



**micore**

3 November, Małkocin, Poland

MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS

# Storm Impact Forecasting Early **W**arning **S**ystem EWS US v.1.0

<http://micore.ztikm.szczecin.pl>

University of Szczecin  
Kazimierz Furmańczyk, Natalia Bugajny



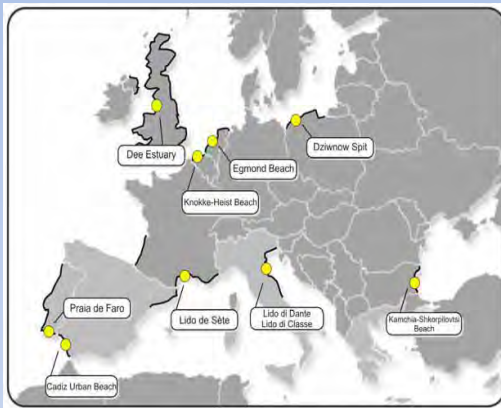


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3 November, Małkocin, Poland

MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS

## About Project



# MICORE - Morphological Impacts and Coastal Risks induced by Extreme storm events


## *Five key outcomes:*

1. Understanding past coastal storm trends across Europe
2. Demonstrating new data and knowledge sharing protocols - the OpenEarth approach
3. Expanding and validating a new open-source model of coastal storm impacts
4. Operating on-line prototype Early Warning Systems for coastal storm hazard
5. Building better bridges between coastal experts and end-users




# Website of EWS

[www.micore.ztikm.szczecin.pl](http://www.micore.ztikm.szczecin.pl)


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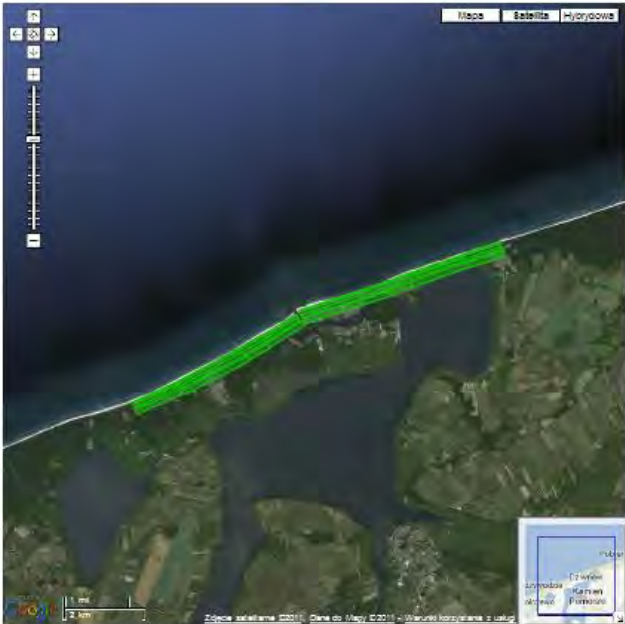
**STORM IMPACT FORECASTING  
EARLY WARNING SYSTEM**

PREPARED BY THE PROJECT MICORE - MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS



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Forecast calculated 2011-10-26 for the next 6 hours:




Forecast is calculated each day at 10.00, on the basis of WAM wave model data from the same day at 0.00 am and of sea level model - M2D L2B at 0.00 am.  
Morphology is represented by the profiles of the Maritime Office in Szczecin, showing the status of the measurement, which takes place annually during the summer.


1020-01-01 00:00:00  
Dziś w Szczecinie  
Wietrzyk: silny  
Dziś w Szczecinie  
11°C  
Dziś w Szczecinie  
Wietrzyk: silny, z przelotnymi deszczami

Liczba odwiedzin: 956

In order to correctly display website is required Adobe Flash Player and Internet Explorer or Opera.



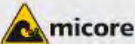

Maritime  
Office in  
Szczecin



Dziwnow  
Community

MICORE project is a research project carried out between 2005 - 2011 under the 7th Framework Programme of the European Union in the subject ENV - 2007.1.1.1.1.

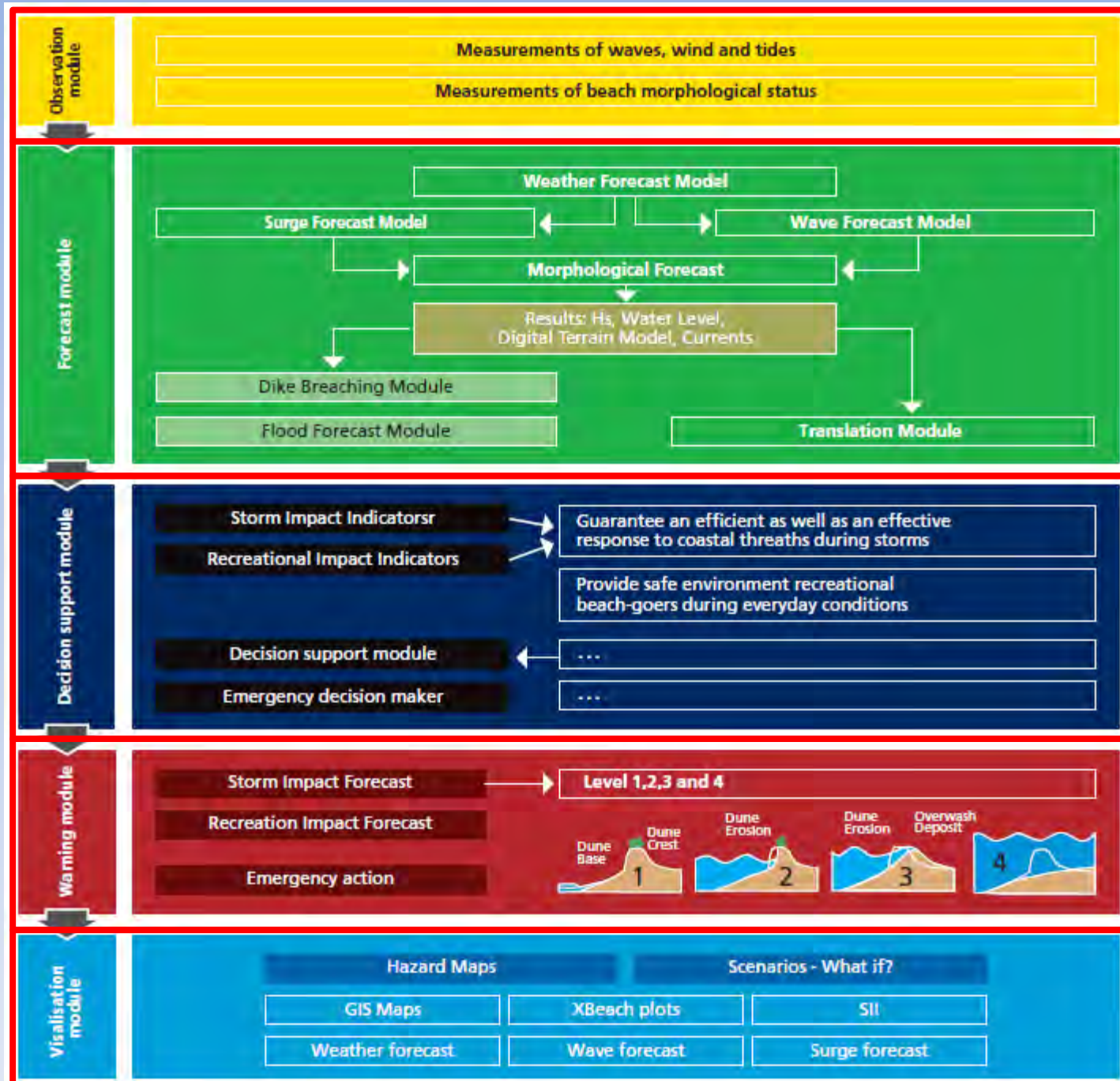
Grant agreement no.: 02730. Coordinator: Prof. Piotr Czerwinski, University of Pekař.

