

KEPLER Deliverable Report

Report on Deliverable D7.3

Deliverable name	Report on presentations and discussions at the project General Assembly at the end of Year 1.		
Scheduled delivery	month: 14	date:	February 2020
Actual delivery	month: 15	date:	March 2020
Report type	Internal report		
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Context of deliverable within Work Package

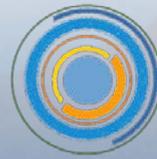
This is the report on one of the three whole-project annual meetings. The first was the kick-off, D7.2, at the start of the project in Oslo. This mid-term meeting for this deliverable was held at the end of the first year, in November, and our thanks go to our hosts at CSIC in Barcelona for their assistance in organisation and in the use of their venue.

Explanation of delays

The meeting was held on time, the report was slightly delayed due to staff illness - there are no consequences to the project for this.

Report

Please see appended report.



KEPLER

Mid Term Meeting Report

25th-28th November 2019



Summary of Meeting
ICM, Barcelona



Co-funded by the Horizon 2020 programme
of the European Union





KEPLER Mid Term Meeting Report

Barcelona, 25th-28th November 2019

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Mid Term Meeting

Barcelona 25th-29th November 2019

Overview

The Key Environmental monitoring for Polar Latitudes and European Readiness (KEPLER) project kicked off in Oslo, 28-30 January 2019. A total of 44 attendees from 17 European institutes discussed plans for the project, which runs from January 2019 to March 2021. The KEPLER initiative is built around the operational European Ice Services and Copernicus information providers to prepare a roadmap for Copernicus to deliver an improved European capacity for monitoring and forecasting the Polar Regions.

On 25th-29th November 2019, the KEPLER project consortium met again, holding a Mid-Term Meeting in Barcelona, hosted by the Institute of Marine Sciences (CSIC). Participants and Project Advisory Board members from the UK, Norway, Denmark, France, Spain, Finland, Sweden, & Germany reviewed the last year's work and collaborated on upcoming deliverables for the remaining 15 months of the project. Video conferencing software was utilised so some participants could join remotely.

KEPLER aims to raise awareness of the Copernicus programme, inform and educate users from the public and private sectors, and enable improved access to Copernicus data and information. As the climate of the Polar Regions is changing, so too are the challenges and opportunities. Because of these shifts, the project includes two themes on identification of research gaps regarding integration/assimilation, and improved sea-ice mapping and forecasting. These are needed to provide opportunities for better understanding the environment, research opportunities, establishing new industry sectors and startups, and importantly empowering citizens.

KEPLER aims to release the full potential of Polar Regions Earth Observation, including from ESA and EUMETSAT, by identifying and eliminating the barriers that impede the use of the tremendous resource that is Copernicus. This also brings together key European stakeholders and competent entities, and grows the Copernicus brand and user-base through providing enhanced scientific and technical support. A key objective of KEPLER is to provide a mechanism that enables the broad range of Polar Regions stakeholders to be equipped with the most accurate and relevant, environmental information so that they can seize the many benefits that Copernicus products generate for society and economy.

More information can be found on the project website at <http://kepler-polar.eu/> and via Twitter @KeplerEU.

Timetable

Monday 25th November: Introductions, KMB meeting & EU project presentations

Tuesday 26th November: Presentations summarising WP1, 2 & 6. PAB feedback.

Wednesday 26th November: Presentations summarising WP 3, 4 & 5.

Thursday 27th November: KMB meeting & Project planning.

Programme

All presentations are available on the KEPLER shared drive: [Mid Term Meeting Presentations](#)

Monday 25th November - PM: Presentations & KMB meeting

				Room
KMB	11:00-13:00	KMB	Kepler Management Board meeting	P4*
	13:00		Registration & lunch	Main Hall
	14:00	CSIC & Nick Hughes	Welcome & overview of agenda	Sala d'actes
	14:10	Nick Hughes	KEPLER Year 1 debrief	Sala d'actes
WP6	14:20	Nick Hughes	KEPLER 2020 overview WP6 - call for events/ collaboration	Sala d'actes
WP7	15:00	Elaina Ford	WP7 Project coordination overview and interim reporting	Sala d'actes
	15:15	Stein Sandven	INTAROS project information	Sala d'actes
	15:30		Break for tea and coffee.	
	16:00	Nick Hughes	Extreme Earth project information	Sala d'actes
	16:15	Bente Jonassen/ Nick Hughes	ARCSAR project information	Sala d'actes
	16:30	Nick Hughes	Questions	Sala d'actes
Open session	16:50-17:50		Open session - Seminar Room available for working.	P31
Booked session	16:35-17:50	Task 3.4	T3.4 Progress meeting	P4
Booked session	16:35-17:50	Nick Hughes	ASSW planning meeting	Sala Julia

Tuesday 26th November - WP7, 1, 2 &5 overview presentations and break out discussions

				Room
Arrival & Tea	08:45 - 09:00		Sign in, tea and coffee	Main Hall
	09:00	Nick Hughes	Welcome	Sala d'actes
	09:05	Sally Taylor, Ola Nordbeck	European Commission	Sala d'actes
	09:30 - 10:30	PAB	PAB feedback. Questions for the PAB are to be compiled in advance from WP leaders. Template to be distributed.	Sala d'actes
Tea Break	10:30 – 11:00		Break for tea and coffee	Main Hall
	11:00	Nick Hughes	Copernicus update	Sala d'actes
WP1	11:15	Ole Jakob Hegelund	Work Package 1 Stakeholder Needs and Network Coordination. Overview of work completed and upcoming milestones/deliverables.	Sala d'actes
	11:30	Ole Jakob Hegelund	T1.1: Maritime and Research Sector Needs	Sala d'actes
	11:40	Kaisu Mustonen	T1.2 Community-based Observing and Societal	Sala d'actes
	11:50	Helge Goessling	T1.3 Climate and Weather Forecasting Needs	Sala d'actes
	12:00	Nick Hughes	T1.4: Overall assessment of stakeholder needs	Sala d'actes
	12:10	Ole Jakob Hegelund	WP1 Questions	Sala d'actes
Photo	12:30		Group Photo	Front of CSIC
Lunch	12:40 – 13:40		Break for lunch	Main Hall
WP2	13:40	Gilles Garric	Work Package 2- Polar Regions provision in Copernicus Services. Overview of work completed and upcoming milestones/deliverables.	Sala d'actes
	13:55	Marko Scholze	T2.1 Copernicus Land Monitoring Service (CLMS)	Sala d'actes
	14:05	Corinne Derval	T2.2 Copernicus Marine Environment Monitoring Service (CMEMS).	Sala d'actes
	14:15	Gilles Garric	WP2 questions	Sala d'actes
Break	14:30 – 14:45		Quick Break	Main Hall
WP1	14:45	Ole Jakob Hegelund	WP1: Break out discussion	Aula Pepita Castellvi
WP2	14:45	Gilles Garric	WP2: Break out discussion	P-41/43
Tea Break	15:45 – 16:10		Break for tea and coffee.	Main Hall
WP6	16:10	Nick Hughes	WP6 Dissemination, training and engagement update and plans for	Sala d'actes

