ANTARCTICA INSYNC

Theme II:
Rapid sea ice decline and its causes and consequences

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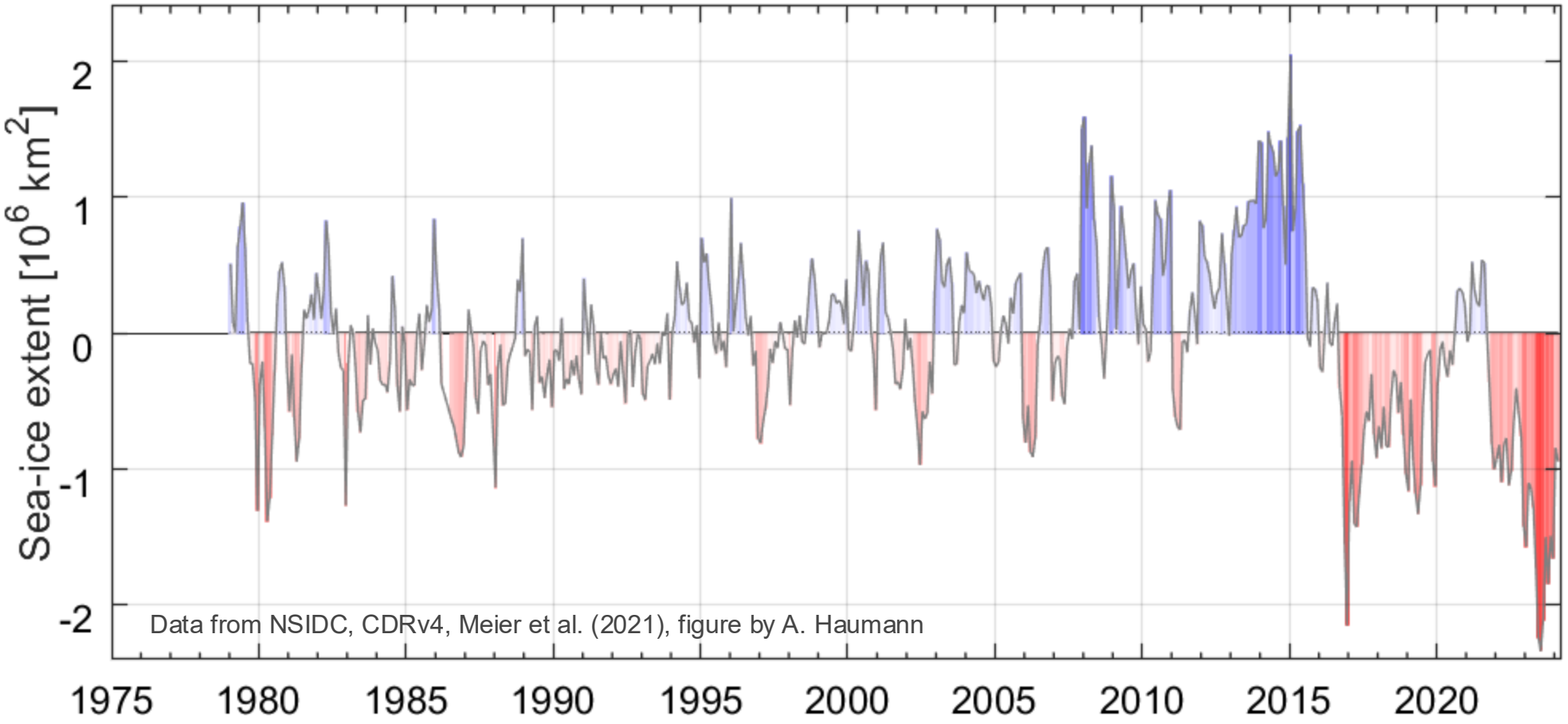
Current state and change of Antarctic sea ice

Rapid decline of Antarctic sea ice

- What?
- Why?
- How?



