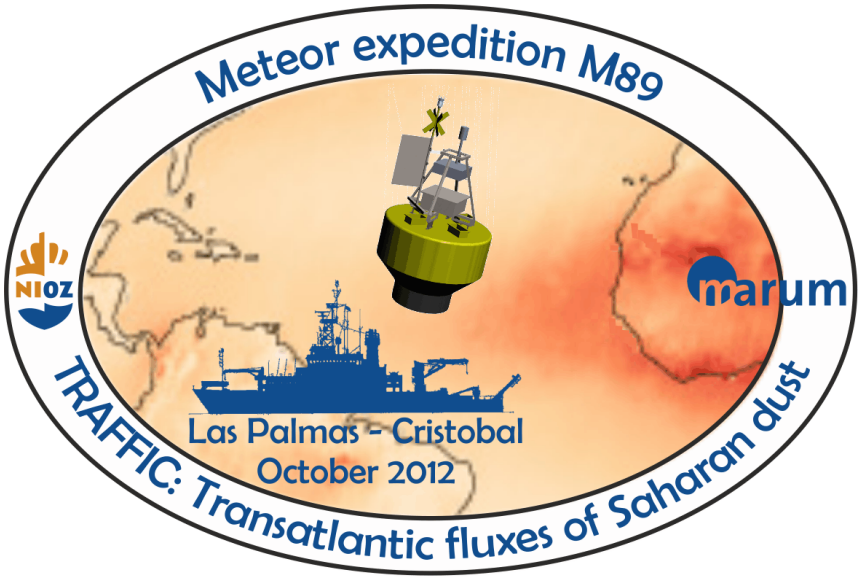
Short cruise report of *RV Meteor* cruise M89

TRAFFIC: Transatlantic fluxes of Saharan dust



Jan-Berend Stuut, Barry Boersen, Matthias Brück, Akio Hansen,
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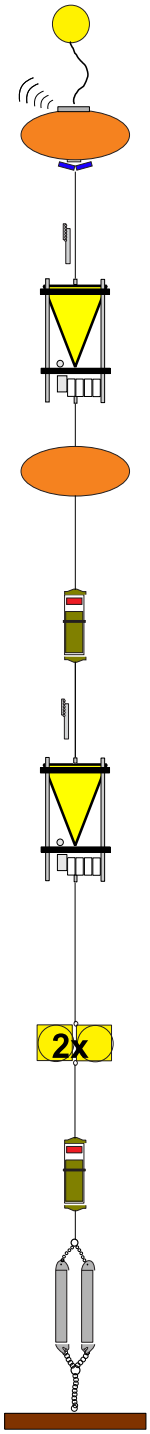

Short report and preliminary results of *RV Meteor* cruise M89,
Las Palmas de Gran Canaria, Spain – Cristobal, Panama 3 - 25 October 2012

1. *Participants*

Name, title	Discipline	Affiliation
Jan-Berend Stuut, Dr	Marine Geology, chief scientist	NIOZ & MARUM
Barry Boersen	Marine Technics	NIOZ
Matthias Brück	Meteorology	MPI
Akio Hansen	Meteorology	MPI
Bob Koster	Marine Geology	NIOZ
Andreas Räke	Meteorology	DWD
Hartmut Sonnabend	Meteorology	DWD
Michèlle van der Does	Marine Geology	NIOZ
Yvo Witte	Marine Technics	NIOZ

NIOZ – Royal Netherlands Institute for Sea Research, Texel, the Netherlands
MARUM – Center for Marine Environmental Sciences, Bremen, Germany
MPI – Max Planck Institute for Meteorology, Hamburg, Germany
DWD – Deutsche Wetter Dienst, German Meteorological Survey, Hamburg, Germany

2. *Research program*

TRAFFIC - Transatlantic Fluxes of Saharan Dust is a project consisting of four transatlantic research cruises meant to monitor and collect Saharan dust that is dispersed across the Atlantic Ocean. The final objective is to study the marine environmental effects of mineral dust deposition. Cruise M89 was the first of these four cruises, during which five stations were visited at which water- and sediment samples were taken as well as moorings were deployed. These moorings will yield time series of sediment deposition as well as oceanographic data for an initial period of one year. During consecutive cruises, this time series will be expanded. In addition, meteorological data --including cloud observations and measurements, and Cloud Condensation Nuclei measurements-- were collected by two students from the Max-Planck Institute for Meteorology in Hamburg, Germany.

