

French-Japanese Ocean Development Sub-Committee
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Summary

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1. Strategic approach for oceanographic research

Three French speakers and one Japanese speaker explained strategic approach for oceanographic research as follows:

1.1 Introduction on the national research strategy and the national support to marine research in France

Dr. Jean-Marie FLAUD and Mr. Alain LAGRANGE, Ministry of Higher Education and Research introduced the national research strategy and national support to marine research.

Since 2005, a number of important national initiatives have been launched including the creation of a funding agency for research (ANR; 2005), a research evaluation agency (AERES; 2007), a new education law increasing the universities' autonomy (2007), followed by another law (2013) for higher education and research regional clustering, and implementation of a national Research Strategy with the help of multiannual (5 years) financial programming.

The French research and innovation system is coordinated by the Ministry of Higher Education and Research together with the other concerned Ministries and the Regions, within the European Research Area. As consultative bodies contributing to the national programming, there are 5 national Research Alliances bringing together the national research institutes and foundations as well as the universities and 'Grandes Ecoles'.

All these initiatives have been possible thanks to an R&D national budget which has been regularly increasing since 2005. In 2013, the R&D total expenses reached a total of 47.2 Billion Euros representing 2.23% of national GDP (EU objective: 3% GDP) and a total employment of about 260,000 researchers shared between the public (103,000) and the private (157,000) sectors. In comparison, marine sciences in the public sector represent a total of 3,600 researchers (3.5% of total) for a budget of 388 Million Euros.

In regard to scientific publications, France occupies the 6th position and is 2nd in Europe for public patent registration. In the last 10 years, France has got 8 Nobel prizes and 4 Fields medals.

Currently, there are 3 main topics of concern: 1) improving the university system to favour students' success; 2) creating synergies and facilitating cooperation between universities and national research institutes; 3) speeding up the dynamics of innovation while bridging the gap between public and private research.

The National Research Strategy ('France-Europe 2020') aims at mobilizing all stakeholders around 10 great societal challenges:

- Sustainable resources management and climate change adaptation
- Secure, clean and efficient energy
- Industrial rebirth
- Health and wellbeing
- Food security and demographic challenge
- Mobility and sustainable urban systems
- Information and communication society
- Innovative, inclusive and adaptive societies
- A space ambition for Europe
- Liberty and security for people

The National Research Strategy was translated to 5 action Plans.

The 'Earth system' Action Plan includes 4 main marine goals: intelligent monitoring, sustainable management of natural resources, assessment and monitoring of climate and environmental risks, a coastal (littoral) laboratory.

As regard the main large research infrastructures, those concerning marine sciences are the European multidisciplinary seafloor and water column observatory (EMSO), the French fleet of research vessels (FOF), and Euro-Argo as the European contribution to the Argo international programme.

At the European level, a Joint Programming Initiative (JPI) has been set up regarding the oceans (JPI

Ocean). It is a research coordination platform which covers all European sea basins with 21 member countries participating to its management board. It is open to European member states but welcome as well cooperation with other countries like it could be the case with Japan.

Amongst its 10 strategic areas (www.jpi-oceans.eu), France supports 4 pilot actions: ecological aspects of microplastics, multi-use of infrastructure for monitoring, ecological aspects of deep sea mining, intercalibration for the EU Water framework directive.

1.2 Future of the ocean as a global issue

Ms. Nevine KOCHER, Ministry of Higher Education and Research explained future of the ocean as a global issue as follows:

Ocean research is globally guided by a number of initiatives and frameworks like the IPCC (COP 21 in Paris), the SDGs including SDG 14 on oceans (Life below water), the ICSU Future Earth programme, the EU Horizon 2020 programme (Research and Innovation), and very recently the Tsukuba Communiqué from the G7 Science and Technology Ministers' Meeting.

The SDG 14 (Life below water) is about 'Conserving and sustainably using the oceans, seas and marine resources for sustainable development' which amongst its 10 targets, aims at preventing and reduce pollution, managing and protecting marine ecosystems, assessing ocean acidification and its effect, increasing scientific knowledge, developing research capacity and transferring marine technologies.

The follow up of the Agenda 2030 SDGs goals and targets require a set of global indicators to then produce annual progress reports using national and regional scales data. At the European level, the European Commission published a report on "the role of science, technology and innovation policies to foster the implementation of the SDGs" (2015). Therefore the SDGs have been translated into the research programme 'Horizon 2020' with two ocean-related societal challenges: 1) Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy; 2) Climate action, environment, resource efficiency and raw materials. Besides SDG 14, it includes the SDG 13 about "taking urgent action to combat climate change and its impacts", as well as the conclusions of COP 21 Paris Agreement.

Last May in Tsukuba, the Science & Technology Ministers' Meeting highlighted two ocean-related issues (Deep sea mining; Marine litter and plastic wastes), confirming the the results of the last G7 Science & Technology Ministers' Meeting in Berlin in 2015. In addition, it was highly recommended to combine (integrate) research and share costly-to-operate research instruments and infrastructures. The G7 Future of the oceans final communiqué stipulates:

"The seas and oceans are changing rapidly, with overuse and destruction of marine habitats, warming, increased ocean acidity and depleted oxygen.

The health of the oceans has been recognized as a crucial economic development issue and was included as the UN sustainable development goal 14.

Despite this progress, many parts of the ocean interior are not sufficiently observed...it is crucial to develop far stronger scientific knowledge..."

At EU level, the EU Horizon 2020 research programme, is open to third party countries like Japan which is among the 'priority partner countries' and as such, is fully open to participants from Japan with the help of the Japan Science and Technology Agency (JST) on selected calls. The JEUPISTE project offers guidance and support for cooperation between EU and Japan within Horizon 2020 (National contact point: Olivier Steffen (Olivier.steffen@recherche.gouv.fr)).

1.3 Focus on oceanography and common interest in the Pacific Area

Mr. Anisse BEN YOUNES and Ms. Vigdis BEAUSSIER, from the Ministry of Foreign Affairs and International development, gave a presentation on oceanography and common interest in the Pacific Area as follows.

France has a huge EEZ over the three oceans thanks to its overseas territories, more particularly in the Pacific which represents more than 50% (6.8 million km²) of the total French EEZ (10.2 million km²).

The top priority regarding French Overseas Territories in the West Pacific is their regional integration. The France-Oceania Summit is a partnership dialogue mechanism established in 2001 to bring together France and its Pacific territories in a dialogue with the Pacific Forum countries and other regional organizations about current political and security, economic, environmental, social and development issues. The last one was hosted by the Government of France at the end of 2015. On this occasion, President François Hollande set out three challenges for France-Oceania cooperation: to help the Pacific region find its place in the global economy, to preserve biodiversity, and to tackle climate change.

