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Short Cruise Report
RV MARIA S. MERIAN – Cruise MSM112/2

Cartagena – Las Palmas
18.11.2022 – 5.12.2022
Chief Scientist: Dr. Frank Nitsche
Captain: Ralf Schmidt



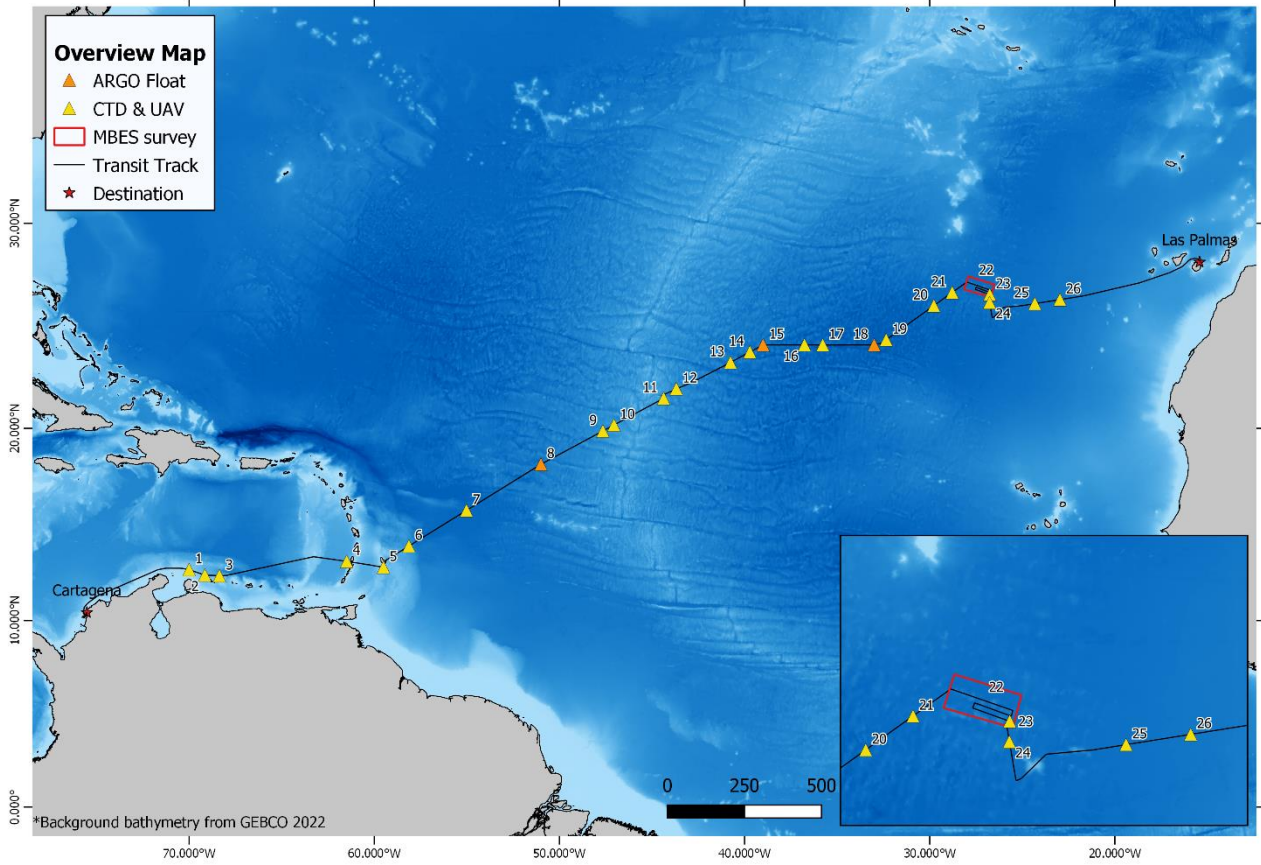


Fig 1: Track chart of Cruise MSM112-2 (Cartagena – Las Palmas).