			2020	
	16:15	Fabrice Messal	WP6 Training	Sala d'actes
	16:30	Jeremy Wilkinson	WP6 Best practice guide overview/ update	Sala d'actes
	16:40	Nick Hughes	WP6 Questions	Sala d'actes
Open session	17:00-18:00		Open session -Meeting room available for working	P4
Booked session Thomas Kaminski	17:00-18:00	Task 3.4	T3.4 Progress meeting	P-41/43
Booked session Nick Hughes	17:00-18:00	Arctic Frontiers	Arctic Frontiers planning meeting	Aula Pepita Castellvi
Dinner	19:00		Project dinner at La Fonda del Port Olímpic	

Wednesday 27th November - WP7, 1, 2 & 5 overview presentations and break out discussions

				Room
Arrival & Tea	08:45-09:00		Sign in, tea and coffee.	Main Hall
	09:00	Nick Hughes	Welcome	
WP3	09:05	Carolina Gabarró	Work Package 3- Identification of research and capacity gaps. Overview of work completed and upcoming milestones/deliverables.	Sala d'actes
	09:15	Jeremy Wilkinson	T3.1 In situ observing systems.	Sala d'actes
	09:25	Nick Hughes	T3.2 New and novel in-situ and airborne observation sensors and techniques.	Sala d'actes
	09:35	Carolina Gabarro	T3.3 Space-based capability.	Sala d'actes
	09:45	Thomas Kaminski	T3.4 Integration and assimilation through Quantitative Network Design (QND).	Sala d'actes
	09:55	Carolina Gabarró	WP3 Questions	Sala d'actes
Break	10:10 – 10:20		Quick Break	Main Hall
WP4	10:20	Steffen Tietsche	Work Package 4 - Improved sea-ice mapping and forecasting. Overview of work completed and upcoming milestones/deliverables.	Sala d'actes
	10:30	Antti Kangas	T4.1 Sea-ice mapping for maritime purposes.	Sala d'actes
	10:40	Steffen Tietsche	T4.2 Monitoring sea-ice as an essential climate variable (ECV).	Sala d'actes

	10:50	Steffen Tietsche	T4.3 Assess the scope for sea-ice forecast products.	Sala d'actes
	11:00	Steffen Tietsche	WP4 Questions and discussion	Sala d'actes
Tea	11:10 – 11:40		Break for tea and coffee	Main Hall
WP3	11:40	Carolina Gabarró	WP3: Break out discussion	Aula Pepita Castellvi
WP4	11:40	Steffen Tietsche	WP4: Break out discussion	P-41/43 **
Lunch	12:40 – 13:40		Break for lunch	Main Hall
WP5	13:40	Frank Kauker	Work Package 5 - End-to-end operational system Overview of work completed and upcoming milestones/deliverables.	Sala d'actes
	13:55	Laurent Bertino	T5.1 Synthesis on the visions of the evolution of the Copernicus services.	Sala d'actes
	14:05	Frank Kauker	T5.2 End-to-end operational system roadmap.	Sala d'actes
Tea	14:15 – 14:40		Break for tea and coffee	Main Hall
	14:40	Frank Kauker	WP5: Plenary discussion (all to participate)	Sala d'actes
	15:40	Nick Hughes	Recap/conclusions from the Mid Term Meeting	Sala d'actes
	16:10-16:30	Nick Hughes	Questions & close	Sala d'actes
Open sessions	16:30-17:30		Open session – 2 meeting rooms are available for working	P-41/43 & Aula Pepita Castellvi
Booked session Thomas Kaminski	16:30-17:30		T3.4 Progress meeting	P4
Booked session Carolina Gabarro	16:30-17:30		WP3 Progress meeting	Sala Julia
	17:30		Close of Day	

List of Attendees

External invited attendees:

Delegate Name	Affiliation
Sally Taylor	European Commission (VC)
Ola Nordbeck	European Commission (VC)

KEPLER partners:

Delegate Name	Affiliation
Emma Armitage	British Antarctic Survey
Katharina Beckmann	INTERACT/Lund University
Laurent Bertino	NERSC
Astrid Bracher	AWI (VC)
Corinne Derval	Mercator-Océan
Thomas Diehl	Joint Research Centre - EC
Elaina Ford	British Antarctic Survey (VC)
Carolina Gabarro	ICM/CSIC
Gilles Garric	Mercator Ocean International
Helge Goessling	Alfred Wegener Institute (VC)
Verónica González-Gambau	ICM-CSIC
Isabella Grönfeldt	SMHI
Richard Hall	Equinor (VC)
Ole Jakob Hegelund	Norwegian Meteorological Institute
Nick Hughes	Norwegian Meteorological Institute
Shridhar Jawak	Svalbard Integrated Arctic Earth Observing System (SIOS)
Bente Jonassen	JRCC North Norway
Thomas Kaminski	The Inversion Lab

Antti Kangas	FMI
Frank Kauker	OASys
Thomas Lavergne	Norwegian Meteorological Institute (VC)
Svetlana Losa	AWI
Eirik Malnes	Norce Research
Fabrice MESSAL	Mercator Ocean International
Tero Mustonen	SNOWCHANGE (VC)
Kaisu Mustonen	SNOWCHANGE (VC)
Malte Müller	Norwegian Meteorological Institute
Leif Toudal Pedersen	Eolab
Marcin Pierechod	Norwegian Meteorological Institute`
Keld Qvistgaard	DMI Ice Service
Stein Sandven	NERSC
Marko Scholze	Lund University
Jaakko Seppänen	FMI
Steffen Tietsche	ECMWF
Janne Valkoen	DNV GL
Michael Vossbeck	The Inversion Lab
Jeremy Wilkinson	British Antarctic Survey

Day 1 Summary

The first day of the Mid Term meeting was focused on providing an overview of work completed in the past 11 months, and reviewing upcoming deliverables & milestones.

KEPLER Management board meeting

Welcome & Introduction from Nick Hughes, followed by a KEPLER management board meeting.

Minutes & actions produced for this meeting can be viewed [here](#).

KEPLER Year 1 debrief & KEPLER 2020 overview – Nick Hughes

NH welcomed & gave an overview of KEPLER project progress and upcoming work scheduled for next year. A reminder that the project has a number of milestones to close this year and will be followed up on during the meeting. A prominent gap has been noted in Copernicus marine services as users in the maritime community have been requesting more high-resolution products for the last 15 years.

WP6 - call for events/ collaboration - Nick Hughes

Presentations highlighted the various EU projects working alongside KEPLER. Participants were encouraged to notify the KMB and Work package leaders of upcoming event and opportunities that can be used to push KEPLER dissemination activities and engagement in the project.