© Copyright (WAM L2B - A) Radosław Rederick

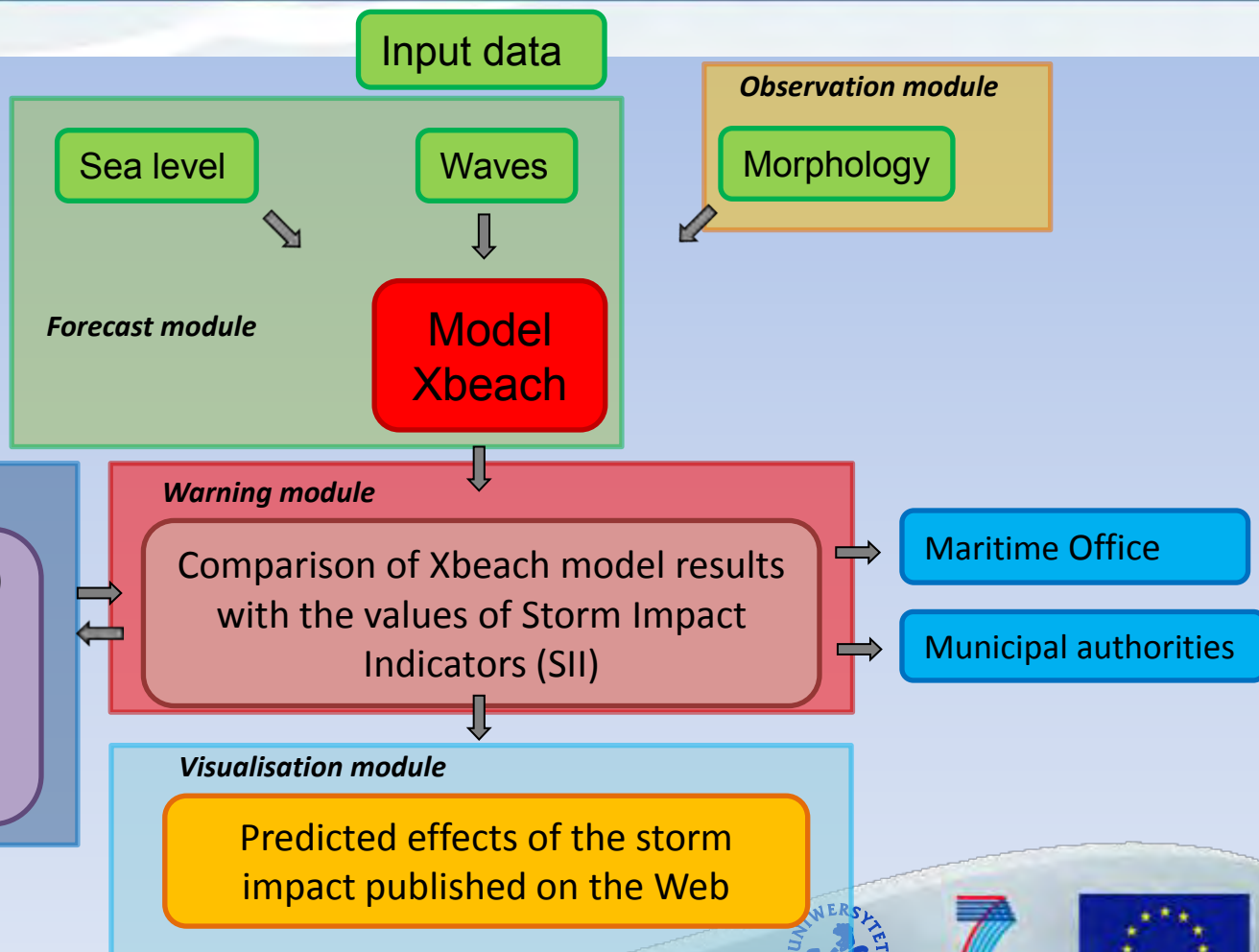


# A generic structure for a EWS






## Schemat EWS US v.1.0




## About System




# STORM IMPACT FORECASTING EARLY WARNING SYSTEM

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## ABOUT SYSTEM




```

graph TD
    A[Input data  
• Sea level  
• Waves  
• Meteorology] --> B[Storm Model]
    B --> C[Comparison of Storm model results with the values Storm Impact Indicators (SII)]
    C --> D[Storm impact indicators (SII)  
• water flooding  
• dune erosion  
• dune overwash/creaking]
    C --> E[Maritime office]
    C --> F[Municipal authorities]
    C --> G[Predicted effects of the storm impact published on the sites]
    
```

**Input data:**

Sea level: [AD202 UG](#)



