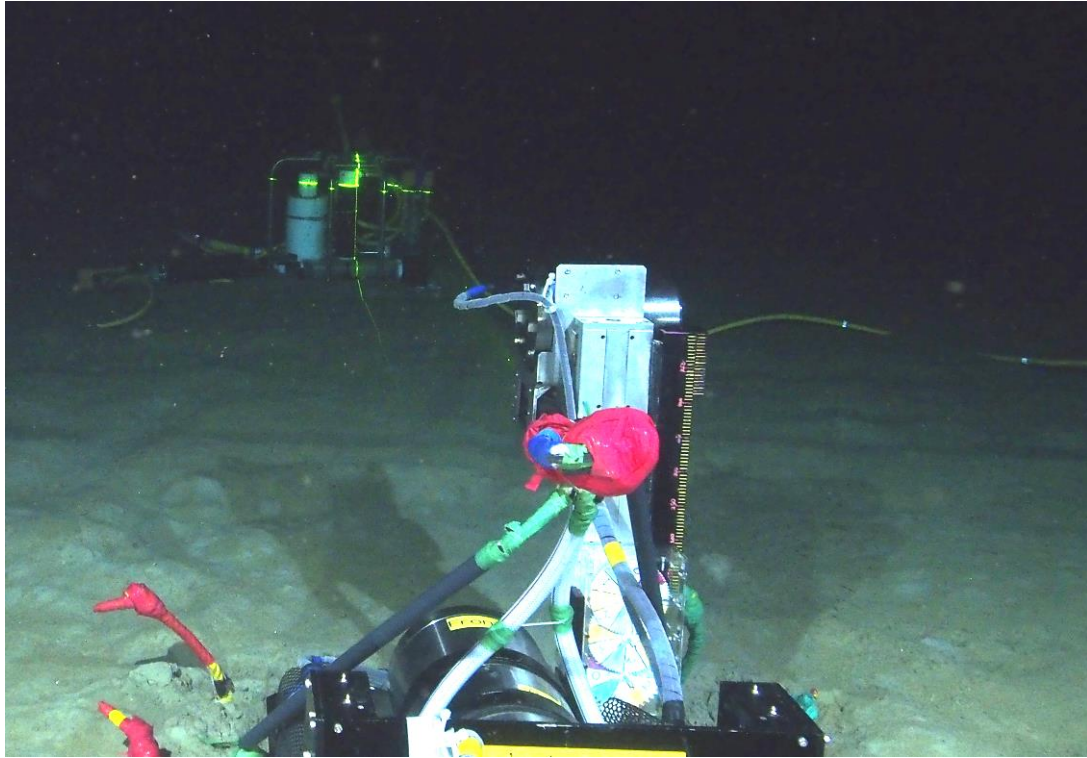




Kairei / Kaiko
KR19-09 Cruise Report



Real time ocean bottom crustal movement observation

Off Kii Suido & Kumano-nada

Oct. 6th, 2019 - Oct. 21st, 2019

R&D Center for Earthquake and Tsunami Forecasting
Research Institute for Marine Geodynamics
Japan Agency for Marine-Earth Science and Technology