WP7 Project coordination overview and interim reporting - Elaina Ford

A reminder from EF about ongoing project tasking, including the Gender Action Plan and Risk register.

Upcoming reporting deadlines were presented to the consortium, and reminded that we have one formal project reporting period, that will until the end of March 2021. There will however be internal reports due both for internal monitoring of progress, and to provide information to the EC for the external review that will take place in late spring 2020. This will be in the same format as the final Periodic Report that is due to the EC, and will have contributions from each partner (institute) for each task that they are working on, in addition to overall management sections.

Internal reports due:

Type	Period	Due from	Report Deadline
Financial	1/1/19 – 31/12/20	Each institute	20/2/20
Technical	1/1/19 – 31/3/20	Each institute for each task	30/4/20
Deliverables and milestones	As per DoA	As per DoA	As per DoA

EU Project Presentations

EU Projects were invited to present to the KEPLER consortium, noting any crossover/ common

themes between projects, whether this be goals, challenges or output.

INTAROS project information - Laurent Bertino

Stein Sandven was unable to attend the meeting, so Laurent Bertino presented this on his behalf. The focus of INTAROS is both observing infrastructure and data production and User groups. The importance of user groups correlates with the KEPLER project, and collaboration between our projects should continue.

This was followed up with a joint meeting with INTAROS on the in-situ component in Copenhagen on 26th February.

Presentation available to view [here](#).

INTAROS project information available to view [here](#).

Extreme Earth project information - Nick Hughes

KEPLER is a community support action, which involves more networking whereas this is a research project that is producing science output.

The project focuses on how to make sense of the huge amount of Copernicus data available.

This is a 36-month project involving 11 partners, and includes 6 work packages.

Presentation available to view [here](#).

Extreme Earth project information available to view [here](#).

ARCSAR project information - Bente Jonassen

Provided participants with an overview to the ARCSAR project, and the structure including 5 work packages. ARCSAR will run until 2023.

Table top exercises are due to take place in April 2020, in collaboration with the cruise ship industry, with the aim of creating a common ground between rescue authorities and cruise ship companies.

The PAB encouraged the consortium to consider links between Task 6 in KEPLER and ARCSAR, and risk to cruise vessels and the Polar Code, as ARCSAR have contributed to OSARIS.

ARCSAR's information gaps should be picked up by KEPLER and should expand on this link.

ARCSAR's are interested in route planning, and accident response data use.

The KEPLER consortium were introduced to the 'ARCSAR Innovation Area' and encouraged to join and become associated members. By doing so they will have access on information on ARCSAR activities, events and suggest ideas.

<https://arcsar-innovation.eu/user/register>

Presentation available to view [here](#).

ARCSAR project information available to view [here](#).

T4.1 Gap analysis meeting

Time: 16:35-17:50

The recommendations from T1.4 needs to go into the gap analysis. A challenging task will be to identify different recommendations for the different users.

CMEMS only have Net CDFs, they have to change the format. The resolution is considered poor at 1000m, and does not meet the requests from users.

A possible recommendations for the ice service is to include a confidence/accuracy level of their products.

The ice services would never use data from CMEMS because lack of quality. Hence why ice services use different sources.

Unify/harmonise the ice services to make a regional ice charts covering the whole arctic.

Question re: Commercial ice services- are they providing to CMEMS or other users (like mariners)

T3.3 Progress meeting

Time: 16:35-17:50

- 1) The participants in T3.3 to review and plan the ongoing work on the D3.3 deliverable report. This consisted of going through the 8 sections. The following were noted:
- 2) Comments on the need for latency of 1 hour. This depended on the type of user and the product type. Further work was needed on sewa ice edge and melt ponds parameters.
- 3) Currently covered current Copernicus satellite products and development and there was discussion about expanding this to non-Copernicus products.
- 4) Mostly complete but summary needed for future missions.
- 5) To be reorganised into land and sea, and include references to papers. Covered current sensors, mainly airborne for flexibility beyond satellites.
- 6) Study of assimilation of parameters into models. Needed an alternative work for "severity" for product quality. Everyone to check and comment on the table.
- 7) Assimilation of Level-1 data into models through inverse optimisation.
- 8) Compare parameters provided by services versus end-user requirements. Discuss definitions of "operational".

ASSW planning meeting

Arctic Science Summit week 2020 was identified as an ideal forum to present the KEPLER project results. The ASSW will be at the end of March and will include the 5th Arctic Observing Summit (AOS). Jeremy Wilkinson volunteered to put together a slide to present this event to the consortium on day 2. A decision was made to apply to the AOS for a workshop/meeting, and an application was developed during the Mid-Term meeting and submitted to AOS. It was noted that for this to be a successful event support from attendance of the WPLs would be beneficial – WPLs to liaise with Jeremy Wilkinson.

An application for a workshop on in-situ observing systems at the 5th Arctic Observing summit was submitted 28/11/2019:

Session: [ASSW2020 Community Meeting](#)

Title: **‘Enhancing Copernicus 2.0 information products through optimised usage of in-situ data.’**

Document available to view [here](#).

Day 2 Summary

Day 2 of the Mid Term meeting began with feedback from the European Commission and Project Advisory Board. Followed by presentations and breakout sessions for Work Packages 1 & 2, with updates and reminders for WP6.

European Commission reporting- Sally Taylor

Preliminary plans were to hold the KEPLER review meeting on the first week of April. Due to extenuating circumstances the KEPLER review meeting now has a revised date of June and potential locations include London or Brussels.

The EC expect as a minimum requirement that Work Package Leaders should be present for the review meeting. The following external reviewer has been distributed to the consortium and KEPLER members should get in touch if there is perceived to be a conflict of interest. Prepare a progress report- and confirm deliverables are in 2-3 weeks before the meeting.

- ANDERSEN Henrik Steen (EEA) Henrik.Andersen@eea.europa.eu

As there is no set template, advice is to use the periodic report template. Work package leaders should provide overviews of work done and any issues. The EC also require updates on any milestones and deliverables. Person months should also be noted – if they have been used or changed.

Note: Ethics issues, this review will requires us to show how ethic rules have been respected for the project.

The PAB (RH) raised a possible connection between KEPLER and EU Arctic Strategy on the European Green Deal. RH to share the link to the European green deal.

Presentation available to view [here](#).

