

Summary of findings

Surveys made on user needs for sea ice observations and forecasts

Winfried Hoke

Polar Prediction Project, International Coordination Office,
Alfred Wegener Institute, Germany

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Motivation

- WMO-based document with information to all national weather services (no surveys)
 - Update necessary
- Improve national services
- Overview of services
(public, private, e.g. IceBreakerNet)
- Standards for observations and data

Summary

No.	name	time	n	hemisphere (N/S)	interviewed parties	data	questionnaire available
1	ICEMAR	2002?	?	N	navigation, oil/gas industry, design of ships, environment/weather/ice service and research; on+off shore	SIC, SIT, type, drift, deformation	no
2	ACCESS/SIDARUS	2011	18	N+S	Marine safety (13), Marine and coastal environment (3), Climate and seasonal forecasting (2) - private & organisations	sea ice and weather info/detail/download media/	yes
3	EUMET-SAT	2012	91	N+S	Oceanography, numerical weather predictions, seasonal+ocean forecasting, climate, treaty verification	SIC, SIT, type, drift, melt pond fraction, albedo, temp, salinity	yes
4	COM-NAP	2015	18	S	Managers of National Antarctic Programs (Modelling, science, organisational level)	wind, horizontal visibility, precipitation, temperature, sea state and sea ice	yes
5	ACCAP	2014	263	AK	email lists provided by ACCAP (mostly administrative and science respondents)	feedback on three info and data services	yes
6	AOOS	2013	108	AK?	actors involved with sea ice information??	use of sea ice services in USA and Alaska	yes
7	IN-SII	2015?	10	CA	industry needs, shipping	needs of sea ice users ('Trafficability')	some

1: ICEMON

- First of similar surveys
- Basis for ACCESS/SIDARUS

2: SIDARUS/ACCESS

- SIDARUS in cooperation with ACCESS and WMO EC-P(H)ORS
 - to identify, analyse and assess the requirements for sea ice data specified by the sea ice user community
 - WPs (e.g. user interaction, satellite data, albedo, SAR, SIT)
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- SIDARUS = Sea Ice Downstream Services for Arctic and Antarctic Users and Stakeholders
 - ACCESS = Arctic Climate Change Economy and Society
 - Executive Council Panel of Experts on Polar and High Mountain Observations, Research and Service

3: EUMETSAT

- Cooperation with ESA
- To determine user requirements for users (global and coastal oceanography, numerical weather predictions, weather now- & forecasting, climate monitoring/-change)
- Focus on Error Characterisation
 - (bias, precision, stability)
- Focus on defining Essential Climate Variables
- ESA = European Space Agency

4: COMNAP

- Based here in Chch
- Focus on organisational and scientific organisations
- Longest questionnaire (marine operators and weather service)

5: Alaska and Canada

- Three reports/documents
- AK: ACCAP Climate and Weather Resources Survey
 - Alaska Climate Dispatch
 - Alaska Climate and Weather Highlights
 - Historical Sea Ice Atlas user
 - Information incomplete; individual feedback
- CA: Alaska Ocean Observing System
 - Accessing and Using Sea Ice Information
- CA: Industry needs for seasonal and sub-seasonal sea ice information and predictions
 - Trafficability, ice climate is “one piece of the puzzle in planning”
- ACCAP - Alaska Center for Climate Assessment and Policy (NOAA)

Questions (1/3)

Questions	ICE MON	SIDA RUS	EUMET SAT	COM NAP
Sea Ice Questions	?			
How does your organisation use sea ice information		X		X
Interested in what areas of sea ice information provision		X		X
Interested in which geographical areas		X	X	X
What types of sea ice information are most useful		X	X*	X
What types of complementary environmental parameters most useful (sea ice information)		X		X
What time of year does your organisation operate in Antarctic waters				X
How often would you like sea ice information updated		X		X
How spatially detailed should be the sea ice information		X	X	X**
What time period of tactical and operational ice forecast (short-term) information is most useful for operational planning		X		X
Requirement for long-term predictions, i.e. on the effect of climate change		X		X
What time period of historical sea ice information would be useful		X	X*	X
How would you prefer the information be delivered		X		X
What is the ideal file delivery size of product information (bandwidth/formats)		X		X

Questions (2/3)

