Joint European Research Infrastructure network for Coastal Observatory – Novel European eXpertise for coastal observaTories - **JERICO-NEXT**	
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Lead beneficiary	Ifremer
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Contributors	JRAPs partners
Submitted by	I. Puillat (Ifremer)
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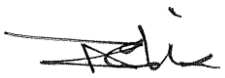
Project coordinator: Ifremer, France.

History			
Revision	**Date**	**Modification**	**Author**
0.1	Sept-Nov. 2016	Gathering of JRAP contributions	Puillat I. and JRAPs leaders
1.0	17 Nov. 2016	Add on: summary, introduction, conclusion and comments	Puillat I.
1.1	21 Nov. 2016	Add on JRAP#1 missing part	F. Artigas and Puillat I.
1.2	30 Nov. 2016	JRAP6 update and Final version	B. Mourre & Puillat
2.0	6 Dec. 2016	Update JRAP1 &2 + approvals	A. Grémare, F; Artigas, I. Puillat

Approvals				
	Name	**Organisation**	**Date**	**Visa**
Coordinator				
WP4 Leaders	Puillat I.	Ifremer	2 dec. 2016	
WP4 co-leaders	Grémare A.	CNRS	5 dec 2016	

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1. Executive Summary

The WP4 of the JERICO-Next is a synthesis of the project built upon activities in other WPs, gathering the consortium around applied Joint Research Activity Projects (JRAPs) selected to put forward the added value of JERICO-NEXT. In order to reach this objective, WP4 keeps on track the JERICO-NEXT course of actions via synthesis and application activities based on interactions with other WPs. WP4 helps establishing some topical approaches for the scientific strategy in WP1 (task 1.2) and will give inputs to establish the network strategy after JERICO-NEXT (task 1.6). Indeed, six JRAPs will be implemented to address different key environmental questions and/or policy requirements such as those considered by the MSFD, and according to the 6 JERICO scientific areas:
1- JRAP-1 on pelagic biodiversity
2- JRAP-2 on benthic biodiversity
3- JRAP-3 on chemical contaminant occurrence and related biological responses
4- JRAP-4 on hydrography and transport
5- JRAP-5 on carbon fluxes and carbonate system
6- JRAP-6 on operational oceanography.

This document reports the progress of the JRAP activities after 1 year in the project. In the following pages, for each JRAP, we report main achievements with comparison to the initial plan, the next steps, the acquired data (link with WP5), the acquired communication material (to feed WP8), and some specific points regarding the science strategy. Indeed, the previous WP4 deliverable (D.4.1) was dedicated to present the science strategy that could be deployed in JRAPs (but not only) and was then reviewed by the members of the Science and Technical Advisory Board (STAC). A meeting with the STAC was then organised the 7 September 2016 to discuss this strategy. As a conclusion JRAP teams were asked to address some common questions and some JRAP-specific ones. This meeting is reported in “Report of WP4 meeting with the Scientific and Technical Advisory Committee (STAC) & Contributions to the JERICO-NEXT science strategy”, provided in annex of this document. In addition, this document also enhances some activities driven in coordination with other WPs such as the WP3.

The reported actions show that technical preparations were undertaken before deployment, some methodologies were reviewed, some field works are already done, some buoys and other systems are deployed and acquiring data, two WP3&4 joint workshops were organised. As a conclusion, JRAPs are well progressing with respect to their initial plans even if they are not developing along the same time line. Indeed some JRAPs already started their data acquisition, whereas some other will start this step later. Some important reported issues will be discussed during the next Steering committee Meeting to be held the 12-13 Dec. 2016. The upcoming important action in 2017 is to well coordinate the JRAPs data acquisition with the data management led in WP5, whereas 2018 will be more dedicated to work on the products delivered by JRAPs as JERICO-RI product prototypes..

2. Introduction

The WP4 of the JERICO-Next is a synthesis of the project built upon activities in other WPs, gathering the consortium around applied Joint Research Activity Projects (JRAPs) selected to put forward the added value of JERICO-NEXT. In order to reach this objective, WP4 keeps on track the JERICO-NEXT course of actions via synthesis and application activities based on interactions with other WPs. WP4 helps establishing some topical approaches for the scientific strategy in WP1 (task 1.2) and will give inputs to establish the network strategy after JERICO-NEXT (task 1.6). Indeed, six JRAPs will be implemented to address different key environmental questions and/or policy requirements such as those considered by the MSFD, and according to the 6 JERICO scientific areas:
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3. Main report

3.1. JRAP#1: Phytoplankton biodiversity and HAB (Biodiversity of phytoplankton, harmful algal blooms and eutrophication)

Involved institutes: SMHI, CEFAS, CNRS-LOV, CNRS-Univ Litt, CNRS-MIO, Deltares, Ifremer, NIVA, RWS, SYKE, VLIZ, and DAFF

Objective of the JRAP (short remind):
The main objectives of JRAP-1 are:
- To enhance the understanding of the dynamics of algal blooms by combining data on phytoplankton distribution, abundance and diversity with chemical and physical oceanographic data,
- To apply novel in situ automated or semi-automated methods to address phytoplankton diversity, abundance, biomass and photosynthesis parameters in marine coastal systems, with a focus on harmful algae and eutrophication,
- To assess their potential for complementing traditional methods, which are based on discrete water sampling and labour intensive laboratory microscope work,
- To formulate inputs for science strategy related to the JERICO-RI and recommendations for its further development (roadmap for the future).

3.1.1. Main achievements and delays

3.1.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
Kattegat-Skagerak area M12-14 Objective: To carry out a study of phytoplankton biodiversity and harmful algal blooms at the Tångesund observatory in the Skagerrak Partners: SMHI, (subcontractors WHOI and Scanfjord), NIVA, Ifremer and IRIS will analyse some samples from the study. RWS-NIOZ contributed with FRRF measurements during one cruise. Non-JERICO partners: the University of Gothenburg, Sweden and Alfred Wegener Institute (Bremerhaven, Germany)	M8-M14: A study of phytoplankton biodiversity, harmful algae and physical and chemical oceanographic conditions was carried out near a mussel farm on the Swedish west coast. In addition, three cruises in the off shore Skagerrak were made. An FRRF was used during one of the crusies (RWS-NIOZ) Oceanographic instrumentation (ADCPs and CTD-rigs) were deployed in several locations in the area. Data from a FerryBox system on the route Oslo-Kiel complement the data from the Tångesund observatory. Modelling of physical processes will complement the observations. An oceanographic buoy was deployed by SMHI in the Tångesund fjord in April 2016 (M8). In August 2016 an imaging flow cytometer (Imaging FlowCytobot) was deployed by SMHI in cooperation with WHOI and Scanfjord in Tångesund as part of a depth profiling system. Setting up the system required a larger effort from technical personnel than expected. Teething problems were encountered; they include problems with internet communication (4G cell phone connection), power supply and profiling systems (winches). After intense work by technical personnel and scientists the problems were resolved. In addition to the automated measurements water samples were collected every week to provide reference data. Water

	samples for analyses in the laboratory were also collected. The study ended in the middle of October 2016. During the study varying wind conditions resulted in upwelling and downwelling conditions. The phytoplankton community varied on the timescale of days. A bloom of the harmful alga *Lingulodinium polyedrum* was recorded. Also other HAB-species were observed.
English channel – North Sea (CNRS, IFREMER, CEFAS, VLIZ, RWS, DELTARES) M8-M13 *Methods used:* – Fluorometry (Spectral Fast Repetition Rate) – Pulse Amplitude Modulated fluorometry (Phyto-PAM) – Pulse-shape recording Flow Cytometry + Image in flow analysis – N Sea Study (VLIZ & RWS) – Spring/Summer bloom – N Sea & E. Channel Study (CEFAS ENDEAVOUR) – Spring/Summer/Autumn – E. Channel study (IFREMER+CNRS) – Spring/Summer/Autumn bloom – Preparations for studies in 2017	**Southern North Sea-eastern Channel combined cruises** **Objectives:** To understand the phytoplankton spatial distribution and community/population successions during the productive season from the eastern Channel to the southern North Sea bight. To test the accuracy of different automated and semi-automated devises to detect and discriminate amongst phytoplankton functional groups, focusing on HAB We started planning the common implementations of automated optic sensors for phytoplankton monitoring in some of the regular monitoring cruises performed by the JERICO partners in a meeting in Woerden (NL) in November (M3), then we implemented some of the sensors in cruises with the participation of at least 2 JERICO partners. **Cruises**: • 11 – 15 April RV Zirfaea ○ FCM (RWS) ▪ Fixed Samples (also VLIZ FCM) ▪ Underway samples ○ FRRF (NIOZ, RWS) • 24-25-26 May RV Simon Stevin ○ FCM (RWS, VLIZ) ▪ Fixed Samples ▪ Underway samples ○ FRRF (VLIZ) ○ Fluoroprobe (CNRS LOG) ○ Phytopam (CNRS LOG) • 13 – 16 June RV Zirfaea ○ FCM (RWS) ▪ Underway samples ○ FRRF (NIOZ) ○ PhytoPAM (CNRS LOG) ○ Fluoroprobe (CNRS LOG) • 21 – 28 June RV Endeavour ○ FCM (RWS, CEFAS) ▪ Underway samples The cruises were successful and some small technical problems were raised and resolved. A common LifeWatch and JERICO-Next workshop was carried out amongst participants in Oostende (BE, August 2016, M12) organized

	by VLIZ and attended by RWS, CNRS-LOG to present the first raw data and to discuss on further analysis Data is still being processed and analysed.
Mediterranean sea: M1-M18 (CNRS-MIO) Improvement of combined phytoplankton and hydrological data observation from a fully sub mesoscale analysis system thanks to a continuous flowthrough of sea water and a succession of sensors. Adaptation for the Ferrybox system (meso scale resolution due to the speed of the ship)	**M1-M11**: OSCAHR cruise (PI A. Doglioli and G Grégori) in the Mediterranean. 10 days sampling, testing of the Cytosense and the pCO2 pocket ferrybox sensors. Resolution of 2km and 30 min sampling for the Cytosense. PCO2 did not work for this cruise. **M15**: CHROME project (PI M Thyssen). First crossing of the Western Mediterranean Sea onboard the "Le Carthage" ferry from the CTN with on its board a Cytosense coupled to a pCO2 sensor (SubCtech OCeanPack) and a pH sensor. Data for one crossing was validated. Ship technical maintenance and route modification forced the removal of the pCO2 recorder and the Cytosense. Next opportunity to install the machine is now in October 2016. As the Mediterranean Sea is characterized by oligotrophic to mesotrophic conditions small cells such as *Prochlorococcus* and *Synechococcus* are widespread and found in abundance. Unfortunately, due to their small size and dim fluorescence, most of them are out of reach of automated *in situ* Cytobuoy flow cytometers. In collaboration with Cytobuoy company, some modifications have been successfully applied to a Cytosense instrument in order to better resolve the *Synechoccocus* and *Prochlorococcus*. In the frame of the OSCAHR cruise in the NW Mediteranean (PI : A. Doglioli & G. Grégori) we had the opportunity to combine together several instruments and sensors on a dedicated sea surface continuum sampling water line (pumped *in situ*, in sub-surface) to record at high resolution several biological (abundances of pico and nanophytoplankton by flow cytometry, chlorophyll *a* concentration by fluorimetry) and non biological variables (temperature, conductivity/salinity, pH, nutrients). The goal is to use such a strategy to better characterize the influence of a sub-mesoscale structure on the planktonic community. This experience allowed for the first time in the Mediterranean, to implement on a Ferry (the Carthage) a Cytosense coupled to a Ferrybox belonging to the Tunisian INSTM institute (Amidex- CHROME Project, PI: M. Thysssen). For the first time ultraphytoplankton has been monitored at high resolution (every hour) on a transect between Marseille and Tunis, across the Western Meditrranean Sea
Baltic Sea (SYKE, SMHI)	The JRAP1 activities in the Baltic Sea commences in year 2017

