2022 ISPRS Educational and Capacity Initiatives

COLLABORATIVE ANALYSIS OF FLOODING EVENTS WITH PROCESSING OF EARTH OBSERVATION DATASETS

Final Project Report

Project Management

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TABLE OF CONTENTS

1. INTRODUCTION

The project has been focused to establish a network that gathers the researchers, studies to collaborate, create a network, and provide impact. An workshop has been organized to to allow the people who will contribute in the platform's potential content and to maintain sustainability.

The project team has broad experience in Climate Science and Earth Observation respectively, which will allow them to focus on the problem with a multi-disciplinary and collaborative approach. The case study will be Bozkurt (Kastamonu, Turkey) where the flood damaged the area largely and caused casualties in the region. During the event in Bozkurt, the region has been affected, mainly damaged and some population in the area has lost their homes due to the collapsing.

The project has tried to produce and collect the state-of-art reasonable flood risk and assessment knowledge that can be used as a baseline for future events. The outcomes of the project will be beneficial to understand the reasons for the damages caused by the flood and also its assessment. Better planning with considering flooding will be able to provide better security and social welfare for their life. Besides, the water may be better managed and controlled considering the foreseen risk. Regarding scientific outcomes, the researchers from different institutions with insufficient infrastructure with a low budget can benefit from the project and disseminate the earnings to their community.

Apart from this socio-economic outcome from the project, a web page and a slack workspace has been established for maintaining sustainability to disseminate the recent methods for flood risk and damage assessment. For this purpose, the researcher will be able to upload information about their research and also datasets that may be available to the public. The project aims also to enhance the networking and collaboration opportunity between the workshop participants to give a large impact on the scientific society.

2.THE WORKSHOP

78 people applied to the Collaborative Analysis of Flooding Events with Processing of Earth Observation Datasets (CollabFloods) event held on 2 October 2023 at the Conference Hall of TMMOB Chamber of Surveying and Cadastre Engineers, Ankara, Turkey. The Chamber also provided technical staff to support the Workshop including online streaming services for the distant participants.

Approximately 35.9 of the applicants are PhD students. 23.1 of them are master's degree graduates (Fig 1). Most of the applicants are between 26-40 years old (Fig 2) and 16.7 per cent of them are from Türkiye (Fig 3). 59 of the 79 participants are working in the field of remote sensing. 37 of them work in the field of climate change and 32 in the field of hydrology (Fig 4). 22 of the 78 participants participated on-site.

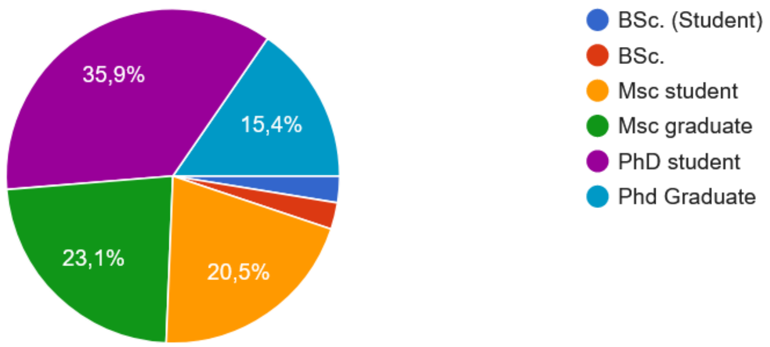

Figure 1. Educational background of the applicants

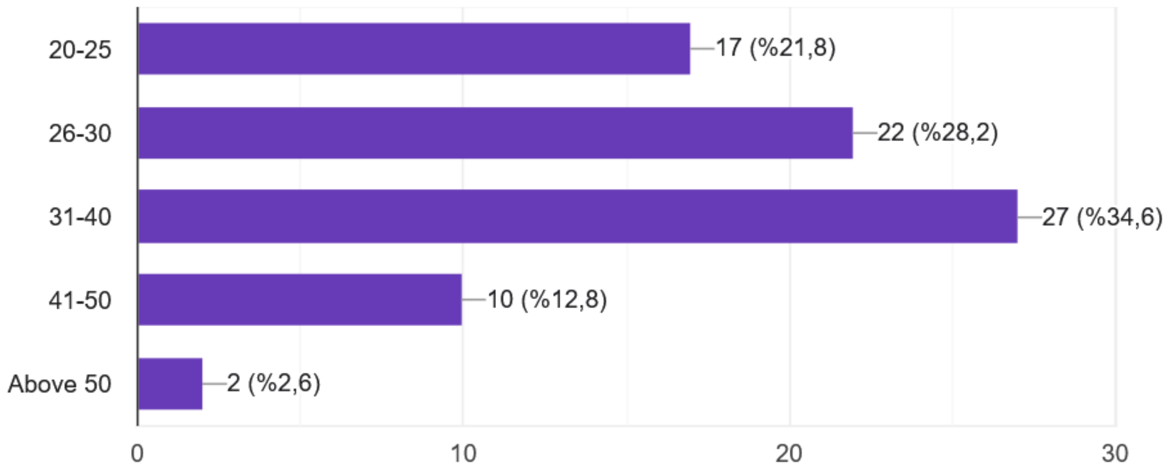

Figure 2. Age range of applicants

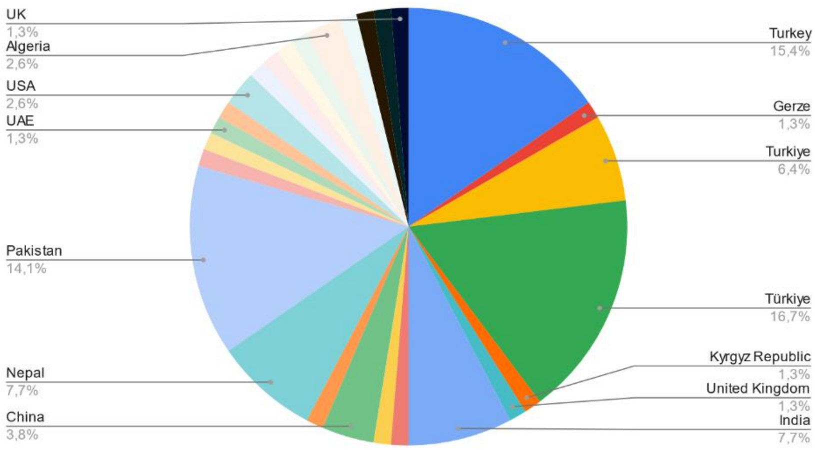

Figure 3. Countries of applicants

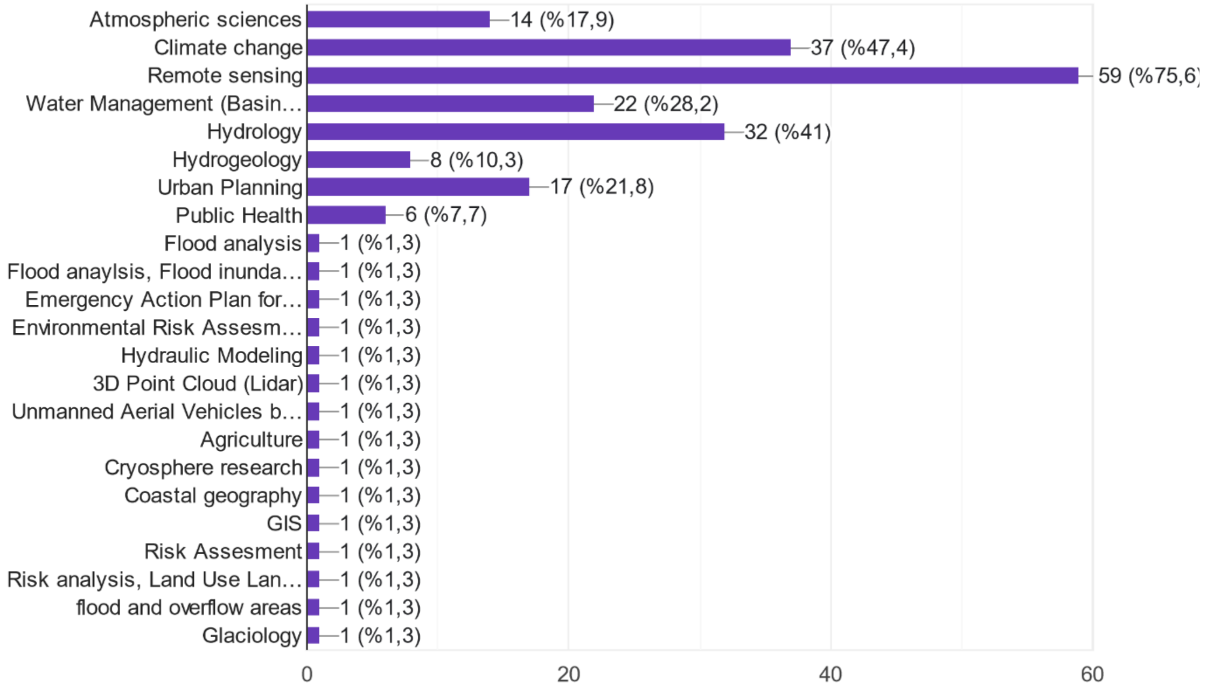

Figure 4. Applicants' research areas.

Figure 5. Group picture of the on-site participants

The streaming record can be found at the

https://www.youtube.com/live/NANPqckXDx4?feature=shared

2.1.Lecturers

Dr.Dogushan Kilic is an atmospheric scientist at the University of Manchester and a member of the National Centre for Atmospheric Research in the UK. His research and publications encompass a wide range of topics, including atmospheric modeling, climate change impact analysis, atmospheric chemistry, atmospheric measurement techniques, environmental data analysis, and remote sensing of the atmosphere. In addition to his research work, he has been actively involved in teaching activities at institutions such as ETH-Zurich, Istanbul Technical University (ITU), and Marmara University, covering various aspects of atmospheric science.

Dr.Meltem Şenol Balaban was graduated from the City and Regional Planning Department (CRP) at Middle East Technical University (METU) in 1998 with a Bachelor in City Planning and subsequently did a Master of Science in Urban Design. Dr. Balaban holds two PhD titles. In her City and Regional Planning PhD thesis she focused on flood disaster management in Turkish cities, targeting the associated risks for society and planning processes. In her second PhD in Urban Engineering as a JICA Scholar she developed a GIS-based model for spatial distribution of potential urban spaces used as evacuation and temporary shelter sites and piloted this concept in a case study of a district in Istanbul. Her experience is highly relevant when it comes to applying disaster risk prevention concepts in a very practical way on the municipal level.

Dr.Mustafa Kubilay Kelesoglu is an Associate Professor of Civil Engineering at Istanbul University, Turkey. He received his Ph.D. in Geotechnical Engineering from Istanbul University in 2006. His research interests include foundation engineering, soil mechanics, deep excavation, ground improvement, soil dynamics, and engineering and technology. Dr. Kelesoglu has published over 50 papers in peer-reviewed journals and conferences. He is also a member of the Turkish Chamber of Civil Engineers and the International Society for Soil Mechanics and Geotechnical Engineering.

DurCivil engineer. Graduate of Istanbul Technical University (ITU). Water and energy policy expert. He worked as a manager at the State Hydraulic Works (DSI). He received education in the USA and the Netherlands. He gave lectures at universities. He served as a manager in the Union of Chambers of Architects and Engineers of Turkey (TMMOB) and the Chamber of Civil Engineers. He received an achievement award from the Agriculturalists Association. He has many publications.

2.2.Web-site

The website has been hosted at www.collabflood.com. It has given the information regarding the organized workshop, and the respective announcements.

Now the website is used as a bridge to the collaborative platform which is based on Slack and WhatsApp. There is a public form on the website that allows people to join in the community for the further networking activities.

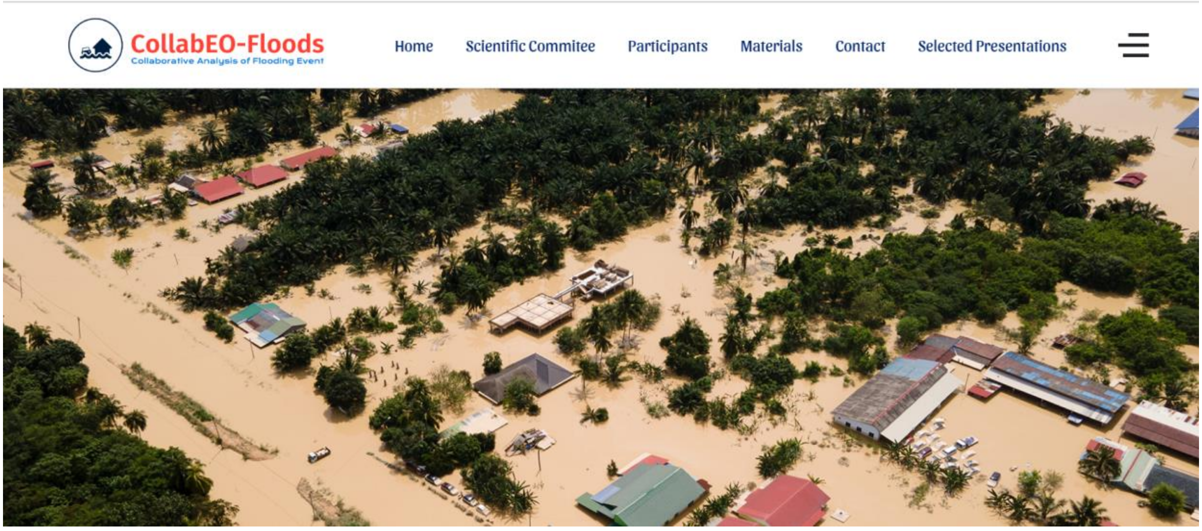

Figure 6. The website of the workshop

2.2.Collaborative Analysis during the Workshop

In the last session of the workshop, a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis was conducted. This analysis was carried out about Collaborative Analysis for Understanding Floods. Participants were divided into 4 groups for SWOT analysis. Each group was given one step of SWOT. After about 1 hour of work, the groups tried to identify the strengths, weaknesses, opportunities and threats of the participatory analyses carried out to understand the floods. The outputs were evaluated with the participation of all groups in the conclusion.

Table 1. Collaborative SWOT Analysis results of the workshop.

S TEAM	**W** TEAM	O TEAM	T TEAM
Forming a team with different backgrounds adding perspectives.	Lack of coordination between institutions	Multidisciplinary work environment if possible	Basins and water bodies which cross through different countries; therefore, political problems may occur
People from NGOs and other disciplines	Social politics problems in land	Data/output quality improvement	Conflict of interest between different disciplines causing

Table 1. Collaborative SWOT Analysis results of the workshop.

S TEAM	**W** TEAM	O TEAM	T TEAM
(academia) can collaborate together.	management for floods protection		miscommunication and not sharing important data and information
Decision makers are inclusive and public health oriented.	Lack of available data such as satellite images or meteorological data etc.	Improving the applicability of outputs	Technical problems with satellites e.g. the fact that sentinel satellite's misfunctioning due to explosions of sun
Advanced knowledge management	Lack of multi hazard analysis	Accurate team decisions because of different perspectives	Weather conditions affect data acquisition e.g. cloud cover, sunlight
No need for separate organizations	Natural flooding also risks analyses and precautions for dam’s floods	Lidar, radar datasets give us more useable DEM data	Effects of climate and geographic location as well as morphology
Existing organization bodies (AFAD, HGM etc.) enabling better use of human power.	Lack of the common terminology for discussion	Deformation analysis of art structures (such as bridges/ culverts) with Interferometry-interferometric SAR	Population growth
Long term memory against to disasters		Pre and post hazards monitoring and assessment of critical situations by using all instruments such as UAV’s, remote sensing methods	Data availability, the fact that there's not much data collected and saved by different organizations
		Compared to in situ works, using remote	Technological developments

Table 1. Collaborative SWOT Analysis results of the workshop.

S TEAM	**W** TEAM	O TEAM	T TEAM
		sensing data is more affordable and saves time	
		Opportunity to monitor large sites	Short-term heavy rains
		Possibility to estimate future datasets by Integrating different historic datasets	Lack of data consistency
		Inspiring future works such as Bozkurt Hazard to all other regions	Modeled and measured data's inconsistency with reality

2.3. Hackathon

As part of the capacity building initiative, we organized a hackathon with collaboration the Chamber. The focus of the study was to identify the extent of land cover damage caused by the floods. The hackhaton has been led by Assoc.Prof.Berk Anbaroğlu and the Project PI Nusret Demir.

Two groups of students have submitted applications for the hackathon. The student groups competed during the hackathon. One student group leader was Michael Can Hucko and the other group's leader was Batuhan Alkaya. An investigation was conducted into the floods that occurred in Libya on September 10th, 2023. The storm named "Daniel" struck the eastern region of Libya on September 10, resulting in flooding in the cities of Benghazi, Beyda, Marj, Suse, and Derna. The World Health Organization has reported that the flood resulted in the loss of 3,958 lives, while approximately 8 to 9 thousand individuals remain unaccounted for. In the area affected by the storm resulting from climate change, the Deren Valley River inundated the city, resulting in the destruction of two dams and bridges along its course.

The study involved comparing satellite images of the region before and after the disaster.

The evaluation of these compared images was conducted using the Normalized Difference Red-Green Index Method in Python.

Figure 7. Before and after images, Libya Flood

Figure 8.Affected agricultural fields

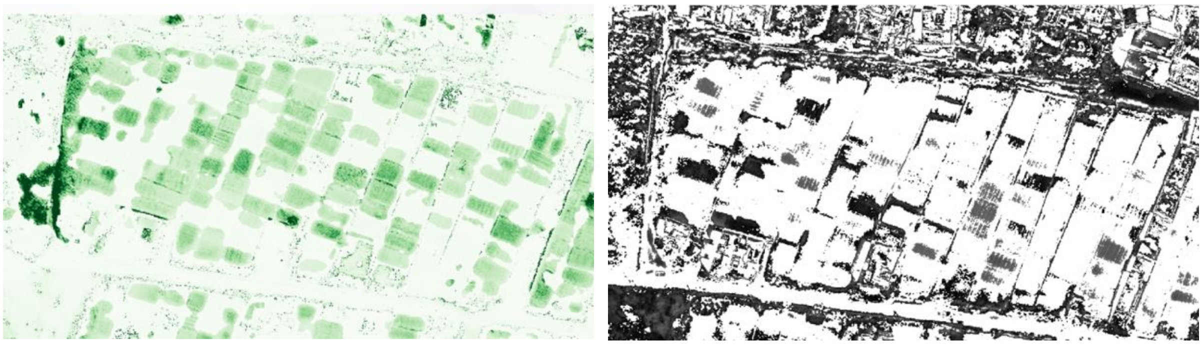

Figure9. The extracted effected regions from the flood

The results are published on a online web platform.

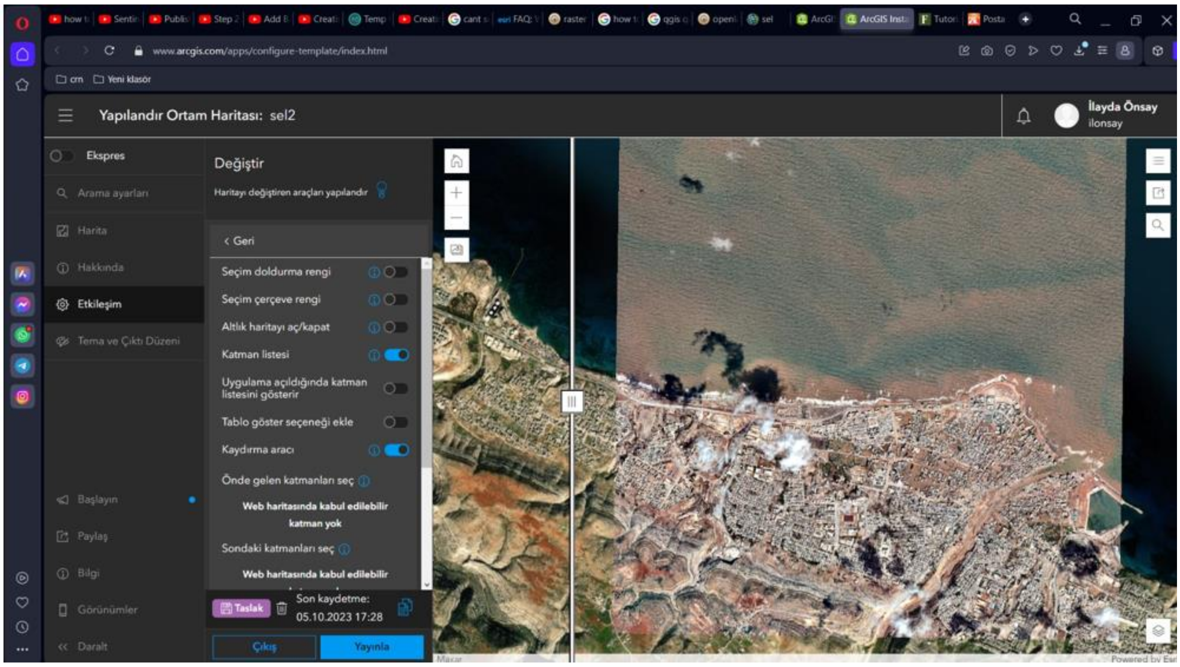

Figure 10. Web Platform fort he derived results.

It is accessable via the following QR code.

Figure 11. Web Platform fort he derived results.

2.4. Evaluation of the workshop

A Google form has been distributed to the participants. The following questions and responses are received.

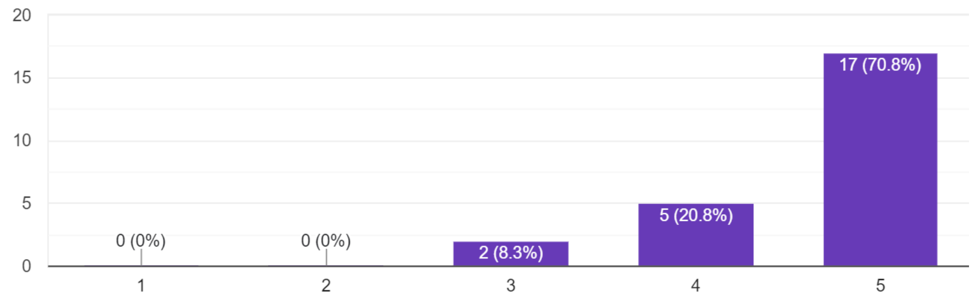

Figure 12. Responses for the Question “Please rate your satisfication of the presentation section”

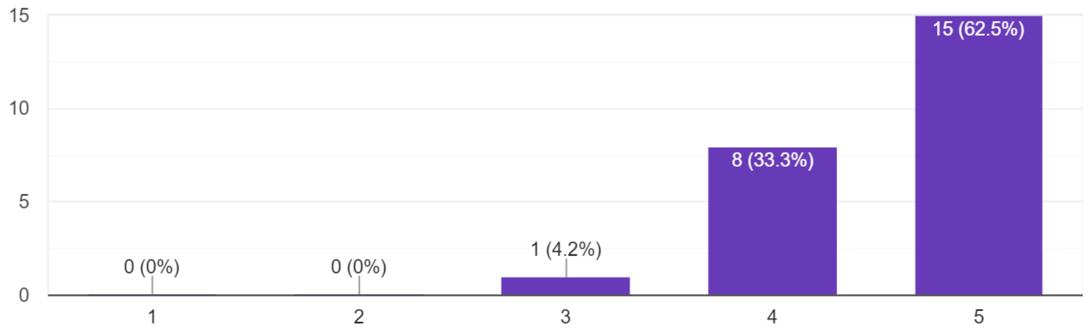

Figure 13. Responses for the Question “Please rate the discussion session”

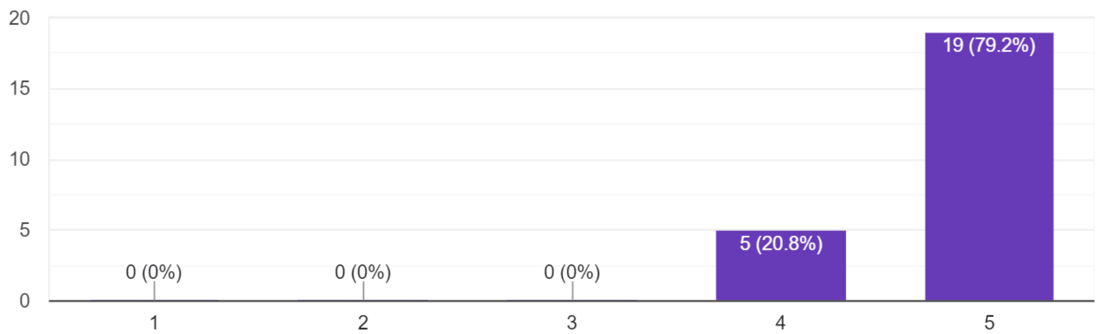

Figure 14. Responses for the Question “ Please rate your satisfication of the event in general”

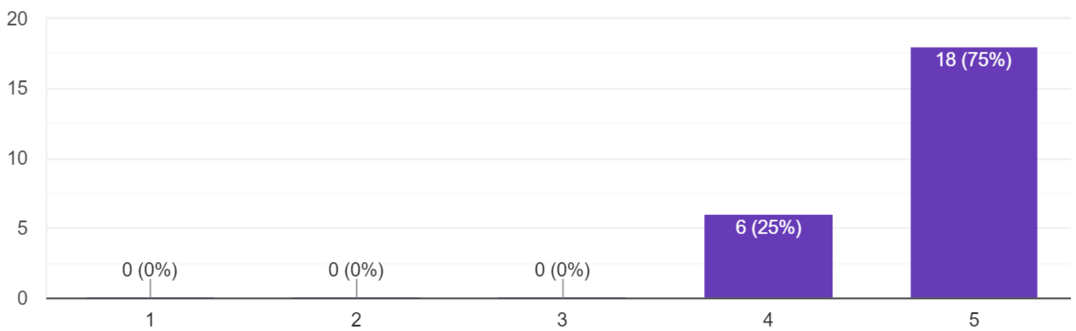

Figure 15. Responses for the Question “Have you learned something new?”

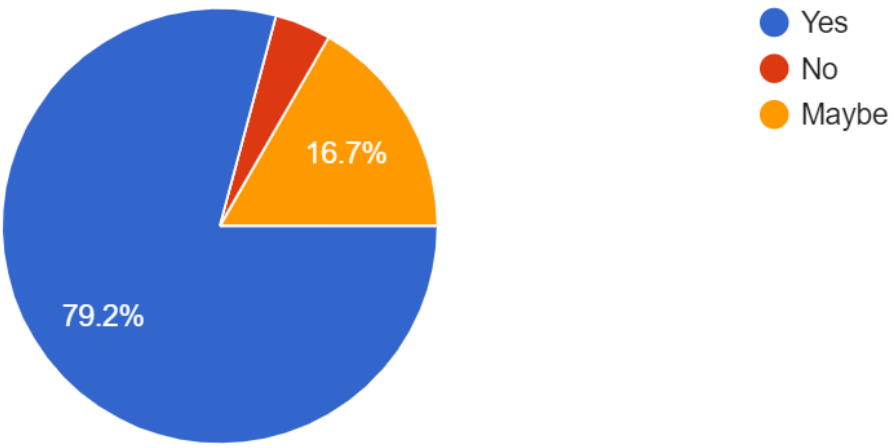

Figure 16. Responses for the Question "Do you think if you may start a collaboration with any of participants?"

3.LECTURE NOTES

AUGUST 2011, BOZKURT FLOOD – DAMAGE ASSESSMENT AND EVALUATION

This note is prepared by M. Kubilay Kelesoglu, Associate Professor, PhD. Engineering Faculty, Civil Engineering Department Geotechnics Division, Istanbul University-Cerrahpaşa, 34320 Avcilar Campus, Istanbul, Turkey, kelesoglu@iuc.edu.tr

On August 11, 2021, following the rainfall in the Western Black Sea region, flood disasters occurred in many districts, especially in Sinop and Kastamonu provinces. During the flood, rainfall increased up to 400 mm/day in Bozkurt and Ayancık districts. The cross-sectional areas of all infrastructures such as bridges and culverts on the streams were reduced due to the trees, stones and blocks dragged from the forested areas with the flood waters (Bozbey et al., 2022).

The flood disaster in Bozkurt district was caused by the overflow of Ezine Stream passing through the district. Ezine Stream has a basin area of approximately 375 km2 and flows into the Black Sea from Abana district after passing Bozkurt district. Bozkurt district, where the flood disaster was most intense, is close to the outlet point of the basin and therefore the settlements within the borders of the district were exposed to the maximum flow generated on the basin surface. The eastern and western bank axes of Ezine Stream are protected by T-type reinforced concrete walls or weight-type retaining walls, and it flows in a cross-section with a width of approximately 32 m and its banks have been rehabilitated.

Two days after the flood disaster, an inspection is carried out in the region, mainly in Bozkurt district (Kelesoglu et al., 2023). In Bozkurt district, it was observed that the coarse material consisting of wood, sand and rock fragments washed away by the flood waters; (i) severely damaged or caused the collapse of the walls along the stream bank, (ii) narrowed the cross-sectional area of all art structures such as bridges and culverts on the stream. Dead wood and logs carried by flood waters from the forested areas (especially in Abana district) caused significant damage to bridge abutments. Due to the blockage of the bridge air joints and the dam effect, the flood waters accumulated behind the bridge overflowed in a short time and caused increased loss of life and property to residential areas.

The main cause of the structural damages and loss of life in Bozkurt district can be summarized as the structural problems observed in the retaining walls and the successive problems initiated by these issues. The foundation depths of the T-type reinforced concrete walls and trapezoidal cross-section gravity masonry walls constructed for rehabilitation and protection purposes on the stream banks are not clearly known. However, based on the visual assessments made on the retaining walls that were overturned while preserving their integrity as seen in Figure 1, it is understood that the retaining structures were on shallow foundations. The photographs in Figure 1 clearly show the scour in the retaining foundations. Due to the high flow and velocity of the flood waters, it is understood that the alluvial layer under the foundation was partially or completely scoured and the retaining walls completely lost their stability.

Figure 17. Damaged and intact retaining walls (Bozbey et al., 2022).

The level of damage to the buildings increases or decreases depending on the location of the building in relation to the stream bed and its proximity to the stream. The damages observed in the buildings can be summarized as follows (Bozbey et al., 2022).

- All of the damaged or collapsed buildings are located along the stream and in the floodplain. Almost all of these buildings were built on sandy river alluvium with large blocks and gravel content, and the foundation depths can be considered as a few meters from the ground surface.
- With the collapse of the retaining structures built to protect the stream line, the soil behind the walls was washed away by the flood waters and the buildings constructed immediately behind the walls were collapsed.

As a result, many buildings collapsed due to the complete or partial loss of the bearing capacity of the foundation soil. In addition to the high flow and velocity of the flood water, it was observed that the exterior walls of the buildings located in the eastern part of the Ezine Stream were damaged due to large material such as trees, stones, etc. (Figure 2). The reason why such damages are more intense in the eastern part of Ezine Stream is due to the lower land elevations in this region compared to the western part.

Figure 18. Destroyed and remaining protective walls

Bozbey İ., Keleşoğlu M.K., Temur R., Gülbaz S., Apaydin N.M., Kazezyilmaz-Alhan, C.M. Damages Observed On The Engineering Structures In Bozkurt District After August 2021 Western Black Sea

Flood Disaster, Zemin Mekaniği ve Geoteknik Mühendisliği 18. Ulusal Konferansı, 29-30 Eylül 2022, Erciyes Üniversitesi, Kayseri

Kelesoglu, M.K., Temur, R., Gülbaz, S., Apaydin N.M., Kazezyilmaz-Alhan, C.M., Bozbey İ. Site assessment and evaluation of the structural damages after the flood disaster in the Western Black Sea Basin on August 11, 2021. Nat Hazards 116, 587–618 (2023). https://doi.org/10.1007/s11069-022-05690-4

The presentation of the lecture can be found at the streaming link :
https://www.youtube.com/live/NANPqckXDx4?feature=shared

UNDERSTANDING RAINFALL AND FLOOD DYNAMICS

This lecture was given by Dr. Dogushan Kilic, Research Associate, The University of Manchester. The following text indicates the content of the given presentation.

1. Introduction to Earth's Atmosphere

- Composition and Layers: Earth's atmosphere consists of various gases, primarily nitrogen and oxygen. The lecture highlights the troposphere, the lowest layer, as the most crucial for weather phenomena.
- Comparison with Mars: A comparative analysis shows distinct differences between Earth's and Mars' atmospheres, underlining the unique conditions that support life on Earth.

2. Atmospheric Circulation Patterns

- Key Circulation Cells: The Hadley, Ferrel, and Polar cells are essential in global atmospheric circulation.
- Role in Rainfall: The upward movement of air in these cells is a critical factor for rain formation.

3. Mechanisms of Rainfall

- Convective Rainfall: Triggered by land heated by the sun, causing upward air movement and cloud formation.
- Frontal Rainfall: Arises from the interaction of cold and warm air masses, leading to cloud formation and precipitation.
- Orographic Rainfall: Occurs when air rises over mountainous areas, cools, and condenses into rain. This is common around the Mediterranean and Black Sea in Turkey.

4. Climate Change and Extreme Weather

• Increased Rainfall Intensity: Climate change, marked by rising temperatures in the troposphere and sea surfaces, is linked to more extreme rainfall events.

5. Atmospheric Data and Forecasting

• Importance of Data Sets: Utilization of observational and gridded data sets (like ECMWF and NCEP/NCAR Reanalysis) is crucial for understanding atmospheric conditions.

• Role of Satellite Imagery and Models: These tools are vital for accurate weather prediction and understanding climatic patterns.