Questions	ICE MON	SIDA RUS	EUMET SAT	COM NAP
Ocean Weather Questions	?			
How do you use Ocean Weather information (tactical/operational/strategical)		X		X
..and impact of ocean information (waves, currents, sea level, temperature etc) on your business		X		X
Do you receive weather and ocean information and which are useful		X		X
How spatially detailed should be the atmospheric weather information; ocean information		X		X
What time period of tactical and operational weather forecast; oceanographic forecast information is useful		X		X
Medium-term forecasts association with their uncertainty is useful		X		
What type of weather sensitive activity does you organisation undertake				X

Questions (3/3)

Questions	ICE MON	SIDA RUS	EUMET SAT	COM NAP
Where do you get weather information from (service providers, websites)				X
How is information provided (File size; communication mode; operation 24h?)				X
Would your organisation benefit from a weather service provided from Antarctica				X
List forecasts used and usefulness of their elements				X
Questions from the EUMETSAT survey	?			
What is your work task(s) where you need sea ice data			X	
What is your requirement for error characterisation: Bias, Precision, Stability (sea ice concentration)			X	
Sea ice thickness (regions; spatial resolution; temporal coverage; other)			X	

* = question similar ** = question in less detail

Results SIDARUS / ACCESS

- users of sea ice charts require as much information on different parameters as possible with the best detail available, ... made available to them as often as possible
- Users: now- and forecast, e.g. once a day sea ice with 0,1-1km resolution
- Forecasters: sat image for validation & verification; missing e.g. high-res long-term observations in key regions
- Data products as outcome of whole SIDARUS, hosted by individual organisations
- Challenge mentioned: 'hard to get in touch' with users for dissemination and cooperation, due to limited time/ resources to travel to a workshop

Results EUMETSAT

- Idea of uncertainty not always clear or based on intuition (Error Characterisation)
 - SIC daily; 'must have' 10-20 km, ideal <10 km
 - SIT similar
 - Ice drift, ice volume, snow cover, melt pond fraction, albedo, surface temperature, sea ice salinity (<20 km)
 - “Demand for sea ice data is much larger than the basic ECV parameters defined by GCOS (ice concentration, ice thickness). There is therefore a significant user potential for new satellite derived products for sea ice.”*
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- GCOS - WMO's Global Climate Observing System
 - * ESA- User Requirement Document - 2012-06-01-(SIDARUS) SICCI URD (D1.1) Issue 1.0.pdf

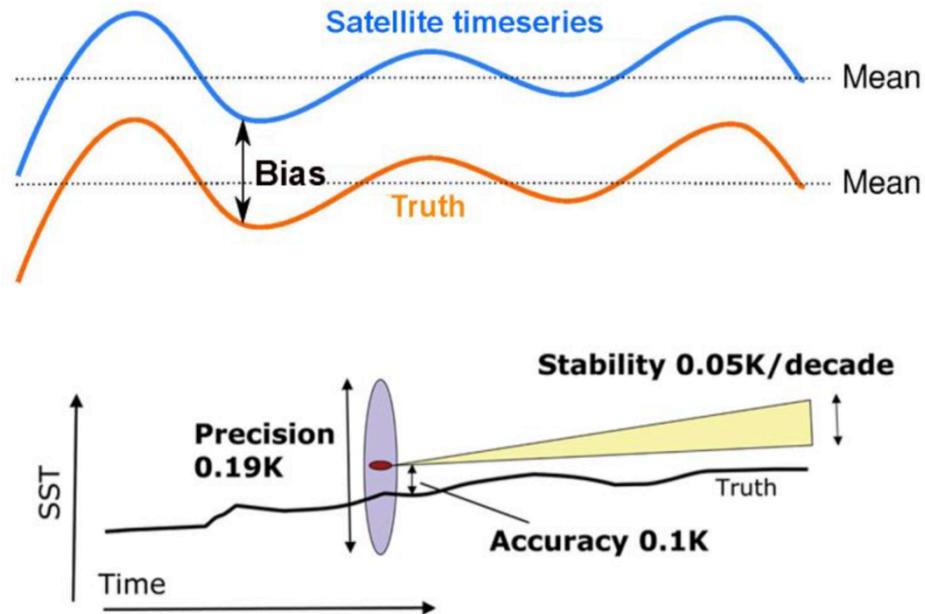


Figure 4-1: Illustration of bias, precision and stability of satellite measurements, using SST as an example. Bias is defined as the offset of the mean satellite observations from the “true” values; Precision is defined as scatter of multiple measurements of a constant target, and Stability is defined as drift in observed mean value of a constant target over a decade.

