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LitusGo Manual
Module 16
**Flood risks:
Flood risks and coastal
flooding due to storm surge**



Editor: Isotech Ltd, Environmental Research and Consultancy
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Preface to the LitusGo Education Manual

The LitusGo Manual is part of the LitusGo educational package which is included in the LitusGo portal: www.litusgo.eu. LitusGo aims at the training and capacity building of Local Authorities and local stakeholders in Integrated Coastal Zone Management issues and the reaction to the impacts of climate change.

This Manual consists of 20 autonomous, self-contained and inter-related modules. The modules are available in four languages, Greek, English, Maltese and Turkish and in three different forms: the dedicated wiki application in the LitusGo portal, the dvd and the hard copy version. This hard copy version of the LitusGo Manual consists of 20 self-contained booklets, one for each module, kept in a hard collective case.

List of modules of the LitusGo Educational Manual

- Module 1: European legal framework
- Module 2: Stakeholder involvement/Public participation
- Module 3: Sustainable tourism-carrying capacity
- Module 4: Water resources management
- Module 5: Fisheries/fish farming
- Module 6: Coastal water quality
- Module 7: Ecosystems management (land and coastal ecosystems)
- Module 8: Waste management/recycling/compost
- Module 9: Air pollution
- Module 10: Land uses/urban planning/coastal over-development
Landscape and marine-scape management
- Module 11: Coastal erosion control
- Module 12: Community annoyance issues 1: noise pollution
- Module 13: Community annoyance issues 2: light and thermal
- Module 14: pollution, odours
Archeological areas/historic sites/cultural heritage
- Module 15: Extreme conditions management: flood risks, coastal
- Module 16: flooding and storm surge
Droughts
- Module 17: Desertification
- Module 18: Energy use, consumption and management
- Module 19: Green buildings
- Module 20:

Credits

The LitusGo Education Manual has been developed by the LitusGo Educational Manual Working group:

Modules 1, 2, 6, 7, 8, 9, 12, 13, 14, 16, 17, 18, 19 have been prepared by the scientific team of the beneficiary/coordinators ISOTECH Ltd. Major authors: Michael I. Loizides, Chemical/Environmental Engineer and Xenia I. Loizidou, Civil/Coastal Engineer. Constantinos Georgiades (MSc in ICZM) is responsible for the overall editing. The hard copy of the educational Manual is designed by Anastasia Georgiou.

Modules 3, 4, 5, 10, 11, 15, 20 have been prepared by the scientific team of the Sustainable Aegean Programme of ELLINIKI ETAIRIA - Society for the Environment and Cultural Heritage. Major authors: Georgia Kikou, Geographer, MSc Environment (Manager of the Sustainable Aegean Programme), Alexandros Moutaftsis, Economist, MSc Environment, Leonidas Economakis, Political Sciences, MA International Development.

Dr Alan Pickaver on behalf of partner The Coastal & Marine Union (EUCC) was responsible for the quality control of the educational material.

LitusGo partnership:

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ONISIS web development www.onisis.gr

Malta:

Municipality of Kirkop www.kirkop.gov.mt

The Netherlands:

EUCC – The Coastal & Marine Union www.eucc.net

Module 16

Flood risks:

Flood risks and coastal flooding due to storm surge

1| Theoretical background

1.1. Flooding

According to European Directive 2007/60/EC (23 October 2007) on the assessment and management of Flood risks (article 1) [8]:

“flood means the temporary covering by water of land not normally covered by water. This shall include floods from rivers, mountain torrents, Mediterranean ephemeral water courses, and floods from the sea in coastal areas, and may exclude floods from sewerage systems”.

“flood risk means the combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event”.

Types of flooding:

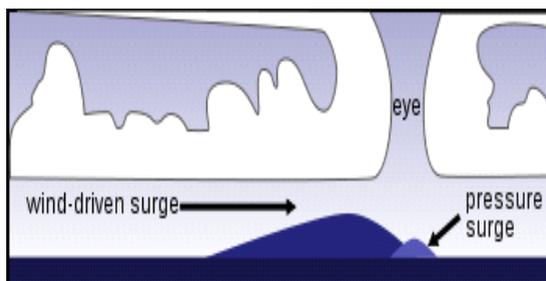
- River Flooding: flooding along rivers is a natural phenomenon. Some floods occur seasonally when winter or spring rains, coupled with melting snow, fill river basins with too much water too quickly.
- Coastal Flooding: Winds generated from tropical storms and

hurricanes or intense offshore low pressure systems can drive sea water inland and cause significant flooding. Storm surges or even tsunamis are the sea waves that cause the flooding and the destruction.

- Urban Flooding: as land is converted from fields or woodlands to an urban area with buildings, roads or parking lots, it loses its ability to absorb rainfall. Urbanization increases runoff 2 to 6 times over what would occur on natural terrain.
- Flash Flooding: several factors contribute to flash flooding. The two key elements are rainfall intensity and duration. Topography, soil conditions and ground cover also play an important role.