The last year has seen a momentum for the France - Japan relationship, with the visit of Prime Minister Manuel Valls to Japan in October 2015, mutual visits of the Ministers for Foreign Affairs in January and April 2016 and the G7 summit which was held in Japan just a few days ago.

2016 will be an eventful year for scientific and technological cooperation between France and Japan: the France-Japan Year of Innovation was launched on October 5th, 2015, and will run until the end of the year, and the France-Japan Joint Committee for Science and Technology will meet in the coming months, to define the orientations of our scientific cooperation in the coming years.

While a number of Japanese oceanographic campaigns have been carried out in the French EEZ since 2012, it is hoped that, in the future, we will see more joint cruises operated in the West Pacific between France and Japan. There is an ongoing reflexion to strengthen cooperation between the two countries on a number of topics, based on a transversal approach. Subjects which could benefit from this approach include the issue of ocean monitoring, but also the study and exploitation of deep sea mineral resources.

1.4 Japanese strategic approach for oceanographic research

Mr. Eisho SATO, the Japanese co-chair, explained Japanese strategic approach for oceanographic research as follows. Firstly, he explained the governmental organizations that were in charge of ocean policy and ocean research. Headquarters for Ocean policy is in charge of ocean policy and Ministry of Education and Science is in charge of ocean research. Headquarters for Ocean Policy was established based on the Basic Act on Ocean Policy that was effective in 2007. Members of Headquarters for Ocean Policy are all the Ministers. The Secretariat of Headquarters for Ocean Policy is in Cabinet Secretariat. The Cabinet approved New Basic plan in Ocean Policy in 2013 and Japan's Arctic Policy in 2015. He also explained the structure of Ministry of Education, Culture, Sports, Science and Technology (MEXT). Oceanographic research is conducted by Ocean and Earth Division, Research and Development Bureau in MEXT.

Secondly, he explained five main research activities that were conducted by Ocean and Earth Division in MEXT. The main activity 1 is about arctic research named Arctic Challenge for Sustainability (ArCS). ArCS is 5 year project between 2015 and 2019, whose budget is 5.5 M USD. Activities of ArCS consist of supporting for international joint research, establishing research stations in Arctic States, and dispatching young researchers. The objectives of ArCS are to understand changes in Arctic holistically, to understand causes and mechanism of these changes, to predict changes that would occur in future, and to deliver robust scientific information to stakeholders. The main activity 2 in Ocean and Earth Division in MEXT is about Antarctic research. Antarctic research is conducted by National Institute of Polar Research. Antarctic observation is conducted by several Ministries including Ministry of Education and Science (MEXT), Ministry of General Affairs, Japan Meteorological Agency, Japan Coastal Guard. International research is cooperated with US, UK, Germany and so forth. The main activity 3 in Ocean and Earth Division is about research on Tohoku marine ecosystem, which was devastated by 2011 Great East Japan Earthquake and its Tsunami. Research on marine ecosystem consists of monitoring of ocean environment, monitoring of marine ecosystem, monitoring of rubble distribution, monitoring of young fish distribution, debriefing to fisherman, improving fishing method, and analyzing recovery process of marine ecosystem. The main activity 4 in Ocean and Earth Division is about research on seafloor mineral resources. Tokyo University implements the main research cooperating with Ministry of Education and Science (MEXT) that is in charge of scientific research development, and

with Ministry of Economic, Trade and Industry (METI) that is in charge of technology development for commercialization. Subjects of the research include development of acoustic survey on hydrothermal areas, estimation of distribution of Cobalt-rich crust, in-situ chemical measurement, exploration and structural analysis of hydrothermal ore and so forth. The main activity 5 in Ocean and Earth Division is about promoting JAMSTEC's research. JAMSTEC's main activities are: research on submarine resources, research on ocean and global climate change, research on seismogenic zones, research on marine bioscience, promotion of integrated ocean drilling science, development of cutting-edge integrated information science, and construction of research base to explore the ocean frontier. He also explained research vessels managed by JAMSTEC.

Thirdly, he briefly explained the discussion of G7 Science and Technology Minister Meeting in Tsukuba that was held on 15-17 May 2016. Communiqué on G7 Ministers of Science said: In support of the achievement of the SDG14 and other relevant goals and of the objectives of related conventions, we support taking the following actions:

- i. Support the development of an initiative for enhanced global sea and ocean observation required to monitor inter alia climate change and marine biodiversity, e.g. through the Global Argo Network and other observation platforms, while fully sustaining and coordinating with ongoing observation;
- ii. Support an enhanced system of ocean assessment through the UN Regular Process to develop a consensus view on the state of the oceans, working to a regular timescale which would enable sustainable management strategies to be developed and implemented across the G7 group and beyond;
- iii. Promote open science and the improvement of the global data sharing infrastructure to ensure the discoverability, accessibility, and interoperability of a wide range of ocean and marine data;
- iv. Strengthen collaborative approaches to encourage the development of regional observing capabilities and knowledge networks in a coordinated and coherent way, including supporting the capacity building of developing countries; and
- v. Promote increased G7 political-cooperation by identifying additional actions needed to enhance future routine ocean observations.

He also quoted oceanographic related part of the statement in G7 Ise-Shima Leaders' Declaration, which said: "we support scientific work to enhance global ocean observation and assessment for the science-based management, conservation and sustainable use of marine resources."

2. Keynote speech

2.1 Keynote speech of Japanese side

Dr. Teruhisa KOMATSU explained past, present and future collaboration in oceanography between Japan and France for realizing healthy and sustainable oceans and sea as follows. Dr. Teruhisa KOMATSU, President of the Japanese-French Oceanographic Society (JFOS), made a comprehensive presentation about a history and activities of JFOS and the Société franco-japonaise d'Océanographie de France (SFJO). Collaborations between French and Japanese scientists started from manned submersible of Bathyscaphe since 1958 and lead Japanese scientists to establish JFOS in 1960. This collaboration continues to explore geological surveys in trench through Kaiko Project till now. Collaborations of fisheries sciences started in late 1960s by providing Japanese oyster seeds to France at the risk of oyster culture crush due to massive death of seeds. When collaborations became active, SFJO was founded in France by French researchers who came to Japan in 1984. Since then, JFOS and SFJO have co-organized Japan-France Symposium of Oceanography alternatively in France or Japan at intervals of several years. Collaborations of marine sciences also started in 1990s through exchange of researchers of both countries. In recent five years, French researchers with French oyster farmers contribute to restauration of coastal fisheries in Sanriku Coast after the East Japan Great Earthquake disaster by supplying research equipment and those for fisheries, and visited Sanriku Coast to help Japanese fishermen to recover fisheries discussion and encouragement with fishermen and Japanese researchers. Future collaboration may include sustainability science and researches under Future Earth of which two of

five global hub secretariats are set in Paris and Tokyo. This collaboration will bring fruitful contributions to realize sustainable ocean and coastal waters because oceanographers of two countries have different viewpoints and also interactions like Ukiyo-e-shi and impressionists in last Edo period.

