

CRUISE REPORT

FRS ALGOA

VOYAGE 178



Prepared by

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CRUISE:	ASCLME LOCO & ATLAS Mooring Service
START:	28 September 2010, Port Elizabeth, South Africa
STOPOVERS:	08-10 October 2010, Toamasina, Madagascar
END:	31 October 2010, Port Elizabeth, South Africa



agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA



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1. SCIENTIFIC PERSONNEL:

Field	Names	Affiliation	Gender
Leg 1: LOCO moorings			
Chief Scientist	Jenny Ullgren	NIOZ, Dutch	Female
Senior technician	Dewi le Bars	NIOZ, Dutch	Male
Instrument technician	Theo Hillebrand	NIOZ, Dutch	Male
Mooring technician	Jack Schilling	NIOZ, Dutch	Male
Mooring technician	Leon Wuis	NIOZ, Dutch	Male
Scientist	Andriantsilavo Rabary	IHSM, Malagasy	Male
Scientist	Tsimanaoraty Mahatante	IHSM, Malagasy	Male
Scientist	Heriniaina Ramanantsoa Dany	IHSM, Malagasy	Male
Scientist	Gildas Todinanahary Boleslas	IHSM, Malagasy	Male
Leg 2: ATLAS moorings			
Chief Scientist	Linda Stratton	NOAA/PMEL, USA	Female
Mooring technician	Michael Craig	NOAA/PMEL, USA	Male
Mooring technician	Bradley Blows	DEA, South African	Male
Mooring technician	Richard Harding	DEA, South African	Male
CTD & mooring technician	Lisa Hancke	DEA, South African	Female
Phytoplankton, nutrients & GIS	Thomas Bornman	ACEP, South African	Male
Phytoplankton	Marthinus Sonnekus	NMMU, South African	Male

List of abbreviations

ACEP	African Coelacanth Ecosystem Programme, South Africa
ASCLME:	Agulhas & Somali Current Large Marine Ecosystems project
DAFF:	Department of Agriculture, Forestry and Fisheries, South Africa
DEA:	Department of Environmental Affairs, South Africa
DRAM	Direction Régional des Affaires Maritimes
IH-SM:	Institut Haliéutique et des Sciences Marines, Madagascar
MOI:	Mauritius Oceanography Institute, Mauritius
NIOZ:	Royal Netherlands Institute for Sea Research
NOAA:	National Oceanic and Atmospheric Administration, USA
NWO:	Netherlands Organisation for Scientific Research
PMEL:	Pacific Marine Environmental Laboratory, NOAA, USA
SAIAB:	South African Institute for Aquatic Biodiversity, South Africa
SCMRT:	Seychelles Centre for Marine Research & Technology
SFRI:	Seychelles Fishing Research Institute, Seychelles

Land based personnel:

ASCLME Regional cruise coordinator: Dr Tommy Bornman: tommy.bornman@asclme.org
ASCLME Seychelles cruise coordinator: Me Ketsie Georges: kgeorges@sfa.sc
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SMIT-Amandla Marine Vessel Coordinator: Mr Jon Klopper: j.klopper@smit.com
SMIT-Amandla FRS Algoa Coordinator: Mr Robert Hales: r.hales@smit.com
Atlas coordinator: Dr Mike Mcphaden: Michael.J.Mcphaden@noaa.gov
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2. SCIENTIFIC RATIONALE

2.1. Introduction

The Agulhas and Somali Current Large Marine Ecosystems (ASCLME) Project undertook a mooring cruise onboard the FRS *Algoa* in September and October 2010 to deploy new LOCO (Long-term Ocean Climate Observations) moorings on the south-east coast of the Madagascar Shelf and service ATLAS moorings along the 55°E line of the RAMA (Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction) network (Figure 1). This cruise report pertains to both Leg 1 (LOCO mooring cruise) and Leg 2 (ATLAS mooring cruise).

2.2. Objectives

1. Deploy five LOCO moorings along the south-east coast of Madagascar (Coordinates given in Table 1)
2. Retrieve and re-deploy ATLAS mooring at 8°S; 55°E
3. Retrieve and re-deploy ATLAS mooring at 12°S; 55°E
4. Deploy ATLAS mooring at 16°S; 55°E
5. Deploy seven Argo floats (coordinates given in Table 3)
6. CTD casts to 1200 m before and after each mooring deployment
7. Capacity building of ASCLME regional scientists
8. To fulfil the data management agreement contained in Appendix A.

2.3. Outcomes & Deliverables

Deliverables will include:

1. Successful deployment of LOCO and ATLAS moorings
2. Successful deployment of Argo floats and satellite drifters
3. Cruise report
4. Data report (including electronic inventories)
5. Training and capacity building

See Appendix A: Data management agreement for more detail.

