

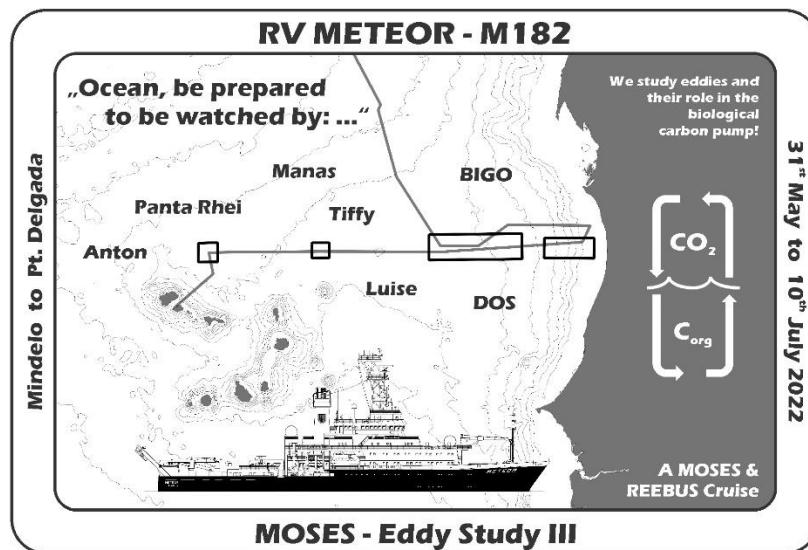
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## Short Cruise Report

### RV METEOR

### Cruise M182

Mindelo (Cabo Verde) – Pt Delgada (Azores)  
31 May 2022 to 10 July 2022  
Chief Scientist: Prof. Dr. Jens Greinert  
Captain: Rainer Hammacher



## Objectives

Cruise M182 is the third and last research cruise within the frame of the BMBF funded REEBUS project with the overarching objective of studying regional eddies in eastern boundary upwelling systems, their impact on pelagic biogeochemical processes and the modulation of the carbon export towards the seafloor. In parallel, it is part of the Helmholtz funded technology project MOSES that aimed to develop modular systems for Earth System studies. Both projects jointly conducted the previous two RV METEOR cruises M156 and M160. The study area of the REEBUS project is the northern tropical Atlantic between Cabo Verde and Mauritania along an E-W transect at about 18° north. The two previous cruises focussed on water column investigations including eddy hunting by using physical oceanography tools and approaches (ship based ADCPs, CTD, glider) with parallel water column sampling for biogeochemical investigations. In addition, seafloor studies with sediment sampling, optical and acoustic mapping as well as in-situ biogeochemical flux measurements with landers were performed. Furthermore, M160 coordinated a mission with the Stemme S10 VTX motorglider from Aachen University for detecting eddies.

During M182 we focused on biogeochemical investigation of the seafloor but also did a substantial water column sampling program including an ADCP and CTD-based eddy hunt survey. As the time between applying for the cruise and the actual cruise was rather long, an additional group looking at gelatinous organisms in the water column joined and broadened our studies. For achieving our overarching objective, a number of tasks guided the work during M182 which can be summarized as follows:

- Map, characterise and ‘pin-point’ an eddy using physical oceanography (ship-based ADCP, CTD) and satellite-based sea-surface height information
- Sample the eddy along a cross-transect for biogeochemical investigations
- Perform vertical water column sampling and optical investigations along horizontal transects for gelatinous organisms
- Investigate the potentially small scaled heterogeneity of the biogeochemical carbon turnover on the seafloor using
  - AUV based mapping technologies (acoustically and optically)
  - XOFOS-based high resolution optical seafloor mapping
  - detailed sediment sampling with TV-MUC and GC
  - in-situ biogeochemical flux measurements with BIGO landers and the Panta Rhei rover
- Deploy the BBL lander (CTD, ADCP, sediment trap, time laps camera) and the deep-sea rover Panta Rhei (benthic oxygen flux chambers, ADCP, CTD, cameras) to investigate the potential impact of a passing eddy until their recovery on 15 January 2023 with RV MS MERIAN

To achieve these tasks a substantial amount and variety of equipment was shipped to Mindelo (11 containers in total) including two BIGO landers, the BBL lander, the deep-sea rover, the deep-diving AUV (Abyss), two 500m diving AUVs (Anton, Luise), a 5m gravity corer, a TV-guided multicorer, a Maxi-Multinet (9 nets), a CTD with 24 water bottles carousel, and the XOFOS ocean floor observation system (Figure 1).



*Figure 1: Impressions of gear and work during M182*

## Narrative

M182 had five full weeks of station work, followed by a transit of 4.5 days from our last sampling location, the Cape Blanc site, to Pt Delgada on the Azores. Figure 8 shows the cruise track from Mindelo up to Cape Blanc. During all the time the EM 122 multibeam, the ship-based 38kHz ADCP and the thermosalinograph kept running to acquire needed data for the eddy hunt and also to add underway data e.g. for mapping uncharted parts of the seafloor and add them to the GEBCO compiled data of our oceans. Members of the scientific party started to arrive on Sao Vicente, an island of the archipelago of Cape Verde in the Atlantic Ocean at 16°53' N and 25° 00' W, already on 27<sup>th</sup> of May. The last member of the scientific party arrived on 30<sup>th</sup> after an unplanned stop-over in Lisbon. The 29<sup>th</sup> and 30<sup>th</sup> May were busy with loading and installing equipment and making it ready to leave harbor the next morning.

### Week 1 – 31<sup>st</sup> May to 6<sup>th</sup> June

The M182 expedition started at 9:00 am local time on 31<sup>st</sup> May in Mindelo on Sao Vicente. We arrived at our first station the Cabo Verde Ocean Observatory site (CVOO) at 13:35 local time, where we conducted a multi-net haul (station 001) and our first of 52 CTD casts. On June 1<sup>st</sup>, two LBL transponders were deployed in our western-most working area (E1) to prepare for AUV Abyss dives. The second CTD was taken (station 005) as the eastern most CTD station of a long E-W transect stretching from the E1 to E5 area. This CTD section is a repetition of an equivalent transect performed during M156. After our first TV-MUC sampling we deployed the BIGO lander in E1 to measure benthic fluxes for several days (stations 008 and 010). Subsequently, the XOFOS was deployed for the first time and all its functions were checked and tested and the seafloor was surveyed optically. More multibeam data were acquired while RV METEOR approached the next multi-net and CTD position between work area E1 and E2 marking the second CTD station on the E-W transect (stations 013 and 014). The multibeam echo sounder on the transit revealed

a seamount structure (E1-Hill), which we selected for the second BIGO deployment in the early night of June 2<sup>nd</sup> (station 015). To save time, the heel frame normally used to deploy the lander was sent on a reconnaissance trip in NE direction to explore the sediment surface and bioturbation type and intensity in the lander vicinity. On the morning of June 3<sup>rd</sup>, a TV-MUC (station 016) was taken near the lander position before we returned to the E1 area.

Back at E1 the Panta Rhei rover (station 018) was deployed for the first time in such great water depth and particularly the group around Stefan Sommer was very much looking forward to its recovery and hopefully successful completion of the mission. A second XOFOS surveyed the E1 area again (station 019) before another sediment core was taken for a colleague at GEOMAR (station 020). After that, we continued mapping to the east to take a multi-net, a CTD, a TV-MUC and an XOFOS to visually inspect the top 1000 m of the water column (stations 025 to 028) at the E1-Hill site. This site turned out to be the NW periphery of the eddy that we sampled in more detail later.

