

The Black Sea Coastline Erosion: Index-based Sensitivity Assessment and Management-related Issues

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Implementation of the UN 2030 SDGs in the Black Sea Region

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Topics for Today

- Context and Motivation**
- Methodology**
- Coastal Sensitivity Index: variables and distribution**
- Future CZM – some recommendations**

Context



UN 2030 Agenda for Sustainable Development

Goal 13. Take urgent action to combat climate change and its impacts

- 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
- 13.2 Integrate climate change measures into national policies, strategies and planning
- 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

Context



***Changes in storminess and coastal erosion
induced by climate variability along the
Black Sea coasts.
Management and adaptation.***

Motivation

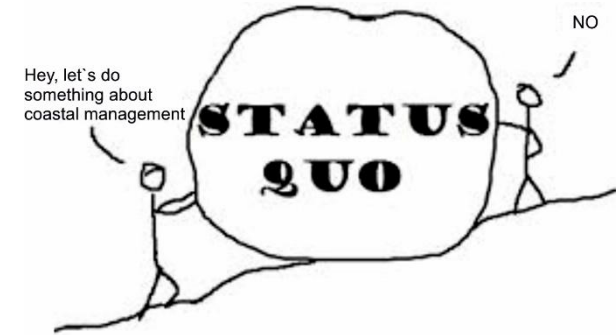
Coastal erosion – A real problem



Storm impact on the Bulgarian and Romanian coasts

- 24% of the world's sandy beaches eroded at rates exceeding 0.5 m/yr since 1984 (Luijendijk et al., 2018)
- 61% of Black Sea beaches have maximum widths less than 50 m and 47% present coastal defence schemes (Allenbach et al., 2015)
- For 0.5 m SLR 56% of all beaches are projected to retreat by 50% of their maximum width, for a 0.82 m SLR about 41% are projected to retreat completely, whereas for 1 m SLR about 51% of all Black Sea beaches are projected to be entirely drowned or shifted landward (Allenbach et al., 2015).

Motivation



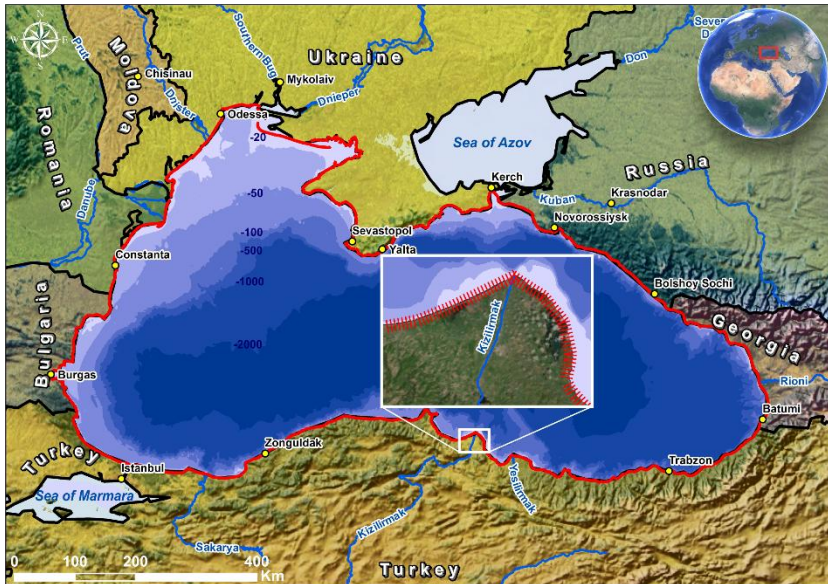
Status Quo

Solving punctual (space and time) coastal erosion problems; individual solutions; limited common datasets/views

Scarce comprehensive integrated views of coastal erosion on the Black Sea coasts

Methodology

✓ 4021 sectors (1-km wide)