2.4. General cruise plan

1. Port of departure: Port Elizabeth, South Africa
2. Loading of vessel: 27 September 2010
3. Departure date: 28 September 2010
4. Transit to LOCO mooring line: 28 September – 5 October 2010
5. LOCO mooring deployment: 5 – 6 October 2010
6. Port stop: Toamasina/Tamatave, Madagascar: 08-10 October 2010. Disembark LOCO mooring scientists and embark Atlas mooring scientists
7. Wait for Seychelles Coast Guard: 11 – 13 October 2010
8. Meet up with Seychelles Coast Guard: 14 October 2010
9. High Risk Zone mooring deployment (8°S & 12°S): 15 – 20 October 2010
10. Leave behind Seychelles Coast Guard Escort: 20 October 2010
11. ATLAS deployment at 16°S: 22 October 2010
12. Transit: 16°S to Richards Bay: 22 – 28 October 2010.
13. Port stop: Richards Bay: 28 October 2010. Bunker
14. Transit: Richards Bay to Port Elizabeth: 29 – 31 October 2010
15. Port of arrival: Port Elizabeth: 31 October 2010

2.5. Research activities

1. Deploy five LOCO moorings off the south-east coast of Madagascar at positions indicated below.
2. Retrieve, service and re-deploy existing in situ ATLAS moorings at 8°S; 55°E and 12°S; 55°E.
3. Deploy new ATLAS mooring at 16°S; 55°E.
4. Deploy 10 Argo floats at positions indicated below.
5. Deploy three satellite drifters as part of NOAA's "Adopt-a-Drifter" programme in collaboration with South African schools.
6. CTD casts to calibrate mooring instruments. Water samples will be collected during the CTD cast for analyses of nutrients and phytoplankton.

