WP1: Requirements and strategy for Pan-Arctic Observing systems

Lead: Stein Sandven, NERSC, co-lead: Erik Buch, EuroGOOS

The overall objectives of WP1 are to

(1) Review the high-level requirements and develop the strategy for the Pan Arctic Observing system based on present initiatives(i)

(2) Plan and coordinate the INTAROS activities in agreement with AOS recommendations and stakeholder requirements, and

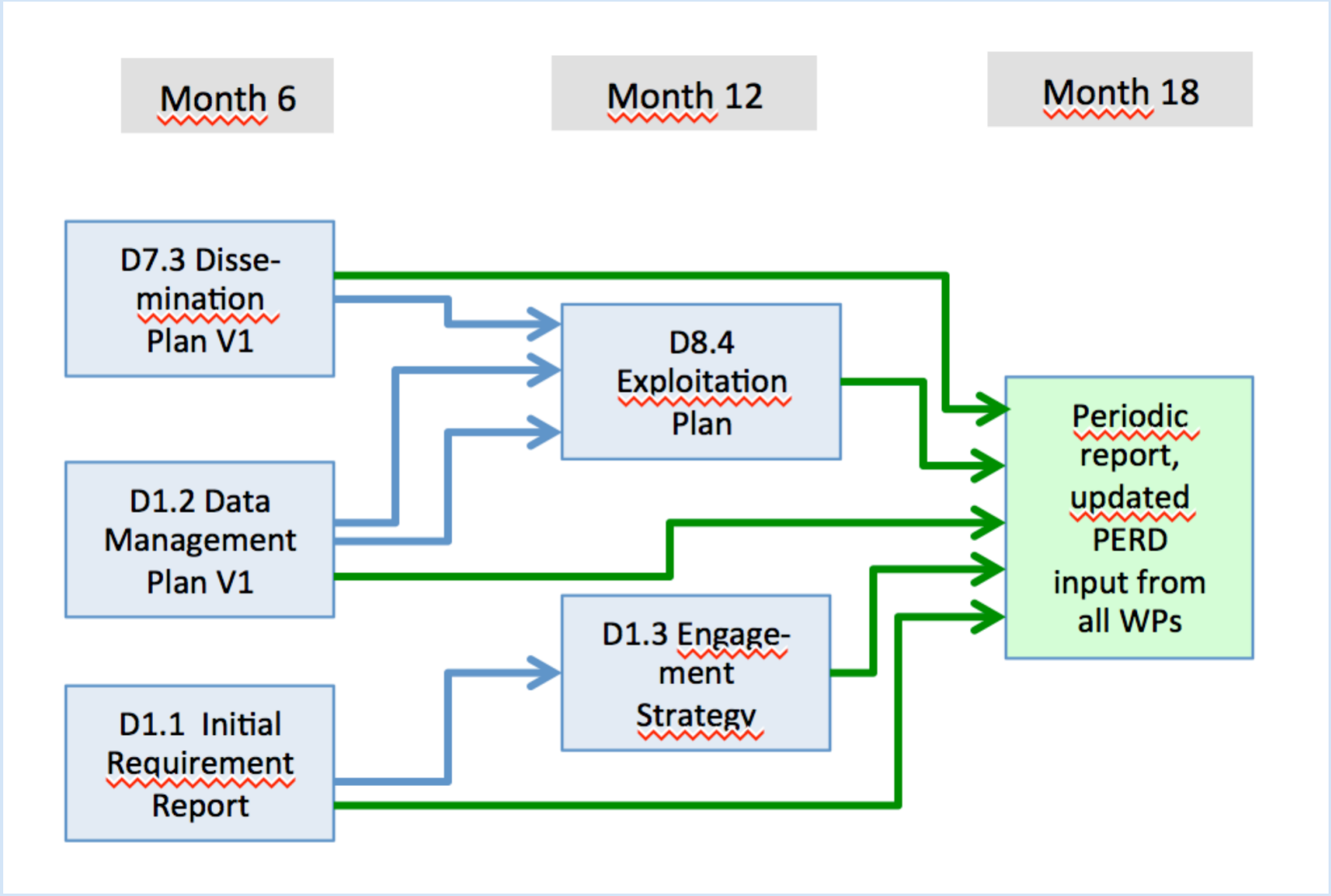
(3) Strengthen European participation in Arctic Observing Networks