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Results COMNAP

- Sea state and sea ice as main forecast elements on daily to sub-daily updates are imperative for reducing costs and risks
- National Antarctic Ice Services
 - Small (national) group of users
 - National → discontinuities (experienced staff needed)
 - IAATO “rely less on National weather services, preferring instead to use free internet sites and ship based visualisations of raw model weather data”
- Authors suggest that “service capacity be built up at the National and International level through co-investment, commercial development and improved coordination to minimise duplication of effort and maximise on skill and resource sharing.”
- State-of-Play and collaboration between science and operators
- IICWG
- IAATO - International Association of Antarctica Tour Operators
- International Ice Chart Working Group

Summary, Outcomes, next steps (1/2)

- Surveys have different scopes and foci – difficult to compare
- „data should be available as detailed and often as possible” → prioritisation? (IICWG)
- “that service capacity be built up at the National and International level through co-investment, commercial development and improved coordination to minimise duplication of effort and maximise on skill and resource sharing” (COMNAP)

Summary, Outcomes, next steps (2/2)

- Exploit available information → efficiency
 - “But when are you going to act on our information needs from last survey??”
- Bridge natural science (modelling etc.) with social/applied sciences (SERA etc., TK, etc.)
- Where are gaps?
 - Which gaps? Who?
 - Role of SERA+



Thank you

	Service line		
SIDARUS services	Daily/regular products and services from satellite data	Seasonal and interannual products from satellite and non-satellite data	User groups
High-resolution sea ice and iceberg products from SAR	Regional products showing ice types, concentration, deformed ice, icebergs Data from ENVISAT, TerraSAR-X, RSAT-2 Preparation for use of Sentinel-1 data	SAR data and derived products will be available year-round in Arctic and Antarctic Systematic SAR coverage will start with Sentinel-1 from ≈ 2013	Operators including marine traffic, offshore industry (design and operations), shipping, ice and weather forecasting, marine safety
Sea ice albedo	Regular products will be available during the project	Method development to derive seasonal products for spring, summer and autumn. Time series of albedo and meltpond fraction from 2003 to present	Sea ice and climate modellers
Sea ice thickness	Daily products according to SMOS data coverage	Time series of SMOS – derived ice thickness maps Archives of in situ data from submarines, HEM-flights, AUVs	Climate research, sea ice modellers, offshore industry shipping
Sea ice habitat conservation	Daily sea ice maps combined with marine mammal tracking data in selected areas in Arctic and Antarctic	Time series and maps for movement and migration analysis. Archives of products will be available for users	Environmental management, wildlife protection
Ice forecasting	Produced by highresolution ice-ocean model for the Barents Sea. Produced by circumpolar model for the Antarctic	Drift of icebergs in Antarctic circumpolar current and in Arctic combined with detection of individual icebergs within the sea ice zone	Marine Safety (shipping, sailing, offshore)

Table 5: Services delivered by SIDARUS

Delivery method	Response		
	Marine Safety Response	Marine and Costal environment	Climate and seasonal forecasting
Download from web	10	3	2
E-mail	8	2	
Electronic Navigation chart	9		
Navtex	2		
AIS	7		