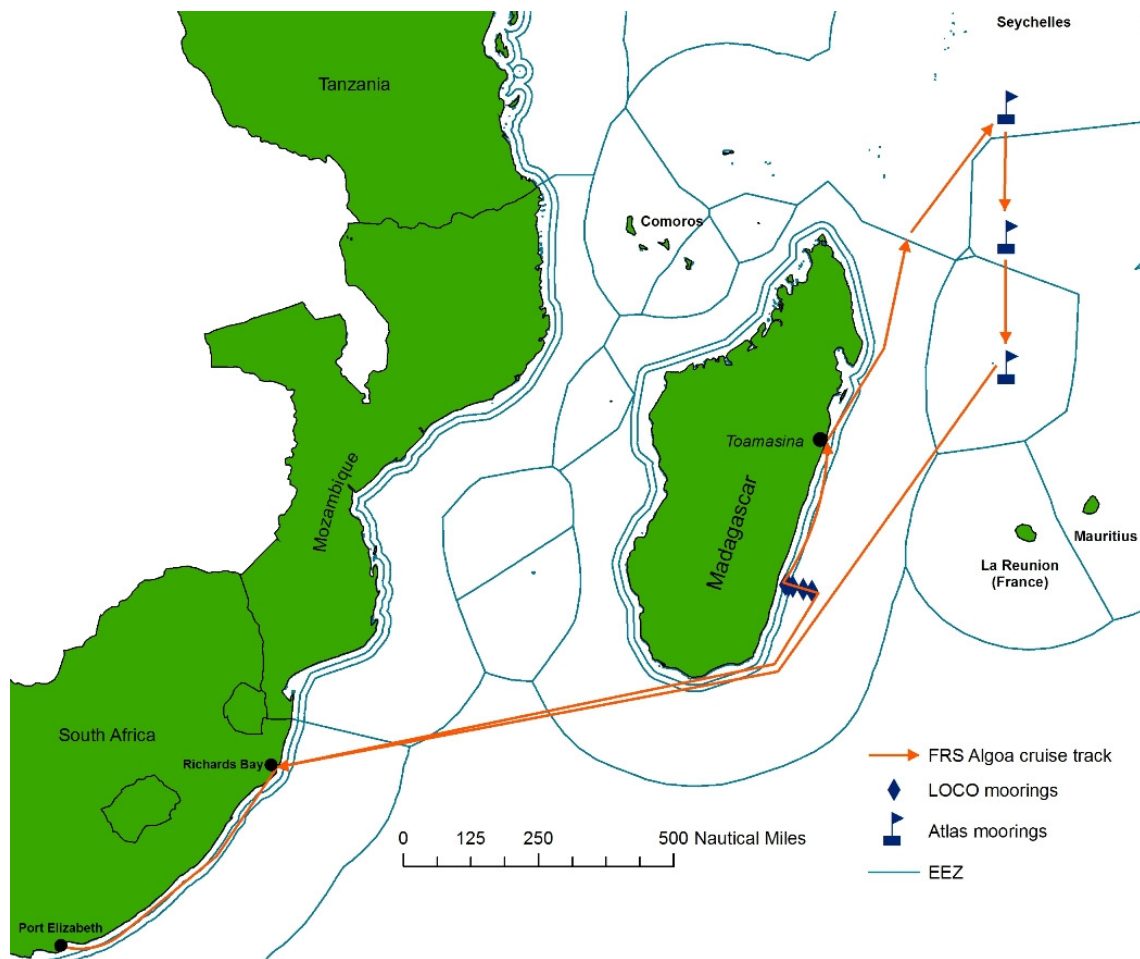


Figure 1. Map of the 2010 ASCLME mooring cruise

3. LEG 1: LOCO MOORINGS

3.1. Introduction

An array of five moorings, containing current meters, ADCPs and T-S sensors were deployed in a line over the shelf on the south-east coast of Madagascar. (Figure 2 and Table 1). The observations from these subsurface moorings will be used mainly to quantify the variability of the meridional mass and heat transport, to relate this variability to Indian Ocean (or El Nino) climate modes and to study the relation between this variability and the 'downstream' formation of Agulhas Rings. Preliminary results have indicated that the formation of the Agulhas Current has important consequences for climate variability at regional to global scales. The Long-term Ocean Climate Observations (LOCO) moorings are funded by the Netherlands Organization for Scientific Research (NWO). The array of LOCO moorings along the south-east coast of Madagascar will extend the current network deployed in the Mozambique Channel and provide valuable data on the functioning and importance of the East Madagascar Current in the formation of the Agulhas Current. For more information on the moorings, visit:

http://www.nioz.nl/nioz_nl/e56559cda63ee97ddd82c4e987f866f0.php

3.2. CTD casts

A CTD cast to 1000 m (max = 1200 m) was conducted after deployment and in the vicinity of the LOCO mooring (see table below for coordinates and dates). An additional two CTD stations were sampled on 7 October 2010 at: a) 19° 13.9'S; 049° 35.3' E and b) 19° 13.8'S; 049° 41.9'E. The CTD measured conductivity (salinity), temperature, oxygen, fluorescence, pH and PAR. No Niskin bottles were triggered. Data from the CTD will be used to calibrate the instruments on the moorings.

3.3. Results

The location of the LOCO mooring sites are given below (Table 1) and shown in Figure 5. The moorings will be serviced again in 2012 after which the first dataset will become available.

Table 1. Deployment coordinates for the five LOCO moorings

	Position	Depth	Date	Time (GMT)	EEZ
1	22° 41.8786' S 048° 01.0006' E	504 m	06/10/2010	14:22	Madagascar
2	22° 43.4847' S 048° 08.0129' E	1603 m	06/10/2010	13:05	Madagascar
3	22° 46.9545' S 048° 22.8581' E	2654 m	06/10/2010	09:53	Madagascar
4	22° 48.6894' S 048° 30.8272' E	3799 m	06/10/2010	05:18	Madagascar
5	22° 55.4840' S 049° 00.2788' E	3959 m	05/10/2010	14:36	Madagascar

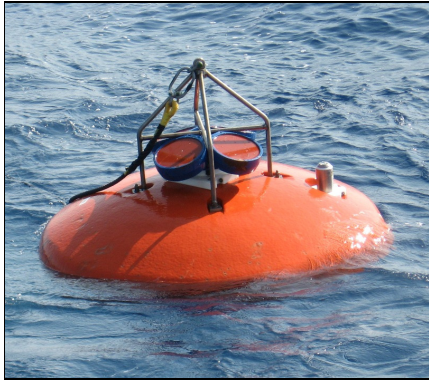


Plate 1. Floatec buoy with upward looking ADCP



Plate 2. Upward looking ADCP



Plate 3. LOCO mooring deck crew

4. LEG 2: ATLAS MOORINGS

4.1. Introduction

4.1.1. ATLAS moorings

The Pacific Marine Environmental Laboratory (PMEL) of the USA's National Oceanic and Atmospheric Administration (NOAA) deployed three Atlas moorings along the 55°E longitude as part of the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA) network. The three ATLAS (Autonomous Temperature Line Acquisition System) moorings were deployed at 8°S; 55°E, 12°S; 55°E and 16°S; 55°E (Figure 1 and 2). Standard ATLAS moorings (Plate 1) measures surface winds, air temperature, relative humidity, sea surface temperature, and ten subsurface temperatures from a 500 m long thermistor cable. No additional instruments, e.g. a fluorometer, were installed. Daily-mean data are telemetered to shore in near real-time via NOAA's polar-orbiting satellites and Service Argos (see below). A small subset of hourly values (2-3 per day) coinciding with satellite passes are also transmitted in real time. Hourly values of surface data are internally recorded and available after mooring recovery. The buoy is anchored on the seafloor and can be seen on radar from 4-8 nautical miles depending on sea conditions. For more info on the RAMA network and the Atlas moorings, please visit the following website: http://www.pmel.noaa.gov/tao/proj_over/mooring.shtml

4.1.2. Argo Floats

Ten Argo floats (Plate 2 and Table 3) were deployed in the Mascarene Basin in the vicinity of the Atlas moorings (Figure 2). Argo floats spend most of their life drifting at predetermined depths where they are stabilised by being neutrally buoyant. At 10-day intervals, the floats pump fluid into an external bladder and rise to the surface over about 6 hours while measuring temperature and salinity. Satellites determine the position of the floats when they surface, and receive the data transmitted by the floats. The bladder then deflates and the float returns to its original density and sinks to drift until the cycle is repeated. Floats are designed to make about 150 such cycles. As the float ascends a series of 200 pressure, temperature and salinity measurements are made and stored on board the float. These are transmitted to satellites when the float reaches the surface. For more info on the Argo floats, please visit: <http://www.argo.ucsd.edu/>

4.1.3. Satellite drifters

Three satellite drifters were supplied by NOAA as part of their "Adopt-a-drifter" programme.