**Model: M3D UG (University of Gdansk)**

**Format:** file \*.txt

**Update:** 1/day  
**Forecast:** 48 hours

**Server**

**XBeach**

**Wave model: WAM (ICM)**

- Significant wave height - Hs
- Peak period - Tp
- Mean wave direction - Dir

**Format:** file \*.txt

**Update:** 1/day  
**Forecast:** 84 hours

**Server**

**XBeach**

**Morphology**

**Bathymetry and topography profiles (JAM)**

Format: file \*.txt

Update: 1/year

**GPS topographical survey (JUT)**

Update: after each storm

**XBeach**

**17:00:00 01-01-2019**

Latest forecast

Temperature: 8.0°C

**Storm: Wind Prediction**

**10°C**

Sea on alert



Wind: gale, wind: 1, gusting: 15 to 16

Lechia advertisement

956




In order to correctly display website is required [Adobe Flash Player](#) and [Internet Explorer](#) or [Chrome](#)

partners:

MICORE project is a research project carried out between 2008 - 2011 under the 7th Framework Programme of the European Union in the subject DPI1 - FP7-5.5.3.2

Cooper agreement no.: 020792 | Cooperation: 01-0. Public Expense | University of Gdansk

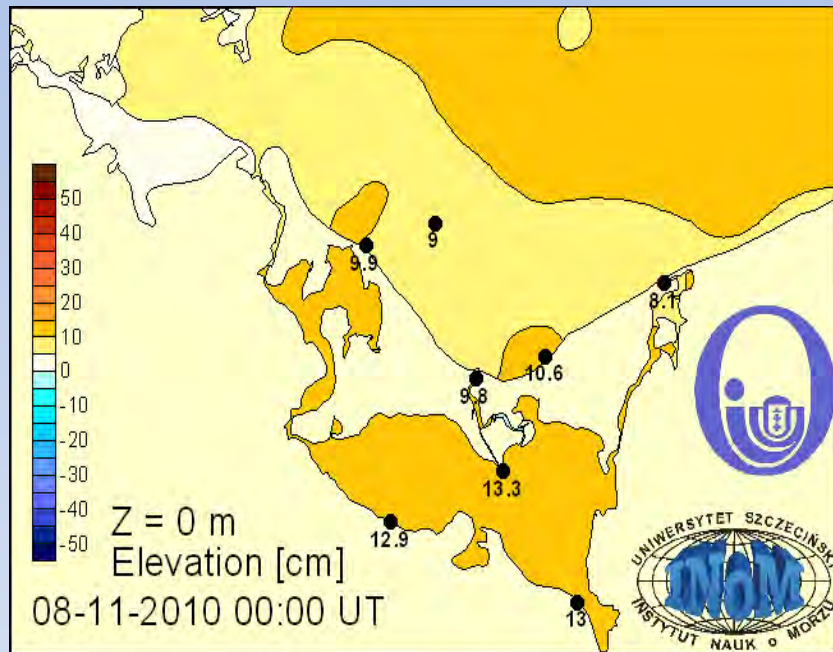






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MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS

Input data: Sea level



Model M3D UG  
(UG)



Format: file \*.txt



Update: 1/day  
Forecast: 48 hours



Server



XBeach



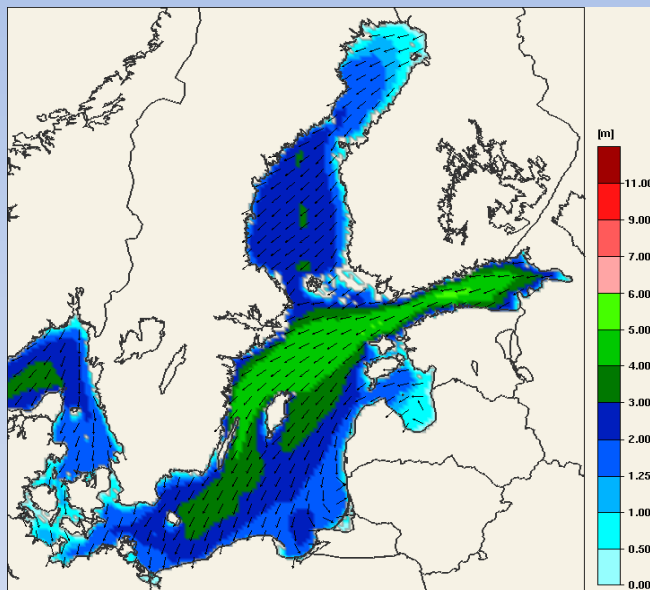




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MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS

## Input data: Waves



Wave model WAM (ICM)

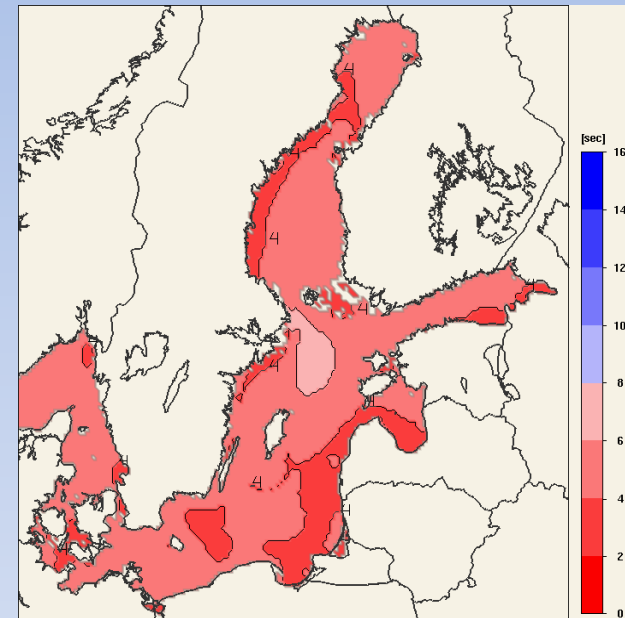
- Significant wave height -  $H_s$
- Peak period -  $T_p$
- Mean wave direction - Dir

