A developing strategy for supporting the Arctic Regional Component of the Global Ocean Observing System


frontiers

A Framework for the Development, Design and Implementation of a Sustained Arctic Ocean Observing System

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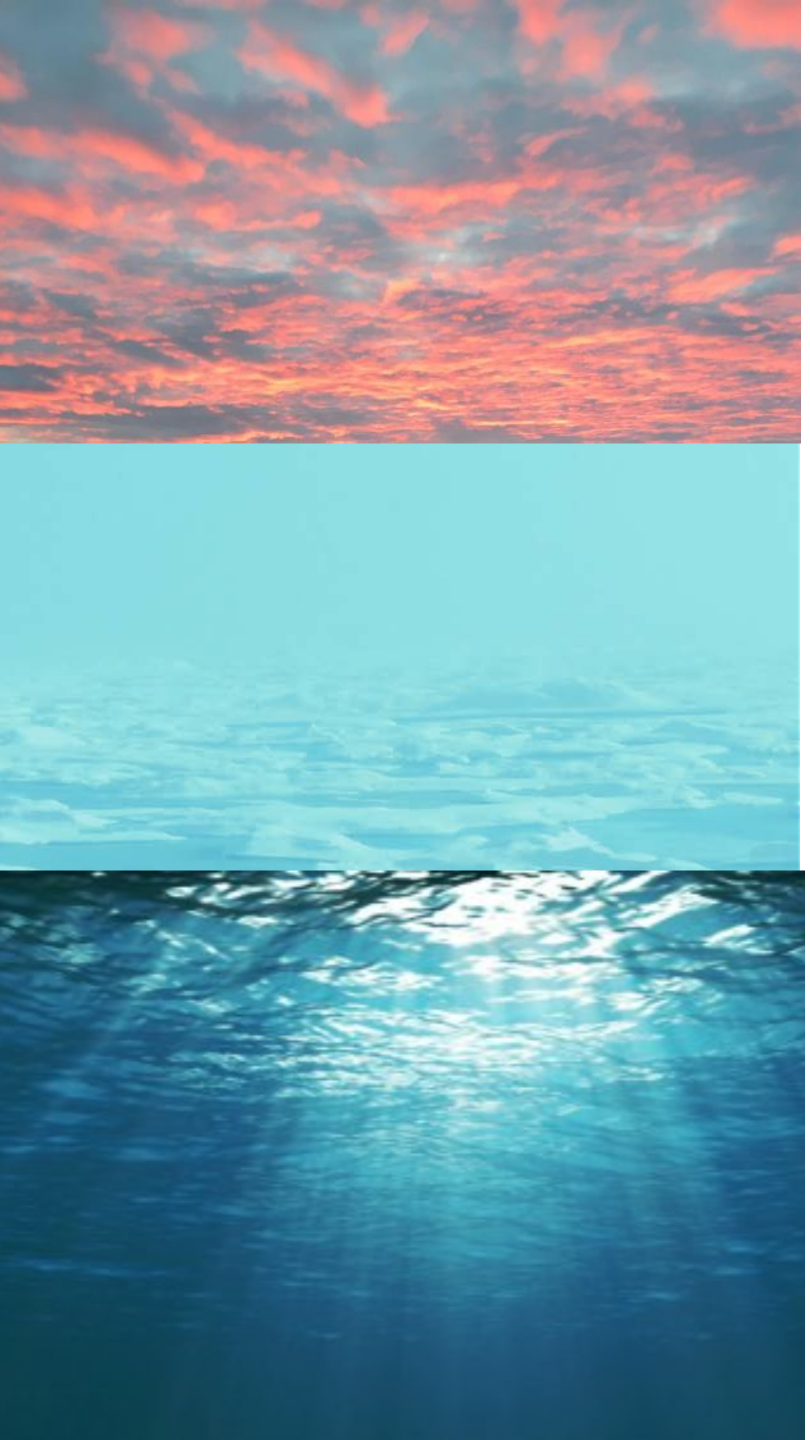

ARC-GOOS – Outline

1. The ARC-GOOS Vision
2. The ARCGOOS development strategy
   a. Methodological
   b. Organizational Leadership
3. Example Gap: Arctic ARGO (Lee)
4. Next for ARCGOOS…

1. The ARCGOOS Vision

- Decadal scale observations of a broad array of variables that describe the state and dynamics […] of an environment undergoing transformative, globally relevant change;
- A combination of community-based monitoring and sustained pan-Arctic sensor-based observations to help them understand and respond to a rapidly changing Arctic, preparing for rapid- and slow-onset hazards and supporting sustainable development;
- National, local, and Indigenous governments are receiving focused, meaningful information about long term change and variability from an observing system that supports planning and decision-making for community health and sustainability;
- Resource management agencies access reliable long-term records available to inform prudent management action and policy;
- Emergency response organizations draw on a suite of near real-time environmental observations that guide emergency response and hazard mitigation efforts.

1. The ARCGOOS Vision

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“A successful ARCGOOS needs the cooperation of a broad range of experts including different scientific disciplines, economic sectors and society, and indigenous peoples. An ARCGOOS that is co-designed with multiple partners and user needs in mind will have the greatest likelihood of long-term sustainability, usability, and relevance.”

ARC-GOOS proposes methodological and organizational responses to this grand challenge.

2.ARC-GOOS Development Strategy

a) Methodological: Developing an international consensus assessment methodology that is co-designed, scalable and compatible with existing programs;

b) Organizational Leadership: Advancing stronger relationships on observing system sustainment between US efforts, global partners, regional efforts, and indigenous experts.