2.2 Keynote speech of IFREMER

Dr. Jean-Marc DANIEL gave a presentation on Ifremer activities related to Physical resources and deep sea ecosystems.

IFREMER research activities are carried out under 4 Departments:

- Biological resources and environment
- Physical resources and deep-sea ecosystems
- Oceanography and ecosystem dynamics
- Marine and digital infrastructure

The second one (Physical resources and deep-sea ecosystems) is the subject of this presentation. It has 3 main research Units on deep-sea ecosystems, marine geosciences and technological development. The marine geosciences Unit works at different scales touching upon the geodynamics and sedimentary recording, geochemical cycles and resources, sediment dynamics and geohazards, with the help of a technical support laboratory for mapping, varied tools development, and in support of public policy like the 'Extraplac' programme about the extension of the French continental shelf.

The Deep-sea ecosystems Unit covers the description and understanding of the structure and functioning of deep sea ecosystems, the study of adaptive processes and production of molecules with potential economic interest. The required key infrastructures and equipment cover a whole range of tools from scientific ships on the surface to deep sea observatories on the bottom.

The department units' playground is spread over the three oceans and the varied types of bottom structures and associated ecosystems (vents and seeps, nodules, corals and canyons, etc.). It is in charge of deep sea minerals exploration and the environmental challenges of the future mining: knowledge of ecosystems functions, development of new observation tools, and all kind of new approaches like in situ/in vivo experimentation, modelling, and metagenomics.

The technical research and development Unit has several objectives: i) to contribute to eco-friendly resources production, ii) innovate on key technology to assist research, improve the understanding of interactions between the ocean and the structures at sea, iii) and develop new tools for efficient environmental monitoring. Among the examples, it is worth mentioning the new ocean warming recording system (Deep Arvor) capable to operate during several months at 4000m depth.

Regarding the infrastructures, it is worth mentioning the IFREMER test facilities in Brest (wave and wind sea water tank) and Boulogne sur Mer (fisheries). The other facilities regard the study of materials durability/resistance in marine environment (chemistry and pressure). Work is done as well regarding the improvement on IFREMER fleet like the minimization of bubble generation. Another important topic is related to the marine renewable energies in strengthening the knowledge of the environmental conditions and the response of structures, the societal impacts, and the follow up of demonstrators with a focus on technological innovations.

The department is labelled as a 'Carnot institute', meaning it has a commitment to develop partnership with the industry in the key sectors of deep sea mining (including oil & gas), biotechnology, renewable marine energies, and environmental metrology.

2.3 Keynote speech of CNRS

Dr. Aurelien PONTE explained the ocean circulation at very high resolution: numerical modelling and observational perspectives as follows.

The first modeling experiments of ocean mesoscale eddies go back to the 70s with the Polygon/MODE project. Since then, satellite observations (altimetry, temperature) made a great leap forward and, with the help of in situ measurements from the global Argo dataset, allow a rather precise characterization of those mesoscale eddies which appear to be in a 'quasi-2D' dimensions. Since the beginning of the 1990s, the satellite altimeters gave indeed a good coverage of the signature of mesoscale eddies at global scale, revealing their ubiquitous existence during the last 25 years of

observation. In the early 2000s, modeling studies (1/10th degree resolution) confirmed that all oceans are crowded with a large number of mesoscale eddies. Nowadays, high resolution satellite images (sea surface temperature and colour) have revealed not only mesoscale eddies (>100 km) but also smaller scale (<50 km) front and filaments called sub-mesoscales. The latter are a matter of concern since their horizontal dispersion and vertical circulation ranges are determinants in the distribution of energy, the structuration of marine life, and in the heat and carbon storage in the ocean.

The last 15 years have seen strong efforts put into the understanding of the sub-mesoscale dynamics. Thanks to the Earth Simulator, multiple numerical simulations have been performed proposing varied scenario: i) interactions between mesoscale eddies produce sub-mesoscales (stirring); ii) instabilities of sub-mesoscale front and filament produce small-scale eddies; iii) these eddies subsequently merge leading to larger scale eddies. These predictions allow a better understanding of real observations together obtained from satellite altimetry and in situ measurements (Argo).

Interestingly, at sub-mesoscales, fluctuations are rapid enough to break free from the strong constraints imposed by Earth rotation and ocean stratification on oceanic motions. This fact explains the vigorous vertical circulation that characterizes the eddies, inducing the release of available potential energy and the production of kinetic energy at sub-mesoscale then transferred to larger scales via classical mechanisms of 2D turbulence (eddies merging).

Practical examples of these phenomena are shown for the North West Pacific region and along the coast of Japan through OFES simulation amazing maps (JAMSTEC, Earth Simulator): here, the seasonality of small-scale structures is due to the development of mixed layer instabilities which produce a vigorous vertical circulation extending below the mixed layer, and affect mesoscale dynamics with a 1 month lag. These observations have strong implications for simulation of large-scale ocean circulation where a tremendous effort is required to pass from global/basin scale to much finer resolution, i.e. the scale of 1 km!

To do that, an ambitious experimental project (LatMix), in addition to other experimental efforts, was launched in the Gulf Stream area. It consists in direct observation of the seasonality of ocean turbulence dynamical regimes showing for example shallower spectra in winter as attributed to the powerful sub-mesoscale mixed layer instabilities at that period of the year.

From a very practical point of view, it is interesting to look at the sub-mesoscale circulation impact on dispersion of any floating or sub-floating object or material like plastic, oil spills, pollutants in general, but also marine life like plankton. The simulations show that the expected dispersion is significant, strongly motivating a series of experimental scientific cruises in the Gulf of Mexico (CARTHE consortium) following the BP Deep Water Horizon incident. Another recent experiment is the LAgrangian Sub-mesoscale ExpeRiment (LASER) with the use of no less than 1000 surface drifter!

As said before, mesoscale and sub-mesoscale eddies structure marine biodiversity. They provide ecological niches to varied phytoplankton species, with 65% of their biomass inside sub-mesoscale filaments. There are ongoing collaborations between LOPS (Laboratory of Physical and Spatial Oceanography) and LEMAR (Laboratory of Marine Environment Sciences) on these issues.

New perspectives are expected with the NASA-CNES launching of satellite SWOT (Surface Water Ocean Topography) in 2021. It will be devoted to sub-mesoscales with a 15 km resolution (vs. about 100 km) and a much improved coverage. This approach is very similar to the JAMSTEC-JAXA COMPIRA project. But the new methods of analysis are complicated by the presence of internal gravity waves (generated by wind, currents, surfactants and swell) that should be more studied in the future, using either active (Synthetic Aperture Radar or SAR) or passive (optical sensor near sun glint) satellite observations. Therefore, future developments lie in remote sensing techniques at fine scale (e.g. SWOT), in situ observations of rapidly evolving processes, numerical simulation with high resolution (performance, storage, post-processing, algorithms), and inter-disciplinary approaches (biogeochemistry, climate change, air-sea interactions).

