Prof. Dr. Sebastian Krastel
Christian-Albrechts-Universität zu Kiel
Institute of Geosciences
Otto-Hahn-Platz 1
D24118 Kiel, Germany

Tel.: +49-431-880 3914
Fax: +49-431-880 4432
email: sebastian.krastel@ifg.uni-kiele.de

Short Cruise Report
RV Maria S. Merian-Cruise MSM82/2.

Montevideo – Las Palmas
26.04.2019 – 14.05.2019
Chief Scientist: Prof. Dr. Sebastian Krastel
Captain: Björn Maaß

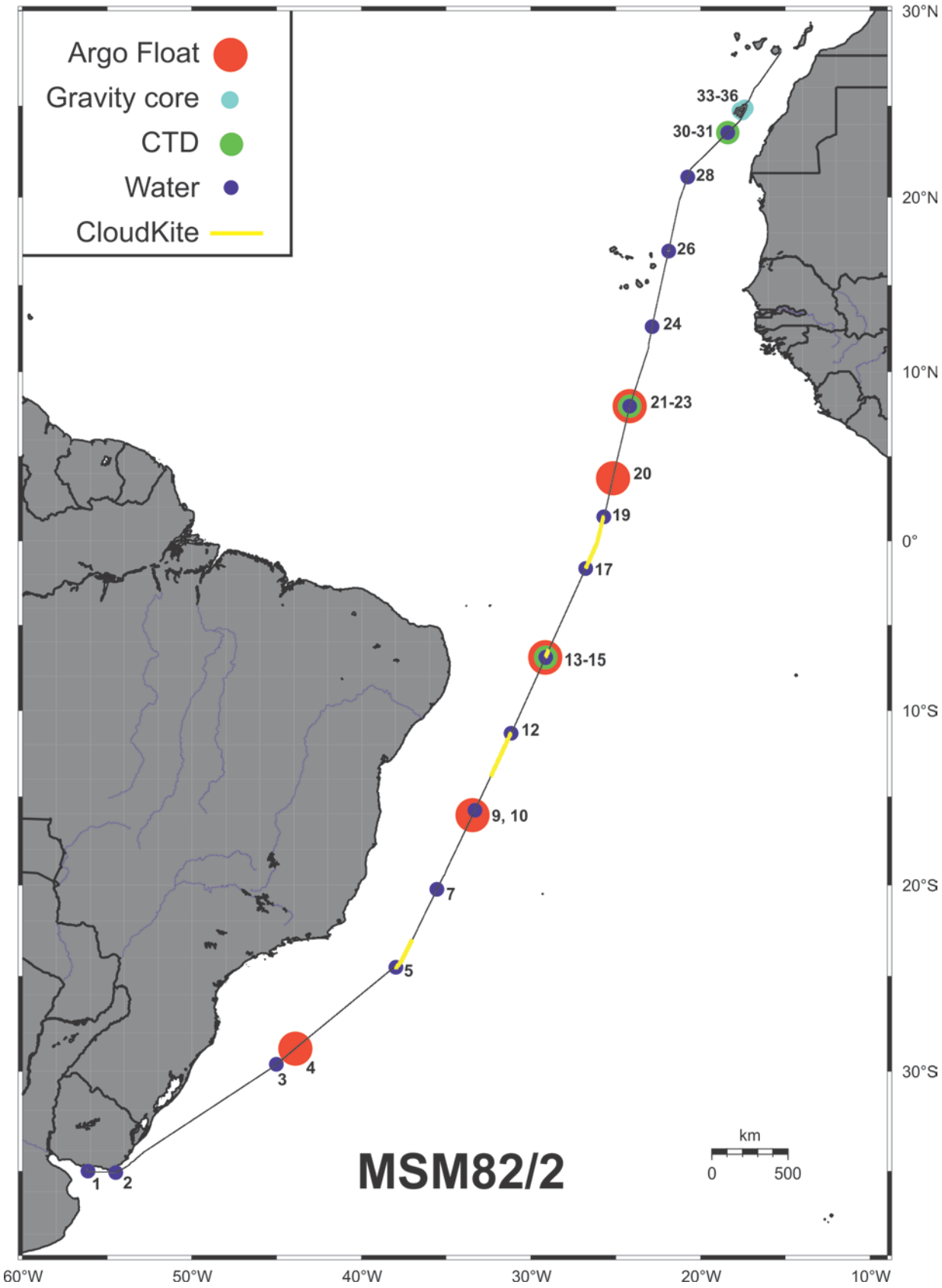

Fig 1: Track chart of Cruise MSM82/2 (Montevideo – Las Palmas).