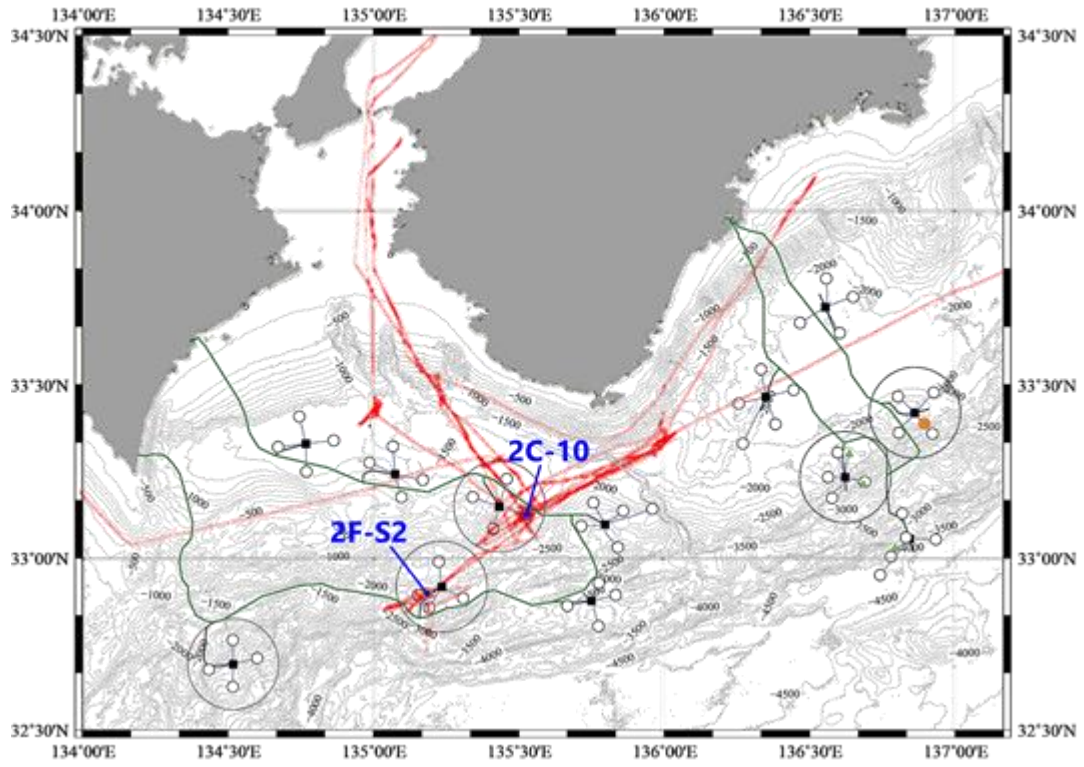
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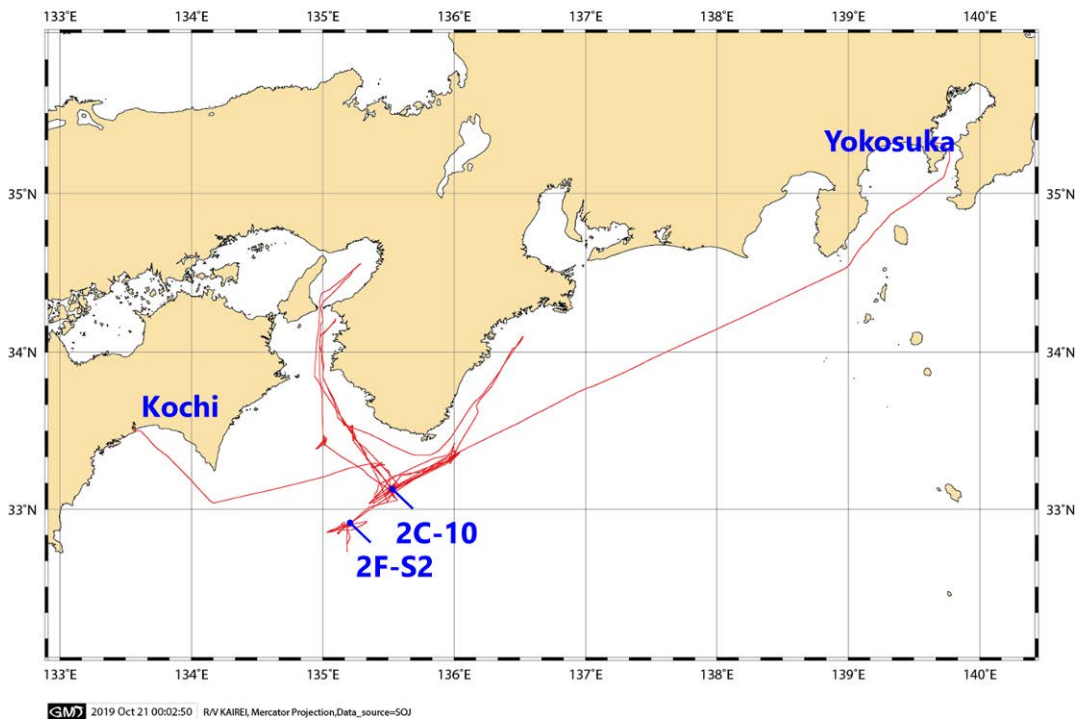
1. Cruise Information