(i) GEO Cold Region Initiative (CRI), SAON and other international initiatives, related to the Arctic and European Blue Growth strategy;

WP1 Specific objectives

1) Formalize collaboration with other EU projects, programmes and infrastructures contributing to Arctic observing systems (EU-PolarNET, ALLOCATE, BLUE ACTION, ATLANTOS, INTERACT, ++
2) Establish cooperation with US Arctic programmes (ONR, NSF), Canadian programmes, Russia, China, Japan and Korea.
3) Establish and maintain links to stakeholder groups such as Arctic Council working groups (AMAP), global programmes (WCRP), Copernicus services, industries, ++
4) Formulate an Engagement strategy and establish a Pan-Arctic Observation Forum (e.g. Arctic Observing Summit)
5) Include indigeneous and local perspectives and knowledge in project planning and implementation
6) Prepare data management plan and data governance framework (through the SAON/IASC Arctic Data Committee)
7) Develop a roadmap for future sustainable Arctic Observing System

Deliverables in the first 18 months



Key deliverables by month 12

- The *Initial requirement Report (D1.1)* has been prepared where the theme leaders provided significant description of what observations are needed for the atmospheric, ocean and terrestrial themes. Essential variables to observe and observational technologies to obtain data are described.
- The *Engagement Strategy* (D1.3) has been prepared where stakeholder groups are identified, measures to involve data providers, users and other stakeholders are described. It is a baseline document for establishment of the Pan-Arctic Observing Forum (PAOF).
- The first version of the *Data management plan* (D1.2) has been prepared. New datasets collected or generated by partners in the project, will be managed according to guidelines for FAIR (Findable, Accessible, Interoperable, Reusable) data management in H2020.

The Engagement Strategy

- Describes how collaboration will be developed between actors inside and outside the INTAROS consortium. This document is intended to:
- Be a baseline document for establishment of the Pan-Arctic Observing Forum (PAOF).
- Support the project in efficiently describing the target audiences when engaging with stakeholders, attracting more users, and improving data usage and information flow between society and science.
- Identify measures to be implemented

Stakeholder categories

- Science – through projects and programmes, in particular climate and environment – Arctic Science Ministerial
- Service providers: e.g. weather and ice services (Copernicus services)
- Government agencies: e.g. national institutes, fishery directorate, oil directorate, coastal directorate, ++
- European / international agencies/bodies: EU, EEA, ESA,
- Private sector: e.g. shipping, oil/gas, fishery, tourism, ++
- International programmes: e.g. SAON, AMAP, IPCC, GCOS, GOOS, WMO or ECMWF, ++
- NGO's
- Local communities

Stakeholder engagement in INTAROS

- First workshop in Brussels 05 May 2017 addressing high-level requirements across the various disciplines and stakeholder groups.
- Two workshops on Community-based observing (Fairbanks and Quebec) and one workshop in Oslo with Norwegian providers and stakeholders
- Stakeholders in each of the thematic areas engaged through WP6 (Atmosphere, Ocean and Seafloor, Sea ice, Marine Ecosystem, Terrestrial sciences, Glaciology, Natural hazards, and Community-based monitoring
- Advisory Panels with stakeholder representatives
- More workshops in 2018 and onwards

Collaboration with SAON

- INTAROS has started to work with the Arctic Data Committee and the Committee on Observing Networks under SAON (Sustaining Arctic Observing Networks), since they are established as pan-Arctic and multidisciplinary committees. SAON's vision is to facilitate a connected, collaborative, and comprehensive, long-term, pan-Arctic Observing System that serves societal needs. SAON is therefore important as a mechanism for future continuity of the INTAROS work.

Constribution to IMOBAR

- INTAROS contributes to the project “Impact Assessment on a Long-Term Investment on Arctic Observations (IMOBAR)” conducted by the Joint Research Centre (JRC) and Directorate General for Research and Innovation (DG RTD). The project will provide input and justification for the large investments needed to develop sustainable Arctic observing systems. Results of the project will be presented at the upcoming Second Arctic Science Ministerial in Berlin in October 2018.