European Commission Feedback - Ola Nordbeck

- We are reporting on the deliverables that are due later in the project, that is appreciated
- **D3.1- Part 3 of 3.1** – disagreed that in-situ measurements were handled by Copernicus in an ‘AD hoc manner’. Noted to check that this is revised in the draft next version of D3.1.
- EAA is coordinating the ‘In-situ dark arctic data report’ It addresses all 6 themes relevant for KEPLER. Although **D5.1** is in a very early stage ON shared this with colleagues to gain more feedback. It was noted that some of 6 services where missing – and it was requested if we could show synergies between the project and these links. Focus so far has covered Land and Marine services, but advised to consider other services - Security and Emergency monitoring and how these would link in. These services will require near real time support. JRC are compiling a report on the synergies, which will be available to view in December/ early January. EC are grateful for efforts so far on this deliverable. They have reviewed D1.1, 1.2 & 1.3 and found them to be interesting reading, and look forward to the final products. Please reflect on the above points for the next draft revision.
- **T3.1** Weather & climate forecasting needs - RE not seen as part of contingency. There is clear linkage to T1.1, but review scale and sources, currently this has been heavily focused on

European sections, but this scale issue can be addressed if we consider tactical navigation in both EU and polar area. CIMR is not viewed as a continuous service, rather an extended one.

- **D1.1:** Same scale issues, consider the different groups. Spatial and temporal resolution. Review the wording - ON is happy to discuss more in detail. Scale issue is the main concern.
- EU commission to include positioning information from Galileo - potentially interesting communications aspect.
- Response from WP1 to ON: The Synthesis report for WP1 in progress and will be with the EC end of January.

PAB feedback

Questions for the PAB were compiled in advance from WP leaders, using a template set up in response to requested information by the PAB. Document available to view here:

[KEPLER PAB feedback request from WPLS](#)

During the Mid Term meeting, the PAB held a break out session to review the reports from WP leaders. They returned to present their feedback to the participants

Participants were introduced to the new EU Arctic strategy document. This has been emailed to the consortium group.

[Council conclusions on Oceans & Seas \(Arctic section VIII\)](#)

RH presented on the process, and stressed that our role is to understand the relationship between data, information and knowledge.

- KEPLER should be user centric and focus on user experiences and needs. RH stressed that we should capture these needs as user stories. A reminder that the key factor will always be related to safety. A suggestion is to create a simple document/flow chart to help us map these needs out.
- Talk to ARCSAR for rescue requirements.
- Bente Jonassen advised KEPLER to consider the future- What requirements will there be in the future? Specifically preparedness in the Arctic for the SAR community. Where will they be able to build areas for treatment/ transport rescued persons to?
- Think about where KEPLER sits in the EU-Cluster. What is the EU interest of the Arctic?
- Regarding the SAR community, what is the growth or user landscape for the future?
- Define the operational and climate research use.
- At the end of two years, we will have our deliverables what and how to we summarize what we have achieved. Consider the format of the final roadmap document - should it be a brochure a small report?
- A summary statement should make sure the information within our deliverables reaches the correct people.
- This is a tight program with focused deliverables, we would like to know what the document we produce should be aiming at. Noted that the document, format and goals should be added to the Kepler Management Board meeting agenda for January.

RH provided a video linking different levels of observation to produce information for users. This can, I think, be adapted to be input to defining “high resolution” and a training video for captains to understand how observations fit together.

http://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Atmosphere_services

RH also provided a list of user stories to be utilized as a starting point to inspire KEPLER to come up with more user stories. KEPLER could demonstrate its output by answering user stories. Document available to view [here](#):

[KEPLER user stories- satellite and surface monitoring](#)

Copernicus update- Nick Hughes

The Copernicus update was moved to allow for PAB feedback and will be distributed to the participants via email.

Presentation available to view [here](#).

Work Package 1 Stakeholder Needs and Network Coordination. Overview of work completed and upcoming milestones/deliverables- Ole-Jakob Hegelund

OJH provided an overview of WP1s aim and challenges ahead, as well as reviewing milestones and deliverables completed so far.

Presentation available to view [here](#).

T1.1: Maritime and Research Sector Needs- Ole-Jakob Hegelund

Established that the users require a large number of parameters, but to summarize the main priority is a higher resolution.

Refer to slide 9 in the presentation below for key information feedback. In particular, WP1 have established that users want Ice information for navigation are required to be better than 300m. They have identified user needs, as well as types of users. Something to consider is budget for users.

Presentation available to view [here](#).

T1.2 Community-based Observing and Societal- Kaisu Mustonen

Provided a reminder of task objectives, reindeer tracking system using GPS. There is a lot of data and information about the needs of reindeer herders coming from the Saami community. Issues with the wilderness community- reach. Cell services have expanded new possibilities in European north. To summarize, the Sami should be seen as a special access stakeholder.

Presentation available to view [here](#).

T1.3 Climate and Weather Forecasting Needs- Helge Goessling

HG reviewed the time line throughout T1.3, summarized work completed and the user-scape produced. Expert groups- Review the questions asked by T1.3 & key points across groups.

Presentation available to view [here](#).

T1.4: Overall assessment of stakeholder needs - Nick Hughes

T1.4 is using analysis of the results from WPs 1.1 maritime, 1.2 societal, and 1.3 forecasting to identify gaps in information provision or user understanding of availability, and untapped observational resources, that can be used to recommend enhancements to the European capacity for monitoring the Arctic.

Needs are common to marine and terrestrial end-users - Intermediate users have different needs, but also need the end-users

Affordable, higher bandwidth, communications - without access to communications, user uptake of high data volume products and services will be slow

True (meter-scale) high resolution information products - the focus of the typical Polar user is on the short-term tactical (situational awareness). 'How do I stay safe in what I am doing today?' If this is addressed, then the user has survived to maybe think about long-term planning and have a need the low resolution (kilometre-scale) information products currently on offer.

Presentation available to view [here](#).

Work Package 2 - Polar Regions provision in Copernicus Services. Overview of work completed and upcoming milestones/deliverables- Gilles Garric

Copernicus services are driven by the user- the most important aspect is user uptake. We are required to assess the status of what is going on in the Copernicus services and present a vision for the future. Both land & marine.

WP2 will feed into 3, 4 & 5. Reported that WP are on track for both deliverables and milestone. Gilles have requested feedback from people on the work produced so far. Looking forward to the break out discussion has given a bullet point list. See slide 8

Presentation available to view [here](#).

T2.1 Copernicus Land Monitoring Service (CLMS) - Marko Scholze

T1.2 is on track for deliverables and milestones, they have restricted themselves to the global component, rather than the pan- European component due to this being limited.

CLMS has three products; Lake Ice extent, Snow cover extent and Snow water equivalent. Gaps have been identified for permafrost, ice sheets, glacier and snow.

However, the global land service is much bigger and covers a large of of variables that are available. Input for this task is expected from the Arctic Frontiers round table discussion & feedback from the questionnaire to access land products. These activities will also feed into task 3.4. The draft version has been circulated to the consortium for comments and participants were encouraged to engage with this.

Presentation available to view [here](#).

T2.2 Copernicus Marine Environment Monitoring Service (CMEMS) - Gilles Garric, Corrine Deval

Provided an overview of the tasks still to do.