Cruise ID:	KR19-09
Name of vessel:	Kairei
Title of cruise:	Real time ocean bottom crustal movement observation
Representative of the Science Party [Affiliation]	Shuichi Kodaira [JAMSTEC]
Chief Scientist [Affiliation]:	Shuhei Nishida [JAMSTEC]
Boarding Scientist	Hiroyuki Matsumoto [JAMSTEC] Takashi Yokobiki [JAMSTEC] Shojiro Ishibashi [JAMSTEC] Takashi Saito [Mitsubishi Electric TOKKI Systems Corporation] Masaaki Kai [Mitsubishi Electric TOKKI Systems Corporation] Toshimasa Nasu [Nihon Marine Enterprise] HisanoriIwamoto [Nihon Marine Enterprise]
Cruise period:	October 6th, 2019 - October 21st, 2019
Ports of departure / arrival:	Yokosuka, Nissan #6 Pier / Kochi Port
Research area:	off Kii-suido, Kumano-nada

Research map



KR19-09_NavTrack



2. Research Proposal

JAMSTEC has been implementing the "Observation Project on the wide area variation of the ocean floor for building national resilience" since FY2017 in order to achieve the national mission of toughening the national land, securing people's safety and security. In this project, (1) development and deployment of ocean bottom crustal deformation observation technology based on the submarine cabled observation and monitoring system for earthquake and tsunami (DONET), using a pressure gauge, an inclinometer, a long-term borehole observation system installed in a borehole of "CHIKYU" deployed in the Nankai Trough. (2) High precision wide area survey of active submarine faults using a three-dimensional seismic survey system of the ocean floor wide area research ship "KAIMEI" and etc., in Nankai Trough segment area, which is important for the evaluation of interactivity, and the Japan Trench outer rise area that may cause a tsunami earthquake. (3) Development and evaluation of more realistic simulation and transition prediction methods incorporating new survey and observation results obtained in (1) and (2) will be conducted. Through this, the prediction of the occurrence of huge earthquakes (Evaluation of urgency, scale and distribution) was imploded. In addition, the accuracy of tsunami inundation immediate prediction is improved by accurately estimating the epicenter area, its size, and the tsunami source immediately after the earthquake occurrence. The purpose is to realize disaster prevention and mitigation through these efforts.

3. Activities and Results

The purpose of this research is the real time sea floor observation for crustal deformation based on submarine cabled monitoring system for the earthquake and tsunami (DONET) deployed in the Nankai Trough using various sensors, such as pressure gauges, inclinometers and borehole observation system.

In this expedition KR19-09, in-situ calibration and Fly-By calibration with ROV, re-tensioning of optical fiber strain meter were carried out.

(1) IN-SITU CALIBRATION

The measurement was done at 2C-10 and 1B-8. Figure 4-1 shows the pictures taken before diving. The payloads were mounted in front of the ROV Kaiko shown in picture 4-1 (a) and (b). Figure 4-2 shows pictures taken during the measurement. In Fig.4-2 (a), the pressure gauge of DONET was shown on the upper left, and the mobile pressure calibrator was shown in the lower right. In this measurement, the calibrator was installed the position where the distance between them is about 2.5 m. As shown in Fig.4-2 (b), the laser was irradiated to the black and white boundary of the cylinder in the pressure gauge, and the level was measured. At the same time, by subtracting the pressure corresponding to the difference of level from the pressure measured by the mobile pressure calibrator, the desired value of DONET pressure gauge can be obtained.