1.2 Storm Surge

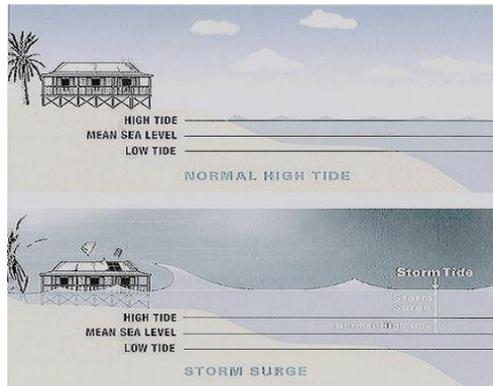
A storm surge is an abnormal rise above the normal water level along a shore. Storm surge should not be confused with astronomical tide, which is the rise and fall of sea levels caused by the combined effects of the gravitational forces caused by the moon and the sun and the rotation of the earth [6].



Picture 1. Storm surge [5].

Briefly, what generally happens with the storm surge is that for every 1 mbar decrease in atmospheric pressure, water level rises 1 cm (Koutitas, 1998, Androulidakis et al., 2009).

The worst impacts occur when the storm surge arrives on top of a high tide. The combination of these two is called storm tide.



Picture 2. The combination of a storm surge and an astronomical tide [13].

The area of sea water flooding may extend along the coast for over 100 kilometers, in low lying lands [7]. The combined effects of the storm surge and waves can knock down buildings, wash away roads and run ships aground.

2| Objective

Although 143 million people live along the Mediterranean coasts, there is a significant lack of information and management skills regarding the issue of floods and storm surges, mainly at local level. Local Authorities and local stakeholders are not informed on ways to manage floods and defend against storm surges. They need information, training and capacity building on these issues in order to be able to take action. The LitusGo project aims at supporting local authorities and local stakeholders to build their capacity and acquire competences and skills for this so important issue of coastal floods and storm surges.

3| Problem

Considering that more than 70% of the world's population lives on coastal plains, it is obvious why protection from storm surges and flooding is absolutely necessary. There are many problems related to floods and storm surges, some major ones are:

- Storm surges, unlike astrological tides, are not easy to predict. A combination of factors (such as wind and barometric pressure changes) makes a storm surge difficult to predict.
- Increased risk to human life since coastal urbanization has been highly increased in the last decades.
- Destruction of urban coastal areas, touristic coastal areas, coastal infrastructures such as roads, harbors etc.
- Serious impacts on tourism.



Picture 3. Results of a storm surge produced by Hurricane Katrina's strike - Orange Beach, Alabama. Image by USGS (the arrows show the specific buildings before and after the storm) [7].

4| How to deal with the problem

How to deal with the storm surges – flood problems

A flood and a storm surge phenomenon can be life-threatening, thus good information and preparation are necessary. Prevention, protection, and preparedness are the three important actions for limiting the negative effects of floods and storm surges on coastal human populations, according to EU Directive 2007/60/EC “On the assessment and management of flood risks”.

Local Authorities have an important role to play in prevention, protection and preparedness:

- **Training/education:** Local Authorities should organise seminars, dedicated trainings, and capacity building programmes in order to enhance expertise and to train local decision makers and practitioners on how to react during floods and storm surges, and how to satisfy the requirements of the EU Directive 2007/60/EC “On the assessment and management of flood risks”. These are relatively new issues and Local Authorities and their personnel do not have the necessary knowledge for the implementation of correct management plans. The organisation of specialised training programmes is therefore crucial.
- **Flood Risk/Coastal Vulnerability Maps:** Despite the fact that, according to Directive 2007/60/EC, all Member States must have their Coastal Vulnerability Maps ready by December 2013, most of the Mediterranean central governments have not yet prepared them! Local Authorities can take the initiative and

proceed with the preparation of the Flood Risk/Coastal Vulnerability Maps for their coastal area (according to the guidelines of EU Directive 2007/60/EC). They must secure funds (there is funding available for this task) and proceed with the necessary studies to prepare the Flood Risk/Coastal Vulnerability Maps of their area as it is of vital importance to each Locality.

- **Flood risk management plans:** Local Authorities should take the initiative to prepare **Flood risk management plans, after they complete the vulnerability maps**. They are a very important tool for the preparation of an area against the impacts of floods. Above are some immediate and not too difficult tasks that a Local Authority can implement; according to the Directive, flood risk management plans shall take into account relevant aspects such as:
 - costs and benefits,
 - flood extent,
 - flood conveyance routes and areas which have the potential to retain flood water, such as natural floodplains,
 - soil and water management,
 - promotion of sustainable land use practices, spatial planning, land use, nature conservation,
 - There are smart tools (like automatic screens rising after a certain warning) that can be implemented to protect areas near rivers and coastal areas,
 - navigation and port infrastructure.

- **Flood forecasts and early warning systems:** it is very important to install early warning systems. Local Authorities should make an investigation of which systems are most appropriate for their area, where they can be placed and who is the most reliable consultant.

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