JERICO Plankton workshop I (CNRS-LOG, CNRS-MIO, CNRS-LOV, IFREMER, Cefas, Vliz, RWS, NIOZ, HZG, SYKE, SMHI, NIVA, HCMR, WHOI, U Mons, DAFF, NIVA, Algatech) (joint WP3.1, WP2.4.2 and WP4.1) Month 10	**International Workshop on Automated Phytoplankton Observation** The International Workshop on current advances in the application of (semi-)automated techniques for studying phytoplankton dynamics in coastal and marine waters, organized by the Laboratory of Oceanology and Geosciences (UMR 8187 CNRS-ULCO-UL1) took place from May 31 to June 2, 2016, in Wimereux. It gathered together scientists from 15 partners or contracted partners and SMEs of the JERICO-Next consortium in Europe, as well as some international external experts. Plenary presentations of innovative optical techniques and their application in observing systems were followed by practical discussions on technical and analytical improvements for *in situ* and *in vivo* monitoring of phytoplankton abundance, biomass, diversity and photosynthetic parameters. These discussions helped preparing Joint Research Actions on the implementation of innovative automated techniques in pelagic biodiversity - plankton, Harmful Algal Blooms and eutrophication studies, in connexion with actions on Coastal Carbon fluxes.
JERICO Plankton workshop II (SMHI, CNRS-LOG, CNRS-MIO, IFREMER, VLIZ, U Gent, RWS, NIOZ, HZG, SYKE, NIVA) (joint WP3.1 and WP4.1) M13	**The second International Workshop on Automated Phytoplankton Observationwas held at SMHI in Gothenburg (Sweden) by September 27-30, 2016.** Altogether 18 persons participated. The focus was on practical aspects of observing phytoplankton using advanced instrumentation. Participants brought instruments to the practical workshop. A presentation and demonstration of the use of each sensor was carried out by participants in order to make all attendees to benefit from the details and discussions that followed presentations. The instruments were used to analyse water collected at the Tångesund observatory where SMHI operates an *in situ* imaging flow cytometer together with other oceanographic instruments. Workshop participants used *in situ* instruments at Tångesund during an excursion as part of the workshop. In addition, water was collected at Tångesund and analysed at the laboratory at SMHI by the different sensors, together with phytoplankton monoculture samples. *Instruments used and demonstrated (companies and partners involved)* • Imaging Flow Cytometer: Imaging Flow Cytobot (McLane, WHOI-SMHI) • Pulse shape-recording Flow Cytometer with imaging capabilities: CytoSense (two instruments, CytoBuoy, RWS

	and CNRS-LOG) • Plankton imager: FastCAM (IFREMER) • Fast Repetition Rate Fluorometer: - FRRF-FASTOcean (Chelsea Instruments, RWS) • Multi-spectral Fluorometer (Phyto-PAM, Walz, CNRS-LOG) Multi Exciter (JFA Advantec, SYKE) Fluoroprobe (bbe Moldaenke, CNRS-LOG) • Spectrophotometer – PSI-CAM (HZG) In addition samples were analysed using microscopy (SMHI, NIVA)
Kattegat-Skagerak area M12-14 Objective: To carry out a study of phytoplankton biodiversity and harmful algal blooms at the Tångesund observatory in the Skagerrak Partners: SMHI, (subcontractors WHOI and Scanfjord), NIVA, Ifremer and IRIS will analyse some samples from the study. RWS-NIOZ contributed with FRRF measurements during one cruise. Non-JERICO partners: the University of Gothenburg, Sweden and Alfred Wegener Institute (Bremerhaven, Germany)	**M8-M14:** A study of phytoplankton biodiversity, harmful algae and physical and chemical oceanographic conditions was carried out near a mussel farm on the Swedish west coast. In addition, three cruises in the off shore Skagerrak were made. An FRRF was used during one of the crusies (RWS-NIOZ) Oceanographic instrumentation (ADCPs and CTD-rigs) were deployed in several locations in the area. Data from a FerryBox system on the route Oslo-Kiel complement the data from the Tångesund observatory. Modelling of physical processes will complement the observations. An oceanographic buoy was deployed by SMHI in the Tångesund fjord in April 2016 (M8). In August 2016 an imaging flow cytometer (Imaging FlowCytobot) was deployed by SMHI in cooperation with WHOI and Scanfjord in Tångesund as part of a depth profiling system. Setting up the system required a larger effort from technical personnel than expected. Teething problems were encountered; they include problems with internet communication (4G cell phone connection), power supply and profiling systems (winches). After intense work by technical personnel and scientists the problems were resolved. In addition to the automated measurements water samples were collected every week to provide reference data. Water samples for analyses in the laboratory were also collected. The study ended in the middle of October 2016. During the study varying wind conditions resulted in upwelling and downwelling conditions. The phytoplankton community varied on the timescale of days. A bloom of the harmful alga *Lingulodinium polyedrum* was recorded. Also other HAB-species were observed.

3.1.1.2. Acquired data and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type	Archiving place	Status: raw data, processed,

(parameters)		Quality checked, needs to make the data flowing to the standardised channel?
CTD-data (salinity, temperature, depth)	SMHI, Swedish Oceanographic Data Centre	Processed but not fully quality controlled
CTD-data (salinity, temperature, depth)	CNRS-LOG	Processed but not fully quality controlled
CTD-data (salinity, temperature, depth)	Ifremer	Processed but not fully quality controlled
CTD-data (salinity, temperature, depth)	RWS	Processed but not fully quality controlled
CTD-data (salinity, temperature, depth)	VLIZ	Processed but not fully quality controlled
Chlorophyll data	SMHI, Swedish Oceanographic Data Centre	Raw data
Oceanographic buoy - automated measurements, salinity, temperature, etc.	SMHI, Swedish Oceanographic Data Centre	Raw data
Phytoplankton data based on microscopy	SMHI, Swedish Oceanographic Data Centre	Samples are being analysed
Phytoplankton data based on imaging flow cytometry	SMHI, Swedish Oceanographic Data Centre	Raw data
Ferrybox data from the route Oslo-Kiel	NIVA	Processed but not fully quality checked
Phytoplankton data based on Flow Cytometry	VLIZ	Raw data
Data on photosynthetic parameters (Fast Repetition Rate Fluorometry)	VLIZ	Raw data
Chlorophyll fluorescence, Ferrybox data from the route Cuxhaven-Immingham	HZG	Processed but not fully quality checked
Chlorophyll fluorescence, stationary Ferrybox, Cuxhaven	HZG	Processed but not fully quality checked
Phytoplankton data based on flow cytometry	CNRS-LOG	Raw data
Phytoplankton data based on multi spectral fluorometry	CNRS-LOG	Raw data
Data on photosynthetic parameters (PAM - Pulse Amplitude Modulated-Fluorometry)	CNRS-LOG	Raw data
Ferrybox data: Phycoerythin fluorescence,	SYKE	Raw data
Phytoplankton data: phycoerythrin containing species	SYKE	Raw data
Phytoplankton data based on	RWS	Raw data

Flow Cytometry		
Data on photosynthetic parameters (Fast Repetition Rate Fluorometry)	RWS	Raw data
Carbon fixation, C-13 method	RWS	Raw data
Phytoplankton data based on Flow Cytometry	CNRS-MIO	Raw data
Data on photosynthetic parameters (Fast Repetition Rate Fluorometry)	CNRS-BOREA	Raw data
Phytoplankton data based on multi spectral fluorometry	Ifremer	Raw data
Phytoplankton data based on Flow Cytometry	Cefas	Raw data

3.1.1.3. Communication materiel

The list below includes material collected until September 2016.

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?
Images and video	Tångesund study, Skagerrak	Contact SMHI
Images	Cruises in the North Sea	Contact RWS
Images	JERICO Plankton workshop 1	Contact CNRS-LOG
Images	JERICO Plankton workshop 2	Contact SMHI,RWS and CNRS-LOG

3.1.2. Next steps (Sept. 2016-Aug. 2018)

when	what
M13-M36: (Sept. 2016- Aug. 2018)	**1) Baltic Sea** Year 2017 will be the main sampling year in the Baltic Sea. Measurements and sampling will be carried out by SYKE and SMHI with a contribution from CNRS-LOV. The spring bloom and summer cyanobacteria bloom will be in focus. **SYKE** Platforms: Utö Island ocean observatory in the Archipelago Sea. Ferrybox Helsinki-Stockholm Activities: Continuous measurements using different fluorometers, Multiexciter, OSCAR PsiCam, FRRF etc. Continuous measurements are planned for the whole growing season. In addition, 3 to 5 campaigns (one or two weeks) will be carried out in Utö during phytoplankton events.

	Variability between the seasons will be investigated using sensors for phycoerythrin (PE, specific to some algal groups) and phycocyanin (PC, specific to some cyanobacteria). How can the different instruments characterise the changes in diversity and biomass, separation of pico-cyanobacteria and filamentous cyanobacteria during summer, optimal discrimination? Supporting information from microscopy and possibly also from imaging flow cytometry (IFCB) will be made available. **SMHI** Platforms: Ferrybox system: Lübeck-Oulu-Kemi-Lübeck Oceanographic buoy Huvudskär E. (NW Baltic Proper) Research vessel Aranda Activities: Continuous measurements of PC and chl fluorescence using the Ferrybox. Water sampling and microscope analysis Measurements of fluorescence parameters using the oceanographic buoy. Use of underwater video profiler (UVP5) during research cruise in July 2017 from a R.V. Aranda. The focus is to study vertical distribution of cyanobacteria **2) Kattegat-Skagerrak Region** The study at Tångesund in 2016 was a major effort. In 2017 samples and data will be analysed to produce deliverables and scientific articles. Continued work includes the measurements made using Ferrybox Oslo-Kiel (NIVA) with several optical sensors. SMHI plan to replace a wave buoy located at Väderöarna in the Skagerrak with a more advanced oceanographic buoy with optical sensors. **3) North Sea - E. Channel** Scientific/policy questions: • Making a map of the distribution at sub-mesoscale of phytoplankton abundance/biomass/diversity (mainly functional) in the North Sea and eastern Channel • To better understand the phytoplankton community changes and development of the spring bloom at high temporal resolution • To contribute to the surveillance of the status of North Sea and Channel (Marine Strategy Framework Directive) and proposing measurements for exploration of new indicators of Good Environmental Status (GES) North Sea-Channel opportunities to work onboard Research Vessels: Endeavour (Cefas), Simon Stevin (VLIZ), Zirfaea (RWS), Côtes de la Manche (CNRS). • Combined cruises to follow/track the bloom (*Phaeocystis* & diatoms) from the Bay of Seine towards the southern North Sea, characterizing functional groups/biodiversity/ physiology bloom (state/activity/..). • Auomated data associated with reference data as well as

	completed with other physico-chemical parameters. Calibration with other sensors. E. Channel opportunities to monitor phytoplankton dynamics, at high temporal resolution, on fixed/mooring stations: Marel Carnot - Fixed station Boulogne sur Mer (E. Channel), to be implemented late 2017 - early 2018 (IFREMER-CNRS LOG) : study at high frequency of changes in abundance/biomass/ SMILE Buoy - Bay of Seine- E. Channel (CNRS Borea-IFREMER) : study at high frequency of changes in biomass / photosynthetic parameters under direct estuarine influence. North Sea opportunity for regular spatial assessment of phytoplankton distribution at meso-scale : Ferry Box in the Cuxhaven (UK) - Zeebrugge (BE) - Haldan (NO) line, where JRAP#5 will install sensors for pCO2, pH and total fluorescence (and will perform microscopy counts): possibility to join sensors of JRAP 1 will be explored **4) Mediterranean Sea** -Observation of the phytoplankton autumnal and winter distribution (focusing mainly on the relative importance of pico- and nanoplankton) in the Western Mediterranean Sea: Installation of the Cytosense onboard the ferry le Carthage. This strategy will be complemented by some new generations of sensors capable to bring more information about the structure and the dynamics of the community (FRRF, PAM, Cytosense, O2/ar, pCO2). Such an approach will be first implemented at the Marine station of the Mediterranean Institute of Oceanography (in Endoume station) where a sampling pump will bring the seawater to a lab where the sensors will be implemented and tested. Once this will be done, then the system will be implemented onboard on various cruises. - Work on the Database for phytoplankton developpement thanks to a close coordination with the SeaDataCloud consortium. -Minicosm study at the MIO: primary production from several sensors (if funded, SYKE FRRF), Oxygen/argon sensor, flow cytometer. Preparation for the *In situ* observation site expected at the Marine Station of Endoume.
M31: JERICO Plankton workshop III (joint WP3.1 and WP4.1) - May 2018	A third International Workshop on Automated Phytoplankton Observation is planned to be arranged in Marseille in May 2018. The focus will be on reporting results achieved in WP3.1 and WP4.1 and to compile the JRAP1 contribution to the final report from the JRAP's (D4.5)

3.1.3. Answers to the STAC after D4.1 report

Question 1: **Please clarify how the JRAP activity links to other ongoing collaborative works/projects, indicate an approximate % age of contribution**.

