SMART LEVEE in Poland. Full-scale monitoring experimental study of levees by different methods

Aleksandra BORECKA, Klaudia KORZEC, Jacek Stanisz

Department of Geology, Geophysics and Environmental Protection, UST AGH, Krakow

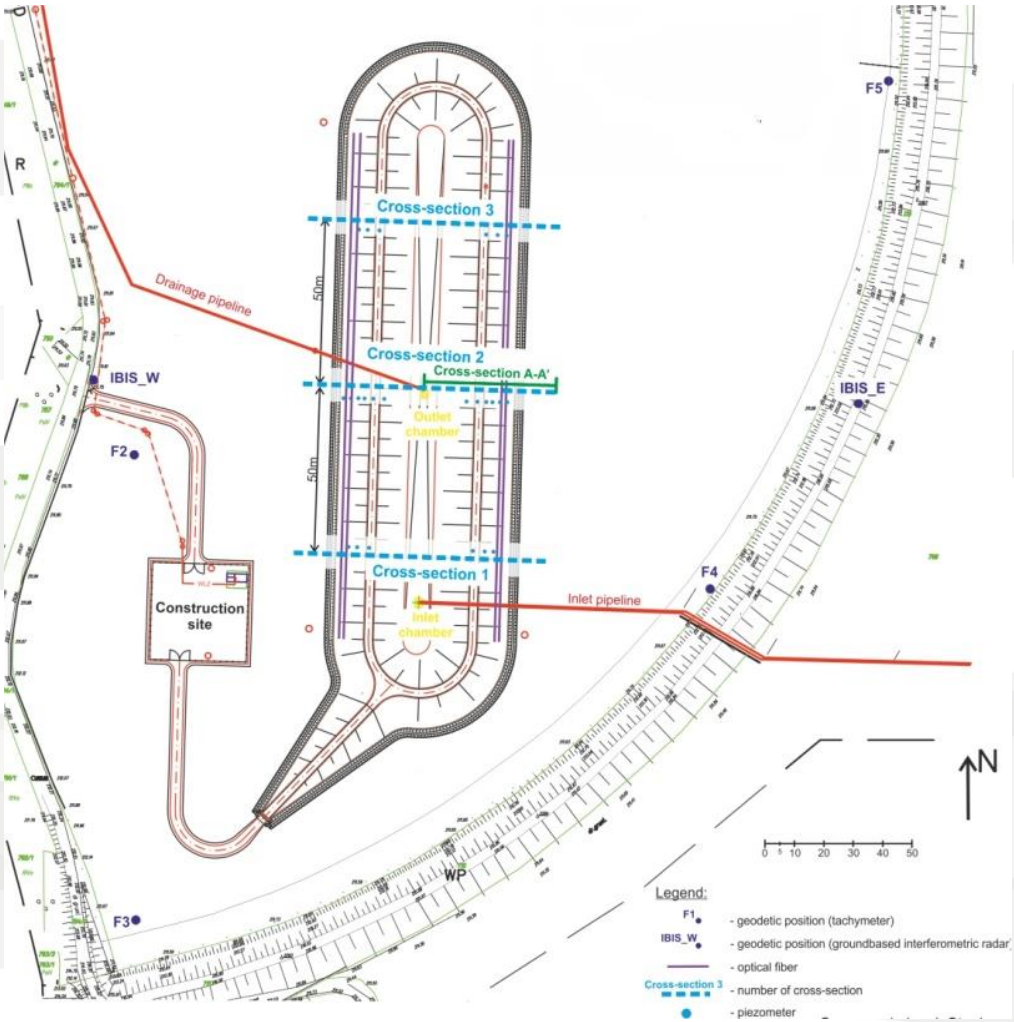
The aim of ISMOP project

The idea of the project is a systematic approach to the issue of monitoring the static and dynamic behavior of the levee in real time.