Objectives

The objective of this cruise was composed of 6 sub-projects:

- Precise knowledge of seabed topography and water column information are necessary to understand many marine processes. For sparsely surveyed areas, the bathymetry often creates the first image of the seafloor. Satellite altimetry on the other hand, shows only a rough estimation of seafloor characteristics, while it cannot give correct depth information. Therefore, detailed bathymetric data were acquired to extend our knowledge on seabed topography in the Atlantic. Sub-bottom profiler information was also collected and optimized to give a better insight of the ocean floor during the transit cruise. The hydroacoustic studies onboard R/V Maria S. Merian included seafloor mapping, the investigation of the uppermost sediment layers and water column.
- Atmospheric properties of aerosol, clouds, trace-gases and state were collected to improve reference data coverage for satellite remote sensing and (climate) modelling. In addition, diurnal cycles, longitudinal cross-sections via time-series and data association via joint histograms are examined. The longitudinal cross-sections cover the region from the Caribic Island of St Vincent/Grenadines all the way across the Atlantic to the Canary Islands.
- The ocean-atmosphere investigations involved coordinated lower atmospheric profiles in combination with upper ocean profiles, with a focus on late afternoon times, when exchange processes at the ocean surface are expected to be at their maximum. The main goal was to test feasibility of an undisturbed measurements of stratification across an air-sea interface, that is a profile from 5m below the ocean surface to 500m above it. The focus was on afternoon conditions, when potential development of a diurnal warm layer at the ocean surface is expected at its maximum magnitude. Four different payload packages were utilized, each focusing on different properties.
- Despite the importance of protists in the microbial food web, little is known about the biodiversity and biogeography of these tiny organisms. Applying high-throughput sequencing, we want to answer the question, if a species found only in surface waters of the South Atlantic during the last cruise, is also present in the North Atlantic or if the equatorial counter current is forming a physical barrier. In particular, the Caribbean Sea, harbors a high number of warm water species, which have barely been investigated. The aim of this project is to enhance the dataset for protist from understudied areas and to contribute to the understanding of protist species distribution (vertical and horizontal).
- The knowledge on the vertical distribution of microbial life along the depth continuum is still very limited. So far, only a few regions of the world's ocean have been studied in this respect. Protists can span more than five orders of magnitude in size and the different modes of feeding comprises pure heterotrophy, parasitism of other protists and metazoans, mixotrophy and phototrophy. The special behavioral aspect of nanofauna is that they may switch between aggregate- and sediment-associated life. This is why one could find benthic organisms in the whole pelagial and distribution of benthic organisms could potentially occur also via the water column. This is different from nearly all larger protists and metazoans.

- An ARGO float is a diving oceanic robot that regularly takes profiles of temperature, density and pressure of the upper 2000m of the ocean. Currently, there are about 4,000 floats operating in all oceans worldwide. The lifetime of these floats, is limited to 3 to 5 years. Thus, to maintain ocean monitoring capability new floats need to be added continuously, preferably in regions where the density of the free-drifting ARGO floats is low, deep ocean deployments are only permitted outside economic exclusive zones.

Narrative

All 19 scientists of the MSM112/2 research cruise boarded the RV MARIA S. MERIAN in the early morning of Nov 16 in Cartagena after being tested all negative for the COVID infection. The scheduled Nov 17 morning departure, however, was delayed until late evening on Nov 18 due to a delay in custom clearances, which also meant that needed equipment of the biology group had to be left behind.

Due to the late departure, the minimum speed requirement was lifted, so that the scientific program was not marginalized.

With already one confirmed COVID case, soon after the departure four more COVID cases (3 among scientists) were identified. Thus, for the next 10 days in total 7 persons were isolated, meetings disallowed. Personal distances had to be kept also during meals and masks needed to be worn – fortunately without major setbacks to the scheduled science program.