In conclusion, understanding the nature of sub-mesoscale eddies and their impact on oceanographic and climatic systems has been a very significant achievement of the last 15 years in oceanography. The key results about mesoscale eddies observation: 1) they are part of complex cross-scale energy pathways such that resolving these processes through numerical simulations can lead to an increase

in total kinetic energy by a factor 1,5 to two; 2) they can explain up to 50% of the vertical velocity field; 3) they contribute significantly to dispersion of any floating body near the ocean surface; 4) they structure marine ecosystems (along with mesoscale eddies).

3. Review of On-going Projects

3.1 Ocean observation

The following 8 ongoing projects were presented and discussed.

- 1) A99-1(CNU01): *KAIKO-NanTroSEIZE Project*
- 2) A02-2(CNU05): *Marine Biogeochemistry – Microbial food webs and cycling of organic matter in oceans: effects on biogeochemical cycles*
- 3) A02-5(IFR10): *ARGO*
- 4) 2009-new7: *Deep sea magnetic methodology and examples to investigate the deep seafloor: the magnetic signature of active and fossil hydrothermal fields*
- 5) 2014-new 8: *Organic compound distribution in the Atmosphere and Seawater (COMATSEA)*
- 6) A4(IFR03): *Data Exchange*
- 7) 2003-new7: *Earth Simulator Project*
- 8) 2014-new5: *Japan-French joint research project on marine N₂-fixation*

1) *KAIKO-NanTroSEIZE Project*

Mr. Eisho SATO on behalf of co-coordinators explained the project about Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) which is one of IODP projects using the Drilling Vessel Chikyu. The objective of the project is to investigate the aseismic to seismic transition of the mega-thrust system and processes of earthquake/ tsunami generation at the subduction zones around Japan. 11 Japanese and 1 French scientists participated in Expedition 338 of IODP, and 10 Japanese and 2 French scientists joined Expedition 348. Dr. Pierre HENRY, who works as French contact person, visited Japan in April 2013 and participated in Expedition 348 in the winter of the same year. As for the future cooperation of NanTroSEIZE, co-coordinators decided to suspend this project because they had accomplished their intended objectives. However, they agreed to resume discussions on research collaboration in the future.

2) *Marine Biogeochemistry – Microbial food webs and cycling of organic matter in oceans: effects on biogeochemical cycles*

Mr. Eisho SATO on behalf of co-coordinators explained the project about *Marine Biogeochemistry*. The objective of this project is to combine existing French and Japanese expertise on the biogeochemistry of elements that have significant effects on climate and marine renewable resources. The project focuses on the roles of microbial food webs in the cycling of organic matter in oceans and their effects on biogeochemical cycles. In 2013, Prof. Louis LEGENDRE was invited as an expert in a workshop at the Okinawa Institute of Science and Technology. Then International workshop "Ocean Acidification in coral reefs" was held in Tokyo and Hakone, Japan. This project was terminated.

3) *ARGO*

Dr. Shigeki HOSODA on behalf of co-coordinators had a presentation about the contribution by each of JAMSTEC and IFREMER to the international Argo program that has unique experiences in float technology and data management. Since JAMSTEC and IFREMER actively deployed normal, deep and biogeochemical Argo floats in the concerned area improving sensor calibration method up to now, knowledge of float observations, observed data and variable information were exchanged to maintain the global Argo array, to construct deep and biogeochemical Argo array and to go forward ocean researches. JAMSTEC is planning to deploy Argo floats after 2016, to maintain the global Argo array, serving the delayed mode quality controlled data as the Pacific Argo Regional Centre. In addition, many deep and biogeochemical Argo floats will be deployed to construct the deep and

biogeochemical Argo array in the global ocean, with improvement of sensor calibrations and delayed mode data management method. For the same purposes, in the next years, several floats of new technology will be deployed by IFREMER. In order to improve accuracy of new sensors, particularly for future expansion towards deep Argo, IFREMER and JAMSTEC will be able to exchange information about results at sea. This collaboration could contribute to encourage the manufacturers to improve their products. To continue and expand the Argo program and research field, JAMSTEC and IFREMER need to continue cooperation in the float technology, data management and scientific research fully utilizing current and future Argo capabilities, including deep and biogeochemical Argo.

IFREMER and JAMSTEC contribute the Argo program as leaders, exchanging knowledge and information on float mechanics and data management. AST16 and 17 were hosted by IFREMER in 2015 and JAMSTEC in 2016.

4) *Deep sea magnetic methodology and examples to investigate the deep seafloor: the magnetic signature of active and fossil hydrothermal fields*

Dr. Jerome DYMENT on behalf of co-coordinators had a presentation about the development of instrumentation and processing tools for deep sea magnetic surveys to investigate the magnetic signature of active and fossil hydrothermal fields. The co-operative work resulted in the publications of three papers (Szitkar et al., *Geology*, 2014; Szitkar et al., *GRL*, 2015; Fujii et al., *JGR*, 2015) and the preparation of two other manuscripts (Szitkar et al., submitted to *EPSL*; 2016; Dymont et al., submitted to *EPSL*, 2016). Participants presented works related to the project at several sessions on the topic, including a special session at the Fall Meeting of the American Geophysical Union in December 2013 and a session at InterRidge Theoretical Institute in September 2015. Co-coordinators plan to continue their cooperative work, with a focus on the development of data processing tools for deep sea magnetic surveys together with exchange of scientists, graduate students, and information.

5) *Organic compound distribution in the Atmosphere and Seawater (COMATSEA)*

Dr. Gilles LERICOLAIS, on behalf of the coordinators, briefed the project as follows. This project is based upon Academic Exchange Agreement between Chubu Institute for Advanced Studies, Chubu University, Kasugai, Japan and the Mediterranean Institute of Oceanography of OSU Pytheas-CNRS-AMU. Professor K. KAWAMURA and R. SEMPERE have been cooperated for 20 years in atmospheric and marine organic chemistry. Prof. K. KAWAMURA has been engaged in invited Professor and has cooperated with Dr. Honoris CAUSAE in Aix Marseille University. R. SEMPERE has been invited 3 times by Hokkaido University as an invited Professor. One French PhD thesis was co-led by R. SEMPERE and K. KAWAMURA and 10 common articles have been already published in peer review journals. This project aims to (1) to improve detection of organic compounds at trace level in sea water and in the atmosphere, (2) to calibrate analytical methods used by the two groups, (3) to better understand distribution of specific organic compounds including diacids and related polar compounds as well as phthalates and sugars in different atmosphere and marine waters of Asia and Mediterranean basin. These compounds are useful for an understanding of some geochemical processes. Indeed, Diacid molecular distribution can provide information on aerosol aging whereas phthalates and Levoglucosan (sugar) may give a signature of anthropogenic input and biomass fire signature, respectively.