The lecture can be found at the following link :

https://www.youtube.com/live/NANPqckXDx4?feature=shared

FLOOD RISK MANAGEMENT AND URBAN PLANNING: POSSIBLE CAUSES OF FLOOD DISASTERS IN TÜRKİYE

The third lecture by Assoc. Prof. Dr. Meltem Şenol Balaban provides comprehensive insights into flood risk management and urban planning, with a focus on both global examples and specific cases in Türkiye. The content of the lecture as follows, and the lecture notes are attached as an appendix. Disaster statistics and climate change impacts.

- Flooding and flood risk management (FRM) cycles.
- Examples of FRM in various countries.
- Case studies in Türkiye, focusing on common mistakes in spatial planning and engineering.
- Discussion on integrated flood risk management.
- Disaster Impacts
- Increasing urban population exacerbates disaster impacts.
- Urban areas are exposed to multi-hazards, which are increasing in frequency and intensity.
- Global Paradigm Shift in Disaster Response
- Emphasis on proactive actions and risk estimation using alternative scenarios for risk reduction.
- Main Requirements for Disaster Risk Management
- Spatial data collection on hazards and risk evaluation.

- Development of risk reduction plans and their implementation.
- Hydro-Meteorological Disasters
- Examples from global cities and Türkiye, including floods, hurricanes, heavy snowfall, and droughts.
- Flood Definition and Main Factors
- Flood: Temporary covering of land by water outside its normal confines.
- Factors include meteorological, hydrological, and human influences.
- Major Types of Flooding
- River flooding, flash floods, coastal/tidal floods, urban drainage flooding, and groundwater flooding.
- Urban Adaptation and Risk Reduction Measures
- Structural measures (e.g., dams, levees) and non-structural measures (e.g., policy planning).
- Gray infrastructure (e.g., flood water discharge tunnels) and green infrastructure (e.g., parks, green roofs).
- Soft measures including management policies and land-use plans.
- Examples from Various Countries
- Case studies on flood risk management from France, Britain, Germany, the Netherlands, and others.
- Major Problems in Türkiye
- Infrastructure issues, loss of permeable surfaces, unauthorized developments, and inaccurate interventions.
- Integrated River Basin Management
- Emphasizes the need for basin-wide flood risk maps, urban planning, and proactive measures for risk reduction.
- Conclusion and Key Remarks

The lecture can be found at the following link :

https://www.youtube.com/live/NANPqckXDx4?feature=shared

4. AVAILABLE TOOLS AND TRAINING RESOURCES

In this section, the available resources and tools are listed which is shared with the participants and the community.

1.World Bank Flood Mapping Scripts : The World Bank Flood Mapping Scripts is a collection of open-source scripts designed for the analysis and mapping of flood hazards and risks. The Python scripts are authored and can be accessed on GitHub. The scripts are components of the Geospatial Operations Support Team (GOST), a collective of specialists who offer technical assistance to the World Bank's initiatives in disaster risk management.

The scripts have the capability to execute a range of tasks, such as:

- Obtaining flood data from satellite imagery and additional sources.
- Conducting an analysis of flood hazards through the creation of flood hazard maps and the identification of areas prone to flooding.
- Evaluating flood hazards through the examination of the prospective consequences of floods on individuals, infrastructure, and the ecosystem.

The scripts are inherently adaptable and can be tailored to suit the distinct requirements of various projects. Additionally, they are specifically engineered to be user-friendly, even for individuals lacking substantial expertise in geospatial analysis or programming.

https://github.com/worldbank/GOST_SAR/tree/master/Flood%20Analysis%20and%20Mapping

2. **The UN-SPIDER Flood Mapping Tool** is a best practice for mapping flood hazards. It offers guidance on determining the extent of flooded areas by utilizing a hydro data model in conjunction with advanced GIS tools for modeling flood hazards. The tool is specifically designed to create a map that shows the extent of a flood. This map is used to assess the areas that have been affected by the flood. The tool achieves this by using a change detection method on Sentinel-1 (SAR) data. The tool was developed by UNOOSA and is a component of the UN-SPIDER initiative, which is under the auspices of the United Nations.

The tool is specifically designed for government users to manipulate various parameters in order to identify deficiencies in their countries' flood defenses and emergency responses.

The tool is accessible on the UN-SPIDER website and can be found at https://www.un-spider.org/advisory-support/recommended-practices/recommended-practice-flood-mapping/step-by-step

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3.**The Radar Based Flood Mapping** content is a Jupyter Notebook that offers a systematic tutorial on utilizing the UN-SPIDER Radar-based Flood Mapping Tool for assessing the scope of inundated regions through Synthetic Aperture Radar (SAR) satellite imagery. The notebook is designed to be compatible with Google Colab, a cloud-based computing environment that enables the tool to be utilized on devices with limited computational capabilities, such as phones and tablets, as well as in regions with limited internet connectivity. The notebook encompasses the entire sequence of steps involved in processing, starting from querying and downloading data, and concluding with exporting a final flood mask product. This is achieved by utilizing freely available Sentinel-1 SAR data. The notebook generates a directory named 'radar-based-flood-mapping' in Google Drive and saves the processed data in a subdirectory named 'output'. The storage of Sentinel-1 images requires the creation of a subfolder named 'input'. In the absence of an image, the subfolder will be generated automatically when using this tool to access and download data from the Copernicus Open Access Hub. If there is a file available that represents an area of interest (AOI), it must be placed in a subfolder named 'AOI'. The supported formats for this file are GeoJSON, SHP, KML, and KMZ. If no AOI files are available, the user will have the option to manually create and/or upload AOI files that are stored locally. The tool is available at https://colab.research.google.com/github/UN-SPIDER/radar-based-flood-mapping/blob/main/resources/notebooks/radar-based-flood-mapping-colab.ipynb

4. Data Basin is a platform that utilizes scientific principles to create maps and conduct analysis. It facilitates learning, research, and the promotion of sustainable environmental stewardship. The purpose of this tool is to assist users in examining, illustrating, and examining spatial information for educational, investigative, and ecological management purposes 1. The platform offers a diverse range of tools and resources to assist users in generating personalized maps, accessing carefully selected spatial data, and uncovering novel insights from multiple origins.

Data Basin is a versatile platform that can be utilized for a diverse array of applications. Data Basin can facilitate environmental management by granting users access to data and tools that aid in comprehending the ramifications of human activities on the environment and devising strategies to alleviate said ramifications. Data Basin facilitates conservation planning by granting users access to data and tools that aid in the identification of regions with significant conservation worth and the formulation of strategies to safeguard such regions. Data Basin facilitates natural resource management by granting users access to data and tools that aid in comprehending the distribution and abundance of natural resources. This, in turn, enables the development of sustainable strategies for resource management. Data Basin is an initiative established by the Conservation Biology Institute (CBI), a non-profit organization dedicated to promoting the advancement of conservation biology through scientific research and practical application.

The tool is available at https://databasin.org/

4. **The EzFlow** repository is a PyTorch library that utilizes neural networks to estimate optical flow. It is designed to be modular in nature.. The library is designed to be adaptable and user-friendly, even for individuals lacking extensive familiarity with PyTorch or optical flow estimation .

The library offers a diverse range of models suitable for optical flow estimation, encompassing:

DICL,DCVNet, FlowNetS, FlowNetC,PWCNet,RAFT,,VCN

The tool is available at https://github.com/neu-vig/ezflow

5. **Sen1Floods11** is a dataset with geographical references that can be utilized for training and evaluating deep learning flood algorithms specifically designed for Sentinel-1 [1]. The dataset comprises unprocessed Sentinel-1 images and categorized permanent water and flood water. It contains a total of 4,831 chips, each with dimensions of 512x512 pixels, covering an area of 120,406 square kilometers. The dataset encompasses all 14 biomes, 357 ecoregions, and 6 continents worldwide, spanning across 11 flood events. The dataset was utilized to train, validate, and assess fully convolutional neural networks (FCNNs) for the purpose of segmenting permanent and flood water. The findings indicated that deep learning models applied to radar data for flood detection exhibit superior performance compared to threshold-based remote sensing algorithms. Moreover, these models demonstrate enhanced efficacy when trained with labels that specifically encompass flood water, rather than solely permanent surface water.

The tool is available at https://github.com/cloudtostreet/Sen1Floods11

6. **Previsico** is a company specializing in sophisticated forecasting technologies for flood impacts and prevention. Their services include providing practical flood notifications, tools to mitigate losses, and insurance solutions for individuals and organizations. Previsico's sophisticated forecasting technologies empower individuals and institutions to enhance their ability to withstand and recover

from floods. [1]. The company was established in 2019 and emerged from Loughborough University after two decades of research and development .

Previsico offers a diverse range of products and services aimed at assisting users in effectively managing flood risks. Previsico offers real-time, street-level predictions of surface water flooding to minimize the effects of floods worldwide. This includes immediate and actionable warnings for current and future street-level floods. Previsico offers users a range of tools to accurately identify and effectively manage flood risks. These tools encompass flood risk assessments, flood defense design, and flood defense maintenance .

The tool is commercial and available at https://previsico.com/

7. **Floodbase** is a comprehensive flood data solution that facilitates the creation and activation of worldwide parametric flood coverage. The company offers insurers a range of tools to effectively handle flood risks, such as flood prediction, risk mitigation tools, and insurance options. Floodbase's technology combines satellite-derived observations with hydrological and meteorological data, models, and other ground observations to produce continuous, almost instantaneous flood maps. These maps facilitate the development of effective flood policies and enable automated triggering, a capability that was previously unavailable. Floodbase is an initiative established by Cloud to Street, a Public Benefit Corporation that offers sophisticated prediction technologies for flood consequences and mitigation.

The tool is commercial and available at https://www.floodbase.com/

8.DE Digital Africa Risk Analysis Tools, , offers a comprehensive collection of open-source example notebooks and Python tools for facilitating Earth observation on the DE Africa Sandbox [1]. The platform offers a diverse range of tools and resources to assist users in generating personalized maps, accessing carefully selected spatial data, and uncovering fresh perspectives from multiple origins. DE Africa Analysis Tools is a compilation of open-source sample notebooks and Python utilities that showcase various analysis techniques using code and present outcomes through plots and visualizations. The tools are designed to possess adaptability and can be tailored to fulfill the distinct requirements of various projects. The tools encompass a broad spectrum of applications, encompassing water resources and flood vulnerability, agriculture and food stability, and additional areas.

The tool is available at https://www.digitalearthafrica.org/platform-resources/analysis-tools

9. Colorado Flood Observatory, The Flood Observatory at the University of Colorado has initiated a project called "Space-based Measurement, Mapping, and Modeling of Surface Water." This project aims to create a comprehensive archive of significant flood events that have occurred from 1985 to the present. The archive comprises inundation maps, satellite river discharge measurements, and additional tools for detecting floods . In addition, the Flood Observatory offers a range of supplementary resources to assist users in mitigating flood hazards, such as flood prediction, measures to prevent damage, and insurance options. The primary objective of the Flood Observatory is to utilize satellite-based techniques to quantify, delineate, and simulate the distribution of water on the Earth's surface. This data is intended to be used for scientific research, humanitarian efforts, and managing water resources. The Flood Observatory is a component of the Community Surface Dynamics Modeling System, which is housed at the University of Colorado . The Flood Observatory offers a diverse range of tools and resources to assist users in effectively mitigating flood hazards, encompassing. The Flood Observatory undergoes regular updates and enhancements through collaboration with end-users and partner institutions. The Flood Observatory is accessible through the University of Colorado website at https://floodobservatory.colorado.edu/ .

Apart from the operational tools, here we list some training materials websites.

- Training: NASA Remote Sensing for Flood Monitoring and Management | https://lnkd.in/dGkTZuZe
- Training: Monitoring and Modeling Floods using Earth Observations | https://lnkd.in/dZ5h-mgA
- Training: Monitoring Urban Floods Using Remote Sensing | https://lnkd.in/dCACC-ps
- Training: Satell Using NASA Remote Sensing for Flood Monitoring and Management | https://lnkd.in/dGYyMe2eite Remote Sensing of Flood Monitoring and Management | https://lnkd.in/d_dcdvCM
- Training : ARSET - SAR for Detecting and Monitoring Floods, Sea Ice, and Subsidence from Groundwater Extraction, https://appliedsciences.nasa.gov/get-involved/training/english/arset-sar-detecting-and-monitoring-floods-sea-ice-and-subsidence
- North India Floods, Maxar Imagery, https://www.maxar.com/open-data/india-floods-oct-2023
- Workshop on developing Python frameworks for earth system sciences Lecture Notes, 2017, https://www.ecmwf.int/en/learning/workshops/workshop-developing-python-frameworks-earth-system-sciences?fbclid=IwAR2SixblEB1DMfCKdcMhrSDrid-SjNxQmv8Hl24E1rgZB25rFWLmmVGKISU

Finally, the following page is recommended for the further reading.

Climate change drives disaster risk, https://www.preventionweb.net/understanding-disaster-risk/risk-drivers/climate-change?utm_source=LinkedIn&utm_campaign=PreventionSavesLives

5.COLLABORATION PORTAL

The collaboration portal has been set in two different platforms, one in Whatsapp, and the other in Slack. The all registered participants are included in. Any tool/information arised about the floods, the people and the lecturers are sharing there accordingly. Project calls and other collaboration opportunities are shared as well for the further development.

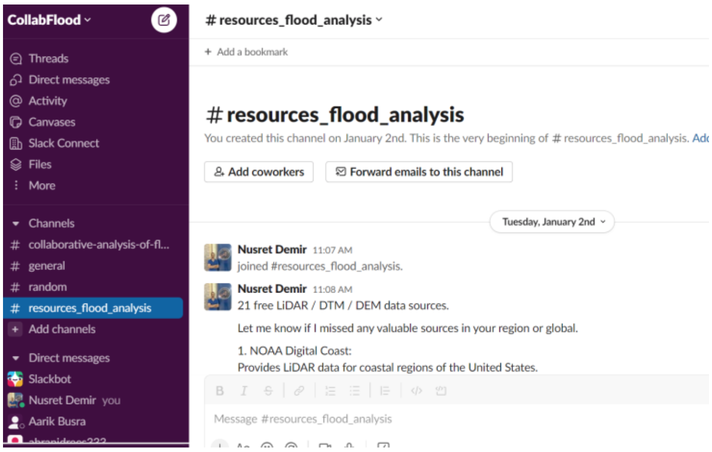

Figure 19. Slack Portal for the collaboration

APPENDIX

- Submitted Papers to The Workshop
- Lecture Notes presented
- Images from the workshop
- Example of the given certificates
- Given promotional materials.
- List of the participants

COLLABORATIVE ANALYSIS OF FLOODING EVENTS WITH PROCESSING OF EARTH OBSERVATION DATASETS WORKSHOP ABSTRACTS

Edited by

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PRECISE FLOOD INUNDATION MAPPING USING SUPERVISED MACHINE LEARNING: TURKISH BLACK SEA CITIES CASE

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ABSTRACT:

Floods remain a persistent concern in Turkish coastal cities along the Black Sea, driven by substantial heavy rainfall. These inundations result in dire outcomes, encompassing the loss of human life, significant material devastation, breakdowns in communication networks, and the paralyzing of urban transportation systems. Given these formidable challenges, the urgency for precise and timely flood inundation mapping emerges as a linchpin in effective disaster management strategies, holding the potential to curtail the impact of future calamities. The recent convergence of state-of-the-art technologies in satellite imagery and remote sensing, particularly the fusion of change detection mechanisms and advanced machine and deep learning techniques, has forged a formidable alliance that exhibits remarkable prowess in flood detection and precise flood mapping. Against this backdrop, the present study makes a noteworthy contribution by introducing a comprehensive and meticulously crafted framework for flood inundation mapping. At its core, this framework harnesses the distinct advantages of Sentinel-1 synthetic aperture radar (SAR) images with VV polarization and Sentinel-2 optical images, utilizing specific bands (B12, B2, and B3). These data sources, generously made available by the European Space Agency (ESA), provide a rich repository of flood-associated information without imposing financial constraints. Zooming in on the geographic scope, the study focuses on the Bozkurt district within the Kastamonu province in northern Turkey. This locale, characterized by its rugged topography and human settlements clustered along riverbeds, emerges as a prime target for flooding vulnerabilities. The catastrophic flood event of August 2021 further underscored this region’s susceptibility. Similarly, the investigation extends to the Gediz Plain, a pivotal agricultural expanse marked by extensive croplands. The flooding witnessed in February 2021 reinforces the rationale for including this area in the study’s ambit. The methodological foundation of the proposed framework is established through a meticulous regimen of data pre-processing, encompassing calibration, radiometric correction, and spatial alignment of Sentinel-1 and Sentinel-2 datasets. Following this preparatory phase, a battery of cutting-edge supervised machine learning algorithms, including the adept Random Forest Classifier (RF), K-Nearest Neighbor (KNN), Maximum Likelihood Classifier (MLike), as well as the innovative deep learning-driven CswinFormer model, undergoes rigorous evaluation. The central criterion for this assessment revolves around the efficacy of these models in accurately identifying inundated regions. To achieve this, the training phase unfolds within the Sentinel Application Platform (SNAP) toolbox, leveraging meticulously crafted manual annotations. The empirical results arising from this study’s experimentation on the selected study areas are revealing. The supervised machine learning models, notably the RF, demonstrate commendable accuracy in flood detection for Sentinel-2 images, achieving an F1-score accuracy of 81.5%. The MLike closely follows with an accuracy of approximately 79.8%. The true standout, however, is the CswinFormer model, showcasing exceptional proficiency with an accuracy of 83.2% for the Sentinel-2 dataset. The

proposed CswinFormer model showed satisfactory results reflecting flood inundation in Bozkurt district. By enriching the array of tools available for addressing inundation events, this study underscores its potential in fostering resilience and minimizing the far-reaching consequences of floods.
Keywords: Flood Mapping, Supervised Learning, Change Detection, SAR and Optical Imagery, Turkish Black Sea Floods.

INTEGRATED STUDY FOR HYDROCARBON ASSESSMENT OF JOYA MAIR AREA, UPPER INDUS BASIN, PAKISTAN USING SEISMIC DATA AND WELL LOGS

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ABSTRACT:

The Joya Mair oil field is situated in the S-SE fragment of the Potwar Foreland Basin of Pakistan. The basin contains many promising oil producing fields from the Pre-Cambrian to Eocene reservoirs. Overall, the estimated oil reserves in the Potwar Basin are 40 million barrels and a yearly production of about 2.2 million barrels is carried out. Therefore, it acts as one of the most productive oil producing basins in Pakistan. The oil reservoir is structurally present in the anticlinal or dome type structures associated with the E-W Soan syncline, bounded by the Salt range in the south and the Kala Chitta range in the north. The structural arrangement resulted from the compressional tectonic regime between the Indian and Eurasian plates. The region bears a feasible petroleum system, having proper seal and source rocks. The structure of the research area (Joya Mair) is delineated with the help of seven dip lines and two strike lines. The main reservoirs of the area, i.e., the Chorgali and Sakesar limestones of the Eocene age, are interpreted on the seismic lines. The time and depth contour maps are prepared for both reservoir levels that delineate a triangular zone, which acts as suitable traps for petroleum play. The Minwal-X-1 well is drilled on the exact structure, i.e., the anticlinal portion having thrust faults. The well information is utilized to quantify petrophysical information, including shale, porosity, and saturation. A petrophysical study shows a good percentage of effective porosity of 13% in both reservoirs with hydrocarbon saturation up to 75%. The petro-elastic relationship is utilized through model-based seismic inversion, which differentiates the hydrocarbon bearing zones by evaluating the acoustic impedances. The seismic and inverted impedances are incorporated into the porosity estimations using the multi-attributes and probabilistic neural networking (PNN) techniques. The PNN technique is most suitable for dealing with complexities related to lithological heterogeneities. The resultant porosities are verified over the measured porosities and good correlation is observed. The porosity volumetrics delineated a reasonable porosity within the Chorgali reservoir. Hence, the integrated approach, i.e., structural, geological, petrophysical and geophysical, resulted in a reliable potential evaluation of the reservoirs.

INVESTIGATION OF THE 2021 BOZKURT FLOOD DISASTER FROM PLANETSCOPE REMOTE SENSING DATA

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ABSTRACT:

Turkey's northern Black Sea region, particularly the eastern Black Sea geographical area, is regarded as the most rainy region of the nation. Events like floods and overflows, common in the Black Sea region, can be harmful and fatal. However, the most significant flood disaster in history, which occurred in August 2021 in the Bozkurt district of Kastamonu province, located in the Western Black Sea Region, resulted in dozens of fatalities, hundreds of evacuations, and thousands of affected living things. Researchers should talk about the consequences of this catastrophe and the steps that need to be taken to stop it from happening again. The remote sensing (RS) technology data used in this investigation were divided into 10-day intervals and visually analyzed. Using PlanetScope Multispectral (MSI) quad-band (Red, Green, Blue, and Near-Infrared) optical satellite data, the False Color Composite (FCC) and the Normalized Differences Water Index (NDWI) over data pairs Aug 03 - Aug 13, 2021, and Aug 06 - Aug 16, 2021, were generated. The analysis of the Bozkurt Flood Disaster in 2021 was done with RS by choosing key locations. RS illustrates the destruction and floods brought on by the flood tragedy. The geographical studies that were conducted utilizing the Digital Elevation Model (DEM) basis sought to provide a solution to the problem of how major floods and flood disasters could be prevented. The results obtained through the generation of a correlation between the produced Slope Map and regional meteorological data are discussed.

Keywords: Bozkurt Flood Disaster, Normalized Differences Water Index (NDWI), PlanetScope.

A MULTI-CRITERIA APPROACH FOR ASSESSING FLOOD RISKS ON RAILWAY LINES IN TURKEY

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ABSTRACT:
The railway system is pivotal in urban and suburban transportation, distinguished by an expansive network of lengthy parallel or intersecting routes intricately interwoven with numerous rivers. It becomes imperative to deeply explore the complexities in designing railway crossings that align parallel to rivers and at their intersections, such as bridges and culverts. When addressing parallel passageways, a meticulous consideration of river delineation becomes indispensable, contingent upon the morphology and capacity of the floodplain. Under specific circumstances, the railway track might traverse through the floodplains of the River, potentially leading to inundation and erosion of the railway embankment due to the constriction of the floodplain itself.

In situations involving intersections, apart from ensuring the railway's resilience against significant floods (ranging from 100 to 500-year design floods), there's a possibility of encountering backwater floods. These phenomena could result in adverse impacts and damage to the railway system and its surrounding environment, spanning agricultural, industrial, and residential areas. The current regulatory framework falls short of providing a comprehensive approach to tackle the multifaceted environmental and societal consequences that can arise from railway construction. Consequently, a more thorough evaluation of railway alignment and infrastructure is imperative, particularly concerning flood dynamics and associated risks.

This study is centered around railway construction projects in Turkey. This research uses a benchmark model to conduct preliminary flood risk assessments (PFRA) to identify regions susceptible to heightened flood impacts. This assessment encompasses the evaluation of potential risks to human populations and the potential for economic, social, and environmental repercussions. Factors such as flood duration and magnitude are also incorporated into the flood risk assessment. The approach involves implementing flood risk modeling within areas flagged by the preliminary risk assessment as having moderate to high levels of risk (Kron et al., 2019). A visual representation of flood conditions upstream and downstream of the proposed drainage infrastructure can be established through modeling.

Based on the outcomes of the modeling efforts, the study aims to identify the need for more comprehensive investigations and potential redesigning of the proposed drainage structures. It is crucial to interpret this study as assessing the requirements outlined in the socio-economic protection (Tsakiris,2014). Here, the intention is to demonstrate that the proposed development would not exacerbate the risk of flooding in any area. This risk is defined as either a marginal increase in flood depth or an exacerbating of existing vulnerabilities in more severe cases (Bubeck,2019). This consideration is mainly extended to locations with minimal receptors or instances where assurance of adequate mitigation for high-risk zones cannot be ensured.

Keywords: Flood Risk, Railway, Assessment, Multi-Criteria, Under-Construction

PERFORMANCE ASSESSMENT OF REGCM5 IN SIMULATING HIGH-INTENSITY PRECIPITATION: A CASE STUDY OF THE KASTAMONU, TÜRKİYE

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ABSTRACT:

Short-term intense precipitation events constitute a prominent category of climate-induced extreme weather phenomena within the geographical context of Türkiye, frequently leading to adverse consequences such as flooding, landslides, and erosion. In this study, we utilized the Regional Climate Model version 5 (RegCM5) to investigate the high-intensity precipitation event that occurred in the Bozkurt district of Kastamonu between August 10 and 11, 2021. The fifth generation of ECMWF reanalysis data (ERA5) was employed as the driving force for initial and boundary conditions, and various cumulus convection schemes, including the Kuo, Grell, Emanuel, Tiedke, and Kain-Fritsch, were tested to determine the optimal configuration for the model. We assessed the performance of the RegCM model in accurately simulating high-intensity precipitation through the evaluation of the Global Precipitation Measurement (GPM) Integrated Multi-Satellite Retrievals for GPM (IMERG) products. The results indicate that the RegCM model was capable of detecting rainfall trends based on hourly data. Specifically, using the Grell scheme over land and the Emanuel scheme over the ocean produced more accurate precipitation results within the research region for the single high-intensity precipitation event.

Keywords: High-Intensity Precipitation, RegCM, IMERG, Kastamonu.

ANALYSIS OF DERİK DISTRICT IN TERMS OF FLOOD AND OVERFLOW SUSCEPTIBILITY USİNG GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND REMOTE SENSING METHODS

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ABSTRACT:

Floods and overflows are low-frequency events that affect human life, physical infrastructure and socio-economic structure. They have direct and indirect impacts in the regions where they occur. Floods and overflows, in addition to being the reason for the loss of life and property, cause a wide range of negative consequences such as disruption of agricultural areas, disruption of transportation (destruction or flooding of roads, destruction of bridges) and, disruption of education and training activities. In terms of preventing the possible damages of floods and overflows and responding to these disasters, it is extremely important to determine the potential areas where floods and floods may occur and to determine the sensitivity of these areas in terms of floods and overflows. In this study, it was aimed to determine the sensitivity of Derik district in terms of flooding and overflows by using Remote Sensing and Geographic Information Systems (GIS) techniques.

Derik district is located in the western part of the Dicle Division in the Southeastern Anatolia Region. Hydrologically, the district is located in the Fırat Sub-Basin. The most important rivers of the district are Çırcıp, Akıncılar and Dikmen streams.

A flood susceptibility map was created to analyze the flood and overflow sensitivity of the study area. In the creation of this map, SRTM DEM data was processed in ArcGIS 10.7 software. Parameters such as slope, aspect, elevation Normalized Difference Vegetation Index (NDVI) and soil properties were taken as the basis for determining the susceptibility of the area to flooding and overflow. These parameters were mapped with GIS, the layers obtained were divided into subclasses and weight values were assigned according to their effects on flooding. The weighted layers were summed up and a flood susceptibility map was created by using the Weighted Overlay method in Multi-Criteria Layer Analysis (MCAA).

In the susceptibility analysis, it was determined that 5.8 % of Derik district is very little susceptible, 62.2 % is less susceptible, 30.9 % is susceptible, and 1 % is very susceptible to flooding. When the temporal change of the development of Derik city is examined; it is seen that the district centre has developed towards the areas susceptible to floods and overflow in the last twenty years and the district has grown towards the river beds. The growth of the district centre in this direction will cause severe damage possible floods and overflows in the future.

Keywords: Southeastern Anatolia Region, Mardin, Derik, Flood and Overflow, Susceptibility Analysis

ANALYSING THE IMPACT OF LAND COVER AND LAND USE DECISIONS ON FLOODS WITH MULTITEMPORAL SENTINEL-1 SAR AND SENTINEL-2 DATA: A CASE STUDY OF BOZKURT, TURKIYE

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ABSTRACT:

The number of major flood events are increasing in many parts of the world, but recently these natural phenomena turned into great disasters because of the rapid urban growth and erroneous changes in land cover and land use. These are the main factors which increase the risk of severe flooding as the permeability of the surface decreases and imperviousness of the surface rises. As, a consequence, these disasters not only have destructive impacts on urban dynamics, economic and social order, but also they put human lives at risk and make societies extremely vulnerable. Even though floods cannot be controlled fully, its damage to cities, economies and people can be reduced by analysing the flood events to obtain information about the extent of floods as well as causes and factors. Detailed spatial information which can be obtained from the inundation maps will also be necessary for the development of flood management concepts, flood protection measures, planning and sustainable development.

Spaceborne imaging systems and observations made by these systems are widely used for flood mapping. One type of this Spaceborne imaging system is Synthetic Aperture Radar (SAR). SAR’s ability to be independent from cloud cover as it can penetrate this cover causes SAR system to be a preferred tool for flood monitoring and to detect water extent, since floods are closely related to heavy rain, in which optical remote sensing instruments capability of imaging the water is practically not possible.

Floods occur with the highest rate among meteorological natural disasters in Turkiye affecting large areas and causing casualties. Black Sea region, especially coastal areas, are affected the most due to the short- term, heavy rains and amount of rainfall. Due to the high slope in this region, settlements were built on plains near the coastline or rivers. As population in cities increased over time, settlements expanded and came closer to rivers by narrowing river beds. Other serious changes in land cover happened following these sprawl such as conversions of forest areas to agricultural lands or allowance of stream beds for settlements which affect the permeability of the surfaces. These factors have led to the increase in the severity of flood disasters such as the disaster in Bozkurt district in the past years. Although the occurrence of these disasters and the causes related to land use decisions have been discussed in other studies, the relationship between land use changes and floods in urban areas needs to be investigated and analysed more, with the help of optical and SAR images.

This study sought for answers for the questions of which areas in a certain category of land cover decreased or increased and whether the flooded areas have increased over the years in areas where changes in land cover have occurred and if so, which change triggered this increase. So, answers to these questions will indicate the changes in Bozkurt, Kastamonu’s land cover as well as the relation of these changes to extent and impacts of floods.

Land cover and land use of Bozkurt district will be classified into nine classes including natural and man-made areas such as water, trees, crops, built areas using Sentinel 2 multi spectral instrument data. Classifications will be conducted using annual satellite data, consequently, change detection on land use and land cover between years can be observed. Examining these changes will provide important information about whether the areas with high permeability increase or are replaced by impermeable, man-made structures such as buildings and roads.

Flood extent of inundated areas when flood events occurred will be detected by classifying maps into two classes which are flooded and non-flooded and time interval which is used for change detection will be the same for analysing this extent. Sentinel-1 SAR data will be used for classifying flooded and non-flooded areas on the days of floods over the specified time interval. These inundation maps will be overlaid with classified land use maps, by taking the dates of flooding into consideration. As a result, the relationship between erroneous land use decisions and the occurrence of flood disasters will be analysed and these decisions' impacts will be presented with the help of SAR and optical data.
Keywords: Flood Mapping, Synthetic Aperture Radar, Land Cover, Change Detection

CONTRIBUTION OF REMOTE SENSING, GEOGRAPHIC INFORMATION SYSTEM AND ARTIFICIAL INTELLIGENCE (ML) TO THE ESTABLISHMENT OF A ZONING ACCORDING TO THE RISK OF FLOODING “NORTH-EASTERN WATERSHED OF ALGERIA”.

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ABSTRACT:

The study of flood risk involves the knowledge of the spatial variability in the characteristics of the vegetation cover, terrain, climate and changes induced by the intervention of humans in watersheds. The increased needs of the actors in land management mean that static maps no longer meet the requirements of scientists and decision- makers. Access is needed to the data, methods and tools to produce complex maps in response to the different stages of risk evaluation and response.

The availability of very high spatial resolution remote sensing data (VHSR) makes it possible to detect objects close to human size and, therefore, is of interest for studying anthropogenic activities. The development of new methods and knowledge using detailed spatial data, coupled with the use of GIS, naturally becomes beneficial to the risks analysis. Indeed, the extraction of information from specific processes, such as vegetation indices, can be used as variables such as water heights, flow velocities, flow rates and submersion to predict the potential consequences of a flood. The functionalities of GIS for cartographic overlay and make it possible to identify the flood zones according to the level of risk from the flood, thus making it a useful decision-making tool. This study was carried out on the territory of watersheds in the Annaba region, East of Algeria. The choice was guided by the availability of data (satellites images, maps, hydrology, etc.) and hydrological specificities (proximity to an urban area). The adopted model is divided into two parts. The first part is to establish a methodology for the preservation of wetland biodiversity and the protection of urban areas against floods. . The second part of the model consisted of the integration of cadastral information with the flood risk map obtained in the first part of our research. Thanks to remote sensing techniques (RS), and machine learning classification models, namely decision trees and AdaBoost. [DEFRANCE, B]. They were implemented to create a flood risk map in Annaba region; we established a flood risk map for the watershed defined above. The results showed that AdaBoost was satisfactory compared with the field reality and the most optimal model with an AUC value of 0.90. Risk research is not purely theoretical: the aim is often to improve decisions involving human lives and land uses through decision making which is better and thus permits guidance regarding the economic and social development of the sectors concerned [GILARD, Olivier].

Many methods for acquiring geographic information are available. This study of natural hazards is based on the technological development of satellite imagery, including remote sensing from airborne or space borne platforms .These techniques and methods can be used at different stages in the risk management process: in anticipation of a hazardous event, in crisis management, and then for feedback and mitigation.