*Project names, project type: (H2020, etc..), ~% contribution to the JRA***P:** **Baltic Sea (SYKE, SMHI)** JRAP#1 build on ferrybox infrastructure operated and maintained by project Algaline (SYKE and SMHI, Baltic Sea co-operation project , in operation >20years, SYKE coordination) and Utö infrastructure operated and

maintained mainly by FMI and partly by SYKE (institutional funding). All these infrastructures in Finland are part of national marine research infrastructure FINMARI, which coordinates all Finnish marine observations and is partly supported by Academy of Finland. SMHI (Sweden) operate the FerryBox line Oulu-Lübeck together with SYKE since 2010. SMHI also operates the Huvudskär buoy in the Baltic Proper as part of the Swedish infrastructure.

Kattegat-Skagerak (SMHI, NIVA)

JRAP#1 activities build on the Tångesund observatory operated by SMHI with subcontractors WHOI and Scanfjord. The oceanographic buoy in Tångesud is part of a Swedish National buoy newtwork partly funded by the Swedish Research Council. SMHI also operates an oceanographic buoy in the Skagerak. The ferrybox infrastructure (Oslo-Kiel) is operated and maintained by NIVA.

North Sea – English Channel

JRAP#1 activities with automated optical sensors in the E. Channel and North Sea were started, build upon former projects as the DYMAPHY (EU INTERREG IVA "2 Seas", 2010-2014), the CHARM III (Interreg IVA "France-Channel-England", 2009-2012) and PROTOOL (FP7 – 2009-2012), which started to explore, test and inter compare the existing automated phytoplankton optical sensors, combined to reference methods.
They are at present supported by current projects as the Alg@nline ferry box project (FMI-SYKE-SMHI), the Life Watch EU project coordinated within VLIZ (Belgium) and Swedish Lifewatch (SMHI), the EU EMODNET Database facility (VLIZ), as well as National/local projects (Smart Buoys – Cefas, RWS current monitoring programmes, CPER MARCO-CNRS/Ifremer, SMILE-CNRS/IFREMER

Mediterranean Sea, CNRS-MIO and CNRS-LOV

JRAP#1 activities build on the Ferrybox infrastructure operated and maintained by the CNRS-MIO together with Tunisian partners, in the frame of A*Midex CHROME-CNRS project.

Question 2: **Please elaborate a list of products derived from the acquired data and/or the analysis method to be used.** (ex. Data assimilation based on xxxx to produce yyy, statistical modeling to forecast XXXa or derive YYY, maps of integrative information , etc…)

Main product: Technical strategy and recommendations towards reliable measurements of phytoplankton dynamics at high spatial and/or temporal resolution, performed by a combination of phytoplankton optical sensors in different European coastal areas, focusing on diverse phytoplankton regimes and communities, responsible for a wide variety of phytoplankton outbursts (mainly but not only, Harmful Algal Bloom).

This strategy and recommendations will benefit from the results of both the literature review provided by WP2.4.2 on optical sensors, WP3.1 on technical and analytical improvements.
The particularity of this JRAP consists in combining different optical sensors based on three approaches (image acquisition/analysis, single-cell analysis and bulk multispectral analysis) for addressing phytoplankton dynamics at a monitoring rate that fits the most species growth rates, on order to be able to get deep in the understanding of the factors triggering the onset, maximum growth and biomass, population successions and collapse pf phytoplankton blooms, of outmost importance for understanding and defining the status, trends and regime shifts due to anthropogenic or global change pressures.

The results will be spatialised and the overall range of spatio-temporal variability in the succession, triggering and ending characteristics of phytoplankton and inner dynamics of phytoplankton communities will be characterised in contrasted European coastal systems, improving (when possible) the understanding of the environmental controls of this variability.

At last, we will combine the biological results with (when available) results of air-sea C-fluxes and carbonate system components results gathered within JRAP#5, in order to better differenciate between biological vs.

solubility carbon pump in different European coastal seas.

Question 3: Science integration in the Bay of Biscay and Med. Sea.
Your advice on and interest in working during 2 years (maybe 3) to write a common paper (or 2, or maybe something more important?) to tackle:

- 1-2 "scientific questions" (to be defined) for the bay of Biscay?
- 1-2 "scientific questions" (to be defined) for the Mediterranean Sea?

Here above referred "Scientific questions" that should be cross cutting and integrative with biology, physics, chemistry.
This means to agree on the scientific focus, make the bibliographic reviews, analysing data and jointly conclude on the results. This is actually what should be the main outcome of the WP4 together with the inputs to the overall JERICO-RI strategy.
Do you and/or some your JRAP team agree? Y/N, if yes please explain what contributions your team could be involved in; if no, please explain why (max 1page).

We discussed together about these propositions during the last Automated Plankton Observation workshop in Gothenburg.

Some of the partners involved within JRAP#1 might be interested in :

- a review and data analysis on the connection between environmental parameters and phytoplankton changes in diversity and abundance/biomass leading to phytoplankton blooms
- joining one of the JRAP#4 (HF Radar and hydrodynamics) field measurements in summer 2017 in the Bay of Biscay, by adapting the JRAP#1 strategy and approaches to hydrodynamic approaches (favouring not only the coupling of physics and biology but also by recommending further inter disciplinary studies
- coupling their current field studies within JRAP#1 together with other JRAPs field studies/techniques (as JRAP#5 and JRAP#6 approaches) in the Mediterranean

Nevertheless, all partners concluded that these efforts concerning Science Integration could also be performed including Nordic regions (Baltic, Straits and Fjords, Channel-North Sea) where many JRAP partners/countries have activities.

Details of Science Integration initiatives:

Baltic Sea

In the Baltic Sea, collaboration between JRAP#1 & JRAP#5 is very strong (same actors, partly same infrastructures).

1. We aim at writing a JRAP1/5 paper on how the different bio-optic proxys for phytoplankton taxonomy/production may be combined with carbonate system dynamics, in analyzing the effectivity of biological C-pump vs. solubility pump. (cooperation between FMI, SYKE, SMHI and other possible collaborators, partly through TNA possibilities)
2. We look for another potential topic combining JRAP#1/5 and JRA#P6

Mediterranean Sea, Aegean Sea

A JRAP#1 & JRAP#5 link is under creation (HCMR, SYKE, CNRS) to test limits of automated tools for phytoplankton coastal observation in the oligotrophic Cretan Sea at the location of JRAP#5 activities (FB, HCB). Contacts have been made and TNA possibilities are explored to test several instruments lower detection limits.

Straits, Fjords and Norwegian Shelf

We intend to combine data from JRAP1/JRAP5 to examine the relative roles of the biological and solubility pumps, especially addressing seasonal and spatial scale. The JRAP activities will also be used for assessing major contributions to coastal acidification (ocean acidification in coastal regions), especially with regards to freshwater input via rivers and fjords. Together with HZG, we plan to look at

carbonate system variability in the North Sea, with collaboration between NIVA/FMI/SYKE/SMHI on inorganic C and total alkalinity fluxes from the Baltic into the North Sea.
We aim to produce JRAP1/5 papers on the interannual variability of the coastal and shelf carbonate system, the influence of marginal inputs and sensitivity to ocean acidification.

North Sea-Channel-Bay of Biscay

A collaboration will be strengthened between JRAP#1, 5 and 4 in order to combine at least one integrated field study combining hydrodynamics, chemistry of carbonate and phytoplankton automated optical sensors, benefitting from the FerryBox platforms and/or JRAP#4 dedicated cruises and measurements (collaboration between HZG, VLIZ, CNRS, AZTI).

3.1.4. Updates with regards to the scientific strategy of your JRAP

No consequent changes were currently experienced during the first year of the project, with regards to the strategy expressed in D4.1.
Most partners developed joint field studies concerning the monitoring of phytoplankton dynamics and blooms (including HABs) in the sites and periods planned for the year 2015-2016. The collaboration was effective at least amongst a pair of partners, subcontractors and non-European laboratories when the expertise was not present in Europe.
For some sites and periods, the year 2015-2016 was dedicated to prepare the actions that will be carried out in 2016-2017 and to make contacts with some of the JERICO-Next partners to complete the actions by incorporating new sensors to the field activities.

3.1.5. Any Comment

JRAP#1 leaders and partners have found difficult to deal with the deadlines requested for reporting about the workshops, as well as on advancement deliverables more than twice a year. These requests are time consuming, when compared to the time allocated to the discussion on scientific approaches and on the analysis of the first results gathered together. They hope there will be enough time to meet and discuss on these matters further in the project, in order to meet the final deadlines of each JRAP.

24 Nov. 2016: Answer from the WP4 leader also scientific coordinator of the project (I. Puillat, Ifremer):
This will be discussed during the next Steering committee meeting to be held the 12-13 Dec. 2016, in Issy Les Moulineaux, near Paris

3.2. JRAP#2: Monitoring changes in benthic biodiversity

PI: Antoine Grémare
Involved institutes: CNRS/HCMR/IFREMER

Objective of the JRAP):
The overall aims of JRAP-2 are: (1) to carry out several sequences of observations in view of practically assessing the interaction between disturbance(s), benthic diversity and functions, and (2) by doing so to contribute to define an optimal strategy to assess the interactions between these three parameters/ processes. More specifically, considering the remineralisation of Particulate Organic Matter (POM) settling at the sea-floor as an indicator of the functioning of the sediment-water interface, JRAP-2 will deploy a series of measurements of (1) benthic (both micro and macro-) diversity, and (2) the functioning of the water-sediment interface in different study areas facing different sources of disturbance.

3.2.1. Main achievements and delays

3.2.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
M1-M6: -Two sampling cruises for maerl biodiversity and habitat structure, fishing pressure in the Bay of Brest -Preparative work was planned to organise the first sampling actions (cruises) that will take place in October 2016 in both the West-Gironde mud-patch and the Cretan Sea. This preparative work was defined in order to define the sampling strategy.	M1-M6: main achievements, - The two sampling cruises for benthic biodiversity and habitat characteristics have been undertaken at the following dates: - 6 & 7 September 2015 - 5 & 6 January 2016 During both cruises, 8 stations distributed on a fishing pressure gradient have been sampled for macrofauna (grab sampling), Megafauna (quadrat pictures), sedimentology, maerl vitality and complexity. Fishing pressure gradient was obtained through calculations based on AIS data from fishing vessels in the area (data from 2012 to 2016). January sampling strategy was adapted using the latest fishing data (October to December 2016). -Sampling strategy and general schedule defined for the two cruises. -For the West-Gironde mud-patch, a total of 10 sampling stations (from 35 to 65 meters deep) were selected in order to cover two parallel transect lines (NE-SW) crossing the whole mud-patch. -For the Cretan Sea, a total of 5 sampling stations (from 10 to 200 meters deep) were selected along a transect line starting from the sewage outfall until a

	control station where no effect of the sewage outfall should be detected
M6-M12: -Two sampling cruises for maerl biodiversity and habitat structure, fishing pressure in the bay of Brest - West-Gironde mud-patch and Cretan Sea. - Cruise preparation - Resolution of material issues (updates and preparation of specific instruments) in view of the first cruises - intercalibration of sampling and analytical procedures across study sites (workshop planned in Bordeaux M12)	M6-M12: - One sampling cruise for benthic biodiversity and habitat characteristics has been undertaken - 25 & 26 June 2015 - 27 & 28 October 2016 During this cruise, 8 stations distributed on a fishing pressure gradient have been sampled for macrofauna (grab sampling), megafauna (quadrat pictures), sedimentology, maerl vitality and complexity. Fishing pressure gradient was obtained through calculations based on AIS data from fishing vessels s in the area (data from 2012 to march 2016). The sampling strategy was adapted using the latest fishing data (October to March 2016). Next sampling cruise is scheduled for the 27 and 28th of October -West-Gironde mud-patch and Cretan Sea – West-Gironde mud-patch cruise: detailed schedule (including detailed task assignments for all participants) has been established for a cruise taking place between the 22/10/2016 and the 02/11/2016 on the R/V *Côtes de la Manche* – Preparation of the instruments that will be deployed in the West-Gironde mud patch, including multicorer, benthic chambers equipped with sensors, oxygen micro profiler. It should be underlined that the initial plan (in the project proposal) also included the deployment of eddy-correlation system. The deployment of such instrument will however be postponed until the second cruise (scheduled in October 2017) due to technical issues. – The scheduled workshop for harmonization of sampling and analytical procedures across study sites has been cancelled. However, JRAP #2 partners agreed with common guidelines in order to harmonize sampling procedures, particularly regarding sampling biological materials for microbial metabarcoding. – Cretan Sea cruise: detailed schedule is being established for a 2-day cruise that will take place in between 10/10/2016 and 17/10/2016

	on R/V Philia

3.2.1.2. Acquired data and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
Ex: Hydrology (T, S, dens)	Sismer centre	processed

3.2.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?