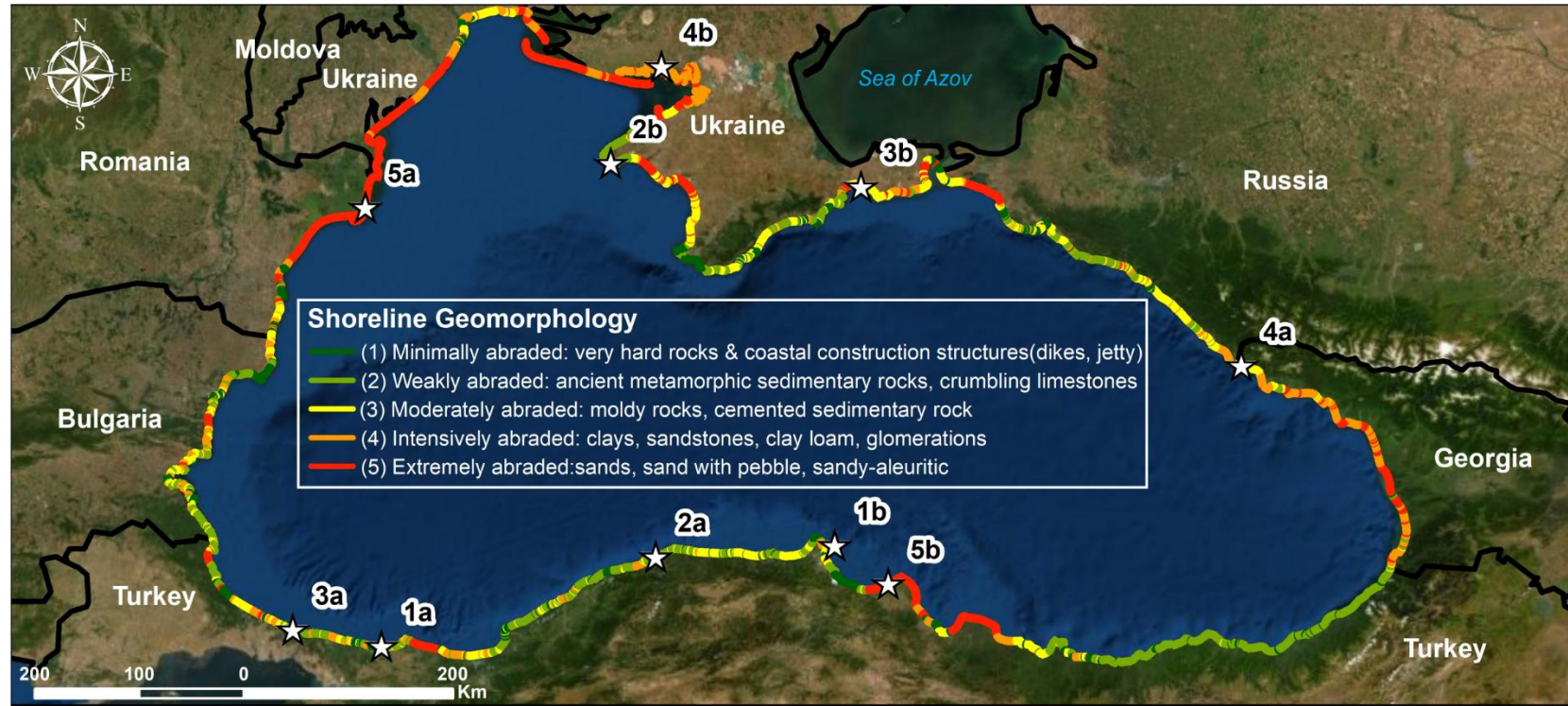


Variable	Very low 1	Low 2	Moderate 3	High 4	Very high 5
Geomorphology	High cliffs & Coastal structures	Minimally abraded rocks	Weakly abraded rocks	Intensively abraded rocks	Extremely abraded rocks
Coastal slope (°)	Very gentle (< 0.25)	Gentle (0.25 – 0.6)	Moderate (0.6 – 1)	Steep (1 – 1.6)	Very steep (> 1.6)
Shoreline change (m/yr)	> 5	1 – 5	-1 – +1	-5 – -1	< -5
Wave incidence angle (°)	0 – 18	18.01 – 36	36.01 – 54	54.01 – 72	72.01 – 90
Significant wave height (m)	< 0.85	0.85 – 0.97	0.97 – 1.12	1.12 – 1.37	1.37 – 1.84
Relative sea level change (mm/yr)	< 0.0	0.0 – 1.0	1.1 – 2.0	2.1 -3.0	> 3.0
Coastal Sensitivity Index (CSI)	< 6.0	6.01 – 8.66	8.67 – 11.61	11.62 – 15.49	> 15.49