Schools in South Africa “adopted” the drifters and they were deployed during the cruise.

4.2. Bathymetric mapping

The bathymetry of the seafloor in the vicinity of the proposed mooring deployment (24 nm²) was mapped using a SIMRAD ES 500 echo sounder and ArcGIS™ (ESRI® ArcMap™, ArcScene™ 9.1) software.

4.3. CTD casts

4.3.1. Introduction

CTD cast to 1000 m (max = 1200 m) was conducted after deployment and in the vicinity of the Atlas mooring (see table below for coordinates and dates). The Sea-Bird Electronics Inc. 9+ CTD measured conductivity (salinity), temperature, oxygen, fluorescence, pH and PAR. Twelve Niskin bottles were triggered at specific depths to collect water samples for nutrient, chlorophyll-a and phytoplankton analyses. Data from the CTD will be used to calibrate the instruments on the moorings.

4.3.2. Materials and methods

Nutrients

- Collect water samples from all depths
- Acid wash and rinse jars (green lid “urine jars”) before sampling
- Rinse jars twice with water directly from Niskin and then fill 50 ml “urine” sampling jar ³/₄ full.
- Do not overfill – set aside 5 – 10 ml space above to allow expansion during freezing
- Clearly mark station number and depth (in pencil) on sticker on the side of the jar and additionally label the lid with a marker pen.
- Place jars in freezer
- Pack all nutrient jars from each station together in a plastic bag, seal and mark bag with station number.

Phytoplankton and chlorophyll

- Determine position of Fmax (chl-a maximum) during the down cast of the CTD
- Collect 500 ml from Niskin bottles on the way up from the following depths (depths depend on profile – space equally if possible)
 - ◆ One depth below Fmax
 - ◆ Fmax
 - ◆ One above Fmax
 - ◆ One below surface
 - ◆ Surface (near as possible to the surface)
- Additional depths can be sampled should the profile prove to be interesting.
- Filter 500 ml (2 x 250 ml) of the collected seawater through the filter towers set-up with the following filter paper:
 - ◆ Top: 20 µm Nylon Net Millipore filter
 - ◆ Middle: 2 µm Macherey-Nagel filter
 - ◆ Bottom: 0.7 µm GF/F Whatman filter
- Discard water accumulating in the collecting chamber
- Remove filter paper with tweezers and place in tin foil and close.
- Label tin foils with stickers and write station number, date and depth
- Place all the labelled tin foils from each station in a plastic ziplock bag and label the bag with a post-it. Write on the post-it the following info:

Date, station, depths collected and fluorescence recorded (from fluorometer attached to CTD) at those depths.

- Freeze in -20 degree freezer or -80 degree freezer if space allows. Place all station ziplocks in one larger ziplock per line (i.e. a ziplock per station and into a larger ziplock per transect)
- The filtration should be carried out immediately after sampling.
- Phytoplankton identification (from Niskin Bottle)
 - Determine position of Fmax (chl-a maximum) during the down cast of the CTD & collect 2 x 1000 ml (in milk jars) from Niskin bottles at Fmax and the surface (near as possible to the surface)
 - Preserve one 1L with 20 ml Lugols (volume pre-set) and one 1L with glutaraldehyde (5 - 10 ml in 1000 ml)