After leaving the national waters of Columbia, first atmospheric samples and CTD cast data were collected near the islands of Aruba, Curacao and Bonaire. After another quick transit through Venezuelan waters, the operational work started in St Vincent waters and continued with regular sampling until Las Palmas was reached. Sampling involved continuous remote sensing (by cloud camera, echosounder and parasound), day-time sampling of aerosol and water vapor (with sun-photometers), twice daily profiling (with CTD casts and complementary drone flights) and the biological analyses of different depth water via CTD bottles and air-samples, with a focus on simple life forms (protist). Bathymetrical analyses along the entire route culminated in shape and altitude characterizations of seamounts close to Las Palmas. In addition, along the way, three ARGO floats of the BSH were deployed and several (or rare) AEOLUS overpasses, radiosondes were launched to provide needed calibration data for upper tropospheric winds.

At selected station, the group of the secondary-use application carried out cultivation of aliquot water samples from different depths focusing on the DCM, OMZ, 1000m, 1500m, 2000m, and below. In addition, DNA was extracted for analysis by Next Generation Sequencing (NGS) for the detection of protistan genotypes.

Acknowledgements

The scientific party of RV MARIA S. MERIAN Cruise MSM112-2 gratefully acknowledges the very friendly and most effective cooperation with Captain Schmidt and his crew. Their great flexibility and their perfect technical assistance substantially contributed to make this cruise a scientific success. We also appreciate the valuable support by the Leitstelle Deutsche Forschungsschiffe (German Research Fleet Coordination Centre) at the University of Hamburg.

List of Participants

Name	Discipline	Institution
Frank Nitsche, PhD	Chief Scientist / Biology	UoC
Sabine Schiwitza, PhD	Biology (protistology)	UoC
Stefan Kinne, PhD	Atmosphere (rem.sensing)	MPI
Ralf Adams	Atmosphere (rem.sensing)	MPI
Ping Wang, PhD	Atmosphere (rem.sensing)	KNMI
Beata Latos	Oceanography (air/sea)	IG-PAS
Michal Ciurylo	Oceanography (air/sea)	IG-PAS
Gavin Demello	Oceanography (GIS)	HCU
Gustavo Binda Souza	Oceanography (GIS)	HCU
Hartmut Arndt, Prof. Dr.	Mar. Ecology, Protistology	UoC
Anja Scherwaß, PhD	Protistology	UoC
Jost Borchering, apl. Prof. Dr.	Food web ecology	UoC
Manon Hohlfeld, M.Sc.	Protistology	UoC
Maria Sachs, M.Sc.	Protistology	UoC
Julian Wagenhofer, M.Sc	Protistology	UoC
Dominik Scepanski, M.Sc.	Protistology, CTD	UoC
Johannes Werner, M.Sc.	Protistology, CTD	UoC
Brigitte Gräfe	Protistology, Cultivation	UoC
Anke Pyschny	Protistology	UoC

UoC	University of Cologne, Inst. of Zoology, Dep of General Ecology, Cologne
KNMI	Koninklijk Nederlands Meteorologisch Instituut, De Bilt
MPI-M	Max-Planck-Institut für Meteorologie, Hamburg
MPI-C	Max-Planck-Institut für Chemie, Mainz
HCU	Hafen City Universität, Hamburg
IG-PAS	Institute of Geophysics Polish Academy of Sciences, Warsaw
BSH	Bundesamt für Seeschifffahrt und Hydrologie, Hamburg