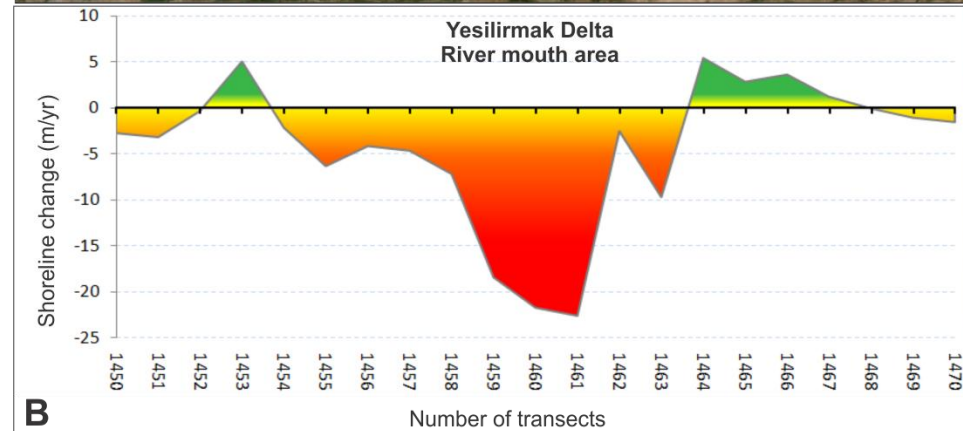
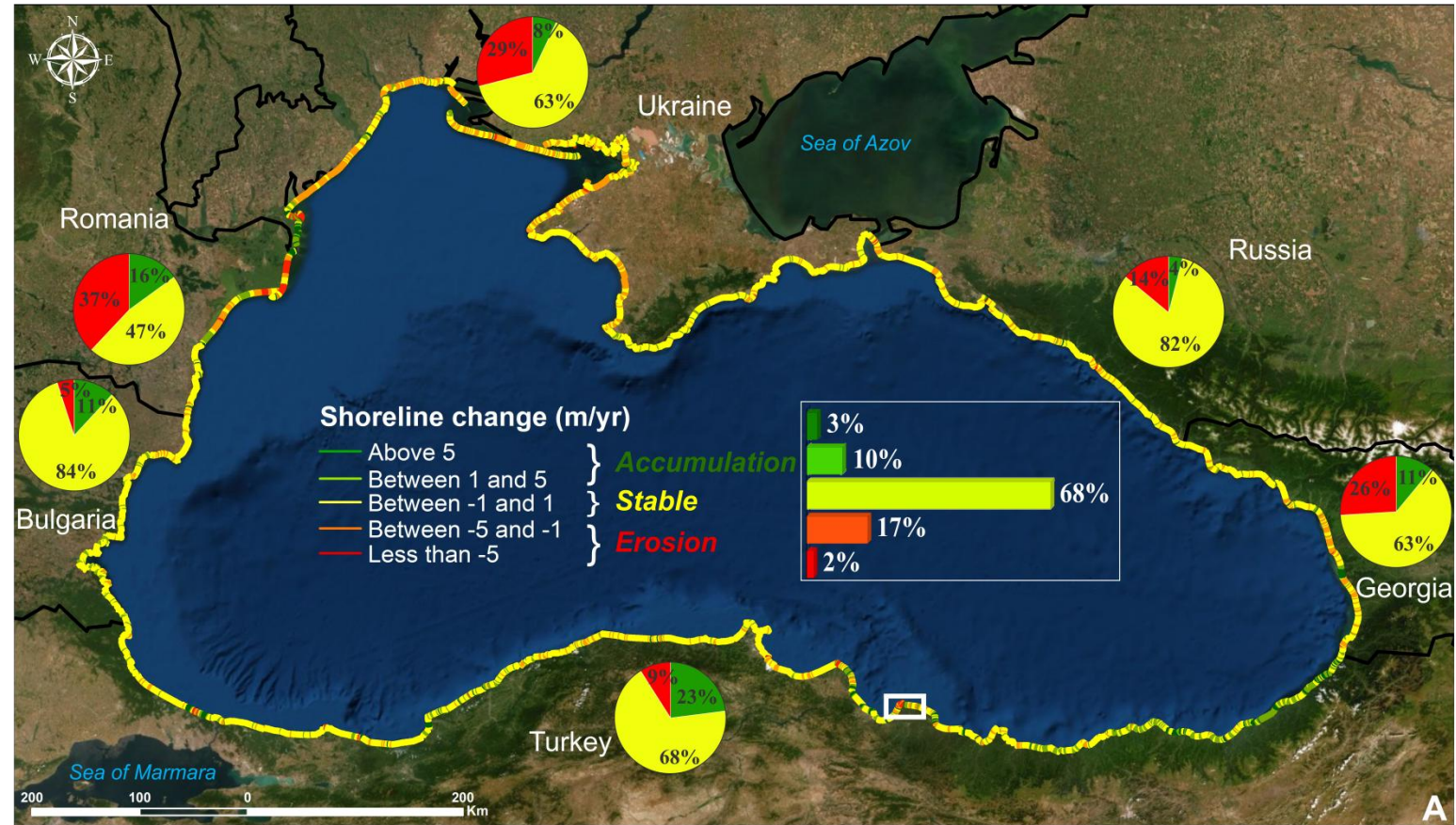
List of variables and rankings used for Coastal Sensitivity Index (adapted version of CSI in Abuodha and Woodroffe, 2010)