4.4. Results:

4.4.1. Bathymetric mapping

8° South mooring

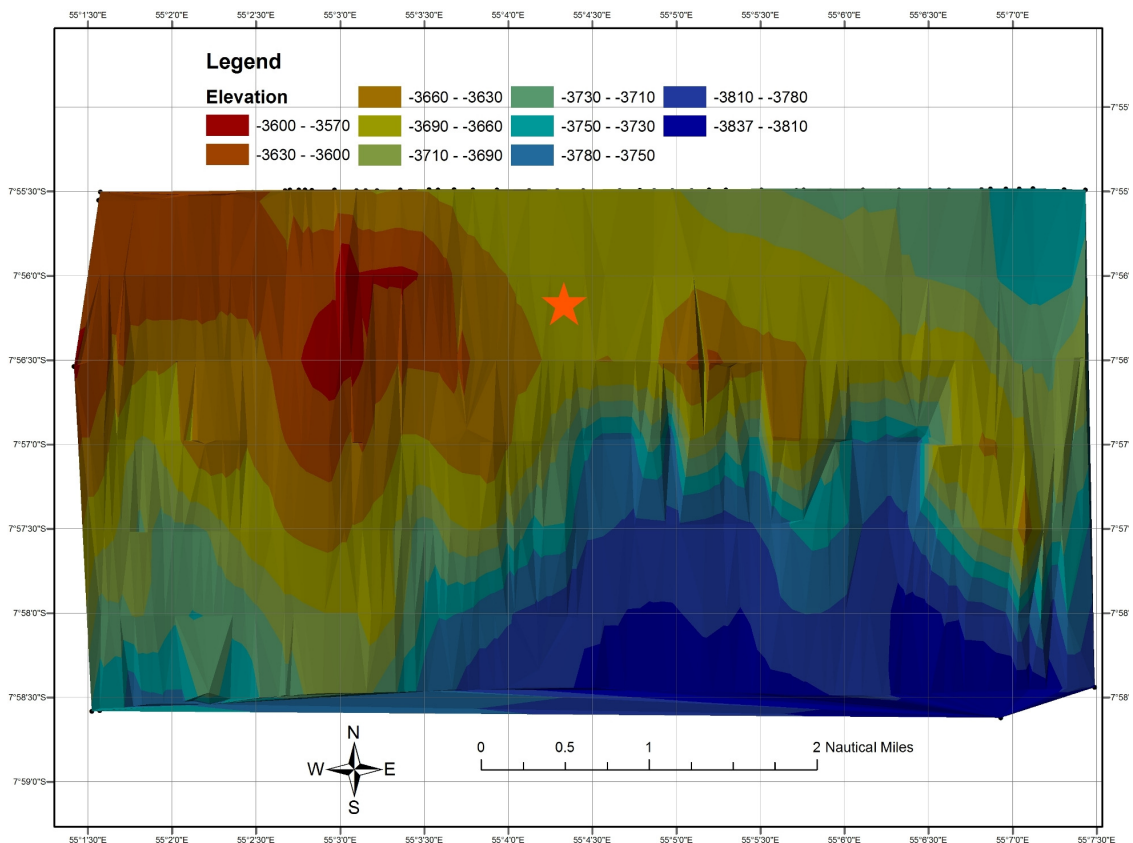


Figure 2. Seafloor bathymetry in the vicinity of 8°S. Red star indicates the area chosen to deploy the new mooring.

12° South mooring

The echo-sounder failed to provide a sounding deeper than 4500 m. The bathymetric map from the 2008 *R/V Dr Fridtjof Nansen* cruise was used (Figure 3 below). Final mooring location provided in Table 2.

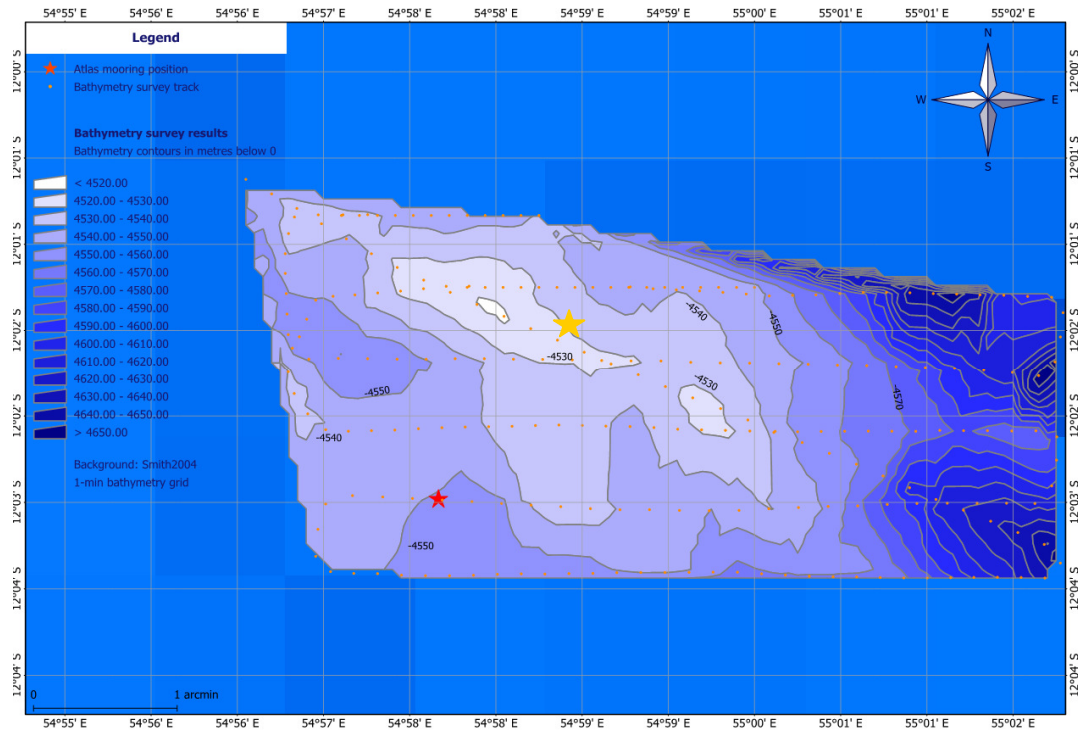


Figure 3. Bathymetric map showing the location of the old (red star) and the new (yellow star) Atlas mooring.

16° South mooring

The echo-sounder failed to provide a sounding deeper than 4500 m. A satellite derived bathymetric map of the seafloor was used (see Figure 4 below).

