



MaRHE

Mapping Technologies and Monitoring Techniques in Coral Reef Environments

13-21 February 2024

III edition

Training Course

*MaRHE Center, Magoodhoo
Faafu Atoll - Republic of the Maldives*

For registration and information:

workshop.marhe@unimib.it

luca.fallati@unimib.it, andrea.varzi@unimib.it

Introduction

Why this workshop?

Coral reefs are a complex and productive ecosystem that encompasses the highest biodiversity of any marine ecosystem. They are unique as they depend 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. Moreover, it is crucial to improve coral reef conservation with a view of changing environmental conditions resulting from an increased stress by both anthropogenic and climate changes. To date, we have lost most of the global coral reef systems worldwide due to several impacts, such as overfishing, coastal development, sedimentation, marine-based pollution (e.g. plastic pollution).

Until less than a decade ago, geomorphological mapping in coral reef environments was carried out using satellite data ground-truthed by field studies. Because of this, geomorphological mapping lacked a 3D representation at high spatial resolution. As a consequence, geomorphological and habitat mapping, together with monitoring investigations, were challenging topics. Nowadays, detailed mapping of coral reef environments is possible thanks to the use of both acoustic equipment (e.g. Multibeam Echosounder - MBES) and Uncrewed Aerial Vehicles (UAVs or drones), thus we are able to map, study and plan monitoring actions to be carried out to preserve such productive ecosystems.

The III Edition of the Mapping Technologies and Monitoring Techniques in Coral Reef Environments is your opportunity to gain hands-on experience on data acquisition and post-processing techniques by using different equipment, focusing on the importance of cutting-edge monitoring techniques for mapping coastal and nearshore environments.

Introduction

About the workshop

During the first edition of *Mapping Technologies in Coral Reef Environments* in 2019, the main goal was to provide an overview of the most advanced technique used to collect elevation data in coral reef environments and to integrate multi-scale elevation datasets to obtain seamless Digital Terrain Models (DTMs).

The III Edition of this practical training, as well as the past II edition, is called ***Mapping Technologies and Monitoring Techniques in Coral Reef Environments***, and it also aims at providing advanced knowledge on how to plan and carry out multi-scale and multi-sensor monitoring activities in nearshore environments.

This course will entail an overview of the most advanced techniques used to collect remote sensing data in coral reef environments (e.g. UAVs and MBES) and to ground-truth them (Photogrammetry). We will present post-processing procedures for both MBES data (Bathymetry and Backscatter) and UAV imagery (Structure for Motion - SfM), other than data interpretation thanks to the use of GIS toolboxes (ArcMap).

Lessons will be held at the *Marine Research and High Education Center (MaRHE Center)* of the University of Milano-Bicocca in Magoodhoo Island, Faafu Atoll, which is about three hours by speedboat from Malé airport.

Field activities will be carried out either on land, or on board a traditional Dhoni (wooden sailing vessel), or in snorkelling.

Practical activities will include the use of dedicated software for processing collected data and performing their integration and interpretation.

Introduction

What to expect

The course will consist of a series of frontal lessons and field activities. It will be coordinated by researchers with experience in the use of aerial drones (UAVs) and underwater instruments (MBES) to perform coastal and seafloor mapping together with photogrammetry techniques.

After completion of this training course, you will be able to:

1. plan drone surveys with the ground station software and;
2. perform the survey and georeference the obtained models with GPS ground control points;
3. recognise main carbonate producers in coral reef environments;
4. collect terrestrial and submarine topographic/bathymetric data using different technologies (UAV, MBES, photogrammetry);
5. process MBES bathymetry and backscatter with specific software (Qimera, FMGT);
6. process imagery data with Structure from Motions (SfMs) algorithms to build orthomosaics and/or 3D models (Agisoft Metashape);
7. create geomorphological and habitat maps (ArcMap).

At the end of the Training Course the University of Milano-Bicocca will release a digital certificate (Open Badge) to recognize the participant's skills and achievements in Mapping Technologies and Monitoring Techniques.