Thematic areas for synchronous research in the SCAR Horizon Scan and Action Plan

- **Processes/Feedbacks driving changes** in extent, volume, properties and distribution of Antarctic sea ice – and its interactions with atmosphere and ocean
- Seasonal variability of sea ice contributing to ocean/air **fluxes across a range of spatio-temporal scales**
- Impact of sea ice on ocean circulation, biogeochemical cycling and biological processes (**ice/ecosystem interaction**)
- Influence of changes in **freshwater fluxes** from iceberg melting, sub-ice shelf melting, subglacial discharge and sea ice on ocean circulation and marine ecosystems

→ **What are causes and consequences of the rapid sea ice decline?**

Work toward these objectives

- Standardized observations and surveys of sea ice and snow properties at both small and floe-size scales
- Deployment of a comprehensive, multi-disciplinary network of autonomous ice-tethered platforms for seasonal observations along Lagrangian drift trajectories
- Regional airborne surveys by drones, helicopters, and airplanes
- Continuous generation of comprehensive seasonal validation datasets for satellite remote sensing, along with enhancements in retrieval methodologies and accuracy
- Enhanced process understanding in climate models through increased resolution and refined model parameterizations

Antarctica InSync as a community opportunity

Existing initiatives in the Antarctic sea ice community

Existing international working groups

ASPeCt
Antarctic Sea Ice Processes and Climate

BEPSII
BIOGEOCHEMICAL EXCHANGE PROCESSES AT SEA ICE INTERFACES

SCAR
INTERNATIONAL SCIENCE COUNCIL
SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

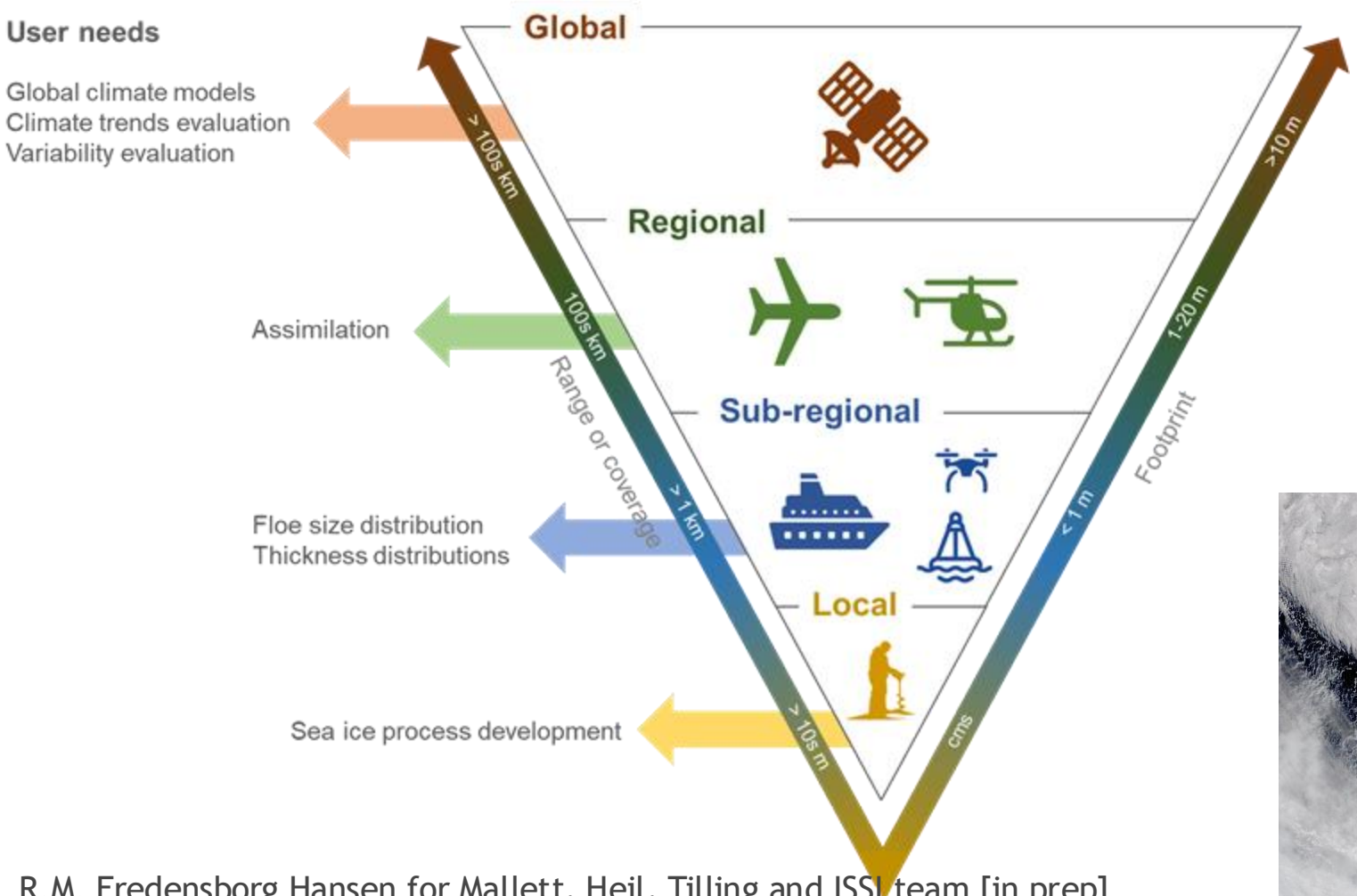
International Antarctica InSync Sea Ice Team