We went back to the E1-Hill site to conclude sampling at this area by deploying the BIGO lander once more, take a second TV-MUC at the top of the hill and run a XOFOS seafloor survey down the hill in northward direction. At the end of the XOFOS transect we sampled for organisms in the upper 1500m using the multi-net (stations 030 to 033). With 33 stations, we concluded the first week of work by heading back to the E1 area.

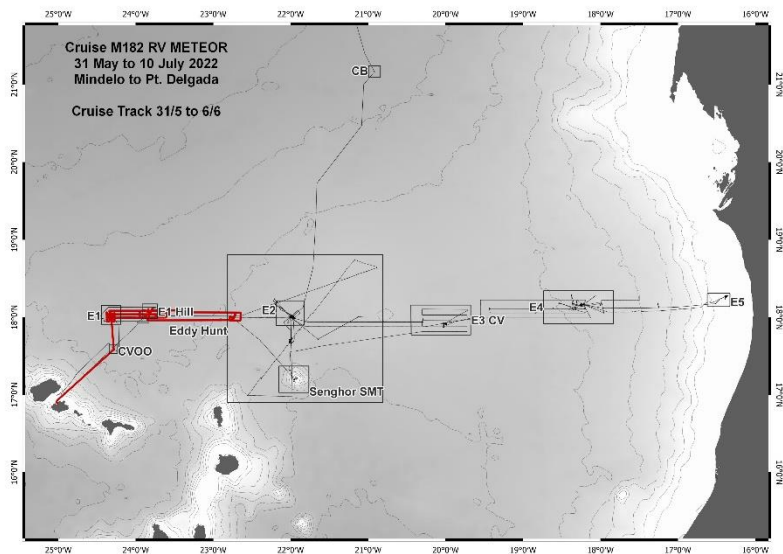


Figure 2: Cruise track week 1.

### **Week 2 – 7<sup>th</sup> to 13<sup>th</sup> June**

Back at E1 we took our first gravity corer of the cruise and recovered the two LBL transponders. Unfortunately, AUV Abyss could not be deployed as an O-Ring of the inertial navigation sensor was broken and despite a large number of spare O-rings on board this particular one was not present. So, after a USBL test-station for AUV Anton (station 038) and two further XOFOS stations (station 039 and 040) for biological water column investigations. Before we headed back towards Mindelo for the delivery of AUV spare parts, the missing O-ring and an additional fluorescence sensor that was kindly supplied by the Ocean Science Centre Mindelo.

After the successful hand over, we turned back north to take a night multi-net at CVOO (station 042) followed by a long multibeam survey towards the east and the start of the Eddy-Hunt CTD transect.

Satellite images showed sea surface height anomaly indicative of an eddy with a core position roughly at the E2 area. The supposed eddy had dimensions of about 115 km by 180 km and as such was rather big. Starting early morning at 00:44 the first (station 045) of 15 CTDs physically explored the eddy every 8 nmi. In addition, the ship-based 38kHz ADCP was used to measure the water current direction and speed in the upper 800m to 900m in 32m thick layers. A short additional USBL testing for AUV Anton was performed at the location of CTD station 053 for solving issues with lever-arm offsets which are needed for accurate underwater navigation. After finishing the physical exploration of the eddy towards 70° we turned southward on a 220° course to sample the eddy every 16nmi. The last CTD station along this transect was station 068 in the morning of 12<sup>th</sup> June.

To take the needed gravity core at E2 we headed back to this area but after sampling went back south to take a CTD, a water column XOFOS and a multi-net at the supposed eddy centre at 17°41.229' N and 21°59.659' W (stations 71 to 73). We used the chance to investigate the central part of the eddy in more detail by deploying AUV Abyss in a zig-zag water column mapping mode. This new possibility came with the upgrade of the system after 2.5 years of repairs. This first dive of Abyss (station 074) was a success after the delay due to the missing the O-ring. After the Abyss dive we went back to E2, deployed the LBL transponders and the BIGO and took another CTD before in late in the night of the 13<sup>th</sup> June ninth XOFOS went into the water to observe the seafloor across the sampling and lander site of E2.

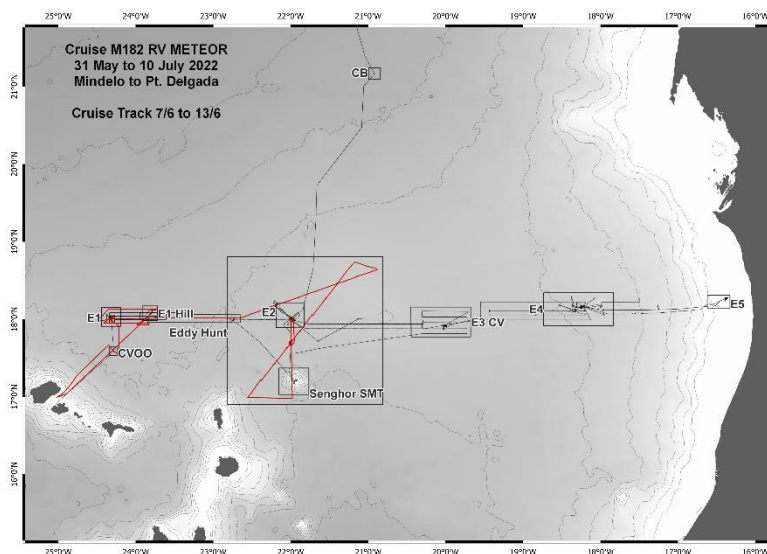


Figure 3: Cruise track week 2.

### **Week 3 and one day – 14<sup>th</sup> to 20<sup>th</sup> June**

After finishing the XOFOS in the E2 area we acquired additional multibeam data of the E2 area and before we took a multi corer and deployed the deep sea rover and the AUV to perform their monitoring and mapping missions (stations 080 to 082). While these two devices were running we sampled a station 16nmi towards the NW at the periphery of the eddy with two CTD cast a water column XOFOS and a multi-net (stations 083 to 086). After recovering the AUV we headed south again to the eddy core location for further CTD, sediment and biological water column sampling (stations 088 to 092). Continuing the CTD stations across the eddy towards the south we took CTD station 093 at the northern flank of the Senghor seamount and performed an EM122 multibeam survey of the top of the seamount to prepare for a AUV Anton dive in about 105m depth. Prior to the AUV deployment we surveyed the top to ensure that no lost



fishing gear as nets or lines can cause damage to the AUV. The fauna on the seamount was spectacular and color full and was very much contrasting to the much more homogenous and 'brown' seafloor in the abyss. After Anton's successful recovery, we continued sampling the western periphery of the eddy (CTD stations 098) and continued in the same direction towards the E1-E2 mountain range for a final TV-MUC sampling. We went back to E2 and deployed AUV Abyss for another camera and sidescan sonar mapping survey (station 100) and used the time of the mapping to move back to the NW eddy periphery to take an XOPOS and a multi-net during the day (stations 101 and 102). Three consecutive CTDs were performed on our way towards the east adding more stations along the long E-W CTD transect (stations 103 – 105). During the transit towards the E3 area we recognized a mountain range like area that we decided to map in greater detail for subsequent sediment sampling. After acquiring the TV-MUC sample at the top of the range, we deployed AUV Abyss again in the E2 area (station 108) and after retrieval of the AUV and the LBL transponders we completed a second CTD cats at an updated eddy core location a bit south of the previous core location (station 111) before we went on a long multibeam survey to cover the supposed to be 'new' long-term monitoring area for the BBL and rover deployment in Cabo Verde waters (area E3-CV). The time of the multibeam mapping (station 112) was used to celebrate the mid of the cruise and a combined birthday of 11 crew members and scientists.