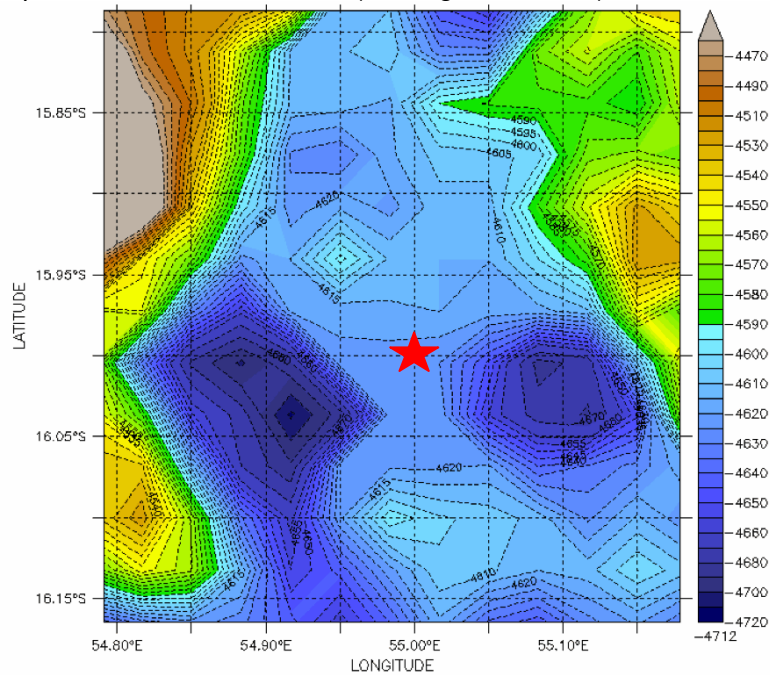


Figure 4. Satellite derived map of the seafloor showing the location of the new Atlas mooring (red star).

4.4.2. ATLAS mooring locations

The location of the ATLAS mooring sites are given below (Table 2) and shown in Figure 5.

Table 2. Deployment coordinates for the three ATLAS moorings

	Position	Depth	Date	Time (GMT)	EEZ
1	07° 56.1521' S 055° 04.9309' E	3647 m	18/10/2010	06:44	Seychelles
2	12° 01.7557' S 054° 58.9681' E	4557 m	20/10/2010	07:36	Mauritius
3	16° 00.162' S 054° 59.873' E	4633 m	22/10/2010	07:35	Ile Tromelin (France)

4.4.3. Argo floats

Locations of the ten Argo floats deployed are given below (Table 3) and shown in Figure 5.

Table 3. Deployment coordinates for the ten Argo floats

	Float No.	Position	Date & time (GMT)	EEZ	Deployed by
1	4063	07° 54.60' S 055° 05.90' E	18/10/2010 13:00	Seychelles	M. Craig L. Stratton
2	4015	10° 00.602' S 055° 00.187' E	19/10/2010 03:02	Mauritius	M. Craig L. Stratton R. Harding
3	4367	11° 00.00' S 055° 00.06' E	19/10/2010 10:45	Mauritius	M. Craig L. Stratton
4	4368	12° 02.50' S 054° 48.9' E	20/10/2010 13:55	Mauritius	M. Craig L. Stratton
5	4607	12° 59.49' S 054° 59.87' E	21/10/2010 00:01	Ile Tromelin (France)	T. Bornman T. Sonnekus
6	4466	13° 59.99' S 055° 00.103' E	21/10/2010 06:29	Ile Tromelin (France)	M. Craig L. Stratton T. Bornman
7	4366	14° 59.996' S 054° 59.923' E	21/10/2010 13:10	Ile Tromelin (France)	M. Craig L. Stratton R. Harding
8	4608	16° 00.031' S 054° 59.423' E	22/10/2010 08:50	Ile Tromelin (France)	M. Craig L. Stratton R. Harding
9	4365	17° 00.04' S 054° 11.012' E	22/10/2010 18:58	Ile Tromelin (France)	M. Craig T. Bornman
10	4671	18° 00.014' S 053° 59.49' E	23/10/2010 01:22	Ile Tromelin (France)	T. Bornman T. Sonnekus

4.4.4. Satellite drifters

Three satellite drifters were deployed during the cruise. One of the southern point of Madagascar and the other two in the Mascarene Basin (see Table 4 below) and Figure 5.

Table 4. Deployment coordinates for the three NOAA satellite drifters

	Position	Drifter no.	Date	Time (GMT)	EEZ
1	26° 26.4' S 042° 11.8' E	70972	03/10/2010	06:09	Madagascar
2	15° 59.5492' S 054° 58.6019' E	70970	22/10/2010	10:38	Ile Tromelin (France)
3	20° 00.00' S 054° 01.875' E	70971	23/10/2010	13:52	La Reunion (France)