CMEMES user uptake program. It is a 5-year programme. Budget of 1m a year. - Corrine Deval. A way to show the value added change for user. SLIDE 7 might be interesting way of showing how KEPLER has an impact?

The CMEM web page portal (slide 9) displayed two examples of how CMEM have been utilized.

Gilles provided an overview of T2.2 CMEMS activity that has fed into their report- completing an inventory of parameters, there is a clear requirement for sea ice products.

For 2021, they are planning a continuity of the service, increase horizontal & temporal resolution.

Presentation available to view [here](#).

WP1: Break out discussion

Time: 14:45- 15:45

Participants: Ole-Jakob Hegelund, Nick Hughes, Jeremy Wilkinson, Richard Hall, Frank Kauker, Keld Qvistgaard, Antti Kangas, Jaakko Seppänen, Isabella Grönfeldt, (Penny, Kaisu and Helge via VC)

- For T5.2 we should review the user landscape again and update graphic format clean it up and simplify it. Alternatively let them reform it.
- In response to earlier PAB feedback, there are user stories in T1.4 however, we should consider making the presentation of these stories clearer.
- Thomas Lavergne suggested in the D1.4 document omments to rephrase text on CRISTAL and CPEG to make it clear that CPEG was addressing pan-Arctic scales.
- WP1 plan to hold a telecom with Ola and follow up on his earlier feedback for clarification on his points regarding D1.1.
- Draft a summary Include Galileo and GLONASS. Specify why we need Galileo systems. To who do we address the resolutions- WP5? CMEMS? Include spatial and temporal resolution and change the figure of spatial and temporal - both y and x-axis.
- Keld Qvistgaard suggested that they include figures on different users and sea ice parameters, (user stories).

WP6 Dissemination, training and engagement update and plans for 2020

ASSW/ 5th Arctic Observing Summit - JPW provided a presentation on plans for participation in ASSW 2020. Due to be held in Iceland. The theme of this year's summit is **Science for sustainable Arctic**. The AOS themes are relevant/important to the KEPLER project- we should consider participating in this also.

Refer to the ASSW planning meeting [above](#) for details on KEPLER's application to this event

ASM3 ISAR6 in Japan is linked with the Arctic Ministerial, a great opportunity to engage with powerful stakeholders and feed information into the ministerial. The outputs of this meeting has high value for engagement & funding opportunities.

KEPLER should consider attendance, however for this to be a success it would be beneficial if some WPLs were to attend, if registration is still open. However, some organizations are restricting consortium members from long distance/ air travel. Noted to add this event to the Kepler Management Board Meeting agenda for January (with JPW in attendance).

WP6 Training

A training workshop was held in Helsinki on 18-19th November with 28 participants with positive input from all. The session was a side-event of the 3rd Polar Data Forum and attracted participants both from the public and private sector. More information about this event is available here:

<http://marine.copernicus.eu/copernicus-marine-service-training-workshop-for-the-arctic-sea-region/>

Laurent Bertino gave a presentation about KEPLER and presented the [WP1.3 questionnaire](#). Results have been collated and are available to view [here](#).

NH mentioned that there is funding in the WP6 budget to provide student training event sometime in 2020 in conjunction with the data assimilation working group meeting to be held in Toulouse next Autumn.

WP6 Best practice guide overview/ update - Jeremy Wilkinson

JW gave an overview of the task and partners involved. Stressed the difficulties due to poor communications, geostationary- relying on Iridium service where the bandwidth is small, and sending large files is problematic and expensive.

An example of 'good' practice is the South Korean research ship Aaron. Challenges included thick sea ice, tight timelines and stations that were spread widely apart in the sea ice. Real time remote sensing images allowed them to adjust their schedule and survey imagery to create the most efficient navigation method. The reason this wasn't 'great' practice is because there was no two way dialogue, the data the program created during this time was not shared back to the ice service. This is something to keep in mind for KEPLER's best practice guide.

JW requested for comment on his draft (D3.1) and also for any input on the format this best practice guide will take. Noted as an action to follow up that FK and JW set a meeting to discuss. Confirm that JW will attend the WP5 kick off meeting in Hamburg, January 2020.

Presentation is available to view [here](#).

T3.4 Progress meeting - notes from Thomas Kaminski

Time: 16:30 - 18:00

Participants: T. Kaminski, F. Kauker, T. Lavergne (VC), M. Scholze, L. Toudal Pedersen
M. Vossbeck

- Discussed observational scenarios and target quantities for the quantitative network design (QND)
- Discussed the results of the QND assessments
- Discussed WP3.4 presentation on Wednesday
- Discussed presentation of results in D3.4
- Discussed recommendations
- Deliverable ready by June 2020, but the results need to be fed to Frank Karcher in WP5 in December. The milestone is drafted with a good amount of figures and data, and will be ready by June 2020.

- The importance of the raw data assimilation was highlighted Marco Sholtze will take the lead of the CLMS. Gilles declared to take the lead on the CMEMS.
- C2 radar free board - Terrestrial component:
 - CO₂
 - 1ppm uncertainty, no gaps
 - simulated HPCM CO2M is an optic mission with all its limitations
- Scandinavian countries and Canada have good in situ sampling networks. The preliminary assessment for the terrestrial component was shown. Methane was the first parameter to monitor in the Arctic through methane fluxes on the continental shelf. CO₂ release is a parameter that integrates both land and marine environments
- The modeling chain will be derived from the road map.
- Evaluation of the sea ice and the data products was presented. The highest resolution is 10 to 15 km! Different uncertainty of the snow depth (expressed in cm) for different products was pointed out. CIMR and CS2 radar freeboard +CRISTAL snow shows similar results. There is a play off between spatial coverage (cloud cover limited) with lower accuracy vs higher sampling freq, with higher accuracy.
- Observational scenarios should be determined by defining the scientific questions.

T3.3 Progress meeting - Notes from Carolina Gabarro

Time: 16:30 - 18:00

Participants:

- We agreed that we should analyse common variables in WP2 and WP3, as much as can be. Now some variables are missing in Wp3 analysis. It is recommended to have a unique list, table of parameters.
- Leif Toudal Pedersen explained that ESA don't want to pay for cal/val activities, and there these activities are normally paid by national Agencies. We think that this is the reason why the in situ data are not well catalogued (data is not share and not in the Copernicus system). Checked with Mark Drinkwater. Jeremy talks about the SION network to put in situ measurements together and to be shared. Maybe this should be a recommendation to be done to EC.
- Thomas Diehl explains that he will share a JRC report about synergies with communications, etc...
- We agreed on how to do the conclusions sections:
 - Summary report per task (similar to what has been done in WP2)
 - Document with some bullets with the main gaps with its priorities.
- Leif Toudal clarifies the differences on future sentinels missions:
 - Sentinel Extension = Sentinel next generation (to be launch not before 2030)
 - Sentinel Expansion = HPCM missions.
- We should consider the Sentinel Extension missions on WP3.3 future missions section.