Objectives

Three different proposals were realized in the frame of the transit cruise MSM82/2. Objective 1 via the proposal ‘Morphology of the headwall area of the Sahara Slide, NW-Africa’ seeks a morphological characterization of the entire headwall area of the Sahara Slide. The importance of submarine landslides for society, economy, and ecology is increasingly being recognized by a large number of scientific disciplines and industries. Submarine landslides present a significant geohazard due to their potential to destroy offshore infrastructure and to trigger significant tsunamis. The NW-African continental margin is well-known for the occurrence of very large but infrequent landslides. Several cruises have addressed sediment dynamics of the NW-African continental margin but detailed hydroacoustic mapping of landslide headwall areas has hardly been carried out. Such mapping, however, is critical for the analysis of submarine landslides as the morphology of the headwall documents failure dynamics and failure volumes, which are the most important parameters for assessing the tsunami potential of submarine landslides.

Objective 2 under the label MOOR addresses different aspects. During the cruise, atmospheric properties of aerosol, clouds and trace-gases were collected. Reference data coverage over oceans is sparse. The data will serve as (1) calibration data for satellite remote sensing retrievals and (2) and as evaluation data for (global) modeling. Atmospheric measurements were enhanced by in-situ samples with a huge balloon-kite by testing a new system, the so-called CloudKite. The balloon is attached to a cable, which is long enough so that the attached balloon instruments can reach into lower altitude clouds. With the sampling of turbulence, and microphysics for cloud particles and available aerosols, a better process understanding is expected, from which modeling will benefit. This relatively new system was tested for ocean-worthiness in preparation for the EURECA campaign in early 2020, when such balloons will be part of the instrumentation package on both RV. MERIAN and RV. METEOR. Float robots contributing to the international ARGO program were deployed. ARGO is a global array of more than 4000 profiling floats that measure temperature and salinity in the upper 2.000 m of the ocean. Multi-beam echo sounder data were acquired, checked for quality, and processed to support the “Seabed 2030”initiative (to completely map the ocean depths by the year 2030). Furthermore, the backscatter data of the EM122 will be analyzed regarding the derivability of geological properties of the seabed.

Objective 3 studies the biodiversity of pelagic protists in an area, which has not been investigated extensively yet. The aim was to isolate as many different protist species along the transect, cultivate them and study them back home regarding their morphology, molecular biology and autecology to contribute valuable data on protist diversity. The main focus was to establish a high number of cultures and to avoid the loss of rare species, which are unable to compete in a mixed culture as experience from previous cruises showed. With this data, the interpretation of NGS (next-generation-sequencing) data will be improved and our understanding on the diversity and spatial separation of the protist fauna in the South and North Atlantic will be extended.

Narrative

The first members of the MSM82/2 scientific crew arrived at RV MARIA S. MERIAN on April 24 shortly after the arrival of the vessel in port in order to start the preparation of the CloudKite but loading activities were only taking place in the evening. April 25 was used to install the launching system for the Cloud Kite at the A-frame, which was successfully completed in the evening due to the great support of the crew. RV MARIA S. MERIAN left the port of Montevideo on April 26 at 09:00h local time at rainy weather conditions. The scientific crew of Cruise MSM82/2 consisted of 22 scientists from 10 different institutions.