Format: file \*.txt

Update: 1/ day  
Forecast: 84 hours

Server

XBeach



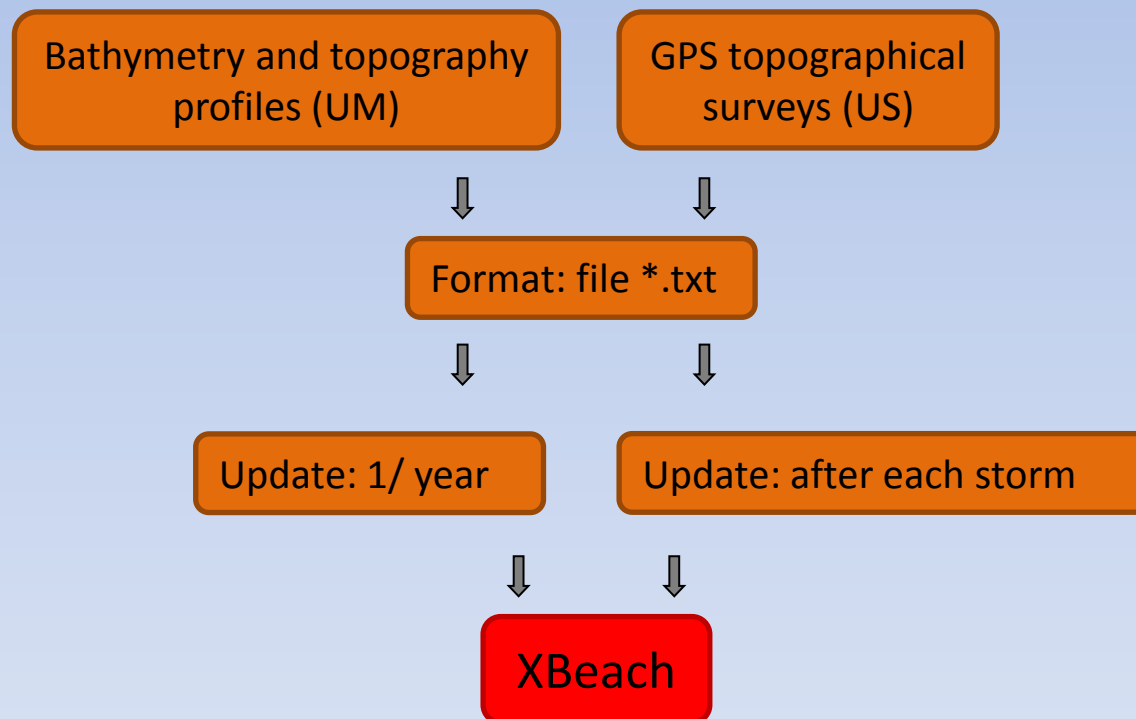




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MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS

## Input data: Morphology





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MICORE

SYSTEM

SII

SECTORS

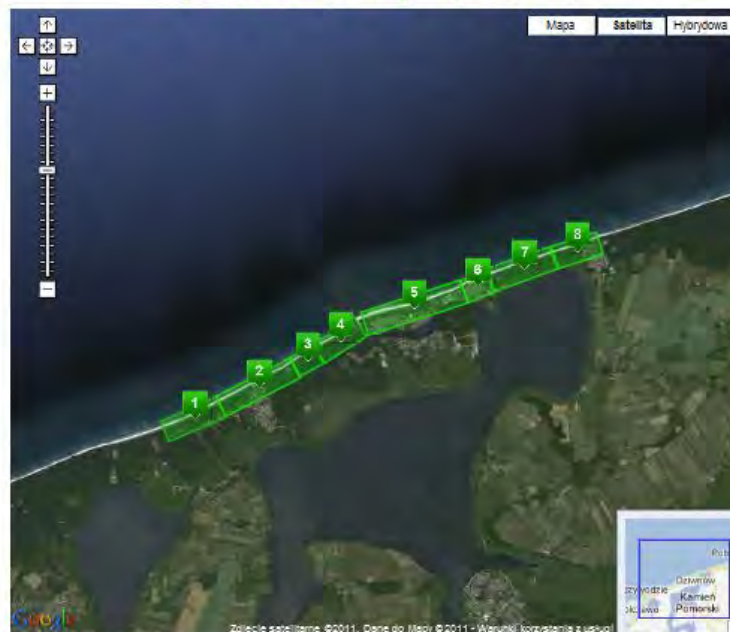
FORECAST

CONTACT



## Sectors

### SECTORS



### LEGEND



Sector

1970-01-01 01:00:00  
Przewaga chmur  
Wielkość: 0.00  
Dziwnów, West Pomeranian  
8°C  
Stan na dziś:  
Wiatr: 0.0-0.0 m/s z szybkością 14 km/h

Liczba odwiedzin:  
947

In order to correctly display website is required Adobe Flash Player and Internet Explorer or Opera.

Partners:



Maritime  
Office in  
Szczecin



Dziwnów  
Community

MICORE project is a research project carried out between 2008-2011 under the 7th Framework Programme of the European Union in the subject ENV. 2007.1.3.1.1.

Grant agreement No.: 202798 - Coordinator: Prof. Paolo Ciavola, University of Ferrara