(2) FLY-BY CALIBRATION

In order to improve the efficiency of in-situ pressure calibration method, a pressure calibration method using AUV has been studied. In the proposed method, a precise pressure measurement unit and a laser distance sensor are combined to measure the actual depth of the bottom pressure gauge.

In this cruise, the ROV measure bottom terrain with this method at DONET observatory 2C-10, and acquired the depth data of the surrounding seabed including the bottom pressure gauge shown in Fig4-3.

(3) RE-TENSIONING OF OPTICAL FIBER STRAIN METER

An optical fiber strain sensor was buried in the sediment in the previous cruise. From the observation data, it was observed that the optical fiber cable was not laid straight. Therefore, the laying condition of the optical fiber was observed and re-tensioned.

The cable was pulled out at the part where the optical fiber was buried. After that, the terminal unit was pulled by about 0.11 [m] shown in Fig4-4 and tension was applied to make the fiber cable was laid straight.

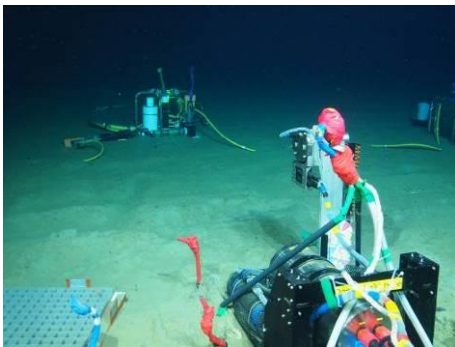