Arctic Frontiers planning meeting - Notes from Marcin Pierechod

Time: 16:30 to 17:00

Participants: N. Hughes, J. Wilkinson, M. Pierechod

A side session at Arctic Frontiers, to be held in Tromsø on the 29th January 2020 was discussed and planned in the context of delivering M6.3 "Round table 3 on CLMS needs (linked to Arctic Frontiers 2020)." It is titled 'Evolving the EU Copernicus programme for the Polar Regions.'

The side session will present the findings of the project in its first year, and explore how Copernicus data and services can better support the development of information and knowledge needed for the smart Arctic. These include how Earth Observation technologies can lead to innovations resulting in more resilient societies through improved infrastructures and connectivity, both on land and in the maritime domain. In the Arctic seas enhancing information provision will result in a more sustainable, and healthy Blue Future so that communities throughout the Arctic can benefit.

Day 3 Summary

Day 3 was primarily for presentations and break out discussion sessions for participants in Work Packages 3 and 4. These sessions were led by the WPLs and allowed participants to discuss completed and upcoming work.

Work Package 3 - Identification of research and capacity gaps. Overview of work completed and upcoming milestones/deliverables -Carolina Gabarro

We reviewed the four tasks within this work package and the objectives, and how the work package fits into the other KEPLER work packages. CG reported that milestones and deliverables are on track, and upcoming milestones M3.3 & M3.4 will be delivered in the next few weeks, with plenty of time to pass over to WP5 for next year.

Presentation available to view [here](#).

T3.1 In situ observing systems – Jeremy Wilkinson

JW requested to sit down with WP1 & 2 to understand how this fits in with this task and is currently investigating the role of citizen science.

Helge Goessling raised a point about- GTS - WMO data regime - the integration of the data is missing, registration of buoys is difficult. Iridium is still the sole data traffic provider. Local people need to have a role in the process, therefore a workshop was organized. There is a hole in the transmission above 80N. Validation of the satellite data is made through ground stations. Citizen Science as an extension of the Copernicus programme - what sensors would we like to have, what is missing?

The below documents were shared with the participants.

[ECMWF- past 30days Surface pressure assimilated](#)

[IABP- 26Nov2019 Including surface buoys](#)

Presentation available to view [here](#).

T3.2 New and novel in-situ and airborne observation sensors and techniques- Nick Hughes

Looking at new platforms that cover the surface and upper atmosphere. What has been completed in first 11months- review, look at what has been done and what can be done in the future. Unmanned Aircraft systems are an option they provide a lot of flexibility and can fill gaps between satellite overpasses. Polar use is however, limited- people are still building experience with these systems, plus the expense and potential cost of recovering them if lost-

as well as pollution hazard. There is also a risk to flight operations. Existing UAS use have been sporadic, not routine. Used global hawk as an example. Awaiting a paper to come out about this.

'Stratobus' solar panel satellites are restricted by their power source, and have therefore limited potential to contribute to polar monitoring. Most applications for these are as communication platforms, to provide a communications link to use with other satellites. Briefly reviewed other airborne systems that may have some potential use for Polar Regions. AUVs are something that JW is very familiar with - the main limiting technologies are onboard batteries, which limit the range and load that can be fitted. A small platform for complex equipment. Long-term deployment can be hit and miss the larger the AUV but smaller AUVs can struggle with conditions and currents. Mentioned gliders which are being deployed a lot in seas around the arctic with impressive endurance, but have to surface to send back data-limiting their use to sea ice-free areas.

Presentation available to view [here](#).

T3.3 Space-based capability - Carolina Gabarro

Have broken down the report into six sections. These are then sectioned off by parameters and further sub sections. Plenty of parameters, the team are asking external experts to reveal this parameter information.

Presentation available to view [here](#).

T3.4 Integration and assimilation through Quantitative Network Design (QND) - Thomas Kaminski

Quantitative network design has a 2-step procedure for quantification of the impact of the data integration to:

1. Inversion observations that can be simulated
2. Prognostics observations are limiting the error bars

Freeboard product cr-2 was discussed and presented. S3 radar freeboard products (hypothetical) extrapolated to 1 month to match the cr-2 (needed for the comparison) has higher accuracy vs spatial coverage. Sea ice volume is a parameter. Posterior uncertainty are reduced when you include the observations. There is uncertainty at the pole hole north of 88 degrees. SST product is based on infrared and SAR however they do not achieve the whole coverage because of cloud cover. Emission data are available on an annual scale, but this needs refinement.

Presentation available to view [here](#).

Work Package 4 - Improved sea-ice mapping and forecasting Overview of work completed and upcoming milestones/deliverables - Steffen Tietsche

Frank noted that WP5 needs initial report from WP4 by Jan 2020. Gap analysis pipeline is a very good example of how to process user requirements and the importance of user stories. Large area coverage however is problematic at a high-resolution.

Presentation available to view [here](#).

T4.1 Sea-ice mapping for maritime purposes- Antti Kangas

Have mapped objectives and presented a timeline of work completed and upcoming. Frank requested WP5. Milestone 4.1 will be used for CMEMS gap analysis. We will also introduced to how the gap analysis will be undertaken. An example of sea ice concentrations and typical resolutions required by users. The demands are high res, timeliness, accurate and the most popular end user format is JPEG, professional user welcome vector formats.

Task 4.1 are particularly interested in User stories as a tool, as they give more insight than numbers.

Gap analysis allows T4.1 to make recommendations. Refer to slide 8 for further information. Noted that Pan Arctic products could be harmonized.

Presentation available to view [here](#).

T4.2 Monitoring sea-ice as an essential climate variable (ECV) - Thomas Lavergne

The pipeline of the data incorporation was explained. ERA5 - individuals at the institutions are feeding the systems, mixed input from different sat data providers leads to errors. There is therefore a need to make the interfaces smoother, however no funds have been secured to perform this work.

Specific list of ice variables is crucial to be provided, which has been done by the IPCC SROCC The methodology was presented. The questionnaire is nearly ready to be release, with 6 themes and questions related to the automated extensions of CDRs.

Presentation available to view [here](#).

T4.3 Assess the scope for sea-ice forecast products - Steffen Tietsche

Current modelling cannot to deliver that sea ice forecasts with a resolution below 300m.

Examples of key question areas

- the SIDFEx drift for MOSAiC expedition - MapViewer soft used for the consensus forecasts
- FMI – they managed to calculate and colour code the ensemble Korea to Finland ship route
- long range forecasting

Presentation available to view [here](#).

WP3: Break out discussion

Time: 11:45 to 12:45

Participants: T. Kaminski, F. Kauker, M. Scholze, L. Toudal Pedersen, M. Vossbeck, S. Jawak, N. Hughes, J. Wilkinson, V. Gambau, C. Gabarro

- Combine variables in WP2 and figure out which ones are missing- improving co-ordination across work packages.