$$CSI = (R_{Geomorphology} R_{Slope} R_{Shoreline} R_{WaveInc} R_{Hs} R_{RSLR})^{1/6}$$

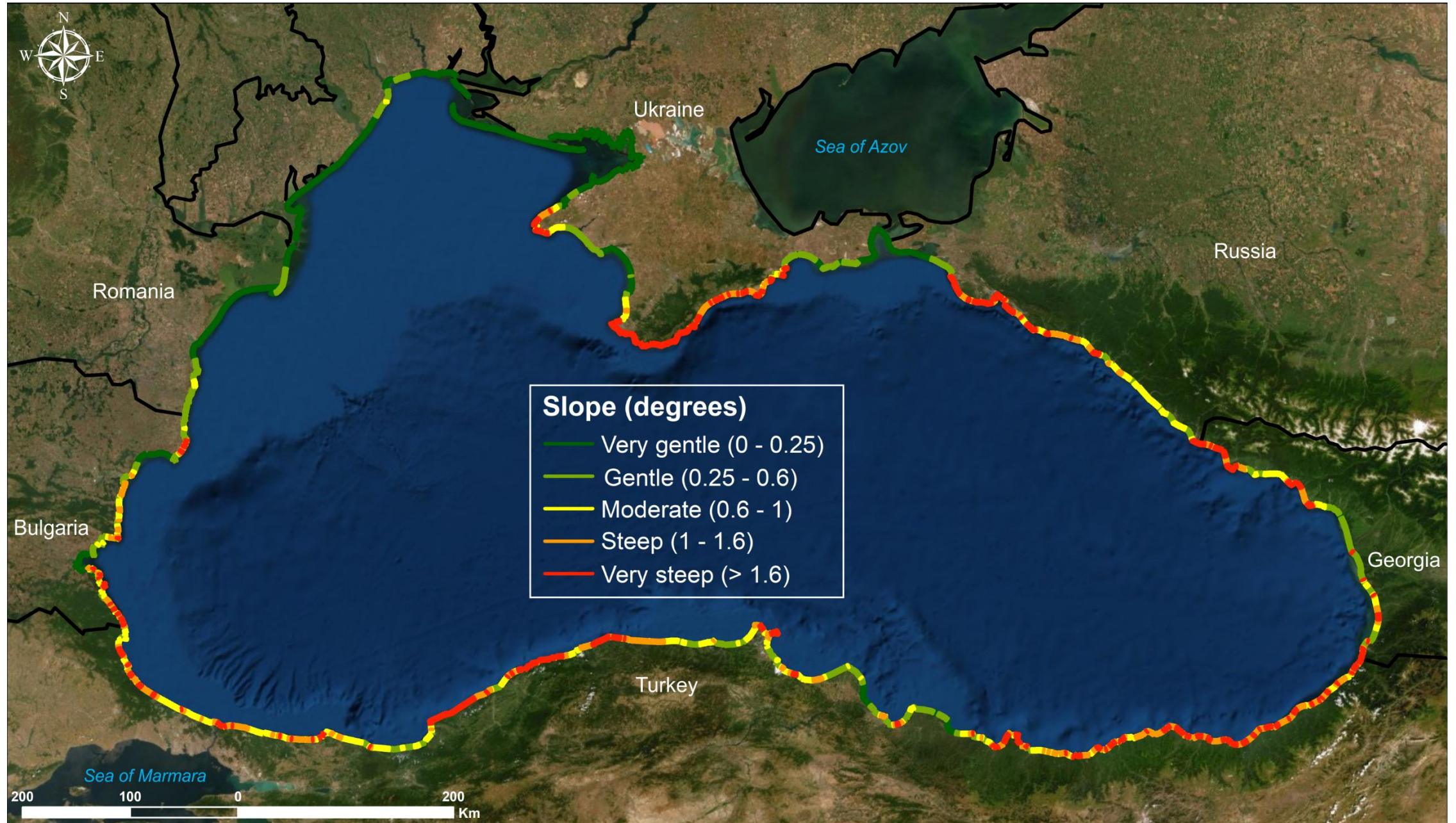