(a) Mobile pressure calibrator with ROV Kaiko



(b) Mobile pressure calibrator on basket for payload

Fig.4-1 Payload with the ROV



(a) Mobile Pressure Calibrator and DONET Pressure Sensor



(b) Laser projected on DONET water pressure gauge

Fig.4-2 Overview of in-situ pressure calibration operation

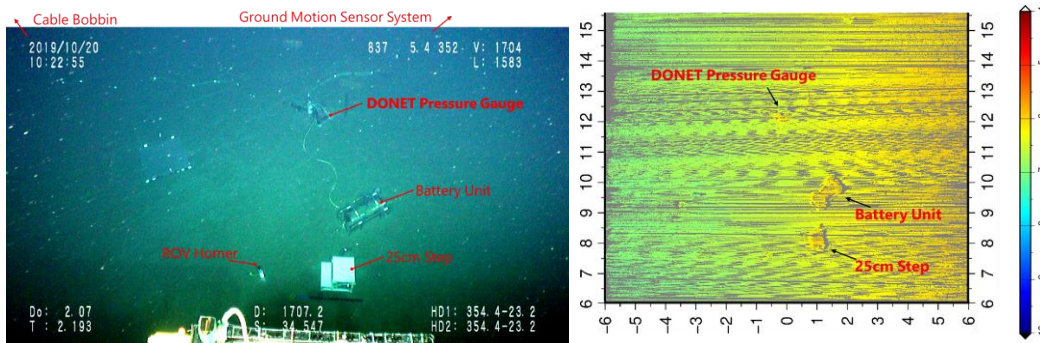


Fig.4-3 photo and scanning image of the bottom instruments from altitude of 5 m

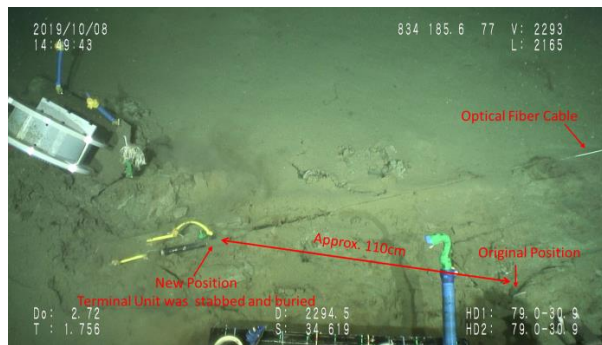
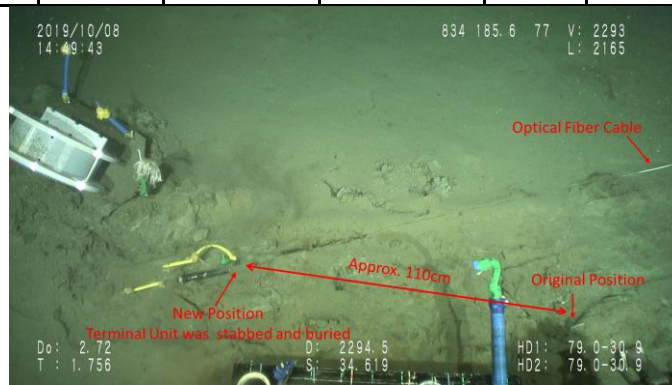


Fig.4-4 terminal unit of optical fiber after re-tensioning

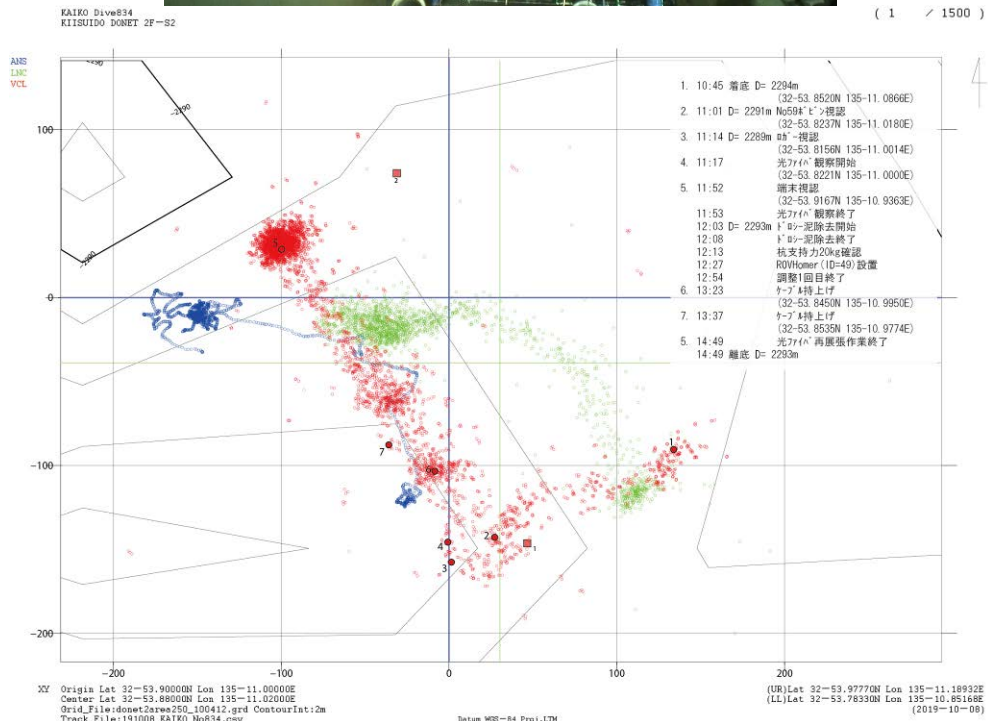
4. Dive Information of ROV Kaiko

No.	Dive Num. Date	Dive Point	Arrival Time	Latitude	Longitude	Depth	Work Summary
			Departure Time	Latitude	Longitude	Depth	
	Kaiko#834 2019/10/08	2F-S2	10:45	32-53.8520N	135-11.0866E	2294m	After observing the laying condition of the optical fiber of the strain meter at 2F-S2, fiber cable was applied tension from terminal unit and fixed on sediment with a pile.
			14:49	32-53.8535N	135-10.9774E	2293m	