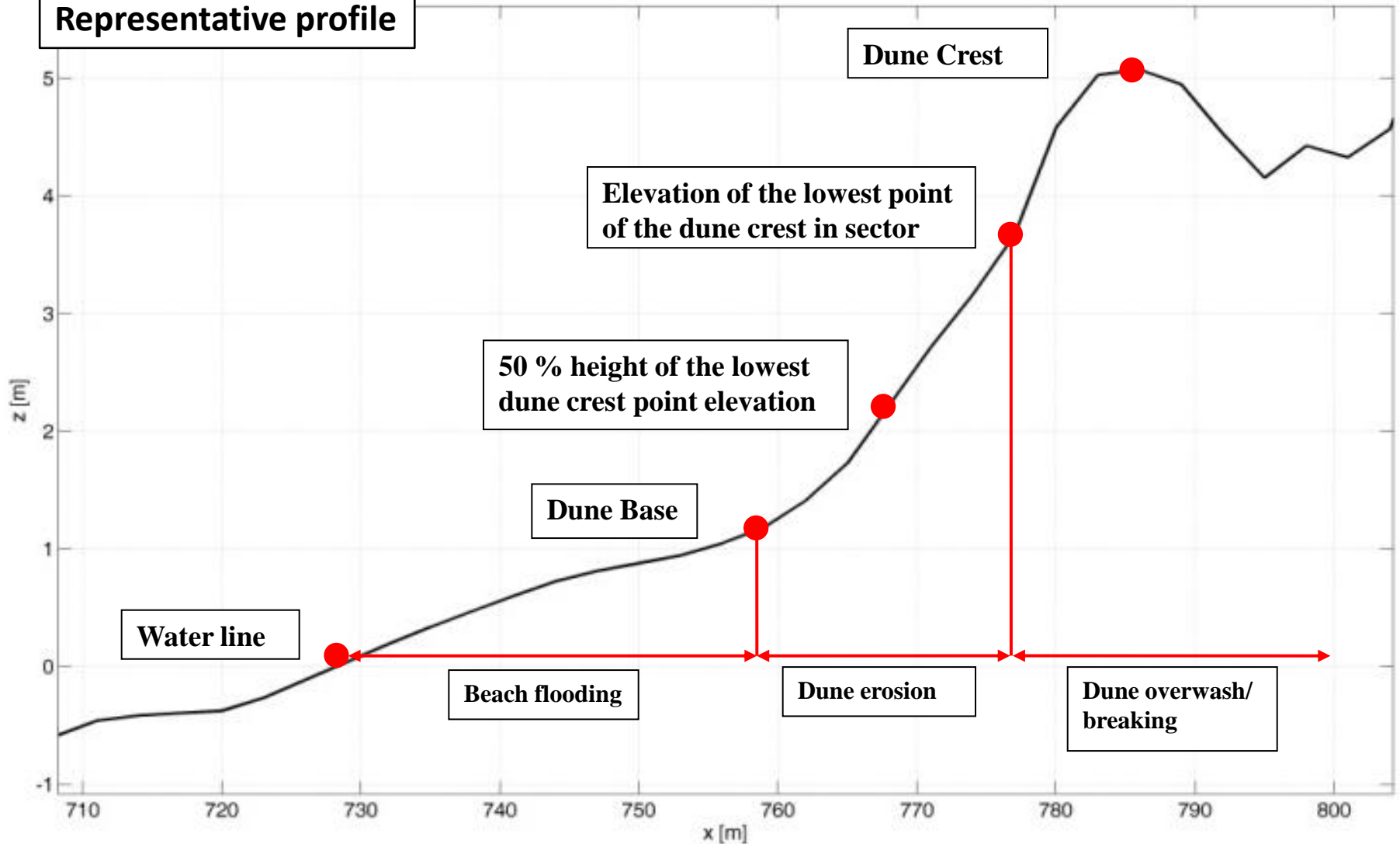




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## Representative profile





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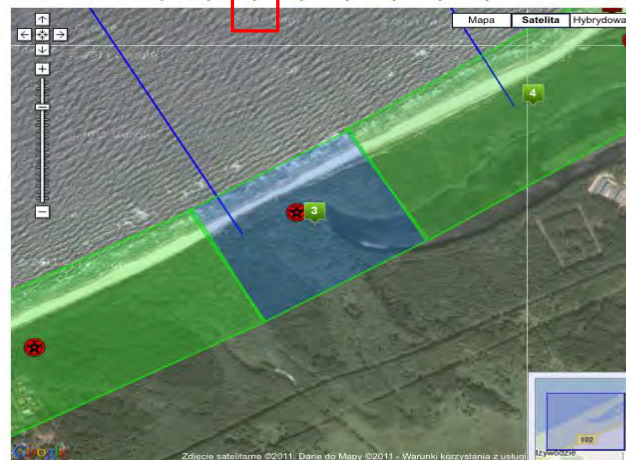
FORECAST

CONTACT



## SECTOR 3

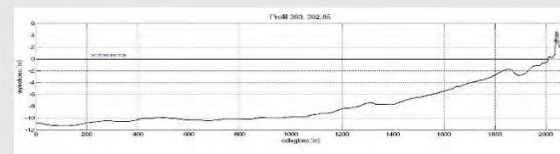
1 2 3 4 5 6 7 8



Sector is located on the west of the Dziwna mouth between 393.15-392.5 km (kilometrage of the Maritime Office).

Representative profile:  
- 393 km -> bathymetry  
- 392.85 km -> topography

### Representative profile



### Path

None specified paths to the sector.

### LEGEND

- Area
- Sector
- Path
- Representative profile
- Lowest points on dune crest

### LAYERS

- on off
- Area
  - Sectors
  - Paths
  - Profiles
  - Lowest points on dune crest

2011-06-05 10:00:00  
Bezchmurnie  
Wilgotność: 57proc.  
Dziwnów, West Pomeranian  
25°C  
Stan na dziś:  
Wiatr: wsch. z szybkością 16 km/h

Liczba odwiedzin:  
555

In order to correctly display website is required Adobe Flash Player and Internet Explorer or Opera.

Partners:



Maritime  
Office in  
Szczecin



Dziwnów  
Community

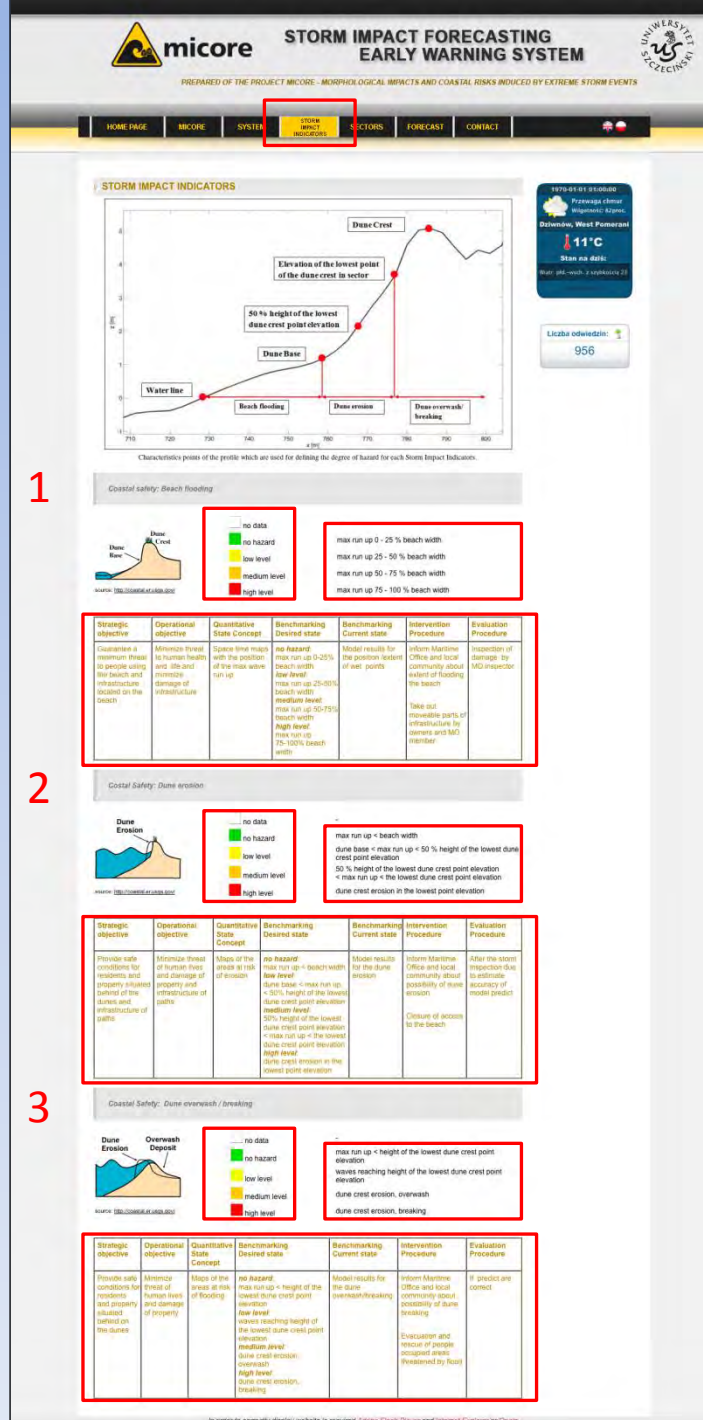
MICORE project is a research project carried out between 2008 - 2011 under the 7th Framework Programme of the European Union in the subject EW. 2007.1.3.1-1.



