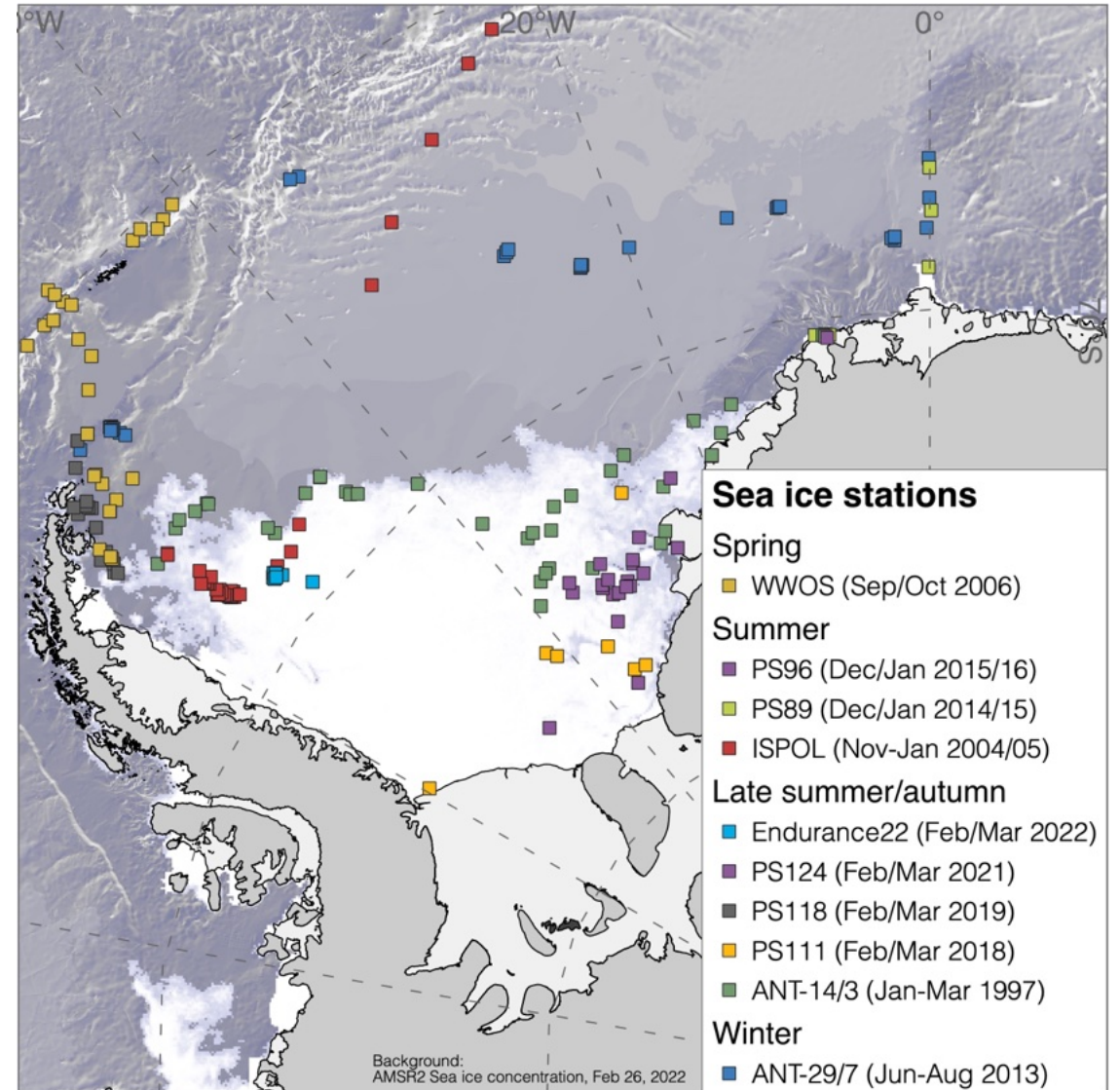
... is a function of the **thermal conductivity** of snow (k_s)