6) *Data Exchange*

Dr. Gilles LERICOLAIS, on behalf of the coordinators, had a brief presentation about the exchange of information and data on ocean research and to activate the bilateral cooperation. In March 2011, during the 21st session of International Oceanographic Data and Information Exchange (IODE) promoted by UNESCO/IOC, views of progress and future plans for the project were exchanged between representatives of Japan Oceanographic Data Center (JODC) and IFREMER/SISMER. (SISMER: Scientific Information System on the Sea.) In the frame of the Global Ocean Surface Underway Data (GOSUD)/IODE project, it is considered to exchange sea surface salinity

data acquired by Japanese research vessels. Japan contributes on a regular basis by providing data from the Voluntary Observing Ships (VOS) NIPPON project.

7) *Earth Simulator Project*

Dr. Aurelien PONTE, CNRS and project co-coordinator, briefed the Project as follows. The objective of the Project is a research on Ocean Scale Interactions involving sub-mesoscale oceanic structures and their impact on larger scales, and on biogeochemical tracers using the outputs from high-resolution ocean simulations conducted on the Earth Simulator. This research is strongly motivated by the scientific objectives of the future satellite altimeter missions SWOT (CNES-NASA) and COMPIRA (JAXA). P. KLEIN visited JAMSTEC four times in 2014 and 2015 to discuss with Japanese researchers. H. SASAKI and Y. SASAI visited IFREMER for 2 weeks in June 2014 and in June 2015 to discuss the analyses of the simulation outputs.

Dr. P. Klein and JAMSTEC researchers organized two sessions on Submesoscales at the AGU fall meeting in December 2014 and were the conveners of the Symposium on Oceanic Submesoscales of the Japan Oceanography Society in Japan in September 2015. Eight referee publications co-authored by Japanese and French scientists have been published or accepted in the last two years.

The future cooperation focusing on Ocean Scale Interactions should strongly contribute to the next satellite missions SWOT (NASA/CNES) and COMPIRA (JAXA). They will analyse new outputs of high-resolution (1km) ocean simulations of the North Pacific Ocean.

8) *Japan-French joint research project on marine N₂-fixation*

Dr. Gilles LERICOLAIS briefed the Project as follows. Nitrogen (N) is essential for life as an important constituent of proteins and nucleic acids. In the marine environment, the availability of N is one of the most influential factors controlling primary productivity. The Project have organized scientific meetings or special sessions at ASLO meeting (Spain, 2005), Pacific Science congress in Okinawa (Japan, 2008), N₂ fixation meeting (Japan, 2010), and Coral reef mini symposium in Florida. 5 articles were published in international Journals on this topic. In 2014, a memorial seminar was held at the Mediterranean Institute of Oceanography (MIO). Funding comes from Mitsubishi Co, and also from Kakenhi. The main concept of the project is to follow comparative approaches combining biological and biogeochemical studies that are common to both countries with a particular effort to promote exchanges of students and researchers. Especially, they carried out research in New Caledonia for understanding the role of cyanobacteria in the nitrogen cycle and foodweb.

3.2 Marine technology and research infrastructure

The following 3 projects were presented and discussed.

- 1) A8(IFR04): *Underwater Technology*
- 2) P00-3(IFR09): *Deep Sea Floor Observatory*
- 3) A9(IFR06): *Technical cooperation of Environmental Impact of Maritime Structure*

1) *Underwater Technology*

Dr. Hiroshi YOSHIDA had a brief presentation about the acceleration of R&D cooperation in underwater technology in both countries. In 2014, a research engineer of JAMSTEC visited Toulon and discussed about underwater technology. Information exchange and at sea cooperation by mutual engineers are continuously executed. IFREMER is interested in the framework of current major development projects HROV (battery powered fiber linked ROV, 2011-2016) and CORAL (6000m AUV for exploration and inspection, 2016-2020), in exchanging on technological research and field experience in key areas: (e.g. system architecture, energy sources, advanced sensor systems, intelligent control strategies, AUV safety management, underwater communication, etc.).

2) *Deep Sea Floor Observatory*

Dr. Jean-Marc DANIEL on behalf of co-coordinators had a brief presentation about Deep Sea Floor Observatory. The development and deployment of long-term ocean bottom observatory for

geodetic, magnetic, seismic and environmental studies is necessary for understanding of earth and ocean dynamics. IFREMER and JAMSTEC exchange science and technology information about the long-term ocean bottom observatory and practical use of data from seafloor JAMSTEC would like to continue this cooperation on installation of a borehole observatory and quality estimation of seismic data gathered in the borehole. IFREMER is willing to share standardization efforts including in acquisition of seismic and environment parameters.

3) *Technical cooperation of Environmental Impact of Maritime Structure*

Dr. Masayuki BANNŌ, one of the project coordinator, briefed the Project as follows: The objective of this project is to develop ocean and coastal engineering, and to promote technical cooperation on deep water breakwater and large floating plate. In 2016 they exchanged the research results on morphological changes due to climate change. Both sides agreed to visit each institute in the next two years to discuss coastal dynamics including those influenced by climate change and extreme storms. They will exchange information and papers on coastal dynamics including those which are influenced by climate change and extreme storms.

3.3 Biological resources

The following 3 ongoing projects were presented and discussed.

- 1) 2009-new6: *How minimizing the footprint of the aquaculture and fisheries on the ecosystem?*
- 2) 2012-new2: *Study on ecology and diversity of marine microalgae using genomics approach*
- 3) 2007-new1: *Research collaboration on the genomics and molecular phylogeny of *Ecotocarpus siliculosus* (Phaeophyceae)*

1) *How minimizing the footprint of the aquaculture and fisheries on the ecosystem?*

Dr. Tsutomu TAKAGI, one of the project coordinators, briefed the Project as follows: This project aims to investigate possible mitigation measures that could be used to develop sustainable and responsible fisheries and aquaculture by using newly developed analysis techniques. Cooperative research investigating mitigation measures of fisheries and aquaculture has been conducted. Tracking of sharks, stingrays and marine turtles by using archival tags and acoustic pingers has been conducted as a cooperative project between IFREMER and JAMSTEC. To mitigate bycatch problems, experiments to assess the capture of immature tunas during purse seine fishing were carried out. The techniques of the Hybrid method by which the 3-D path of an individual in the capture process is determined and the assessment by using Relative Entropy method will be applied in future in situ activities. Some ICT methods for cultured fisheries management have been developed to mitigate environmental loads and save energy in aquaculture. These techniques for the mitigation of the impact of fisheries and aquaculture are being implemented with support from IFREMER and Hokkaido University, Kinki University and other Japanese institutions.