Collaboration with US and Canada

- Participation in the CANAPE project field experiment in the Beaufort Sea, led by Scripps
- Contributed to the Arctic Workshop of the Transatlantic Ocean Research Alliance organised by EU in Brussels 29-30 March 2017
- Started a networking project, UAK, between Norway, USA and Canada to strengthen links between science and education on Arctic topics (2018 – 2020).
- Will implement the CAATEX project as part of the MOSAIC programme 2019-2020
- ++

Collaboration with China, Japan and South Korea

- Collaboration with the Chinese Arctic icebreaker expeditions 2017-2018 to collect sea ice data.
- INTAROS has signed a MoU with the Chinese DBAR HiMAC programme (*Digital Belt and Road Program - High Mountain and Northern Cold Region)* led by RADI.
- Japan: collaboration in the framework of ArCS, a major Arctic interdisciplinary programme, for the period 2015-2020
- Collaboration with KOPRI on sea ice and ocean research using satellite data and insitu data from the ARAON icebfeaker

Joint work in the Arctic Cluster

Develop collaboration with three task groups:

(1) Outreach and communication activities: Arctic Circle 2017, COP23
(2) Stakeholder interaction and workshops
(3) Data management

(more in presentation by Kristina Baer)

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WP 1
T1.1 Initial requirement report
T1.2 Stakeholder meeting

Erik Buch

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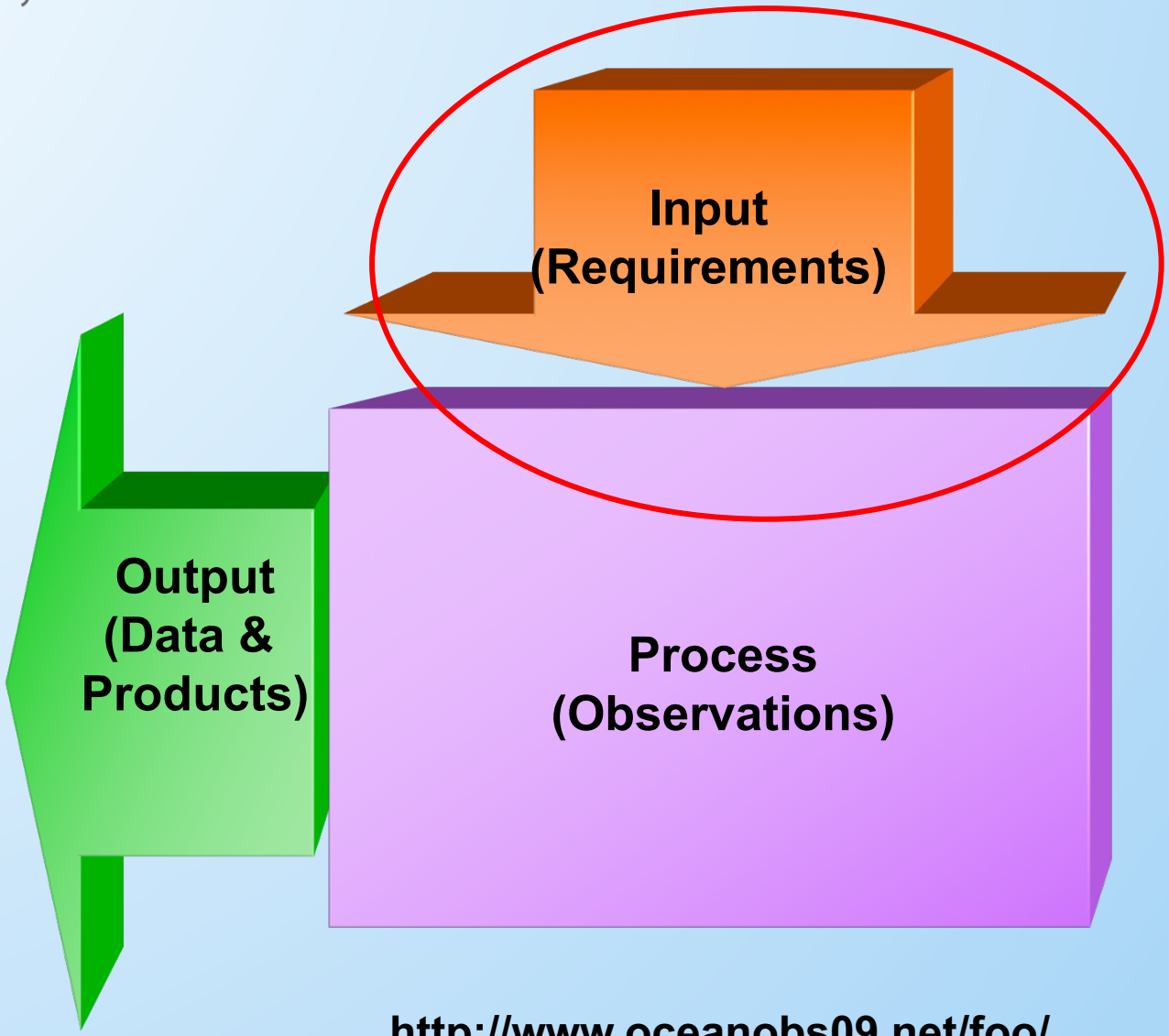
Framework for Ocean Observing
A simple system