3.2.2. Next steps (Sept. 2016 - Aug. 2018)

when	what
M13-M18: (Sept. 2016-Feb. 2017)	Objectives: – First West-Gironde mud-patch and first Heraklion Bay cruises (M14) – Bay of Brest dredging survey sampling (M13; 16). Two sampling cruises are scheduled (October and early January) – Preparation for joint sampling/experiment aiming at sampling for both biodiversity and functions in the bay of Brest in M20 (April 2017) – Preparation for cruises taking place in M22 (June 2017) in the Cretan Sea and in M24 (August 2017) in the West-Gironde mud-patch. – Data extraction and analyses from (1) first cruises in the West-Gironde mud-patch and in the Cretan Sea and (2) seasonal survey of dredging in the bay of Brest. – Developments of the eddy correlation system

M19-M24: (Mar. 2017-Aug. 2017)	M19-M24: Objectives: – Second West-Gironde mud-patch (M24) and second Cretan Sea (M22) cruises – Bay of Brest dredging survey samplings (M19; M23) – Bay of Brest joint sampling/experiments (sampling for both biodiversity and functioning) in M19. This joint effort will encompass the assessment of the effect of both (1) dredging intensity and (2) invasive species (*Crepidula fornicata*) density on biodiversity and functioning of the benthic compartment in the Bay of Brest along two respective disturbance gradients. – Data extraction and analyses from (1) second cruises in the West-Gironde mud-patch and in the Cretan Sea, (2) joint samplings/experiments in the Bay of Brest, and (3)seasonal survey of dredging in the Bay of Brest. – Preparation for cruises taking place in M29 and M32 (January and April 2018) in the Cretan sea and in M30 and M33 (February and May 2018) in the West-Gironde mud-patch.
M25-M36	Objectives: – Last West-Gironde mud-patch (M30 and M33) and Cretan Sea (M29 and M32) cruises – Bay of Brest dredging survey sampling (M25) – Data extraction and analyses from (1) cruises in the West-Gironde mud-patch and in the Cretan Sea, (2) seasonal survey of dredging in the bay of Brest. – Overall data analyses in view of cross-systems and cross-disturbance type comparisons.

3.2.3. Answers to the STAC after D4.1 report

Question 1: **Please clarify how the JRAP activity links to other ongoing collaborative works/projects, indicate an approximate % age of contribution**.
Project names, project type: (H2020, etc..), contribution to the JRAP:
LifeWatchGreece, ESFRI: 5% contribution to JRAP#2, through the MedOBIS data repository (for the Cretan Sea area) possibility of integrating data from previous studies in the same site.

It is also worth noticing that parts (e.g. WGMP and parts of Bay of Brest actions) of JRAP2 will be achieved In tight connection with national projects (e.g. ANR AMORAD -25% contribution to JRAP2) and BENTHOVAL (10% contribution to JRAP), and AAMP IMPECAP (50% contribution to JRAP). We do believe that such a nesting may prove a key point in building a pan European coastal observatory.

Question 2: **Please elaborate a list of products derived from the acquired data and/or the analysis method to be used.** (Ex. Data assimilation based on xxxx to produce yyy, statistical modelling to forecast XXXa or derive YYY, maps of integrative information, etc…)

Data on benthic biodiversity could be used to estimate the functional diversity of the study areas, in respect to

their sources of disturbance. Based on the measurements of the physicochemical parameters, statistical modelling could be employed to predict responses of the benthic biodiversity under different scenarios. Both analyses can be integrated through indicators which can subsequently be used for the assessment of the ecological status of the sampling stations in all regions of the JRAP#2 implementation.

Data derived from Sediment Profile Imaging can also be used to derive ecological quality status of benthic stations in relation with the nature and the intensity of disturbances.

Corresponding outputs may consist in maps of ecological quality status of benthic habitats using different tools/approaches within tested areas.

Question 3: Science integration in the Bay of Biscay and Med. Sea.
Your advice on and interest in working during 2 years (maybe 3) to write a common paper (or 2, or maybe something more important?) to tackle:

- 1-2 "scientific questions" (to be defined) for the Bay of Biscay?
- 1-2 "scientific questions" (to be defined) for the Mediterranean Sea?

Here above referred "Scientific questions" that should be cross cutting and integrative with biology, physics, and chemistry. This means to agree on the scientific focus, make the bibliographic reviews, analysing data and jointly conclude on the results. This is actually what should be the main outcome of the WP4 together with the inputs to the overall JERICO-RI strategy.
Do you and/or some your JRAP team agree? Y/N, if yes please explain what contributions your team could be involved in; if no, please explain why (max 1page).

Basically, yes provided that the objectives are clear. For example, a recent review paper has been produced by the MERMEX group for the Mediterranean Sea (Marine ecosystems' responses to climatic and anthropogenic forcing in the Mediterranean, Progress in oceanography 91:97-166) and we clearly have to adjust our own objectives not to be redundant.

JRAP2 involved in the assessment of macro benthic diversity (both taxonomic and functional) and microbial diversity (using molecular tools). The latter will be tackled by the HCMR team for all study areas.

Possible scientific questions that could be addressed are:
1) Taxonomic vs functional diversity of macro and micro benthic organisms: two sides of the same story?
2) Microbial and macro benthic co-occurrence: do taxa co-occur more often than expected by chance? Which are the outcomes of this non-random co-occurrence?
3) What are the predictions for benthic biodiversity under increasing disturbance?

3.2.4. Updates with regards to the scientific strategy of your JRAP

Comparing to the initial scientific plan of the JRAP #2 as expressed in the document D4.1. and after the feedback given by the STAC, JRAP #2 partners realized on the interest of developing derived products.

Accordingly, they agreed on the formulation and the development of two kinds of products:
-The first one refers to proposal for developing appropriate sampling designs allowing for the assessment of the impact of different disturbance types on benthic communities and associated ecosystem functions. Such formulation will be formulated after analysing the results of the different study cases investigated within JRAP #2.
-The second one refers to the development and use of ecological quality status indices particularly derived from (1) benthic fauna (abundance and biomass) matrices, (2) qualitative and quantitative analyses of images of the sediment column (sediment imaging profiler) and (3) direct and indirect measures of disturbance intensity.

3.3. JRAP#3: Occurrence of chemical contaminants in coastal waters and biological responses

PI: Luca Nizzetto (NIVA)
Involved institutes: NIVA, HZG, CEFAS, IMR, IRIS

Objective of the JRAP:
1) To identify new contaminants in European coastal waters that are not yet addressed by regulation but which can pose a pressure to the coastal marine ecosystem.
2) To describe spatial distribution of chemical contaminants in European coastal waters exploiting integrated fixed and mobile monitoring infrastructures.
3) To investigate the patterns of the spatial distribution exploiting information from physical and chemical sensors available on the infrastructures.
4) To Analyze co-linearity between contaminant signals and biological signals (specifically tracking the presence of pollution feeding microorganisms in areas with high contamination exposure.
Specific objectives of the JRAP3 are:
-To deliver technical protocols and best practices for the monitoring of chemical pollutants using existing coastal infrastructures
-To optimize existing chemical sensor technology for use on fixed coastal monitoring infrastructures
- To provide guidelines for the implementation of contaminant monitoring using JERICO infrastructures (e.g. information on outcomes from adopting different spatial resolutions.

3.3.1. Main achievements and delays

3.3.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
M1-M5: Purchase and testing of materials for passive sampling deployment on fixed platforms;	**M1-M5**: Accomplished. We designed from scratch a new frame (or cage) for allowing deployment of passive samplers on marine mooring and a totally new protocol for the deployment-collection operation of passive samplers on fixed platforms. We have built two prototypes of the cage in anticorrosion materials (PTFE and high grade stainless steel). We optimized the design and produce a first lot of 15 units. Sampling materials for passive samplers were prepared and installed in the new cages) The cages were sent out to our JERICO partners awaiting for deployments. In few cases the deployment has already started before the planned time).
M7-M12: Initiate Sampling with FerryBox units	**M7-M12:** The sampling through the FerryBox units have already started. We have completed two missions in the Norwegian sea and planned another mission (foreseen in October for the Skagerrak and Kattegat). We estimated that 40% of the sampling activities with FerryBox is accomplished, at date.

3.3.1.2. Acquired date and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
Ex: Hydrology (T, S, dens)	Sismer centre	processed

3.3.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?

3.3.2. Next steps (Sept . 2016-Aug. 2018)

when	what
M13-M24: (Sept. 2016- Sept. 2017)	All sampling activity concluded. These include: - One high resolution campaign in the Baltic Sea-Skagerrak-Kattegat on FerryBox (planned for October-November 2016). The campaign will include consistent chemical and biological sampling for biomolecular markers. Ant sampling of Polycyclic Aromatic Hydrocarbons in Water. - Deployment of passive samplers in all the selected moorings.
M13-M24: (Sept. 2016- Sept. 2017)	Chemical analysis
M24-M36	Data analysis
M24-M44	information sharing with other JRAP and JERICO WP
M36-M44	Synthesis, Dissemination.

3.3.3. Answers to the STAC after D4.1 report

General questions

Question 1: **JRAP activity links to other ongoing collaborative works/projects**

Activities of JRAP#3 are linked to the EU Norman Network of reference laboratory (http://www.norman-network.net/). This is an initiative stemmed from an EU FP7 project that seek to facilitate the exchange of information on emerging environmental contaminants in Europe and encourages the validation and harmonisation of common measurement methods and monitoring tools so that the requirements of risk assessors and risk managers can be better met. The Norman Network is a main tool for informing the development of EU regulation on chemical pollution. Specifically the Water framework directive and the Marine

strategy framework directive. One scope is to gather information on monitoring results and compile lists of detected pollutants from different environmental compartment. Data of contaminants of emerging concerns in marine and coastal waters are still fragmentary in the context of European monitoring activities, since infrastructures to support marine monitoring are limited and gathering data in this case is expensive. Jerico-next is a golden opportunity to cover this gap. Specifically, JRAP 3 will serve to populate much of the missing information on marine coastal water pollution which are necessary for the implementation of the Marine strategy framework directive. We have already presented Jerico activities to Norman workshops and we were explicitly asked to share our data to support Noram activities and aims.

Concerning the case study listed below, JRAP will be active in the following regions:
Bay of Biscay: This is a "supersite" for JRAP 3. In collaboration with JRAP4 we are deploying passive samplers with high spatial resolution to deliver data on chemical tracers that can be used for modelling purposes.
German Bight: Monitoring with Ferry boxes for contaminants of emerging concern. This may provide data for cross comparison with information on micro plastic (See below)

Question 2: **A list of products derived from the acquired data and/or the analysis method to be used**

JRAP 3 will contribute to this list with a map of chemical pollutant distribution for the Kattegat and Skagerrak (derived from high resolution spatiotemporal analysis of a range of contaminants). Based on correlation analysis we will assess whether the distribution of some pollutants can be described by a physical proxy (e.g. temperature, salinity, etc., turbidity) or a combination of them. If this will be achieved we will be able to generate a high resolution map for this region. This would be a relevant products, since Kattegat and Skagerrak receive the outflow from the Baltic (one of the most polluted (from a chemical point of view) sea in the world) and deliver this plume it to the North sea and Norwegian sea.