Risk mapping requires a multidisciplinary approach (e.g. involving meteorology, hydrology, statistics, hydraulics, topography, geology, civil engineering, economy and environment). Once these data are collected, analysis makes it possible to control the use and the development of land. Any analysis of natural hazards must be carried out based on the understanding that risk

mapping will allow planners to reduce hazards not eliminate them, because zero risk does not exist and knowledge is uncertain [BOLSTAD, Paul. GIS].
In this context, our study of flood risk aims to study the practical application of spatial information in the management process and more precisely its integration in the process of Artificial intelligence allowing the reduction of relative uncertainties in our understanding of the risk.
Keywords: Annaba region, Remote sensing, VHSR, GIS, Flood risk. AdaBoost, Decision tree, Machine learning.

Earth’s Atmosphere and Rainfall

Dr. Dogushan Kilic

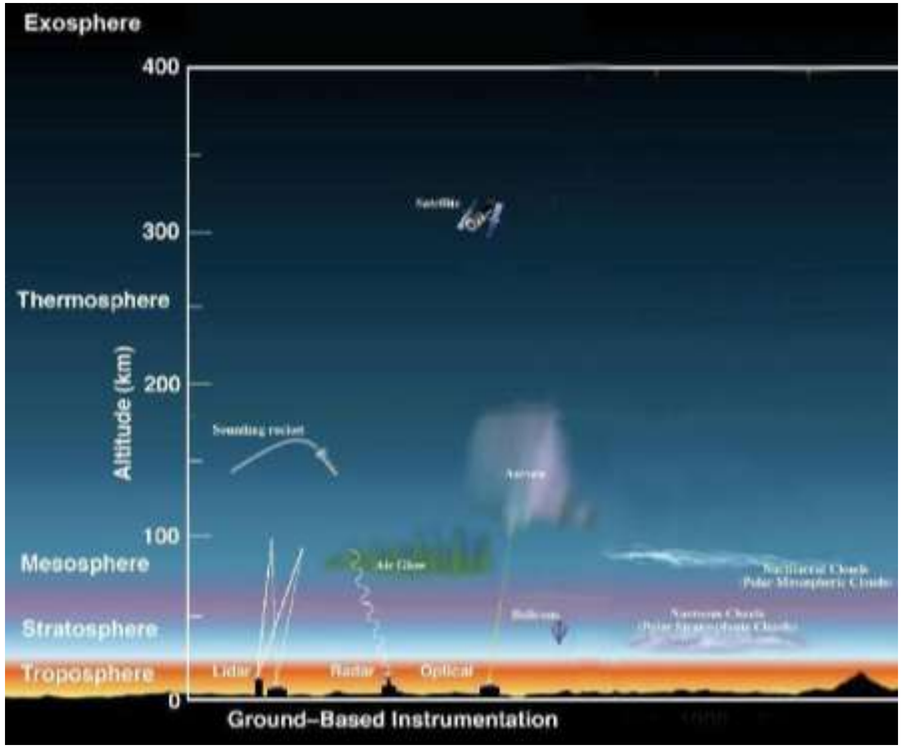
Research Associate

The University of Manchester

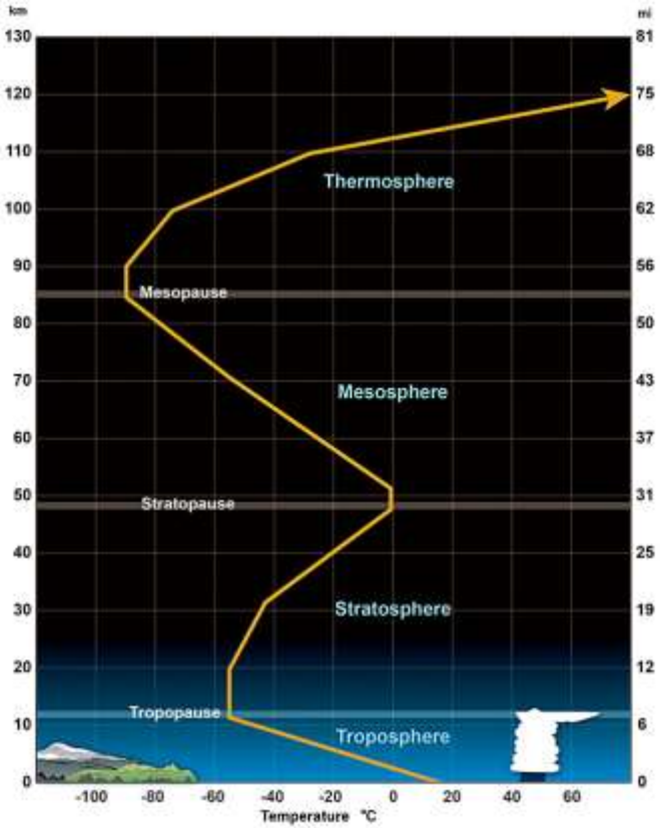
Outline

- **Atmospheric Composition**
- **Atmospheric Circulation**
- **Mechanisms of Rainfall**
- **Impact of Changing Climate on Extreme Rainfall**
- **Outlook: Long-term Atmospheric Datasets**

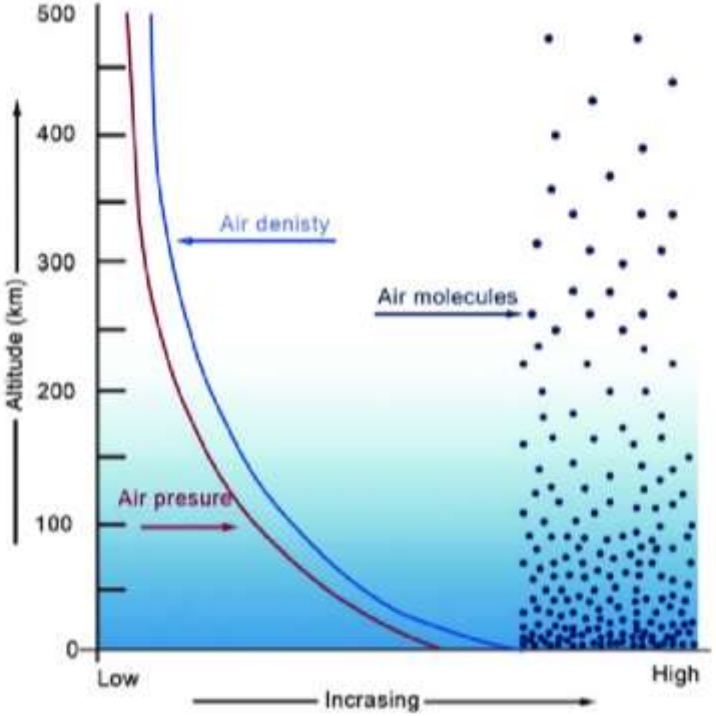
Atmospheric Layers



Source: https://climate.nasa.gov/news/2919/earths-atmosphere-a-multi-layered-cake/



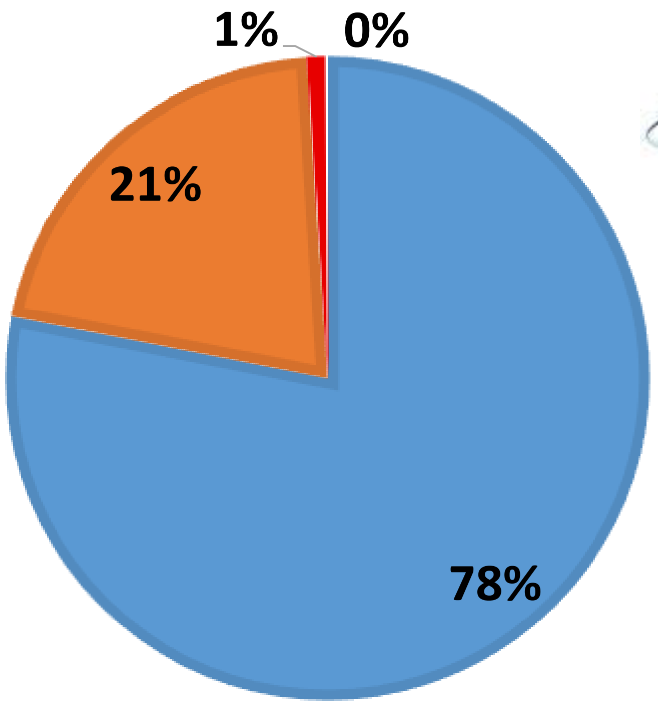
Source: https://www.noaa.gov/jetstream/atmosphere/layers-of-atmosphere



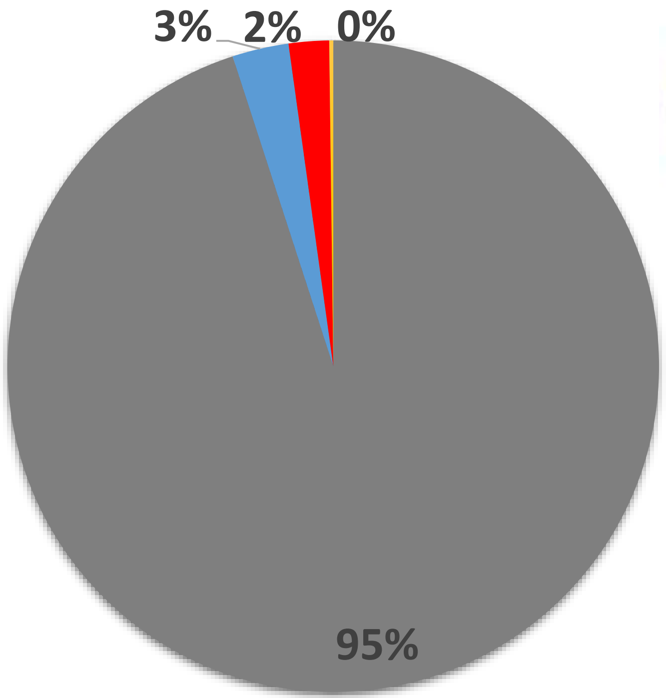
Source: Pacher, Bernhard, et al. *Agricultural meteorology and climatology*. Firenze University Press, 2018.

- **Troposphere contains 75% of the total atmospheric mass, about 99% of the total atmospheric water & aerosols**
- **Almost all meteorological events take place (most of them originate) in the troposphere.**
- **Temperature decreases with increasing altitude in the Troposphere (0.65 Celsius per 100 m – adiabatic lapse rate)**

Atmospheric Composition: Earth vs. Martian Atmospheres



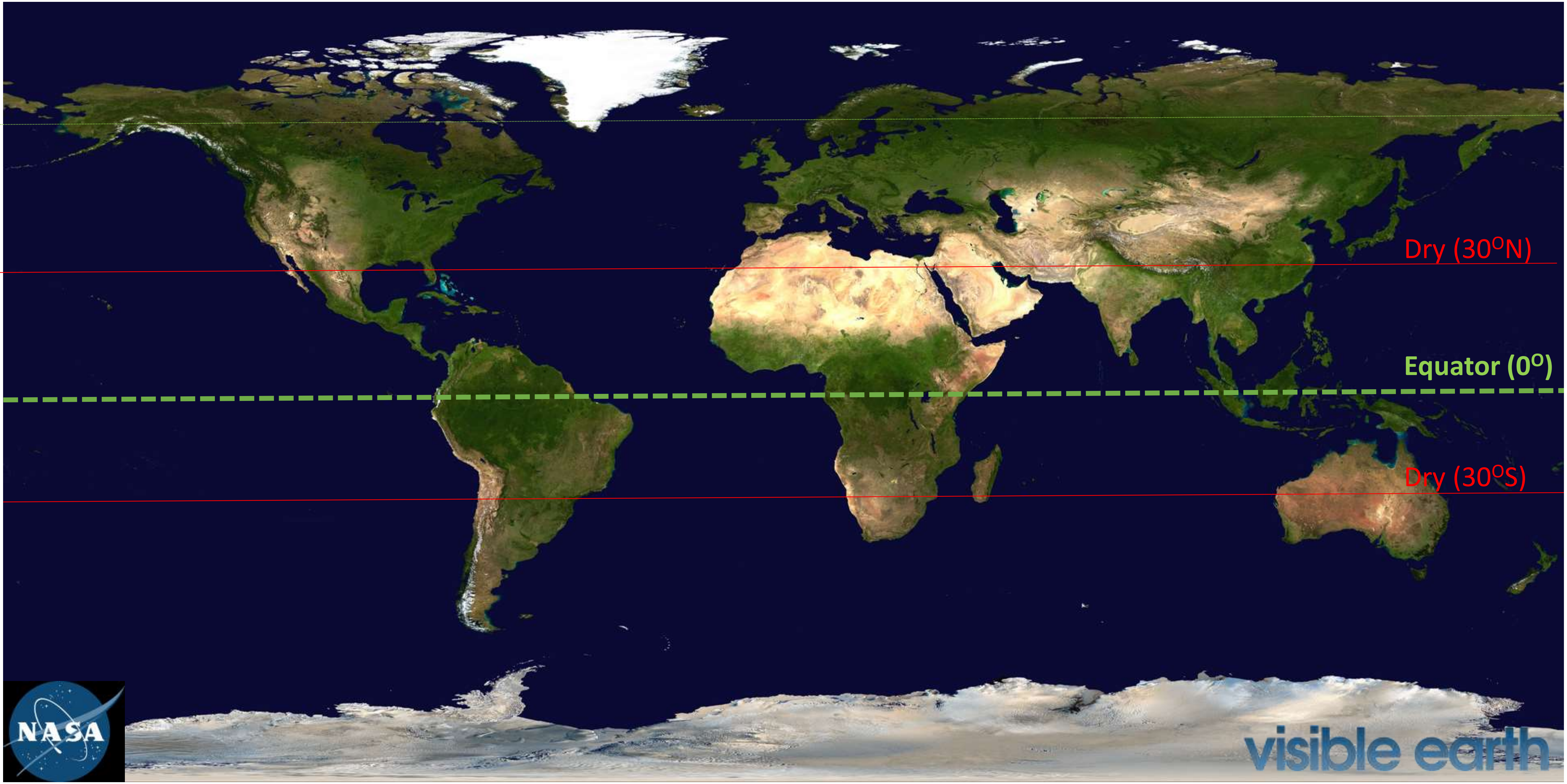
≈ 2 %



1. Nitrogen 78.08 %
2. Oxygen 20.09 %
3. Argon 0.93%
4. CO_2 0.0417%

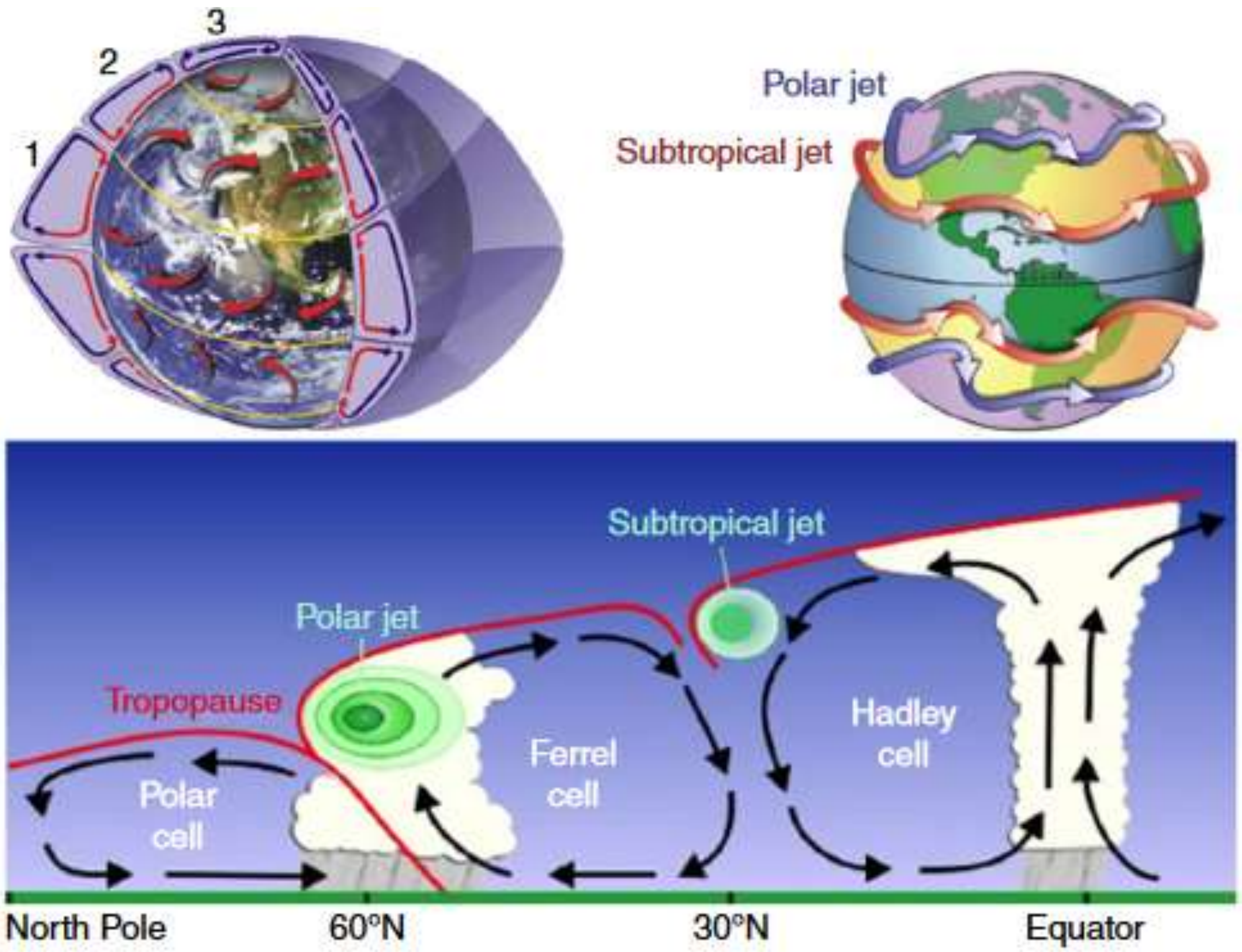
1. CO_2 95%
2. Nitrogen 3 %
3. Argon 2%

Less than 1% H_2O and O_2



Available on: https://visibleearth.nasa.gov/images/57752/blue-marble-land-surface-shallow-water-and-shaded-topography

Atmospheric Circulation



1. **Hadley (0^{O} – 30^{O})**
2. **Ferrel (30^{O} – 60^{O})**
3. **Polar (60^{O} – 90^{O})**

Upwards movement is required for rainfall

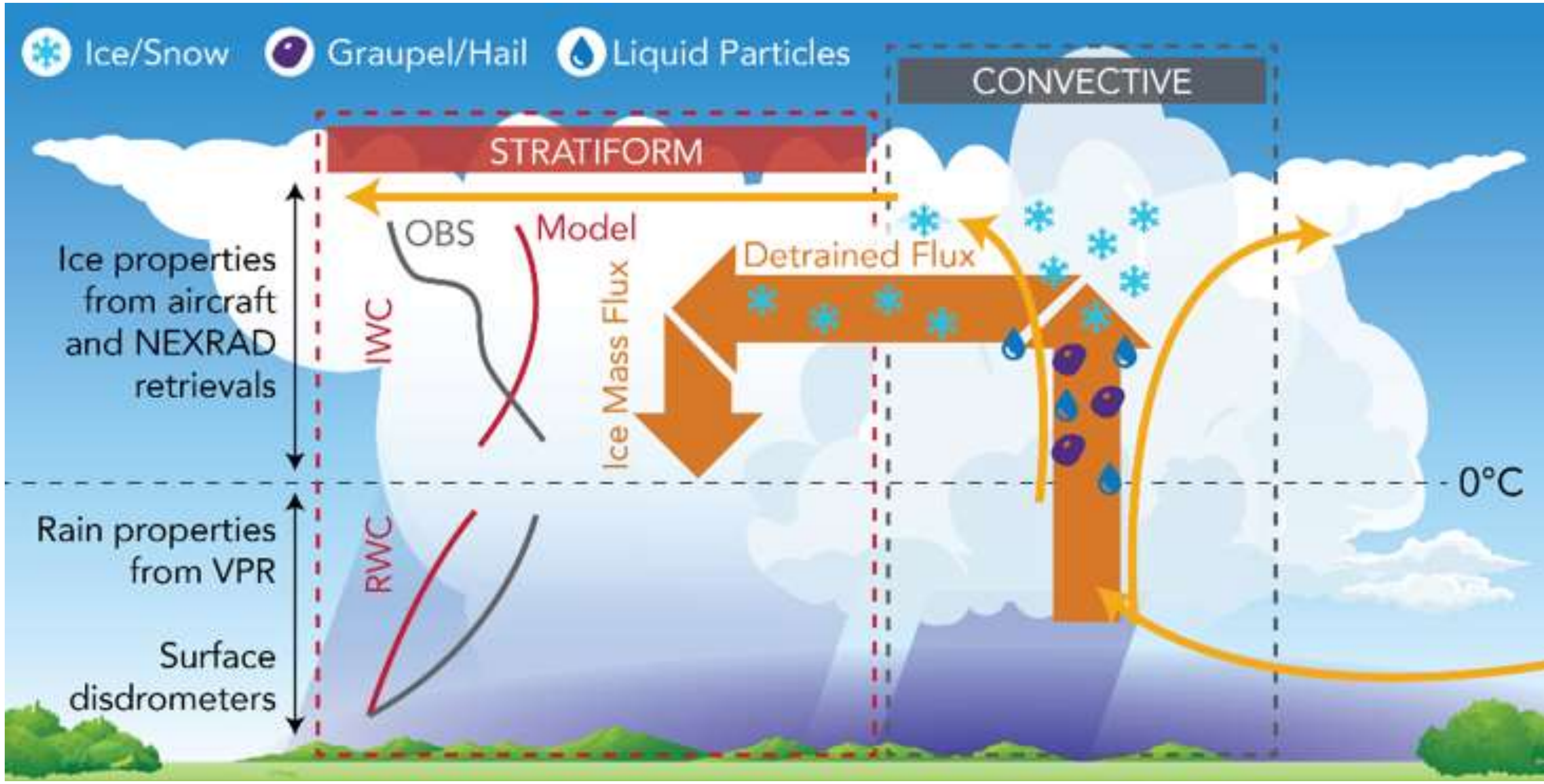
Source: **Griffin, Dale W., et al. "Global-scale atmospheric dispersion of microorganisms."** ***Microbiology of aerosols*** **(2017): 155-194.**

Water on Earth: Gas, Liquid, Solid

- Rain = Water droplets + Gravity
- Water droplets = Condensable Water Vapour + **Cloud Condensation Nuclei** (**CCNs**),
- CCNs also known as **cloud seeds**, with an average diameter of 0.2 µm
- CCN can be super-cooled water or aerosols can act as CCN
- Aerosols such as sea salt, desert dust, pollen, bacteria…

Convective Rainfall

- The sun heats the land.
- Generates rising air parcels (warm air), known as convection currents.
- Warm air rises rapidly, where it starts to cool and condenses to form clouds.
- These clouds can potentially be cumulonimbus clouds.

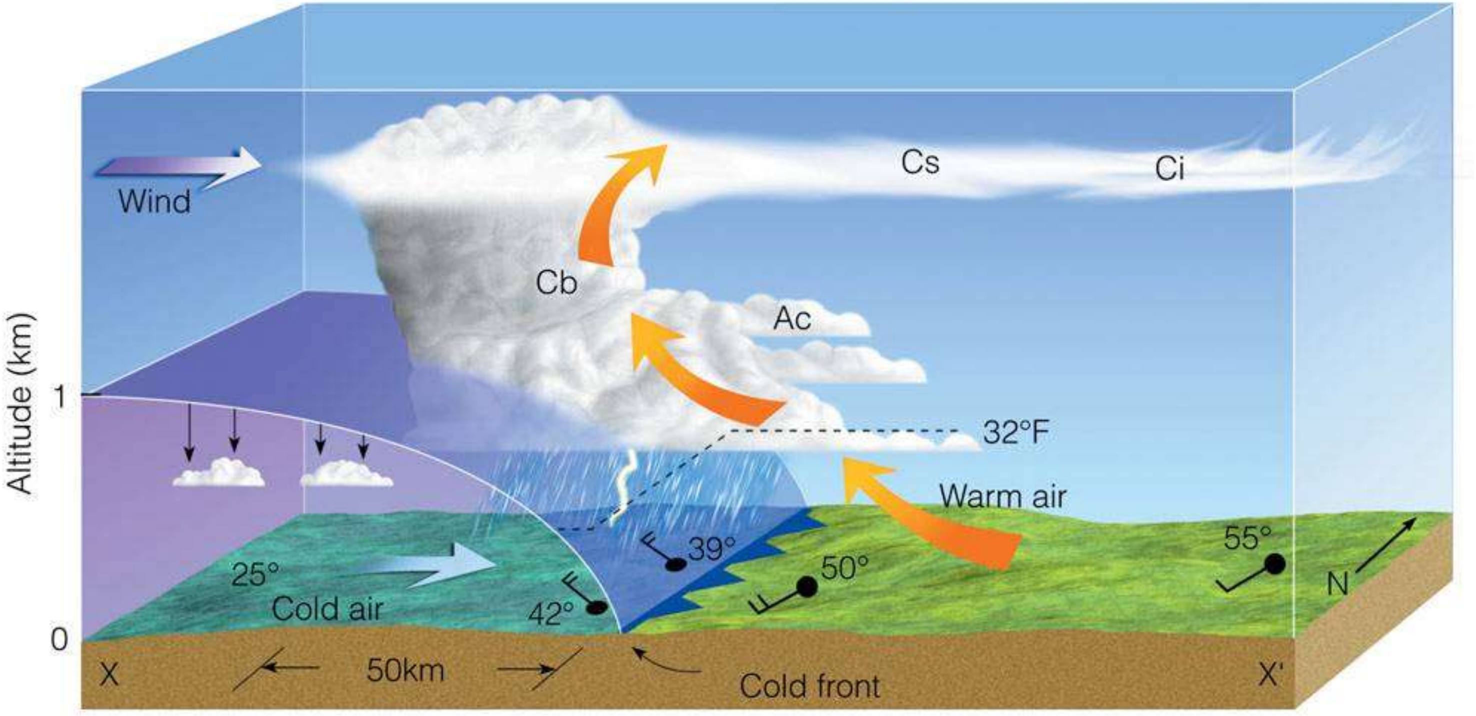


Source: https://www.arm.gov/research/highlights/881

- **Convectional rainfall usually occurs during the summer and early autumn in Turkey**
- **These clouds potentially produces heavy rainfall and thunderstorms**

Frontal Rainfall

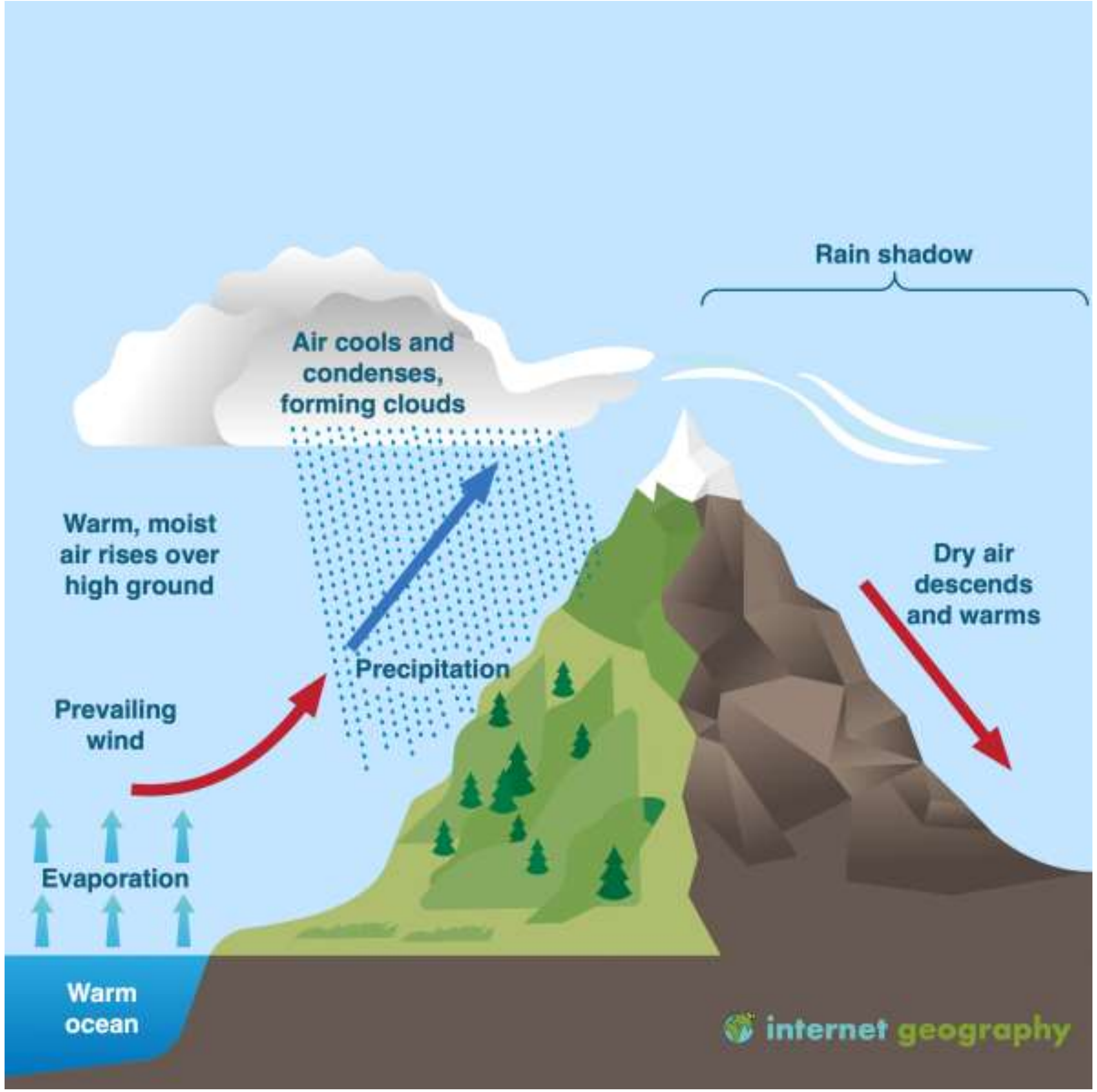
- **Frontal rainfall occurs when cold and warm fronts meet.**
- **Wind directed heavier cold air sinks to the ground, forcing warm air to rise above it.**
- **Rising warm cools.**
- **The cooler air condenses and form clouds.**
- **The clouds formed bring heavy rain.**



Available on: http://www.phys.ufl.edu/~matchev/MET1010/notes/Chapter11b.pdf

Orographic Rainfall

- Orographic rainfall occurs when warm, moist air from the Mediterranean or Black Sea rises up over mountains.
- The warm air rises, cools and condenses (by forming clouds), brings rain.
- Once the air has passed over the mountains, it descends and warms (adiabatically).
- This creates drier conditions known as a rain shadow.