New Zealand United Kingdom South Africa
Finland Australia Germany Switzerland
Japan Belgium Denmark Norway US …

SOOS
SOUTHERN OCEAN OBSERVING SYSTEM

Antarctica InSync as a multi-scale approach

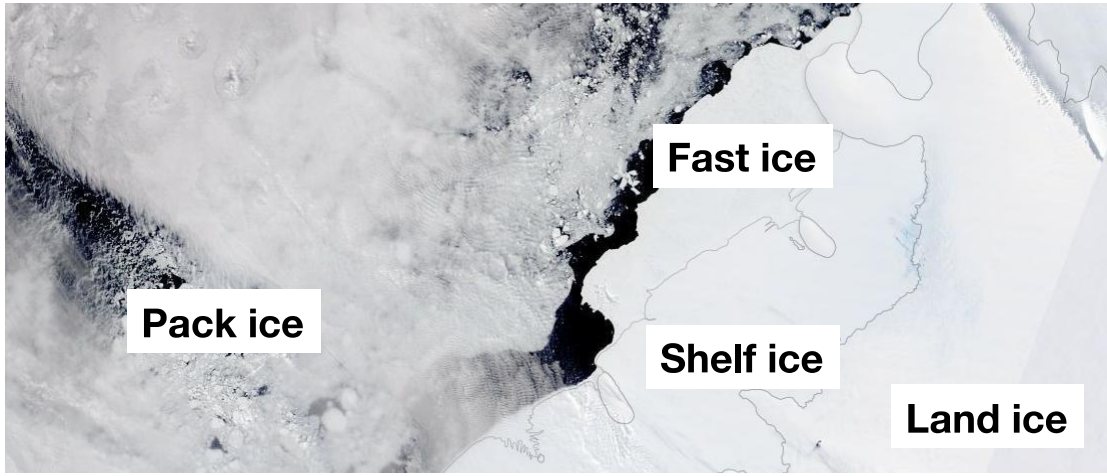
Bridging observations, models and satellite remote sensing



R.M. Fredensborg Hansen for Mallett, Heil, Tilling and ISSI team [in prep]

Challenges and Uncertainties in Observing Antarctic Sea Ice

- Fast ice/ coastal polynyas
- Pack ice
- Marginal ice zone (MIZ)