2a. Methodological: Drawing from US AON TASK - SEA ICE FORECASTING (SIF)

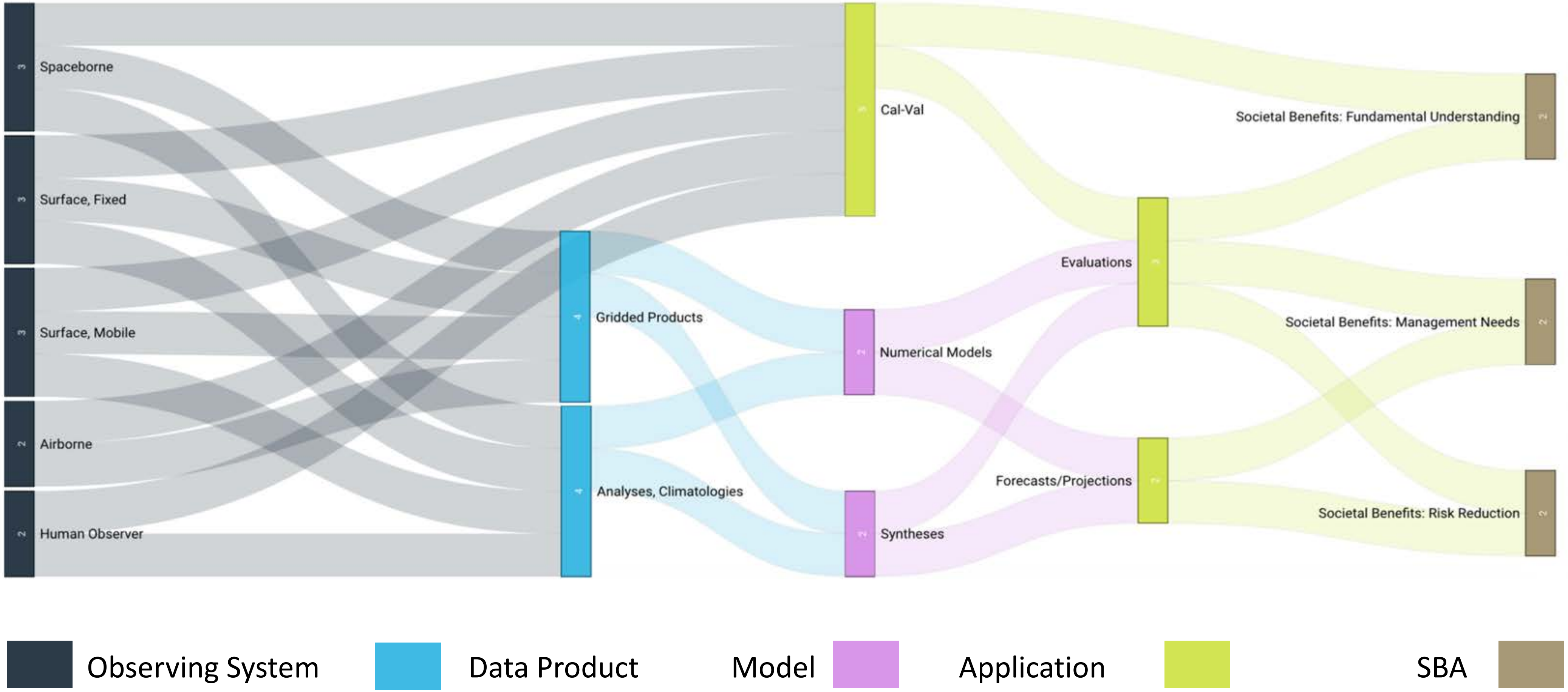
OBJECTIVE: Outline requirements to mobilize critical observations to improve SIF

- Clarify the user base for the SIF observing system and their product/service/information needs
- Identify barriers to efficient exploitation of current observing system to meet those needs and address
- Improve readiness for the future observing system (gaps, needs, consolidated requirements)

2a. Methodological: Societal Benefit Areas (SBA'S) for Arctic applications

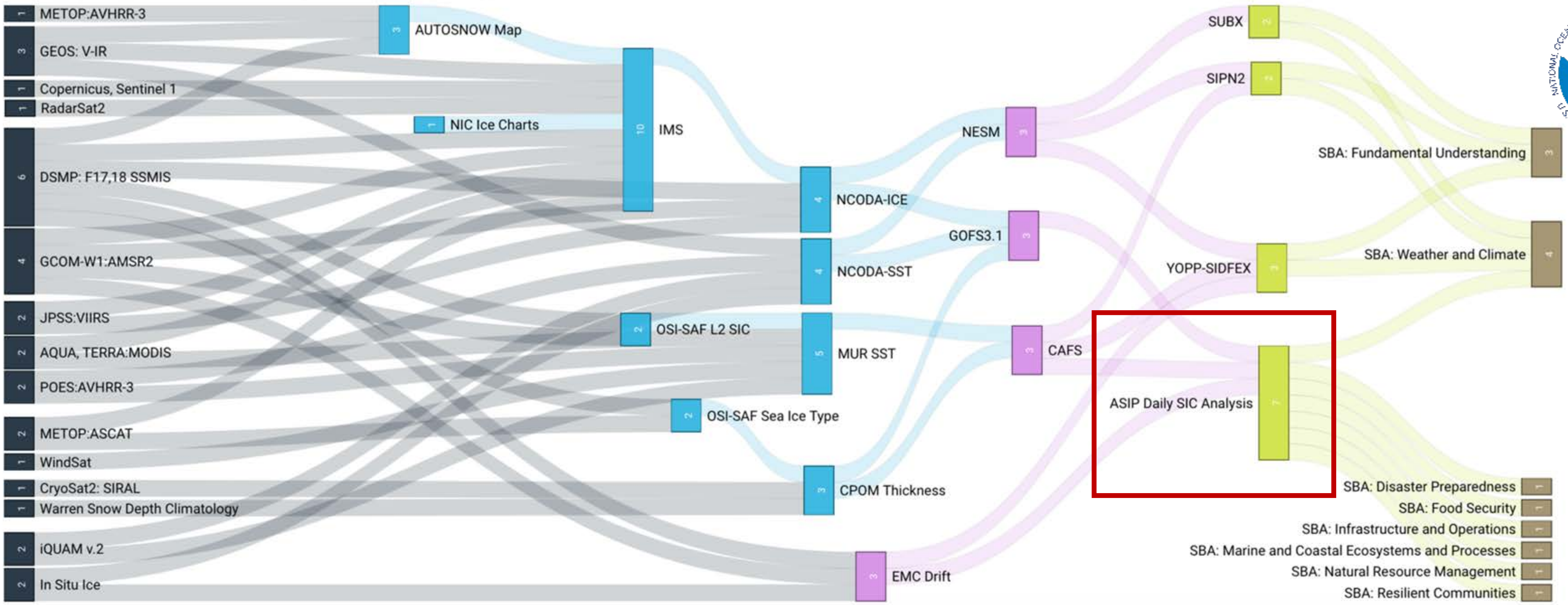
1. Disaster Preparedness
2. Environmental Quality
3. Food Security
4. Fundamental Understanding of Arctic Systems
5. Human Health
6. Infrastructure and Operations
7. Marine and Coastal Ecosystems and Processes
8. Natural Resources
9. Resilient Communities
10. Sociocultural Services
11. Terrestrial and Freshwater Ecosystems and Processes
12. Weather and Climate