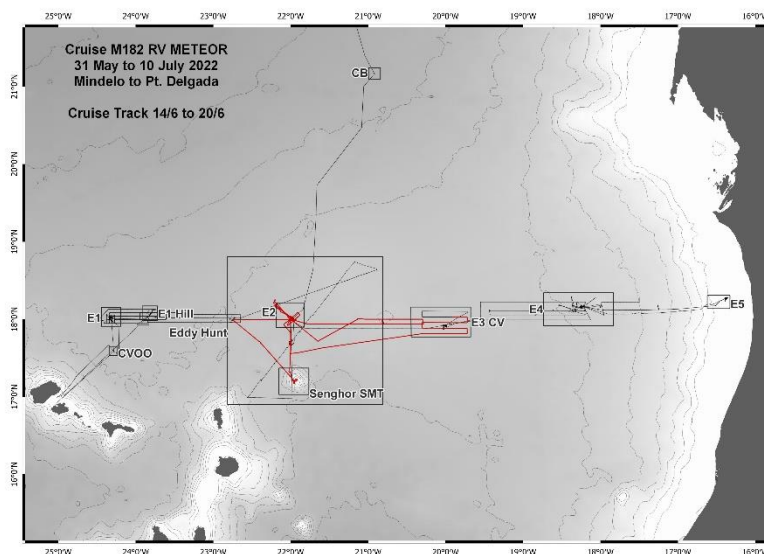


Figure 4: Cruise track week 3.

#### **Week 4 – 21<sup>st</sup> to 27<sup>th</sup> June**

The next six stations after our midterm break aimed at characterizing this new working area; this included a TV-MUC (station 113) an AUV deployment, GC sediment recovery, BIGO and rover deployments with CTD station 118 as last station on 21<sup>st</sup> June. During the very early morning of 22<sup>nd</sup> June, two XOPOS dives took place one for inspecting the water column, the second for exploring the seafloor of the supposed long-term monitoring area. We left the site and one BIGO lander and headed further towards the east to start working in area E4. On the way we took another CTD of the long E-W transect (station 124) and started with GC sampling upon arrival in E4. Until noon of the 28<sup>th</sup> we stayed in the E4 area mapping and sampling different habitats and geological structure of this much more versatile area. Changing between multibeam mapping and XOPOS transects during the night to lander and TV-MUC deployments during the day and in between AUV deployments and recoveries, we undertook stations 121 to 152 during this time.

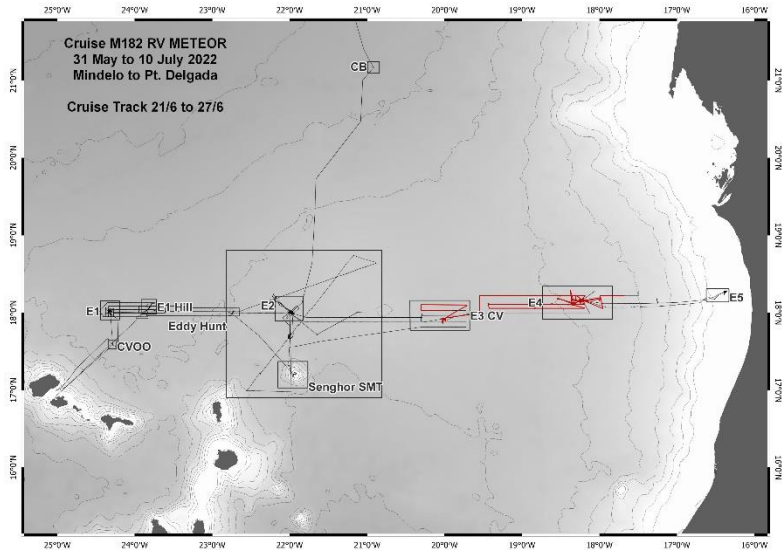


Figure 5: Cruise track week 4.

### **Week 5 – 28<sup>th</sup> June to 5<sup>th</sup> July**

In the afternoon of the 28<sup>th</sup> June we started steaming further towards the east and lowered CTD number 47 (station 154) early evening of the 28<sup>th</sup> followed by a water column XOFOS station between working area E4 and E5 in about 2150m water depth. Work in E5 started in the morning of the 29<sup>th</sup> June with one CTD at 176m water depth, the most eastern CTD of the long E-W transect and an even shallower CTD at 75m water depth (stations 156 and 157), at an area that was studied already during M107 as part of SFB754 studies. Next to sampling this area we aimed at more intensely deploying the small Girona 500 AUVs. In preparation for this we lowered a USBL transponder of the small AUVs and performed a number of loop and crossing transects over it to further develop and compare position offsets of GEOMARs Beluga software and the commercial equivalent. This work happened during the night after the BIGO was deployed for a 3 days measurement and two TV-MUCs were taken (station 160 and 161). An XOFOS in the evening showed as the shallow water habitats of this heavily fished area. METEOR was surrounded by eight and sometimes more large fishing vessels which apparently focus on pelagic fishing, as the seafloor that we inspected showed little impact of bottom trawling. In the morning of 30<sup>th</sup> July both small AUVs, Anton and Luise were launched to perform a camera survey (Anton) and a number of automated water column surveys (Luise). During recovery of Luise she was pulled below the ships hull and due to her internal safety features, stayed below the surface and could not be retrieved immediately; we could pick her up about 2h later after she had drifted off about 2.5nmi towards the south. Following this short search and recover operation, we successfully deployed AUV Abyss for two camera missions (station 167). After two additional seafloor XOFOS transects during the night, we left the E5 area to retrieve the rover in the E4 and the BIGO in the E3-CV area. On the way two additional TV-MUCs were taken in a canyon system of E5 and at 1700m water depth further to the west (stations 171 and 172 and an additional CTD for the E-W transect was taken between E4 and E5. The recovery of the rover and the BIGO went well, although the recovery of the rover during the night with 2m waves was challenging. Due to the visual and sidescan inspection of the seafloor within E3-CV we decided earlier to shift the longterm monitoring location towards E2, where we arrived early morning on 3<sup>rd</sup> July readily prepared to deploy the BBL lander and the rover until 15<sup>th</sup> January 2023 (stations 176 and 177) and undertake a camera and sidescan inspection of

their deployment area. A final CTD at E2 aimed at characterizing t0 of the longterm deployment at this site.

Moving north towards the Cape Blanc area we added multibeam data where GEBCO maps did not show existing coverage. We arrived after 24h and performed our three last physical sample stations, a CTD, TV-MUC and GC, before we concluded sampling and started our transit towards the Azores. Until the 200nmi zone of the EEZ we continued acquiring multibeam and ADCP data and continued without data recording until we arrived the pilot station at 19:30 on 9<sup>th</sup> July.