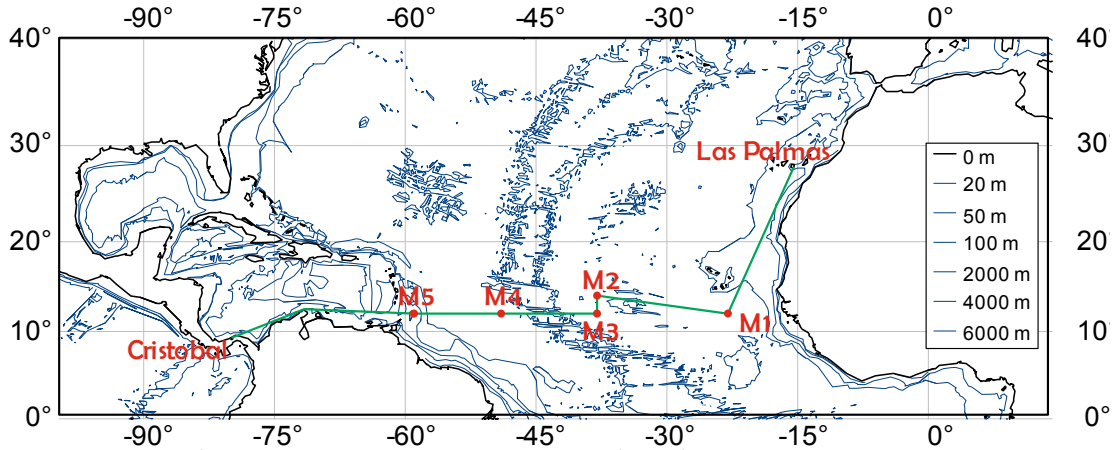

Figure 2.1: Track of *RV Meteor* cruise M89. Positions of the five mooring stations are marked Mx.

Most important data from the cruise: the key data of the deployed moorings

Station	Lat	Lon	Depth	Deployment date	Start date data loggers
M1	11°59.961'N	23°00.201'W	5000m	7 Oct 2012	8 Oct 2012
M2	13°48.631'N	37°49.189'W	4789m	11 Oct 2012	10 Oct 2012
M3	12°23.698'N	38°37.674'W	4638m	12 Oct 2012	12 Oct 2012
M4	12°03.784'N	49°11.495'W	4670m	15 Oct 2012	13 Oct 2012
M5	12°01.187'N	57°02.623'W	4403m	17 Oct 2012	19 Oct 2012

3. *Narrative of the cruise*

On Tuesday 3 October 2012 the Research Vessel *Meteor* left the harbour of Las Palmas de Gran Canaria at around 11.00 local time with five scientific staff from the Royal Netherlands Institute for Sea Research, and two from the Max Planck Institute for Meteorology. We set off on a southern course, in the direction of the Cape Verdian islands, just to the Southeast of which lay our first station. Directly after leaving the 3-miles zone of Spain, all continuous measurements (thermosalinograph, pump systems, air filtering, meteorological observations, and echosounding) were started.

After two days of transit we made a short stop in the EEZ of Cape Verde to quickly test both the CTD and the water samplers with a shallow cast; both functioned really well. A day later the team that was going to deploy all the moorings at the five scheduled stations also did a test deployment to get to know the interplay between the different people and the operation of the double cap-stan winch, A-frame, and cranes. Also this test was very satisfactorily.