http://www.oceanobs09.net/foo/

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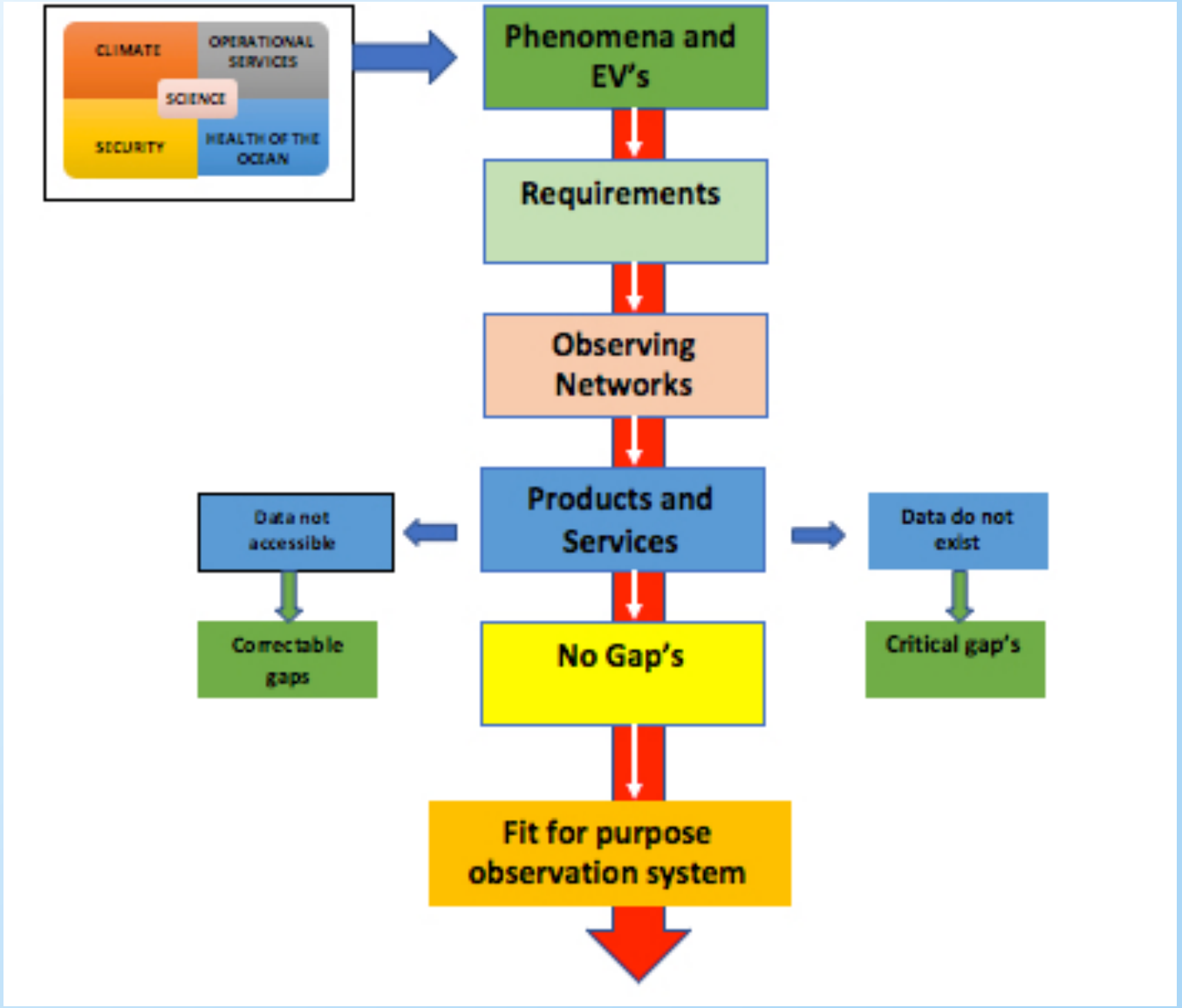
Value chain