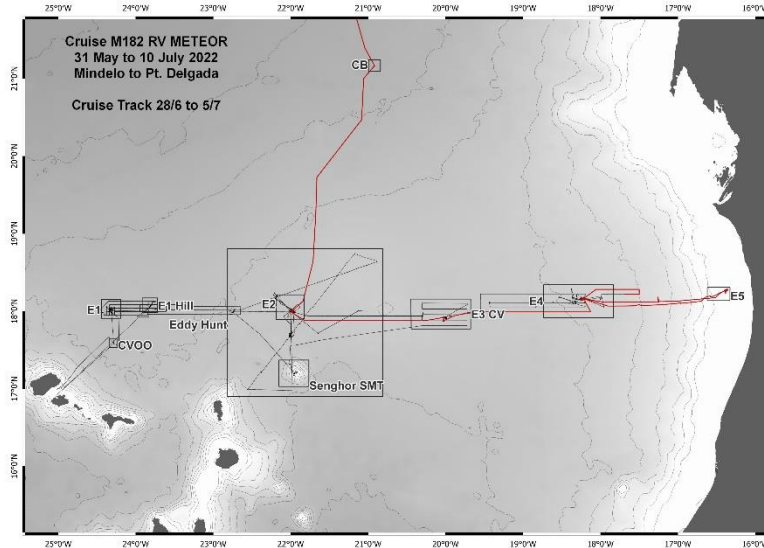


Figure 6: Cruise track week 5.

## Acknowledgements

All members of the scientific party would like to express their greatest thanks to the captain and crew of M182 for their excellent work and cooperative attitude, we felt very welcome and enjoyed the time on board. We will certainly come back. Thanks also go to our colleagues from the physical oceanography department (Marcus Dengler, Tim Fischer), the data management of GEOMAR (Carsten Schirnick) and Robert Kopte from CAU who supported our eddy hunt remotely. The cruise was financially supported through the ships-proposal grant GPF 19-02\_020 and the BMBF funded project REEBUS (grant 03F0815). Technological support for our MOSES equipment came from the Helmholtz Association. Additional financial support came from GEOMARs 'Schiffstopf'.



Figure 7: Group photo just before arriving in Pt Delgada.



## Cruise Track with bathymetry

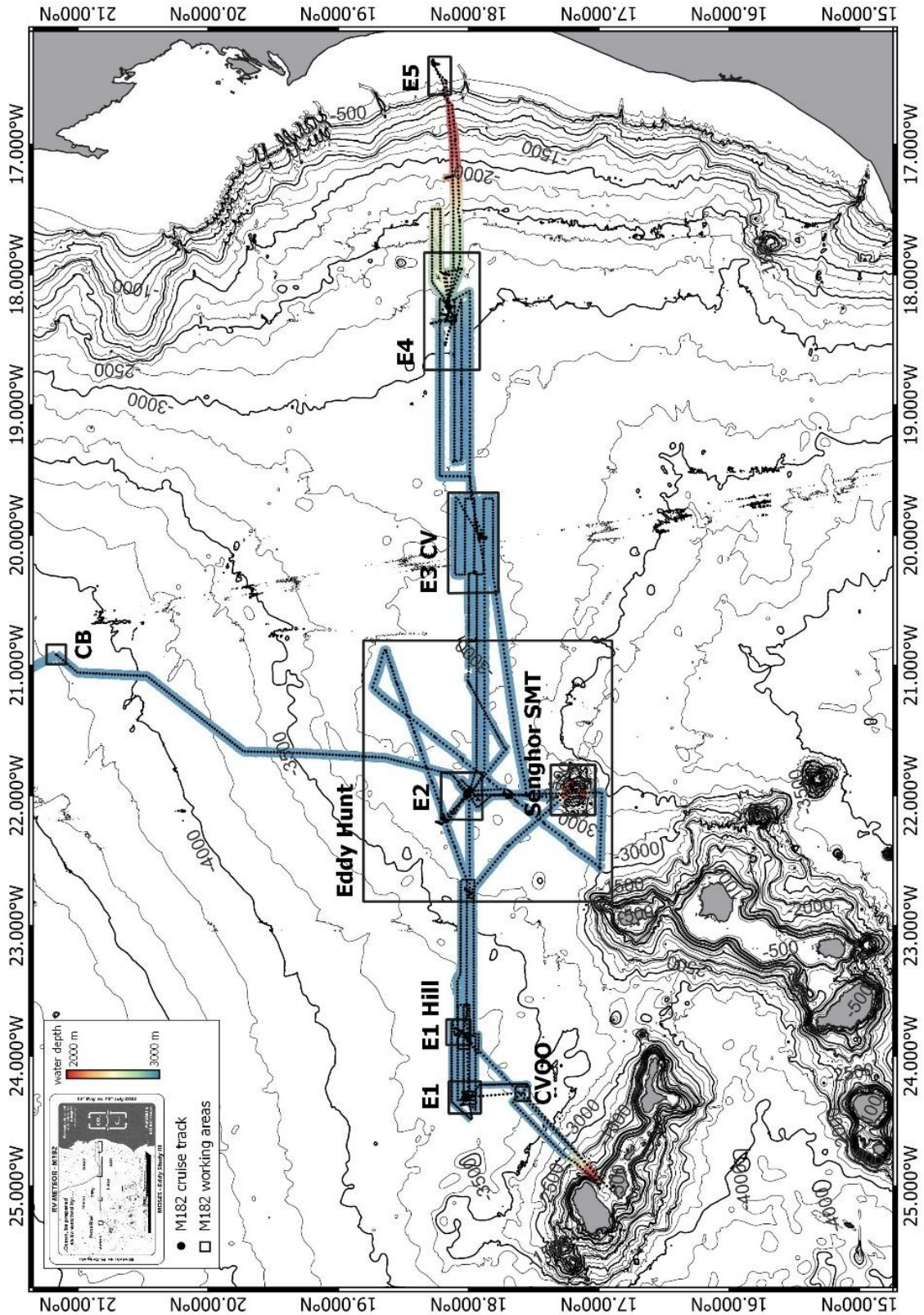


Figure 8: Cruise track and multibeam data of M182 with our various detailed working areas.

## Participants

Below the list of scientific and technical personal during M182. This was a pure GEOMAR cruise which, however included three departments and was truly and multidisciplinary joint effort.