In the early morning of Saturday 7 October we then reached our very first station: M1 at about 12°N/23°W. First we did a relatively short multi-beam survey to find a suitable location for our mooring. This turned out to be relatively easy as the bathymetric information that we based the planning on, appeared very accurate. After a short grid with a total of 8.5nm we found a good location where we first deployed the CTD with water sampler.

As the sediment traps were designed to end up at 1200 and 3500m water depth, respectively, we needed to have water from these depths to fill the beakers underneath the funnel of the traps. This water was sampled using the four 12-liter tanks mounted on the CTD frame.

The sediment-trap beakers (N=24) are pre-filled with chemicals to prevent small animals to eat each other as well as to buffer the seawater against turning acid by decomposing organic tissue and thereby potentially dissolving the calcium carbonate tests of plankton that is raining down through the water column and collected in the sediment trap. As the preparation of the beakers takes about 2 hours, a multicorer was deployed directly after the CTD cast. At a water depth of 5km and a winch speed of about 1m/s, a multicorer cast takes approximately 3½ hours. The multicorer worked fine and yielded 8 neat sediment cores of about 27cm with a beautiful undisturbed sediment-water interface.
Finally, directly after noon, the first mooring was deployed in less than 4 hours. To determine where exactly the anchor had landed, four soundings were carried out in a circle of about 1nm diameter around the guesstimated position.
Station M1 was completed in just over 14 hours.

We directly set sail to station M2 at about 14°N/37°W.

In the late evening of Tuesday 10 October we reached the approximate position of station M2, but the bathymetric information in this remote area is much less well restrained.
For this reason, an extensive multi-beam survey was needed and a grid of about 66nm was sailed before a suitable position was found.

Like at M1, a CTD and water sampler were cast to collect water from the pre-determined depths of 1200 and 3500m, respectively. However, as the multi-beam survey caused a bit of delay in the original schedule, we decided to deploy the multicorer after the mooring in order to be sure that the latter could be completed in full daylight. This way, the multicorer was deployed in the early evening of Wednesday 11 October, and it was very successful again with a yield of 8 sediment cores of 26cm. Owing to the long multi-beam survey, station M2 was completed in just over 24 hours.

We directly set sail to station M3 at about 12°N//37°W.

The multi-beam survey at station M3 was relatively short as a good spot for the mooring was found relatively easily despite lacking accurate bathymetric data. In the early morning of 12 October we followed the regular order again of CTD + water sampling, multicorer, mooring deployment, and echo sounding of the final location. Station M3 was completed in just over 16 hours.

We directly set sail to station M4 at about 12°N/49°W.

In the early morning of Monday 15 October we reached station M4, for which again accurate bathymetric info was lacking. A grid of 22nm was surveyed with the multi-beam until the right position and depth were found. The original order of instruments was kept but this time the multicorer came on deck empty, although it had over-penetrated. For reasons of deploying the mooring by daylight, we again decided to deploy the mooring first and try the multicorer afterwards. In the early evening the multicorer was deployed a second time and again without success. This time, there was mud on the upper parts of the multicorer, indicating that it most likely had tipped over. A third deployment of the device resulted in 8 beautiful cores and a sediment length of 31cm.

After 22 hours of station work we set sail to the last station at about 12°N/57°W.

In the late afternoon of Wednesday 17 October, we started the multi-beam survey for station M5. A relatively extensive survey of about 18nm yielded the right location for the mooring. At this station, an extra mooring was to be deployed, to test a 100m Kevlar cable. For practical reasons the multicorer was planned as the final cast after the CTD + water sampler, short test mooring, and TRAFFIC mooring.

The mooring was deployed in a new record of 2 hours. Unfortunately, the echo sounding of the short test mooring failed; no contact could be made with the releasers. The multicorer at station M5 yielded a record length of 32cm. The last station was completed in 14 hours.

During the whole transatlantic transect from NW Africa into the Caribbean, aerosol measurements, cloud observations, and cloud-condensation nuclei analyses were carried out by two meteorology students from the MPI in Hamburg.