2a. Methodological: Value Tree Assessments



Value Tree Assessments Relate Observing Systems to
Societal Benefit Areas (SBA's) through Products, Models and Applications

2a. Methodological: Value Tree Assessments



Observing System | Data Product | Model | Application | SBA

VTA for US SIF – Based on Subset of Sea Ice Service Applications (6 HR gridded)

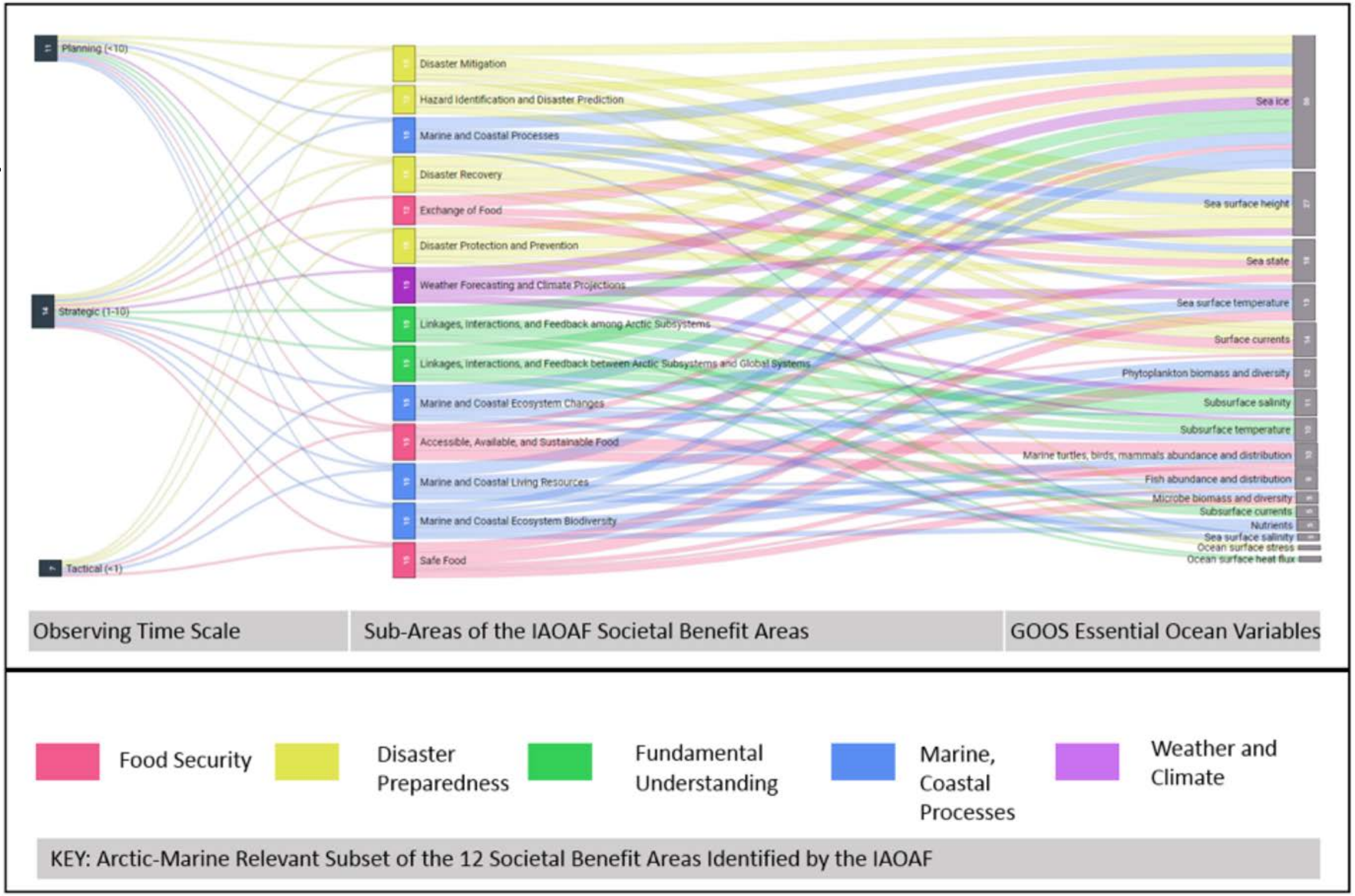
2a. <u>Methodological</u> – Supporting an Arctic Regional Component of GOOS (ARC-GOOS), **relating Arctic Value to Global Variables**

ARCGOOS will use three time scales of obs needs to organize and drive progress under the framework:

Planning (+10)

Strategic (1-10)

Tactical (<1)



2b. Organizational Leadership

- SAON – Roadmap for Arctic Observing and Data Systems (ROADS)
- Global Ocean Observing System (GOOS) Regional Association (GRA)
- Partnership for Observation of the Global Ocean (POGO)
- What is CLIVAR's role?