Coastal Geomorphology



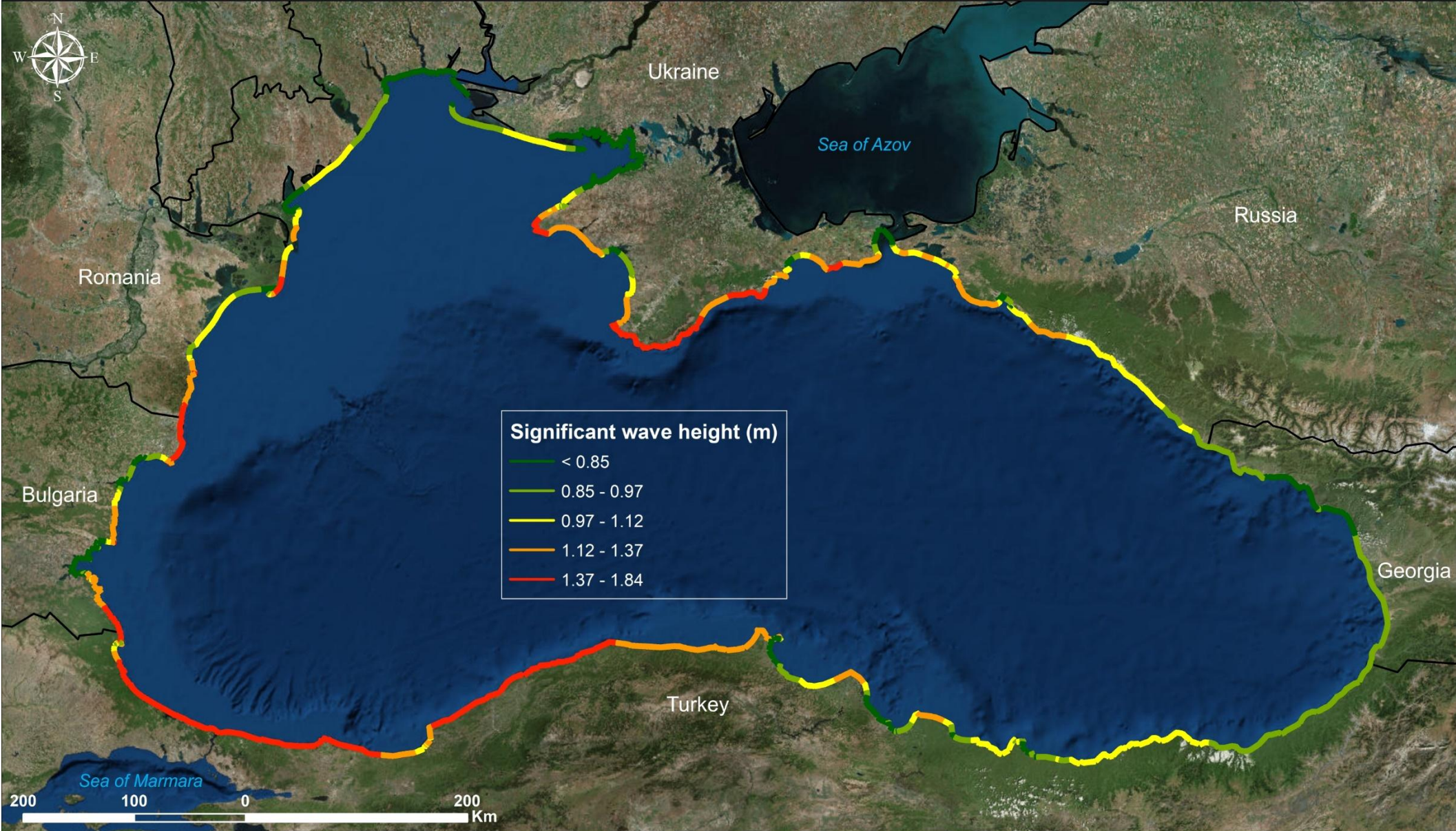
Shoreline Changes (1984 – 2017)