2) *Study on ecology and diversity of marine microalgae using genomics approaches*

Dr. B. BLANKE, CNRS/INSU Deputy Scientific Director, briefed the Project as follows. The objective of this project is to investigate the ecology and diversity of marine microalgae by using genomics approach and to implement cooperative analysis of field samples and isolated strains of marine microalgae by using genomics and flow cytometry technique. Dr. KUWATA visited the Station Biologique de Roscoff in November 2010, July 2013, November 2014 and November 2015. Dr. VAULOT visited the Tohoku National Fisheries Research Institute in May 2011, November 2013, March 2015 and March 2016 to hold a seminar. A part of the result of the project was published in the ISME Journal.

3) *Research collaboration on the genomics and molecular phylogeny of *Ecotocarpus siliculosus* (Phaeophyceae)*

Dr. B. BLANKE briefed the Project as follows. The objective of this project is to pursue collaborative research in the fields of the genomics and molecular phylogeny of the marine model macroalga *Ectocarpus siliculosus*. Mark Cock visited Kobe University in September 2015 for lecture on the biology of *Ectocarpus*, and made discussions on research collaboration plans. The culture strains of *Ectocarpus siliculosus* used for the full-genome sequencing project and related biological studies are housed in the Macroalgal Culture Collection of Kobe University Research Centre for Inland Seas (KU-MACC). KU-MACC is running a project to cryopreserve related *Ectocarpus* strains for long-term preservation. Kobe University group is analysing the molecular phylogeny of *Ectocarpus* strains for elucidating the taxonomy of *Ectocarpus* species under collaboration with Roscoff group. Co-coordinators plan to continue the research collaboration on the genomics and molecular phylogeny of *Ectocarpus siliculosus*.

3.4 Deep sea ecosystems

The following 5 ongoing projects were presented and discussed.

- 1) 2009-new1/2012-new3: *Benthic Foraminifera as environment Proxy*
- 2) 2012-new4: *Biodiversity and ecological connectivity in deep-sea chemosynthesis-based habitats*
- 3) 2009-new2/2009-new3: *Modern and Past time environmental proxy with minor elements in foraminiferal test*
- 4) 2014-new4: *Ecological aspects related to hydrothermal vents and massive sulfides deposits*
- 5) 2009-new4/A10(IFR05): *Exploring the Deep-Sea and Subseafloor Biosphere*

1) *Benthic Foraminifera as environment Proxy*

Dr. Jean-Marc DANIEL briefed the Project as follows: In January 2014 “Proxy calibration in cold seeps based on fossilizing benthic meiofauna” started. In May 2014, C. FONTANIER attended a special session at the JPGU organized by T. TOYOFUKU. In December 2015, a partnership between JAMSTEC and Ifremer/TOTAL involving T. TOYOFUKU as service provider in PAMELA project was launched. In January 2016, new topic “Proxy calibration in tropical ocean: source-to-sink transfer of organic matter under monsoonal regime” started. In May 2016, C. FONTANIER attended a special session organized by TT at the JPGU and dedicated to “Proxy calibration”. In the framework of a “FRANCE-JAPAN” collaboration between TT and CF, partners will gather data to determine the ecological features of foraminiferal communities and their geochemical composition. Partners want to calibrate environmental tools to track deep-sea ecosystems at tropical latitudes. Shell geochemistry of both living and dead foraminifera are investigated from different areas (Pacific and Indian Oceans).

2) *Biodiversity and ecological connectivity in deep-sea chemosynthesis-based habitats*

Dr. Jean-Marc DANIEL briefed the Project as follows: Deep-sea biodiversity is still far from being completely known, both in its phylogenetic and functional aspects. Chemosynthesis-based ecosystems function on alternative energy pathway where reduced chemical compounds are oxidized to produce organic matter in the absence of light. These deep-sea habitats are fragmented, distributed world-wide, and are home to endemic organisms with original adaptations in their dispersal and colonisation strategies, resistance to extreme and variable environmental conditions, and complex interactions with the geo-microbiological compartment. As exploitation of living and mineral resources is advancing faster than ecological knowledge of these deep-sea ecosystems, a comprehensive analysis of species distribution, biodiversity patterns and ecological connectivity is needed. Through the analysis of sets of colonisation experiments that mimic potential stepping stones for species typical of chemosynthesis-based ecosystems, project partners will jointly investigate biodiversity, and how ecological connectivity may contribute to maintain it. Both institutes jointly selected a candidate for post-doctoral researcher regarding the meiofaunal biodiversity and connectivity. This researcher was employed by IFREMER in 2013 and joined to JAMSTEC from 2015. Both institutes will continuously conduct the research collaboration on

biodiversity and ecological connectivity in deep-sea chemosynthesis-based habitats.

3) *Modern and Past time environmental proxy with minor elements in foraminiferal test*

Dr. B. BLANKE briefed the Project as follows. The objective of the project is to evaluate environmental proxy with modern and foraminifera. In 2011 two Japanese scientists were invited to CEREGE financed on a French budget. In 2013 research results were published. In 2014, micro-elemental measurements were done at JAMSTEC on demand of CEREGE. In 2015, stable isotope measurements were done at JAMSTEC on demand of CEREGE. Co-coordinators plan to continue the research collaborations.

4) *Ecological aspects related to hydrothermal vents and massive sulfides deposits*

Dr. Jean-Marc DANIEL briefed the Project as follows: Scientific components of this project are related to the ecological aspects of hydrothermal vents that include the structure and functions of benthic communities at active and inactive vents, the influence of hydrothermal plume on benthic communities, the connectivity among key species at active and inactive vents in the West Pacific and North Atlantic, the resilience of benthic communities that would be affected directly or indirectly due to the cessation of hydrothermal activity, and so forth. In 2015, they held the EcoDeep-SIP workshop on the seabed mining of hydrothermal vent filed at French Embassy of Tokyo, and published the workshop report to synthesize discussions of this workshop and to explain the state of knowledge of seabed mining in the context of assessment and management of deep-sea environments, especially hydrothermal vent fields associated with seafloor massive sulphide. The next cruise is planned to conduct the integrated project on massive sulphides deposits.

5) *Exploring the Deep-Sea and Subseafloor Biosphere*

Dr. B. BLANKE gave a presentation on behalf of co-coordinators. The objective of this project is to understand how the deep biosphere which appears to be one of the last frontiers on Earth, could contribute to a better understanding of major biogeochemical processes. The IODP achievements have evidenced the existence of deep biosphere in oceanic plates. A first project has been introduced by Ken TAKAI as the coordinator (IODP 601) in order to explore the subseafloor microbial ecosystem associated with physical, geochemical and hydrogeologic variations in Mid-Okinawa Trough hydrothermal system. This project was completed successfully with the IODP Expedition 331 which is at present in the final process of review. Information exchange will be continued. Both parties share a high interest in this field and would like to establish a long-term based cooperation.