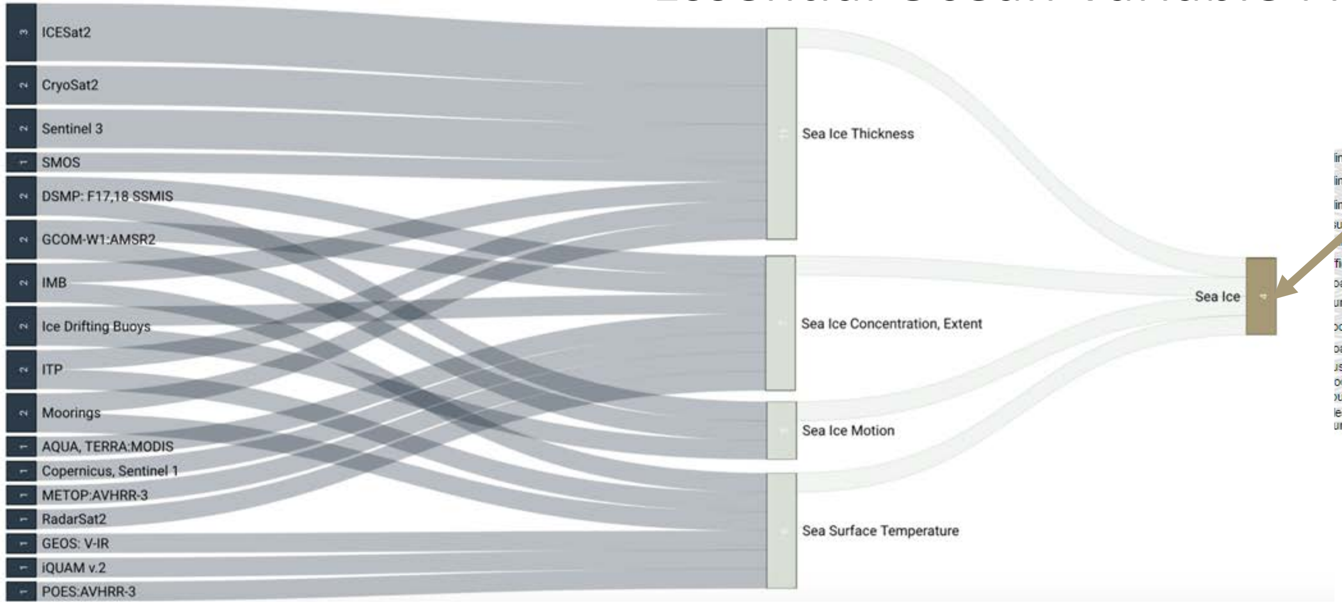
2b. Organizational Leadership: Supporting SAON's Roadmap for Arctic Observing and Data Systems (ROADS)

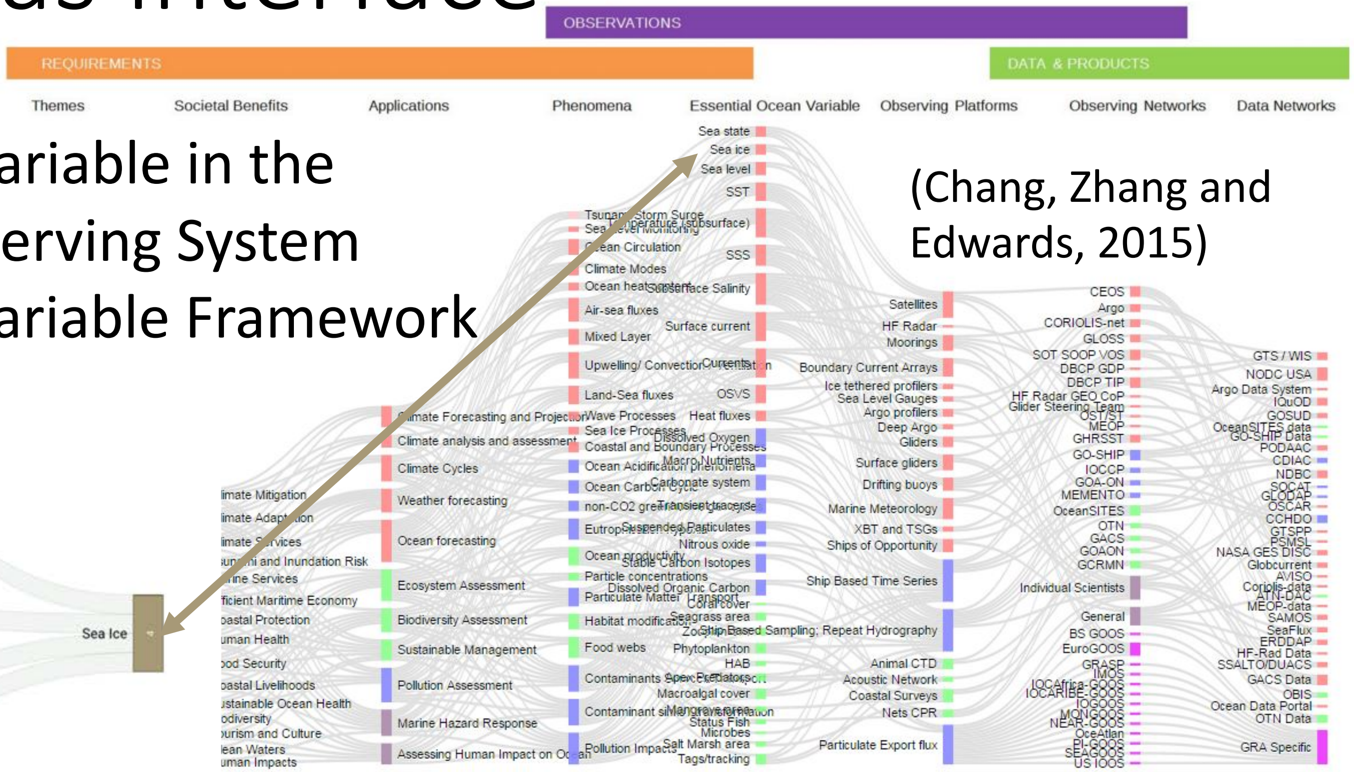
2b. Organizational Leadership: Using GOOS Regional Association as interface