At least 2 scientific publications are expected to emerge from JRAP#3 activities.

Question 3: **Science integration in the Bay of Biscay and Med. Sea.**

The Bay of Biscay is a "super site" also for JRAP3. Here we deployed passive samplers for pollutants with a spatial resolution, useful for model calibration and assessment. (In collaboration with JRAP4). We can support a second deployment round in this location. To cover temporal variability aspects.
JRAP 3 is active in the German bight with Ferry Box monitoring. We aim at deploying also 2 passive samplers of two fixed platforms. These data will be available for any modelling purpose.

3.3.4. Updates with regards to the scientific strategy of your JRAP

We confirm the support to JRAP4 and include deployment at higher resolution of passive samplers in the Bay of Biscay.

3.3.5. Any Comment

The strategy of this JRAP has considerably changed compared to the one presented in the JERICO-Next proposal. This has been the result of continuous inputs from JERICO management and STAC committee. We are now entering in a phase where additional changes will be difficult to deal with. We however believe that, following the comments from the STAC JRAP3 present a quality piece of work and match JERICO strategy. This makes us happy.

3.4. JRAP#4: 4-D characterisation of trans-boundary hydrography and transport

PI: Anna Rubio (AZTI)
Involved institutes: AZTI, Ifremer, CNR-ISMAR, CNRS, CMCC, HZG

Objective of the JRAP:
JRAP4 aims to demonstrate the potential of coastal observatories and the JERICO Research Infrastructure for the understanding and monitoring of the 4D shelf/slope circulation, with applications in line with several MSFD descriptors. The work will concentrate in three pilot areas (SE Bay of Biscay, NW Mediterranean and German Bight) and rely on the use of information from Observing Systems (HF radar, moored high-frequency thermistor chains, drifting buoys) and high-resolution numerical model experiments (OSSES).

3.4.1. Main achievements and delays

3.4.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
M1-M9 PHASE 4.1 PREPARATION **T4.1.1 State of the art concerning hydrodynamics and methods** OBJECTIVES/SUBTASKS: Review using literature/past work at each study area to identify the key points to be considered for 4D estimates ; Review on methodologies for 4D transport estimations and forecasts (link with TASK 3.2.3 led by CNR-ISMAR)	ACTUAL TIME LINE: unchanged ACHIEVED WORK: -Review of key points completed for D4.1 -Review of methodologies completed for D4.1 Other specific achievements: -M10, AZTI: Completion of work on the application of HF radar to infer surface transports and Short Term Prediction in the SE Bay of Biscay. Related reference: Solabarrieta, L., Frolov, S., Cook, M., Paduan,J., Rubio, A., González,M., Mader, J., Charria, G. Skill assessment of HF radar-derived products for lagrangian simulations in the Bay of Biscay. J. Atmos. Oceanic Technol., 0, doi: 10.1175/JTECH-D-16-0045.1.
M1-M9 PHASE 4.1 PREPARATION **T4.1.2 Analysis of nature runs** Objectives: to assess numerical skills of regional high resolution operational forecasting system actually available in the Adriatic-Ionian basin (AIFS, http://oceanlab.cmcc.it/aifs/) with emphasis on coastal areas; b) to evaluate impact of HF-radar observations on AIFS for the W Adriatic and NW Mediterranean (CMCC).	ACTUAL TIME LINE: Task delayed since nature runs are not yet ready. - M12, CMCC and University of Bologna started an internal collaboration for setting up a re-locatable system in the NW Mediterranean, in order to start new numerical experiments for OSSE. Some delays in activities evolution are representing the major difficulty, due to change in WP3.7 leading. ACHIEVED WORK: CMCC did some significant progress on implementing HF-radar velocity data into AIFS-EnKFDA system that would be used to perform OSSEs in NW Mediterranean region for JRAP-4 activities on the assessment of HF-Radar observing strategies. In particular, Observation operators associated with the radar observation have been started, concerning the design of the numerical setup and implementation in the NW Mediterranean.

	Other specifics achievements: none
M1-M9 PHASE 4.1 PREPARATION **T4.1.3 Discussion of best sampling strategies** Objectives / subtasks: Analysis of the capacity of existing infrastructures to resolve the key processes, reference for demonstrating value-added provided by JERICO_NEXT developments; Definition on the planned sampling strategy and the strategy for OSSES to future definition /evaluation of the sampling strategy in order to reach accurate 4D estimates (and the ability to validate them); Joint identification of metrics/strategy to assess accuracy of 4D estimations and forecasts and of Lagrangian diagnostics (in relation with MSFD).	ACTUAL TIME LINE: M1 – M12 Ongoing discussion on strategy for OSSES in progress, waiting for OSSES and nature runs first results. M1 – M12 Ongoing discussion on of metrics/strategy to assess accuracy of 4D estimations and forecasts and of Lagrangian diagnostics (in relation with MSFD). ACHIEVED WORK: -M7 : Special session on JRAP4 held during the 1st JERICO-Next HF radar workshop in San Sebastian (09-11/03/2016) were JRAP4 science strategy was discussed towards the D4.1. (http://www.jerico-ri.eu/download/JericoNext-HFR-workshop-Minutes_vf.pdf) -M9: Definition of best sampling strategies by study area ready (without OSSES) for first version of D4.1. Other specific achievements: -M10, AZTI, IFREMER: (June 23-24) Poster presentation on the sampling strategy for the Bay of Biscay at ISOBAY XV, Bilbao. Session 1: Physical Oceanography. Towards 4D shelf/slope circulation and transport estimations in the SE Bay of Biscay, within the framework of JERICO-NEXT Joint Research Activity Projects (JRAPs). A. Rubio, A. Caballero, G. Charria, P. Lazure, P. de Mey, L. Marie, J. Mader and I. Puillat.
M1-M9 PHASE 4.1 PREPARATION **T4.1.4 Report JRAP-4 Science Strategy to D4.1**	ACTUAL TIME LINE: unchanged ACHIEVED WORK: M9- JRAP4 Science Strategy for first version of D4.1 was reported in May 2016. Other specific achievements: none
M10-M23 P 4.2 ON-SITE IMPLEMENTATION **T4.2.1 MASTODON**	ACTUAL TIME LINE: unchanged ACHIEVED WORK: Other specific achievements: -M8 and M11, IFREMER. The project for the Campagne Etoile in the SE Bay of Biscay (subject to external funds) was submitted in April 2016 and has been positively evaluated and marked as a priority. Preliminary dates are 3-4/07/2017 (leg1) and 24/07/2017 (leg2). Etoile campaign will be used for deploy mastodon moorings and perform complementary measurements in the HF radar footprint area.
M10-M23 P 4.2 ON-SITE IMPLEMENTATION **T4.2.2 HFR** Objective/subtasks: Implementation of new	ACTUAL TIME LINE: unchanged ACHIEVED WORK: The installation of 2 HF radar antennas in the NW Med area has been completed by

HF radar sites in the framework of the JERICO_NEXT infrastructure.	CNR-ISMAR. The system is composed of 2 SeaSonde antennas at 25 Mhz, installed in the Tino island and in Monterosso respectively, and covering the area of the 5Terre in the Eastern Ligurian Sea. The antennas have been calibrated. Other specific achievements: - M3,M5, CNR-ISMAR Presentation meetings with potential stakeholders: Regione Liguria, Genova, February 14 2016; Italian Navy, Lerici, November 10 2015
M10-M23 P 4.2 ON-SITE IMPLEMENTATION T4.2.3 Analyses of OSSES Objective/subtasks: Interaction with OSSE implementation. The set up and testing of HF radar assimilation using Kalman filtering is presently carried out by CMCC. ISMAR-CNR is collaborating with CMCC providing expertise on the characteristics of HF radar data and on the associated errors and uncertainties. CMR-ISMAR is also providing the HF radar data in the NW Mediterranean Sea and also the historical data in the Manfredonia Gulf (in synergy with WP3.7 and WP3.2)	ACTUAL TIME LINE: Task delayed since OSSEs are under development in the NW Med Sea area ACHIEVED WORK: - Other specific achievements: none
M10-M23 P 4.2 ON-SITE IMPLEMENTATION T4.2.4 Auxiliary instruments	ACTUAL TIME LINE: unchanged ACHIEVED WORK: - Other specific achievements: none Good surprises / opportunities: -M13, MIO will deploy (26-28/10/2016) an ADCP 75kHz during 1 year at the ALBATROSS (IR EMSO and SOERE MOOSE, NW Med) mooring, in the footprint area of their HFRs. This will represent a great opportunity to have data In the water column (surface from HF radar and satellite images) to measure the Northern Current and its mesoscale variability. -M1-2, MIO. The OSCAHR cruise was conducted from 29 October to 6 November 2015 in the NW Med. The first leg sampled the coastal waters near the Cote d'Azur, characterized by the presence of the along-shore Northern Current. During the second leg, an offshore region characterized by strong temperature and chlorophyll gradients has been sampled in the middle of the Gulf of Genoa. The scientific objectives of OSCAHR (Observing Submesoscale Coupling At High Resolution) were to characterize a submesoscale dynamical structure and study its influence on the distribution of biogenic elements and the structure and dynamics of the first trophic levels associated with it. The OSCAHR dataset additionally allows for validation of remote sensing measurements (altimetry, ocean color, reconstitution of planktonic assemblages). The cruise strategy utilizes an adaptive

	approach based on satellite, HF radar maps and numerical modeling data to identify dynamical features of interest. The methodology includes the use of very recent or new instruments that sample the surface layer at high spatial and temporal frequency. In particular, an MVP (Moving Vessel Profiler) has been deployed with CTD, Fluorescence and LOPC (Laser Optical Particle Counter) sensors. Furthermore, a new type of cytometer has been installed that allows for near-time, high through- put sampling of phytoplankton functional groups from micro-phytoplankton down to cyanobacteria (Prochlorococcus).
M10-M23 P 4.2 ON-SITE IMPLEMENTATION **T4.2.5 Data processing & analysis** Objective/subtasks: - Analysis of data from HF radar and other complementary platforms in the NW Med to acquire information on variability at various scales and its impact on transport estimates. MIO and CNR-ISMAR are presently analysing historical data from a TOSCA experiment (December 2011) including data from HF radar, gliders, drifters and satellite. -Analysis of HF radar data and satellite information to study mesoscale structures in the SE Bay of Biscay and their impact on shelf/slope transports	ACTUAL TIME LINE: unchanged ACHIEVED WORK: Other specific achievements: M12 – CNR-ISMAR, Presentation at project INCREASE Workshop, September 13-15 2016, Lerici (Italy) M10 – AZTI Presentation at the congress EOF2016 (Alicante, Spain, July 2016) entitled HF radar insight into rapidly evolving mesoscale structures in the SE Bay of Biscay. A. Rubio, A. Caballero, L. Solabarrieta, L. Ferrer and J. Mader.

3.4.1.2. Acquired data and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
Hydrology (current velocity, wave parameters)	HFR raw and processed (radial) data are archived in each of the sites in two mirrored external HDD. A general backup is made at the central CNR-ISMAR Server RadialCombine, where radial data are also combined into total velocity maps. Both radial and total data are stored locally in NetCDF format and a copy is uploaded to a THREDDS server running on a different	Archived data are: - quality controlled radial velocity data - quality controlled total velocity data - Spectra (raw data)

	machine which provides data access and visualization via the catalog: http://ritmare.artov.isac.cnr.it/thredds/ritmare/CoastalRadarOS/HF_RADAR/Tyrrhenian_Ligurian_Sea/catalog.html	
Hydrology (current velocity, wave parameters)	HF radar data for the SE Bay of Biscay system are stored locally (spectra, radials, totals, waves). Total data converted to netcdf and put available in a thredds server connected ot Emodnet (http://oceandata.azti.es/thredds/catalog/data/RADAR_OO/catalog.html)	Spectra and wave are raw data Radials and totals are quality controlled using basic procedures Gap-filled totals using OMA are produced operationally and upload to a threads test server.