Table 11: Preferred delivering mechanism

Response to the user application areas

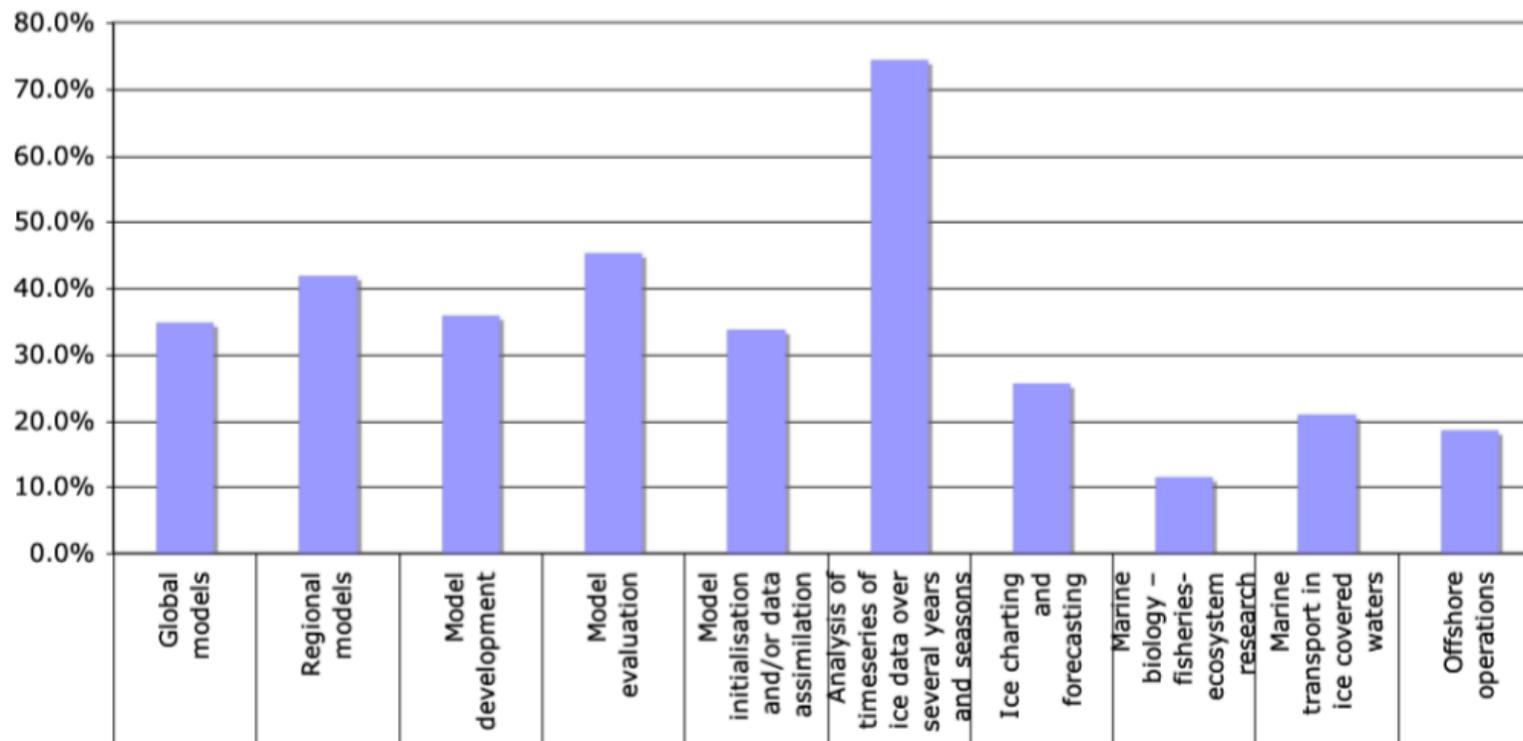


Figure 4-2: Distribution of replies among the user application areas

How important are the following sea ice parameters in your work tasks ?