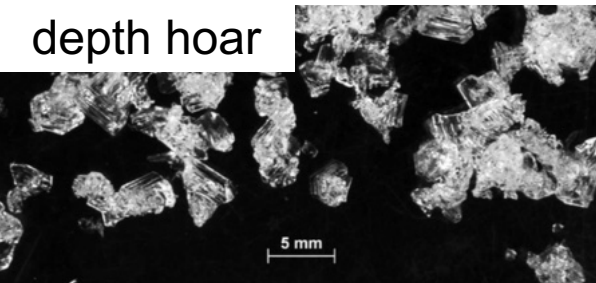
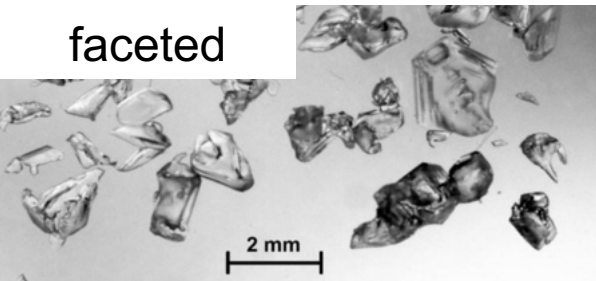
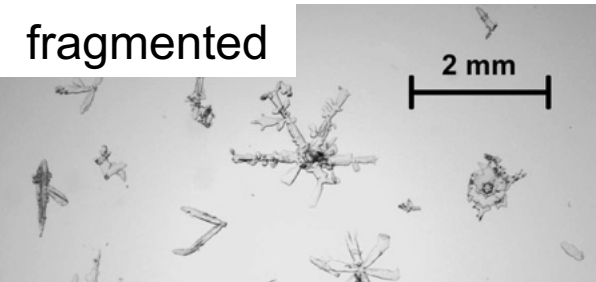
... is a function of **snow density**



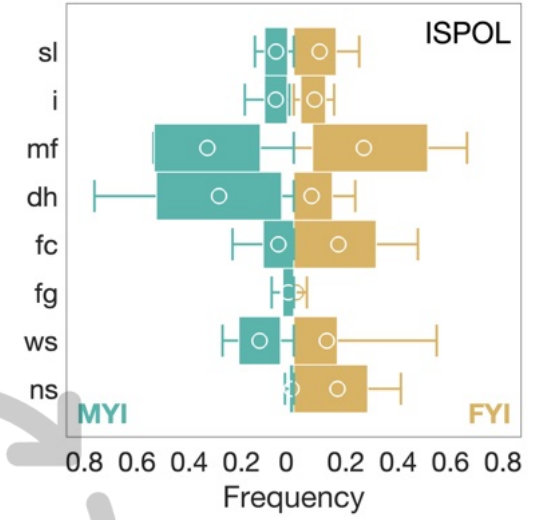
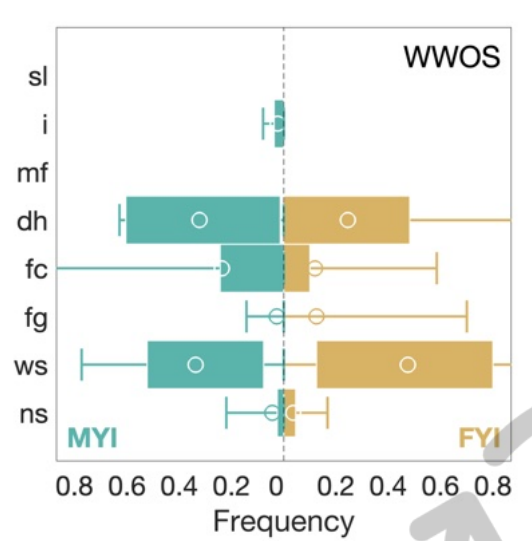
... is a function of **grain type**