3.4.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?
Photos	Photos of HF radar sites and antennas	email

3.4.2. Next steps (Sept . 2016-Aug. 2018)

They are indicated only if different from the initial planning or any other precision is needed

when	what
M14	Scientific results of Optimal OSE/OSSE System in the NW Mediterranean will be consolidated by M14. Thanks to the new data available in the Ligurian Sea, transport diagnostics will be set up for the NW Mediterranean and preliminary results will be provided by M14. CMCC teamwork agrees to start to think on a more robust design of the data assimilation systems towards operations, in order to capitalize the JERICO-Next future results for improving operational oceanography, ocean forecasting and numerical modelling. Discussions will start inside WP3.
M22	Campagne Etoile in the SE Bay of Biscay (subject to external funds) was submitted in April 2016 and has been positively evaluated and marked as a priority. Preliminary dates are 3-4/07/2017 (leg1) and 24/07/2017 (leg2). Etoile campaign will be used for deploy mastodon moorings and perform complementary measurements in the HF radar footprint area.

3.4.3. Answers to the STAC after D4.1 report

Question 1: Please clarify how the JRAP activity links to other ongoing collaborative works/projects. Project names, project type: (H2020, etc..)

Bay of Biscay

The project LIFE LEMA - Intelligent marine Litter removal and Management for local Authorities (LIFE15 ENV/ES/000252) was finally approved in June 2016, and is starting in September 2016.The project aims at defining a holistic management service to guide local authorities in selecting the most sustainable approach to

address floating marine litter (FML) and to prevent and reduce the impact FML causes to the environment and society. The service will be implemented in 2 transnational regions in the SE Bay of Biscay (Gipuzkoa and Pyreneess-Atlantiques). One of the LIFE LEMA tasks will focus on the applications of modelling tools (in coordination with JERICO-NEXT WP4 Task JRAP 6) and transport characterization from HFRs and other in situ platforms (in coordination with JERICO-NEXT WP4 Task JRAP 4), to specific purposes related with FML. The way to use the information on ocean dynamics for FML trough three approaches (offshore collection, management of FML onshore, and source identification) will be the specific challenge of LIFE LEMA. LIFE LEMA project is, thus, especially well adapted for demonstrating the impact of the proposed innovative solutions of management assisted by Operational Oceanography tools.

The project COCTO (Coastal Ocean Continuum in surface Topography Observations; PIs: N. Ayoub, P. De Mey) funded by TOSCA/ROSES in the frame of SWOT altimetry mission - 2015-2018. This project concentrates on the transition ("continuum") between estuaries and the deep ocean, with a central focus on shelves. It has 3 objectives: (1) advance our understanding of fine-scale dynamical processes within the estuary-mouth-plume-shelf-break-ocean continuum; (2) identify the signature of these processes in current and future measurements, in particular Sea-Surface height (SSH) and other surface measurements; (3) characterize the potential impact of future SWOT measurements, together with complementary in situ measurements, on the estimation of those processes. We will study two regions with geographical similarities (presence of an estuary, wide shelf, macro-tidal dynamics) yet sufficiently different (mainly tropical vs. mid-latitude site) to provide a wide spectrum of physical processes and to open new perspectives for SWOT applications: the Bay of Biscay (including the Gironde estuary) in the North East Atlantic and the Gulf of Tonkin (including the Red River estuary) in the South China Sea. The approach is mainly based on high-resolution numerical simulations, with which we will (1) characterize the relevant dynamical processes, (2) analyse surface signatures of those processes, (2) perform data assimilative impact studies of simulated SWOT observations. Observations (in situ and satellite) will also be explored to better understand those small-scale processes. As one of the regions of interest is the South-Eastern part of the Bay of Biscay, diagnostics developed in this project will be potentially used in the frame of JERICO-NEXT for comparisons between numerical experiments and in situ observations.

NW Med

The IMPACT project (Maritime Cross Border Cooperation Project Italy-France) is presently considered for funding starting by the end of 2016. IMPACT deals with the challenge of managing Marine Protected Areas (MPAs) in coastal regions next to industrial ports, focusing on the North Western Mediterranean Sea. The objective is to define cross border plans to protect MPAs while keeping into account port development in the general framework of Blue Growth. IMPACT will provide a dedicated GIS system with the following information: a) transport by ocean currents between ports and MPAs, based on HF radar and drifter measurements; b) ecological retention properties of MPAs, based on ecological sampling and numerical models: c) contaminant distribution based on historical and dedicated measurements. The project is strictly linked with JERICO-NEXT JRAP4 in terms of transport products and ecological consequences.

The RITMARE Flagship Project extends until the end of 2016, It is the leading national marine research project in Italy and it includes the setup of an Observation System for the Marine Environment (WP5). In this framework, a network of coastal radars is in the process of being implemented, fostering data interoperability and scientific collaboration. In particular, a network of HF radars has been set up in the Tyrrhenian and Ligurian Sea, in coordination with JERICO-NEXt.

Collaboration with the COPERNICUS MARINE ENVIRONMENT MONITORING SERVICE for the Mediterranean Sea is foreseen through the JRAP partner CMCC in the framework of the European Service for Marine Service, operational since May 2015. The Consortium, led by CMCC, is composed by the Italian National Institute of Geophysics and Vulcanology (INGV), the Hellenic Centre for Marine Research (HCRM) and the Istituto Nazionale di Oceanografia e Geofisica Sperimentale (OGS): they are responsible of the Mediterranean Monitoring and Forecasting Centre (Med-MFC). Med-MFC provides regular and systematic information about the physical state of the ocean and marine ecosystems for the Mediterranean Sea, starting from the pre-operational

system developed during the MyOcean projects. The Med-MFC products include analysis, 10-days forecast, specific and targeted products and reanalysis. Products describe waves, currents, temperature, salinity, sea level and pelagic biogeochemistry. Further information are available at http://marine.copernicus.eu

German Bight

A possible cooperation could be developed with the project "Macroplastics Pollution in the Southern North Sea – Sources, Pathways and Abatement Strategies" funded by Lower Saxonia and coordinated by the University of Oldenburg. An important component of this project is the analysis of macro plastic drift at the surface, which fits into the activities planned in JERICO_NEXT.

Question 2: Please elaborate a list of products derived from the acquired data and/or the analysis method to be used.

1- Maps of surface currents and integrated transport

As stated in JRAP-4 section, main efforts will be put in quantifying transport by ocean currents and its potential impact on the distribution of floating matter (plankton - jellyfish or other pelagic organisms, marine litter, pollutants, etc.). In addition to the transport estimations, specific actions within the different study areas will be devoted on producing information and maps on integrated transport that can be used as a basis for several applications, including those of interest of other JRAPs. In the German Bight the plan is to derive transport estimates based on a combination of numerical model, HF radar data and tide gauge observations.

2- Specific products for numerical modelling validations and data assimilation (in coordination with JRAP6)

In the SE BoB the specific cross-cuttings with JRAP-6 will involve joint analysis of data and simulations for model assessment, specific products will be elaborated for this task (e.g. monthly means of surface currents, spectral analysis of surface currents, data and plots of integrated and surface transports with time…). In the **NW Mediterranean Sea**, CNR will be providing HF radar data for numerical model validation, set up of an assimilation system and implementation of an OSSE system. Led by CMCC, the cross cutting action with WP3.7 and JRAP6 consists in the development of an observation operator for assimilation of HF radar radial velocities. A data assimilation system is set up for assimilating HF radar data in the Gulf of Manfredonia area to improve modelling in coastal areas and perform an OSSE in the Adriatic and NW Mediterranean area.

3-Finally, in the SE Bay of Biscay There will be also the possibility to propose integrated products from in situ observations in the region including cruise data in 2017

Question 3: Science integration

The most directly related JRAP is the JRAP6. Although there are identified physical-biological approaches in all of the study areas, there is no any obvious overlap with other JRAP specific topics or data. A common opinion is that it would be nice to consolidate the JERICO-Next knowledge through multidisciplinary publications with other JRAPs colleagues, but only if we can find the historical data for a real cross-cutting integrative exercises. We should think about the scientific questions based on the available data and have the opportunity to discuss more specifically on this, for instance in a dedicated meeting.

3.5. JRAP#5: Coastal carbon fluxes and biogeochemical cycling

PI: Lauri Laakso, FMI; Jukka Seppälä, SYKE
Involved institutes: FMI, SYKE, NIVA, SMHI, HZG, HCMR, CNR, CNR

Objective of the JRAP:
JRAP#5 will exemplify how JERICO-NEXT can contribute to address the role and responses of the European Coastal Ocean and Marginal Seas in the global C-cycle, and to provide recommendations for a European integrated C-cycle monitoring. JRAP#5 will assess the sensitivity of biological and physical controls of air-sea C-fluxes. JRAP#5 will analyse the variability of sea-air C-fluxes and biogeochemical C-cycles, and will provide a mechanistic understanding on how marine biological and physical processes affect the C-cycle.

3.5.1. Main achievements and delays

3.5.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
Task 1 Inventory of methodologies and instrumentation (M6-M9) Objective: Collect detailed information of existing instruments and methodology. Collect information for each main type of instrument (pCO_2, pH, alkalinity, chlorophyll, O_2), their status and maintenance and the typical ranges of analysts. This information provides first-hand information on the diversity of sites and methodologies involved. After this primary information has been pooled (spring 2016) we still have ample time to react if immediate issues in comparability of methodologies arise.	**M1-M12: main achievements** The questionnaire was send in March 2016 to JRAP#5 partners, requesting general information of the study sites, instrument types (pCO2, alkalinity, pH, Chlorophyll/O2), their status, instrument methodology, typical measurand variability at the site, calibration procedures applied, maintenance frequency and methodology and problems & challenges encountered. The questionnaire was finalised by May 2016, with information from all JRAP#5 partners.
Task 2 Inter-comparison of methodologies (M14 -M17) Objective: Within Jerico-next e.g. pCO_2 is measured with at least 6 different methods and instruments, the same diversity of instruments applies also to alkalinity and pH measurements. This diversity may lead to observation results which are not comparable between the sites. The aim of the task is to organise scientific inter-comparison exercise (note, such exerciser has not been described in the original Description of Actions, but the need for such exercise was raised during later phases of planning JRAP#5.	**Main achievements** It was planned that the intercomparisons exercise should take place in Oslo and organized by Lauri Laakso (FMI) and Jukka Seppälä (SYKE) with support from Kai Sørensen and Andrew King from NIVA. Preparations started in February 2016 with a joint meeting at Oslo calibration facility, where technical details and approach of workshop was planned. Until now, we have not yet found enough funding sources for intercomparison including all JRAP#5 participants and alternatives are looked for in M12-14. If funding cannot be organised, the exercise will be postponed or

	maybe even cancelled. We hope to carry out intercomparison exercise after the intensive period, utilizing the potentially unspent TNA funding.

3.5.1.2. Acquired date and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file "data inventory table.xls").

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
Data collection not yet started in JRAP#5.	SOCAT database for pCO2-data	Processed data after the intensive period

3.5.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?

3.5.2. Next steps (Sept. 2016 - Aug. 2018)

when	what
Task 2 Inter-comparison of methodologies (M14 -M17) (Oct. 2016- Jan. 2017)	Within Jerico-next e.g. pCO2 is measured with at least 6 different methods and instruments, the same diversity of instruments applies also to alkalinity and pH measurements. This diversity may lead to observation results which are not comparable between the sites The aim of the task is to organise scientific inter-comparison exercise (note, such exerciser has not been described in the original Description of Actions, but the need for such exercise was raised during later phases of planning JRAP#5 Until now, we have not yet found enough funding sources for intercomparison including all JRAP#5 participants and alternatives are looked for in M12-14. If funding cannot be organised, the exercise will be postponed or maybe even cancelled. We hope to carry out intercomparison exercise after the intensive period, utilizing the potentially unspent TNA funding.

M18-M30: Intensive measurement period (Febr 2017-March 2018)	Objective: The main research period of this JRAP is from spring 2017 to spring 2018, in which we will collect combined carbon and relevant biological data throughout European Seas and analyze the data especially for spatial and temporal variability, and links between the biology, and physical and chemical state of the sea. Intensive measurements are done from spring 2017 to spring 2018 at all sites At each marginal sea several platforms are used.