Stationslist

Activity No.	Date / Time [UTC]	Device	Action	Latitude	Longitude	Ocean Depth [m]	Rope Length m
MSM112/2_1-1	20.11.2022 12:53	CTD	max depth/on ground	12° 41,738' N	070° 00,256' W	652	500
MSM112/2_2-1	20.11.2022 18:19	CTD	max depth/on ground	12° 24,409' N	069° 09,282' W	297	282
MSM112/2_3-1	20.11.2022 23:45	CTD	max depth/on ground	12° 22,318' N	068° 21,971' W	1949	1900
MSM112/2_4-1	22.11.2022 13:36	CTD	max depth/on ground	13° 07,665' N	061° 29,479' W	2756	2600
MSM112/2_4-3	22.11.2022 12:58	Drone	UAV (drone) started	13° 07,665' N	061° 29,478' W	2755	
MSM112/2_4-3	22.11.2022 13:04	Drone	UAV (drone) started	13° 07,665' N	061° 29,478' W	2756	
MSM112/2_4-3	22.11.2022 13:21	Drone	UAV (drone) started	13° 07,665' N	061° 29,478' W	2756	
MSM112/2_4-3	22.11.2022 13:47	Drone	UAV (drone) started	13° 07,665' N	061° 29,479' W	2756	
MSM112/2_5-1	23.11.2022 02:03	CTD	max depth/on ground	12° 49,159' N	059° 30,306' W	812	500
MSM112/2_6-1	23.11.2022 14:53	CTD	max depth/on ground	13° 55,891' N	058° 07,966' W	3831	2500
MSM112/2_7-1	24.11.2022 12:26	CTD	max depth/on ground	15° 47,364' N	055° 01,245' W	5500	500
MSM112/2_7-3	24.11.2022 12:18	Drone	UAV (drone) started	15° 47,364' N	055° 01,244' W	5502	
MSM112/2_7-3	24.11.2022 12:42	Drone	UAV (drone) started	15° 47,364' N	055° 01,244' W	5502	
MSM112/2_8-1	25.11.2022 14:05	Float	deployed	18° 10,002' N	051° 00,085' W	4856	
MSM112/2_8-2	25.11.2022 15:22	CTD	max depth/on ground	18° 10,001' N	051° 00,065' W	4838	4000
MSM112/2_8-4	25.11.2022 14:32	Drone	UAV (drone) started	18° 10,001' N	051° 00,065' W	5501	
MSM112/2_8-4	25.11.2022 14:59	Drone	UAV (drone) started	18° 10,000' N	051° 00,065' W	4851	
MSM112/2_8-4	25.11.2022 15:20	Drone	UAV (drone) started	18° 10,001' N	051° 00,065' W	5548	
MSM112/2_8-4	25.11.2022 15:46	Drone	UAV (drone) started	18° 10,001' N	051° 00,065' W	4854	
MSM112/2_8-4	25.11.2022 15:58	Drone	UAV (drone) started	18° 10,002' N	051° 00,065' W	4863	
MSM112/2_8-4	25.11.2022 16:17	Drone	UAV (drone) started	18° 10,001' N	051° 00,065' W	4853	
MSM112/2_9-1	26.11.2022 12:21	CTD	max depth/on ground	19° 51,728' N	047° 39,382' W	3774	500
MSM112/2_9-2	26.11.2022 12:09	Drone	UAV (drone) started	19° 51,728' N	047° 39,383' W	3773	
MSM112/2_9-2	26.11.2022 12:29	Drone	UAV (drone) started	19° 51,728' N	047° 39,382' W	3772	
MSM112/2_10-1	26.11.2022 18:15	CTD	max depth/on ground	20° 09,962' N	047° 03,263' W	3290	
MSM112/2_10-2	26.11.2022 18:11	Drone	UAV (drone) started	20° 09,963' N	047° 03,263' W	3304	
MSM112/2_10-2	26.11.2022 18:21	Drone	UAV (drone) started	20° 09,963' N	047° 03,263' W	3290	
MSM112/2_11-1	27.11.2022 11:15	CTD	max depth/on ground	21° 30,587' N	044° 22,376' W	3244	500
MSM112/2_11-2	27.11.2022 11:03	Drone	UAV (drone) started	21° 30,587' N	044° 22,376' W	3221	
MSM112/2_11-2	27.11.2022 11:27	Drone	UAV (drone) started	21° 30,587' N	044° 22,376' W	3190	
MSM112/2_12-1	27.11.2022 17:45	Drone	UAV (drone) started	21° 59,447' N	043° 41,156' W	3522	
MSM112/2_12-1	27.11.2022 17:57	Drone	UAV (drone) started	21° 59,448' N	043° 41,156' W	3498	
MSM112/2_12-2	27.11.2022 18:01	CTD	max depth/on ground	21° 59,448' N	043° 41,156' W	3506	298
MSM112/2_13-1	28.11.2022 11:18	CTD	max depth/on ground	23° 18,009' N	040° 45,708' W	5052	500
MSM112/2_13-2	28.11.2022 11:06	Drone	UAV (drone) started	23° 18,009' N	040° 45,708' W	5049	
MSM112/2_13-2	28.11.2022 11:28	Drone	UAV (drone) started	23° 18,008' N	040° 45,708' W	5050	
MSM112/2_14-	28.11.2022 17:39	CTD	max depth/on ground	23° 48,974' N	039° 42,902' W	5316	300