3.5 Coastal ecosystems

The following 3 ongoing projects were presented and discussed.

- 1) 2014-new1: *Japan-France Joint Research project on the response and adaptation of coral ecosystem under the high-CO2 world and global warming*
- 2) 2014-new2: *JFOS-SFJO 16th French Japanese Symposium on Oceanography*
- 3) 2014-new3: *Effect of global changes on the biodiversity and the resilience of coral reefs: Comparison between Ryukyu Island (Japan) and French Polynesia Islands (France)*

1) *Japan-France Joint Research project on the response and adaptation of coral ecosystem under the high-CO2 world and global warming*

Dr. Yves HENOCQUE, IFREMER and JAMSTEC Guest Researcher, on behalf of the coordinators, briefed the Project as follows: The objective of this joint research project is to study the response and adaptation of coral reef organisms to ocean acidification and global warming. The project co-coordinators will focus their research on chemical and biological processes describing mechanisms of response and adaptations to multiple environmental stresses. 6 research papers were published by international Journals: 1) Charpy L. etc.(2012): Cyanobacteria in coral reef ecosystems: A review. *Journal of Marine Biology*, 2) Cuet P, etc. (2011): CNP budgets of a coral-dominated fringing reef at La Réunion, France: Coupling of oceanic phosphate and groundwater nitrate. *Coral Reefs*, 3) Charpy L, etc (2010): Dinitrogen-fixing cyanobacteria in microbial mats of

two shallow coral reef ecosystems. Microbial Ecology, 4) Casareto BE, etc. (2008): Nitrogen fixation in coral reef environments. Proceedings 11th International Coral Reef Symposium, Florida, 5) Failoz MFM, etc. (2008): Role of organic matter in chemical symbiosis at coral reefs: release of organic nitrogen and amino acids under heat stress. Proceedings 11th International Coral Reef Symposium, Florida, 6) Casareto BE, etc. (2006): Phototrophic prokaryotes in Bora Bay, Miyako Island, Okinawa. Surveys will be combined to study two types of reefs: those affected by anthropogenic activities and those far from human influence. At the same time laboratory incubation experiments will be realized to test the response of at least two coral species to combined stress.

2) *JFOS-SFJO 16th French Japanese Symposium on Oceanography*

Dr. Hubert CECCALDI and Dr KOMATSU, the two coordinators, briefed the Project as follows: The objective of the Project is to facilitate and enhance cooperation between Japan and France in the field of marine sciences from education to research levels. Workshops have been regularly organized in both countries on specific subjects such as: new species for aquaculture, artificial reefs, port management, floating debris, structure of fisheries cooperatives and Satoumi in Japan, etc. All meetings, especially symposium, have produced a final document edited in “La Mer” or as a book (Springer Ed.) as for the 2013 symposium held jointly in Boulogne sur Mer and Marseille. One of the common results highlighted are for instance: adapting the messages and the tools to the beneficiaries of the research outcomes, not just only considered as recipients but as partners in the learning process. Both sides agree that it is still very difficult to reach out to the communities and the public at large, which remain poorly aware of coastal and marine issues. The knowledge and information transfer issues and their facilitating process will certainly be at the core of the conference to come in France. While some new specific topics are in consideration like impacts of global warming on physical and chemical oceanography, marine ecosystems and fisheries, the knowledge integration and transfer issue will probably apply to marine and coastal sustainability science that solves environmental problems. They organize the 17th Japan-France Symposium on Oceanography in Bordeaux.

3) *Effect of global changes on the biodiversity and the resilience of coral reefs: Comparison between Ryukyu Island (Japan) and French Polynesia Islands (France)*

Mr. Romain TROUBLE, Tara Expedition General Manager, briefed the Project as follows: Coral reef ecosystem monitoring is key information for evaluating the effect of future global climate change. The study will allow them 1) to describe herbivore diversity and functional redundancy on coral reefs along a temperature gradient and two acidified sites; 2) to know if fish populations are locally adapted to their thermal regime, the physiological, biochemical, and/or molecular mechanisms involved, and whether some populations are more vulnerable than others to the global warming and ocean acidification; 3) to better understand the adaptation/evolution of fish in the face of seawater temperature rise. Since 2005, Dr. NAKAMURA and Mr. LECCHINI collaborated together with several studies conducted either in French Polynesia or in Ryukyus Islands. Thus, they worked on ecology of coral reef fishes for more than 10 years. They had a lot of publications and organized a session “Behaviour ecology of marine fish larvae” in the 9th Indo-Pacific Fish Conference 2013. 2017 will be more particularly highlighted by the Tara Expedition cruise stopping in several ports in Japan and continuing its sampling of 40 reefs across the Pacific Oceans and along the route from Moorea, French Polynesia, which will allow a very interesting comparative approach between Okinawa, French Polynesia and 38 other reefs for corals condition and impacts by climate change.

3.6 Ocean and Coastal management

The following 2 ongoing projects were presented and discussed.

- 1) 2015-new1: *Application of Science and Technology for Integrated Coastal Management*
- 2) 2009-new5: *Integrated Coastal and Ocean Management (ICOM): From National Policy to Local Implementation*

1) *Application of Science and Technology for Integrated Coastal Management*

Dr. Yves HENOCQUE briefed the Project as follows: The project aims to obtain scientific data and research results that contribute to integrated coastal management. For sustainable use of coastal areas with diverse activities, a mechanism that harmonizes such areas with natural environment and manages them from an integrated point of view is needed. Integrated Coastal Management (ICM) that aims to coordinate diverse users has brought significant results within international frameworks. Dr. Hideaki TANOUE started preliminary studies in the frame of the project together with Dr. Sandrine RUITTON at the Mediterranean Institute of Oceanography (MIO) under a French Government Scholarship from April 2014 to March 2015. Dr. Sandrine RUITTON will soon come to Japan to study marine biodiversity effects by setting artificial reefs.

2) *Integrated Coastal and Ocean Management (ICOM): From National Policy to Local Implementation*

Dr. Yves HENOCQUE briefed the Project as follows: The objective of this project is the comparative analysis of national strategies for Integrated Coastal and Ocean Management (ICOM) in France and Japan under international, regional and national ocean governance. France and Japan are currently implementing their ocean/maritime policies in very different contexts but under the same global changes and development trends. Collaboration has been practically re-activated since October 2013 with Dr. Yves HENOCQUE As a Visiting Fellow, (until September 2016) he is sharing his time with JAMSTEC where he is hosted as a Guest Researcher, under the exchange of staff agreement between JAMSTEC and IFREMER. The overall objective for future collaboration will be through the promotion of lessons learned exchange between ongoing local ICOM sites from both countries.

3.7 Miscellaneous

The following 2 project was presented and discussed.