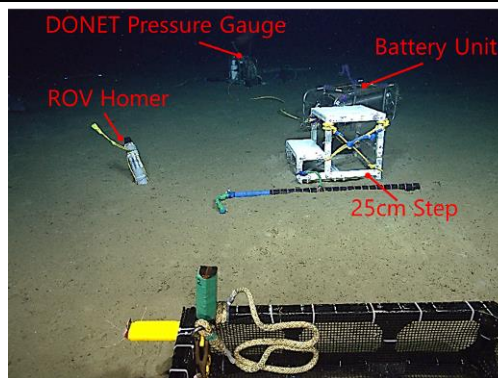
01



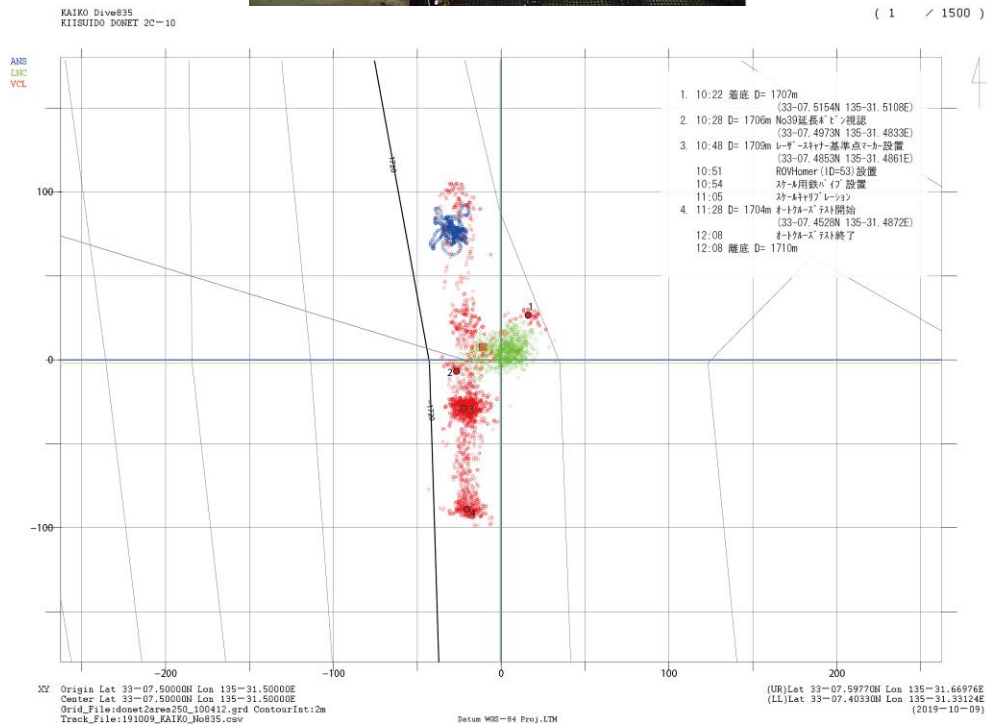
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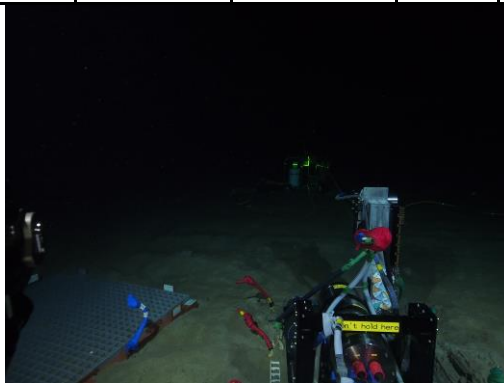
No.	Dive NUM. Date	Dive Point	Arrival Time	Latitude	Longitude	Depth	Work Summary
			Departure Time	Latitude	Longitude	Depth	
	Kaiko#835 2019/10/09	2C-10	10:22	33-07.5154N	135-31.5108E	1,707m	At the 2C-10, a reference marker (step) for the laser scanner and a miniature transponder (ROV Homer ID: 53) were deployed near the battery unit for the pressure sensor. After that, the ROV auto-cruise mode was tested.
			12:08	33-07.4528N	135-31.4872E	1,710m	