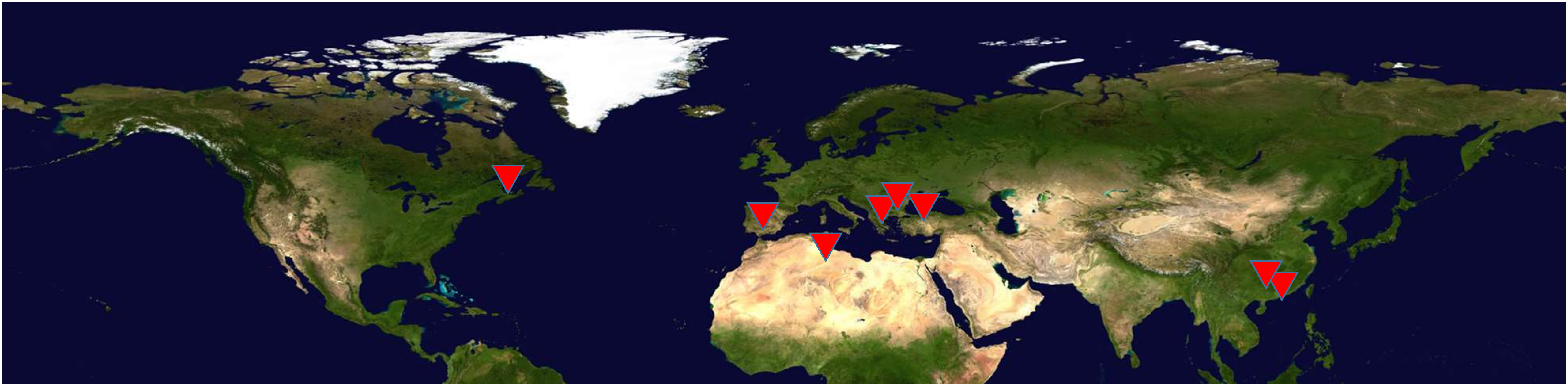
Source: https://www.internetgeography.net/topics/what-is-relief-rainfall/

We frequently see this type of rainfall in Mediterranean and Black Sea region in Turkey

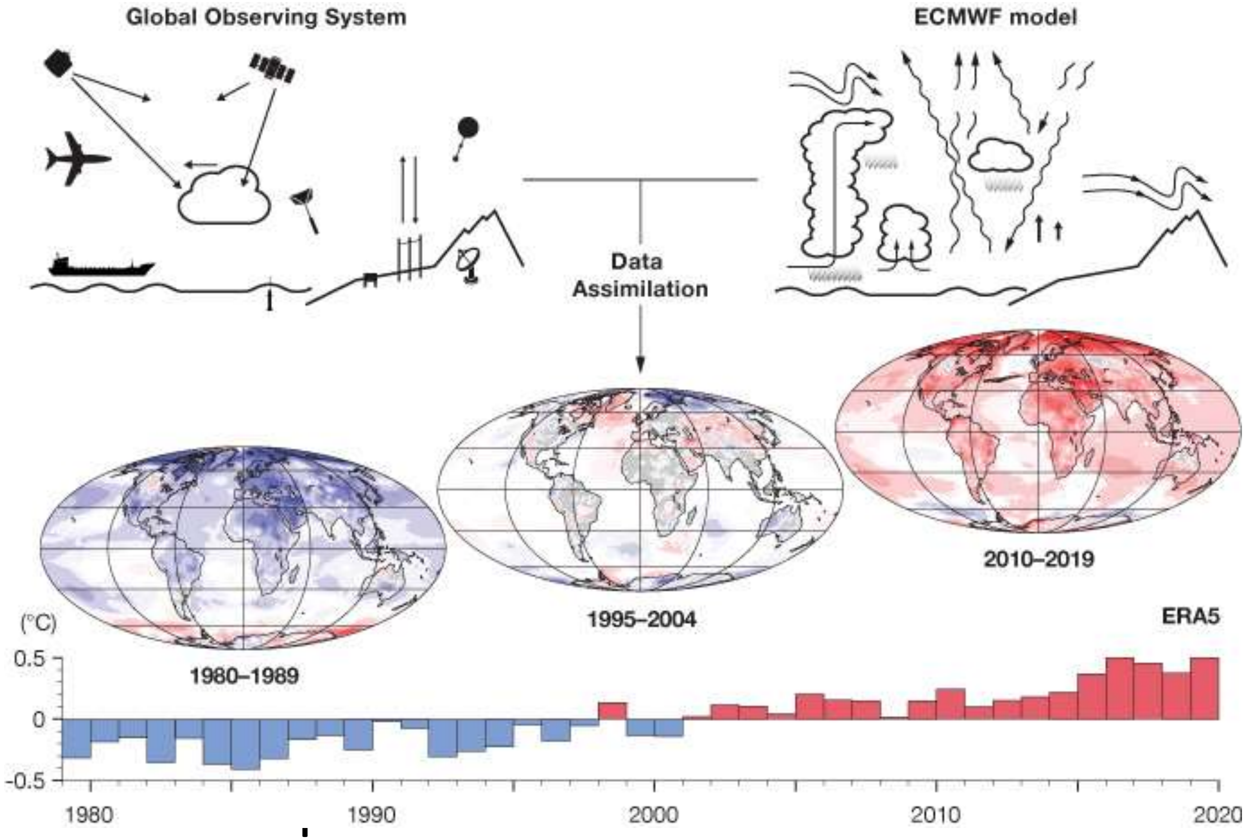
Changing climate increases extreme event intensities

- **Increased tropospheric temperatures**
- **Increased sea surface temperatures**
- **Elevating water vapour from surface waters (*e.g.*, oceans)**
- **Increased aerosols emitted due to anthropogenic activities**

Condensable water + cloud seeds (CCNs) both increases



Outlook: Atmospheric Datasets



Source: https://www.ecmwf.int/en/about/media-centre/focus/2023/fact-sheet-reanalysis

- Gridded (Re-analysis) Data Set
  - Constructed via observations and computational models
    - Satellite images and numerical weather models
  - Available datasets
    - ECMWF re-analysis (ERA)
    - NCEP/NCAR Reanalysis (NNRP)
    - CRU TS & Cy

For hands-on training: ERA5 registration
https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=overview

Supplementary Information

- What is reanalysis?
- https://www.ecmwf.int/en/about/media-centre/focus/2023/fact-sheet-reanalysis
- https://youtu.be/FAGobvUGl24

FROM FLOOD CONTROL TO INTEGRATED FLOOD MANAGEMENT

Political and social dimensions of flood risk reduction

Dursun Yıldız CE

Water Expert (Msc)

HPA Director

2 October 2023

Ankara Türkiye

CollabEO-Floods

Collaborative Analysis of Flooding Event

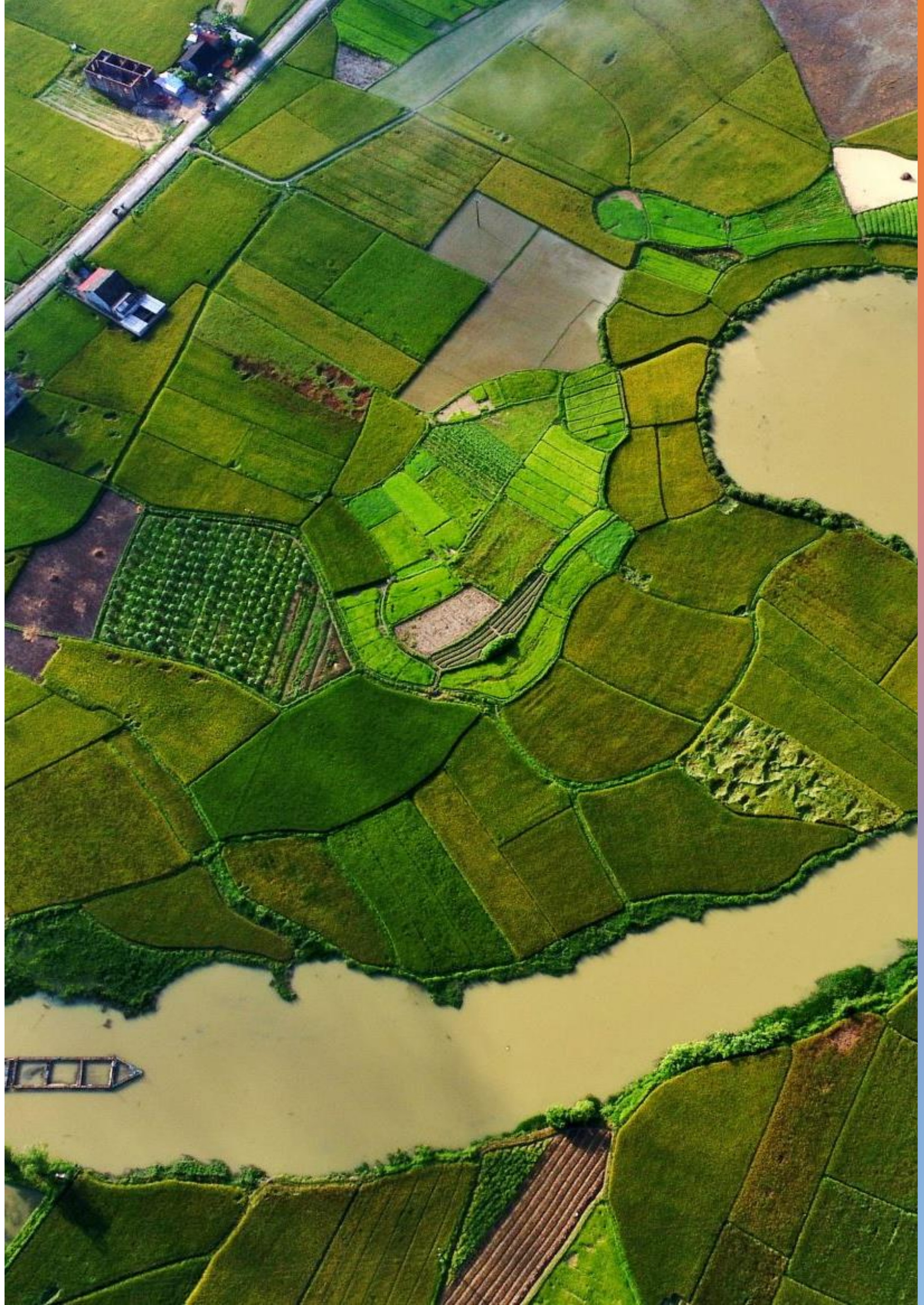
Alarming Rise

- During recent years there has been an alarming rise in human life and economic losses due to **flooding in both developed as well as developing countries.**

- The way we deal with floods co-determines **whether water remains a life-providing element or becomes a destructive force against human life** and economic development.

Challanges

- Prevent flood hazards turning into disasters;
- Increase **multidisciplinary approaches** in flood management;
- Improve information on **integrated flood management** approaches;
- Be aware of political and social dimensions of flood risk management
- Enhance **community participation.**



Control of Floods

- **The initial interventions have largely relied on control of floods** through structural measures, later supported by certain non-structural measures.
- These approaches have been ad hoc and essentially mono-disciplinary in nature.
- The structural measures have largely succeeded in **only shifting them** rather than mitigating flood risks
- It is widely recognized that a paradigm shift is required to **move from defensive to proactive action –**
- **Towards a culture of prevention by managing the risk of and living with floods.**

Integrated Water Resources Management

- IWRM is probably thought of mostly in terms of water supply and water quality, but it also <u>includes flood management and flood risk management</u> as well

The shift from flood control to Integrated Flood Management

- It is a continuous process.
- It requires learning from experience and good practices elsewhere
- Bozkuş flood is very exceptional one

Integrated Flood Management requires

- Adopting a river basin approach to planning through multidisciplinary inputs
- It also strengthens the adaptive capacity to climate variability and change.
- But climate variability brings several obstacles to reduce flood risks

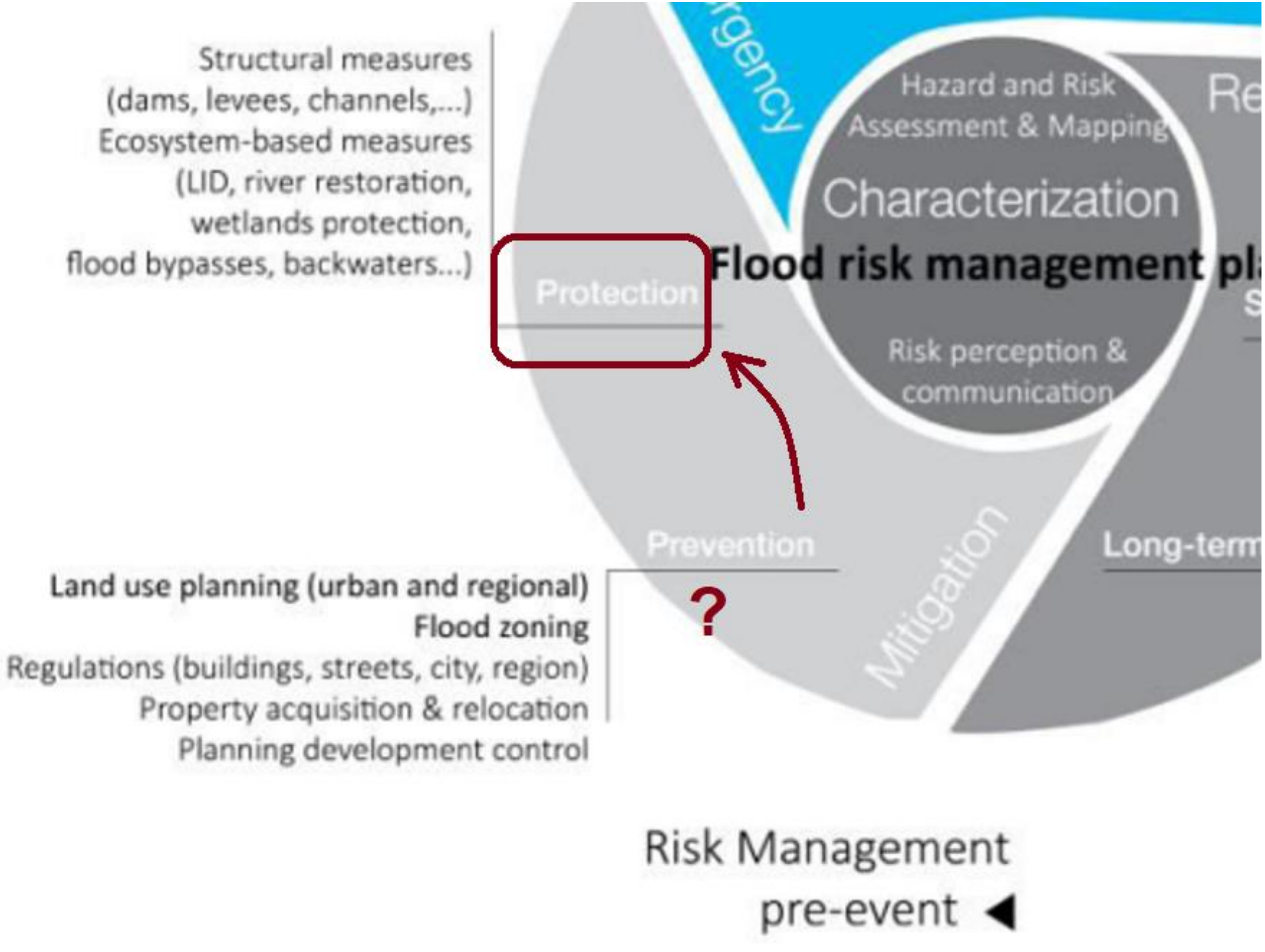
Implementation of the IFM concept

- IFM concept requires developing the capacities by supporting local and regional actions
- This must be supported by a combination of **<u>training and awareness building measures</u>**

- The flood risk
Management cycle

E3S Web of Conferences 7, 20006 (2016) DOI: 10.1051/e3sconf/20160720006
FLOOD*risk* 2016 - 3rd European Conference on Flood Risk Management

Figure 1. The flood risk management cycle (6).



Structural measures
(dams, levees, channels,...)
Ecosystem-based measures
(LID, river restoration,
wetlands protection,
flood bypasses, backwaters...)
Protection
rgency
Hazard and Risk
Assessment & Mapping
Characterization
Flood risk management pl
Risk perception &
communication
Prevention
?
Mitigation
Long-term
Land use planning (urban and regional)
Flood zoning
Regulations (buildings, streets, city, region)
Property acquisition & relocation
Planning development control
Risk Management
pre-event

Why are we forced to Protective measures

- Why do we shift from Preventive Measures to Protective Measures
- Climatological
  - Change of precipitation regime
  - Increase in flash floods
  - Increase in uncertinty in water management
- Social and Political
  - Land use planning, settlement restriction in flood zone is politically unfisible ??
  - Resettlement is difficult
  - Protection measures are more visible to gain polical credit

Flood Risk Management Plan

Prevention:

this seeks to avoid flood plains and promotes conservation

Protection:

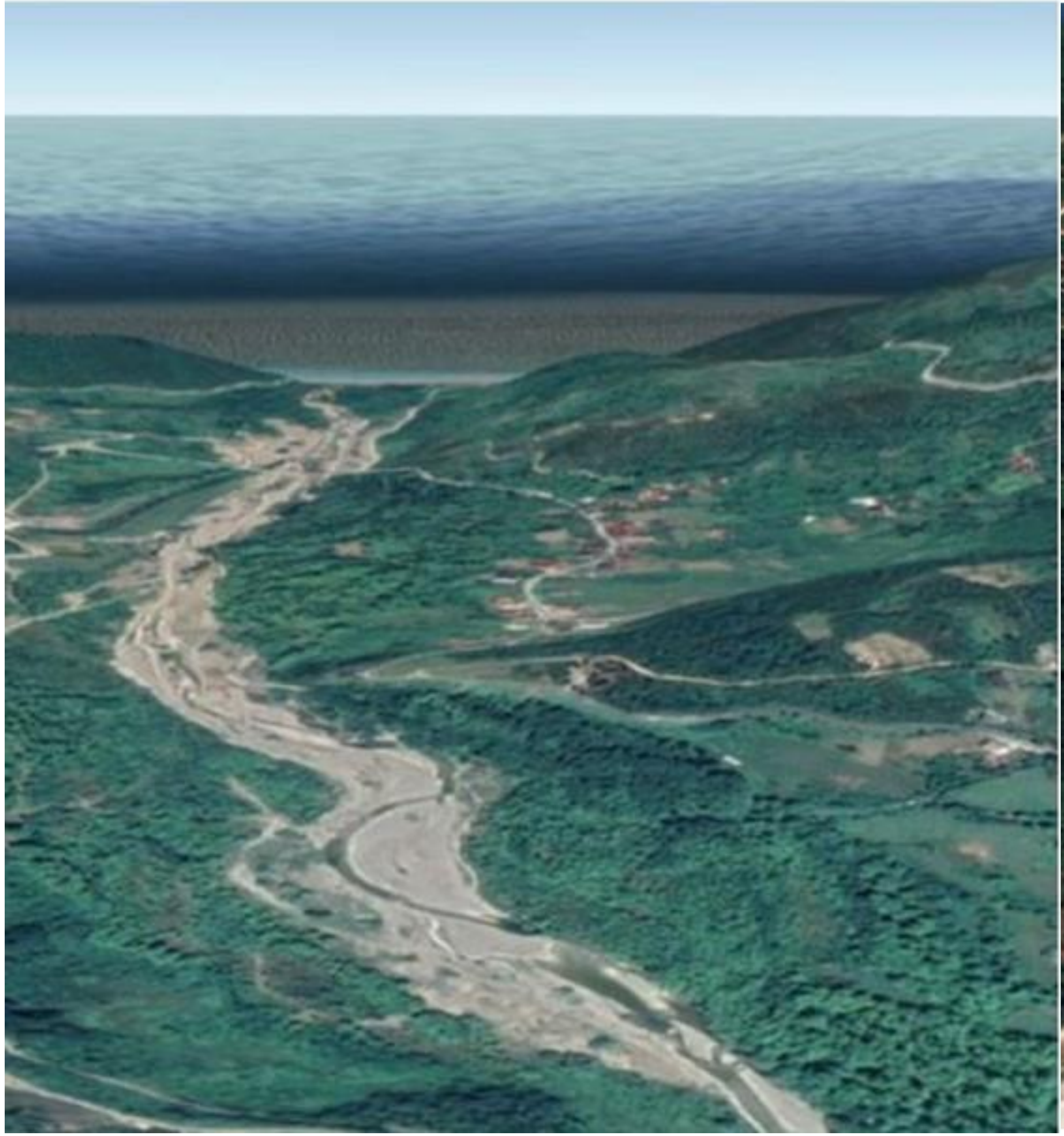
adoption of structural and non structural approach to reduce flooding

Preparedness:

through information dissemination and readiness to act

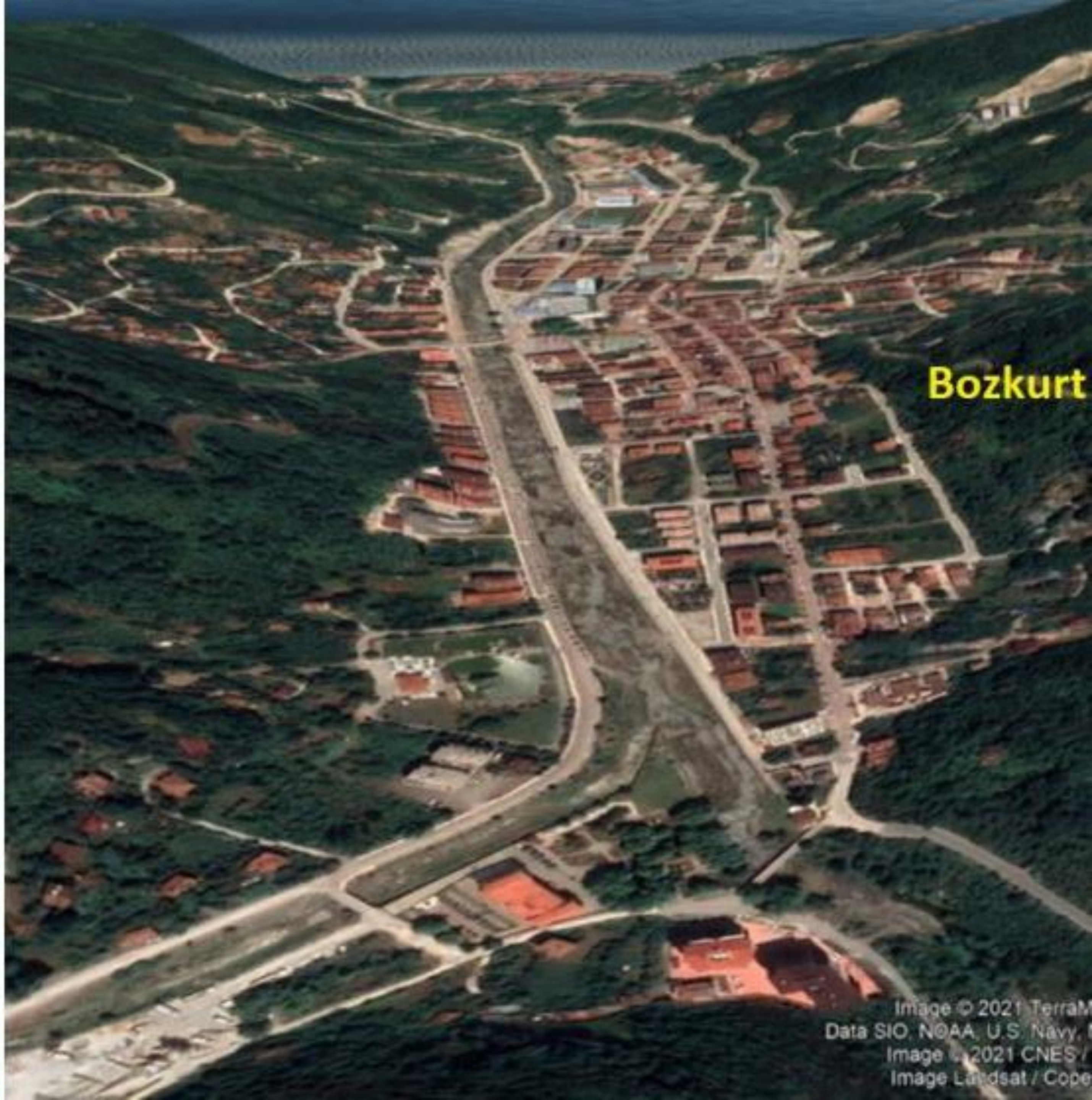

The most
preventive measure
to aviod flood risks

by avoiding building in vulnerable areas prone to flooding.



How to prevent and protect this area from flash floods


Image © 2021 CNES / Airbus
Image © 2021 TerraMetrics


Bozkurt

Ezine River Basin Area : 375 km2

From zone protection to life protection

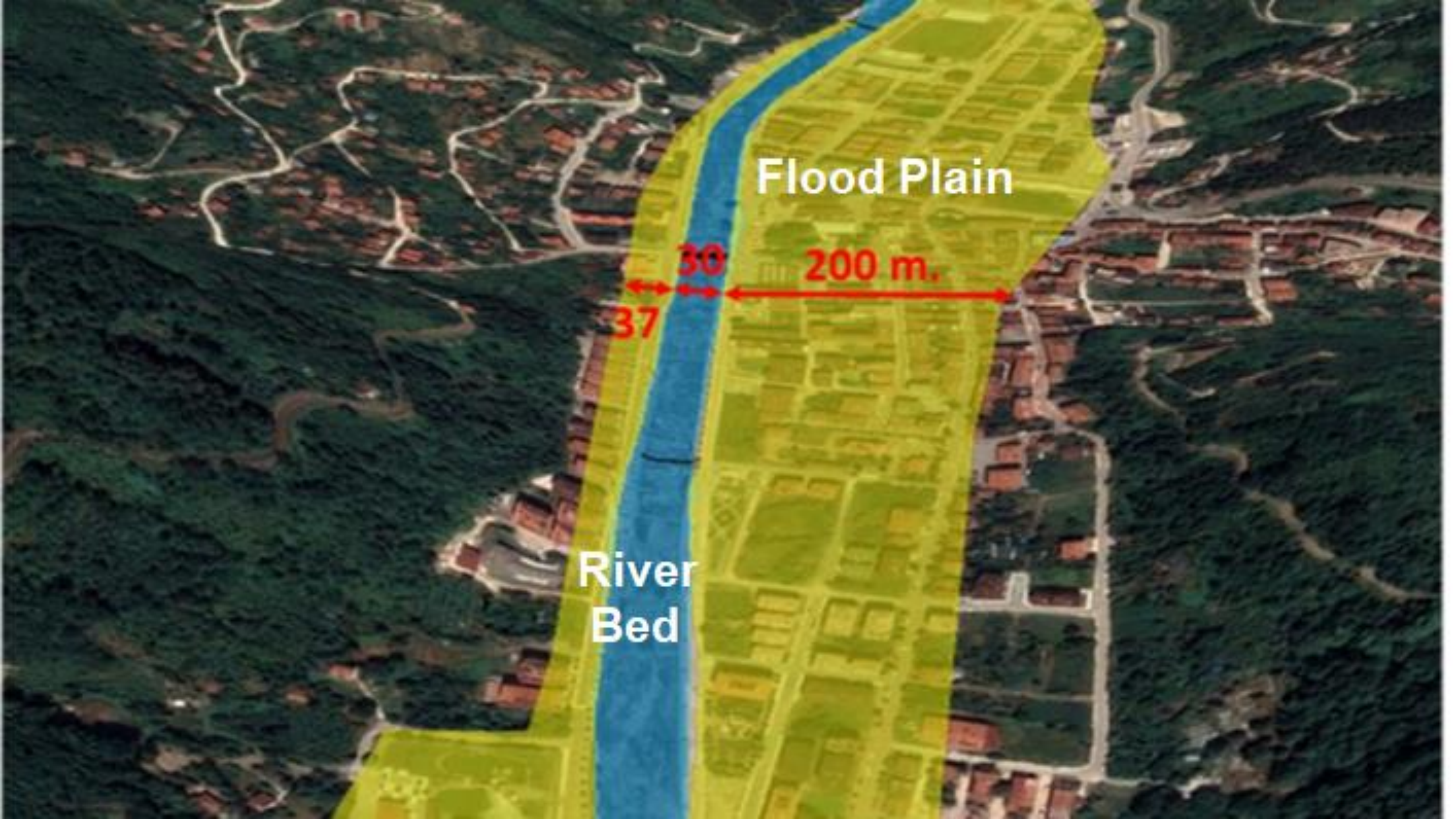
- To increase the flood awareness,
- To forecasts and warnings

Flash Floods forecasting methodologies and early warning become more important

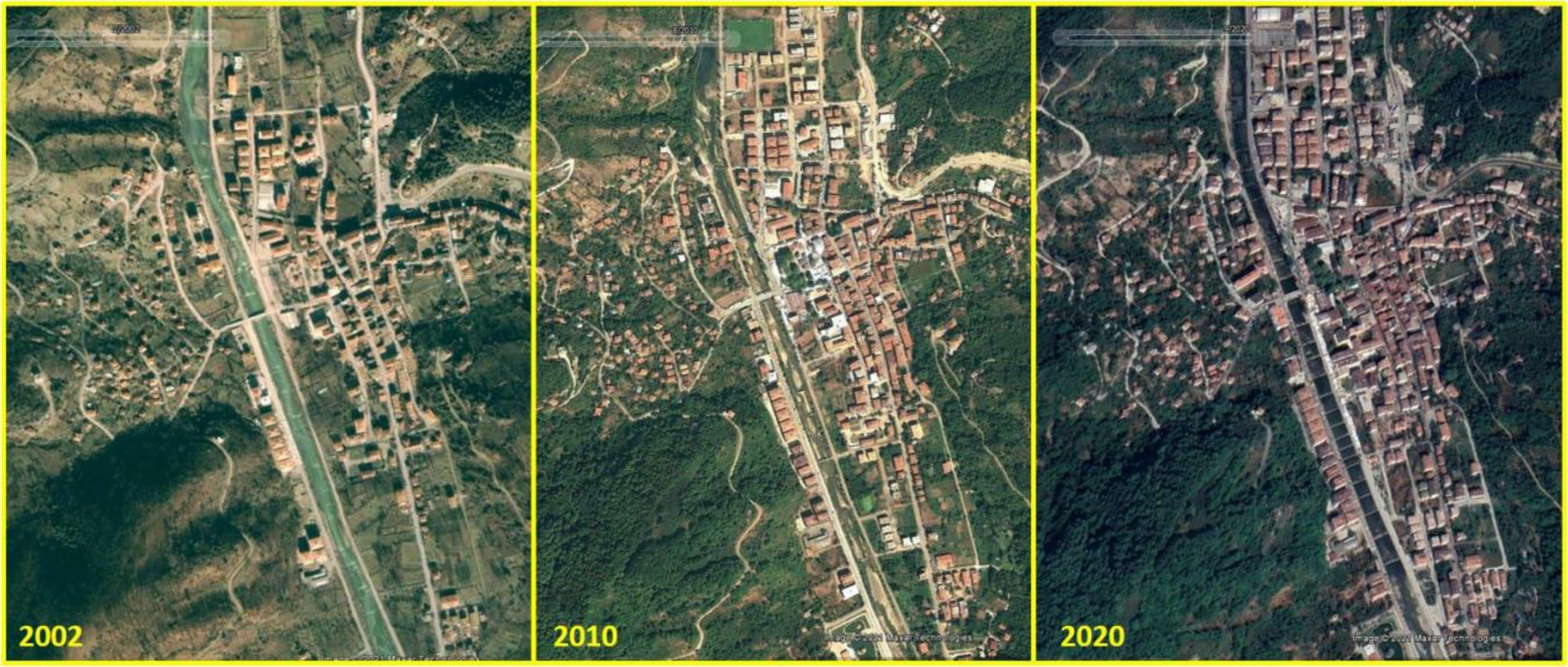
- <u>11.08.2021 Bozkurt flood incident reveals how vital the early warning system is.</u>
- <u>It is known that heavy rain started around 07:00 and lasted for about 4 hours.</u>
- <u>It is thought that the peak flow rate of the flood passed through Bozkurt district center at noon.</u>
- <u>There is a period of at least 2-3 hours between the heavy rain that causes the flood and the peak flood flow.</u>

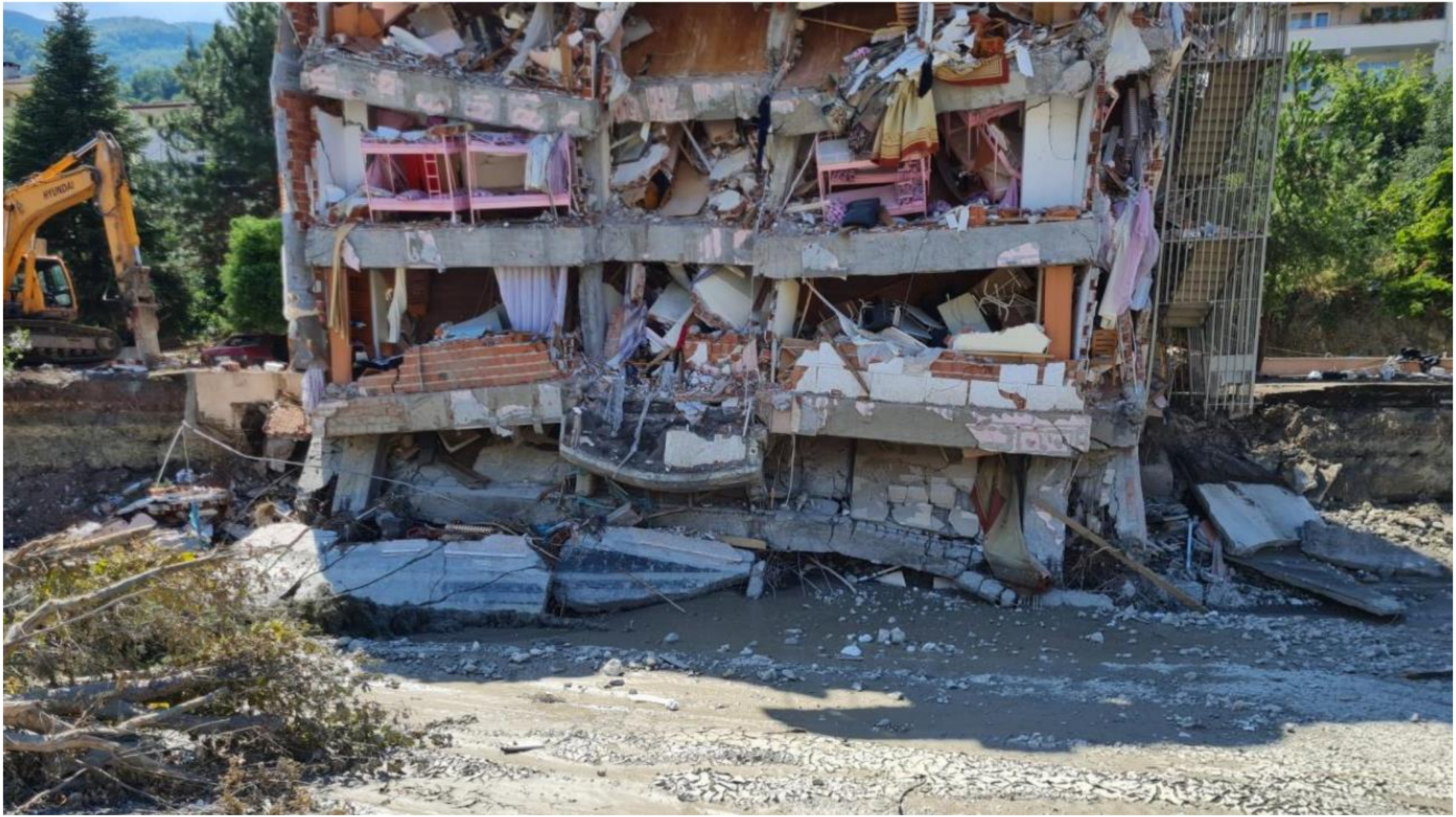
Obstacles to taking disaster preventive measures against floods

Where the water management face difficulties for Integrated Flood Management ?