The beauty of seasonal snow grain types



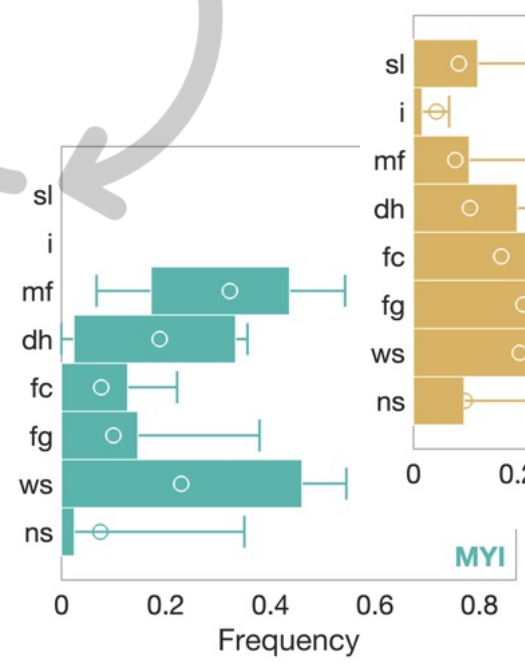
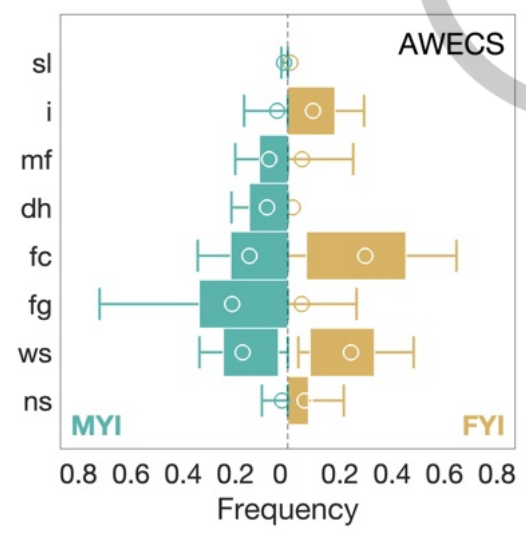
spring



summer

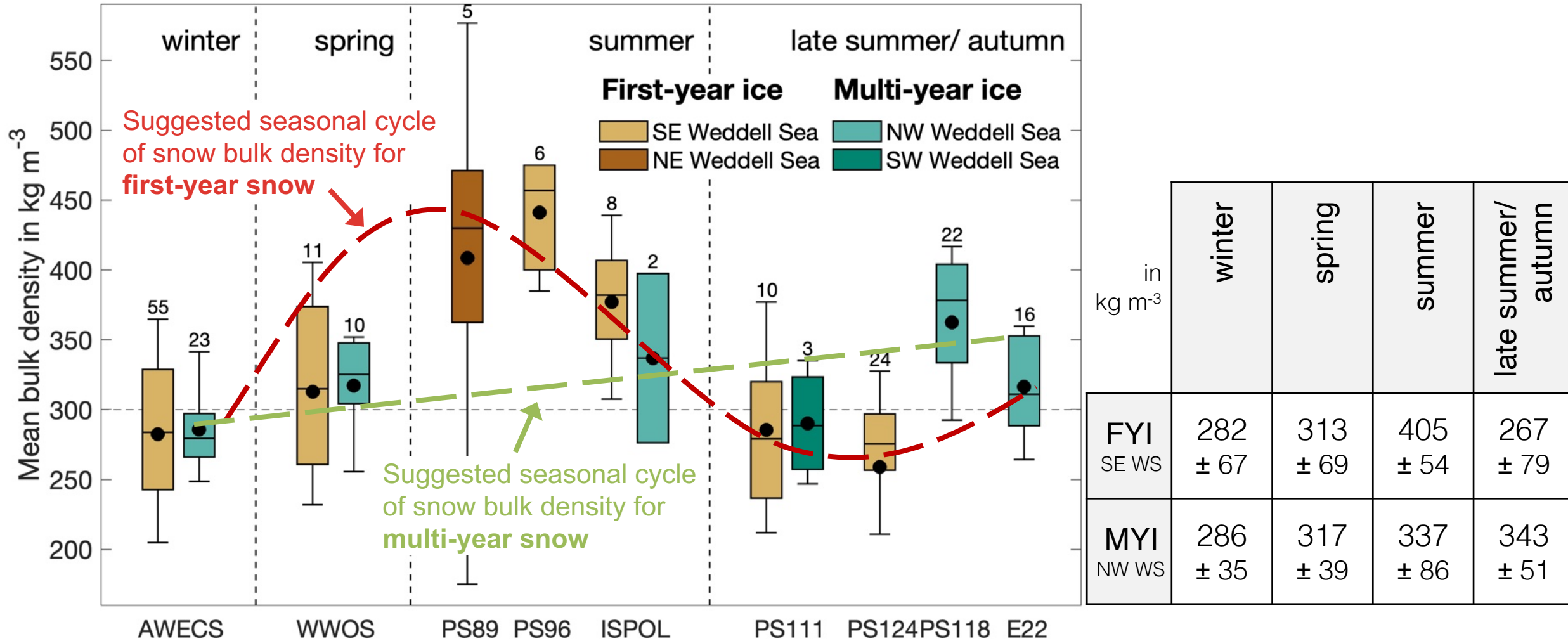
- sl: slush
- i: ice layers
- mf: melt-freeze forms
- dh: depth hoar
- fc: faceted crystals
- fg: fragmented crystals
- ws: wind slab
- ns: new snow