The first surface water sample was taken directly after leaving the port of Montevideo. The hydroacoustic systems were switched on when leaving the Uruguayan territorial Sea at 17:10h the same day. A second surface water sample was taken at 18:00h. Unfortunately, relatively strong winds from the NE slowed down the vessel quite significantly. Hydroacoustic data recording was stopped at 05:00h on April 27 because we entered the Brazilian EEZ. The morning of April 28 was used for a first successful test of the small lift balloon of the CloudKite system. The balloon was left in air in order to have space on deck for filling the main balloon with a ten-time larger volume (275 m^3). The underway measurements (hydroacoustics and atmospheric observations) were continued when reaching international waters on April 28 at 19:48h. Water buckets were taken from this point on about every 5° latitude. A first Argo Float was deployed very early morning on April 29. The first test of the CloudKite was on April 30. For this test, the instrument box included only devices for measuring wind speed, accelerations, GPS locations, pressure, temperature, humidity, and drop sizes. Therefore, it was relatively light (ca. 20 kg). The ship was stopped and turned against the wind and swell for the first launch. The launch worked very well. The CloudKite was flown between 600 m and 1500 m height the entire day. Recovery in the late evening was also very smooth. The transit was continued on May 1 without any further activities. The second float was deployed early morning on May 2. The day was used for the preparation of the CloudKite for a night flight because cloud coverage is higher during the night. The launch at 19:00h could be done without an interruption of the transit because the wind was coming from the front. The kite was flown between 400 and 1500 m height. At midnight, we realized that the tensiometer was broken because the rope of the kite cut into the rollers of the tensiometer. The kite was left at a constant height for the rest of the night and safely retrieved in the morning of May 3. May 4 started with the deployment of the third ARGO-float, a 2000 m-deep CTD, and a plankton net. The CloudKite was deployed afterwards (10:00h) but already retrieved at 13:00h because the communication to one of the lasers was broken. An inspection of the instrument box identified a loose cable as error source.

The next launch of the CloudKite was on May 5 in the early evening. The instruments were working this time and we crossed the equator on May 6 at 01:30h local time when towing the kite. The CloudKite was retrieved in the morning. The next Argo Float was deployed in the evening at about 220 nm north of the equator. The transit was continued under fine weather conditions on May 7. A 2000 m-deep CTD and the last Argo Float were deployed in the evening of this day. Unfortunately, the multibeam system was not working afterwards. It took until May 9 around noon to fix the error with support by the manufacturer. Transit speed on May 8 decreased to less than 12 knots because we entered the area with constant Northeast trade winds. The Cape Verde EEZ was reached on May 8, 11:31h local time (12:31h UTC). We passed the Cape Verde Islands about 30 nm miles to the east in the morning of May 9. The last test of the CloudKite started at 16:00h on May 9. This time, the instrument box was equipped with additional devices (several laser systems). We had about 12 m/s wind from the front; therefore, the launch was done while the vessel was stationary. The launch was again done in a very professional way but the upper smaller balloon started to rotate when the vessel was picking up speed. The reason were some entangled ropes and the CloudKite

was retrieved again. A damage of the CloudKite at its keel was noticed when the kite was back on deck. Hence, it was decided not to deploy the CloudKite again. Despite some problems, the test of the kite was a big success. It could be shown that such a kite can be operated from RV MARIA S. MERIAN and collect numerous interesting data.

We left the Cape Verde EEZ at 08:48h local time on May 10 and continued to head against wind and waves to the headwall area of the Sahara Slide. A last CTD was taken on May 11 in the morning. This CTD was only 200 m deep because the main task was to sample protists in relatively shallow depth around the chlorophyll maximum. We started our hydroacoustic survey of the headwall area of the Sahara Slide in the afternoon of the same day. The new data show that the location of the upper and lower headwall is different than expected and continues much further to the north. Mapping was interrupted on May 12 for gravity coring at three locations around the lower headwall area. Hydroacoustic surveying was continued until May 13 at 19:00h local time (18:00 UCT) shortly before reaching the Spanish EEZ.

RV MARIA S. MERIAN-Cruise MSM82/2 was a great success. Hydroacoustic data were collected along the entire transit for the Seabed 2030 project and designated mapping of the headwall area of the Sahara Slide gave new insights in the slide dynamics. The ability to deploy a large CloudKite from the rear of the ship was demonstrated. Atmospheric shipboard measurements were used to profile and measure parts of the Atlantic ITCZ, which is poorly constrained by data. The water-sampling program allowed broadening the understanding of the diversity and spatial separation of the protist fauna in the South and North Atlantic.