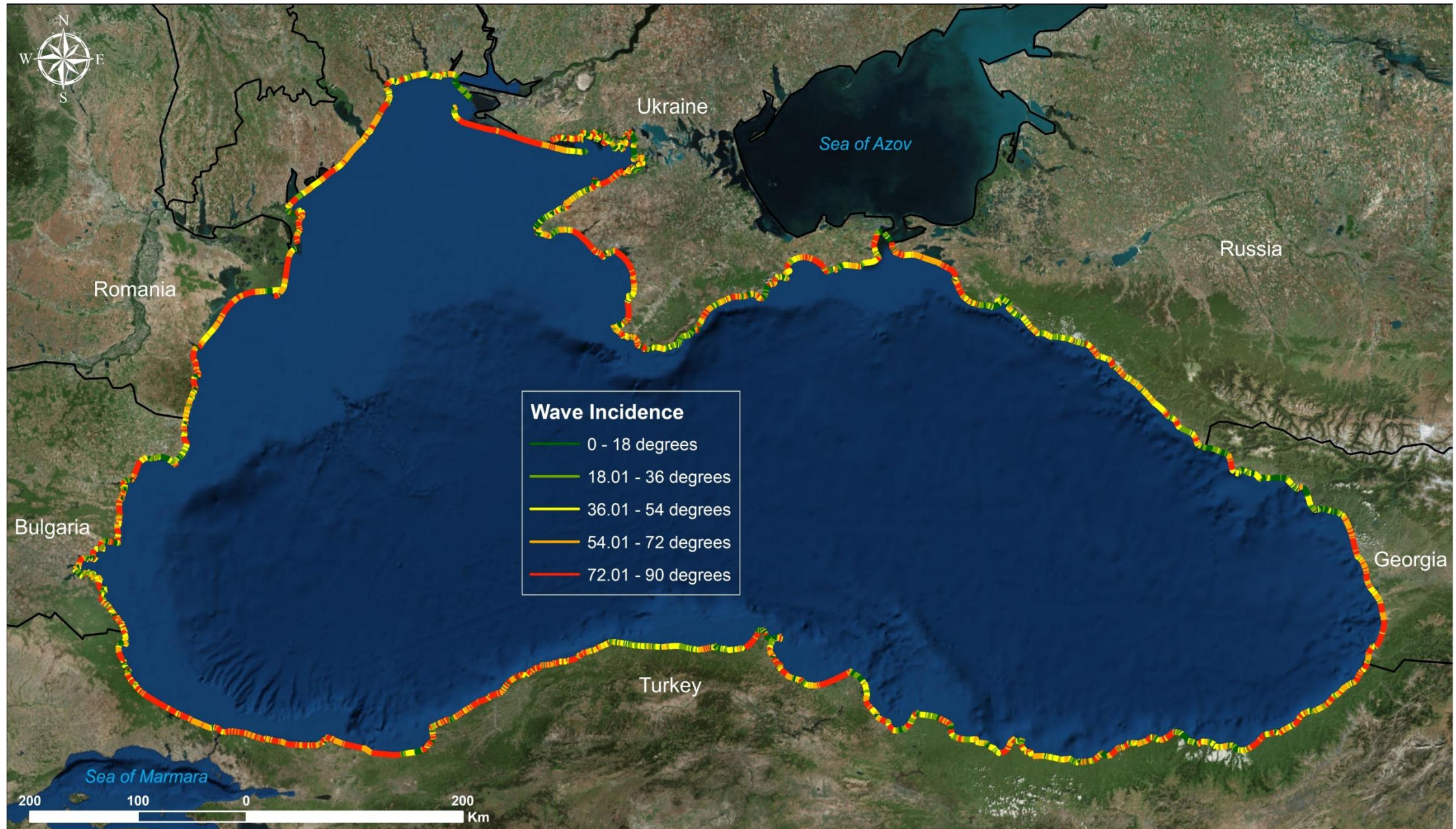
Underwater Slope (0 – 20m depth)



Significant Wave Height (P95)