Plate 4. 8°S mooring deployment

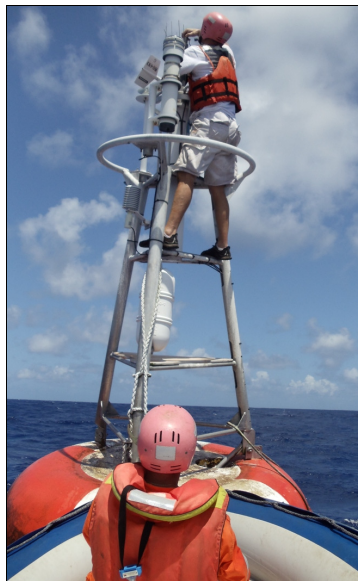


Plate 5. Old 8°S mooring instrument retrieval



Plate 6. Retrieved Atlas mooring



Plate 7. Satellite drifter before deployment



Plate 8. Atlas mooring deck crew

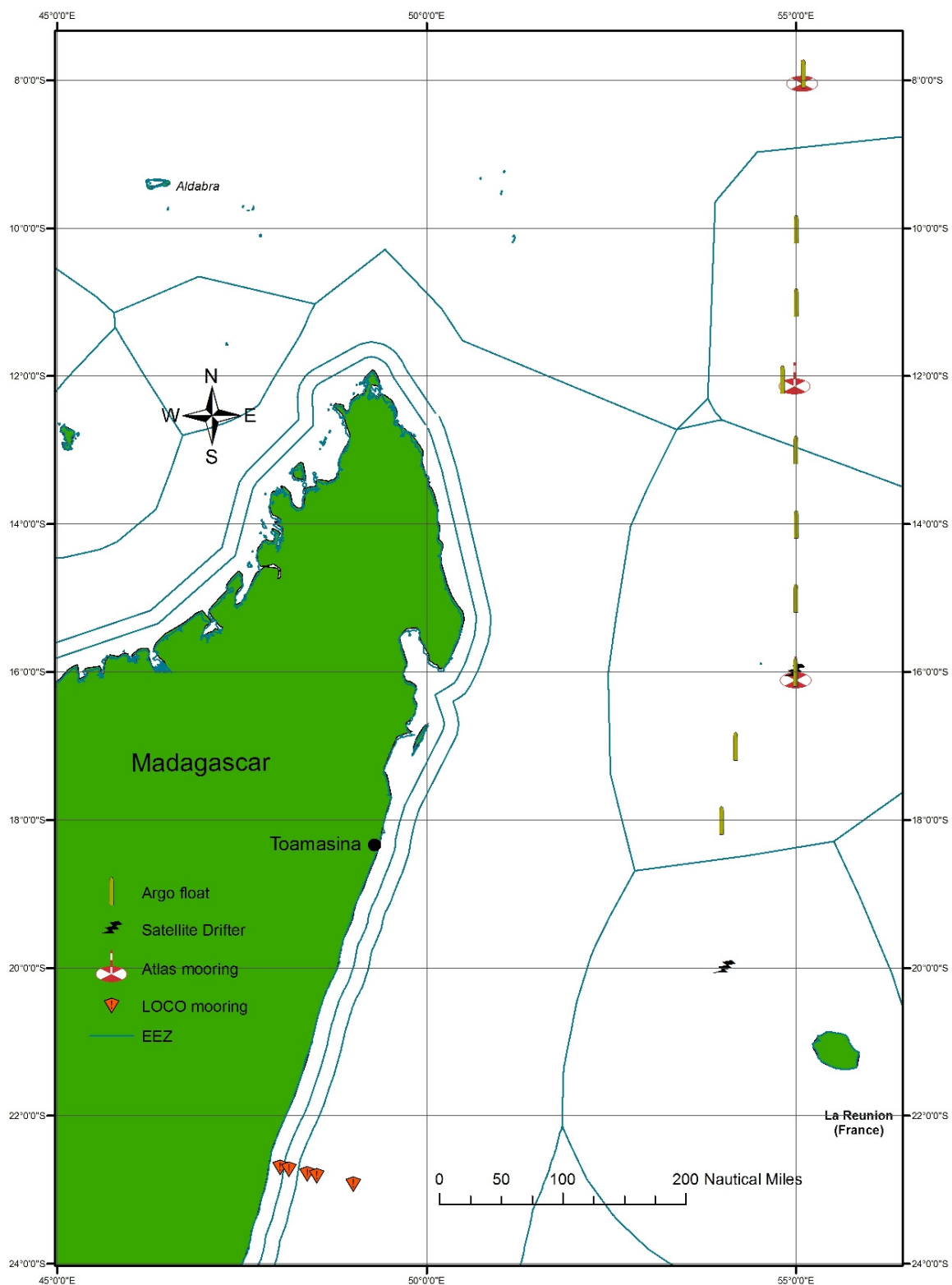
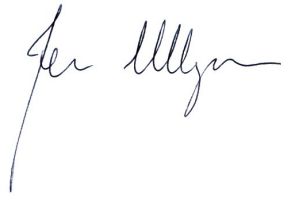


Figure 5. Deployment locations of the five LOCO moorings, five Atlas moorings, ten Argo floats and three satellite drifters.



Jenny Ullgren
Chief Scientist (Leg 1)



Linda Stratton
Chief Scientist (Leg 2)



Thomas Bornman
ACEP/ASCLME Cruise Coordinator

Appendix A: Data Management Agreement for the ASCLME/NOAA/NIOZ Cruise

The intention of this Data Management Agreement is to clarify and protect the interests of all scientists and countries participating in the ASCLME Project.