Antarctica InSync as a multi-scale approach

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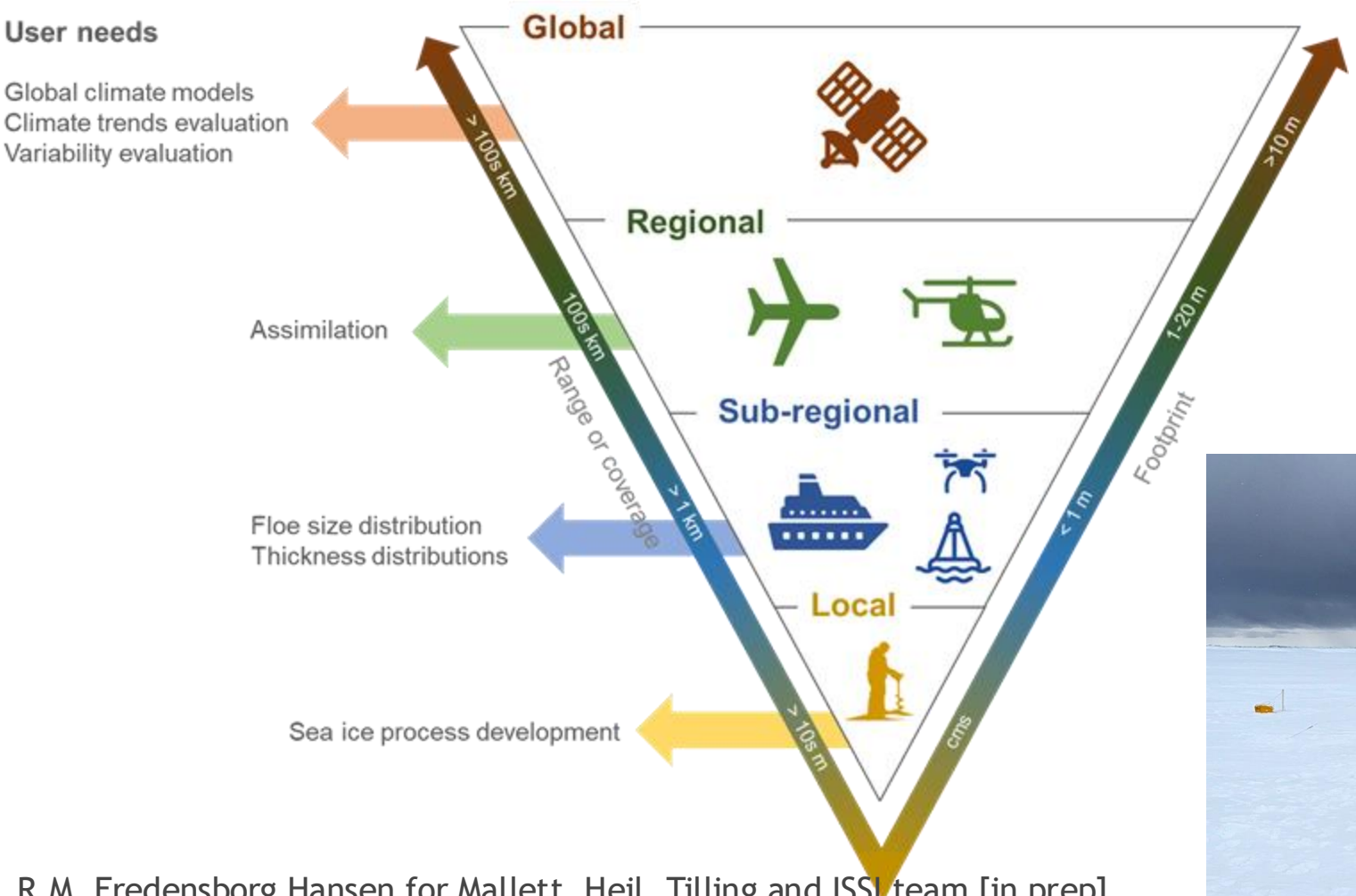
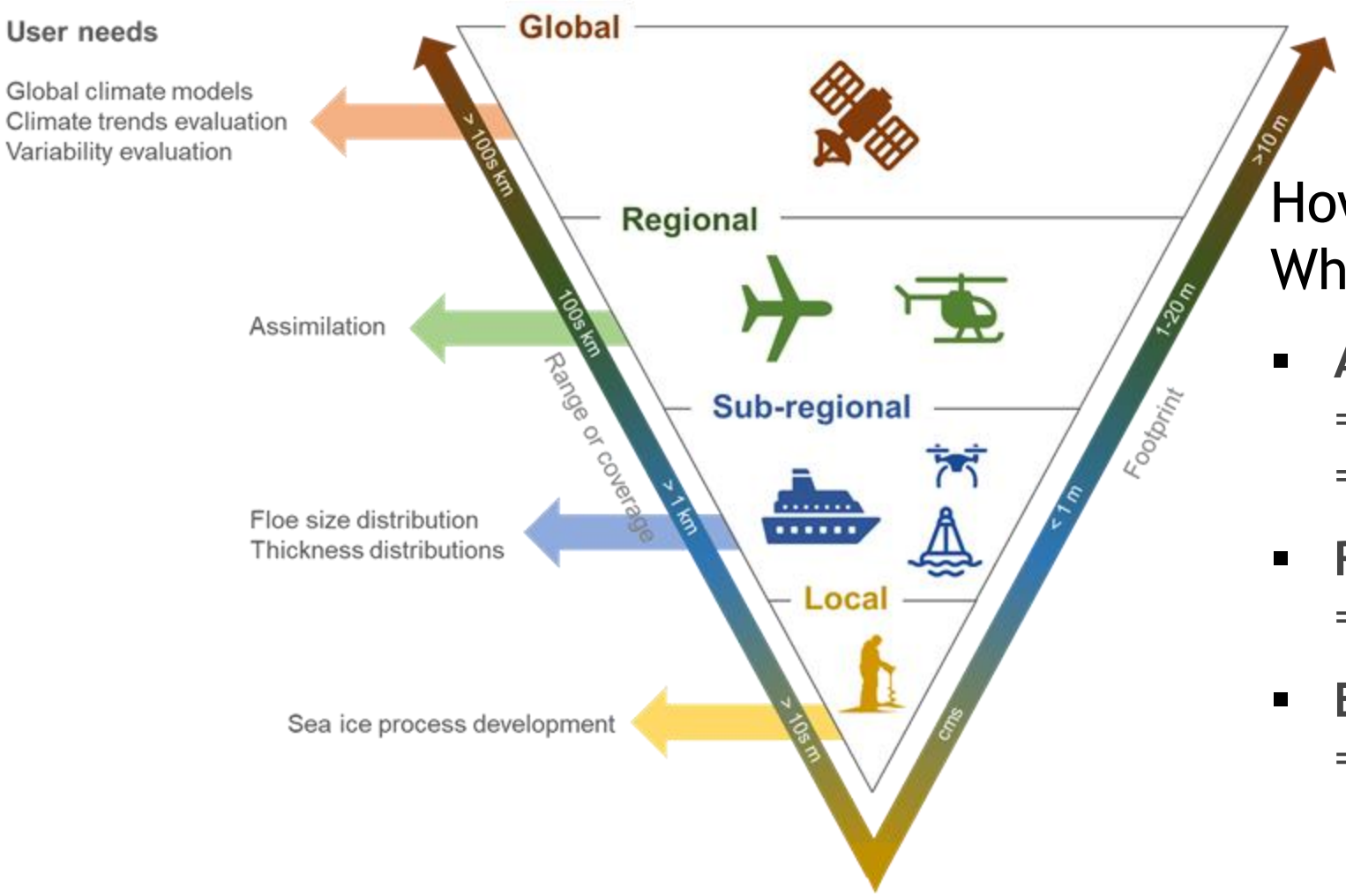