- Implementation of the selected scenarious of flood wave
- Massive collection of data in contunuous mode
- Fast and secure transmission of data
- Analysis of the measurements with the use of computer simulations
- Visualization of test results
- The use of numerical models to predict the state of the levees

Location

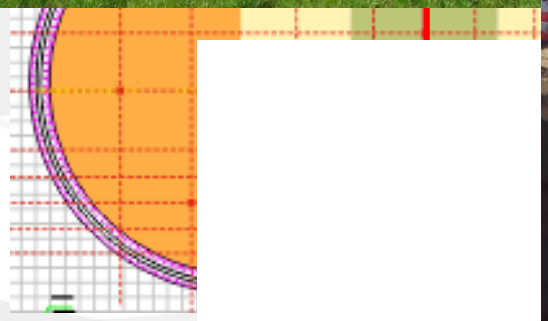
Technical parameters

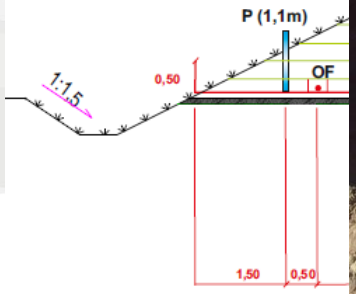


TECHNICAL PARAMETERS:

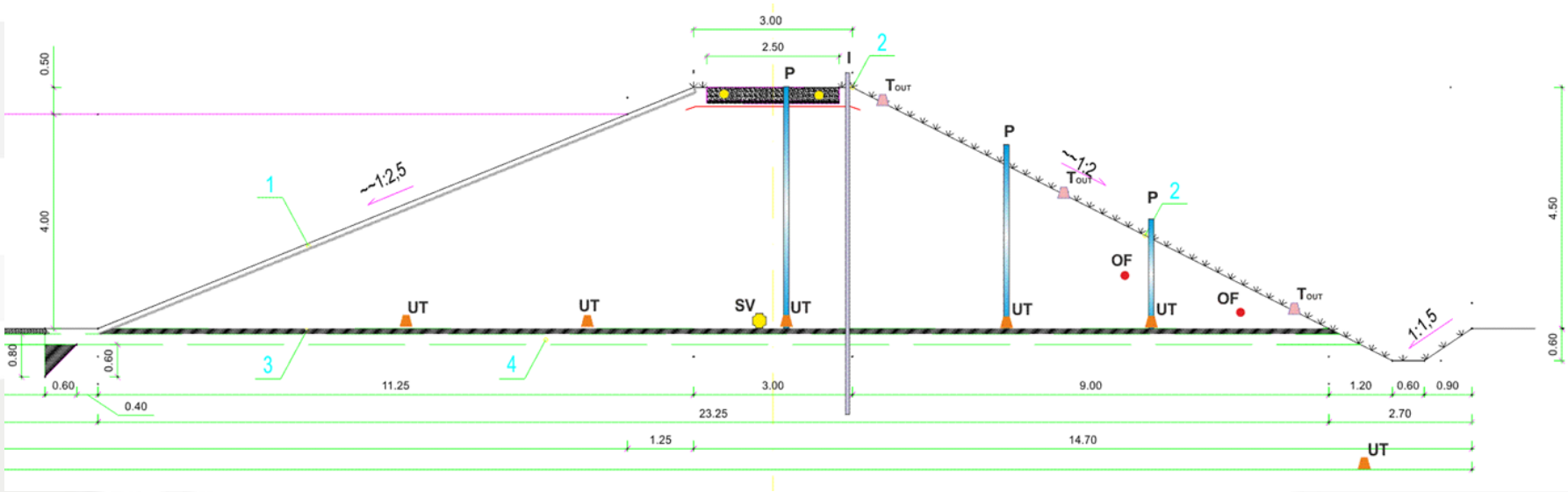
- ✓ Cubature ~ 28 500 m^3
- ✓ Perimeter ~ 407m
- ✓ Length ~ 200m
- ✓ Width ~ 53m
- ✓ Height = 4.5m
- ✓ Slope 1:2.0 (upstream) ÷ 1:2.5(downstream)
- ✓ Maximum water level = 4.0m