Name	Discipline	Institution
Greinert, Jens Prof.	Chief Scientist	GEOMAR
Kampmeier, Mareike	Co-Chief Scientist	GEOMAR
Linke, Peter Dr.	sediment sampling	GEOMAR
Dale, Andy Dr.	sediment geochemical analyses	GEOMAR
Surberg, Regina	sediment geochemical analyses	GEOMAR
Domeyer, Bettina	sediment geochemical analyses	GEOMAR
Chuang, Pei-Chuan	sediment geochemical analyses	GEOMAR
Spiegel, Timo	sediment geochemical analyses	GEOMAR
Sommer, Stefan Dr.	biogeochemistry / lander	GEOMAR
Türk, Matthias	lander technology	GEOMAR
Nolte, Gabriel	lander & rover technology	GEOMAR
Fabrizius, Eduard	XOFOS technology	GEOMAR
Hoving, Henk-Jan Dr.	pelagic biology	GEOMAR
Hansen, Nis	pelagic biology	GEOMAR
Mohrmann, Jochen	informatics	GEOMAR
Hinz, Anina-Kaja	seafloor observations	GEOMAR
Heger, Karl	data management	GEOMAR
Von See, Benedict	Girona AUVs	GEOMAR
Striewski, Peter	AUV technology	GEOMAR
Wenzlaf, Emanuel	AUV technology	GEOMAR
Korbjuhn, Torge	AUV technology	GEOMAR
Danilo, Schappukat	AUV technology	GEOMAR
Pontiller, Benjamin Dr.	water column biogeochemistry	GEOMAR
Golde, Sandra	water column biogeochemistry	GEOMAR
Devresse, Quentin	water column biogeochemistry	GEOMAR
Von Jackowski, Anabel	water column biogeochemistry	GEOMAR
Weyand, Phillip	water column biogeochemistry	GEOMAR

## Station list

The station list below shows all stations. Stations as seafloor observation tracks, multibeam profiles or pelagic optical stations have a start and end coordinate. Event Time is given in DD/M/YYYY HH:MM and coordinates are given in the DD:MM.mmm annotation. MUCs, GCs and landers were typically deployed with USBL navigation. Technical issues or shallow water depth sometimes hindered USBL navigation; this is indicated with 'no transponder' in the table.

Station name	Event Time	Ship-Latitude N	Ship-Longitude W	USBL-Latitude N	USBL-Longitude W	Depth (m)	Working Area
M182_1-1_MN_B9-1	31/5/2022 16:35	17:35.011	24:17.001			3597	CVOO
M182_2-1_CTD-1	31/5/2022 18:53	17:35.012	24:17.000			3597	CVOO
M182_3-1_TP-1	31/5/2022 23:08	17:59.073	24:18.905			3694	E1
M182_4-1_TP-1	31/5/2022 23:22	17:59.842	24:18.746			3694	E1
M182_5-1_CTD-2	1/6/2022 01:15	18:00.006	24:20.014			3694	E1
M182_6-1_TP-2	1/6/2022 03:42	18:00.060	24:19.119			3694	E1
M182_6-1_TP-2	1/6/2022 04:44	17:59.009	24:18.908			3693	E1
M182_7-1_EM122-1	1/6/2022 06:30	18:02.995	24:22.456			3710	
M182_7-1_EM122-1	1/6/2022 08:32	18:02.773	24:20.478			3700	
M182_8-1_TVMUC-1	1/6/2022 10:35	18:00.004	24:20.013	18:00.020	24:20.013	3701	E1
M182_9-1_EM122-2	1/6/2022 13:16	18:02.897	24:18.485			3695	
M182_9-1_EM122-2	1/6/2022 15:40	18:02.988	24:16.449			3690	
M182_10-1_BIGO_I-1	1/6/2022 19:14	17:59.991	24:20.010	18:00.008	24:20.018	3697	E1
M182_11-1_XOFOS-1	1/6/2022 23:24	17:59.993	24:20.009			3696	E1
M182_11-1_XOFOS-1	2/6/2022 00:54	18:00.578	24:19.554			3696	E1
M182_12-1_EM122-3	2/6/2022 02:18	18:02.375	24:15.543			3685	
M182_12-1_EM122-3	2/6/2022 14:27	18:00.264	23:36.604			3614	
M182_13-1_MN_B9-2	2/6/2022 15:20	18:00.016	23:36.556			3614	E1 hill - E2
M182_14-1_CTD-3	2/6/2022 17:44	18:00.016	23:36.559			3612	E1 hill - E2
M182_15-1_BIGO_II-1	3/6/2022 00:31	18:02.874	23:49.170	18:03.203	23:48.994	3563	E1 hill
M182_16-1_TVMUC-2	3/6/2022 09:32	18:02.885	23:49.180	18:02.900	23:49.187	3562	E1 hill
M182_17-1_EM122-4	3/6/2022 11:44	18:05.069	23:55.505			3645	
M182_17-1_EM122-4	3/6/2022 14:37	18:05.068	24:19.940			3699	
M182_18-1_DSR-1	3/6/2022 20:02	17:59.988	24:19.976	18:00.010	24:19.975	3693	E1
M182_19-1_XOFOS-2	4/6/2022 00:08	18:00.058	24:20.059			3694	E1
M182_19-1_XOFOS-2	4/6/2022 03:17	18:01.296	24:19.049			3691	E1
M182_20-1_TVMUC-3	4/6/2022 06:53	18:02.233	24:19.955	18:02.230	24:19.977	3694	E1
M182_21-1_EM122-5	4/6/2022 08:43	17:59.685	24:15.828			3682	
M182_21-1_EM122-5	4/6/2022 11:07	17:59.643	23:55.979			3652	
M182_22-1_CTD-4	4/6/2022 14:19	18:02.957	23:49.224			3556	E1 hill
M182_23-1_XOFOS-3	4/6/2022 15:30	18:02.999	23:49.280			3553	E1 hill
M182_23-1_XOFOS-3	4/6/2022 18:10	18:04.643	23:48.116			3569	E1 hill