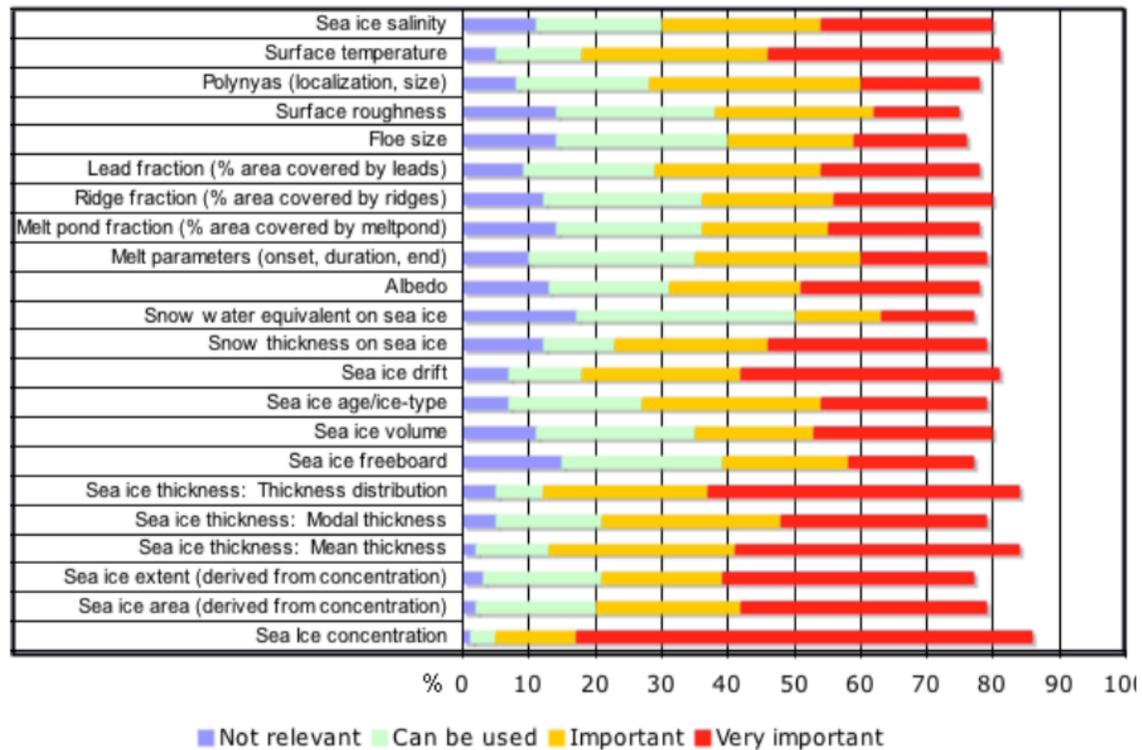


Figure 4-3: Categorization of the importance of various sea ice parameters from the user replies

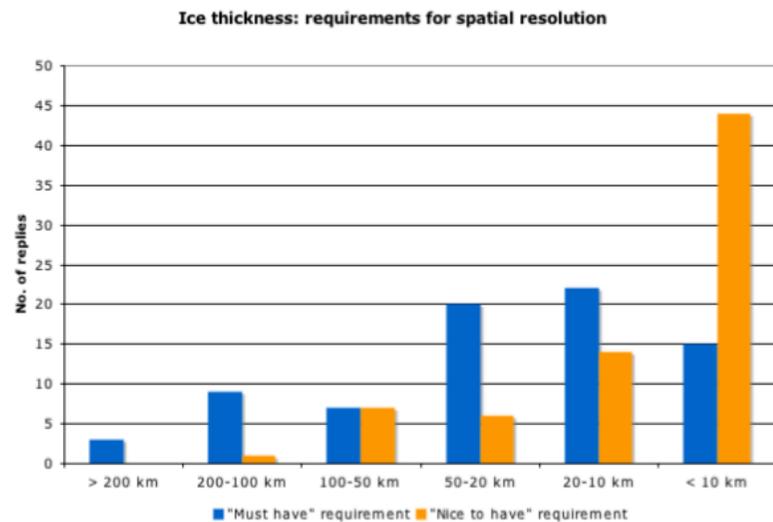
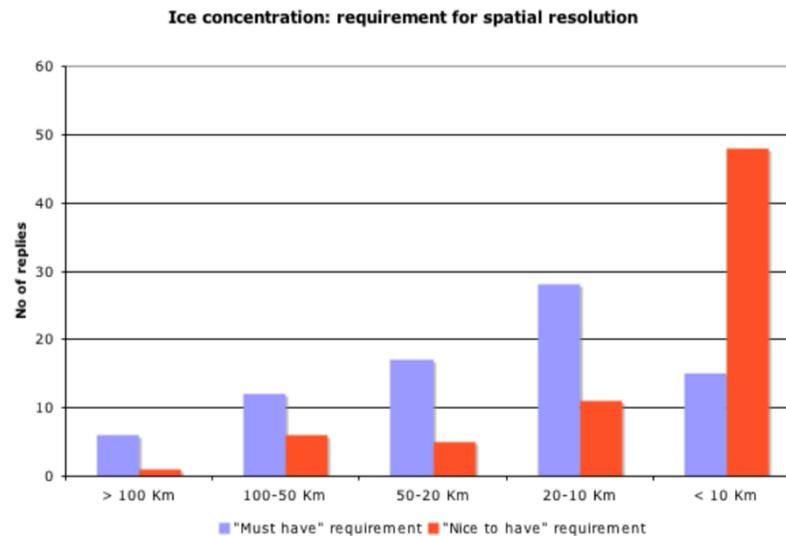
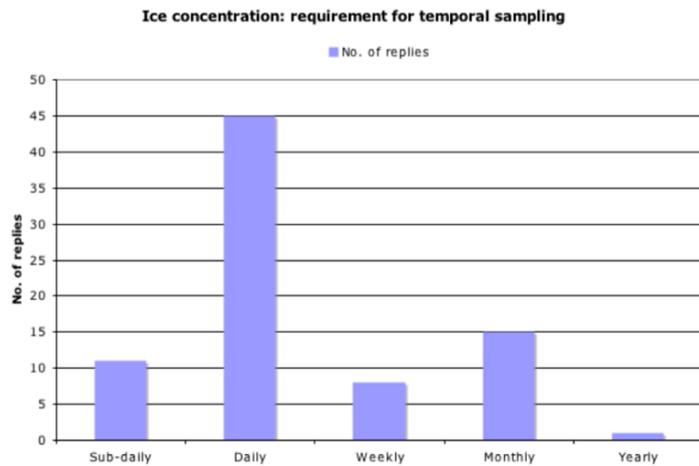