1:1,5



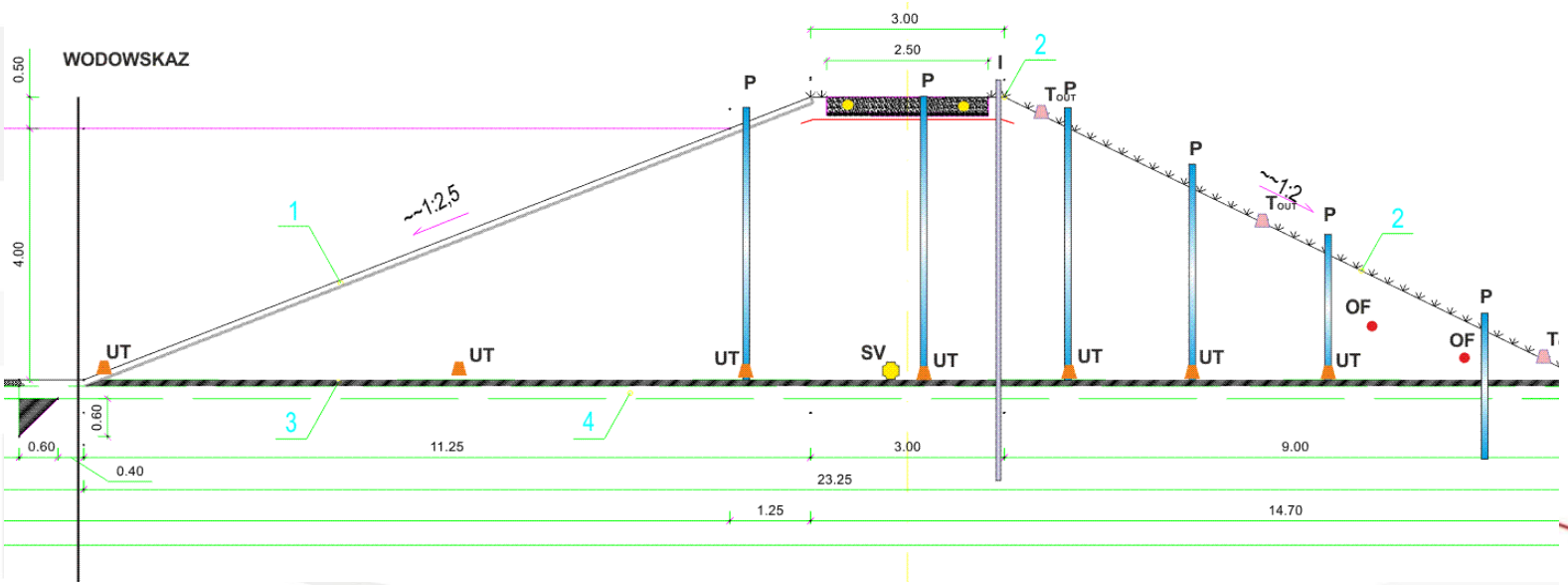

P (1,1m)
1:1,5
0,50
OF
1,50
0,50

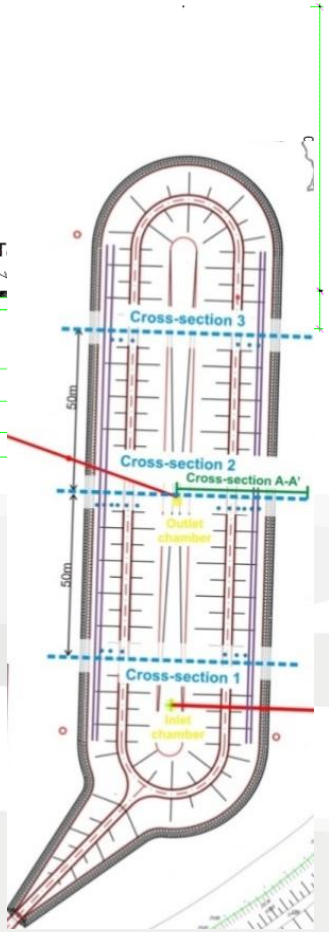
Cross-section 1-1 and 3-3



OF	optical fiber
Tout	sensor of temperature
UT	sensor of pore pressure and temperature
SV	sensor of vertical displacement
P	piezometer
I	inclinometer

Cross-section 2-2





OF	optical fiber
Tout	sensor of temperature
UT	sensor of pore pressure and temperature
SV	sensor of vertical displacement
P	piezometer
I	inclinometer