M182_24-1_EM122-6	4/6/2022 19:32	18:05.216	23:37.413			3629	
M182_24-1_EM122-6	5/6/2022 04:27	17:57.565	22:47.159			3399	
M182_25-1_MN_B9-3	5/6/2022 05:42	18:00.122	22:47.182			3414	Eddy NW
M182_26-1_CTD-5	5/6/2022 07:54	18:00.121	22:47.180			3414	Eddy NW
M182_27-1_TVMUC-4	5/6/2022 10:40	18:00.120	22:47.181	18:00.134	22:47.183	3414	Eddy NW
M182_28-1_XOFOS-4	5/6/2022 15:53	17:58.845	22:45.407			3397	Eddy NW
M182_28-1_XOFOS-4	5/6/2022 23:47	18:01.518	22:43.390			3401	Eddy NW
M182_29-1_EM122-7	6/6/2022 00:51	17:57.808	22:46.695			3410	
M182_29-1_EM122-7	6/6/2022 08:18	17:57.676	23:50.701			3632	
M182_30-1_BIGO_II-2	6/6/2022 11:20	18:02.878	23:49.179	no transp.	no transp.	3559	E1 hill
M182_31-1_TVMUC-5	6/6/2022 14:06	18:04.442	23:51.048	18:04.460	23:51.046	3129	E1 hill
M182_32-1_XOFOS-5	6/6/2022 16:40	18:04.527	23:51.100			3141	E1 hill
M182_32-1_XOFOS-5	6/6/2022 21:57	18:06.240	23:50.346			3445	E1 hill
M182_33-1_MN_B9-4	6/6/2022 22:50	18:06.244	23:50.350			3444	E1 hill
M182_34-1_EM122-8	7/6/2022 00:50	18:07.919	23:45.190			3654	
M182_34-1_EM122-8	7/6/2022 07:27	17:59.334	24:28.971			3699	
M182_35-1_GC-1	7/6/2022 10:08	17:59.891	24:20.020	17:59.908	24:20.024	3692	E1
M182_36-1_TP-3	7/6/2022 11:16	17:59.914	24:20.063			3693	E1
M182_37-1_TP-3	7/6/2022 12:08	17:59.130	24:18.945			3690	E1
M182_38-1_AUV_ANTON-1	7/6/2022 16:08	17:59.851	24:18.657			3691	E1
M182_39-1_XOFOS-6	7/6/2022 17:51	17:59.895	24:18.625			3691	E1
M182_39-1_XOFOS-6	7/6/2022 19:15	18:00.197	24:18.430			3689	E1
M182_40-1_XOFOS-7	7/6/2022 21:08	18:00.208	24:18.424			3690	E1
M182_40-1_XOFOS-7	7/6/2022 23:55	18:02.399	24:17.006			3689	E1
M182_41-1_EM122-9	8/6/2022 01:19	17:56.917	24:23.557			3683	
M182_41-1_EM122-9	8/6/2022 06:31	17:55.462	23:58.652			3633	
M182_42-1_MN_B9-5	9/6/2022 02:04	17:34.970	24:16.988			3601	CVOO
M182_43-1_EM122-10	9/6/2022 03:30	17:33.422	24:12.874			3585	
M182_43-1_EM122-10	9/6/2022 06:54	17:54.692	24:13.271			3664	
M182_44-1_EM122-11	9/6/2022 17:21	18:01.014	23:35.305			3609	
M182_44-1_EM122-11	9/6/2022 23:57	18:00.842	22:39.034			3383	
M182_45-1_CTD-6	10/6/2022 00:44	18:00.815	22:38.995			3383	Eddy Hunt
M182_46-1_CTD-7	10/6/2022 02:40	18:03.601	22:31.797			3349	Eddy Hunt
M182_47-1_CTD-8	10/6/2022 04:37	18:06.289	22:24.082			3345	Eddy Hunt
M182_48-1_CTD-9	10/6/2022 06:36	18:09.208	22:16.530			3335	Eddy Hunt
M182_49-1_CTD-10	10/6/2022 08:37	18:11.650	22:08.838			3325	E2
M182_50-1_CTD-11	10/6/2022 10:43	18:14.261	22:01.394			3305	Eddy Hunt
M182_51-1_CTD-12	10/6/2022 12:48	18:16.848	21:54.019			3275	Eddy Hunt
M182_52-1_CTD-13	10/6/2022 14:49	18:19.623	21:46.801			3249	Eddy Hunt
M182_53-1_CTD-14	10/6/2022 16:57	18:22.128	21:39.177			3192	Eddy Hunt
M182_54-1_AUV_ANTON-2	10/6/2022 16:36	18:22.102	21:39.123			3195	Eddy Hunt

M182_55-1_CTD-15	10/6/2022 19:20	18:25.037	21:31.025			3129	Eddy Hunt
M182_56-1_CTD-16	10/6/2022 21:23	18:27.685	21:23.500			3103	Eddy Hunt
M182_57-1_CTD-17	11/6/2022 00:43	18:30.199	21:15.939			3081	Eddy Hunt
M182_58-1_CTD-18	11/6/2022 02:53	18:32.996	21:08.616			3097	Eddy Hunt
M182_59-1_CTD-19	11/6/2022 04:58	18:35.578	21:00.934			3131	Eddy Hunt
M182_60-1_CTD-20	11/6/2022 07:06	18:38.315	20:53.175			3171	Eddy Hunt
M182_61-1_CTD-21	11/6/2022 11:58	18:27.732	21:23.544			3103	Eddy Hunt
M182_62-1_CTD-22	11/6/2022 14:45	18:15.698	21:33.009			3161	Eddy Hunt
M182_63-1_CTD-23	11/6/2022 17:27	18:02.770	21:43.036			3236	Eddy Hunt
M182_64-1_CTD-24	11/6/2022 20:14	17:50.386	21:53.038			3299	Eddy Hunt
M182_65-1_CTD-25	11/6/2022 22:59	17:37.833	22:02.716			3343	Eddy Hunt
M182_66-1_CTD-26	12/6/2022 01:39	17:25.552	22:12.440			3356	Eddy Hunt
M182_67-1_CTD-27	12/6/2022 04:24	17:12.579	22:22.649			3337	Eddy Hunt
M182_68-1_CTD-28	12/6/2022 07:13	16:59.595	22:33.697			3088	Eddy Hunt
M182_69-1_VMADCP_38kHz-1	12/6/2022 07:55	16:59.600	22:33.645			3094	Eddy Hunt
M182_69-1_VMADCP_38kHz-1	12/6/2022 11:10	16:58.656	21:59.008			3442	Eddy Hunt
M182_70-1_GC-2	12/6/2022 19:13	18:00.002	22:00.039	18:00.029	22:00.043	3295	E2
M182_71-1_CTD-29	12/6/2022 23:03	17:41.609	21:59.917			3332	Eddy Core
M182_72-1_XOFOS-8	13/6/2022 00:31	17:41.641	21:59.875			3332	Eddy Core
M182_72-1_XOFOS-8	13/6/2022 03:04	17:43.957	21:58.995			3325	Eddy Core
M182_73-1_MN_B9-6	13/6/2022 04:44	17:41.491	21:59.864			3332	Eddy Core
M182_74-1_AUV_ABYSS-1	13/6/2022 05:38	17:41.532	21:59.849			3332	Eddy Core
M182_75-1_TP-4	13/6/2022 13:44	17:59.471	21:58.045			3290	E2
M182_75-1_TP-4	13/6/2022 14:03	18:00.199	21:58.021			3290	E2
M182_76-1_CTD-30	13/6/2022 15:41	17:59.966	22:00.064			3294	E2
M182_77-1_BIGO_II-3	13/6/2022 19:05	17:59.963	22:00.064	18:00.009	22:00.072	3294	E2
M182_78-1_XOFOS-9	13/6/2022 23:39	17:59.752	22:00.141			3295	E2
M182_78-1_XOFOS-9	14/6/2022 03:42	18:02.058	21:59.313			3299	E2
M182_79-1_EM122-12	14/6/2022 06:01	17:55.253	22:01.981			3300	
M182_79-1_EM122-12	14/6/2022 08:48	18:00.299	22:00.123			3296	
M182_80-1_TVMUC-6	14/6/2022 10:05	17:59.967	22:00.059	17:59.994	22:00.057	3294	E2
M182_81-1_DSR-2	14/6/2022 15:38	17:59.987	22:00.157	17:59.997	22:00.159	3294	E2
M182_82-1_AUV_ABYSS-2	14/6/2022 17:30	17:59.082	21:57.541			3289	E2
M182_83-1_CTD-31	14/6/2022 22:05	18:06.194	22:07.939			3320	Eddy N
M182_84-1_CTD-32	14/6/2022 23:33	18:09.848	22:12.112			3329	Eddy N
M182_85-1_XOFOS-10	15/6/2022 00:50	18:09.901	22:12.078			3328	Eddy N
M182_85-1_XOFOS-10	15/6/2022 03:52	18:12.238	22:10.170			3326	Eddy N
M182_86-1_MN_B9-7	15/6/2022 05:45	18:09.696	22:12.055			3328	Eddy N
M182_87-1_EM122-13	15/6/2022 08:05	17:59.908	22:00.193			3295	
M182_87-1_EM122-13	15/6/2022 09:56	17:49.791	22:00.208			3313	
M182_88-1_CTD-33	15/6/2022 12:08	17:41.670	21:59.844			3332	Eddy Core