3.5.3. Answers to the STAC after D4.1 report

Question 1: **Please clarify how the JRAP activity links to other ongoing collaborative works/projects**

Baltic Sea (FMI, SYKE, SMHI)

JRAP#5 build on ferrybox infrastructure operated and maintained by project Algaline (SYKE and SMHI, Baltic Sea co-operation project, in operation >20years, SYKE coordination) and Utö infrastructure operated and maintained mainly by FMI and partly by SYKE (institutional funding). Novel methods to measure biological part of C-fluxes relies partly on developments made in project"Integrated experimental platform development "(SYKE, Academy of Finland 2013-17). All these infrastructures in Finland are part of national marine research infrastructure FINMARI, which coordinates all Finnish marine observations and is partly supported by Academy of Finland.

Work done in streamlining data flows (WP4-WP5 link) will guide the future development of biological/chemical data streaming in Baltic Sea observatories.

Work will guide the selection of operational instrumentation, measurement sites and frequencies as used in Baltic sea monitoring.

Results will be communicated to ICOS and will guide the development of coastal carbon observation systems.

Mediterranean Sea, Adriatic Sea (CNR)

The PALOMA research infrastructure (instrumented elastic beacon) is currently operated and maintained mainly by institutional CNR funding and the Italian Flagship Project RITMARE. Data acquired bot with automated instruments and monthly cruises represent the longest time series in the Adriatic Sea to study and monitor CO_2 sequestration and the ocean acidification (oa) process. It is part of the international network to monitor oa (GOA-ON) as well as of the Italian oa monitoring program (Marine Strategy) and contributes to the Italian project on oa (Acid It). It is a proposed site for the ICOS marine network.

Mediterranean Sea, Aegean Sea (HCMR)

The POSEIDON Ferrybox (PFB) operated (by HCMR) in the past on the route Athens-Heraklion, is currently reactivated (installed to a new ship). The system includes a pH sensor and plans to include also a pCO2 sensor are made.

The EU project FixO3 (open ocean fixed observatories) supports the POSEIDON-E1M3A buoy which

recently has been equipped with a pH sensor.
The HCMR's Project (institutional funding) of monitoring by R/V the Cretan Sea (at the E1M3A buoy location), which runs at monthly frequency since 2010, will be extended to include also sampling next to the Heraklion coastal buoy (HCB) recently deployed. In both locations discrete sampling of carbonate system parameters will be made
An ongoing grant from the European Economic Area (EEA) plans to support a pH sensor that may be deployed on the HCB buoy. The combination of the above data collected from offshore strongly oligotrophic waters with low anthropogenic impact to rather more coastal waters will allow the study of the carbon system exchange rates.

Norwegian Shelf (NIVA)

JRAP#5 activities are in cooperation with FerryBox infrastructure on two ships along the Norwegian coastline and in the North Sea (Skagerrak) that is operated and maintained by NIVA. The activities are also dependent on a NIVA-operated cutting edge carbonate chemistry analytical system for high quality determination of total dissolved inorganic C, total alkalinity, CO_2, and pH. The development of sensors for measuring carbonate system variables is being supported by NIVA Strategic Initiative program on Ocean Acidification and an EU H2020 project Integrated Arctic Observation System.
The results from JRAP#5 activities will go into cooperating project involved with the FerryBox infrastructure, including Norwegian Environmental Agency coastal acidification monitoring work, the Fram Centre, a Norwegian Research Council coastal acidification and management project (ACIDCOAST), and the abovementioned EU H2020 Arctic observation project.

Question 2: **Please elaborate a list of products derived from the acquired data and/or the analysis method to be used.**

Main product: Technical strategy and recommendations towards reliable measurements of air-sea carbon fluxes in different European coastal areas.

Based on the results obtained in JRAP5, we formulate general recommendations how to get reliable information on air-sea C-fluxes in different areas. The strategy build on products of 1) Evaluation of reliability of pCO2, pH data obtained with different equipment/measuring configurations, 2) Observed overall range and spatiotemporal variability in carbonate system components in different European coastal seas and 3) Importance of biological vs. solubility carbon pump in different European coastal seas.

Question 3: **Science integration**

Baltic Sea:

In Baltic Sea collaboration between JRAP1 & JRAP5 is very strong (same actors, partly same infrastructures).

3. We aim in writing a JRAP1/5 paper on how the different bio-optic proxys for phytoplankton taxonomy/production may be combined with carbonate system dynamics, in analyzing the effectivity of biological C-pump vs. solubility pump. (cooperation with FMI, SYKE, SMHI)
4. We look for another potential topic combining JRAP1/5 and JRAP6

Mediterranean Sea, Adriatic Sea (CNR)

Extreme meteorological events (heat waves, floods, cold winds outbreaks,) are becoming more and more frequent, as predicted by global change studies. Coastal areas respond quickly to meteorological forcings and moored instruments are essential to gain data on short time scales also under bad weather conditions. The data acquired in the JRAP5 will allow studying the response, in terms of carbon fluxes, of different coastal sites to meteorological forcings, allowing an estimate of how climate modifications

would affect air-sea CO_2 fluxes in different sub-regions of the Mediterranean Basin.

Mediterranean Sea, Aegean Sea (HCMR)

A JRAP#1 & JRAP#5 link is under creation to test limits of automated tools for phytoplankton coastal observation in the oligotrophic Cretan Sea at the location of JRAP#5 activities (FB, HCB). Contacts have been made and TNA possibilities are explored to test several instruments lower detection limits.
The JRAP#2 & JRAP#5 link is strong since benthic biodiversity is studied in the same area as JRAP#5 activities

Link with JRAP6 & JRAP5 since the carbonate system data collected may be used to setup model predictions for solubility pump

Norwegian Shelf (NIVA)

We intend to use carbonate system data from JRAP1 to examine the relative roles of the biological and solubility pumps, especially addressing seasonal and spatial scale. The JRAP activities will also be used for assessing major contributions to coastal acidification (ocean acidification in coastal regions), especially with regards to freshwater input via rivers and fjords. Together with HZG, we plan to look at carbonate system variability in the North Sea, with input from FMI/SYKE/SMHI on inorganic C and total alkalinity fluxes from the Baltic into the North Sea.
We aim to produce JRAP1/5 papers on the inter annual variability of the coastal and shelf carbonate system, the influence of marginal inputs and sensitivity to ocean acidification.

3.5.4. Updates with regards to the scientific strategy of your JRAP

As a response to STAC question, we have formulated in more detail the focused science questions, for whole JRAP#5 and separately for each area.

The general question JRAP#5 answers is, how to organise future network for reliable and consistent C-flux measurements in European seas, which differ largely in their characteristics (e.g. carbonate chemistry and biological pump). This requires that we answer sub-questions: 1) how reliable and comparable is the data collected with different measuring configurations, 2) what are the overall ranges and variabilities in carbonate system components in different areas and what are the required measurement frequencies to cover all details, and 3) based on collected data (which is not having 100% coverage for all variables in all areas) how important is biological carbon pump relative to solubility pump.

The focused specific science questions for each area :
Baltic Sea: How are the carbonate system dynamics and phytoplankton productivity linked in the atrophied waters?
Med Sea, Adriatic Sea: How does the meteorological forcings affect carbon fluxes
Med Sea, Aegean Sea: In the oligotrophic area, are we able to see any indications of biological pump, using contemporary automated methods for phytoplankton detection?
Norwegian Shelf: What are the relative roles of biological and solubility pumps, especially at different seasonal and spatial scales?

3.6. JRAP#6: Operational oceanography and coastal forecasting

PI: Baptiste Mourre
Involved institutes: SOCIB, AZTI, IH, HCMR, CMCC, CNR, FMI, IMR

Objective of the JRAP:
JRAP#6 aims to show the importance of JERICO-NEXT observations for the assessment of operational regional models implemented in the coastal ocean, leading to recommendations for coastal forecasting system improvements, both in terms of models and observations. These objectives will be achieved through a coordinated evaluation of numerical models in seven European coastal areas affected by different physical processes, complemented by model sensitivity tests and data assimilation experiments including Observing System impact studies (OSEs and OSSEs).

3.6.1. Main achievements and delays

3.6.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
M1-M8 **JRAP6 preparation, coordination and strategy** – Define strategy – Define data, models and working plans for the eight partners – Define JRAP6 organization, timeline and reporting	**M1-M8** **JRAP6 preparation, coordination and strategy** – Common strategy defined – Data, models, periods of study and working plans defined – Time line and organization agreed among partners – Strategy iterated with WP4-WP1 leaders according to STAC feedbacks
M9-M18 **Subtask 1.1 - Model assessment using JERICO observations** **Ibiza Channel** – Setup of numerical simulations in the Western Mediterranean Sea – Data acquisition and compilation (HF radar, gliders and mooring in Ibiza Channel) – Developments of tools to compare with model outputs	**M9-M13** **Subtask 1.1 - Model assessment using JERICO observations** **Ibiza Channel** – Setup of numerical simulations: 2-km resolution WMOP operational predictions and long-term free run with the same parameters. High resolution atmospheric forcing from the Spanish Meteorological Agency. – Compilation and first analysis of HF radar data (2013-2016), development of tools to compare with model outputs: EOFs, spectrum, Hovmuller diagrams. – Compilation and first analysis of glider data

	(2011-2016): transport time series across the Ibiza Channel – Compilation and first analysis of mooring data (2009-2016): time series of T, S, UV at fixed locations
Adriatic Sea – Model setup in the Adriatic Sea – Data assimilation setup – Data acquisition – Development of model skill scores	**Adriatic Sea** – Model setup**:** AIFS (Adriatic-Ionian Forecasting System) based on NEMO at 1/45° horizontal resolution and 121 z-levels with partial steps; – Data acquisition: HF-radar data in the W Adriatic (CNR La Spezia), fishing vessels data in the Northern Adriatic (collaboration with CNR Trieste) – CMCC is presently working on assessing AIFS skill scores
Atlantic Iberian margin – Data collection by the MONICAN system – Model setup: LAM-HOPS nested in HYCOM – Evaluation of atmospheric forcing conditions – Skill assessment of reg-HYCOM in area of influence of Nazare Canyon – Skill assessment of LAM-HOPS coupled to reg-HYCOM, without assimilation.	**Atlantic Iberian margin** – Data collection: • Data was collected from MONICAN1 (1800m) buoy from Sep2015 to Sep2016 • Data was collected from MONICAN2 (90m) buoy from Sep2015 to March2016. • Data was collected from Nazare and Peniche tidal stations from Sep2015 to Sep2016. • Data was collected from Ferrel coastal meteo station from Sep2015 to Sep2016. • *Not accomplished:* Due to technical problems MONICAN2 buoy was not in operation from March2016 to the present. Planned to be redeployed in October/November2016. – Revised strategy: Evaluation of models without assimilation was enlarged to also include simulations for the periods June-July2007 and March-April2011 for which consistent data sets exist and were already planned to be explored in the following objective (Models with assimilation). This required to consider results from the regional NEMO model (provided by COPERNICUS CMEMS) for the two selected periods – Model implementation: • LAM-HOPS was implemented and configurations for 2007 and 2011 simulations

	are being tested. • Coupling of this model to the regional models (reg-NEMO and reg-HYCOM) is ongoing. CMEMS) for the two selected periods – Atmospheric Forcing evaluation: 3 periods were selected for this evaluation: • March-April2011 (early upwelling conditions) Meteorological measurements are available from the 2 MONICAN buoys, the Ferrel coastal station and from ship measurements. Forcing fields from ERA-Interim and Aladin were retrieved for the comparisons. Ongoing work. • March-October2012 (summer conditions), measurements from 2 MONICAN buoys and Ferrel station. ECMWF fields retrieved for assessment. Ongoing work • October2015-May2016 (winter conditions), measurements from 2 MONICAN buoys and Ferrel station. ECMWF fields were retrieved for assessment. Ongoing work. - Processing of previously collected data sets to be used in model skill assessment (points 3 and 4 of initial plan) a) Survey 13 June to 03 July 2007 • Ongoing processing of data collected onboard (450 CTDs/VMADCP). • Processed data collected on 3 current meter moorings • Retrieved and processed atmospheric forcing fields (ERA-Interim) for global period. • Retrieved and processed available SST data for global period (JPL-MUR) b) Survey 29March-16April 2011 • Processed data collected on board (161 CTDs), ongoing processing LADCP/VMADCP data • Ongoing processing data collected on two multipara metric buoys (MONICAN1 and MONICAN2) • Processed data collected at two current meter moorings • Retrieved and processed available SST data for global period (NAVO Globe) • Retrieved and processed atmospheric forcing fields (Aladin, ERA-Interim) for global period. - Access to regional model results a) Retrieved NEMO regular grid daily averaged