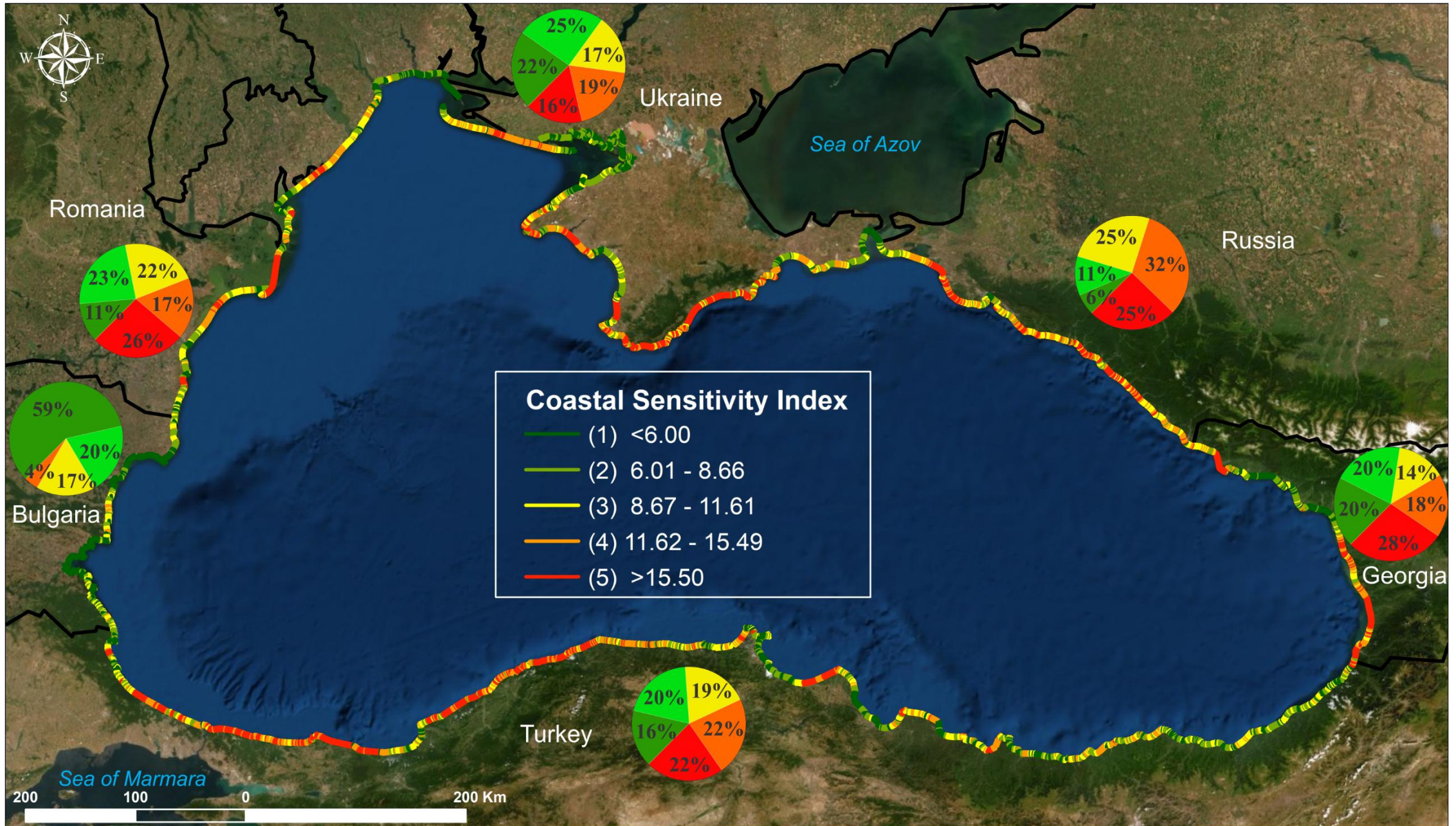
Wave Incidence Angle



Relative Sea Level Change

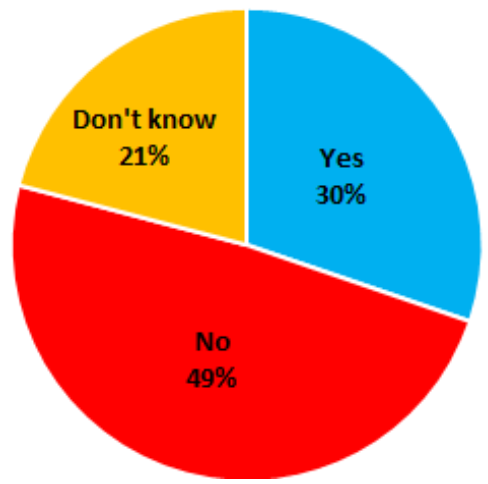


Coastal Sensitivity Index (CSI) Map

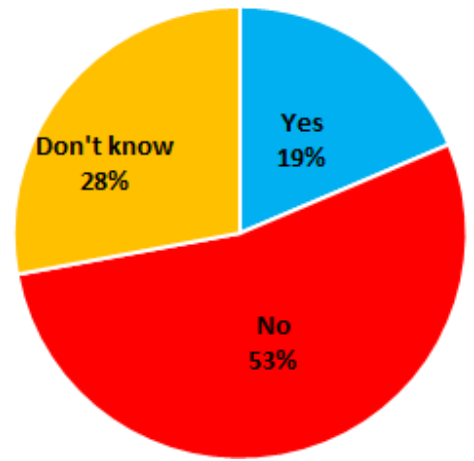


Questionnaire responses of 43 stakeholders from Romania, Turkey and Russia

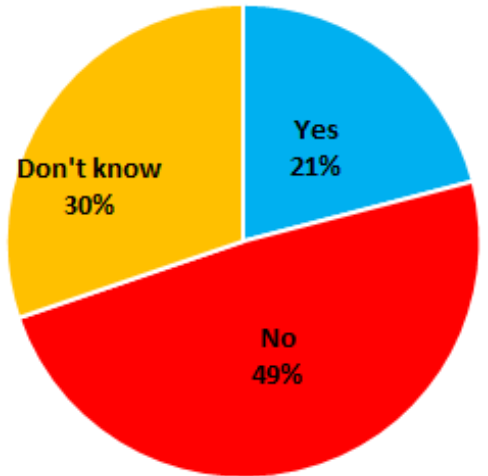
Does your country have a coastal erosion risk management strategy?



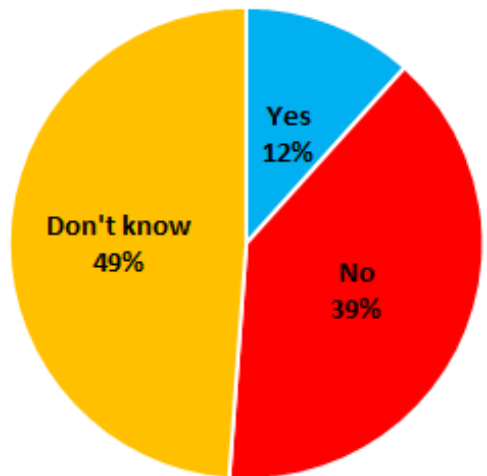
If it exists, does the strategy ensure a clear understanding of the risks of coastal erosion so that investment in risk management can be prioritised effectively?



If not, the legal framework in your country allows the management of coastal erosion risks in an appropriate way, taking account of the needs of communities and the environment?



Are the present protection measures able to reduce the risks in case of coastal hazards?



What went wrong and what did we learn?



EXISTING NEGATIVE FACTORS	DESIRABLE POSITIVE FACTORS
<i>Weak laws and regulations</i>	<i>Clarity, explicitness</i>
<i>Unproper coastal management plans</i>	<i>Different scales; implementation encouraged or forced</i>
<i>Inconsistency</i>	<i>Equal and fair treatment of all citizens</i>
<i>Ineffectiveness</i>	<i>Certainty, stableness</i>
<i>Uncertainty, political clientelism</i>	<i>Good coordination with policies and implementation</i>

How Does the Future Look Like?



- In-depth analysis of the causes of coastal erosion
- Permanent monitoring of the coastal behavior
- Need for the consideration in the future civil protection plans and coastal management works of the evaluation of coastal risk generated by storms with a solid scientific background
- Prioritisation of coastal protection works function of erosional risk – Need for national/local hazard/risk maps
- Clarification of legal and administrative issues; clearly defining the responsibilities and jurisdiction of each actor
- Better cooperation between Black Sea riparian countries
- Better cooperation between research institutes, universities and other institutions involved in coastal zone monitoring, management and planning
- Education programs about the coastal resources, hazards and sustainability must be prepared for different sectors of the community
- Better communication between public authorities, researchers, coastal engineering companies, on one hand, and local communities, on the other hand
- Changing the view/mentality of coastal planners for managing in a sustainable way the coastal hazards impact (erosion) through 'soft' solutions
- Promoting soft solutions for the sustainable management of the coastal hazards impact
- Present projects: more focused on beach nourishment

How Does the Future Look Like?



Beach protection and nourishment works in Tomis area (Constanta – April 2015) in the frame of the project `Protection and rehabilitation of the Southern Romanian Black Sea coast`

THANK YOU VERY MUCH!