winter

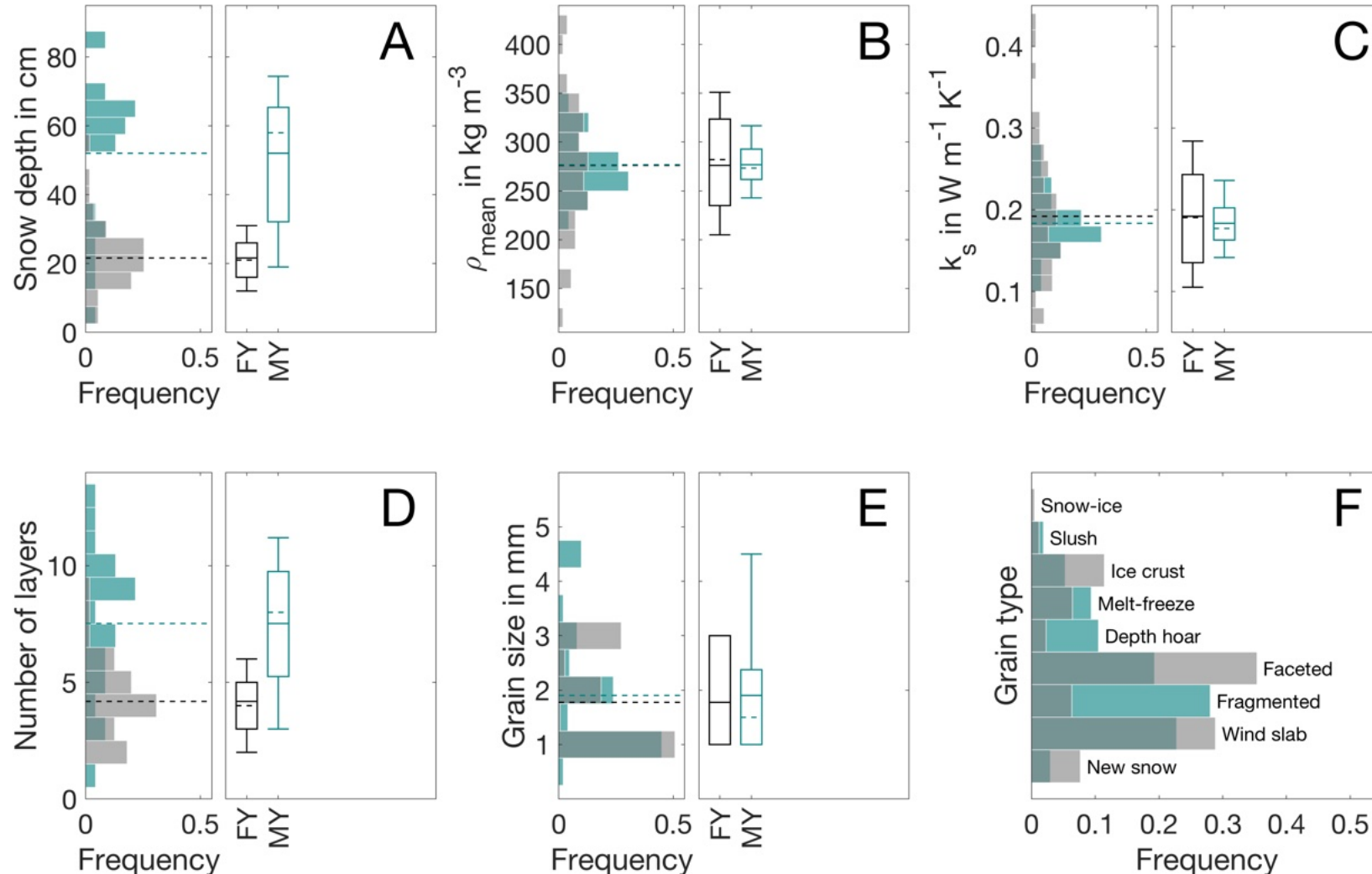


**late summer/
autumn**

Ice-type-dependent seasonality of snow bulk density



Example: Winter snowpack in the Weddell Sea (Antarctica)