US AON Value Tree

"SEA ICE" is one variable in the Global Ocean Observing System Essential Ocean Variable Framework

(Chang, Zhang and Edwards, 2015)

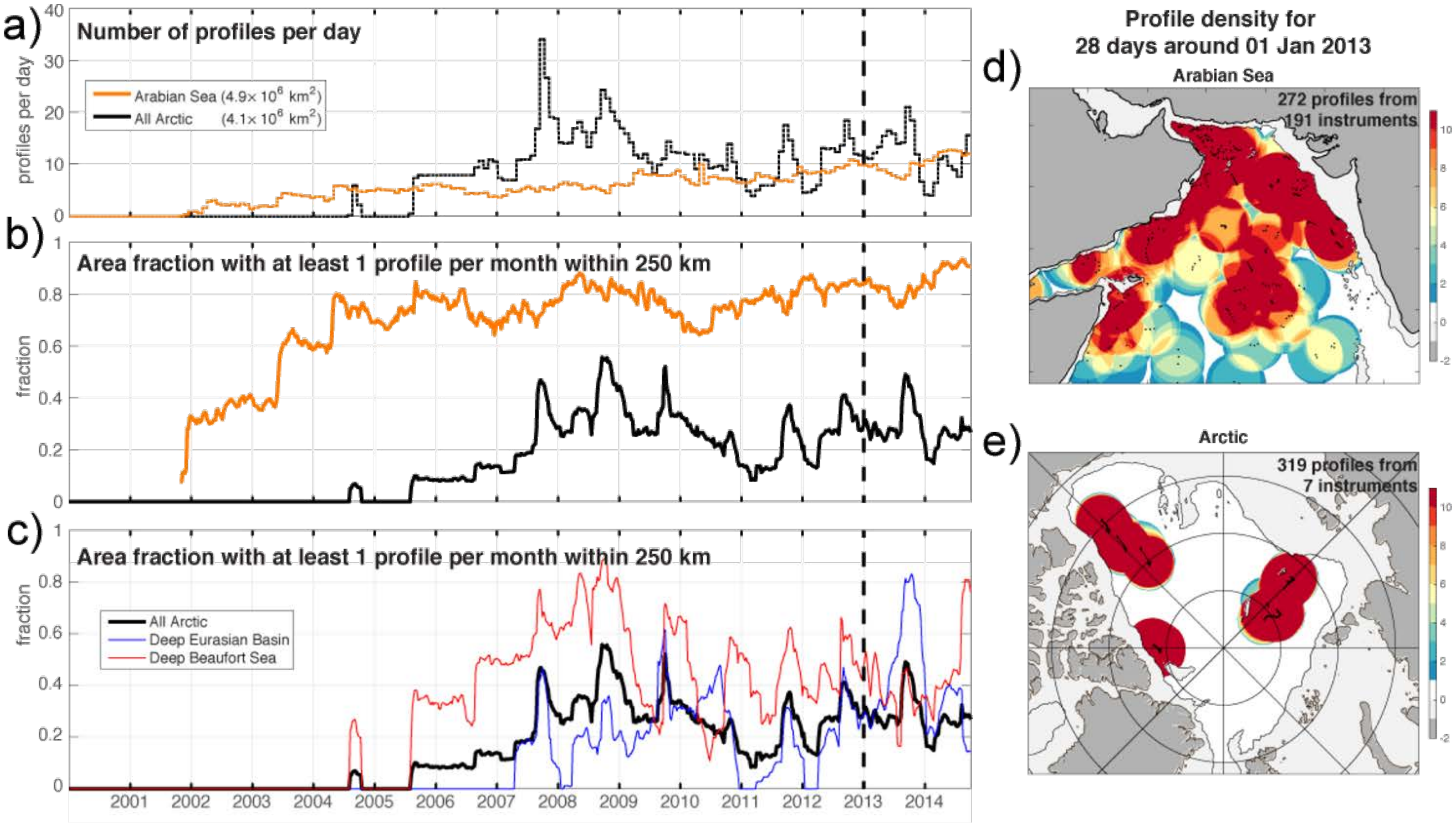




GOOS Essential Ocean Variables

Observing System　SUB Variable　Essential Ocean Variable

3. Example Gap: Arctic ARGO



Sustained, Distributed Measurements in the Arctic Interior