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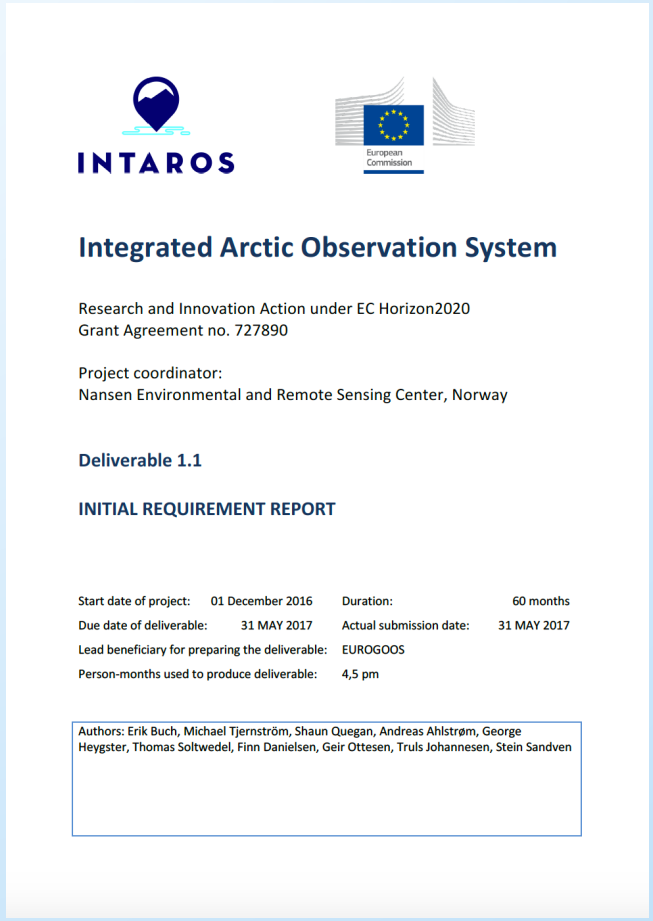
Initial requirement report



INTAROS

European Commission

Integrated Arctic Observation System

Research and Innovation Action under EC Horizon2020
Grant Agreement no. 727890

Project coordinator:
Nansen Environmental and Remote Sensing Center, Norway

Deliverable 1.1

INITIAL REQUIREMENT REPORT

Start date of project:	01 December 2016	Duration:	60 months
Due date of deliverable:	31 MAY 2017	Actual submission date:	31 MAY 2017
Lead beneficiary for preparing the deliverable:	EUROGOOS		
Person-months used to produce deliverable:	4,5 pm		

Authors: Erik Buch, Michael Tjernström, Shaun Quegan, Andreas Ahlstrøm, George Heygster, Thomas Soltwedel, Finn Danielsen, Geir Ottesen, Truls Johannesen, Stein Sandven

- 31 May 2017

- ATMOSPHERE
- TERRESTIAL
- CRYOSPHERE
- SEA ICE
- OCEAN

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Initial requirement report

- The Arctic is a region very sensitive to environmental changes. There is a very close interrelation and delicate balance between the five thematic areas (atmosphere, terrestrial, cryosphere, sea ice and ocean) especially in relation to solar energy retainment and radiation budget and hydrological cycle. This has a great impact on physical, chemical and biological processes in the area.
- Due to the hostile environment, there is a great lack of basic observations in the Arctic that can support scientific understanding of key processes. Most of the existing data are collected via time limited research project. This lack of process knowledge is reflected in big errors in forecasting models – operational as well as climate.
- It is therefore crucial to establish a sustained Integrated Arctic Observing System that in the short timeframe can increase fundamental scientific understanding of the complex and sensitive Arctic environment and in a longer timeframe can secure a robust basis for decision making to the benefit of the people living in the Arctic, the environment, the broader international society, and commercial activities.
- It is foreseen that a future Arctic observation system will rely heavily on satellite observations supplemented more traditional in-situ platforms. Especially the ocean will use several other platforms such as ships, profiling floats, gliders, moorings, AUV's etc. to monitor the interior of the Arctic Ocean.
- In all countries around the Arctic, there are community based observing systems that represent a strong potential for further development. Existing activities shall form the natural basis for a future more intensive and integrated sustainable Arctic Observing System.