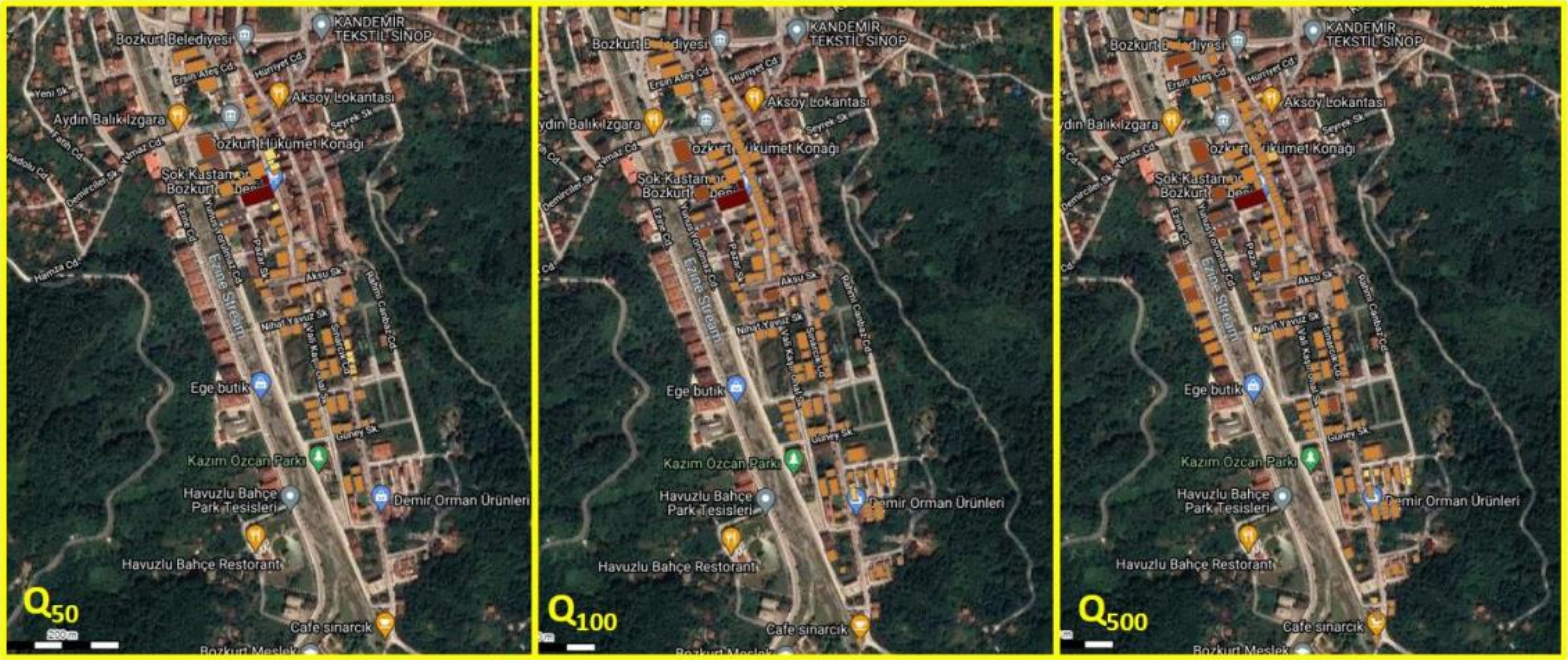

Flood Plain
30
200 m.
37
River
Bed

How can you protect the flood plain?




HYUNDAI

Although **there is a flood risk assesement map**- Bozkurt City



FOTOĞRAF 9: Q_{50}, Q_{100}, Q_{500} RİSKLİ YAPILAR HARİTALARI

New apartments have been built after risk assesement map since 2019

Political and social dimensions of flood risk reduction

Politics of the flood risk and management

the public perception of risk

- <u>the public perception of risk</u> must be in the **centre of attention,**
- In fact, perception (<u>the level of a flood risk perceived by the society)</u> often does not coincide with the flood risk level determined by the experts

Major Problem

- People underestimating the flood risk is a major problem and a challenge in managing it.

Lack of awareness

- One major aspect of the lack of awareness is the public's lack of knowledge on potential risks and impacts of flooding.
- This lack of understanding(in connection with poverty) can lead to a lack of preparedness and a lack of willingness to take steps to protect themselves and their property from flood risks.
- This also contributes to another aspect of lack of awareness which is the public's understanding of the steps they can take to prepare for and respond to a flood event.

Additionally, lack of awareness can also be a challenge

- When it comes to understanding the importance **of land use and development policies** that can help reduce the risks of flooding.
- Many individuals may not understand the **importance of zoning regulations that restrict development** in flood-prone areas.
- Furthermore, lack of awareness **importance of natural flood management measures**, such as preserving and restoring wetlands and other natural areas that can help absorb and slow down water

importance of zoning regulations

- Many individuals may not understand the importance of zoning regulations that restrict development in flood-prone areas.

Empowering the public's awareness in the face of disasters

- This can be achieved through education and outreach programs,
- Public information campaigns, and
- Community-based programs.
- It is also important to involve the community in the development of flood management plans

Limited authority

- Additionally, limited authority can make flood management difficult for different levels of government to work together effectively.
- For example, if a state government has primary responsibility for flood management, but local governments are responsible for land-use planning,
- it can be difficult to ensure that **development in flood-prone areas is being properly regulated** and that the risks of flooding are being minimized.

The gaps and weaknesses in flood risk management (FRM)

- Public awareness, and
- Power and authority weaknessses among **local authorities to implement flood risk zone plans and risk management plans.**


Görüntü tarihi: 7 Şubat 2021


Görüntü tarihi : 7 Şubat 2021
Google Eart
1985
Görüntü Tarihi: 7/2/2021 41°57'22.28"K 34°00'31.94"D yükseklik 42 m göz hizası 317 m

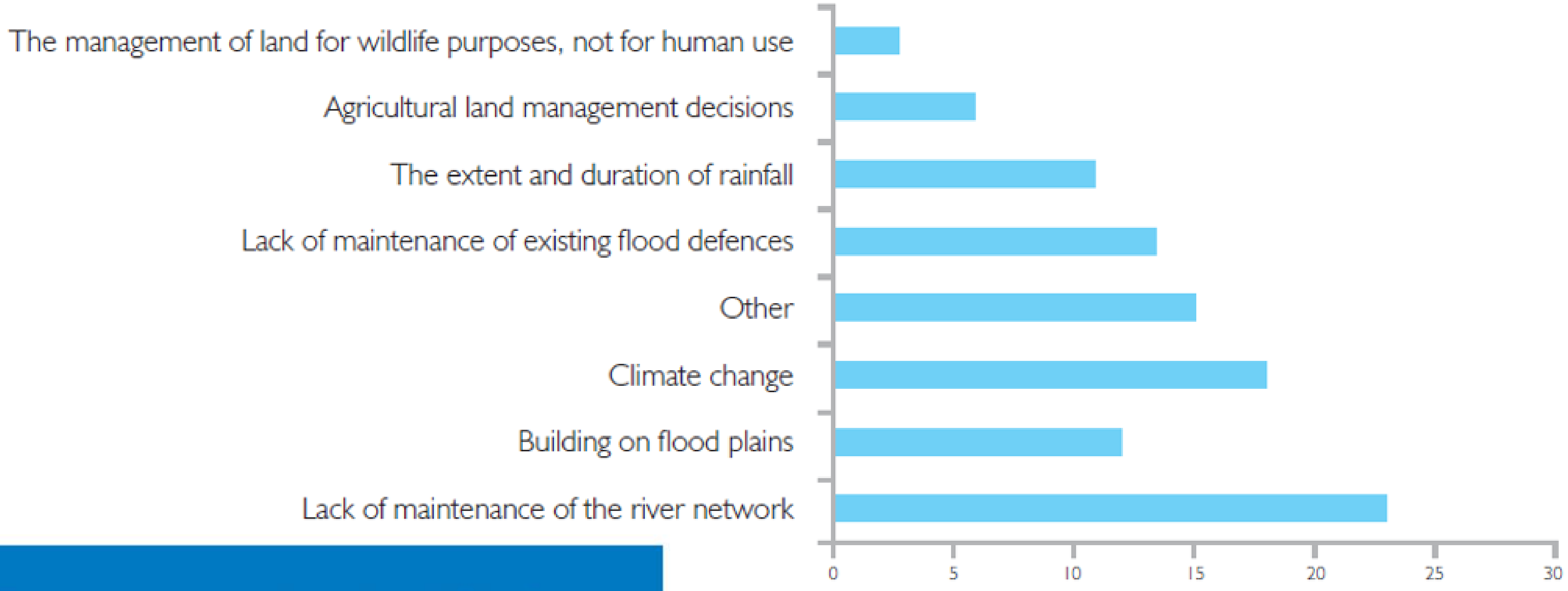

Karadeniz
Görüntü tarihi: 7 Şubat 2021
Image © 2021 CNES / Airbus
Goog

Perceptions of Flood Causes and Solutions

Understanding

- social and
- political dynamics of flood events.

Figure 2: Results from the survey question: What do you believe to be the causes of floods in the UK?



The survey results show that 41% of respondents selected land and river management options as a cause of UK floods compared to only 11% selecting rainfall.

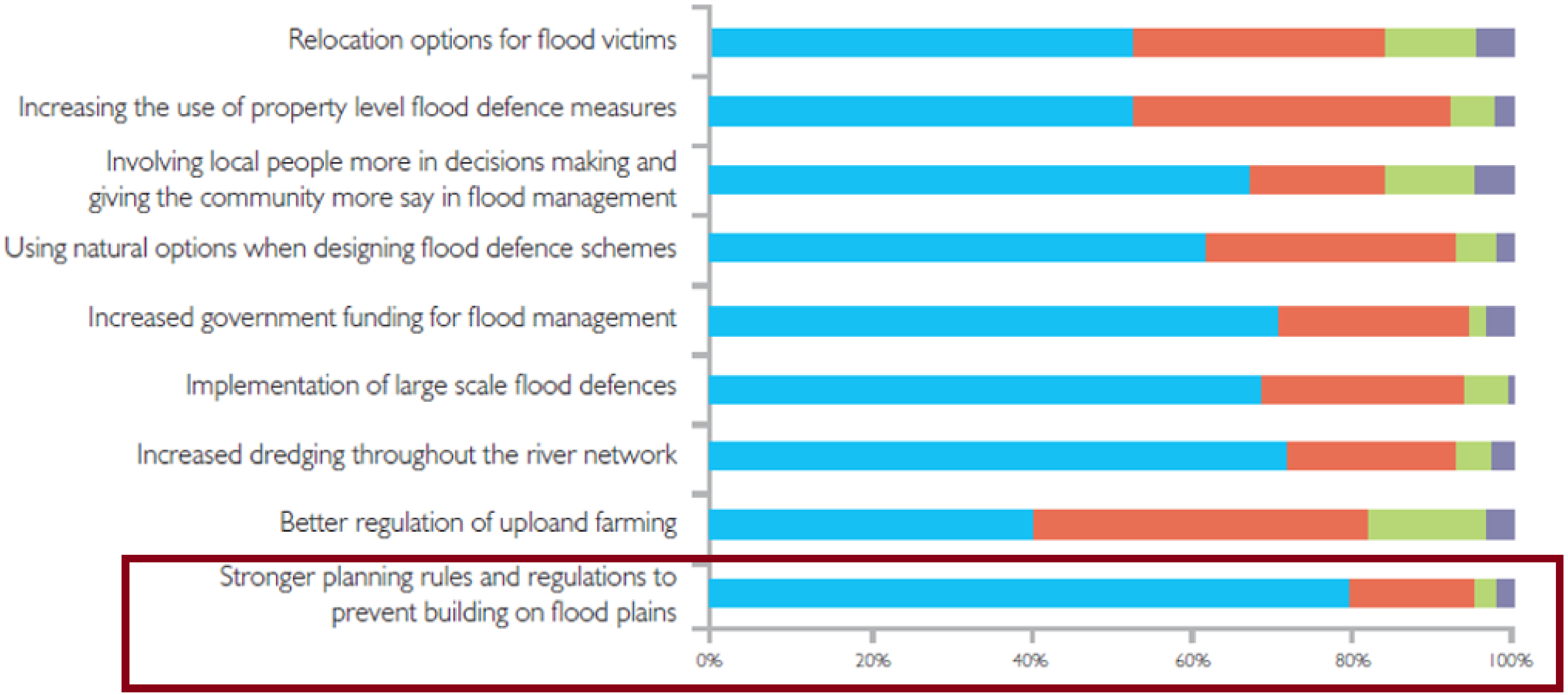
Social and Political Dynamics of Flood Risk, Recovery and Response: A Report on the Findings of the Winter Floods Project

2016

Catherine Butler
Kate Walker-Springett
Neil Adger
Louisa Evans
Saffron O'Neill

The University of Exeter, Exeter.

Figure 3: Responses to the survey questions concerning solutions to flooding in the UK, showing regional totals and overall total for comparison.



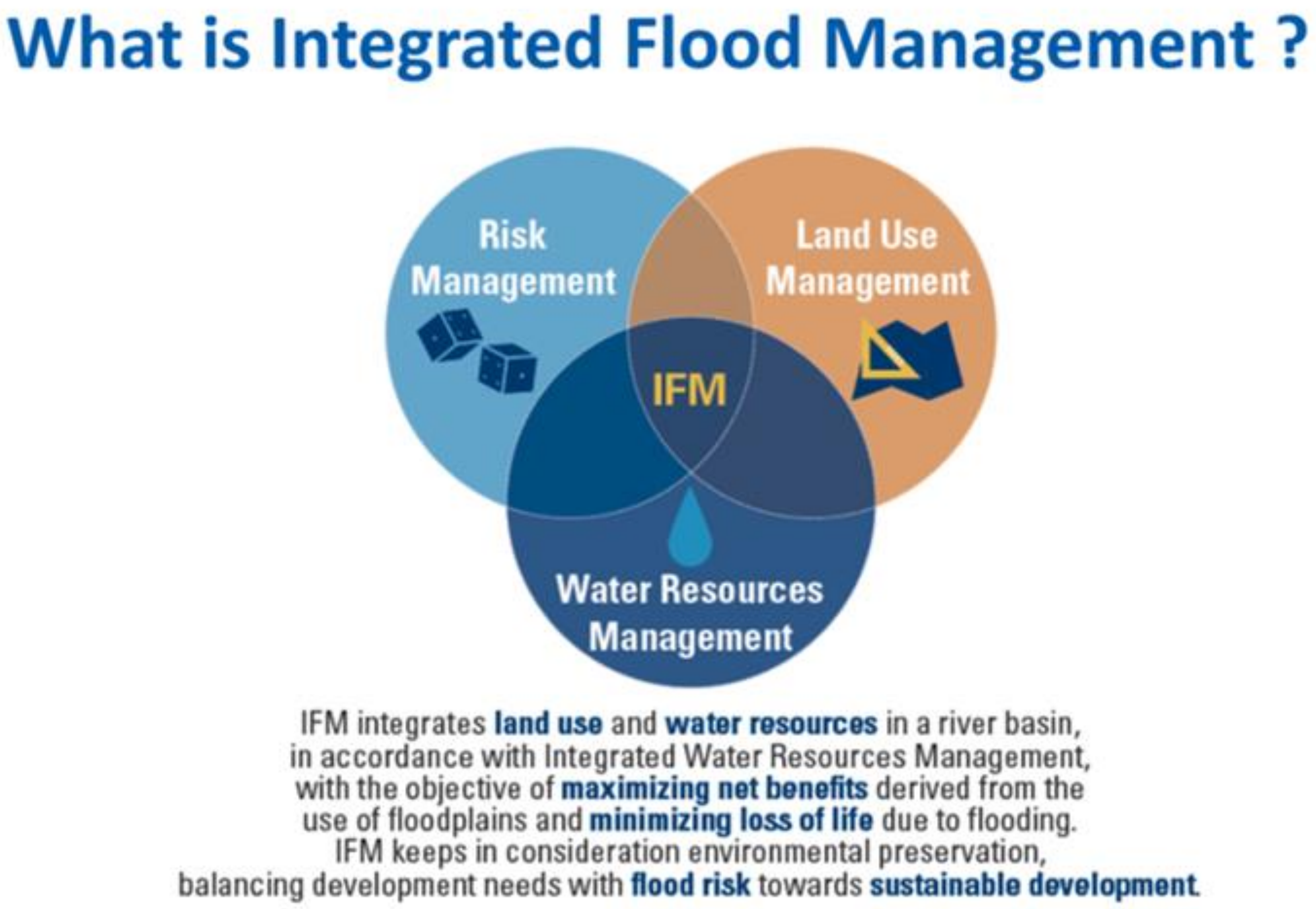
BLUE very important **RED** fairly important **GREEN** not very important **PURPLE** not at all important

Land use,Land Management and Climate Change Nexus

- *There's a need to take a very long term and strategic look at land use and land management in the context of both existing and future flood risk,*
- *in the context of climate change as well.*

In summary; Integrated Flood Management is vital

- Not only focusing to manage the localized flood problem at the specific area.
- The flood management plan should incorporate natural-based approaches at the <u>whole-river-basin level </u>for the long-term solution and sustainable development,
- Preventive,protection and preperadness



Lessons learned

2 Early warning system

Data collection and sharing, modelling and forecasting, Flash Flood Guidance System (FFGS), Coastal Inundation Forecasting Demonstration Project (CIFDP), Severe Weather Forecasting Demonstration Project (SWFDP).

4 Post flood recovery

Flood counseling, flood compensation scheme, flood insurance scheme, recovery and reconstruction planning and implementation; redevelopment fund, etc.

3 Integrated support and emergency response

Coordinated emergency response, viable evacuation system (medical-shelter-food-clean water-sanitation services, electricity-security-communication), evacuation route, evacuation center, etc.

1 Awareness at all level

Encourage the participation of users, planners and policymakers at all levels; decentralizatio of decision-making; involvement of representatives of all the upstream and downstream stakeholders

5 Better land use planning and water resources management

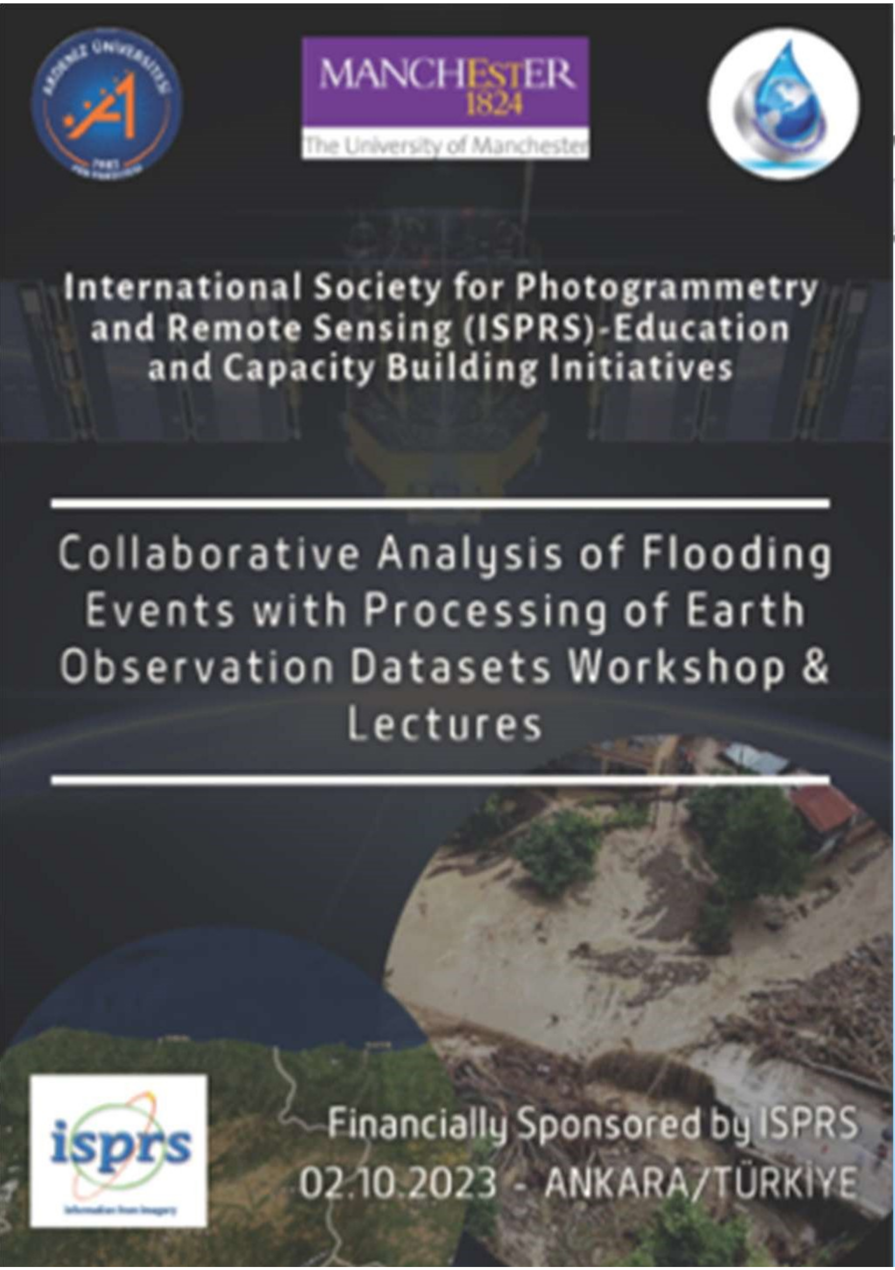
One synthesized plan with a certain common field, such as the mapping of flood hazards and risks, to enable the sharing of information between land-use planning and water management authorities; floodplain management plan; storm water management.

But implementation is difficult

- Political and social dimensions of flood risk reduction measures makes it difficult
- Therefore the overall effectiveness of Integrated Flood Management (IFM) dosent only depend on technical measures
- Heavily depends on the mindset of the politicians as well as the general public.

- Thank you

HYDRO POLITICS ASSOCIATION



CollabFlood2023

FLOOD RISK MANAGEMENT AND URBAN PLANNING: POSSIBLE CAUSES OF FLOOD DISASTERS IN TÜRKİYE

MELTEM ŞENOL BALABAN, ASSOC. PROF. DR.

METU CITY AND REGIONAL PLANNING
METU DISASTER MANAGEMENT CENTER, DIRECTOR

ODTÜ
METU
AYM
DMC

SHORT BIO

(For details: https://avesis.metu.edu.tr/mbalaban)

- **Urban Planner** (METU- CRP 98'), **Urban Designer** (METU-UD 01') and work on Climate Change Issues and Disaster Risk Management fields since 2000's
- **2009, METU CRP (PhD)** on *'Risk Society And Planning: The Case of Flood Disaster Management in Turkish Cities'*

  2011, Tohoku Depremi, Japonya

- **2012, Uni of Tokyo, Urban Engineering (PhD)** on *'Development of a GIS-based Model for Spatial Distribution of Evacuation and Temporary Shelter Sites: Case Study of Fatih District in Istanbul'* (JICA Scholarship)
- **Research Area:** Disaster Risk Mitigation, Urban Planning and Design, Flood Risk Management in Riverine Cities, Evacuation and Temporary Shelter Planning supported by GIS techniques, Urban Risks and Regeneration Projects, Heritage Sites under disaster risks
- Lecturing in **City and Regional Planning** Dpt. @ Middle East Technical University (METU) since 2013
- Director of METU – **Disaster Management Implementation and Research Center** (dmc.metu.edu.tr) since 2018

Annual Round Meetings since 1998

*Visiting position at FEMA-US (2003), GFZ-Potsdam-Germany (2005), Nigiiata-JP (2018)

MY TALK

- Disaster statistics, climate change impacts
- Flooding and flood risk management (FRM) cycle
- Examples among various countries regarding FRM
- How about Türkiye? Case studies and common mistakes regarding spatial (land-use) planning and engineering
- Integrated flood risk management discussion



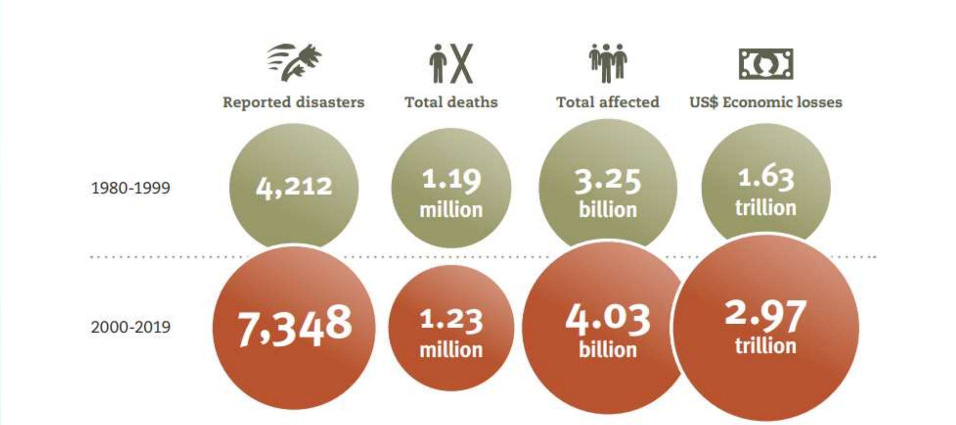




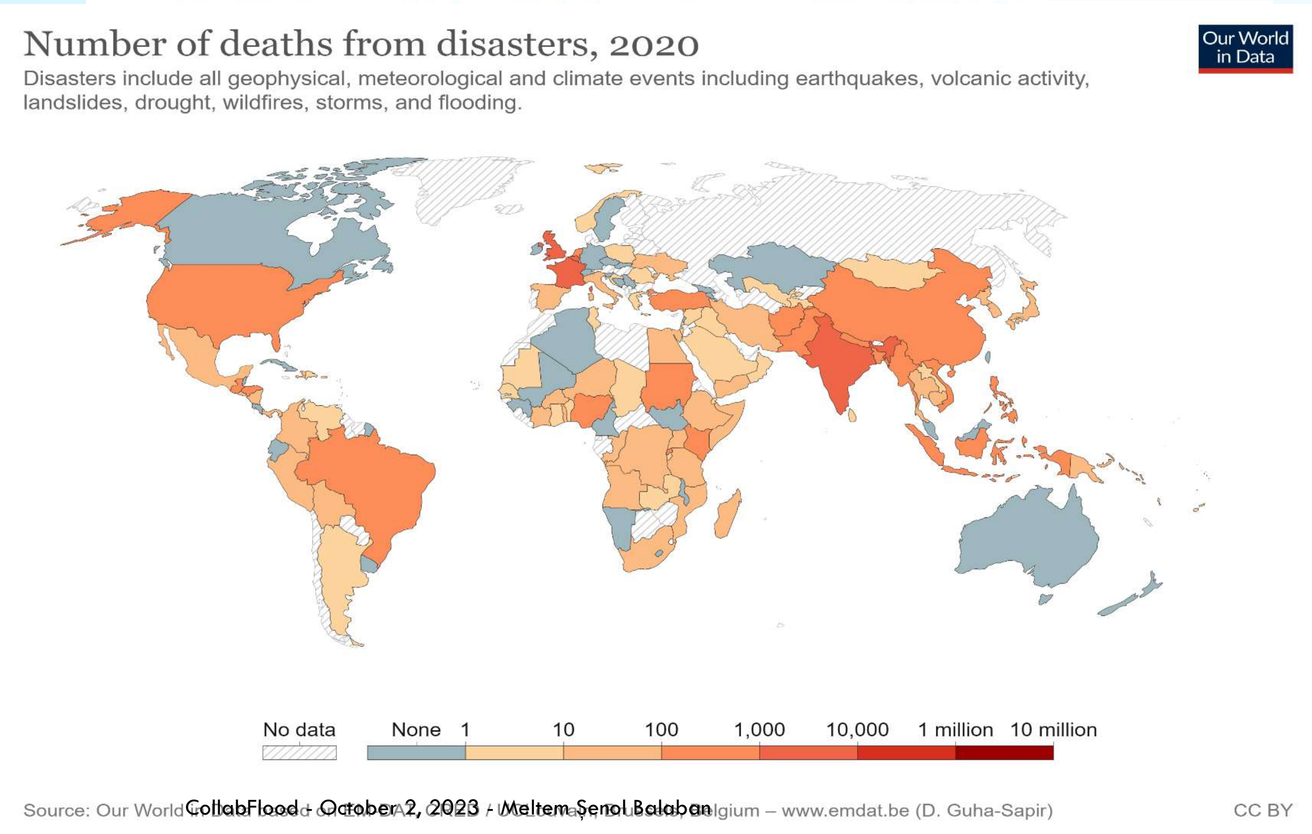

Disasters: Impacts changing and transforming…

55% of world population lives in urban areas and it’s expected to rise coming years.

Today highly populated and dense settlements around the world are exposed to multi-hazards that are increasing in frequency and intensity!!!



Impacts of disasters rising!!!



At global scale damages are increasing!

One reason might be dense and populated areas increased worldwide in urban areas.

Other reason might be climate change and crisis due to human actions, more human settlements are prone to various hazards.

Cities are both the cause and the victim of the crisis.

Source: https://gar.unisdr.org/ 2019

DISASTER RESPONSE TO RISK PREVENTION…

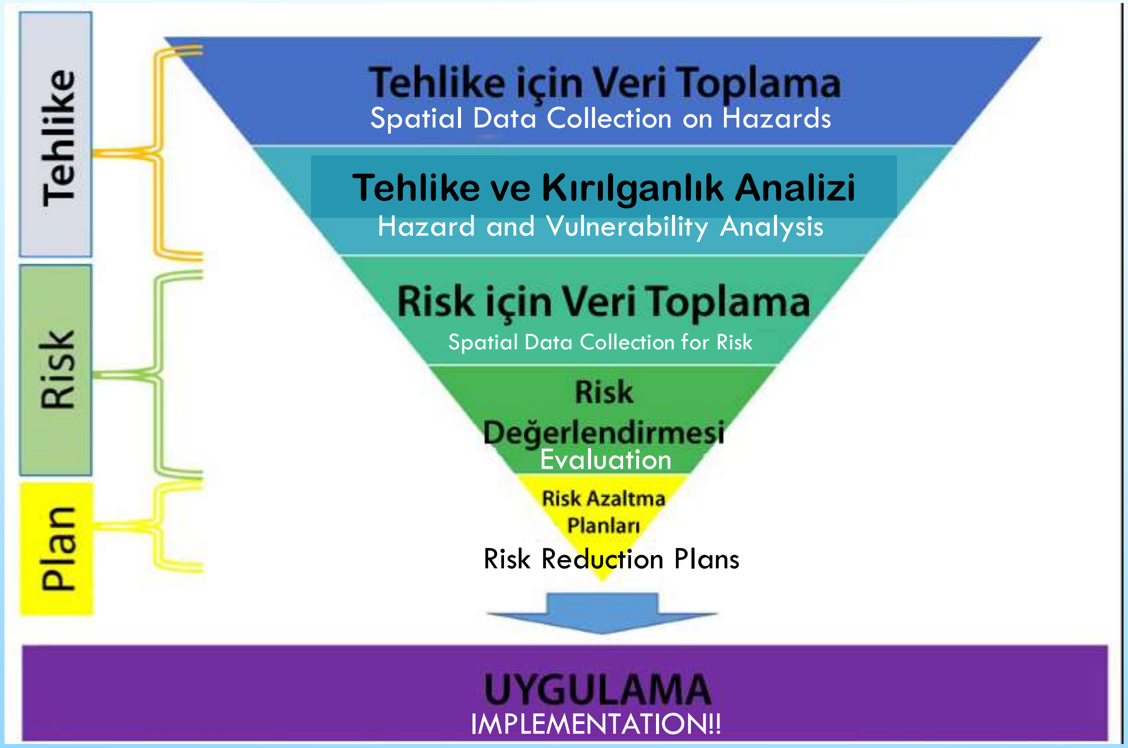
Global paradigm change focus on not only reactive actions but mainly on proactive actions! So we need to estimate possible risks with alternative scenarios as much as we can in order to take proactive risk reduction measure before it happens!!

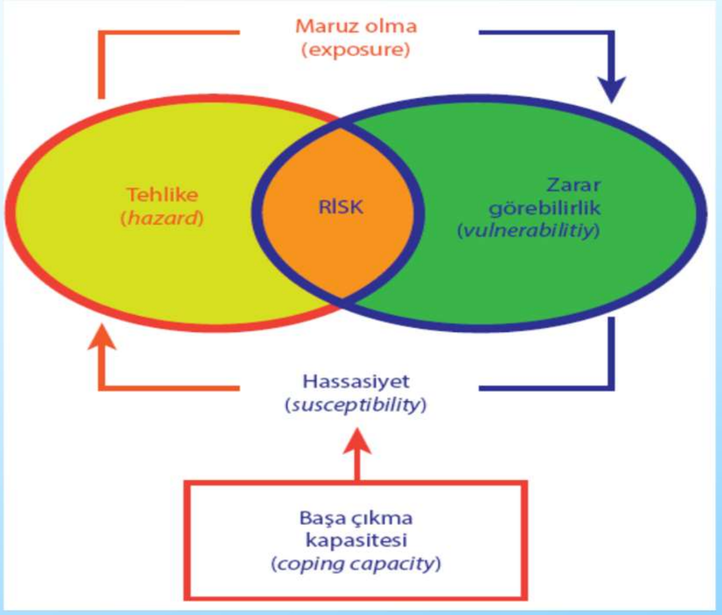
MAIN REQUIREMENTS FOR DISASTER RISK MANAGEMENT AND DISASTER RESILIENCE

Hazard

Risk

Plan






HURRICANE KATRINA
EUROPE FLOODS
HEAVY SNOWFALL IN EASTERN ANATOLIA
DROUGHT
FLOODS IN SOUTHERN ANATOLIA
MERSİN
3.11.2006
MİLLİYET
HURRICANE IN MYANMAR
DENSE FOG IN ISTANBUL
FLOODING IN THRACIA

DEFINITION OF FLOODING

“A temporary covering of land by water outside its normal confines” by munich re (1997)

As in specific terms “temporary inundation of normally dry land areas from the overflow of inland or tidal waters, or from the unusual and rapid accumulation or runoff of surface waters from any source” by FEMA (1986)

MAIN FACTORS

METEOROLOGICAL
-Excessive rainfall
-Snowmelt and snow fall
-Storm Surges
-Temperature

HYDROLOGICAL
-Soil Moisture Level
-Ground water level
-Presence of impervious cover
-Channel cross-sectional shape and roughness
-Topography, slope and basin geometry
- Presence or absence of over bank flow, channel network
- Synchronization of run-offs from various parts of watershed
- High tide and heavy swell impeding drainage
- Presence of strong ice cover on rivers

HUMAN
-Land-use changes (e.g. surface sealing due to urbanization, deforestation)
-Inefficiency or non-maintenance of sewage system; river margins clearing
-Building in flood-prone areas
-Natural stream blockages, reducing/cutting off retention areas

MAJOR TYPES

RIVER FLOODING
Due to intensive rainfalls flooding occurs when the river run-off volume exceeds local flow capacity. Drainage or flood control works upstream failing or being poorly operated may also cause river flooding.