R.M. Fredensborg Hansen for Mallett, Heil, Tilling and ISSI team [in prep]

How to address these challenges? Which research methods are needed?

- Essential Climate Variables (ECVs) vs. scales vs. processes

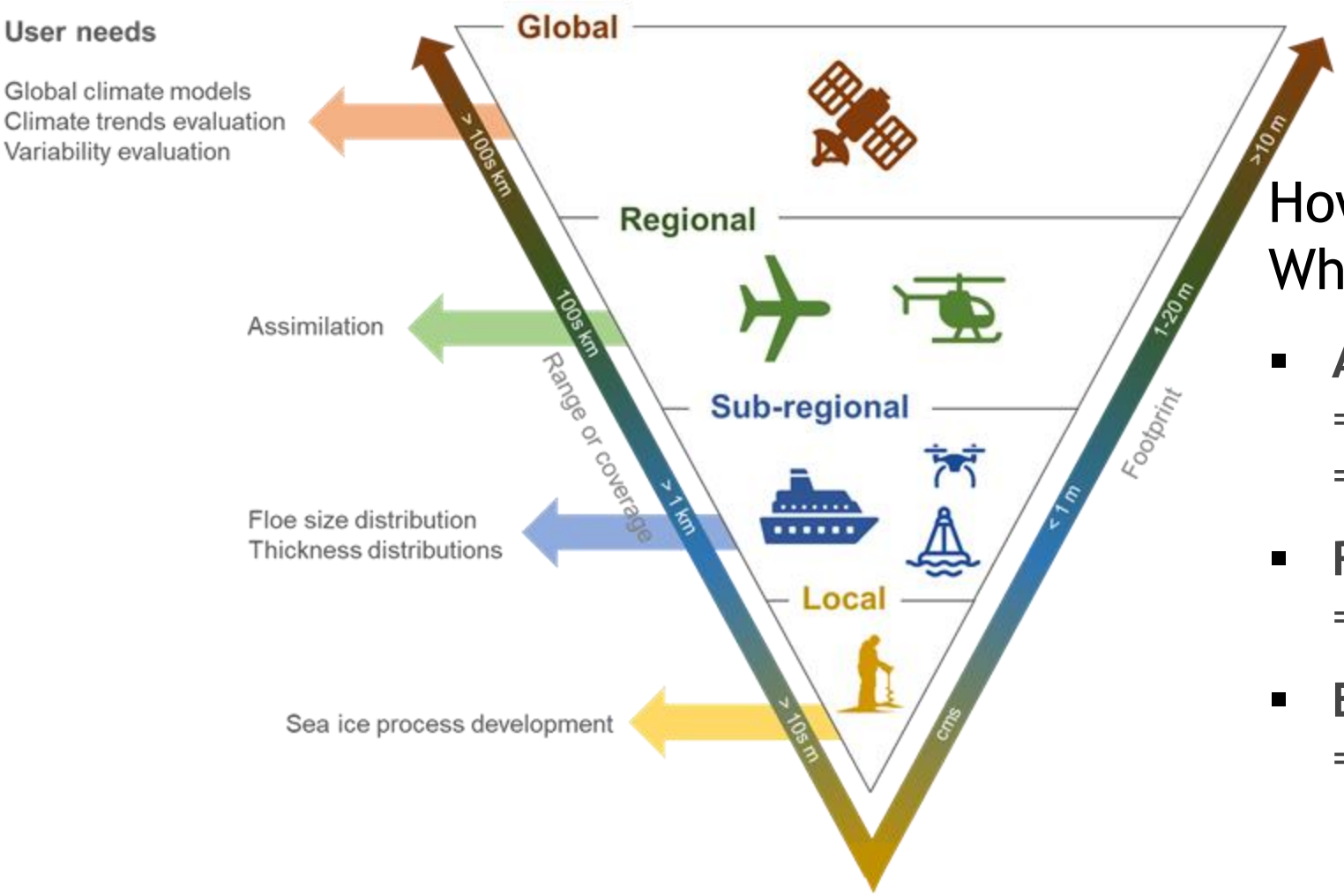
Sea ice work | **What?** Where? How?



How to address these challenges?
Which research methods are needed?

- **Autonomous observations**
  = vertical climate system interaction
  = seasonality/ sequence of events
- **Repetitive observations**
  = process studies/ horizontal distribution
- **Event-driven observations**
  = (local) process studies

Thanks! Questions?



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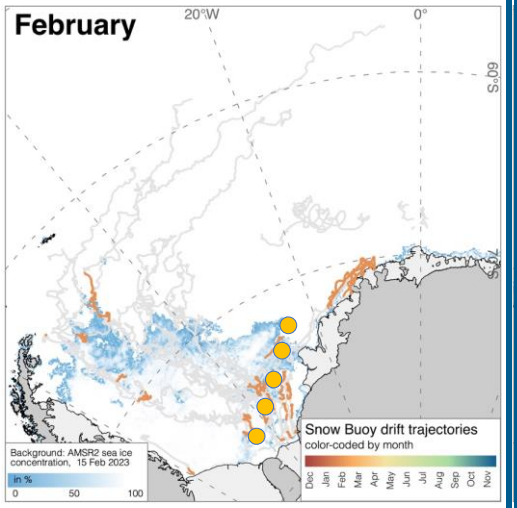
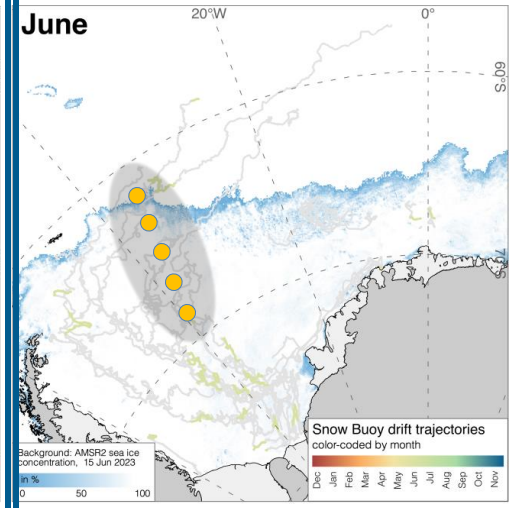
Backup slide(s)

