

# MAPPING TECHNOLOGIES IN CORAL REEF ENVIRONMENTS

## *Training Course*

10-19 March 2019



Organised by:

**Submarine Geomorphology Working Group (IAG)**

at the

**MaRHE center – Magoodhoo, Faafu Atoll, Republic of Maldives**

For registration and information:

[alessandra.savini@unimib.it](mailto:alessandra.savini@unimib.it), [marhe@unimib.it](mailto:marhe@unimib.it),



## THE COURSE

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### *WHY THIS COURSE?*

Coral reefs are unique ecosystems in view of their dependence on a strong interaction between geomorphic and ecological processes. Investigating the formation and morphological change of coral reefs and reef-associated landforms contributes to a deeper understanding of a number of geomorphological, environmental and ecological issues, such as sediment and nutrient transport processes, larval dispersion mechanisms, estimation of their carrying capacity as habitat, etc. It is also paramount to improving coral reef conservation in the face of changing environmental conditions, resulting from an increased stress by anthropogenic and climate changes.

Until less than a decade ago, geomorphological mapping in coral reef environments was carried out using satellite data ground-truthed by field studies, and it is mainly focused on the investigation of the recent evolution of coral-reef associated landforms. Because of this, geomorphological mapping lacked a 3-dimensional representation of coral reef environments at high spatial resolution. The collection of fine-scale elevation data was limited by the difficulty in obtaining reliable submarine elevation data. The use of a research vessel (equipped with traditional acoustic mapping devices) is hampered by the very shallow and topographically complex environments. Today, detailed mapping of coral reef structures is possible, thanks to recent improvements in using Unmanned Aerial Vehicles (UAVs) and the Structure from Motion (SfM) digital photogrammetry image processing technique, among others.

This course will entail an overview of the most advanced techniques used to collect elevation data in coral reef environments, spanning from traditional acoustic mapping (multibeam echo-sounder bathymetry and backscatter, shallow seismic reflection profiling) and seafloor imaging/sampling techniques (remotely operated vehicle (ROV) and grab sampling) to UAV and topographic surveys. We will present techniques used to integrate multi-scale elevation data sets into a continuous digital terrain model (DTM) to understand the processes responsible for the formation of coral-reef environments.



## ***THE SUBMARINE GEOMORPHOLOGY WORKING GROUP (IAG)***

The Working Group on Submarine Geomorphology investigates the morphology and evolution of seafloor landforms, and the processes responsible for their formation. In this working group, scientists from different disciplines are encouraged to interact and employ state-of-the-art seafloor exploration instruments and analytical techniques (e.g. high resolution bathymetry, side scan sonar, seismic reflection profiling, ROV, AUV, seabed sampling, seafloor classification, geomorphometry) to better understand the most extensive geomorphic system on our planet (<http://www.geomorph.org/submarine-geomorphology-working-group/>).

One of the main objectives of our working group is to provide training in techniques used, and disseminate discoveries made, by submarine geomorphologists with earth scientists, professionals and students, while promoting interaction between terrestrial geomorphologists. Coral reefs are a main research topic in coastal geomorphology, but their detailed geomorphological mapping has only recently started to be addressed, with the latter establishing a new field in submarine geomorphology. We therefore think that a training course on mapping technologies in coral reef environments would be of great benefit for young geomorphologists, especially by giving them a unique opportunity to exchange ideas and practices with subaerial/coastal and submarine geomorphologists.

### ***INSTRUCTORS***

The course is being organised and delivered by the Submarine Geomorphology Working Group's chairpersons:

**Alessandra Savini** – marine geomorphologist, University of Milano-Bicocca, Dept. of Environmental and Earth Sciences, Milan, Italy

**Aaron Micallef** – marine geologist and geomorphologist, Marine Geology & Seafloor Surveying, Department of Geosciences, University of Malta, Malta

**Sebastian Krastel** – marine geologist and geophysicist, Marine Geophysics and Hydroacoustics, University of Kiel, Germany



## ***COURSE CONTENT***

This is an 8-day intensive, full-time course involving 80 hours' hands-on program in the field and laboratory. In addition to providing experience in the use of acoustic technologies for seafloor surveying, the course touches on current best practices, appropriate survey design and logistics to carry out advanced geomorphological mapping of coral reef environments.

The course will be divided into a series of classroom lessons and field activities. It will be coordinated by researchers with experience in seafloor and benthic habitat mapping in continental margins and oceanic island settings.