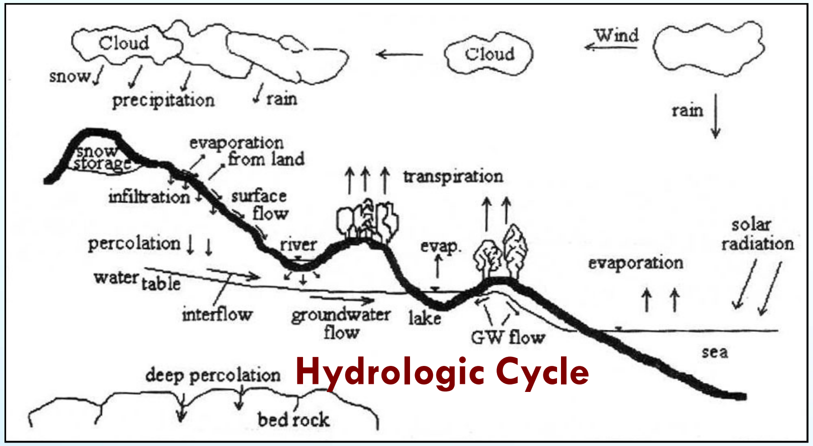
FLASH FLOODS
Due to rapid accumulation and release of run-off waters from upstream mountainous areas that can be caused by extreme rainfall, cloud bursts, landslides, the sudden breakup of a dike or failure of a flood control works (e.g. levee failure, dam breach, etc.)

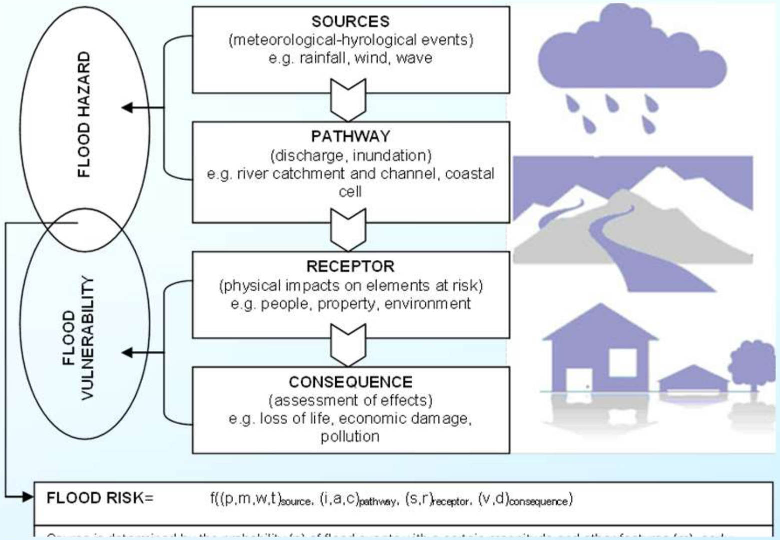
COASTAL/TIDAL FLOODS
Due to temporary rise in sea levels above normal tidal range during storm surges. Exacerbated by river flooding due to lack of discharge into the sea when sea level rises.

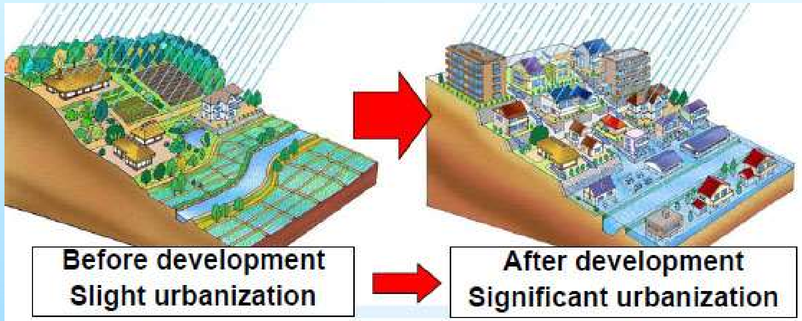
URBAN DRAINAGE FLOODING
Due to insufficient capacity of the piped system or less effective drainage into an outfall because river levels rise during extreme precipitation events. Exacerbated by saturated or impervious grounds such as roads, built surfaces that avoids excessive water to be infiltrated.

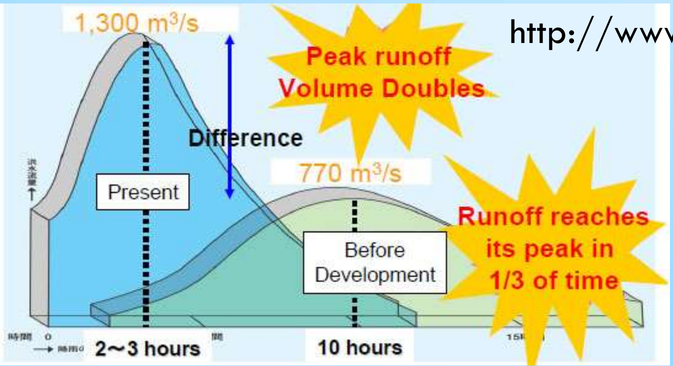
GROUND WATER FLOODING
Due to extensive periods of precipitation (weeks or months) a slow move of ground water to low-lying areas where ground water table breaks the ground water.

(Source: EEA, 2012)

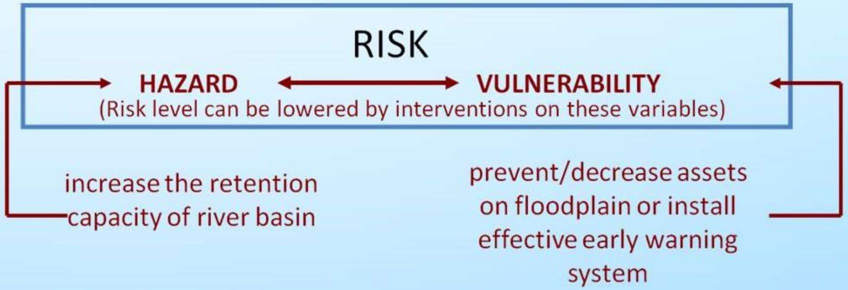


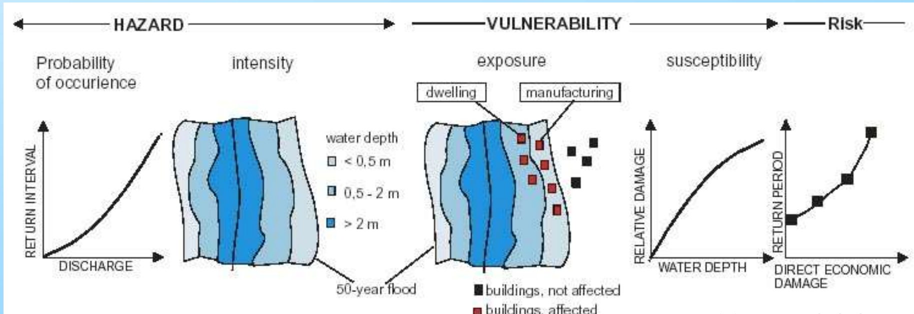






http://www.mlit.go.jp

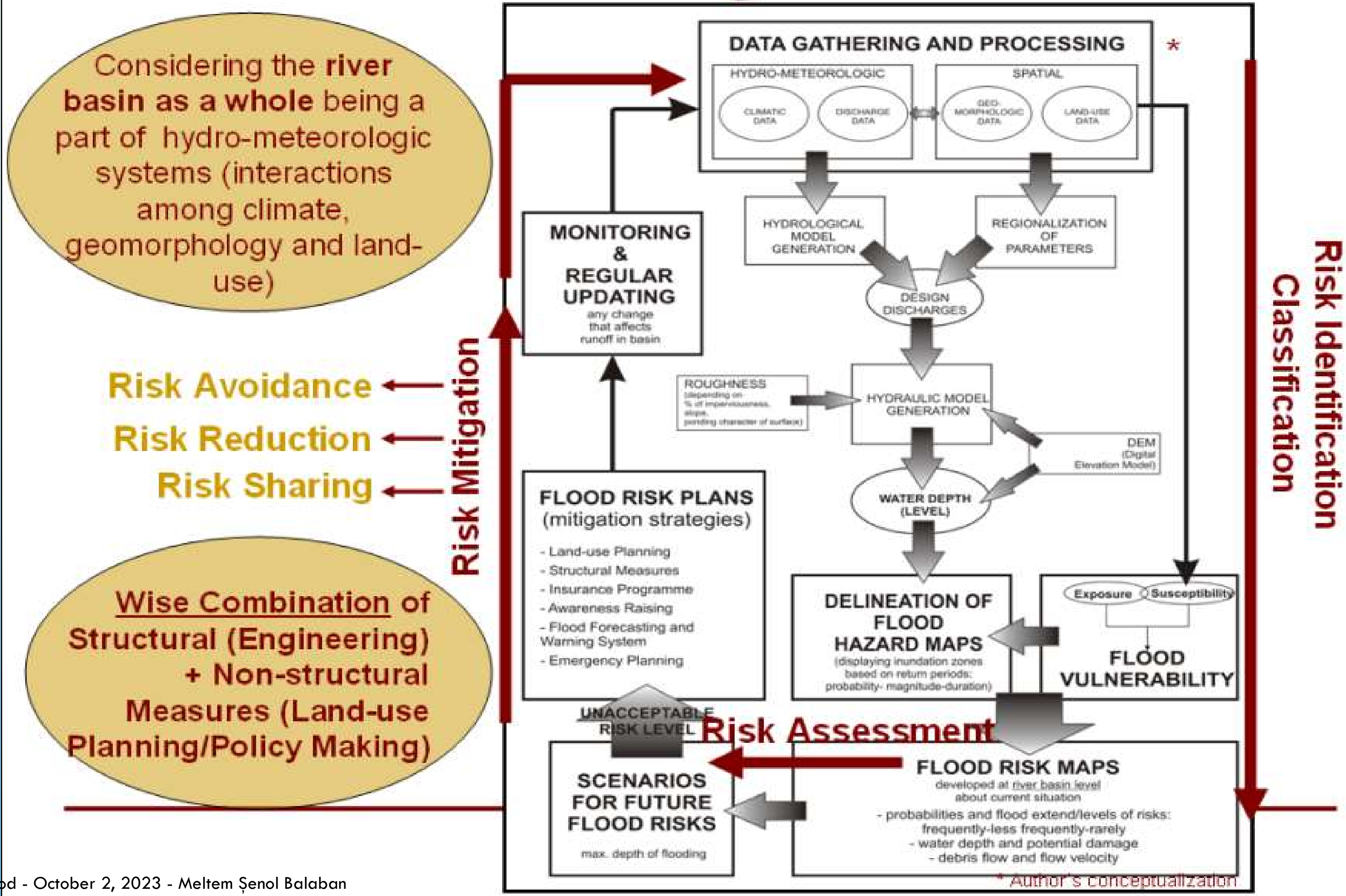




(Merz, 2004)

•ŞENOL BALABAN M., 2016, 'An Assessment of Flood Risk Factors in Riverine Cities of Turkey: Lessons for Resilience and Urban Planning', *METU Journal of the Faculty of Architecture*, 33(2), pp. 45-71. DOI: 10.4305/METU.JFA.2016.2.3

Flood Risk Management Process

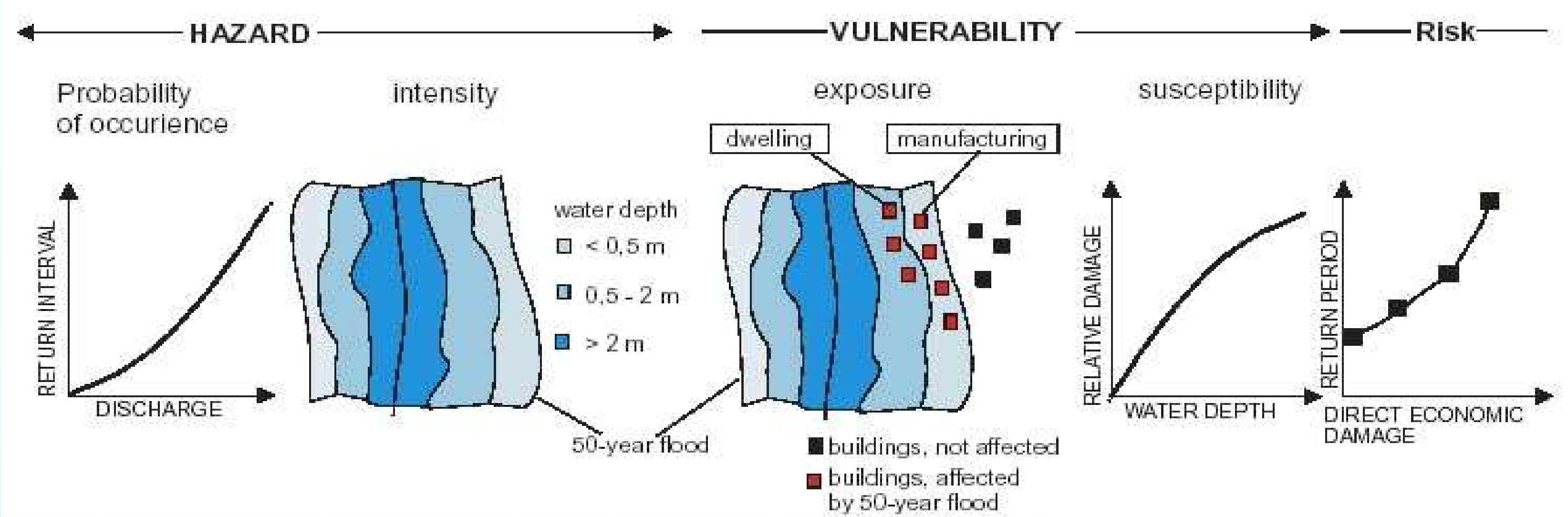


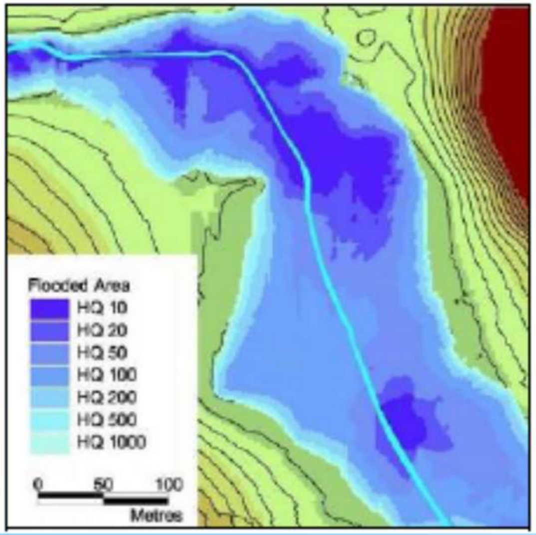
1: CALCULATING AND REPRESENTING RISKS ARE KEY STEPS

We should find way

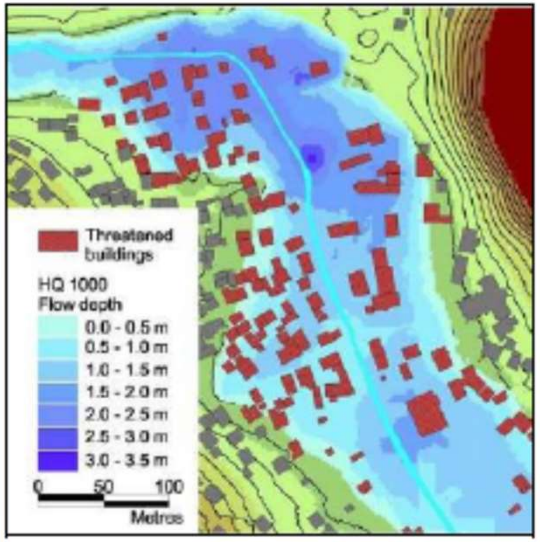
- To calculate risks as much as possible
- To be shown to decision makers, scientists and public by using scenarios, simulations so that we can take precautions, apply countermeasures in order to decrease risks in to tolerable levels

So we should prepare hazard and risk maps and use them for land-use planning and city development decisions!

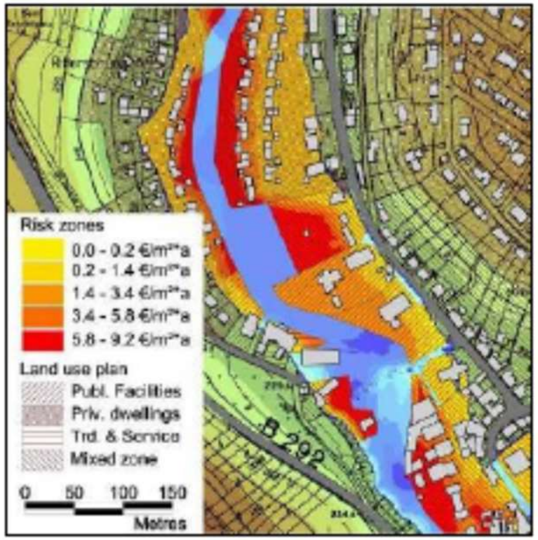




Flood Hazard Map Indicating 10, 20, 50, 100, 200, 500, 1000-Year Inundation Areas *(Merz 2004, 25)*



Flood Vulnerability Map Showing Threatened Buildings *(Merz 2004, 26)*



Flood Damage Risk Map Including Land Uses *(Merz 2004, 27)*

The zones that show various risk levels on these maps can be used for various purposes that are determined for several protection strategies towards these various risk levels. For example, some flood-plains that are frequently inundated can be used for parks, nature areas or ecological reserves, while less frequent and low risk areas can be used for residential purposes, however they ought to be constructed and located according to flood water level so as to be protected for that level of risk. Nevertheless, there is always a residual risk that we should know and prepare all the time.

2: Urban adaptation/risk reduction measures

Previously

Structural measures

Man-made engineering services to keep the consequences of an extreme event away from human-being

Non-structural measures

Policy Planning to keep human-being away from the consequences of an extreme event

Recently

Gray Infrastructure

[dams, levees, dikes, embankments, channel alterations, elevation etc.]

Physical interventions or construction measures using engineering services to make buildings and infrastructure more capable of withstanding extreme events

Green Infrastructure

[more **space for rivers** with vegetated elements; e.g. parks, gardens. wetlands., natural plantation, green roofs and walls etc.]

Such measures contribute the increase of ecosystems resilience, stop biodiversity loss, degradation of ecosystem and restore water cycle, as well as more cost effective and more feasible adaptation solution

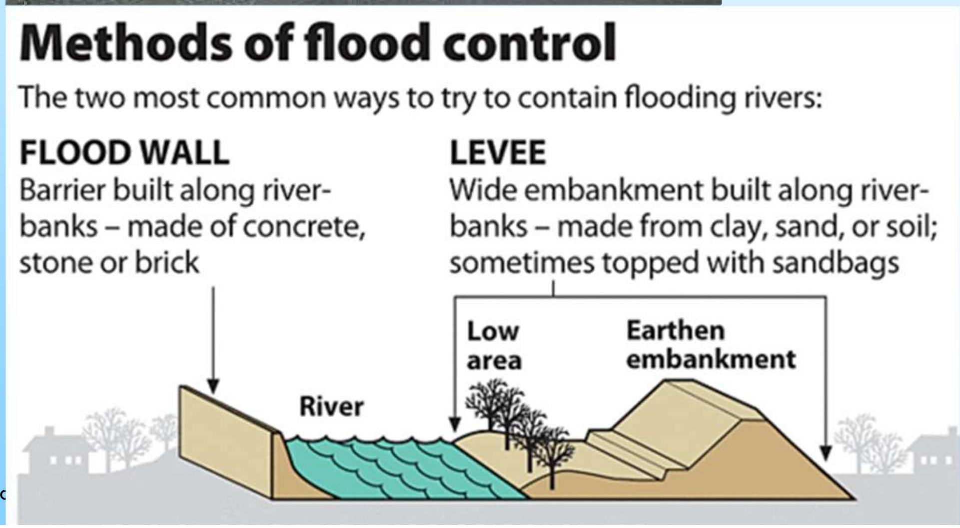
Soft Measures

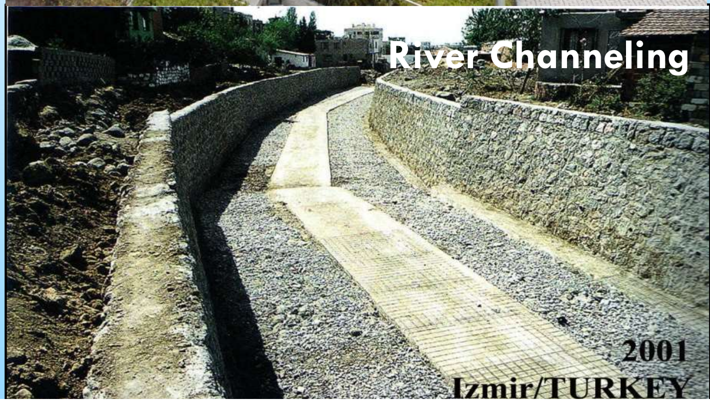
[management policies, land-use plans, programs, procedures, information dissemination, financial incentives , capacity building etc.]

Design and application of policies and procedures that can facilitate the implementation of gray or green measures.

(Source: EEA, 2012)

GRAY INFRASTRUCTURE





GREEN INFRASTRUCTURES FOR FLOOD PREVENTION

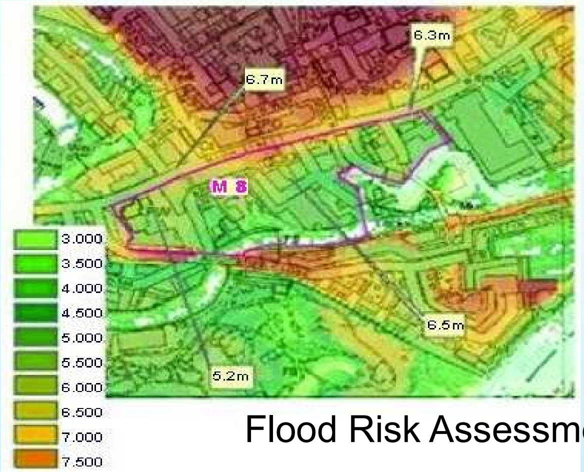
Green spaces as detention basins

Retention ponds

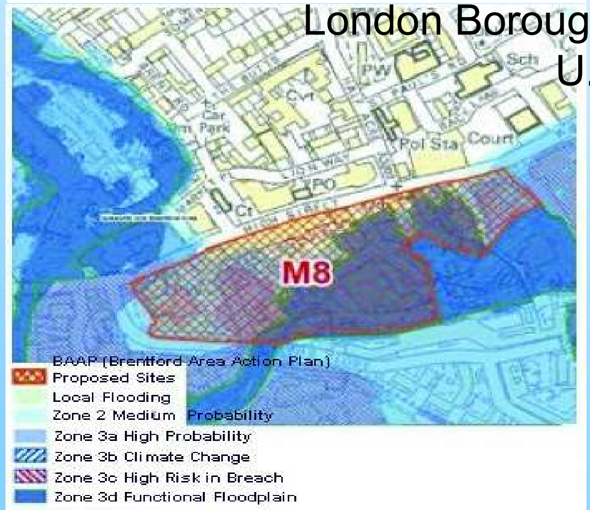
Roof Gardens

Permeable parking lots

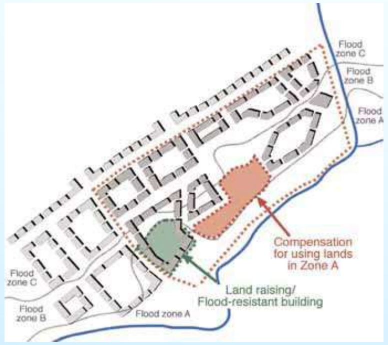
SOFT MEASURES: URBAN PLANNING

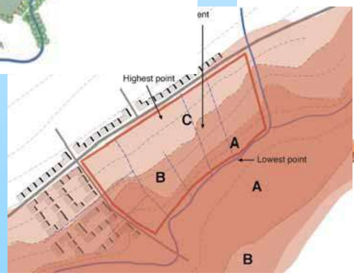


Flood Risk Assessment

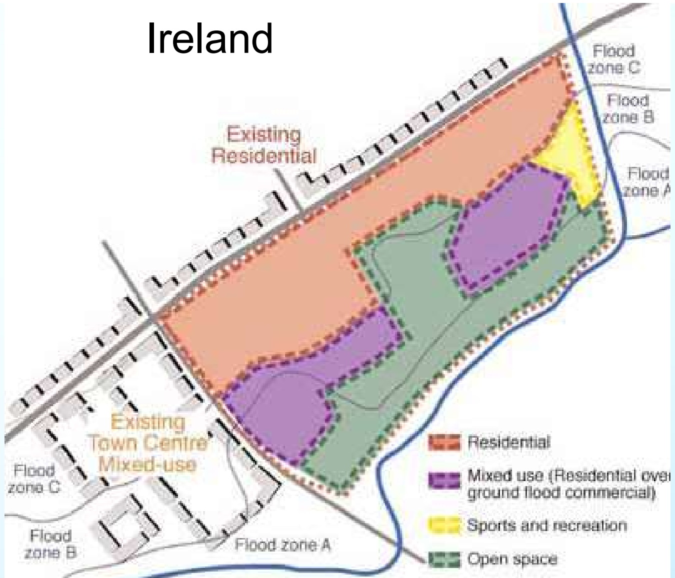


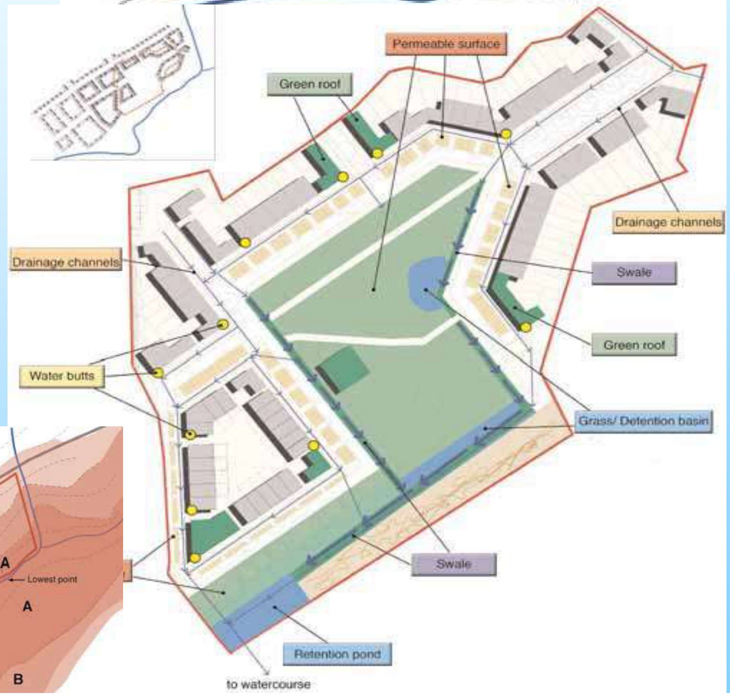
London Borough, U.K





Ireland



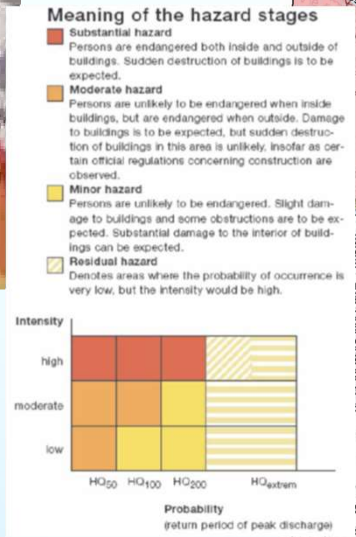


COUNTRY EXAMPLES

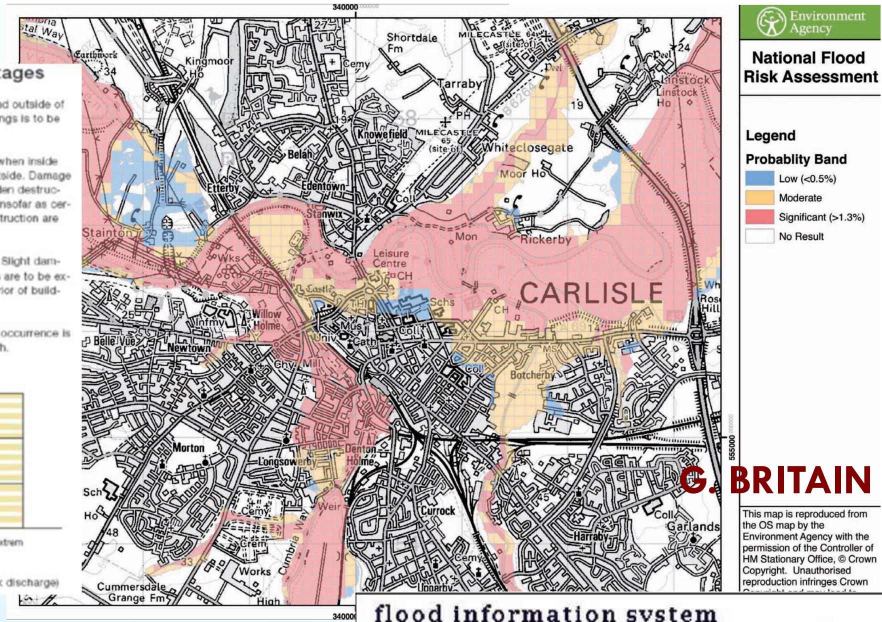
- On flood hazard and risk maps
- On landuse planning and implementations

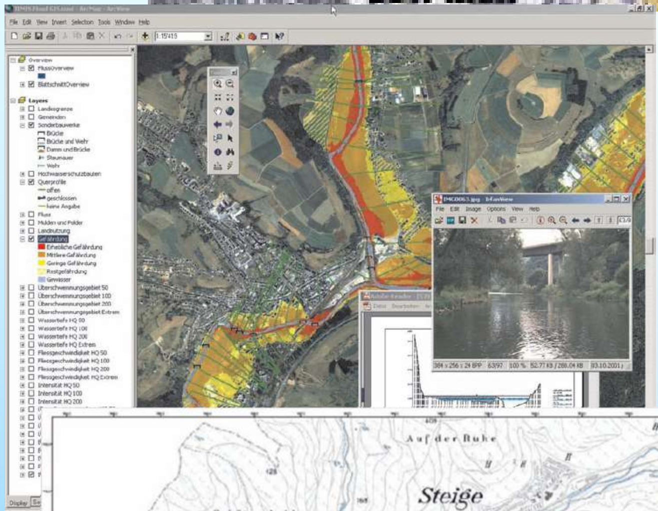
FLOOD RISK MAPS (FOR RISK IDENTIFICATION)