For more details, please visit:

www.openbadges.org and <https://bestr.it/badge/show/400?ln=en>

Daily Programme

DAY 1

- Arrival at Malé International Airport, Maldives
- Transfer by speedboat to MaRHE Center, Magoodhoo Island
- Welcome in Magoodhoo island
- Dinner
- Briefing on the next day's activities

DAY 2

- Classroom Session: Coral Reef environments
- Classroom Session: Remote sensing data retrieval
- Field Activity: Snorkelling and water confidence
- Lunch
- Classroom Session: GPS and georeferencing
- Laboratory Session: Group division and project choice
- Laboratory Session: Software installation
- Classroom Session: UAV introduction
- Field Activity: UAV equipment
- Dinner

DAY 3

- Classroom Session: How to plan a UAV survey
- Laboratory Session: Mission planner - UgCS software
- Laboratory Session: UAV survey planning
- Lunch
- Laboratory Session: UAV survey planning
- Classroom Session: SfM software (Agisoft Metashape)
- Classroom Session: Best practices for underwater photogrammetry
- Field Activity: UAV data acquisition
- Dinner

DAY 4

- Field Activity: UAV/underwater photogrammetry data acquisition
- Laboratory Session: data processing
- Lunch
- Laboratory Session: data processing
- Field Activity: UAV/underwater photogrammetry data acquisition
- Dinner

Daily Programme

DAY 5

- Classroom Session: Acoustic survey in shallow waters (MBES)
- Laboratory Session: MBES survey planning
- Laboratory Session: Group working time
- Lunch
- Field Activity: MBES data acquisition
- Classroom Session: MBES data processing (Qimera)
- Dinner

DAY 6

- Field Activity: MBES/UAV/underwater photogrammetry data acquisition
- Lunch (boat)
- Field Activity: MBES/UAV/underwater photogrammetry data acquisition
- Dinner

DAY 7

- Travel to Adangau
- Field Activity: MBES data acquisition (Adangau)
- Lunch
- Field Activity: UAV/underwater photogrammetry data acquisition
- Travel to MaRHE Center
- Laboratory Session: MBES/UAV/underwater photogrammetry data processing
- Dinner
- Briefing on the next day's activities

DAY 8

- Laboratory Session: Group working time
- Lunch
- Laboratory Session: Group working time
- Classroom Session: Final presentations
- Dinner
- Boduberu

DAY 9

- Transfer by speedboat to Malé, Maldives
- Arrival at Malé International Airport, Maldives

Please note that the program's agenda is subject to slight changes during the workshop.

Useful information

Documents

Travelling to the Maldives requires a **passport**, with **at least 6 months of validity from your departure from the Maldives** and **at least 2 empty pages**.

Clothing and Equipment

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

It is recommended to avoid too skimpy clothing, as the island of Magoodhoo is not a tourist destination and local costumes are those of an Islamic country.

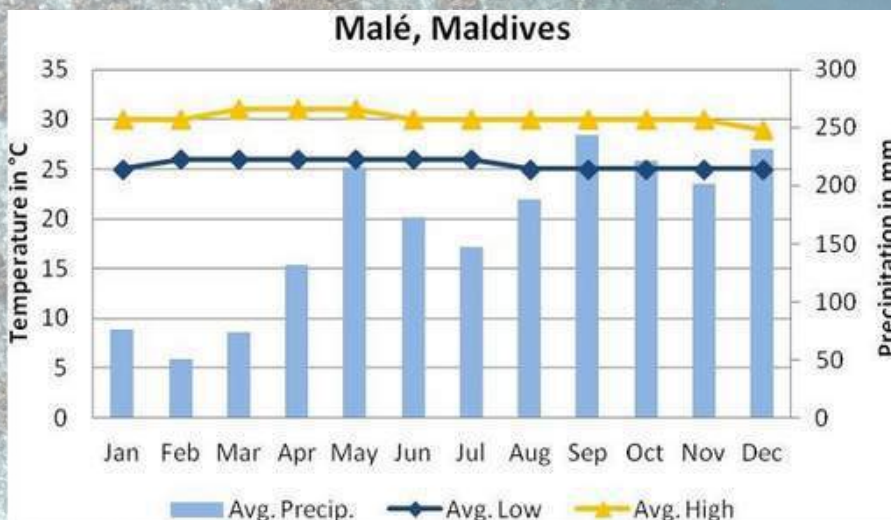


Fig1. Monthly air temperature (°C) recorded in Maldives and monthly averages of sunny and rainy hours recorded in Maldives.