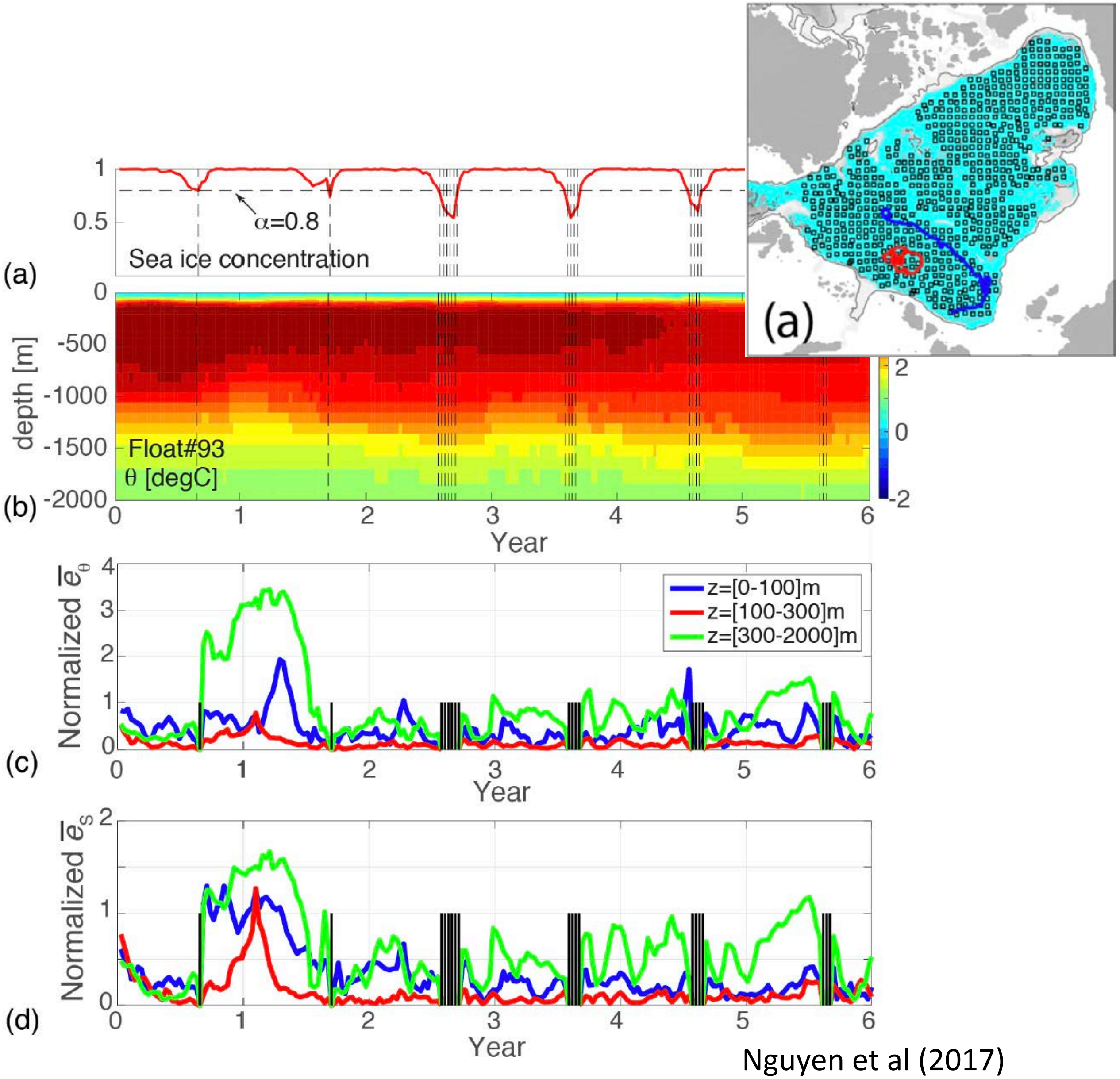
How close are we to Argo-like coverage?

Feasibility Study for Floats in the Ice-Covered Arctic

Nguyen, Heimbach (UT-Austin), Lee, Rainville (APL-UW), Jayne (WHOI)

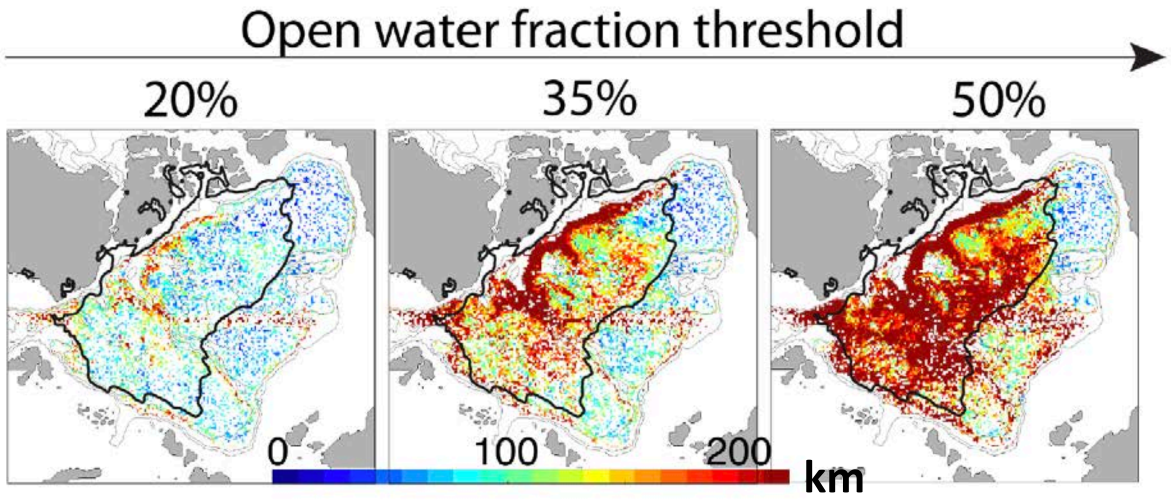
Would large-scale Argo float deployments be useful without acoustic geolocation?