- 1) 2014-New 7: *Academic exchange agreement between AORI and MIO (AORI-MIO)*
- 2) 2014-new 6: *Comparative study about work environment between French and Japanese fisheries*

1) *Academic exchange agreement between Atmosphere and Ocean Research Institute (AORI) and Mediterranean Institute of Oceanography (MIO) (AORI-MIO)*

Dr. Gilles LERICOLAIS briefed the Project as follows: The Project is based on the Academic Exchange Agreement between Atmosphere Ocean Research Institute of the University of Tokyo and the Mediterranean Institute of Oceanography laboratory of OSU Pytheas-CNRS-Aix Marseille University in order to foster international cooperation in science and education with special emphasis in Oceanography. AORI belongs to the University of Tokyo and comprised nine departments, and four research centres. AORI scientists are conducting research in the domain of atmosphere and ocean sciences including physical, chemical biological oceanography, climate variability, dynamic marine variability. MIO is a French oceanography research laboratory, part of the OSU- Pytheas Institute, and is under the joint direction of CNRS, IRD, Aix-Marseille University. MIO goal is to better understand the oceanic system and its evolution in response to global changes. MIO constitutes a centre of expertise in marine biology, ecology, biodiversity, microbiology, physics, chemistry, biogeochemistry and sedimentology in the world ocean and at the atmosphere-ocean interface. Main objectives of the AORI-MIO proposal are to allow exchange of students and scientists, to promote common research programs and to share experience in marine and atmospheric sciences.

2) *Comparative study about work environment between French and Japanese fisheries*

Dr. Yves HENOCQUE briefed the Project as follows: The objective of the Project is to solve recent Japanese fisheries problems such as decreasing and aging labour force and low income of individuals. In 2014, French contact point was introduced with the cooperation of Dr Yves Henocque (IFREMER). In 2015, the methods of comparison were discussed. In 2016, exchange of

statistic information started.

4. New project proposal

4.1 Ocean observation

The following 2 projects were presented and discussed.

- 1) 2016-New 1: *Microbial Oceanography– Microbial community networks and ecosystem stability in changing oceans*
- 2) 2016-New 2: *Japanese-French collaboration for the Years of the Maritime Continent*

1) *Microbial Oceanography– Microbial community networks and ecosystem stability in changing oceans*

Dr. B. BLANKE briefed the Project as follows: The overall objective of the project is to combine existing French and Japanese expertise in biogeochemistry and microbiology domains that have significant effects on climate and marine renewable resources. The project focuses on microbial community dynamics and biogeochemical cycles in ocean ecosystems under current and future anthropogenic forcing. The upcoming cooperation will cover the following aspects: a) Specialized workshops, every 18 months on average; b) Stays (1-2 months, up to 6 months) of researchers in the other country, Activities: analysis of data, preparation of presentations at international meetings, writing of joint publications, lectures; c) Hosting of PhD students and postdoctoral fellows in the other country; d) Occasional participation in oceanographic cruises organized by the other country.

2) *Japanese-French collaboration for the Years of the Maritime Continent*

Dr. Andre VARGAS briefed the Project as follows: The Objective of the Project is to coordinate Japanese and French participations to the Years of the Maritime Continent (YMC) project and to promote collaborative scientific research between the two communities. The preparation for CINDY (Cooperative Indian Ocean Experiment on Intraseasonal Variability in Year 2011) /DYNAMO (Dynamics of the Madden–Julian Oscillation) international campaign in the Indian Ocean has been made since 2010. Kunio YONEYAMA and Jean-Philippe DUVEL have worked together in order to organize the program in terms of observation. The two contact persons for this project will again play this role in the coming YMC program. In particular, there are frequent exchanges of information regarding the French-Japanese campaign involving 3 contact persons with regular mutual visit of scientists.

4.2 Biological resources

The following project was presented and discussed.

- 1) 2016-new5: Identification of bio-active compounds from toxic algae

1) *Identification of bio-active compounds from toxic algae*

Dr. Gilles LERICOLAIS briefed the Project as follows: The objective of the Project is to carry out collaborative research and staff exchange as required for monitoring and research in toxic algae and algal toxin areas. Collaboration should concentrate on the two most advanced topics in the area of the initially agreed objectives: 1) Identification of bio-active compounds in *Ostreopsis* spp., 2) Identification of bio-active compounds in *Gambierdiscus* spp. Future collaboration will be developed in following two axis: 1) Staff exchange, 2) Exchange purified standards for several toxin groups.

4.3 Coastal ecosystems

The following project was presented and discussed.

- 1) 2016-new3: *Comparative study on taxonomy and ecology of coastal benthic animals between France and Japan*

1) *Comparative study on taxonomy and ecology of coastal benthic animals between France and Japan*

Dr. Yves HENOCQUE briefed the project as follows: The objective of the project is to increase the understanding of annelid species boring *Crassostrea gigas* oyster shell in Normandy originated from Northwestern Pacific. In 2016, information of annelid polychaetes spionids shell boring the *Crassostrea gigas* oyster shell was exchanged. Field and laboratory works were carried out and comparison between rocky-shore chalk and oyster was made. There is cooperation between Pr Waka SATO-OKOSHI (Tohoku University) and Pr Jean-Claude DAUVIN (Caen University).

4.4 Ocean and Coastal management

The following 2 new projects were presented and discussed.

- 1) 2016-new6: *Integration of ecological and socioeconomic approaches to harmonize sustainable fisheries with environmental conservation*
- 2) 2016-new4: *Comparative analysis on people's perceptions of marine ecosystem services between Japan and France*

1) *Integration of ecological and socioeconomic approaches to harmonize sustainable fisheries with environmental conservation*

Dr. Yves HENOCQUE briefed the Project as follows: Recently the quality of coastal waters has been gradually and successfully improved in some regions. However, some coastal stakeholders suggest that the improvement is now causing another issue in coastal ecosystem services called "oligotrophication". Oligotrophication has reduced pelagic productivity in coastal ecosystems, sometimes resulting in the decrease of fishery catch because the coastal fishery system in some regions has adapted to the eutrophication. This research is a contribution to the ongoing collaboration of FRA-Ifremer MOU concluded in April 2015. AnIfremer-FRA joint session was organized at The 16th Japanese-French Oceanography Symposium in November 2015. A kick-off meeting and fieldwork will be conducted at Sete in June 2016. They also plan to conduct first field work in the Thau lagoon in June 2016.

2) *Comparative analysis on people's perceptions of marine ecosystem services between Japan and France*

Dr. Yves HENOCQUE briefed the Project as follows. The objective of the Project is comparative analysis on people's perceptions of marine ecosystem services between Japan and France. It is also aimed to clarify differences of people's perceptions of marine ecosystem services based on cultural background and lifestyle. Prof. Kazumi WAKITA will visit Nantes to discuss cooperative studies in the future.