	fields for period June-July 2007 from COPERNICUS CMEMS. Development of routines for handling and pre-processing model fields. b) Retrieved test files from reg-HYCOM. Development of routines for handling and pre-processing model fields.
Aegean Sea – Setup of simulations in the Aegean Sea – Data collection – Introduction of wave-current interaction terms to the Aegean Sea hydrodynamic model – Preparation of glider deployments	**Aegean Sea** – Assessment of the Aegean Sea hydrodynamic model with and without data assimilation by performing annual (during 2013) experiments. Emphasis was given to the SST forecast error and its future reduction – Observations used: Satellite SSH and SST (bulk temperature); In situ data: Argo T/S profiles within the Aegean, the Ionian and the Libyan Sea; POSEIDON buoys data. – Introduction of the wave dissipated energy term (estimated by the WAM model) into the turbulence closure scheme of the Aegean Sea model. Initial tests performed for year 2013. The wave dissipated energy is calculated by a WAM (Cycle 4.5.4) model implementation for the Aegean Sea. – Acquisition and installation of all the necessary equipment for the support of the operation of the glider observing module. Preparation of the two glider units in order to be ready for the deployments.
South Bay of Biscay – Setup of simulations in the Bay of Biscay, coupling ROMS, NEMO and WRF – Inclusion of river forcing	**South Bay of Biscay** – Using Matlab, we prepared the coupling between ROMS and the outputs from NEMO and WRF. The study area covers the Basque Country area with a resolution of 670 m (43.2° N – 48° N, 6° W – 0.9° W) and 32 sigma levels in depth. Hourly WRF outputs (atmospheric forcing) and daily NEMO outputs were used for ROMS. The NEMO data used in ROMS for the boundary conditions consist of daily outputs for temperature, salinity and velocities (3D),

	and sea level height (2D). The eight main harmonic components of the tide are included from the OSU TOPEX/Poseidon Global Inverse Solution (TPXO). – At present, we incorporate in ROMS the mean freshwater discharges from the Nervión, Oria, Bidasoa, and Adour Rivers. With the aforementioned information, we obtain 96-h forecasts. These forecasts are still under analysis and they are not open to the public. – Problems: Using daily information from NEMO, it is possible that there is a residual due to the eight harmonic components of the tides, i.e. these components are not totally removed from the data. Therefore, the incorporation of these components using TPXO could generate instabilities in the numerical result. This aspect must be revised carefully.
Norwegian Sea – Information not received **Baltic Sea** Preparation of the in-situ measurement campaign to be carried out in spring 2017 – spring 2018, as part of JRAP#5	**Norwegian Sea** – Information not received **Baltic Sea** First steps towards the preparation of the intensive measurement period (definition of study sites, instrument types and methodologies, see JRAP#5).
Subtask 1.2 - Data-assimilative model assessment and Observing System Experiments (OSEs) – Preparation of OSEs: period of study, assimilated validation measurements – First steps of development of data assimilation systems	**Subtask 1.2 - Data-assimilative model assessment and Observing System Experiments (OSEs)** **Ibiza Channel** – Definition of test period for HF radar OSE according to the availability of independent validation measurements in the study area (mooring current meter and drifters) **Adriatic Sea** – Data assimilation setup: AIFS-EnKFSA, application of a standard 3D Ensemble Kalman Filter on DART (www.image.ucar.edu/DAReS/DART/) – Progress was made on implementing HF-

Subtask 2.1 - Recommendations for modelling strategy improvements – Perform model sensitivity tests	radar velocity data into AIFS-EnKFDA system that would be used to perform OSEs in the south Adriatic region – The development of HF radar observation operators has been started – Some delays in activities evolution are representing the major difficulty, due to changes in WP3.7 leadership **Subtask 2.1 - Recommendations for modelling strategy improvements** **South Bay of Biscay** – A sensitivity test was made with ROMS to analyze the effect of high river discharges due to strong storms and rain. For this test, we used the real freshwater discharges registered on January 15-18, 2013. The effect of the river plumes on the sea surface circulation is noticeable and also the strong gradient of salinity. From this result, we conclude that it is necessary to include in the modeling a prediction of the river discharges instead of mean values.

3.6.1.2. Acquired date and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
T,S (glider Ibiza Channel) UV (HF radar Ibiza Channel) T, S, UV (mooring Ibiza Channel)	SOCIB SOCIB SOCIB	Processed L0 L1 L2 Processed L0 L1 Processed L0 L1
MONICAN system observations • MONICAN1 buoy (1800m) *Periods:* - Out2015-May2016 - May2016-Sep2016 *Parameters:* - Meteo(Wind,Patm,Tair,Hmd)	• IH database	Period1: QC Period2: Real Time data: QC Archived data: Raw

- Waves - T (6 depths), Currents(ADCP) • MONICAN2 buoy (80m) *Periods:* - Out2015-Mar2016 *Parameters:* - Meteo(Wind,Patm,Tair,Hmd) - Waves - T (2 depths), Currents(ADCP) • Ferrel coastal meteo station *Periods:* Sep2015-Aug2016 *Parameters:*Wind,Patm,Tair,Hmd • Nazare tide gauge *Periods:* Sep2015-Aug2016 *Parameters:* Sea surface height • Peniche tide gauge *Periods:* Sep2015-Aug2016 *Parameters:* Sea surface height **Opportunity ship observations** • 3 CTD casts near MONICAN1 (May2016) - P,T,C,S,Turb (pmax=1927dbar, 808dbar, 53dbar)	• IH database • IH database • IH database • IH database	QC Raw Processed Processed Raw
HF radar data from the Basque operational system.	AZTI	These data have the standard format.

3.6.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?

3.6.2. Nextsteps (Sept . 2016-Aug. 2018)

when	what
M13-M18	Subtask 1.1 - Model assessment using JERICO observations **Ibiza Channel**

	– Complete WMOP model assessment using HF radar, glider and mooring data in the Ibiza Channel – Provide synthesis to JRAP6 subtask 1.1 report **Adriatic Sea** – Complete AIFS model assessment in the S Adriatic Sea – Provide synthesis to JRAP6 subtask 1.1 report **Atlantic Iberian margin** – Complete atmospheric forcing skill assessment (M14) – Complete processing data for June-July2007 period (M14) – Model simulations and skill assessment for June-July2007 period with regNEMO+LAM_HOPS (M14-M15) – Complete processing data for Mar-Apr2011 period (M15) – Model simulations and skill assessment for March-April2011 period with regNEMO+LAM_HOPS (M15-M16) – Complete processing data collected during period of 2016 selected for skill assessment (M16). – Model simulations and skill assessment for period in 2016 period with regHYCOM+LAM-HOPS(M16-M17) (Tentatively period in Oct/Nov2016 for which opportunity ship measurements can be conducted) – Provide synthesis to JRAP6 subtask 1.1 report **South Bay of Biscay** – The coupling between ROMS and NEMO must be revised, especially the possible problem with the tides. Therefore, it is necessary to contact with the organization providing the NEMO data, i.e. Puertos del Estado. – The incorporation of river discharges must be analysed in order to obtain an appropriate data for ROMS, closer to the real discharges. – ROMS will be run daily, generating hourly outputs of the main variables (temperature, salinity and velocity fields). – The dispersal model included in ROMS will be activated and also the coupling off-line with the Sediment, Oil spill, and Fish Tracking model (SOFT), a Lagrangian particle-tracking model. – The operational system will be revised, in function of the results obtained in the M13-M18 period. – Comparisons with available data from surface drifters, HF radar, and CTDs will be performed and analysed. – Provide synthesis to JRAP6 subtask 1.1 report **Aegean Sea** – Complete Aegean Sea model assessment

	– Provide synthesis to JRAP6 subtask 1.1 report **Norwegian Sea** – Information not received
M18 (March 2017) **M38 (November 2018)**	**Subtask 1.1 report** **Baltic Sea** – Incorporate WAM wave model assessment results in terms of wave-induced turbulence and its impact on algae blooms in the Baltic Sea in subtask 1.1 report
M13-M30	**Subtask 1.2 - Data-assimilative model assessment and Observing System Experiments (OSEs)** **Ibiza Channel** – Development and test of HF radar data assimilation – Performance and evaluation of HF radar OSE experiment **Adriatic Sea** – Consolidation of HF radar data assimilation setup and associated observation operators – Performance and evaluation of HF radar OSE experiment in the South Adriatic region **Atlantic Iberian margin** – Simulations and skill assessment for period June-July2007 with assimilation of collected data in LAM-HOPS – Simulations and skill assessment for period March-Apr2011 with assimilation of collected data in LAM-HOPS – Simulations and skill assessment for selected period in 2016 with assimilation of collected data in LAM-HOPS – Processing of HF radar data collected in Nazare Canyon area during period July-December2011 for model assimilation – Development of strategy for assimilation of HF radar data in LAM_HOPS – OSEs to assess the impact of buoy data and HF radar measurements **Aegean Sea** – The introduction of the glider observation module in the Aegean is currently an ongoing activity with the pilot missions to be scheduled for the autumn of 2016. The operational use of the glider units is expected to begin in the first months of 2017 – The collected data from glider missions will be

M30 (March 2018)	undergone through the quality control procedures that are recommended by the EGO community and the EuroGOOSDataMeq working group. – OSE to assess the impact of glider and FerryBox data **Subtask 1.2 report**
M13-M38 M38 (November 2018)	**Subtask 2.1 - Recommendations for modelling strategy improvements** **Ibiza Channel** – Analysis of sensitivity tests about model parameters (momentum diffusion and large scale model in particular) – Provide recommendations about modelling strategy **Adriatic Sea** – Analysis of model sensitivity tests – Provide recommendations about modelling strategy **Atlantic Iberian margin** – Analysis of model sensitivity tests (in particular on model code and resolution) – Provide recommendations about modelling strategy **South Bay of Biscay** – Analysis of model sensitivity tests – Provide recommendations about modelling strategy **Aegean Sea** – Study the contribution of air-sea interactions to the Aegean Sea model performance by introducing air parameters from an alternative to POSEIDON atmospheric model (WRF implementation at 1/20 resolution over the Mediterranean Sea) for year 2014. – Sensitivity runs to decrease model SST bias **Norwegian Sea** – Information not received **Baltic Sea** – Analysis of WAM model sensitivity tests – Provide recommendations about modelling strategy **Subtask 2.1 report**

M13-M40	**Subtask 2.2 - Observing System Simulation Experiments (OSSEs) and recommendations for coastal observing systems** **Ibiza Channel** – Setup of OSSE experiment: definition of nature run and model perturbations – Generation of virtual HF radar observations in the Western part of Ibiza Channel – Assessment of the impact of such observations **Adriatic Sea** – due to recent improvements on AIFS-EnFKDA model setup, CMCC will provide a more detailed test performances of assimilation based on a nature run in the W Adriatic using the free run produced by the unstructured model SANIFS – CMCC plans to proceed with new experiments for OSSE in the W Adriatic using SANIFS – CMCC teamwork agrees to start to think on a more robust design of the data assimilation systems towards operations, in order to capitalize the JERICO-Next future results for improving operational oceanography, ocean forecasting and numerical modelling. **Atlantic Iberian margin** – OSSE to evaluate the added value of T-S profiles over a larger area
M40 (January 2019)	**Subtask 2.2 report**

4. Conclusions

The reported actions show that technical preparations were undertaken before deployment, some methodologies were reviewed, some field works are already done, some buoys and other systems are deployed and acquiring data, two WP3&4 joint workshops were organised. As a conclusion, JRAPs are well progressing with respect to their initial plans even if they are not developing along the same time line. Indeed some JRAPs already started their data acquisition, whereas some other will start this step later. Some important reported issues will be discussed during the next Steering Committee Meeting to be held the 12-13 Dec. 2016. The upcoming important action in 2017 is to well coordinate the JRAPs data acquisition with the data management led in WP5, whereas 2018 will be more dedicated to work on the products delivered by JRAPs as JERICO-RI product prototypes.

5. Annex: "Report of WP4 meeting with the Scientific and Technical Advisory Committee (STAC) & Contributions to the JERICO-NEXT science strategy"