General Introduction

Participating countries in the ASCLME Project, and their designated representatives, have the mandate to develop a comprehensive document on principles and guidelines for ASCLME data and information management so that it facilitates the effective collection, use and dissemination of information in support of TDA/SAP development in the short term and the ecosystem approach in the long term. National Data and Information coordinators in particular, have a responsibility for developing mechanisms for reliable long-term storage and use of information collected under the ASCLME Project. This Agreement is intended to govern the collection, storage and access to data on the ASCLME 2010 Cruises as an interim measure prior to agreement of a more detailed MoU on data access and management which is currently under development as part of the overall ASCLME Programme.

Bearing in mind that access to new data, associated metadata, information collection **activities and resulting products funded by the ASCLME** shall be free and unrestricted;

Data collected on ASCLME cruises, associated metadata, publications and other data products are the joint responsibility of the principal investigator (in the case of a scientific investigation), their institution, participating countries, the ASCLME Project, NOAA and NIOZ. The primary custodians of data sets shall be the NOAA (US Department of Commerce), Royal Netherlands Institute for Sea Research (NIOZ) and the UNDP/GEF ASCLME Project and the member-countries of the ASCLME Project. The primary contact points and archive locations for the survey data shall be at NOAA, NIOZ and nationally appointed data centres as designated by the ASCLME Data and Information Working Group.

These guidelines for intellectual property assume that adequate opportunity has been given to scientists via their national ASCLME focal points to plan collaboration on research projects (data collection, processing and paper-writing), *particularly* from countries in whose territorial waters the research cruises have taken place.

Interim data management guidelines with specific reference to the 2010 ASCLME/NOAA/NIOZ cruise

The NIOZ (Leg 1), NOAA (Leg 2) and ACEP/ASCLME (Leg 2) Chief Scientist will be responsible for ensuring the accurate documentation of activities and backup of electronic data.

Detailed documentation will be made of all measurements and samples collected during each cruise. Documentation will include the cruise track, timing, geo-referenced and time-referenced records of every sampling site, mooring location and station.

Timing of cruise data reports and products

A provisional cruise report and completed data report (containing documentation of all measurements and samples collected during each cruise, including the cruise track, timing, geo-referenced and time-referenced records of every sampling site and station) will be provided to the ASCLME PCU within 45 days of the end of the cruise (15 November 2010).

An electronic version (in Excel) of all activity/site/station records, and video & photographic inventories will be given to the PCU. These will be checked and sent on to each of the ASCLME participating countries.

Processed data from the cruises

Data that have been processed from the 2010 ASCLME/NOAA/NIOZ cruise will be made available to the PCU *within four months of the conclusion of the cruise (20 January 2011)*. Examples of these data will include CTD, ADCP, multibeam data sets, as well as actual mooring data. It is recognized that some data sets may not be processed by this time. In that case, any raw electronic data must be provided to the PCU together with a report on the steps (and timing) that will be taken to process the data.

Data sets that are required for publications will be safely retained offline (i.e. flagged and not made available to other scientists) until either

- a) Chief scientists agree to the dissemination of data sets OR
- b) Publications are submitted OR
- c) Eighteen months has passed since the conclusion of the cruise, whichever is the soonest.

The climatic and oceanographic data collected by the Atlas moorings and the Argo floats are freely available to the public from the following websites:

Atlas moorings: http://www.pmel.noaa.gov/tao/proj_over/mooring.shtml

Argo Global Data Assembly Centers:

- 1) Brest, France: <http://www.coriolis.eu.org/>
- 2) Monterey, USA: <http://www.usgodae.org/argo/argo.html>

As soon as data sets are checked, they will be lodged at nationally appointed data centres as designated by ASCLME National Data and Information Coordinators.

Raw OR processed data collected by scientists under the ASCLME Project shall be immediately available to the Regional Information Working Group (made up of national Data and Information Coordinators) for the sole purpose of (*internally*, not for distribution) informing the TDA/SAP, should it be necessary.

Publications

Plans for publications (including tasks and time lines) will be finalised between principal investigators and participating researchers. Publications from the 2010 cruise are expected to be submitted for publication within two calendar years of the close of the cruise schedule, by 20 January 2012.

Acknowledgement

The use of any expedition-derived data in data products or publications must be associated with proper acknowledgement of the ASCLME Project, the Department of Agriculture, Forestry and Fisheries, South Africa, NOAA and NIOZ. As an example the following sentences could be included in the acknowledgement section of publications:

This study and data collection was undertaken as part of the Agulhas and Somali Current Large Marine Ecosystems Project and the Atlas Mooring Project of the NOAA or the LOCO mooring Project of the NIOZ. These projects are funded by the Global Environment Facility through the United Nations Development Programme and by the US Department of Commerce or by the Netherlands Organisation for Scientific Research. More details about the projects can be found at <http://www.asclme.org> and http://www.pmel.noaa.gov/tao/proj_over/mooring.shtml or http://www.nioz.nl/nioz_nl/