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Copernicus In-situ data requirements mapping

Name	Dissemination	Quality Control Procedure	Group	Uncertainty	Update Frequency	Timeliness	Horizontal resolution	Vertical resolution	State
Subsurface salinity	NRT Service	Automatic	TBD	0,1psu 0,07psu 0,05psu	12h 3h 1h	1d 6h 3h	30km 5km 1km	100m 10m 1m	ready
sea surface salinity	NRT Service	Automatic	TBD	0,1psu 0,07psu 0,05psu	72d 24d 6d	3d 2d 1d	25km 10km 5km		ready
Sea state	NRT Service	Automatic	TBD	0,25m 0,25m 0,1m	24h 3h 6min	6h 1h 5min	60km 10km 5km	N/A N/A N/A	ready
Sea state	Offline	Automatic	TBD	0,25m 0,25m 0,1m	24h 3h 6min	6h 1h 5min	60km 10km N/A	N/A N/A N/A	ready
Sea surface temperature	NRT Service	Automatic	TBD	0,5K 0,2K 0,1K	3d 1d 6h	3h 2h 1h	25km 10km 5km		draft
subsurface temperature	NRT Service	Automatic	TBD	1k 0,5k 0,1k	24d 3d 1d	3d 1d 12h	50km 10km 2km	50m 10m 1m	ready
subsurface temperature	Offline	Manual	TBD	1k 0,5k 0,1k	24d 3d 1d	3d 1d 12h	50km 10km 2km	50m 10m 1m	ready
HRL VALCAL	View and Download Service	TBD	Land cover			N/A N/A N/A			draft
Settlement_Building_Footprint	View and Download Service	Manual	Settlements	25% 10% 5%	6 months 3 months 1 hour	2 Week 1 Week 1 Day	5 m 2 m 0.3 m	N/A N/A N/A	draft

tps://cis2.eea.europa.eu/requirement/13/

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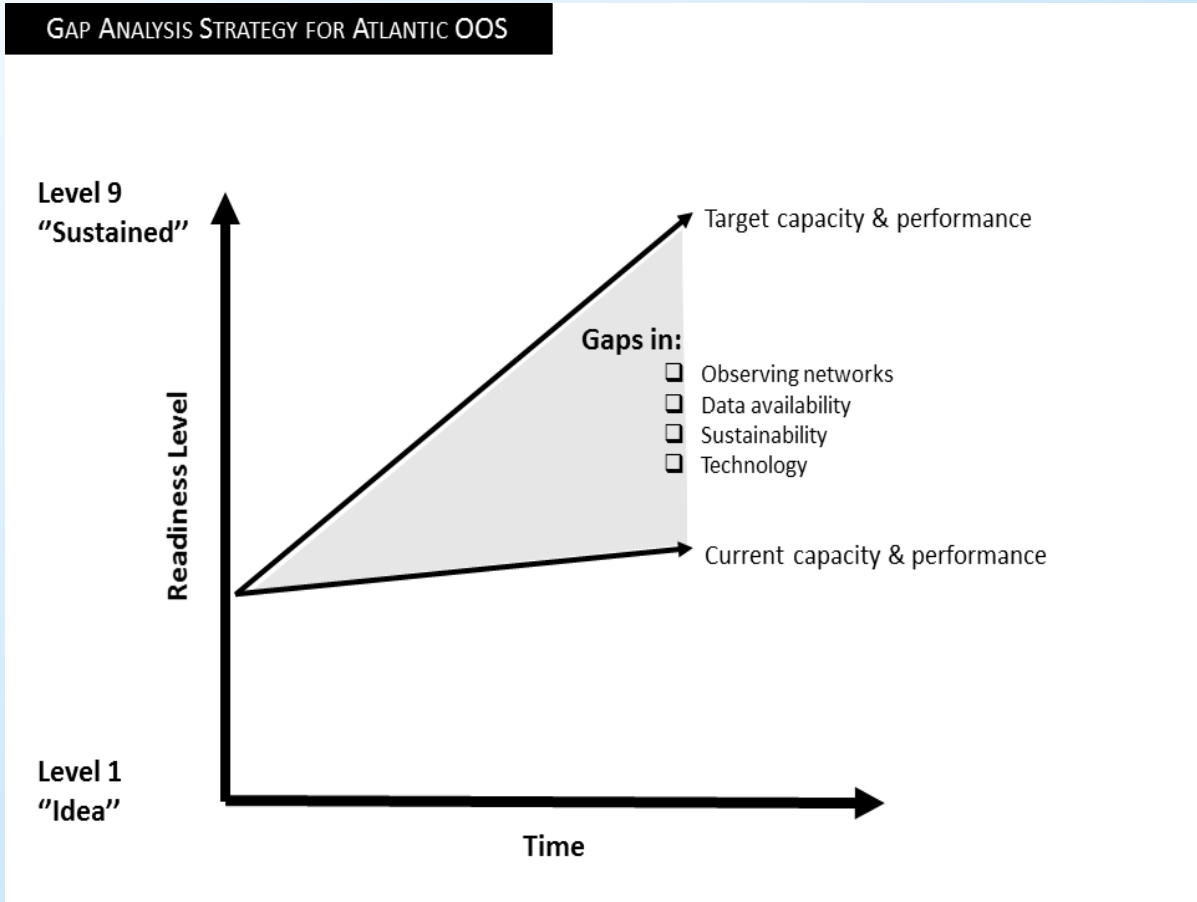
GAP ANALYSIS