- How far would floats drift between surfacing?
- What are the resulting position uncertainties?
- Given the rapid decline in summertime ice extent, what fraction of the potential data return (for 5-year float missions) could be transmitted back to shore given surfacing in fractional ice cover and in summertime open water?
- Is the resulting data useful for constraining the ECCO state estimate for the central Arctic?



Nguyen et al (2017)

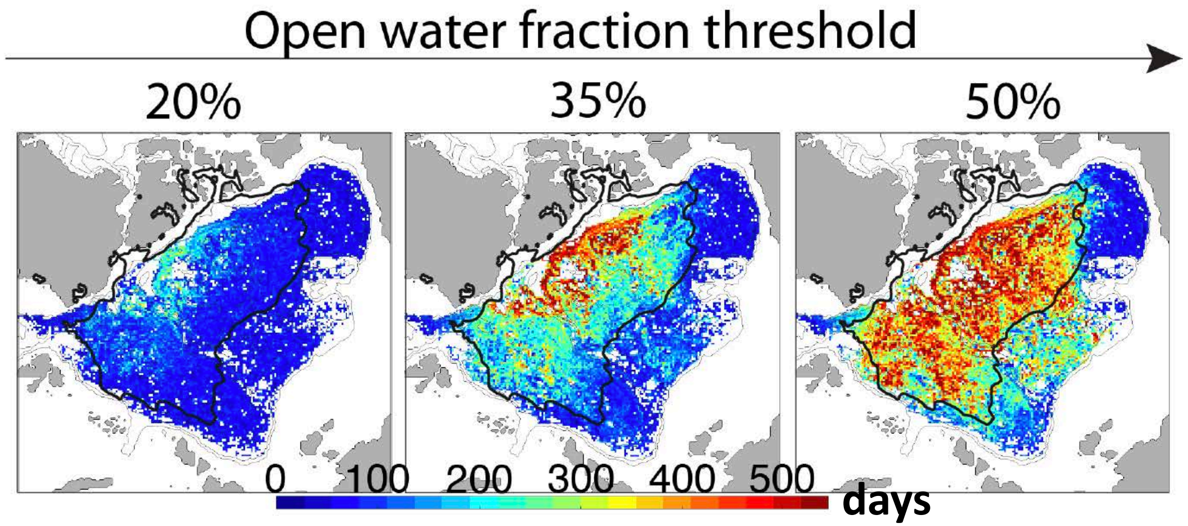
Position Uncertainty and Data Return



Large uncertainties:

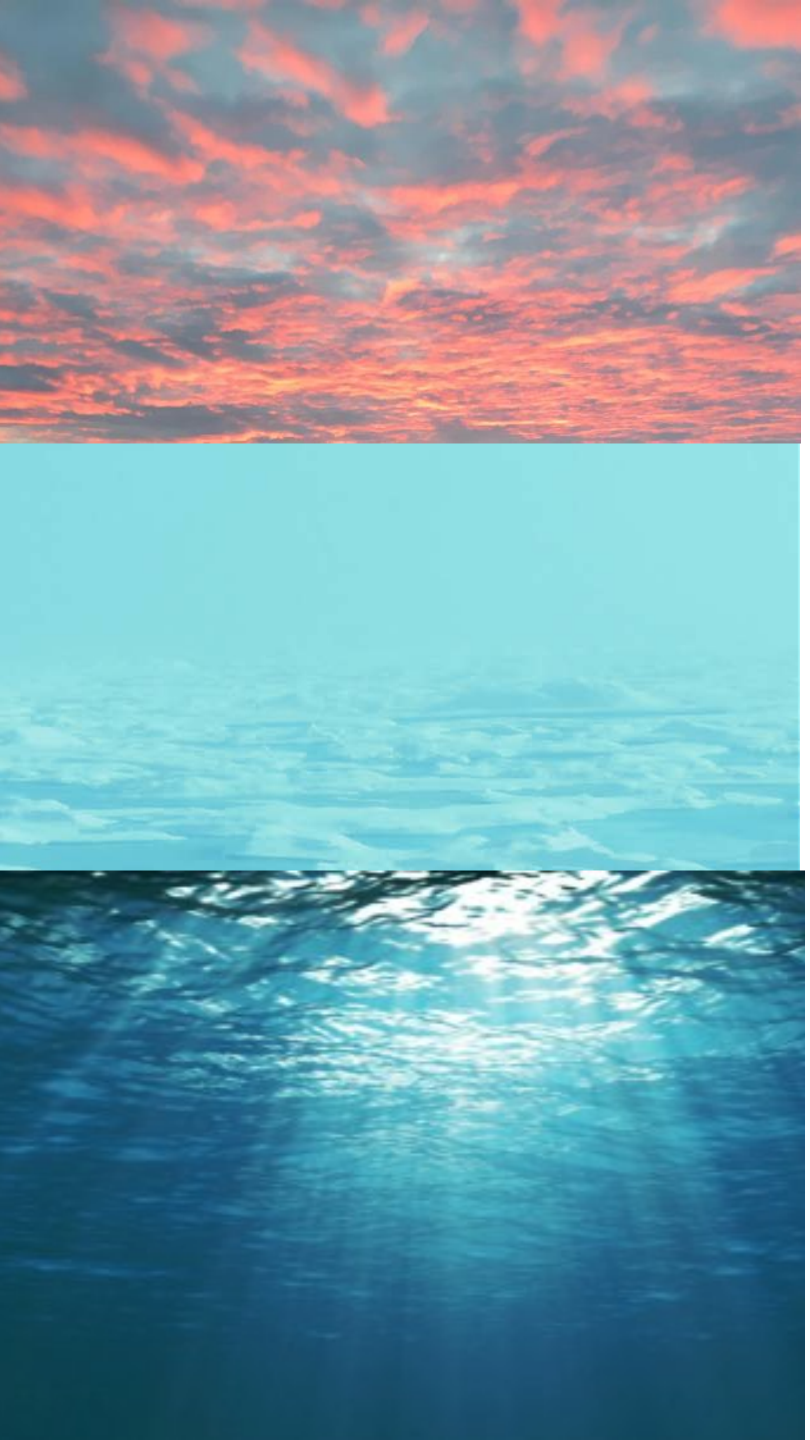
- Heavy ice cover (long drift intervals).
- Energetic currents