- D3.2 has had some feedback that they will include, so will take the next two weeks to include – the deliverable may therefore be a little late.
- Some similar discussions to the WP2 break out. They agreed they should mention when there is a reanalysis variable. Cryostat was a special case. There is a funding gap between when the satellite launches and data availability. That could be a recommendation. Figuring out the best approach.
To cover:
- Identification of research gaps & Identify gaps in situ data and research gaps including satellites
- Important to have input from everyone
- Need a common global platform to collect all the data in one place (open access)
- T3.4 observations are crucial for the model to be as accurate as possible and reduce all the uncertainties

WP3 break out discussion report- Jeremy Wilkinson

Report 3.1 T3.1 In Situ Observing System: Overview of report/Deliverable – Jeremy Wilkinson.

- Definition of in situ observations
- Descriptions of different type of in-situ observations:
 - Community based
 - Scientific/academic
 - Governmental (i.e. weather)
 - Commercial vessels
 - Citizen science
 - Anything missing?
- Time scale associated with in situ observations (NRT to year+ delay for moorings)
- Calibration procedures: some data needs more processing than others
- Key climate variables for use in Copernicus (use same ones as in WP2 and WP3). Refer to WP2 table
 - Land
 - Ocean
 - Sea ice
 - Missing Cryosphere (ice sheets?)
- Data accessibility
 - NRT: GTS or similar
 - Climate/hindcast studies: archived data
 - Open data policy
- Results from questionnaires
- Cal/Val opportunities
- Role of research stations, vessels etc.
- Link to Copernicus services and how in situ data are used and how to be improved.
- How the service struggled with this and what they need to do a better job
- Beefing up Copernicus in situ service aligning it with WMO Cryosphere Watch
- Check with Laurent Bertino
- Recommendations

Comments on the WP3 discussed / agreed during the meeting MTR- Carolina Gabarro

- We prepared with Jeremy a table specifying per parameter if this is served by Copernicus and if it is measured with RS techniques. We will add this table to WP3.3 section 1 (see file table_update2.docx here <https://drive.google.com/drive/folders/1IJIUNG5OPqMaNHg7i44aS-jhhNvHd3NO>)

We think that **some important parameters are missing in section 1 (remotely sensed parameters)**, while they are in the Copernicus table from WP2: **Albedo, Currents, SSH, wind stress, SWH, Land Surface Temperature**. We will take over currents, SSH, wind stress. Voluntaries for the others?

While doing this exercise of comparing products served by Copernicus (WP2) and the ones we are covering in WP3.3, we realized that Snow Avalanche is not on the WP2 CLMS tables, while we think this is distributed in Copernicus.

- Section 3: Future missions. We should add parameters acquired by the future sentinel extension (or next generation) satellites. (FYI: Sentinel Expansion = HPCM and is not the sentinel extension)
- About synergies (section 4), we commented that we should focus on the synergies that are focused on improving accuracy & coverage, and not for improving resolution (downscaling). @Thomas Diehl: could you please share with the team the document you commented from JRC about synergies, I think you said the author is Joaquin Fortuna.
- We agreed in section 5 (assimilation) we could use the traffic lights code for 'severity'. Put as first column the parameter analysed (which is now on column 3 of the tables of this section).
- We should follow the GCOM definition on if the users are operational (Nick it was not very clear to me this part, if you want to add something else)
- Ole Nordbeck from EC commented that he would like to see in the report an assessment on the in situ data for the remote sensing cal/val, so this is taken by Jeremy to be included in WP3.1.
- Documents from WP2.1 Copernicus Land parameters (from Marko and Thomas) could help Laurent to fill in the Land parts in section 6 (assimilation).
- The gap analysis should be done by parameters not for instruments. We should clearly identify the parameters that are not well measured with RS, prioritizing them and state it to WP5 team.
- To be coherent with other WP, we should do an **executive summary section for each task**. For task 3.3 this will be what we called section 8, with the main limitations and gaps on remote sensing data.

- **Very important: We should start writing the conclusions with priorities** as bullets format as Frank required. This is not for the report, this is to be given directly to Frank. It should be done by beginning of January. Please go ahead filling it. I have created a drive document for that called 'Conclusions and Recommendations for WP5' here https://docs.google.com/document/d/18cNHXq-uk2_2m1bLvvgg2oX2ZsxqgifaULrgGplyUrIM/edit
- We should deliver the draft version of our Milestone of T3.3 by mid-December. The final report should be submitted by May 2020.

WP3 break out discussion report - Carolina Gabarro

- a) We agreed that we should analyse common variables in WP2 and WP3, as much as can be. Now some variables are missing in Wp3 analysis. It is recommended to have a unique list, table of parameters.
- b) Leif explained that ESA don't want to pay for cal/val activities, and there these activities are normally paid by national Agencies.

We think that this is the reason why the insitu data are not well catalogued (data is not share and not in the Copernicus system). Checked with Mark Drinkwater. Jeremy talks about the SION network to put insitu measurements together and to be shared. Maybe this should be a recommendation to be done to EC.

- c) Thomas Diehl explains that he will share a JRC report about synergies with communications, etc...

- d) We agreed on how to do the conclusions sections:

- Summary report per task (similar to what has been done in WP2)
- Document with some bullets with the main gaps with its priorities.

- e) Leif Toudal clarifies the differences on future sentinels missions:

- Sentinel Extension = Sentinel next generation (to be launch not before 2030)
- Sentinel Expansion = HPCM missions.

We should consider the Sentinel Extension missions on WP3.3 future missions section.

WP4: Break out discussion

Time: 11:45 to 12:45

Participants *OJ, Marcin, Antii, Keld, Isabella, Jaakko, Giles Garric, Malte Muller, Steffen, Thomas Kauker, Laurent Bertino, (Penny Wagner, Thomas Lavergne, Helge Goselling VC)*

Key points

- 4.1: Collect user stories: polar prediction network has a vlog or user platform.

- 4.2: User needs and requirements on ECV. A lot of time and energy can be saved if they take the decision on a higher level up in ESA and Copernicus level. Things can be organized more smoothly also outside of Copernicus. Structure of contracts between 2nd and 3rd parties. Who is funding the research? Who is paying for changes? If Copernicus want improvements of ECV are they paying?
Product development and weather developing sensors
- 4.3 forecast: It has to be taken in short term planning (mariners) to for high resolution forecast in certain areas. Again user stories can provide input to minimize the terminology between research and ice services.

HG provided a link to 'Polar Prediction Matters' a resource he suggested would be relevant to 'user stories' within KEPLER:

<https://blogs.helmholtz.de/polarpredictionmatters/>

They have collected (and continue collecting) user (and forecaster/provider) stories around the topic of polar prediction. This activity is part of the Year of Polar Prediction (YOPP).