- Missing Observations
- Missing Data
- Sustainability gaps
- Technology gaps

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Stakeholders

- Science - all relevant disciplines
- Service providers
- Private sector – shipping, oil/gas, fishery, aquaculture, tourism
- Government agencies (Europe, US, Canada, Russia, China South Korea etc)
- Military
- International programmes (SAON, AMAP, IPCC, GOOS, WMO etc)
- Projects (Interact, Blue Action, AtlantOS, Applicate, EU-Polarnet, EMODnet checkpoint; Projects in US, Canada, Russia etc)
- NGO's
- Selected representatives from these groups will be involved in INTAROS to discuss and review their requirements for iAOS to increase the relevance and usefulness of the project

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Task 1.2 Establish and maintain cooperation with key stakeholder groups in Europe and internationally

The dialogue will be primarily be performed through three dedicated workshops supplemented by skype, e-mail, teleconferences and newsletters (WP7):

- The first workshop will be organized early in the project
- The second workshop will be a midway workshop to with the aim to monitor status of developments.
- The third workshop in M50 aims to involve stakeholders in the design of the iAOS roadmap.

The dialogue with stakeholders will address issues such as:

- Status of the current observing system (goals, objectives, capabilities, challenges and sustainability).
- Usefulness of the Arctic observing system from stakeholders' perspective.
- Improvements in design, implementation, and coordination of long-term observing infrastructure at relevant reference sites.
- Optimal sharing and use of multidisciplinary data from existing and future Arctic observing systems among scientists, governments, community members and the private sector.
- Finding suitable ways of connecting top-down (scientist-executed and space-based) and bottom-up (community-based) approaches to monitoring
- Specific hindrances to the collection or sharing of Arctic observations in the focus areas, e.g. national strategic reasons, industrial interests, or protection of natural resources.
- Use of iAOS to stimulate sustainable development of Arctic communities

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1. Stakeholder workshop 5 May 2017

"Building long term observing systems in the Arctic – requirements and challenges"

The objective of the workshop:

- Review and discuss the requirements for observational data in the Arctic across thematic areas such as
  1) Atmosphere,
  2) Ocean and seafloor,
  3) Sea ice,
  4) Marine Ecosystem,
  5) Terrestrial data,
  6) Glaciology,
  7) Natural hazards, and
  8) Community-based monitoring.