For field activities in the sea it is necessary to have - in addition to a bathing suit and a towel - the following equipment:

- Mask
- Snorkel
- Fins (booties if needed)

It is possible to rent snorkelling equipment on-site, depending on size and availability. Please inform us in advance in case you need anything.

Useful information

Accommodation and Meals

The accommodation is organised at the Centre, in multiple rooms with bathroom, full board (breakfast, lunch and dinner). Sheets and towels are provided. The food is prepared according to the local customs and consists, for the most part, of fish, chicken, rice and vegetables prepared in different ways. Special dietary requirements and allergies are to be mentioned in the application form.

Health

No vaccination is required for travellers coming to Maldives from Europe. However, each participant should take care of this aspect in order to enter the country.

Safety

Any field activity presents risks and dangers, and there are some basic rules to be observed in order to minimise them.

In the water it is necessary to respect the buddy system: working groups will be settled, and, within the group, working couples will be established.

Currency

The Maldivian currency is the Maldivian Rufiyaa (MVR). Euros and dollars are accepted in any bank and exchange office.

1 Euro = about 17 Rufiyaa

1 US \$ = about 15 rufyiaa

Cost and Registration

Cost

The cost of the III^o Edition of Mapping Technologies and Monitoring Techniques in Coral Reef Environments is:

- 1350 Euro for students (regularly registered at any university course)
- 1550 Euro for non-students

The above amount **includes**:

- entry business visa (if required) to the Maldives;
- boat transfer from/to Malé airport;
- transfers for all the activities envisaged under the internship program;
- room and food at the MaRHE Center of Magoodhoo;
- full board treatment and accommodation in multiple rooms (single rooms are not available);
- lessons and activities provided for the internship program.

The above amount **DOES NOT include**:

- flight to/from Malé;
- passport renewal expenses;
- anything else not specified here above.

Cost and Registration

Registration

To proceed with the registration, you will have to fill in the following Google Form:

<https://forms.gle/3mgQikjGzExF3rmo6>

After completing the above questionnaire, we ask you to send an email to the address workshop.marhe@unimib.it specifying in the subject: "**Name Surname – Registration Mapping Technologies and Monitoring Techniques**" and attach a JPEG colour copy of your passport naming the file "**MTCR23_Surname_Name_PPT**".

IMPORTANT: YOU WILL HAVE TO WAIT FOR OUR CONFIRMATION BEFORE PURCHASING YOUR FLIGHTS.

The workshop will be activated once a minimum number of participants has been reached, thereafter we will give you the green light to purchase the flights and we will send you the invoice, after which you can proceed with the payment of the workshop fee.

The *registration deadline* is fixed for **15 December 2023**.

The maximum number of participants is set to 16-20 people.

Cost and Registration

Flights

You will be responsible for purchasing the flight. The choice of the airline is yours, the important thing is to be at the airport on the day and at the time established (we will share with you the necessary information once registered).

Pay attention while purchasing the flight tickets as your mistakes (incorrect flight dates or other) cannot be reimbursed.

Furthermore, **it is necessary to send us a copy of the air ticket by 13 Genuary 2023 to be able to proceed, if necessary, to the entry visa request, of which we will deal entirely.**

Important notes

Please wait for our confirmation before purchasing the flights.

There will be a **recognition of training credits for students** on the International master's programme in **Marine Sciences (University of Milano-Bicocca)**.

In particular, for such students, the set of all the activities carried out during the workshop can reach a **total of 4 CFU (practical training)**.

Students enrolled in other degree programmes and/or universities must inquire at their teaching secretary.

For any information, please contact us at **workshop.marhe@unimib.it**

Cancellation

Following the payment of the fee, reimbursement for any cancellation will be subject to 10%admin fee.