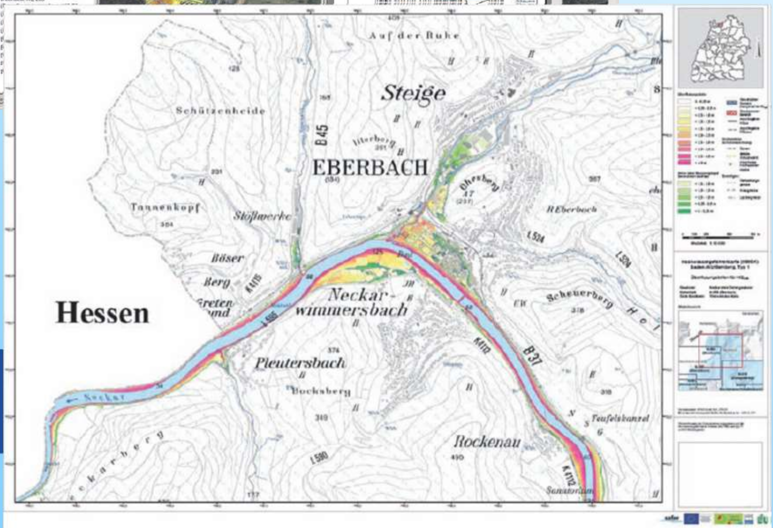
FRANCE



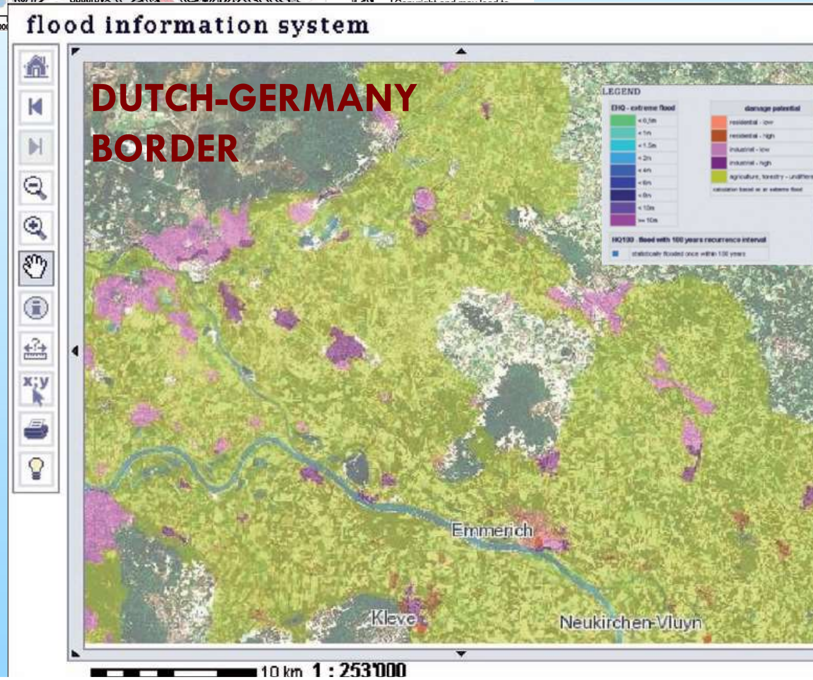
G. BRITAIN



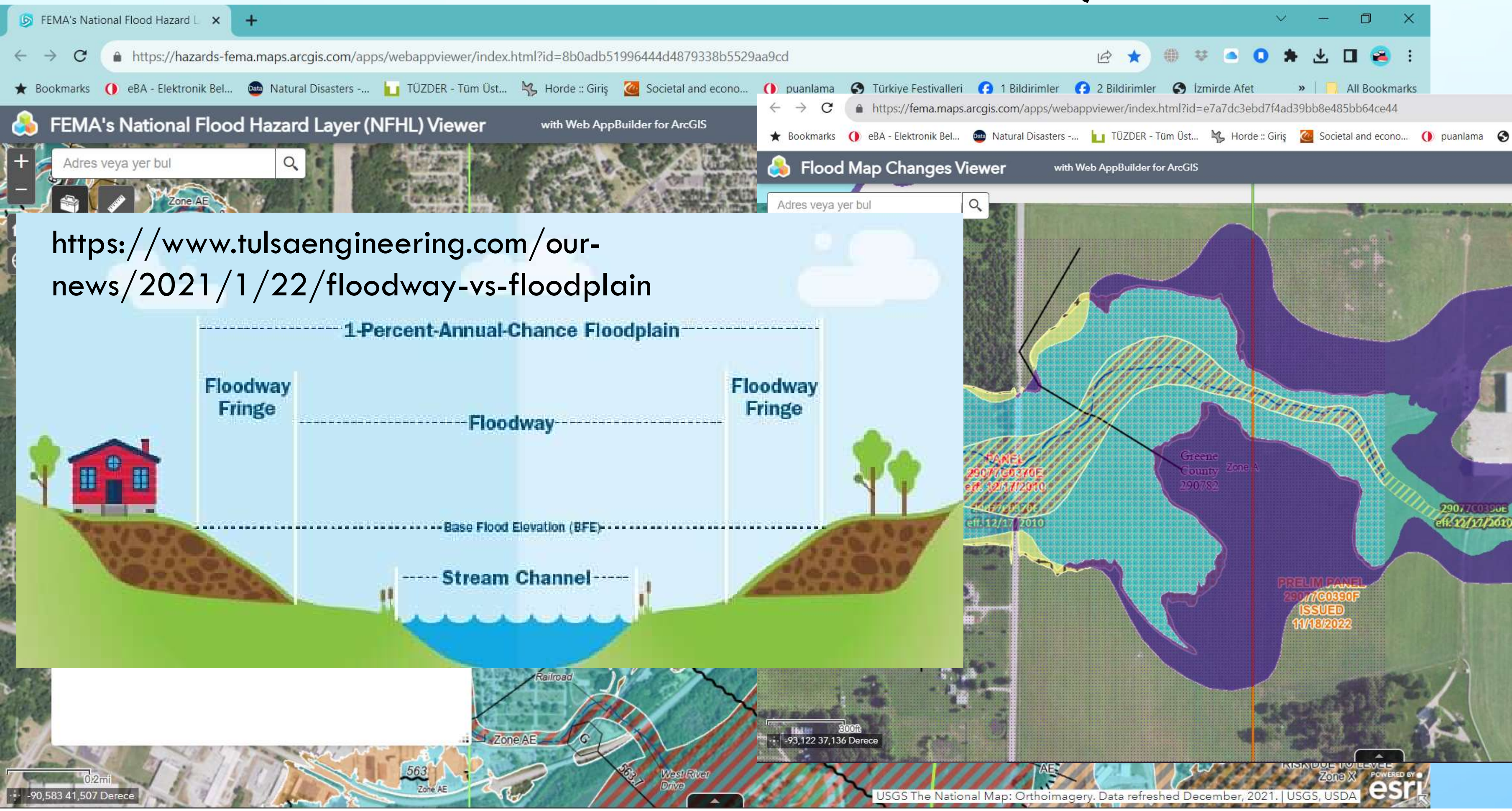




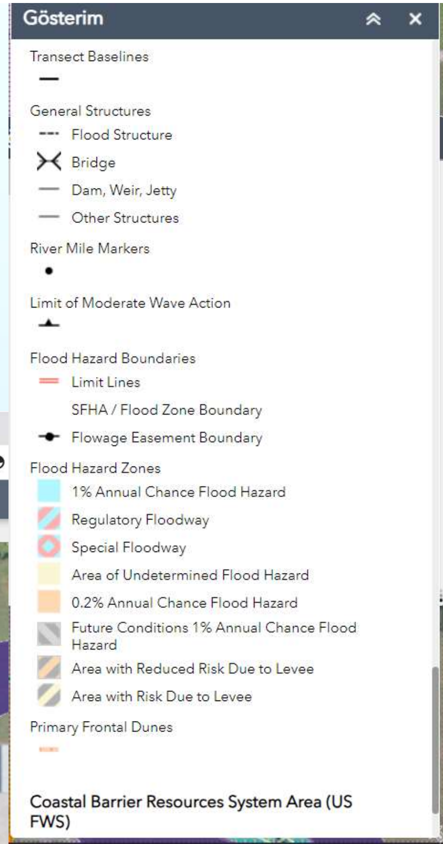
DUTCH-GERMANY BORDER

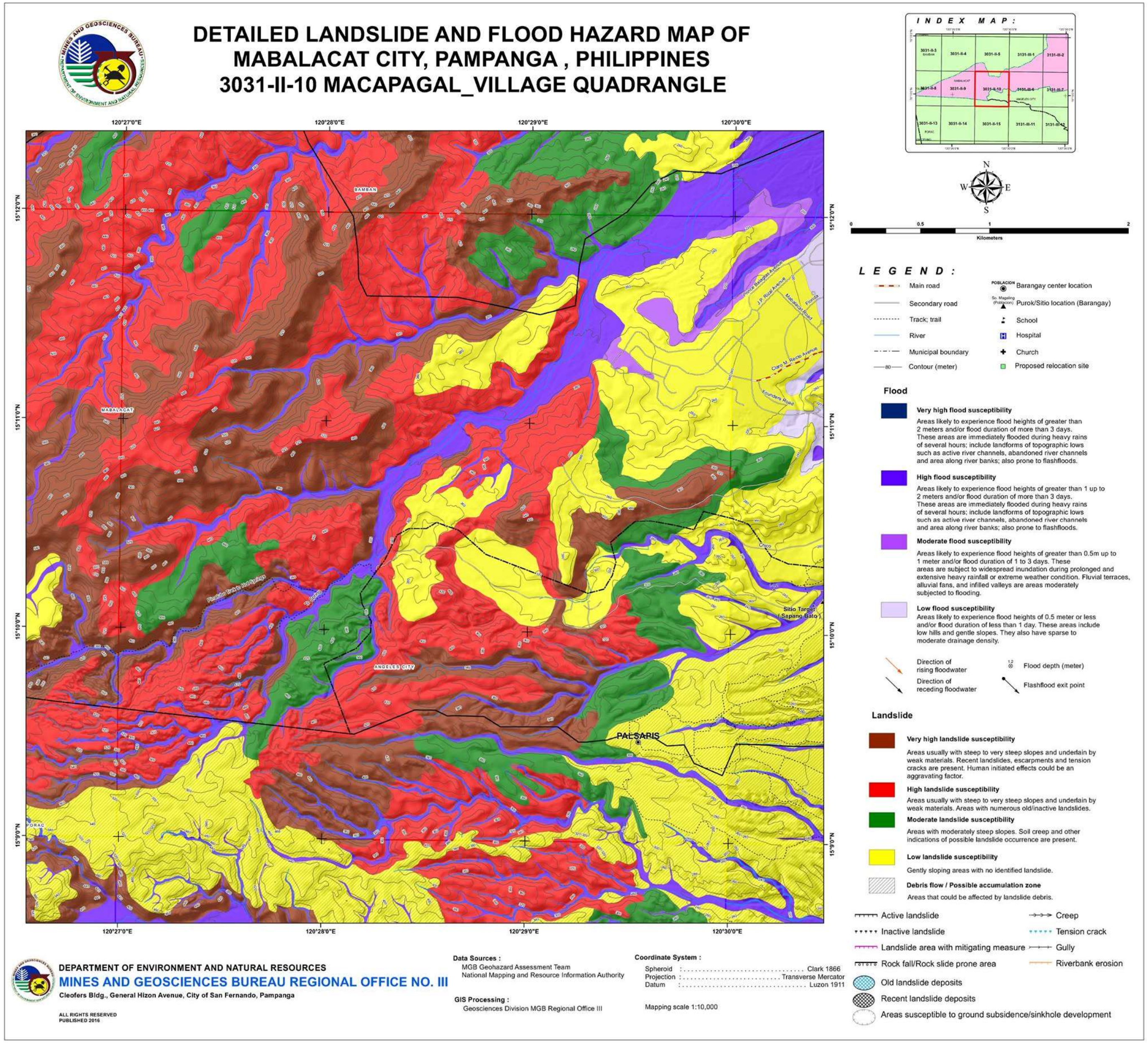


FEMA WEBSITE, U.S.



https://www.tulsaengineering.com/our-news/2021/1/22/floodway-vs-floodplain





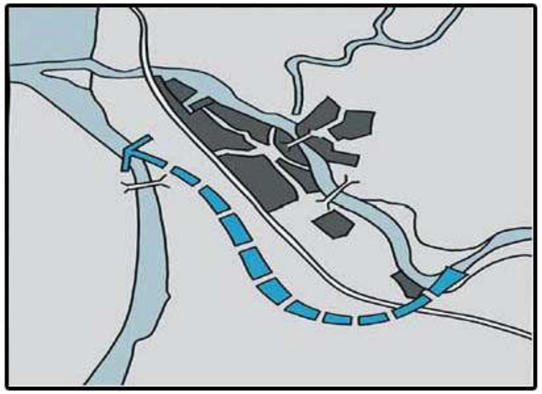
PHILIPPINES

Flood and Landslide Maps at once!!

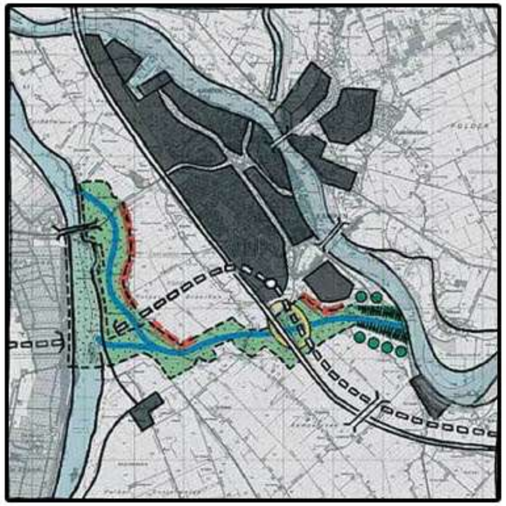
River Basin Management

and Spatial Planning Integration

THE CASE OF NETHERLANDS



(Fokken; 2005)



3. Lowering of floodplains

‘**Room for the River**’ allowing water to occupy more space on land (policy shift: 10% reserved for temporary water retention)

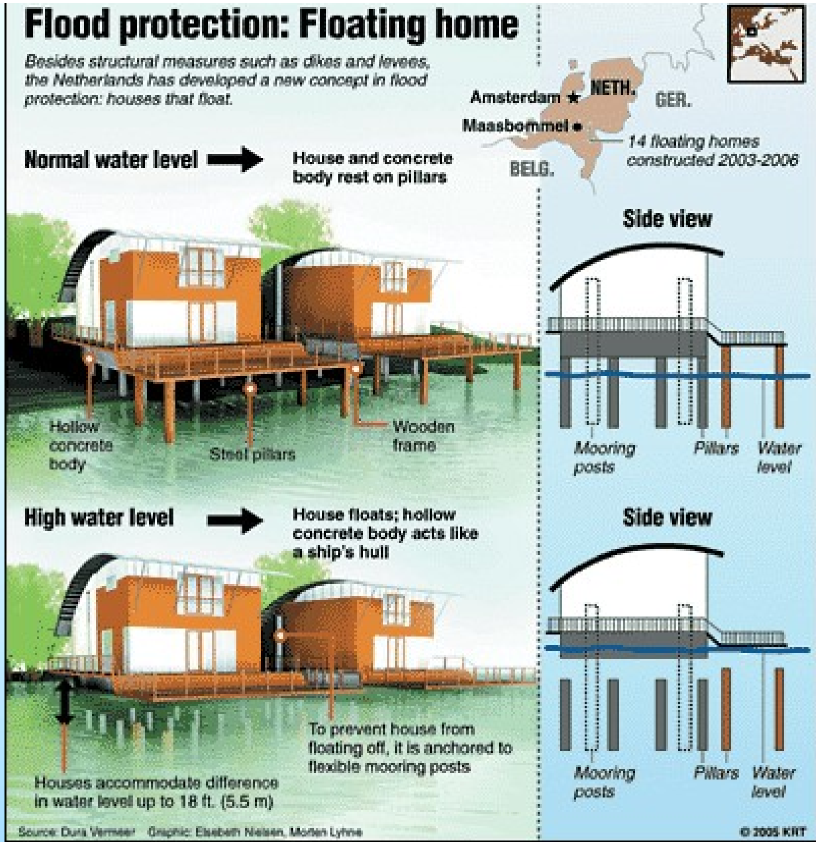
4. Remove hydraulic obstacles

5. Rising dikes (if no other options exists)

6. Dike relocation

7. Green river / bypass

8. Retention area



Source:
http://bouw.duravermeer.nl/projecten/details/1477
/maasbommel_waterwoningen_maasbommel

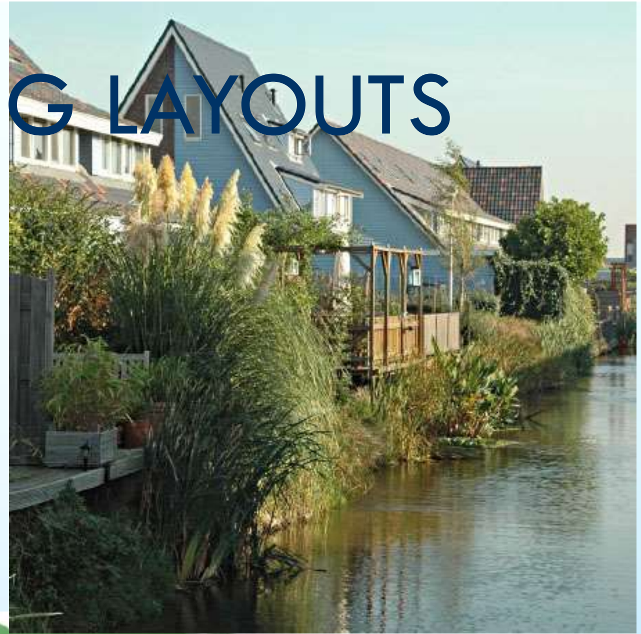
Amsterdam, The Netherlands

Source:
http://bouw.duravermeer.nl/projecten/details/1477
/maasbommel_waterwoningen_maasbommel

Source:
http://bouw.duravermeer.nl/projecten/details/1477
/maasbommel_waterwoningen_maasbommel

Netherlands

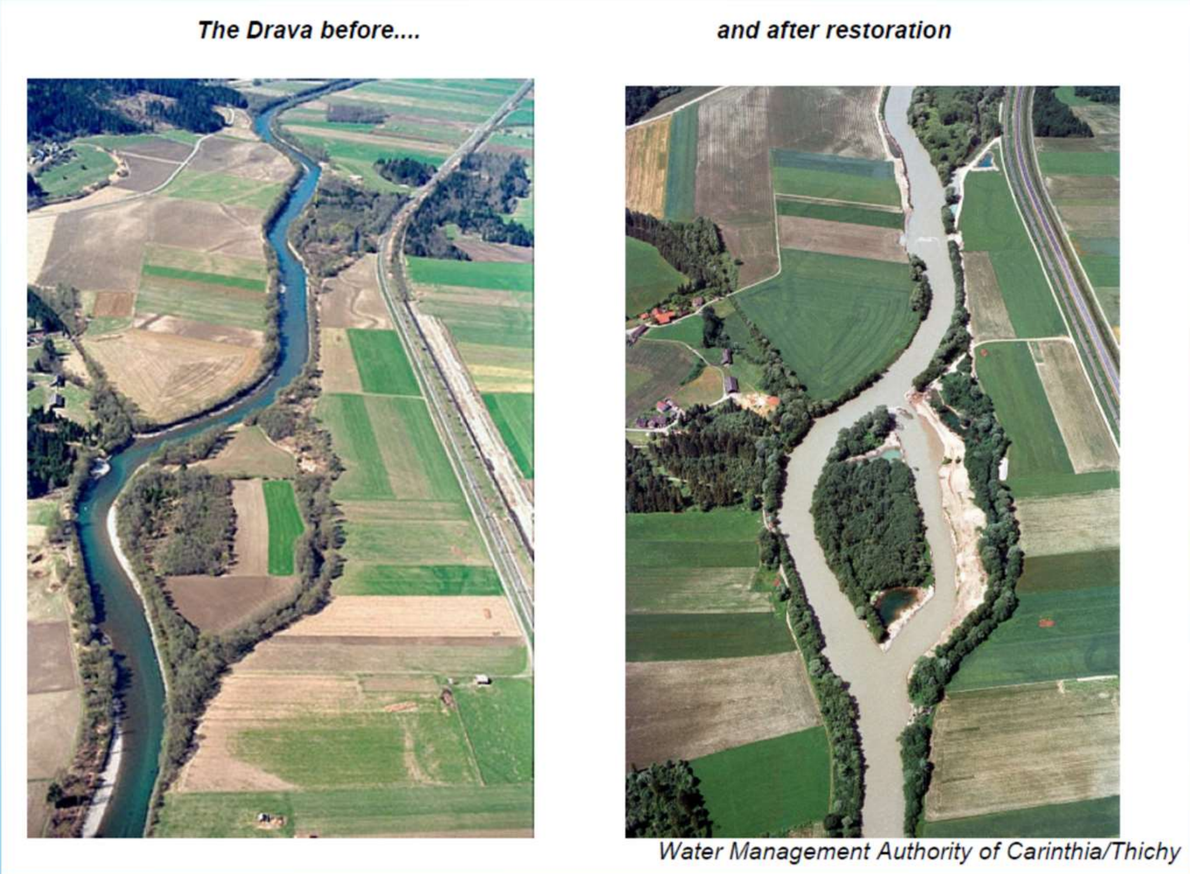
WATERFRONT HOUSING LAYOUTS



Netherlands

WATERFRONT ACTIVITIES

RIVERSIDE REGENERATION

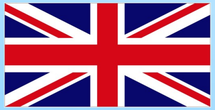


Austria

MIXED RESIDENTIAL DEVELOPMENT

Multi-developers

Sustainable drainage



United Kingdom

Netherlands

RIVER RESTORATION

http:// www.qwag.org.uk/quaggy/restoration.php

Culverted watercourse replaced with natural meandering watercourse

United Kingdom

RE-NATURALIZATION OF RIVERS

Before

After

Restoration activities

-Store flood-water temporarily & Peak discharge reduction

-Lively environment

-Ecologically sustainable

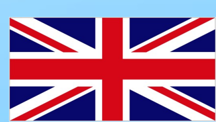
United Kingdom

FLOOD ALLEVIATION PLAN

Aerial view of Sutcliffe Park with the restored QuaggyRiver running through it

BENEFITS

- ✓ Better control over water flows
- ✓ Enhanced public open space (Paddling, Folk Festivals and Craft Fairs)
- ✓ Increased bio-diversity



United Kingdom

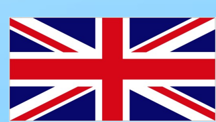
URBAN PARKS

Thames Valley Park

Combination of

lakes, islands, wetland adjacent country park with residential development

- Flood risk reduction
- Improved Amenity& Biodiversity



United Kingdom

HOUSING WITH SUSTAINABLE DRAINAGE

Sustainable Drainage is

integrated
as an amenity within
a **public space**,

creating a
local landmark and

a focus for recreation

Ireland

PUBLIC SPACES FOR DAILY USES

Flood Level Marking Monument

A small levee along the Rhine River blended with recreational area

Germany

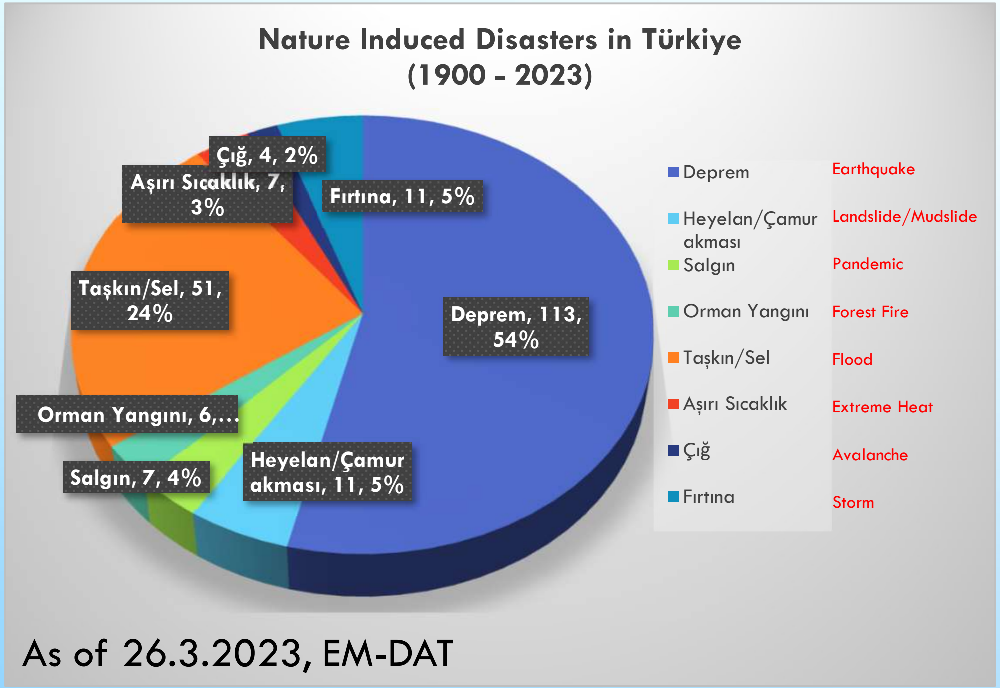
KEY REMARKS

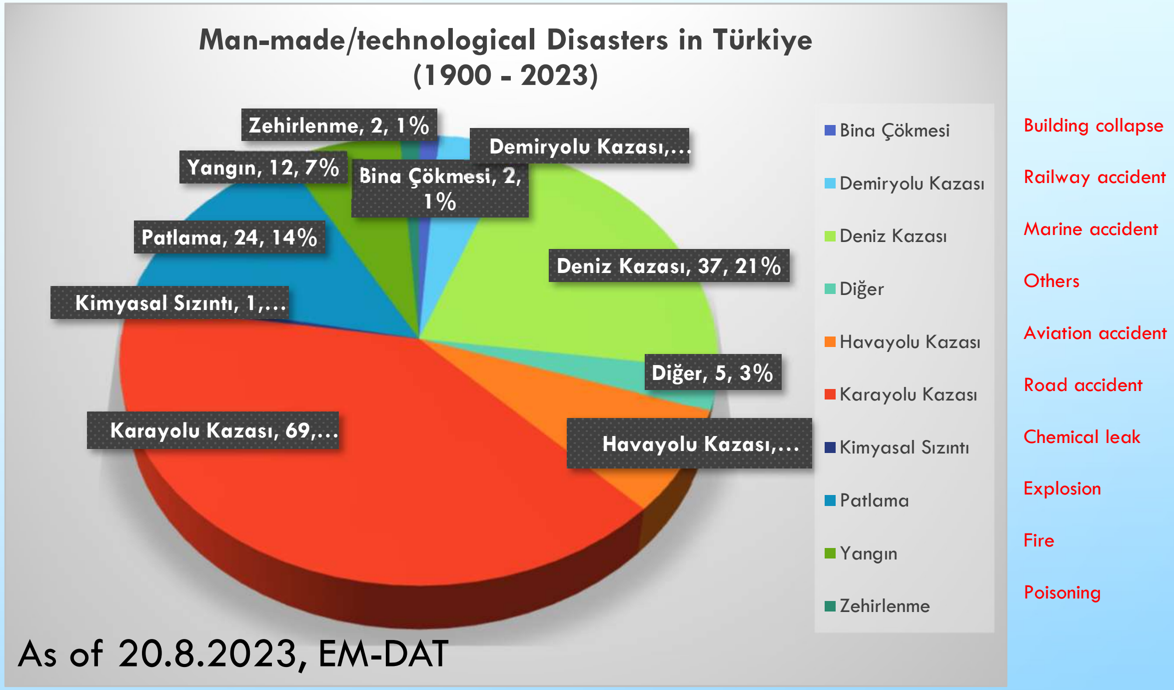
- Integrated water/flood risk management
- Watershed/river basin administration (beyond the national, regional, provincial boundaries)
- Wise combination between ‘structural and non-structural measures’ or ‘grey, green infrastructure and soft measures’
- Trending concepts in use:
  - “Room for rivers”
  - “Riverside regeneration/restoration”
  - “Re-naturalization of rivers”
  - “Sustainable drainage”, “separated rainwater and sewage drainages”
  - “Water plazas”, “floating houses”, “green roofs, walls”
  - “Adaptable flood defenses”
  - Nature-based solutions

FLOOD RISK FACTORS OF RIVERINE CITIES OF TR

https://www.tarimorman.gov.tr/SYGM/Belgeler/T%C3%BCrkiye%20Su%20Kaynaklar%C4%B1%20Haritas%C4%B1-07.07.2020/T%C3%BCrkiye%20Su%20Kaynaklar%C4%B1%20Haritas%C4%B1.jpg

DISASTER PROFILE OF TURKEY





EM-DAT includes all disasters from 1900 until the present, conforming to at least one of the following criteria:

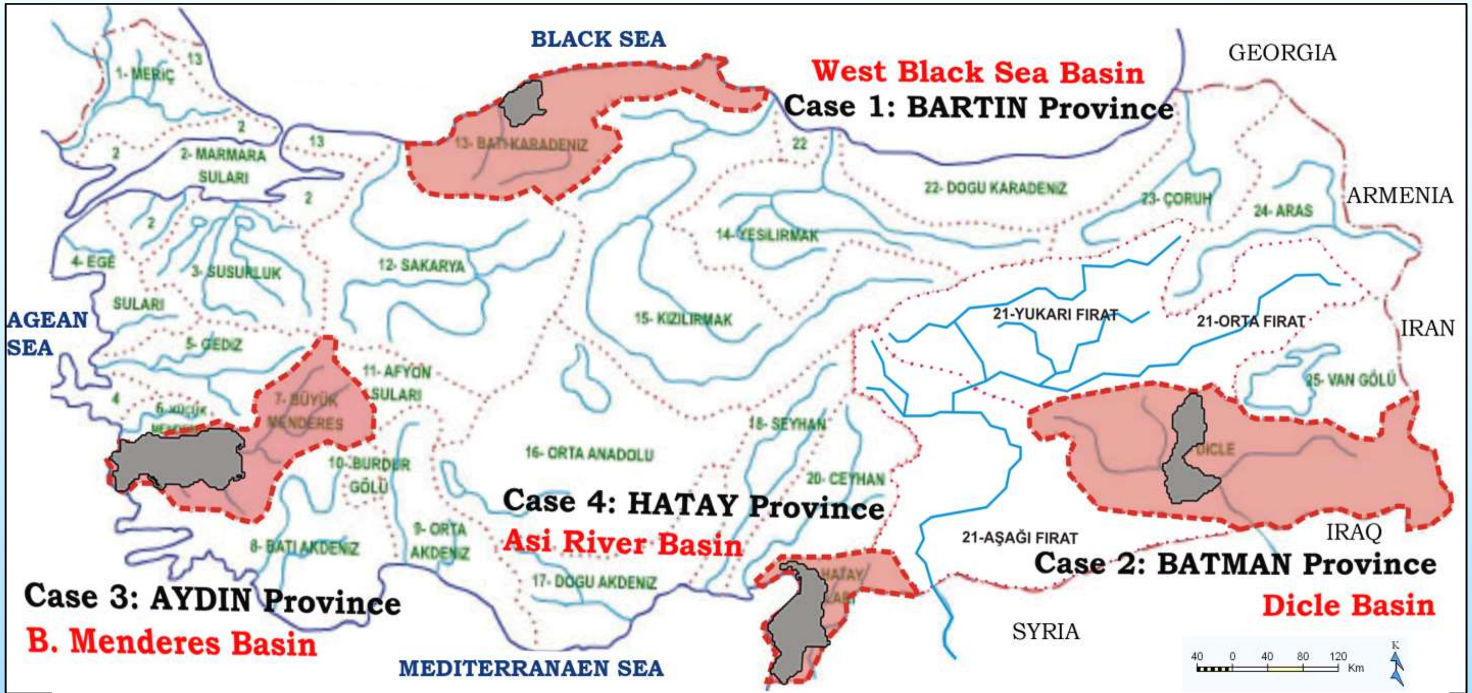
- 10 or more people dead;
- 100 or more people affected;
- The declaration of a state of emergency
- A call for international assistance


ALİBEYKÖY, İSTANBUL
19.08.2004
MİLLİYET
MAVILER
KUAFÖR
SALONU
0535 5188290
BEST
MOTEL
ROSE
MOTEL
ATA
17.08.2004
ALİBEYKÖY, İSTANBUL
POSTA
GÜNEYDOĞU ANADOLU
2.11.2006
MİLLİYET

FLOODS AND STORMS

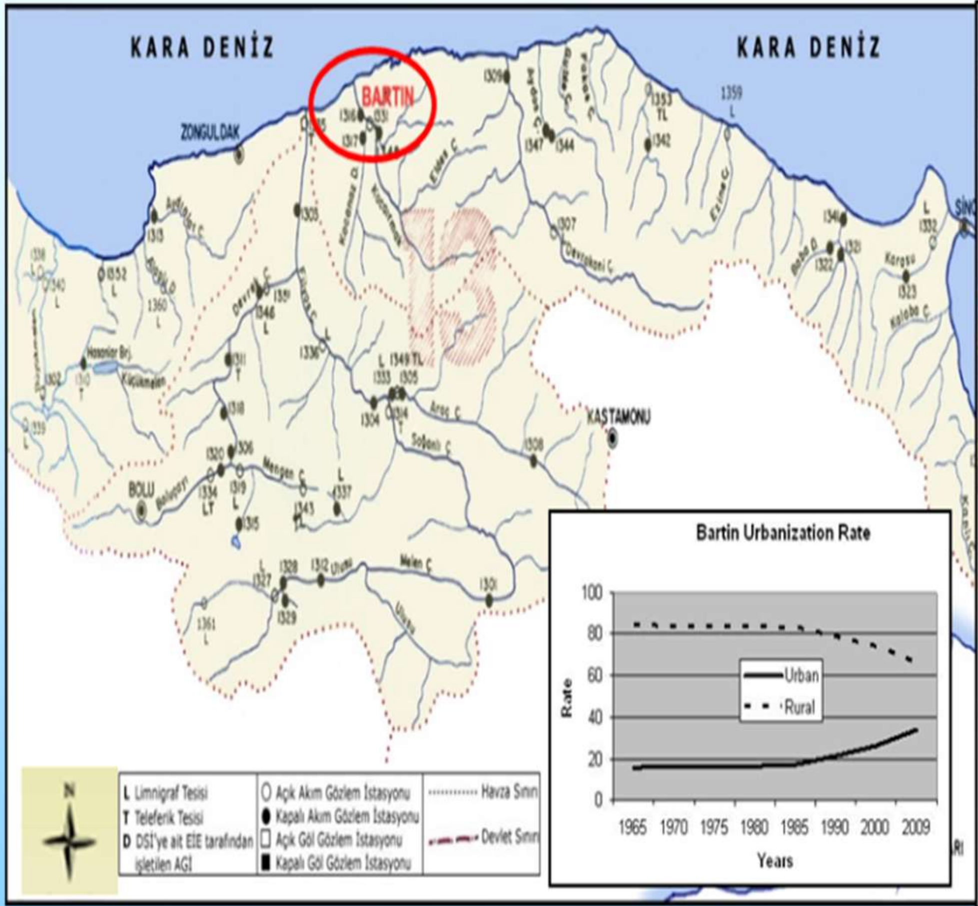
http://jfa.arch.metu.edu.tr/archive/0258-5316/articles/metujfa2016203.pdf