Statement of monitoring sensors installed in the experimantal levee

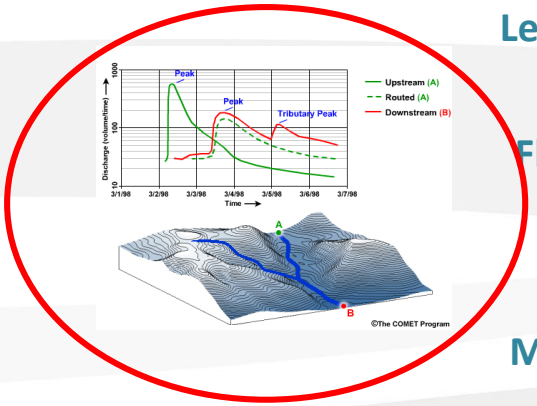
	MONITORING SENSORS					
Cross-section	INCLINOMETER	PIEZOMETER (STANDPIPE)	EARTH PRESSURE SENSOR	PORE WATER PRESSURE SENSOR and TEMPERATURE SENSOR		FIBER OPTIC
Symbol	I	P	SV	UT		OF
1-1	2	6	2	11		1200 m
2-2	2	12	2	13		
3-3	2	6	2	11		
Sum:	**6**	**24**	**6**	**35**		1200 m

Additional measurements

Additional measurements:

- ✓ Geophysical measurements
  - Geoelectrical tomography
- ✓ Geodetic measurements
  - Ground radar interferometr IBIS-L
  - Satellite SAR interferometr
  - Classical methods
- ✓ Thermographic camera
- ✓ Water levels
- ✓ Weather observations
  - Temperature
  - Humidity
  - Pressure
  - Precipitation
  - Wind speed

Project concept



Levee with sensors

Flood Simulation

Automatic Measurement System (AMS)