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Name	Organisation
Stakeholder org:	
Antonio Reppucci	Mercator-Ocean/CMEMS
Attilio Gambardella	European Commission DG Research & Innovation Climate Action and Earth Observations
Cathrine Lund Myhre	NILU/ACTRIS
Christine Valentin	World Ocean Council
Christine Daae Olseng	Sustaining Arctic Observing Networks (SAON)
Elmer Topp-Jørgensen	University of Aarhus/INTERACT
Henrik Steen Andersen	EEA/Copernicus In-situ
Karin Margretha Larsen	Faroe Marine Research Institute/Blue-Action
Kuvvet Atakan	University of Bergen
Lars-Otto Reiersen	Arctic Monitoring and Assessment Programme (AMAP)
Tom Christensen	Circumpolar Biodiversity Monitoring Program
Tom Barry	Conservation of Arctic Flora and Fauna
Michael Zemp	World Glacier Monitoring Service
Nicole Biebow	Alfred Wegener Institute/EU-Polarnet
Thomas Jung	Alfred Wegener Institute/YOPP
Srdjan Dobricic	JRC
Øistein Godoy	Met.no/SIOS
Øivin Aarnes	DNV GL
INTAROS:	
Andreas Ahlstrøm	GEUS
Erik Buch	EuroGOOS
George Heygster	University of Bremen
Lisbeth Iversen	NERSC
Stein Sandven	NERSC
Hanne Sagen	NERSC
Truls Johannesen	University of Bergen
Torill Hamre	NERSC
Vicente Fernandez	EuroGOOS

09.00	Welcome	Erik Buch, EuroGOOS
09.10	INTAROS overview and objective of the workshop	Stein Sandven, NERSC/INTAROS
09.30	Sustainable Arctic Observation Network: a key network established by Arctic Council and IASC	Christine Daae Olseng, chair of SAON
09.50	Arctic Monitoring and Assessment Programme, what have we learned from 20 years of monitoring ?	Lars-Otto Reiersen, AMAP
10.10	Copernicus in-situ data requirements for the Arctic	Henrik Steen Andersen, EEA
10.30 – 11.00	Coffee break	
11.00	Stakeholder interaction in the EU-Polarnet project	Nicole Biebow, Eu PolarNet/AWI
11.20	Data bases and interoperability: what are the barriers and challenges ?	Øystein Godøy, SIOS/Met.no
11.40	Requirements from local communities	Lisbeth Iversen, INTAROS/NERSC
12.00-13.00	Lunch	
13.00	Requirements from atmospheric themes (2x10 min presentation + discussion)	Thomas Jung, YOPP/AWI Cathrine Lund Myhre, ACTRIS/NILU
14.00	Requirements from ocean themes (incl. marine ecosystem and sea ice (2x10 min presentation + discussion)	Antonio Reppucci, Mercator/CMEMS Inigo Martinez / ICES
15.00-15.30	Coffee	
15.30	Requirements from terrestrial themes (incl. snow and glaciers (2x10 min presentation + discussion)	Michael Zemp, WGMS Elmer Topp Jørgensen, INTERACT
16.30	Requirements from the Commission, including benefit analysis of an Arctic observing system	Atillio Gambardella, EC
16.45	Wrap-up of the workshop and contribution to the INTAROS requirement document	E. Buch
17.00	Closure	

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Workshop outcome

- The workshop elaborated on ways ahead to develop and operate long-term observing systems.
- The presentations and discussions displayed:
  - Severe gaps in the in-situ observation network
  - Gaps in the open free sharing of data
  - Gaps in technology
  - Gaps in sustainability
- Satellite earth observation data, has secured long-term funding and is therefore relative sustainable via meteorological missions and the Copernicus programme,
- Most of the in situ data collected in the Arctic are funded by research projects with duration of a few years and are therefore not necessarily sustainable.

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Workshop outcome

- Key challenges that INTAROS will need to address during the project period are:
  - (1) Coordination and collaboration between data providers and stakeholders in the pan-Arctic region in order to better use existing systems and resources
  - (2) Improvement of the observing platforms and sensors, filling of gaps in the observing network and facilitate for year-round operation
  - (3) Data sampling, transmission, calibration, processing, archiving and retrieval of required variables and building distributed and connected databases
  - (4) How to develop sustainability of the observing systems
- In addition to technical and logistical challenges, there are also organisational barriers to building and operating a multidisciplinary observing system. These issues will be addressed in follow-up workshops.
- Input to "Initial Requirement Report" (D1.1)