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MSM112/2_14-2	28.11.2022 17:30	Drone	UAV (drone) started	23° 48,974' N	039° 42,902' W	5315	
MSM112/2_14-2	28.11.2022 17:37	Drone	UAV (drone) started	23° 48,974' N	039° 42,901' W	5315	
MSM112/2_15-1	28.11.2022 21:51	Float	deployed	24° 10,035' N	039° 00,052' W	4899	
MSM112/2_15-2	28.11.2022 23:06	CTD	max depth/on ground	24° 10,043' N	038° 59,977' W	4875	4000
MSM112/2_16-1	29.11.2022 11:34	CTD	max depth/on ground	24° 10,049' N	036° 45,920' W	5210	500
MSM112/2_17-1	29.11.2022 17:25	CTD	max depth/on ground	24° 10,013' N	035° 46,573' W	5607	300
MSM112/2_18-1	30.11.2022 10:02	Float	deployed	24° 09,987' N	033° 00,101' W	5844	
MSM112/2_18-2	30.11.2022 11:23	CTD	max depth/on ground	24° 09,970' N	033° 00,013' W	5843	4000
MSM112/2_19-1	30.11.2022 17:08	CTD	max depth/on ground	24° 24,957' N	032° 21,141' W	0	300
MSM112/2_20-1	01.12.2022 10:14	CTD	max depth/on ground	26° 04,923' N	029° 46,587' W	5678	500
MSM112/2_20-2	01.12.2022 10:02	Drone	UAV (drone) started	26° 04,923' N	029° 46,587' W	5680	
MSM112/2_21-1	01.12.2022 16:55	CTD	max depth/on ground	26° 43,015' N	028° 47,053' W	4778	300
MSM112/2_21-2	01.12.2022 16:46	Drone	UAV (drone) started	26° 43,016' N	028° 47,053' W	4753	
MSM112/2_23-1	02.12.2022 14:09	CTD	max depth/on ground	26° 37,083' N	026° 45,503' W	4948	500
MSM112/2_24-1	02.12.2022 16:48	CTD	max depth/on ground	26° 14,113' N	026° 45,944' W	5164	300
MSM112/2_24-2	02.12.2022 16:40	Drone	UAV (drone) started	26° 14,140' N	026° 45,920' W	5165	
MSM112/2_25-1	03.12.2022 09:14	CTD	max depth/on ground	26° 10,859' N	024° 19,202' W	5133	500
MSM112/2_25-2	03.12.2022 09:07	Drone	UAV (drone) started	26° 10,859' N	024° 19,202' W	5135	
MSM112/2_25-2	03.12.2022 09:24	Drone	UAV (drone) started	26° 10,859' N	024° 19,202' W	5132	
MSM112/2_26-1	03.12.2022 16:35	CTD	max depth/on ground	26° 22,460' N	022° 57,908' W	4976	300