M182_89-1_XOFOS-11	15/6/2022 13:30	17:40.072	22:01.000			3336	Eddy Core
M182_89-1_XOFOS-11	15/6/2022 16:08	17:42.449	22:00.017			3329	Eddy Core
M182_90-1_MN_B9-8	15/6/2022 17:34	17:41.632	21:59.839			3331	Eddy Core
M182_91-1_TVMUC-7	15/6/2022 19:38	17:41.636	21:59.839	17:41.654	21:59.835	3332	Eddy Core
M182_92-1_CTD-34	15/6/2022 21:14	17:41.635	21:59.839			3333	Eddy Core
M182_93-1_CTD-35	16/6/2022 00:47	17:19.256	22:00.917			2891	Senghor SMT
M182_94-1_EM122-14	16/6/2022 02:39	17:12.518	21:58.199			232	Senghor SMT
M182_94-1_EM122-14	16/6/2022 04:30	17:11.279	21:57.532			104	Senghor SMT
M182_95-1_XOFOS-12	16/6/2022 05:29	17:11.431	21:57.563			103	Senghor SMT
M182_95-1_XOFOS-12	16/6/2022 10:02	17:12.375	21:55.661			592	Senghor SMT
M182_96-1_CTD-36	16/6/2022 10:45	17:13.275	21:54.873			1154	Senghor SMT
M182_97-1_AUV_ANTON-3	16/6/2022 12:30	17:11.680	21:57.407			105	Senghor SMT
M182_98-1_CTD-37	16/6/2022 20:25	17:41.708	22:23.238			3342	Eddy Hunt
M182_99-1_TVMUC-8	17/6/2022 00:57	17:59.497	22:44.846	17:59.499	22:44.843	3397	Eddy NW
M182_100-1_AUV_ABYSS-3	17/6/2022 07:16	17:59.286	21:57.265			3289	E2
M182_101-1_XOFOS-13	17/6/2022 11:51	18:12.473	22:13.248			3337	Eddy N
M182_101-1_XOFOS-13	17/6/2022 14:49	18:14.974	22:12.068			3342	Eddy N
M182_102-1_MN_B9-9	17/6/2022 16:11	18:13.729	22:12.618			3339	Eddy N
M182_103-1_CTD-38	17/6/2022 22:39	17:42.683	21:38.540			3303	Eddy Hunt
M182_104-1_CTD-39	18/6/2022 5:04	17:59.970	21:08.095			3123	Eddy Hunt
M182_105-1_CTD-40	18/6/2022 14:03	17:59.986	20:18.040			3160	E3
M182_106-1_EM122-15	18/6/2022 16:08	17:56.288	20:17.921			3163	
M182_106-1_EM122-15	18/6/2022 20:01	17:56.337	20:48.572			2956	
M182_107-1_TVMUC-9	18/6/2022 21:30	17:59.069	20:48.864	17:59.071	20:48.861	2892	E2-E3 hill
M182_108-1_AUV_ABYSS-4	19/6/2022 09:41	17:59.440	21:57.156			3289	E2
M182_109-1_TP-5	19/6/2022 13:15	17:59.823	21:58.474			3292	E2
M182_110-1_TP-5	19/6/2022 13:44	17:59.186	21:58.205			3292	E2
M182_111-1_CTD-41	19/6/2022 22:39	17:32.957	22:00.012			3353	Eddy Core
M182_112-1_EM122-16	20/6/2022 08:33	17:48.827	20:18.148			3180	
M182_112-1_EM122-16	21/6/2022 07:28	18:05.987	19:43.186			3207	
M182_113-1_TVMUC-10	21/6/2022 10:44	17:54.948	20:01.134	17:54.952	20:01.124	3205	E3 CV
M182_114-1_TP-6	21/6/2022 12:19	17:54.652	19:59.946			3208	E3 CV
M182_114-1_TP-6	21/6/2022 12:36	17:55.299	19:59.941			3207	E3 CV
M182_115-1_CTD-42	21/6/2022 13:26	17:54.961	20:01.132			3203	E3 CV
M182_116-1_BIGO_II-4	21/6/2022 19:38	17:54.939	20:01.131	no transp.	no transp.	3204	E3 CV
M182_117-1_AUV_ABYSS-5	21/6/2022 21:58	17:54.209	19:59.235			3211	E3 CV
M182_118-1_CTD-43	21/6/2022 23:56	17:54.852	20:01.093			3204	E3 CV
M182_119-1_XOFOS-14	22/6/2022 01:30	17:54.783	20:01.089			3204	E3 CV
M182_119-1_XOFOS-14	22/6/2022 04:20	17:52.042	20:01.091			3209	E3 CV

M182_120-1_XOFOS-15	22/6/2022 06:46	17:51.926	20:01.044			3212	E3 CV
M182_120-1_XOFOS-15	22/6/2022 10:04	17:53.275	20:01.719			3205	E3 CV
M182_121-1_GC-3	22/6/2022 13:12	17:54.746	20:01.125	17:54.746	20:01.123	3204	E3 CV
M182_122-1_TP-7	22/6/2022 14:00	17:54.729	20:01.136			3204	E3 CV
M182_123-1_TP-7	22/6/2022 14:47	17:54.418	20:00.088			3208	E3 CV
M182_124-1_CTD-44	22/6/2022 20:54	17:59.618	19:33.019			3220	E3 VC - E4
M182_125-1_EM122-17	22/6/2022 23:44	18:13.053	19:32.916			3190	
M182_125-1_EM122-17	23/6/2022 09:36	18:13.385	18:11.342			2838	
M182_126-1_GC-4	23/6/2022 11:10	18:10.128	18:13.251	18:10.127	18:13.252	2864	E4
M182_127-1_BBL-1	23/6/2022 13:08	18:10.137	18:13.000	free fall		2863	E4
M182_128-1_TP-8	23/6/2022 13:58	18:09.496	18:15.124			2877	E4
M182_128-1_TP-8	23/6/2022 14:17	18:10.196	18:15.100			2878	E4
M182_129-1_AUV_ABYS-6	23/6/2022 18:17	18:08.999	18:14.644			2878	E4
M182_130-1_DSR-3	23/6/2022 22:39	18:09.868	18:13.261	18:09.872	18:13.260	2865	E4
M182_131-1_XOFOS-16	24/6/2022 01:15	18:09.873	18:13.274			2870	E4
M182_131-1_XOFOS-16	24/6/2022 04:12	18:10.905	18:12.868			2859	E4
M182_132-1_TVMUC-11	24/6/2022 06:23	18:10.129	18:13.252	no transp.	no transp.	2866	E4
M182_133-1_AUV_ANTON-4	24/6/2022 09:15	18:08.262	18:15.035			2884	E4
M182_134-1_XOFOS-17	24/6/2022 12:39	18:09.376	18:18.990			2881	E4
M182_134-1_XOFOS-17	24/6/2022 16:57	18:13.034	18:18.161			2881	E4
M182_135-1_BIGO_I-2	24/6/2022 19:30	18:10.128	18:13.539	18:10.154	18:13.547	2866	E4
M182_136-1_EM122-18	24/6/2022 21:24	18:06.571	18:12.229			2886	
M182_136-1_EM122-18	25/6/2022 21:08	18:03.331	18:11.931			2904	
M182_137-1_TVMUC-12	25/6/2022 01:49	18:06.978	18:36.671	no transp.	no transp.	3072	E4
M182_138-1_CTD-45	25/6/2022 14:57	18:03.357	18:50.050			3084	E3 VC - E4
M182_139-1_TVMUC-13	25/6/2022 23:06	18:06.281	18:21.470	18:06.295	18:21.475	2977	E4
M182_140-1_XOFOS-18	26/6/2022 00:26	18:06.283	18:21.557			2978	E4
M182_140-1_XOFOS-18	26/6/2022 05:05	18:10.136	18:21.407			2905	E4
M182_141-1_AUV_ABYS-7	26/6/2022 06:59	18:09.298	18:14.787			2876	E4
M182_142-1_TVMUC-14	26/6/2022 11:48	18:10.787	18:32.452	18:10.804	18:32.459	3052	E4
M182_143-1_TVMUC-15	26/6/2022 17:06	18:17.346	18:22.559	18:17.359	18:22.561	2949	E4
M182_144-1_XOFOS-19	26/6/2022 20:22	18:05.832	18:21.183			2930	E4
M182_144-1_XOFOS-19	26/6/2022 23:32	18:07.361	18:21.613			2935	E4
M182_145-1_XOFOS-20	27/6/2022 04:09	18:10.789	17:59.628			2478	E4
M182_145-1_XOFOS-20	27/6/2022 07:39	18:09.098	18:00.230			2579	E4
M182_146-1_TVMUC-16	27/6/2022 09:59	18:10.825	17:59.625	18:10.844	17:59.627	2478	E4
M182_147-1_AUV_ABYS-8	27/6/2022 13:09	18:09.792	18:15.160			2883	E4
M182_148-1_CTD-46	27/6/2022 17:31	18:03.378	17:57.358			2762	E4
M182_149-1_TVMUC-17	27/6/2022 19:44	18:03.378	17:57.357	18:03.395	17:57.368	2733	E4
M182_150-1_EM122-19	27/6/2022 21:46	18:13.110	17:59.236			2471	
M182_150-1_EM122-19	28/6/2022 07:09	18:09.817	18:13.158			2867	