Zoom in



# Storm Impact Indicators



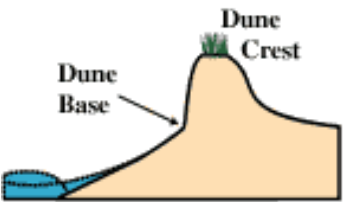


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MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS

## SII: Beach flooding

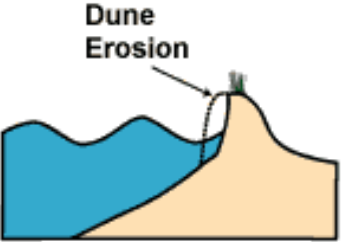
	Color scale	Level of hazard	Thresholds
		no data	-----
		no hazard	max run up 0 - 25 % beach width
		low level	max run up 25 - 50 % beach width
		medium level	max run up 50 - 75 % beach width
		high level	max run up 75 - 100 % beach width

## Reference table for SII: Beach flooding

MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS

Strategic objective	Operational objective	Quantitative State Concept	Benchmarking Desired state	Benchmarking Current state	Intervention Procedure	Evaluation Procedure
Guarantee a minimum threat to people using the beach and infrastructure located on the beach	Minimize threat to human health and life and minimize damage of infrastructure	Space time maps with the position of the max wave run up	<p><b>no hazard:</b> max run up 0-25% beach width</p> <p><b>low level:</b> max run up 25-50% beach width</p> <p><b>medium level:</b> max run up 50-75% beach width</p> <p><b>high level:</b> max run up 75-100% beach width</p>	Model results for the position /extent of wet points	<p>Inform Maritime Office and local community about extent of flooding the beach</p> <p>Take out moveable parts of infrastructure by owners and MO member</p>	Inspection of damage by MO inspector

## SII: Dune erosion

	Color scale	Level of hazard	Thresholds
		no data	-----
		no hazard	max run up < beach width
		low level	dune base < max run up < 50 % height of the lowest dune crest point elevation
		medium level	50 % height of the lowest dune crest point elevation < max run up < the lowest dune crest point elevation
		high level	dune crest erosion in the lowest point elevation



## Reference table for SII: Dune erosion

MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS

Strategic objective	Operational objective	Quantitative State Concept	Benchmarking Desired state	Benchmarking Current state	Intervention Procedure	Evaluation Procedure
Provide safe conditions for residents and property situated behind of the dunes and infrastructure of paths	Minimize threat of human lives and damage of property and infrastructure of paths	Maps of the areas at risk of erosion	<p><b>no hazard:</b> max run up &lt; beach width</p> <p><b>low level:</b> dune base &lt; max run up &lt; 50% height of the lowest dune crest point elevation</p> <p><b>medium level:</b> 50% height of the lowest dune crest point elevation &lt; max run up &lt; the lowest dune crest point elevation</p> <p><b>high level:</b> dune crest erosion in the lowest point elevation</p>	Model results for the dune erosion	<p>Inform Maritime Office and local community about possibility of dune erosion</p> <p>Closure of access to the beach</p>	After the storm inspection due to estimate accuracy of model predict

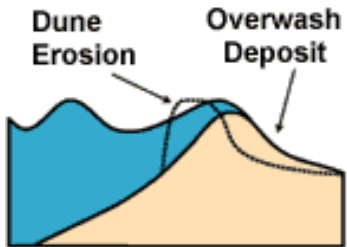


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## SII: Dune overwash/ breaking

	Color scale	Level of hazard	Threshold levels
		no data	-----
		no hazard	max run up < height of the lowest dune crest point elevation
		low level	waves reaching height of the lowest dune crest point elevation
		medium level	dune crest erosion, overwash
		high level	dune crest erosion, breaking



## Reference table for SII: Dune overwash/ breaking

MORPHOLOGICAL IMPACTS AND COASTAL RISKS INDUCED BY EXTREME STORM EVENTS

Strategic objective	Operational objective	Quantitative State Concept	Benchmarking Desired state	Benchmarking Current state	Intervention Procedure	Evaluation Procedure
Provide safe conditions for residents and property situated behind on the dunes	Minimize threat of human lives and damage of property	Maps of the areas at risk of flooding	<p><b>no hazard:</b> max run up &lt; height of the lowest dune crest point elevation</p> <p><b>low level:</b> waves reaching height of the lowest dune crest point elevation</p> <p><b>medium level:</b> dune crest erosion, overwash</p> <p><b>high level:</b> dune crest erosion, breaking</p>	Model results for the dune overwash/ breaking	<p>Inform Maritime Office and local community about possibility of dune breaking</p> <p>Evacuation and rescue of people occupied areas threatened by flood</p>	If predict are correct



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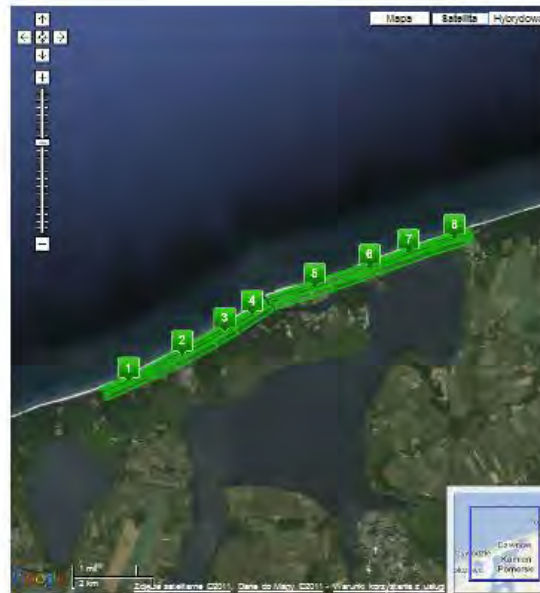
SECTORS

FORECAST

CONTACT



Forecast is calculated, from 2011-10-26 at 10:00, using morphological model XBeach on the basis of data from the WAM wave model from 2011-10-26 at 0:00 and a model of sea level M3 D UG from 2011-10-26 at 0:00. Morphological data show the state of measurement of 30 June 2009.