The lessons will be held at the **Marine Research and High Education Center (MaRHE Center)** of Milano-Bicocca University in Magoodhoo Island, Faafu Atoll, which is about three hours by speedboat from Malé airport. All field activities will be carried out on board a traditional *dhoni* (wooden sailing vessel used in Asia). Practical activities will also include the use of dedicated software for processing collected data and perform their integration and interpretation. This course will result in the production of a multi-scale geomorphological map of the Magoodhoo Island and its surrounding reef.

At the end of the course, students will be able to:

- Plan a geomorphological survey in coral reef environments
- Collect terrestrial and submarine topographic data using a wide range of technologies (UAV, multibeam echosounder, sub-bottom profiler, ROV, sediment sampling)
- Process multi-scale topographic data to generate DTMs
- Recognise main carbonate producers in coral reef environments
- Carry out geomorphological mapping of coral reef environments

Students completing the **Mapping technologies in coral reef environments** course will be given a certificate of practices and knowledge through an international virtual credit named Open Badge released by the University of the Milano Bicocca.

More detail at this page: [www.openbadges.org](http://www.openbadges.org)



## COURSE DAILY PROGRAM

### Day 1

- Arrival at Malé International Airport, Maldives
- Transfer by speed boat to Magoodhoo Island
- Arrival in Magoodhoo island, accommodation and welcome briefing
- Dinner & Briefing about next day's activities

### Day 2

- Classroom Session 1: **Geomorphology and sedimentology of coral reefs**
- On-field activity Session 1: **Topographic survey**
- Lab activity session 1: **GPS Data processing and implementation into a Geographical Information System**
- Classroom Session 2: **Remote sensing and coral reefs**
- Recap & Briefing about next day's activities



**MAPPING TECHNOLOGIES  
IN CORAL REEF ENVIRONMENTS**  
Magoodhoo, Faafu atoll, Maldives – March 2019



- Day 3** Classroom Session 3: **Geomorphological mapping in coral reef environments: An introduction**  
On-field activity Session 2: **Non-destructive sampling methods in coral reef environments (Bionomic transect and video/photo survey)**  
Lab activity session 2: **Coral reef zonation**  
Classroom Session 4: **Remote sensing in coral reef environments and the generation of Digital Elevation Model**  
Recap & Briefing about next day's activities
- Day 4** On-field activity Session 3: **UAV survey**  
Lab activity session 3: **UAV Data processing and generation of a DEM (Structure from Motion technique)**  
Lab activity session 4: **Geomorphometric analysis and investigation of coral reef structural complexity**  
Classroom Session 5: **Acoustic survey in shallow water environments: Multi-Beam EchoSounder (MBES)**  
Recap & Briefing about next day's activities
- Day 5** On-board activity Session 1: **MBES survey (patch reefs and lagoon)**  
Lab activity session 5: **MBES data processing**  
Classroom Session 6: **Acoustic survey in shallow water environments: Backscattering**  
Recap & Briefing about next day's activities
- Day 6** On-board activity Session 2: **MBES survey (reef slope)**  
Lab activity session 6: **MBES (backscattering) data processing**  
Classroom Session 7: **Acoustic survey in shallow water environments: Sub-bottom profiling (SBP)**  
Recap & Briefing about next day's activities
- Day 7** On-board activity Session 3: **SBP survey**  
Lab activity session 7: **SBP Data processing and interpretation**  
Lab activity session 8: **Integration of all remote data and generation of a unique DTM**  
Recap & Briefing about next day's activities



**MAPPING TECHNOLOGIES  
IN CORAL REEF ENVIRONMENTS**  
Magoodhoo, Faafu atoll, Maldives – March 2019



- Day 8**      On-board activity Session 4: **Grab and ROV survey**  
Lab activity session 9: **Analysis of sediment samples and identification of carbonate producers**  
Lab activity session 10: **Remote and field data integration into a GIS**  
Recap & Briefing about next day's activities
- Day 9**      Field trip on an uninhabited island and on-board activity Session 5: **ROV and MBES survey and review of all remote techniques**  
Lab activity session 11:  
**Generation of a multi-scale geomorphological map of the Magoodhoo Island and its surrounding reef**
- Day 10**      Departure from Magoodhoo to Malè airport

**Due to weather conditions or other problems, program may change**

For field activities in the sea, the students should have:

- Bathing suit
- Towel
- Mask;
- Snorkel;
- Fins (booties);
- Wetsuit.

**THE COURSE IS SPONSORED BY:**





#### REQUIREMENTS

- Ideal candidates are recent graduates, PhD students and young researchers or professionals working in the field of coastal/submarine geomorphology, geology and biology.

## PRACTICAL INFORMATION

### DOCUMENTS

To enter the Maldives it is necessary to have a **valid passport** (valid for at least six months after the exit from the country).