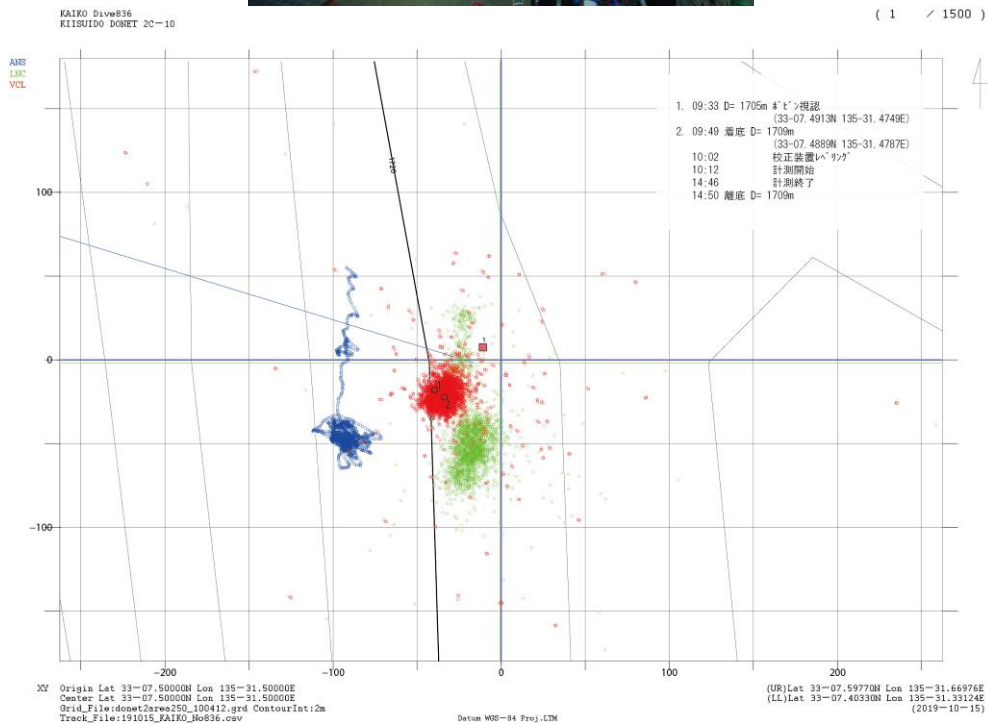
02



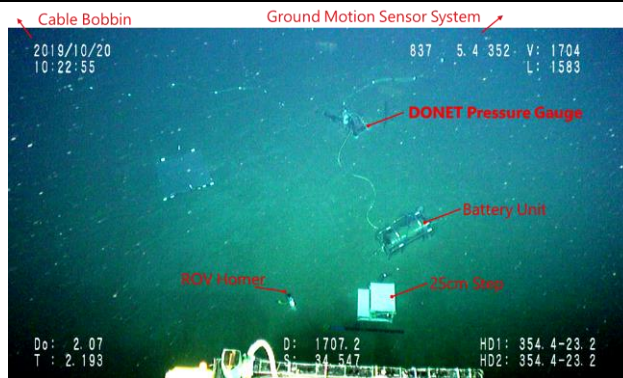
No.	Dive NUM. Date	Dive Point	Arrival Time	Latitude	Longitude	Depth	Work Summary
			Departure Time	Latitude	Longitude	Depth	
	Kaiko#836 2019/10/15	2C-10	09:49	33-07.4913N	135-31.4749E	1,709m	After reaching in front of the DONET 2C-10 pressure sensing system, a mobile pressure calibrator was deployed. And then the level difference with the DONET pressure sensor system and the pressure was measured using the mobile pressure calibrator
			14:50	33-07.4889N	135-31.4787E	1,709m	