Figure 4-4: Distribution of requirements for temporal sampling and spatial resolution
EUMETSAT - Sea Ice Climate Change Initiative: Phase 1
 - User Requirement Document (URD) 2012-06-01-(SIDARUS) SICCI URD (D1.1)

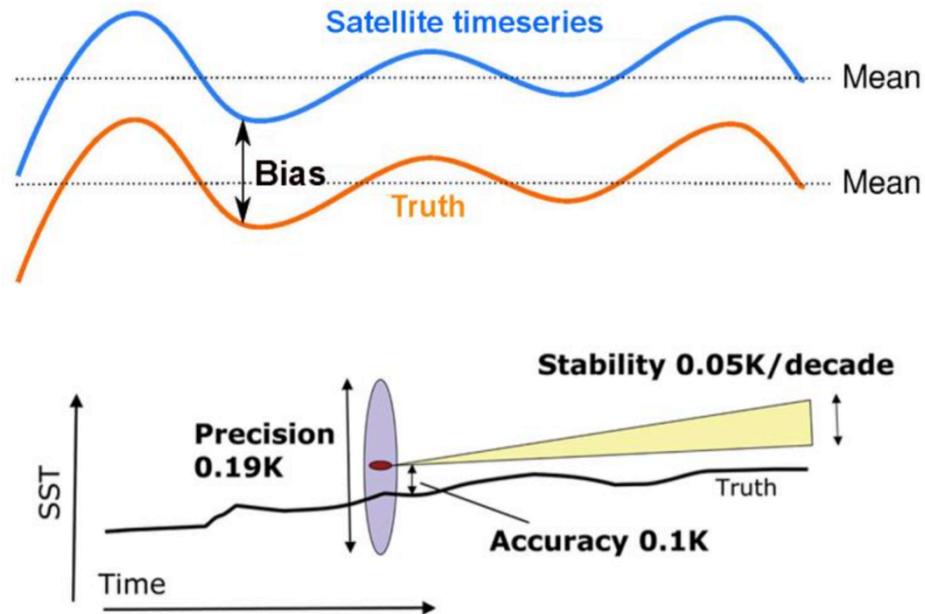


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Exploitable result	NERSC	AWI	CLS	UB	UCAM	Met.no	NIERSC	IPNASB
Sea ice data from previous and new field campaigns (WP2)	X	X			X			
Satellite data for case studies and test areas (WP3)	X	X	X	X		X	X	
Studies of albedo and snow cover, algorithms and processing system (WP4)				X				X
SAR analysis and toolbox for sea ice and icebergs (WP5)	X	X	X			X	X	
Sea ice thickness results (WP6)		X		X	X			
Ice forecasting (WP7)	X		X					
Results of data integration and validation (WP8)	X	X	X	X	X	X		