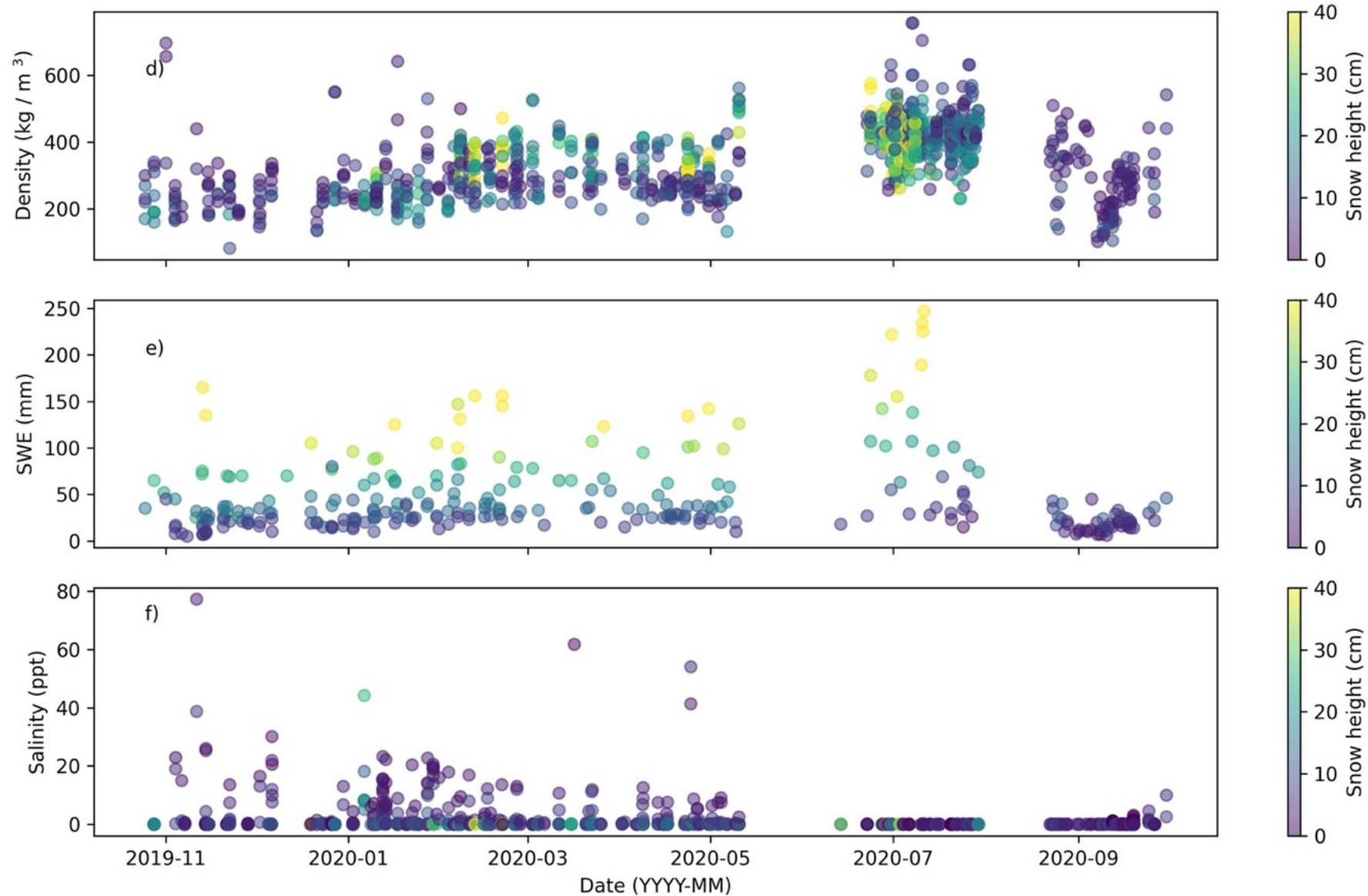
Relative standard deviations (RSD)

	FYI	MYI
Snow depth	0.42	0.42
Density	0.24	0.10
Number of layers	0.38	0.41
Grain size	0.49	0.61

RSD : measure to quantify the variability of different quantities

- Snow property variability substantially higher in MYS than in FYS
- Snow grain size dominates the spatial snowpack variability

Example: Snow characteristics of the MOSAiC ice floe (Arctic)



Macfarlane et al. (2023)