HG wished to highlight three interesting examples:

Polar prediction needs on a range of timescales from the perspective of an ice breaker services company:

<https://blogs.helmholtz.de/polarpredictionmatters/2018/01/sailing-frozen-oceans/>

An example of very short-term and high-resolution sea ice forecasts (similar to radar-based short-term rain forecasts vs. NWP):

<https://blogs.helmholtz.de/polarpredictionmatters/2018/07/predictive-ice-images-an-esa-kick-start-project/>

A land example (reindeer herding):

<https://blogs.helmholtz.de/polarpredictionmatters/2018/11/everyday-life-in-the-arctic/>

Work Package 5 - End-to-end operational system. Overview of work completed and upcoming milestones/deliverables. – Frank Kauker

Participants were provided with a brief introduction into work completed-

Presentation available to view [here](#).

T5.1 Synthesis on the visions of the evolution of the Copernicus services - Laurent Bertino.

Reviewed the scope of this task, involving CMEMS, CLMS, and C3S. Noted that CAMS1,2 have been so far out of their scope. They have completed an inventory of the number of available variables (ECVS/EOVs) and identified the status of these, ranging from 'As consistent as possible,' 'Partial and can be improved,' 'Low missing data,' 'Mix, depends which variable' These are detailed further in the draft report available to view here:

[D5.1 Vision Evolution Services- Draft report July 2019](#)

Missing data cells should be focused on where there are obvious data gaps. One possibility includes regional seasonal predictions for Arctic biochemical models and season predications of wave models. See slide 9&10 in the presentation below for a full bullet list and preliminary summary.

Next steps for D5.1 were also listed.

Presentation available to view [here](#).

Tero Mustonen raised an important point to use caution when using the word ‘assimilation’ within reports and this project as it has negative connotations for the indigenous community and could be interpreted poorly. Participants agreed that using the full phrase data assimilation, or acronym would be a good solution.

T5.2 End-to-end operational system roadmap & WP5: Plenary discussion- Frank Kauker

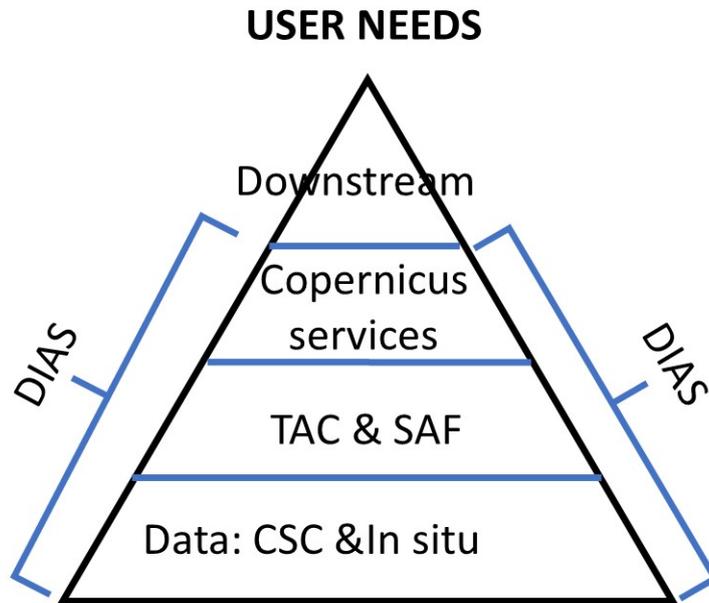
FK provided a time line for the road map end to end operational system. The deliverable is due in one year, and plans to kick of WP5 inter work package collaboration will start in January at a workshop in Hamburg (see below for more information.)

The Mid Term meeting was utilized as a forum for plenary discussion about WP5. The consensus was that the road map should explain that the time horizon should be 10-15 years; it should then lead further into the future. It is important to consider the format- i.e. the length, level of detail etc. JW has suggested that it is vital to decide the format and ideally create a schematic of the road map beforehand – altering this as the WP develops. We can then assess which areas are working, and those that are not. Using this approach, it will be easier identify which milestone is missing, or the deliverable that will enable them to pin point where to put efforts.

The first meeting will be in January in Hamburg at WPL level. FK asked participants to consider if this meeting should bring in expertise from the rest of the consortium also. Jeremy has suggested that the PAB should be involved, at the very least to have minutes/documents from the meeting. This will need to be organized online to allow for sufficient PAB participation due to busy schedules of project advisory board members. The skeleton of WP5 planning should be shared with the PAB. Richard Hall has made himself available but noted that they should make sure that the PAB are equally involved. RH has useful insights and would be a good resource for this meeting. Frank will select the team; it will be a small group to keep this productive. Frank would like WPLs to send a report for each that includes the things that are working well, as well as gaps. This list would ideally be compiled 2 weeks before the meeting.

A question was raised by WP1 that they have identified end users, and what the satellites can provide. However, end user requirements cannot all be achieved. Therefore, WP1 have requested that FK cross check the work WP1 have done so far. Carolina Gabarro will provide the limitations of the satellite products, and the maximum resolution that can be achieved but would also agree that FK should crosscheck this. FK confirmed that the main point of the road map would be to check everything from previous WPs and tie them together. The consensus is that KEPLER are not just looking at things we can solve today, but are also looking ahead to anticipate new developments, but also maybe should push for developments too.

JW suggested the need to create a pyramid/diagram ahead of the WP5 meeting. A rough pyramid diagram was created during this break out session; this is something that follows on from the work created in WP1.



Discussion points raised whilst drafting the above diagram

- Requests by users at the top at the pyramid
- What is needed/data/ things to be done?
- Model improvements to understand user requirements
- Poor communications between Copernicus and various institutes should factor into the roadmap planning.

Using several user stories may help with creating a road map - is it possible to use a story for each service? Explain the services that way. Then If KEPLER link the services, the stories could combine.

The above diagram is available as a PowerPoint file and it is encouraged that the KEPLER consortium add and edit this as the project develops.

Presentations available to view below:

[Kepler T5.2](#)

[WP5 Open discussion](#)

Recap/conclusions from the Mid Term Meeting - Nick Hughes

- 11 Milestones & 10 Deliverables have been completed so far.
- 4 successful round table/workshop events were held in Copenhagen, Ianri, Bremen, & Reykjavik.
- Applications to take KEPLER to Arctic Frontiers and the Arctic Observing Summit have been submitted for 2020.
- The next phase of the project will begin in January, evaluating the data & reports from work packages to create a Roadmap for end-to-end operational system for monitoring in the Arctic.
- Need to assess if the PAB requires additional members, or if they will appoint a spokesperson for the group. Attendance from PAB is low.
- Meeting log should be updated to include potential and upcoming events as well as those already attended
- Event attendance should be carefully considered for ASM3/ ASSW/AOS for these to be successful workshops then WPLS should attend. The individual organization heads may need reminding from the EC that although reduced travel policies are being implemented, EU project participants are expected to be able to attend events.
- User stories will be instrumental to building end to end roadmap