### CLOTHING AND EQUIPMENT

The air temperature is around 28-29°C (Fig 1). The weather is always pleasant and often windy, even during the rainy months (Figs 2 and 3). Please note that most of the day will be occupied by field activities, seminars and exercises, and it is therefore advisable to wear comfortable clothes.

**It is recommended that participants wear sensible clothing in respect of local customs. Magoodhoo island is not a tourist resort.**



Fig 1. Monthly maximum, minimum and average air temperature (°C) recorded in Male (Maldives)



Fig 2. Monthly rainfall (mm) and rainy days recorded in Male (Maldives).



Fig 3. Monthly average and maximum wind speed and gust (mph) recorded in Male (Maldives).

## **ACCOMODATION AND MEALS**

Students will be accommodated at the guesthouse of the Centre, in multiple bedrooms with shared bathroom, with full board (breakfast, lunch and dinner). Sheets and towels will be provided. The food is prepared according to the local customs and mostly consists of fish, chicken, rice and vegetables prepared in different ways.

## **HEALTH**

In the Maldives no vaccinations are required for travelers coming from Europe. The only vaccination officially required by Maldives is one for yellow fever if you are coming from an area where yellow fever is endemic. Malaria prophylaxis is not necessary. However, each participant should take care of checking his/her health and obtaining adequate insurance.

## **SAFETY**

Any field activity presents risks and dangers. A welcome briefing will be set up in Magoodhoo where all the necessary safety information will be communicated.

## **EXCHANGE**

The Maldivian currency is the Maldivian Rufiyaa. Euro and dollar are accepted in any bank and exchange office.

1 euro  $\approx$  18 rufyiaa; 1 USD  $\approx$  15 rufyiaa; 100 rufyiaa  $\approx$  5 euro  $\approx$  6 dollari



## COST AND REGISTRATION

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### The cost of the **WORKSHOP** is

- **1500** Euro per participant

The fee includes:

- boat transfer to/from Malé airport
- transfer for all activities envisaged by the course
- room and board at the MaRHE Center of Magoodhoo with full board treatment and accommodation in multiple bedrooms with shared bathroom
- lessons and activities provided for the internship program

The figure does **NOT** include:

- flight to/from Malé
- any passport renewal expenses
- expenses for obtaining an entry student-visa to the Maldives (for information contact [marhe@unimib.it](mailto:marhe@unimib.it))
- anything else not specified above

**WITHIN 15 January 2019** we need you to:

- Confirm your registration by e-mail sending the registration form duly filled (found below) to [marhe@unimib.it](mailto:marhe@unimib.it) and [alessandra.savini@unimib.it](mailto:alessandra.savini@unimib.it).
- Send a CV
- Pay the 50% of the fee when registering as a cover for the accommodation booking and send it by email along with the documents mentioned above.

The remaining amount must be paid within one month before the beginning of the internship.

Since the maximum number of participants is fixed to 20, a preliminary selection of the participants based on their CV may be required.



## Bank Account details:

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**IBAN: IT87 K056 9601 6280 0000 0200 X71**

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**Headed to:**

UNIVERSITA' DI MILANO-BICOCCA

BANCA POPOLARE DI SONDRIO

AGENZIA DI MILANO AG. n. 29 – BICOCCA, Piazza della Trivulziana, 6

20126 - MILANO

**SWIFT CODE: POSOIT22XXX**

**Purpose of payment:**

“Mapping technologies in coral reef environments” [NAME and SURNAME].

For more information please contact Alessandra Savini ([Alessandra.savini@unimib.it](mailto:Alessandra.savini@unimib.it)) or MarHE Center ([marhe@unimib.it](mailto:marhe@unimib.it))

WE ALSO REMIND YOU THAT:

**DATES ARE APPROXIMATE AND ARE SUBJECT TO A CHANGE ( $\pm$  2 days max) UP TO 15<sup>TH</sup> January, DEPENDING ON THE AVAILABILITY OF THE FLIGHTS and MarHE CENTRE.**



## REGISTRATION FORM

FULL NAME (as reported on the passport) \_\_\_\_\_

PLACE AND DATE OF BIRTH \_\_\_\_\_

ATTENDING THE \_\_\_\_\_ YEAR IN \_\_\_\_\_ (degree course attending)

POSITION:

- Graduate
- PhD Student
- Post-Doc
- Professional
- Other (\_\_\_\_\_)

e-Mail: \_\_\_\_\_ Tel.: \_\_\_\_\_

ALLERGY OR FOOD INTOLLERANCE  No  Yes (if so, please specify)

ALLERGY DRUG  No  Yes (if yes, please specify)

CHRONIC DISEASE  No  Yes (if yes, please specify)

Place and date \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

**SIGNATURE OF THE STUDENT**

\_\_\_\_\_