- High probability of surfacing multiple times per year.
- In regions of multi-year ice, floats may drift for years, until they move to area of seasonal ice cover.



4. Next for ARCGOOS

- Now: Seek input from other organizations, e.g. CLIVAR
- Develop a cross-organizational leadership plan
- Engage with modeling community, expand input from OSSE’s
- Workshop…?



Thank You!

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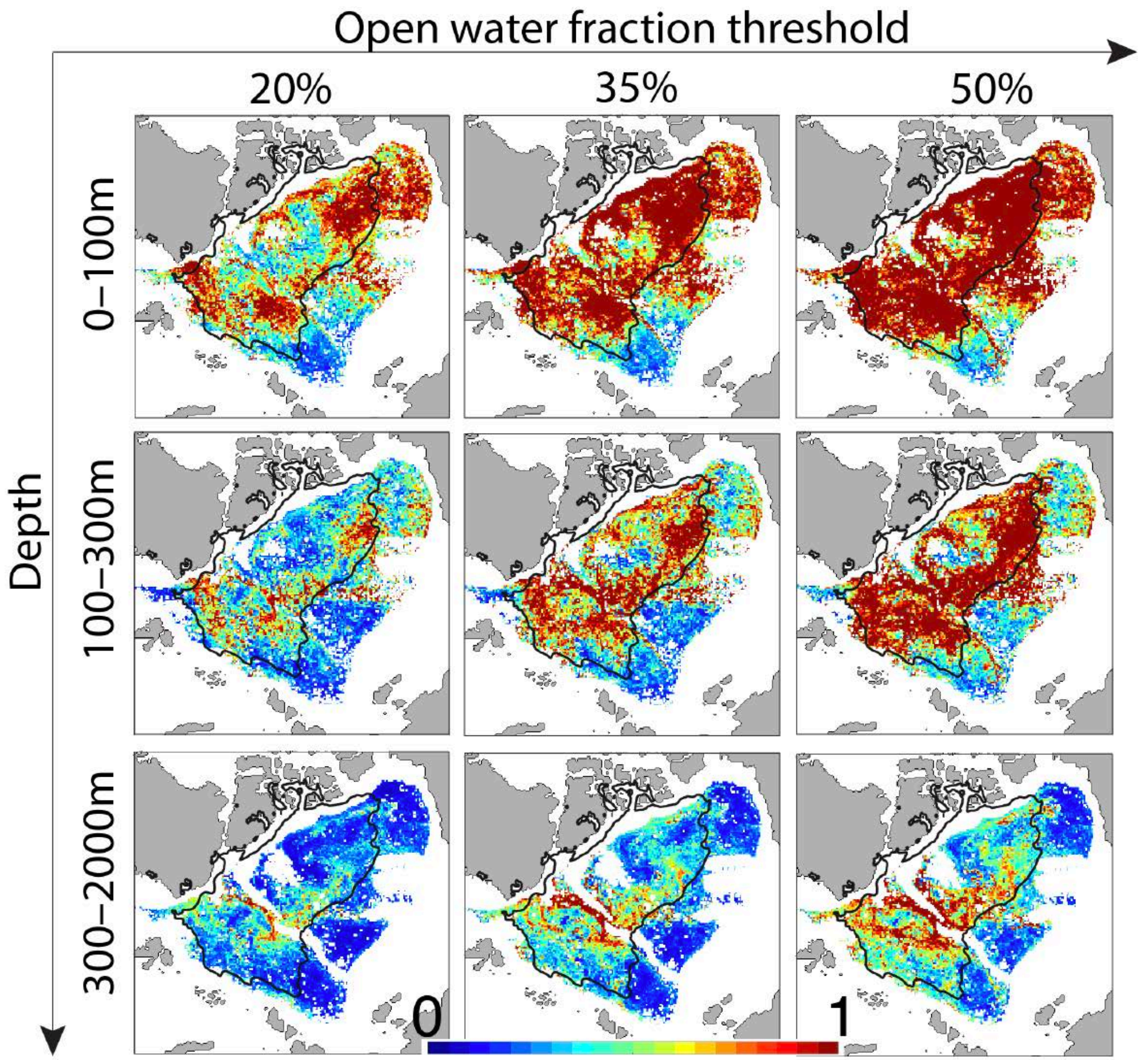
https://aoos.org/aon/about/organization/

Mean Normalized Salinity Error



Nguyen et al (2017)

- e_s < 1 improves state estimate.
- e_s (0-100 m) large as spatial & temporal scales small relative to drift scales.
- e_s (0-100 m) low in where salinity uncertainty high.
- Deeper, longer spatial and temporal scales result in lower e_s.
- In areas with little data, even observations with large position uncertainties can be useful.