Sea ice work | What? **Where? How?**



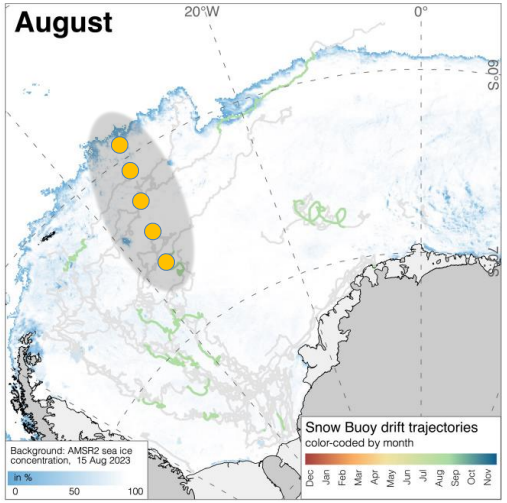
Summer

- § Transect deep into South-East
- § Deployment of autonomous systems: **Distributed network #1**
- § Airborne surveys
- § Gradients of properties



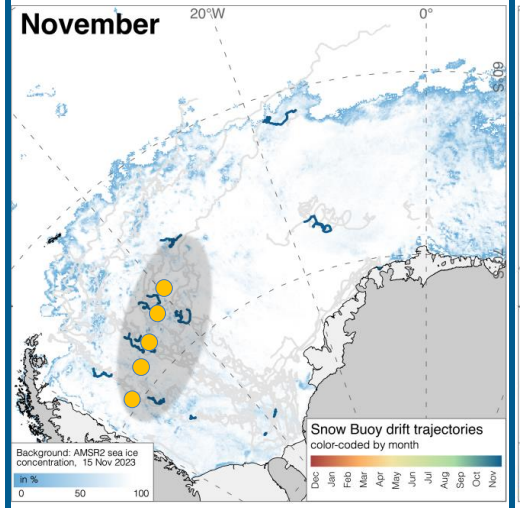
Autumn

- § Transect into ice pack
- § New ice studies
- § Sample second ice regime: **Distributed Network #2**
- § Revisit main floes
- § Airborne surveys



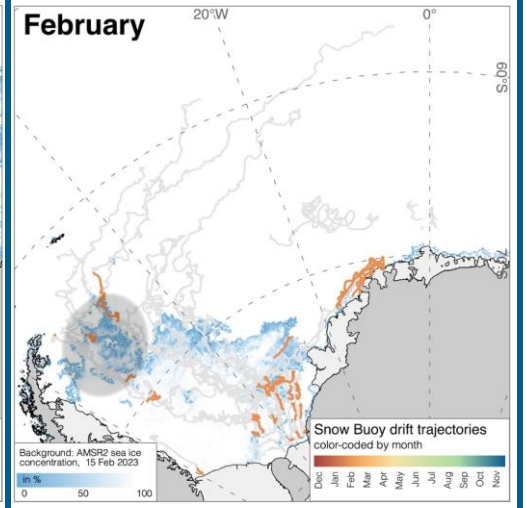
Winter

- § Transect into ice pack
- § Revisit buoy stations
- § Networks 1 (try) and 2
- § **Marginal ice zone work**



Spring

- § **Ice edge surveys**
- § Try to reach DN #1
- § Airborne surveys



Summer #2

- § North-west drift stations, target revisit stations DN1 & 2
- § **Intensive regional surveys in NW Weddell Sea**
- § Airborne surveys

Buoy deployment + revisits

Buoy deployment + revisits
(longer stays on-site in freeze-up conditions)

→ISPOL-2D