Acknowledgements

The scientific party of RV MARIA S. MERIAN Cruise MSM82/2 gratefully acknowledges the very friendly and most effective cooperation with Captain Maaß 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. The expedition was funded by the Deutsche Forschungsgemeinschaft.

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Teilnehmerliste

Name	Discipline	Institution
Krastel, Sebastian, Prof.	Marine Geophysics / Chief Scientist	CAU
Lenz, Kai-Frederik	Marine Geophysics	CAU
Cremanns, Maximiliam	Marine Geophysics	CAU
Düring Annelie	Marine Geophysics	CAU
Schopenhauer, Mila	Hydroacoustics	HCU
Vietheer, Christian	Hydroacoustics	HCU
Bodenschatz, Eberhard, Prof.	CloudKite	MPI-DS
Höhne, Philipp	CloudKite	MPI-DS
Meyer, Marcel	CloudKite	MPI-DS
Schlenzcek, Oliver, Dr.	CloudKite	MPI-DS
Schröder, Marcel	CloudKIte	MPI-DS
Kinne, Stefan, Dr.	Atmospheric Sciences	MPI-M
Stevens, Bjorn, Prof.	Atmospheric Sciences	MPI-M
Wagner, Thomas, Dr.	Atmospheric Sciences	MPI-C
Bischof, Simone	Atmospheric Sciences	MPG
Tewes, Simon	Argo Floats	BSH
Nitsche, Frank, Dr.	Ecology	UzK
Ahlers, Johanna	Ecology	UzK
Jeuck, Alexandra	Ecology	UzK
Schiwitza, Sabine	Ecology	UzK
Pereyra, Noelia	Observer Uruguay	AMU
Rachid, Jihad	Observer Morocco	UHC

BSH	Bundesamt für Seeschifffahrt und Hydrographie
CAU	Christian-Albrechts-Universität zu Kiel
HCU	HafenCity Universität Hamburg
MPI-C	Max-Planck Institut für Chemie, Mainz
MPI-DS	Max-Planck Institut für Dynamics und Selbstorganisation, Göttingen
MPI-M	Max-Planck Institut für Meteorologie, Hamburg
MPG	Max-Planck-Gesellschaft Generalverwaltung, München
UzK	Universität zu Köln
AMU	Armada Nacional, Uruguay
UHC	University Hassan II Casablanca