In the early morning of 18 October, we left for a 1440nm transit to Cristobal, Panama, where we arrived in the early morning of 25 October.

4. *Station list*

Station	Cast	Ship	Device	Date	Time (UTC)	Lat (N)	Lon (W)	Depth [m]	Comment
M1	M1-1	1528	Multibeam	7-okt-12	3:58	12°04,09'	22°58,10'	5039	Total distance d=8,5nm
	M1-2	1529	CTD	7-okt-12	5:20	11°55,84'	23°01,55'	5277	Depths of water sampling: 1200m / 3500m
	M1-3	1530	Multicorer	7-okt-12	10:00	11°58,14'	23°00,88'	5056	Sediment recovery: 32cm (bottom location)
	M1-4	1531	Mooring	7-okt-12	12:18	11°58,00'	23°03,64'	5738	Final position: 11°59.961'N/23°00.201'W, 5000m
M2	M2-1	1532	Multibeam	10-okt-12	20:58	14°00,91'	37°51,56'	5506	Total distance d=66nm
	M2-2	1533	CTD	11-okt-12	6:52	13°48,62'	37°49,18'	4863	Depths of water sampling: 1200m / 3500m
	M2-3	1534	Mooring	11-okt-12	10:28	13°46,89'	37°52,24'	5506	Final position: 13°48.631'N/37°49.189'W, 4789m
	M2-4	1535	Multicorer	11-okt-12	19:49	13°48,15'	37°50,07'	4726	Sediment recovery: 20cm (bottom location)
M3	M3-1	1536	Multibeam	12-okt-12	6:20	12°25,24'	38°37,75'	6001	Total distance d=9nm
	M3-2	1537	CTD	12-okt-12	7:52	12°24,48'	38°38,00'	6443	Depths of water sampling: 1200m / 3500m
	M3-3	1538	Multicorer	12-okt-12	11:50	12°24,49'	38°38,00'	4744	failed
	M3-4	1539	Mooring	12-okt-12	13:41	12°23,24'	38°38,87'	4707	Final position: 12°23.698'N/38°37.674'W, 4638m
	M3-5	1540	Multicorer	12-okt-12	19:18	12°22,76'	38°38,28'	4628	Sediment recovery: 28cm (bottom location)
M4	M4-1	1541	Multibeam	15-okt-12	2:07	12°02,00'	49°00,11'	5000	Total distance d=22nm
	M4-2	1542	CTD	15-okt-12	5:12	12°03,98'	49°11,33'	4722	Depths of water sampling: 1200m / 3500m
	M4-3	1543	Multicorer	15-okt-12	9:20	12°03,98'	49°11,33'	4745	failed
	M4-4	1544	Mooring	15-okt-12	11:28	12°03,40'	49°13,59'	4480	Final position: 12°03.784'N/49°11.495'W, 4670m
	M4-5	1545	Multicorer	15-okt-12	18:56	12°05,00'	49°10,88'	4733	failed
	M4-6	1546	Multicorer	15-okt-12	22:39	12°04,73'	49°12,15'	4197	Sediment recovery: 27cm (bottom location)
M5	M5-1	1547	Multibeam	17-okt-12	14:54	12°03,07'	56°57,03'	4443	Total distance d=18nm
	M5-2	1548	Multicorer	17-okt-12	17:03	11°57,07'	56°56,46'	4429	Depths of water sampling: 1200m / 3500m
	M5-3	1549	Mooring	17-okt-12	19:40	11°57,12'	56°56,10'	4430	test mooring Hans van Haren deployment
	M5-4	1550	Mooring	17-okt-12	20:46	12°00,57'	57°04,05'	4445	Final position: 12°01.187'N/57°02.623'W, 4403m
	M5-5	1551	Multicorer	18-okt-12	3:41	12°02,32'	57°02,23'	4446	Sediment recovery: 33cm (bottom location)