03



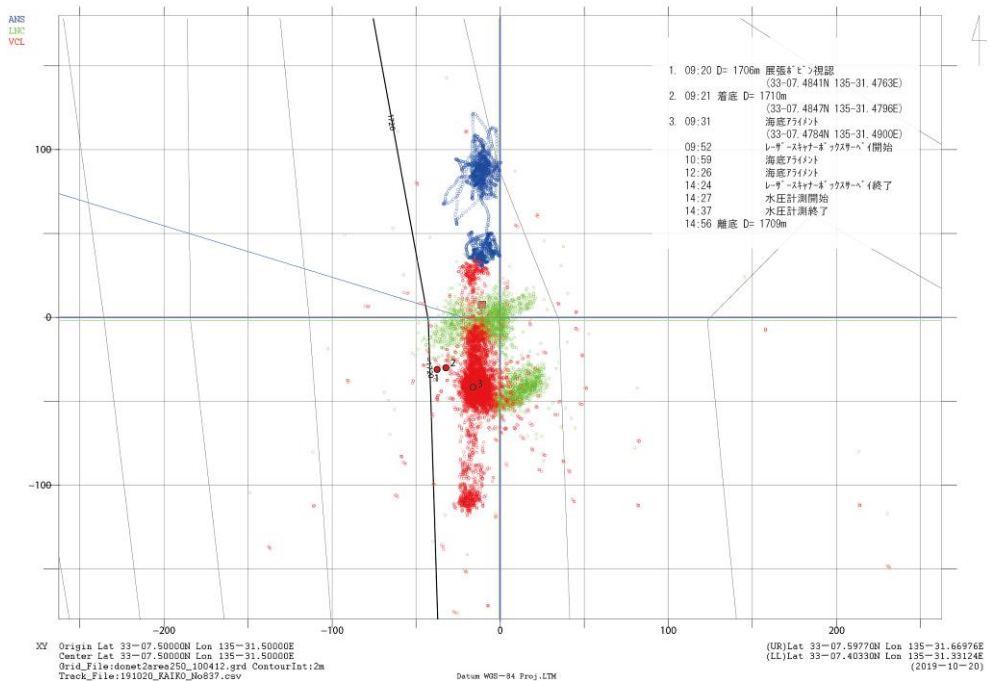
No.	Dive Num. Date	Dive Point	Arrival Time	Latitude	Longitude	Depth	Work Summary
			Departure Time	Latitude	Longitude	Depth	
	Kaiko#837 2019/10/20	2C-10	09:21	33-07.4847N	135-31.4796E	1,710m	At the DONET 2C-10, the bottom terrain on the survey line through the DONET pressure gauge and the reference marker was measured several times using the laser range finder while changing the velocity and altitude of the ROV.
			14:56	33-07.4784N	135-31.4900E	1,709m	



KAIKO Dive#837
KIISUIDO DONET 2C-10

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5. Notice on Using

This cruise report is a preliminary documentation as of the end of cruise.

This report is not necessarily corrected even if there is any inaccurate description (i.e. taxonomic classifications). This report is subject to be revised without notice. Some data on this report may be raw or unprocessed. If you are going to use or refer the data on this report, it is recommended to ask the Chief Scientist for latest status.

Users of information on this report are requested to submit Publication Report to JAMSTEC.

<http://www.godac.jamstec.go.jp/darwin/explain/1/e#report>

E-mail: submit-rv-cruise@jamstec.go.jp