Stationslist

Station - No.	Date, Time	Device	Latitude	Longitude	Depth (m)	Remarks
MSM82/2_1	26.04.2019 13:08	Bucket Water Sampling	35° 00.435' S	056° 08.409' W	14	
MSM82/2_2	26.04.2019 20:56	Bucket Water Sampling	35° 04.657' S	054° 29.982' W	40	
MSM82/2_3	28.04.2019 23:27	Bucket Water Sampling	29° 40.046' S	045° 01.514' W	3601	
MSM82/2_4	29.04.2019 05:13	Float	28° 50.401' S	043° 55.057' W	3769	
MSM82/2_5	30.04.2019 12:53	Bucket Water Sampling	24° 32.409' S	037° 59.203' W	3862	
MSM82/2_6	30.04.2019 13:16	Cloudkite	24° 32.408' S	037° 59.206' W		start, max height: 1500m
MSM82/2_6	30.04.2019 22:14	Cloudkite	23° 02.841' S	037° 00.999' W	3973	on deck
MSM82/2_7	01.05.2019 12:07	Bucket Water Sampling	20° 14.663' S	035° 33.019' W	3680	
MSM82/2_8	01.05.2019 12:07	Expendable Bathythermograph	20° 14.583' S	035° 32.965' W	3698	
MSM82/2_9	02.05.2019 09:40	Float	16° 03.843' S	033° 27.243' W	4599	
MSM82/2_10	02.05.2019 11:06	Bucket Water Sampling	15° 47.703' S	033° 19.375' W	4604	
MSM82/2_11	02.05.2019 21:35	Cloudkite	13° 50.338' S	032° 22.784' W	4768	start, max height: 1100m
MSM82/2_11	03.05.2019 10:51	Cloudkite	11° 20.679' S	031° 10.233' W	5286	on deck
MSM82/2_12	03.05.2019 10:31	Bucket Water Sampling	11° 20.632' S	031° 10.961' W	5281	
MSM82/2_13	04.05.2019 09:58	Float	06° 54.528' S	029° 09.325' W	5491	
MSM82/2_14	04.05.2019 10:50	CTD	06° 54.191' S	029° 09.185' W	5493	
MSM82/2_15	04.05.2019 11:43	Bucket Water Sampling	06° 54.190' S	029° 09.184' W	5492	
MSM82/2_16	04.05.2019 12:53	Cloudkite	06° 53.509' S	029° 10.220' W	5493	start
MSM82/2_16	04.05.2019 15:34	Cloudkite	06° 30.789' S	028° 59.215' W	4385	on deck
MSM82/2_17	05.05.2019 17:42	Bucket Water Sampling	01° 39.935' S	026° 47.706' W	5129	
MSM82/2_18	05.05.2019 17:58	Cloudkite	01° 38.706' S	026° 47.071' W	5122	start, max height: 1000m
MSM82/2_18	06.05.2019 09:36	Cloudkite	01° 24.845' N	025° 41.697' W	3520	on deck
MSM82/2_19	06.05.2019 09:22	Bucket Water Sampling	01° 24.991' N	025° 43.545' W	3539	
MSM82/2_20	06.05.2019 20:30	Float	03° 41.466' N	025° 10.935' W	4264	
MSM82/2_21	07.05.2019 16:46	Float	07° 58.307' N	024° 10.902' W	4833	
MSM82/2_22	07.05.2019 17:35	CTD	07° 58.895' N	024° 10.787' W		
MSM82/2_23	07.05.2019 18:23	Bucket Water Sampling	07° 58.898' N	024° 10.788' W		
MSM82/2_24	08.05.2019 17:55	Bucket Water Sampling	12° 36.477' N	022° 51.152' W	4862	
MSM82/2_25	09.05.2019 11:45	Expendable Bathythermograph	15° 58.998' N	022° 07.541' W	3184	
MSM82/2_26	09.05.2019 17:00	Bucket Water Sampling	16° 57.523' N	021° 53.879' W	3516	
MSM82/2_27	09.05.2019 17:24	Cloudkite	16° 57.523' N	021° 53.878' W	3515	start
MSM82/2_27	09.05.2019 18:15	Cloudkite	16° 58.687' N	021° 53.825' W	3480	on deck
MSM82/2_28	10.05.2019 17:14	Bucket Water Sampling	21° 06.677' N	020° 46.008' W	4124	
MSM82/2_29	11.05.2019 09:59	Expendable Bathythermograph	23° 33.220' N	018° 24.307' W		
MSM82/2_30	11.05.2019 10:08	CTD	23° 33.221' N	018° 24.304' W	2868	200 m
MSM82/2_31	11.05.2019 10:19	Bucket Water Sampling	23° 33.222' N	018° 24.305' W	2869	
MSM82/2_32	11.05.2019 15:13	Multibeam Echosounder	24° 12.311' N	017° 41.139' W	2268	start
MSM82/2_32	12.05.2019 13:56	Multibeam Echosounder	24° 48.311' N	017° 43.875' W	2852	end
MSM82/2_33	12.05.2019 15:20	Gravity corer	24° 43.768' N	017° 40.028' W	2813	no recovery
MSM82/2_34	12.05.2019 17:14	Gravity corer	24° 43.768' N	017° 40.029' W	2813	437 cm recovery
MSM82/2_35	12.05.2019 19:17	Gravity corer	24° 41.886' N	017° 33.559' W	2634	435 cm recovery

Station - No.	Date, Time	Device	Latitude	Longitude	Depth (m)	Remarks
MSM82/2_36	12.05.2019 21:47	Gravity corer	24° 53.160' N	017° 23.202' W	2791	433 cm recovery
MSM82/2_37	12.05.2019 23:11	Multibeam Echosounder	24° 51.443' N	017° 28.991' W	2820	
MSM82/2_37	13.05.2019 17:03	Multibeam Echosounder	25° 56.337' N	016° 50.145' W	3483	