M182_151-1_TP-9	28/6/2022 11:10	18:09.219	18:15.161			2879	E4
M182_152-1_TP-9	28/6/2022 12:13	18:09.260	18:15.170			2879	E4
M182_153-1_EM122-20	28/6/2022 15:08	18:07.021	17:56.995			2806	
M182_153-1_EM122-20	29/6/2022 09:00	18:15.819	16:23.786			76	
M182_154-1_CTD-47	28/6/2022 20:30	18:07.447	17:14.670			2161	E4 - E5
M182_155-1_XOFOS-21	28/6/2022 22:56	18:07.441	17:14.719			2159	E4 - E5
M182_155-1_XOFOS-21	29/6/2022 02:18	18:10.617	17:15.537			2185	E4 - E5
M182_156-1_CTD-48	29/6/2022 07:41	18:10.431	16:30.853			176	E5
M182_157-1_CTD-49	29/6/2022 09:15	18:15.904	16:23.780			77	E5
M182_158-1_EM710-1	29/6/2022 10:06	18:15.850	16:23.524			75	
M182_158-1_EM710-1	29/6/2022 14:10	18:16.324	16:23.695			74	
M182_159-1_BIGO_I-3	29/6/2022 15:36	18:16.293	16:22.887	no transp.	no transp.	71	E5
M182_160-1_TVMUC-18	29/6/2022 16:08	18:16.292	16:22.909	no transp.	no transp.	71	E5
M182_161-1_TVMUC-19	29/6/2022 16:29	18:16.292	16:22.909	no transp.	no transp.	71	E5
M182_162-1_XOFOS-22	29/6/2022 20:12	18:16.118	16:21.994			66	E5
M182_162-1_XOFOS-22	29/6/2022 21:03	18:16.480	16:22.130			432	E5
M182_163-1_TP-10	29/6/2022 22:06	18:16.246	16:22.523			70	E5
M182_164-1_GC-5	30/6/2022 08:26	18:16.239	16:22.909	no transp.	no transp.	72	E5
M182_165-1_AUV_ANTON-5	30/6/2022 10:30	18:16.156	16:22.923			72	E5
M182_166-1_AUV_LUISE-1	30/6/2022 11:14	18:16.157	16:22.924			72	E5
M182_167-1_AUV_ABYSS-9	30/6/2022 19:00	18:16.297	16:22.902			71	E5
M182_168-1_XOFOS-23	30/6/2022 22:11	18:16.180	16:22.876			69	E5
M182_168-1_XOFOS-23	30/6/2022 22:50	18:16.485	16:22.876			72	E5
M182_169-1_XOFOS-24	30/6/2022 23:32	18:16.190	16:22.458			70	E5
M182_169-1_XOFOS-24	1/7/2022 00:01	18:16.433	16:22.459			69	E5
M182_170-1_EM122-21	1/7/2022 09:30	18:14.794	16:25.953			89	
M182_170-1_EM122-21	3/7/2022 07:30	17:59.238	21:58.753			3293	
M182_171-1_TVMUC-20	1/7/2022 11:17	18:11.721	16:35.014	no transp.	no transp.	501	E5
M182_172-1_TVMUC-21	1/7/2022 14:39	18:06.186	16:57.924	no transp.	no transp.	1704	E4 - E5
M182_173-1_CTD-50	1/7/2022 19:24	18:04.219	17:34.887			2571	E4 - E5
M182_174-1_XOFOS-25	2/7/2022 15:36	17:52.251	20:01.822			3208	E3
M182_174-1_XOFOS-25	2/7/2022 17:05	17:53.619	20:01.427			3207	E3
M182_175-1_TP-11	3/7/2022 07:42	17:59.690	21:58.756			3291	E2
M182_175-1_TP-11	3/7/2022 08:15	18:00.764	21:58.753			3292	E2
M182_176-1_BBL-2	3/7/2022 12:44	18:00.176	22:00.001	18:00.209	21:59.999	3296	E2
M182_177-1_DSR-4	3/7/2022 18:28	18:00.301	21:59.939	18:00.319	21:59.939	3296	E2
M182_178-1_AUV_ABYSS-10	3/7/2022 20:15	17:59.556	21:58.629			3291	E2
M182_179-1_CTD-51	3/7/2022 22:22	18:00.436	21:58.767			3290	E2
M182_180-1_TP-12	4/7/2022 07:56	18:00.436	21:58.765			3290	E2
M182_181-1_TP-12	4/7/2022 08:30	18:00.436	21:58.765			3291	E2
M182_182-1_EM122-22	4/7/2022 10:25	18:00.503	21:58.507			3291	

M182_182-1_EM122-22	5/7/2022 10:23	21:09.986	20:55.015			4175	
M182_183-1_CTD-52	5/7/2022 11:24	21:09.997	20:54.998			4176	CB
M182_184-1_TVMUC-22	5/7/2022 14:11	21:09.998	20:54.998	no transp.	no transp.	4176	CB
M182_185-1_GC-6	5/7/2022 16:37	21:09.998	20:57.999	no transp.	no transp.	4176	CB