TIME DIF.	AREA
2011-10-26 0:00 - 2011-10-26 14:00	no sea
2011-10-26 14:00 - 2011-10-26 20:00	Sector 1
2011-10-26 20:00 - 2011-10-27 0:00	Sector 2
2011-10-27 0:00 - 2011-10-27 6:00	Sector 3
2011-10-27 6:00 - 2011-10-27 14:00	Sector 4
2011-10-27 14:00 - 2011-10-27 20:00	Sector 5
2011-10-27 20:00 - 2011-10-28 0:00	Sector 6
2011-10-28 0:00 - 2011-10-28 6:00	Sector 7
2011-10-28 6:00 - 2011-10-28 14:00	Sector 8

## LEGEND

- ☐ Beach flooding
- ☐ Dune erosion
- ☐ Dune overwash / breaking

## LEVEL OF HAZARD

- ☐ no data
- ☐ no hazard
- ☐ low level
- ☐ medium level
- ☐ high level

## LAYERS

- ☐ Area
- ☐ Sectors
- ☐ Paths
- ☐ Profiles

Please select a sector to see detailed forecast.

## Input data

Wave model WAM (data from 2011-10-26.) Sea level model M3 D UG (data from 2011-10-26.)



In order to correctly display website is required Adobe Flash Player and Internet Explorer or Opera

Partners:



Maritime  
Office in  
Szczecin



Dziwnów  
Community

MICORE project is a research project carried out between 2008 - 2011 under the 7th Framework Programme of the European Union in the subject ENV. 2007.1.2.1.5.

Grant agreement no.: 020702 Coordinator: Prof. Ryszard Ciesielski, University of Szczecin



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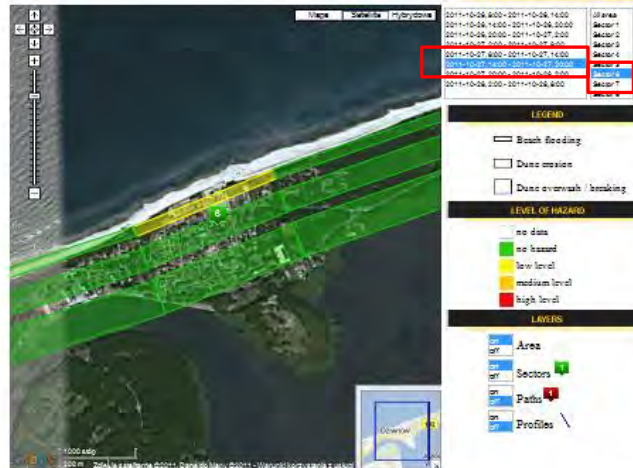
SI

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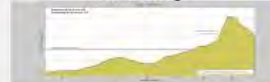
CONTACT

Forecast is calculated from 2011-10-26 at 10:00 using morphological model XBeach on the basis of data from the WAM wave mode from 2011-10-26 at 0:00 and a mode of sea level MJD 112 from 2011-10-26 at 0:00.  
Morphological data show the state of measurement of 30 June 2008.



## Detailed forecast for the next 36 hours for sector 6

### Beach flooding:



### Dune erosion:

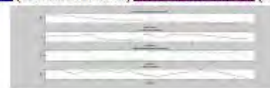


### Dune overwash / breaking:



### Input data

Wave mode WAM (data from 2011-10-26.) Sea level model MJD 112 (data from 2011-10-26.)



In order to correctly display website is required Adobe Flash Player and Internet Explorer or Opera.

Partners:



Ministry  
Office in  
Szczecin



Polish Navy  
Command

MICORE project is a research project funded by the European Union under the 7th Framework Programme of the European Union in the subject D01-2007-1.2.1.1.

Development partners: MICORE, Coordinator: Prof. Paweł Czerwinski, University of Szczecin