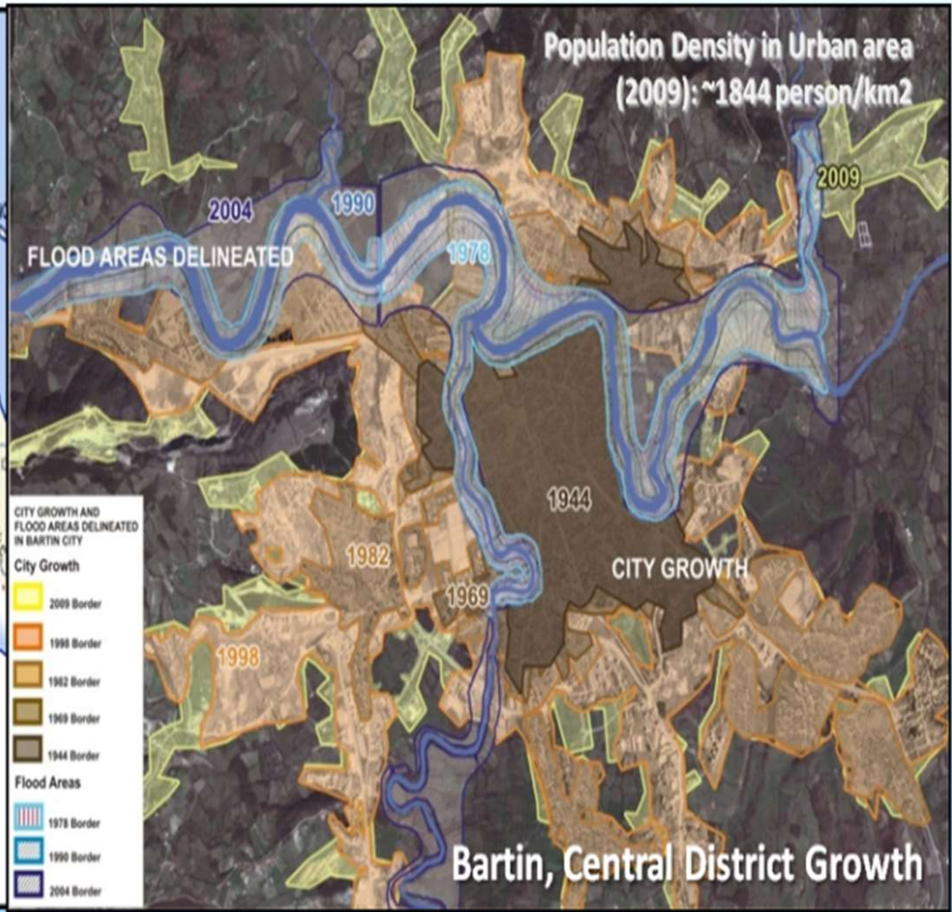
Research on 4 riverine cities dated 2009



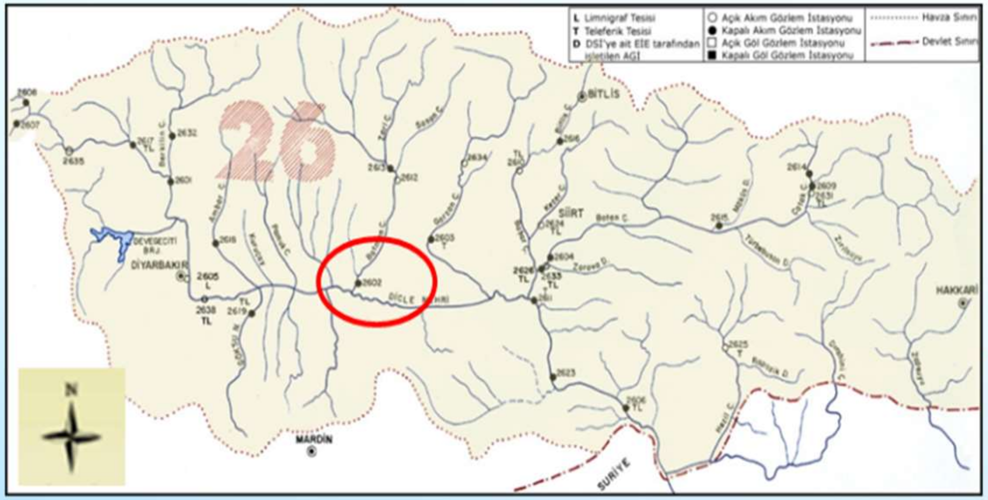
Population Size	Rank over 81 Provinces	Cases
>= 1.000.000	19	Hatay
500.000 – 999.999	20	Aydın
250.000 – 499.999	25	Batman
< = 249.999	17	Bartın

BARTIN CITY

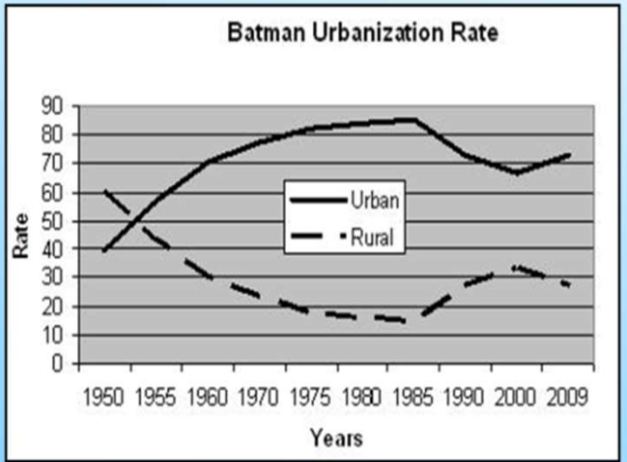

KARA DENİZ
KARA DENİZ
BARTIN
ZONGULDAK
KASTAMONU
BOLU
Bartin Urbanization Rate
Urban
Rural
Rate
Years
1965 1970 1975 1980 1985 1990 2000 2009
L Limnigraf Tesisi
T Teleferik Tesisi
D DSİ'ye ait EİE tarafından işletilen AGİ
Açık Akım Gözlem İstasyonu
Kapalı Akım Gözlem İstasyonu
Açık Göl Gözlem İstasyonu
Kapalı Göl Gözlem İstasyonu
Havza Sınırı
Devlet Sınırı


Population Density in Urban area (2009): ~1844 person/km2
FLOOD AREAS DELINEATED
CITY GROWTH
Bartin, Central District Growth
CITY GROWTH AND FLOOD AREAS DELINEATED IN BARTIN CITY
City Growth
2009 Border
1998 Border
1982 Border
1969 Border
1944 Border
Flood Areas
1978 Border
1990 Border
2004 Border

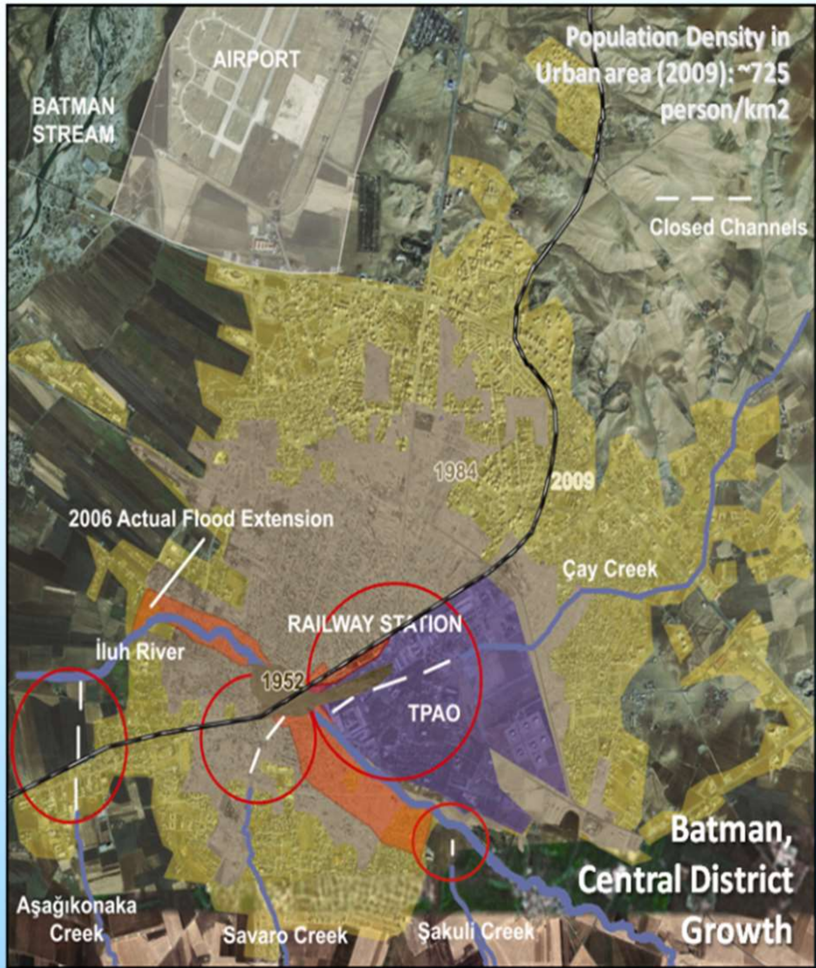
BATMAN CITY



BİTLİS
SİİRT
DİYARBAKIR
MARDİN
HAKKARİ
SURİYE
26

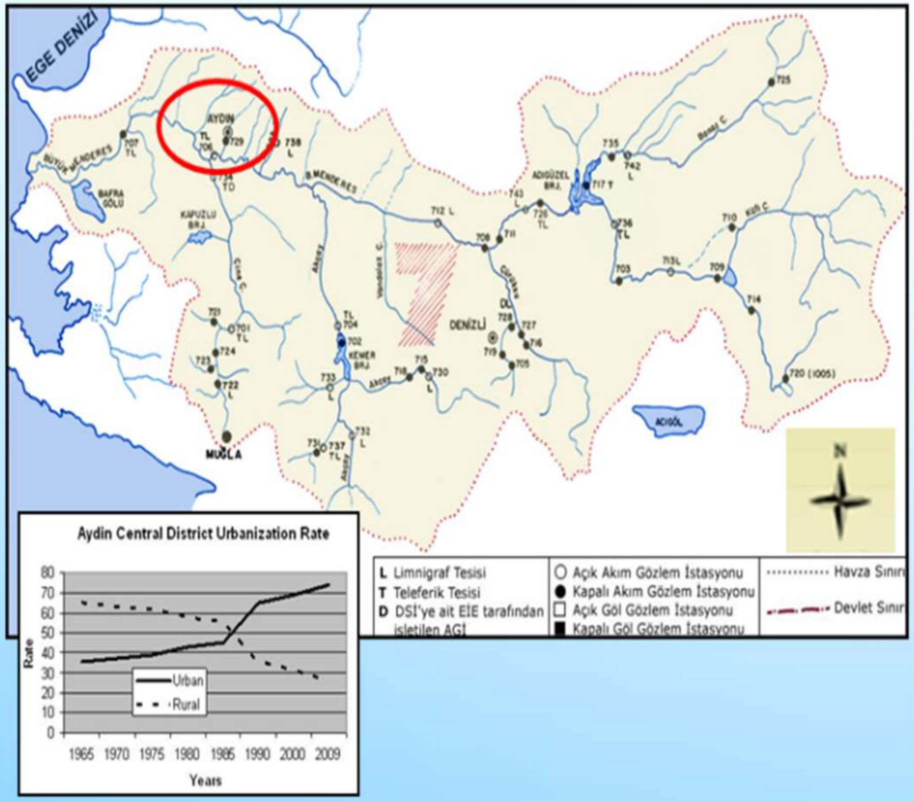


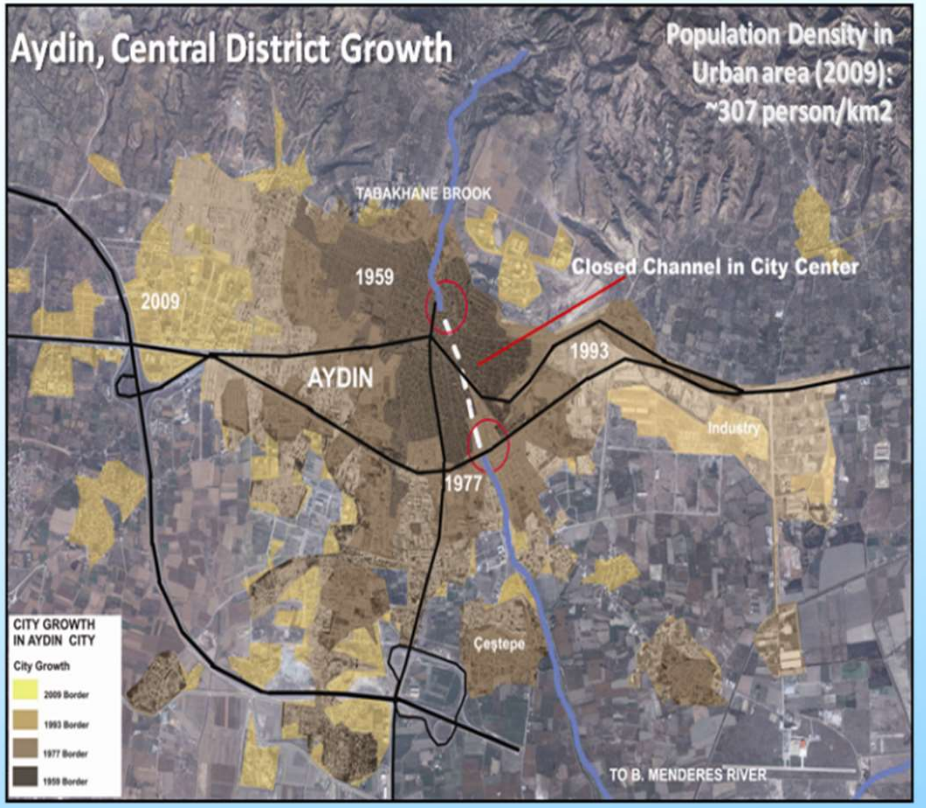
Batman Urbanization Rate
Urban
Rural
Rate
Years
1950 1955 1960 1970 1975 1980 1985 1990 2000 2009



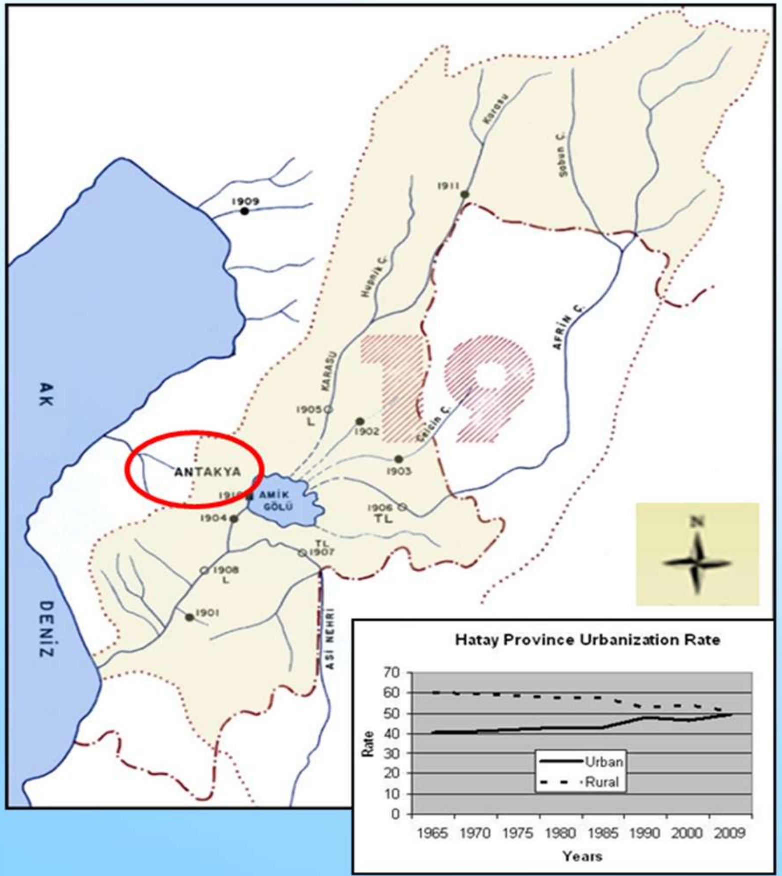
AIRPORT
BATMAN STREAM
Population Density in Urban area (2009): ~725 person/km2
Closed Channels
1984
2009
2006 Actual Flood Extension
Çay Creek
RAILWAY STATION
İluh River
1952
TPAO
Aşağıkonaka Creek
Savaro Creek
Şakuli Creek
Batman, Central District Growth

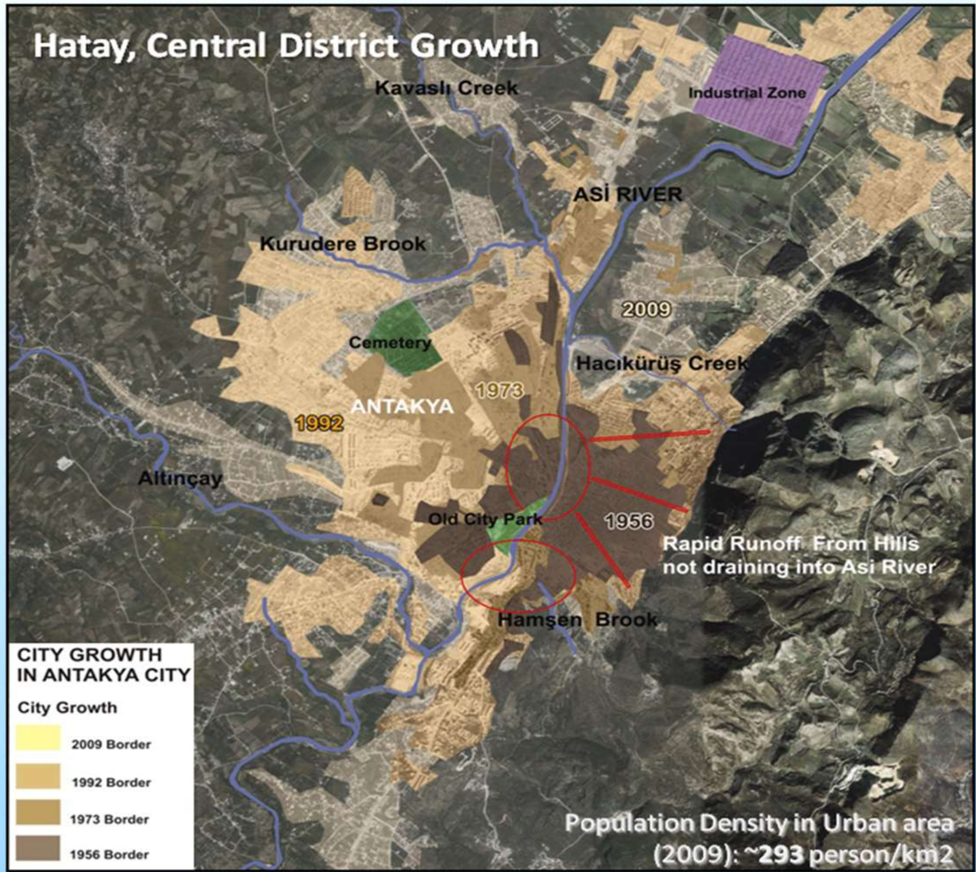
AYDIN CITY


EGE DENİZİ
AYDIN
DENİZLİ
MUĞLA
ACIGÖL
N
Aydin Central District Urbanization Rate
Rate
Years
Urban
Rural
1965 1970 1975 1980 1985 1990 2000 2009
L Limnigraf Tesisi
T Teleferik Tesisi
D DSİ'ye ait EİE tarafından işletilen AGİ
Açık Akım Gözlem İstasyonu
Kapalı Akım Gözlem İstasyonu
Açık Göl Gözlem İstasyonu
Kapalı Göl Gözlem İstasyonu
Havza Sınırı
Devlet Sınırı


Aydin, Central District Growth
Population Density in Urban area (2009): ~307 person/km2
TABAKHANE BROOK
Closed Channel in City Center
1959
2009
1993
1977
AYDIN
Industry
Çeştepe
TO B. MENDERES RIVER
CITY GROWTH IN AYDIN CITY
City Growth
2009 Border
1993 Border
1977 Border
1959 Border

HATAY (ANTAKYA) CITY



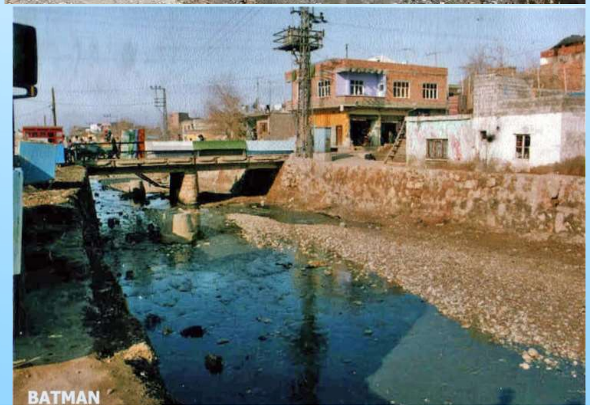
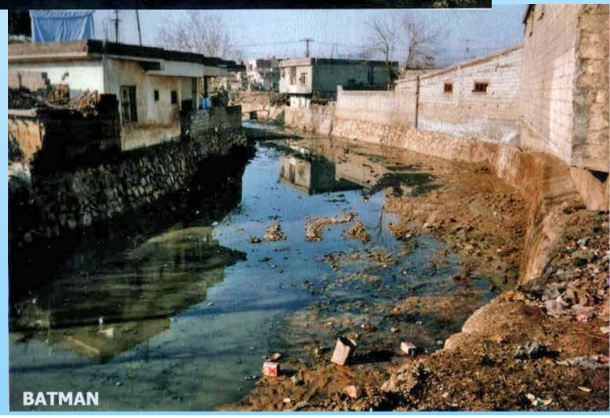



WWW.ISKENDERUNFORUM.COM

WWW.ISKENDERUNFORUM.COM




BATMAN


BATMAN

BATMAN

Major problems observed

- <u>Capacities of infrastructure</u> systems were reduced, and became <u>insufficient</u> due to the unplanned increase in building floors and densities within existing built-up areas,
- <u>Permeable surfaces</u> like green spaces, parks, forests, valleys, etc. in cities were gradually lost and replaced with hard surfaces due to various reasons. Besides, agricultural areas around cities were transformed into urban land-uses not only for meeting the demands of increasing population but also for profit-oriented attempts.
- Riverbeds, flood-prone areas and valley bottoms were usually occupied by <u>unauthorized developments</u> as well as by public facilities and services including streets and public buildings. In almost all cases, it is observed that some parts of <u>river channels within the city centers were converted to closed sections</u> which in turn created high flood losses due to blockage effect.
- <u>Flow discharges of rivers were increased</u> by a number of inaccurate interventions like direct discharging of sewage and rainwater, damping of solid wastes and debris, and insufficient cleaning and maintenance of services.

LOW CAPACITIES IN TIME DUE TO POPULATION INCREASE BUT NO CHANGE IN EXISTING INFRASTRUCTURE

LESS PERMEABLE SPACES LOW INFLITRATION CAPACITY IN URBAN LAND

UNAUTHORIZED DEVELOPMENTS ON RIVERBEDS, FLOOD PLAINS CLOSED SECTIONS OF RIVER CHANNELS AT CITY CENTERS (EG. KAVAKLIDERE, HOŞDERE BLV)

LOW CAPACITY OF RIVER CHANNELS DUE TO OTHER USES AND ACTIVITIES IN RIVER BEDS

Major problems observed (cont.)

- Infrastructural deficiencies created by such inaccurate and discrete engineering interventions as improper design of transport bridges and concrete channel constructions were observed among main sources of flood losses in most of the cases.

IMPROPER DESIGN OF BRIDGES AND NARROW CONCRETE CHANNELS

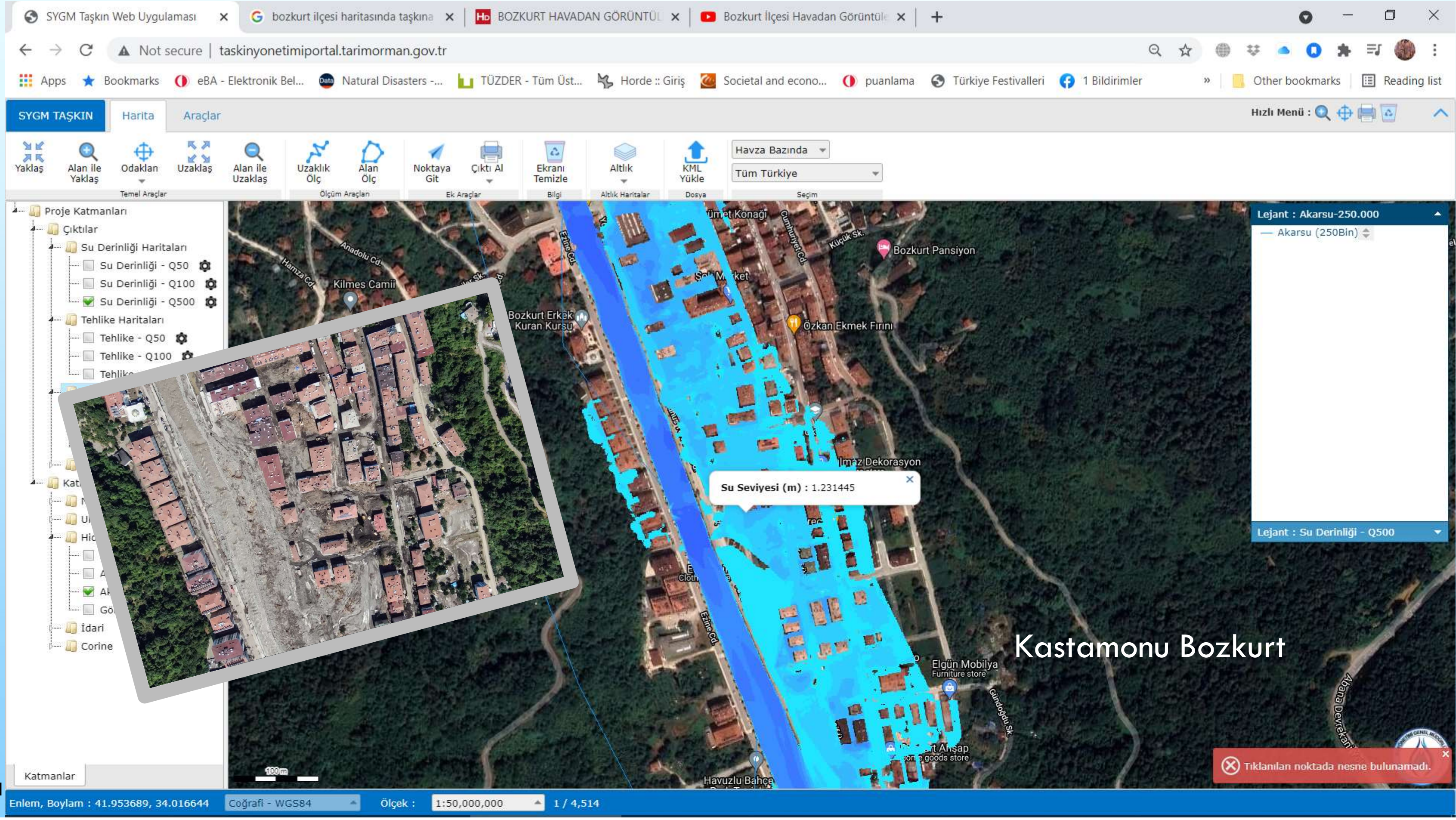
- Inappropriate interventions of municipalities on flood prone areas and riverbeds through urban development plans contribute much to flood losses. Besides, independent and discrete attempts for mitigation; such as river channel reclamation activities, construction of flood walls, seem to generate "illusory" feeling of safety, which aggravates vulnerabilities.

RIVER RECLAMATION ACTIVITIES WITH NON-NATURE BASED SOLUTIONS NOT EASY TO CHANGE FOR FUTURE EXTREMES

- Local ad-hoc interventions may temporarily solve the flood problem at a specific location. However, this may lead to transfer of flood problem to another location based on the rules of hydro-meteorological system in a basin. For instance, deforestation and inefficient or lack of erosion control at upper basin area lead to increase in rapid accumulation of debris and sedimentation in riverbeds, which then reduce the carrying capacity of river courses in areas within lower basin.

BASINWIDE LAND-USE SOLUTIONS (DECISIONS AND IMPLEMENTATIONS) https://www.tarimorman.gov.tr/SYGM/Sayfalar/Detay.aspx?SayfaId=53 (Flood Management Plans for Major River Basins)

FLOOD PORTAL (CURRENTLY UNAVAILABLE), SGYM



INTEGRATED RIVER BASIN MANAGEMENT

- Basin wide flood risk maps should be produced? (currently produced but should be interactive and update frequently and shared like FEMA website as open source)
- For reducing risks counter measures should be included in basin-wide management plans, urban planning of both existing built-up area and development areas (upper basin vs. Lower basin).
- If needed, regeneration projects in existing areas and reserve areas for retention/detention ponds in developing regions should be planned and implemented.
- For the historical areas, heritage sites, highly populated city center and public facilities like hospitals, metro stations early warning systems are critical.. (flood shields, sandbags could be used, evacuation could save lives…)

THANK YOU FOR ATTENTION!

Questions and comments are all welcomed!

Email: mbalaban@metu.edu.tr

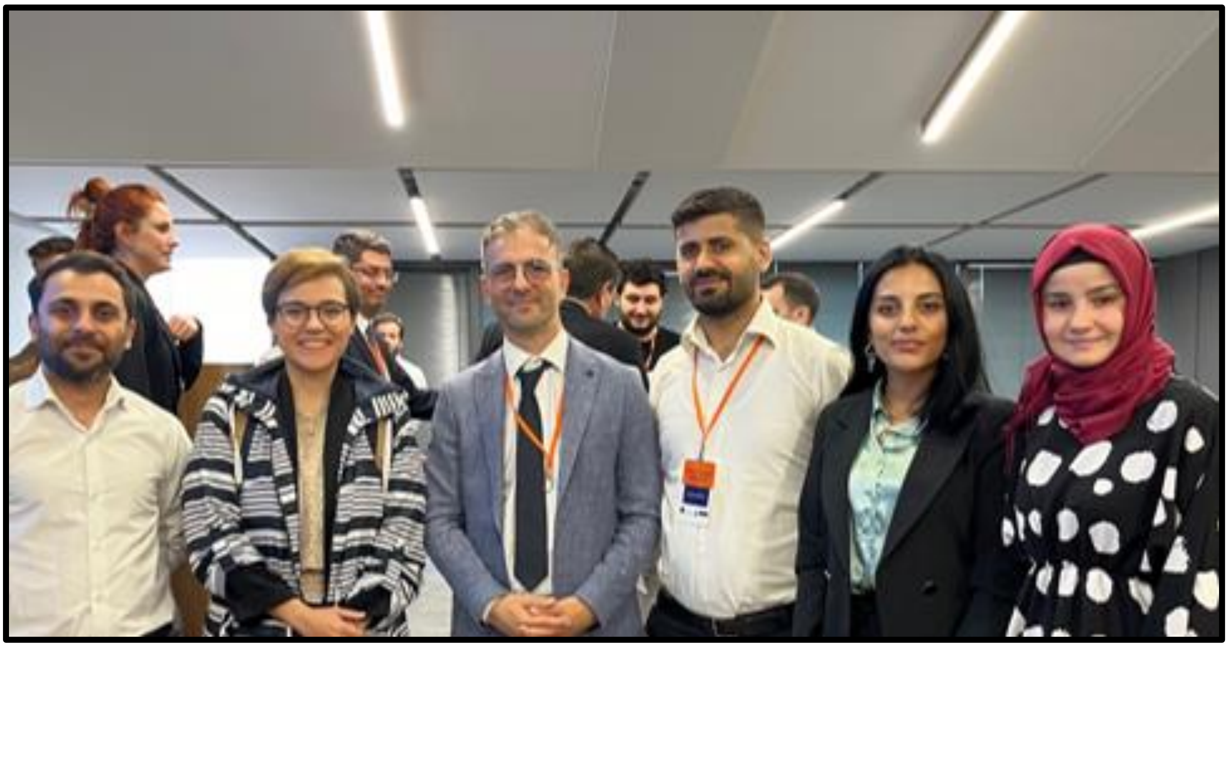
GIVEN CERTIFICATE AND BADGE


COLLABORATIVE ANALYSIS OF FLOODING EVENTS WITH PROCESSING OF EARTH OBSERVATION DATASETS (COLLABFLOOD) WORKSHOP
Berk ANBAROGLU
CollabEO-Floods
MANCHESTER 1824
The University of Manchester

GIVEN PROMOTIONAL MATERIALS

PICTURES FROM THE WORKSHOP


CollabEO-Floods
Collaborative
Analysis of Flooding Events with
Processing of Earth Observation
Datasets
TMMOB
Harita ve Kadastro Mühendisleri
GENEL MERKEZİ

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