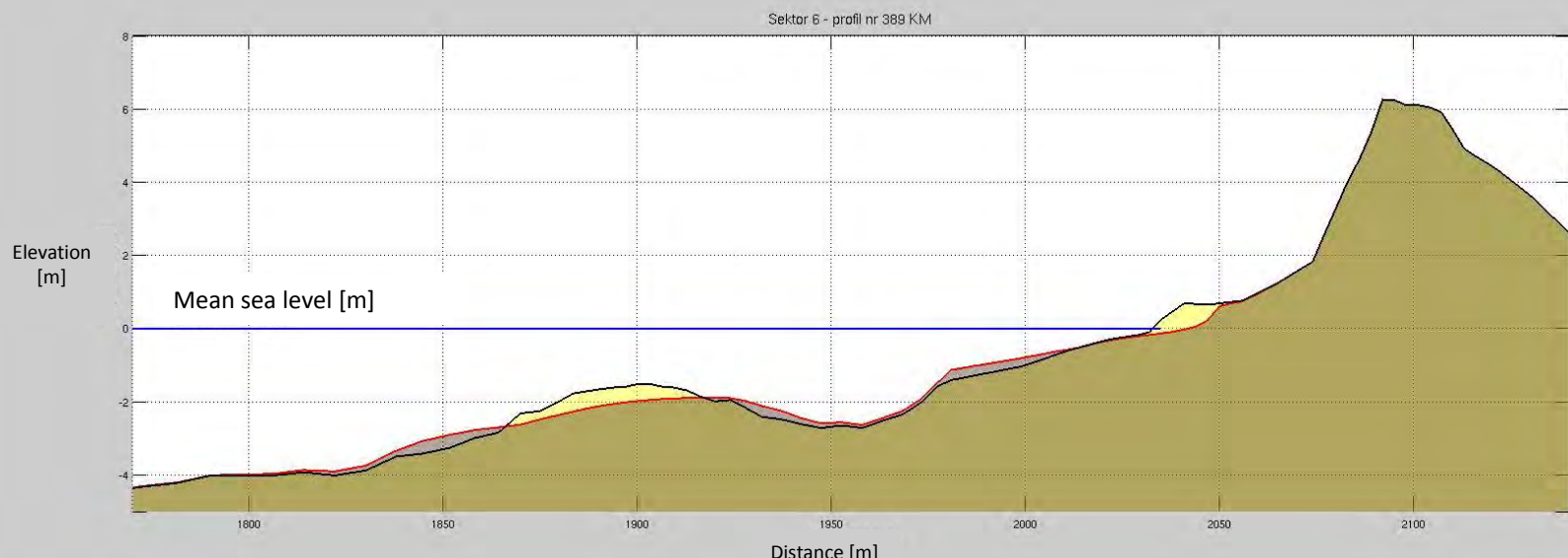
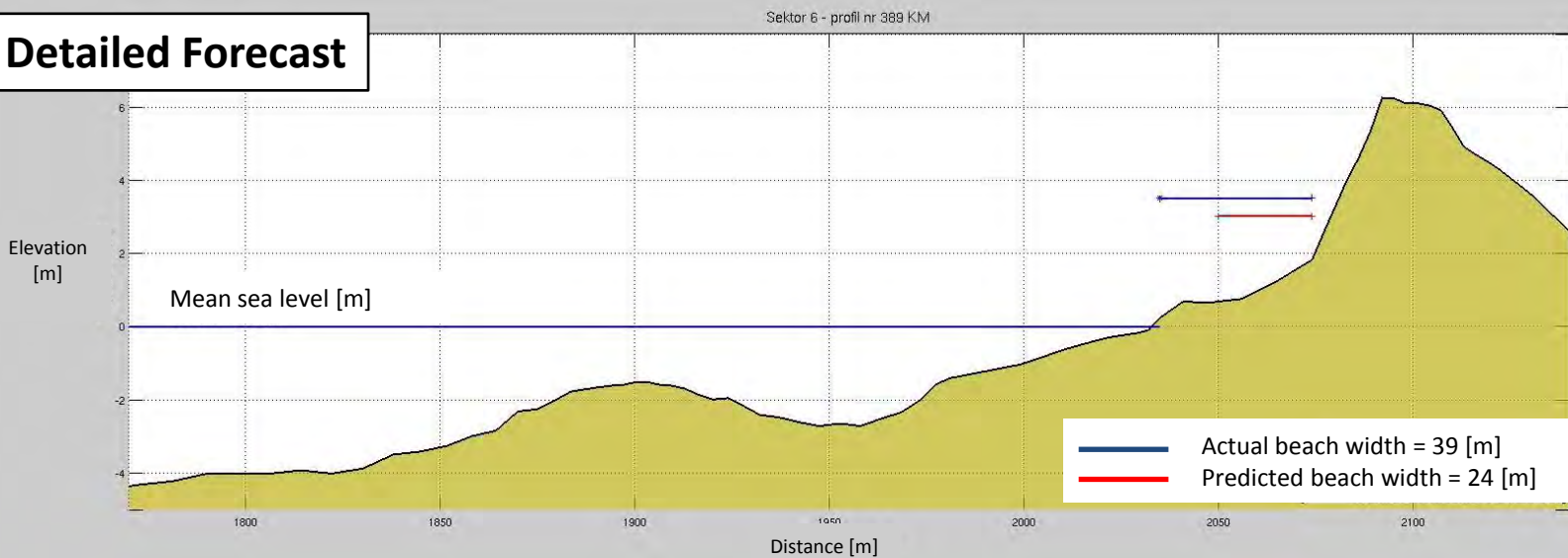




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## Detailed Forecast

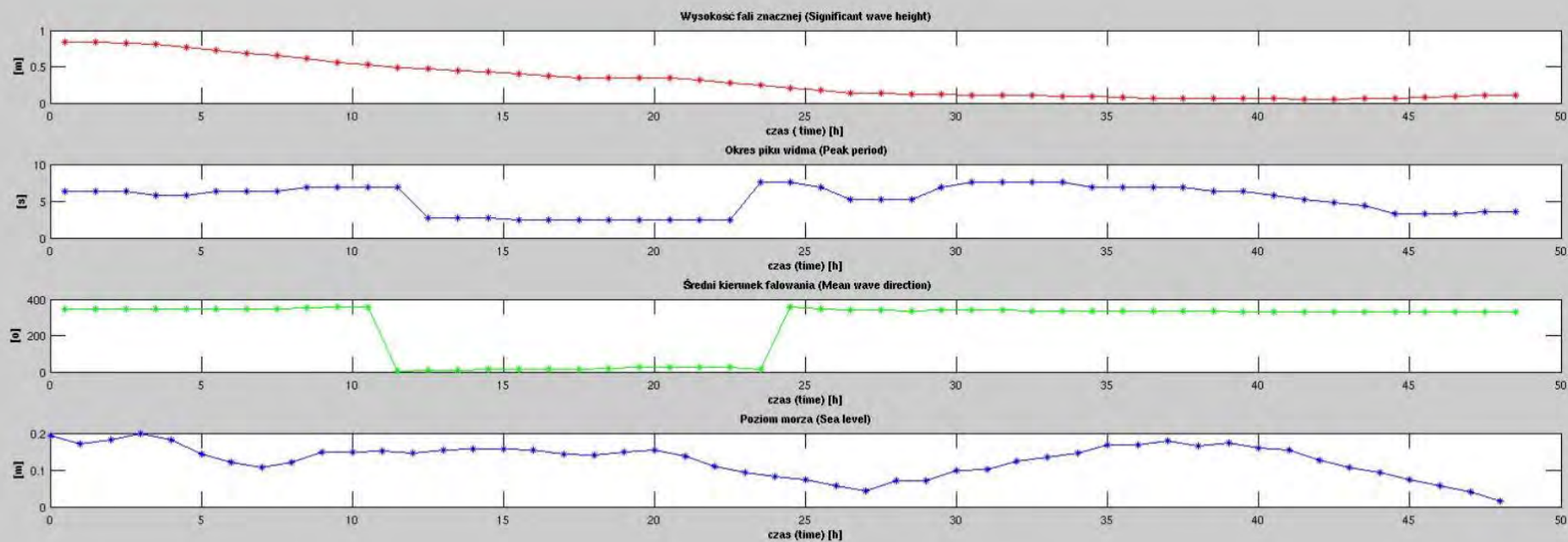




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## Detailed Forecast







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Thank you for your attention 😊