Repeater

Monitoring and Modeling Center (AGH UST) VIRTUAL LEVEE

Reliability Analysis

Anomaly Detection

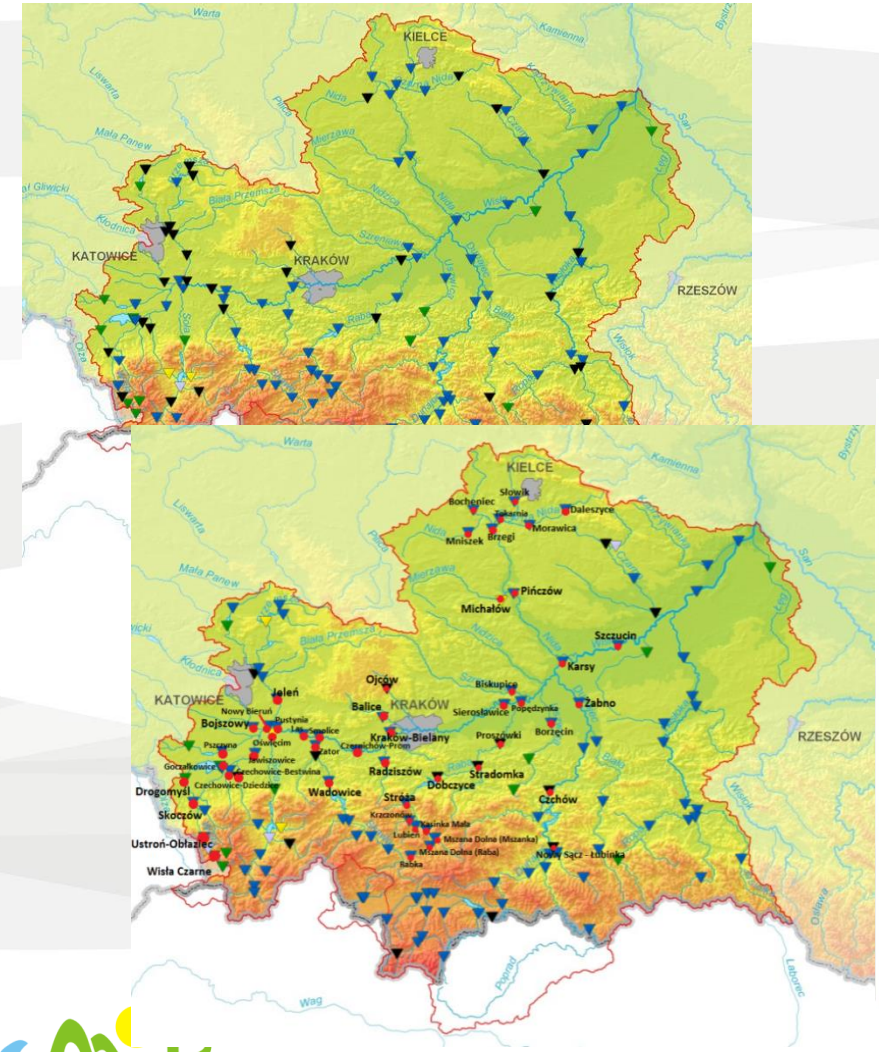
Risk assessment

Low risk?

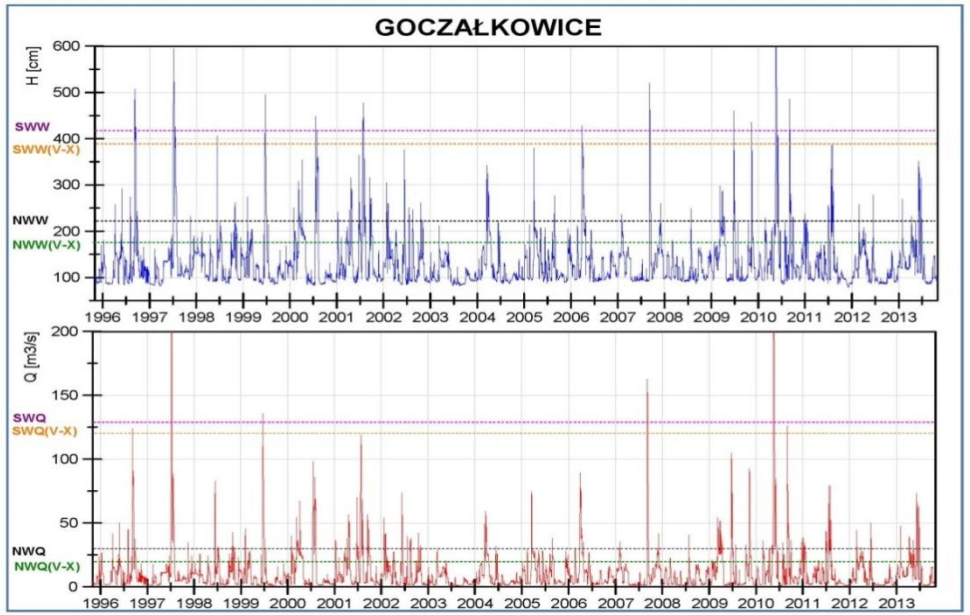
High risk?

Breaching Simulation

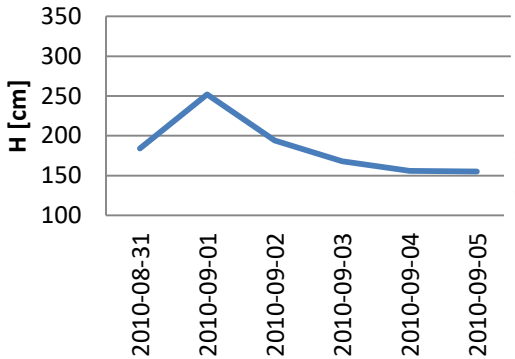
WATER GAUGE – source data

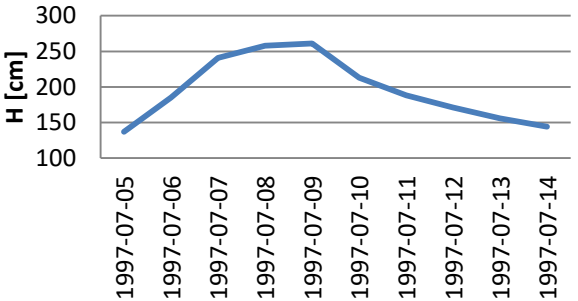


- ✓ 50 points
- ✓ daily data from 1995-2013 (19 years)

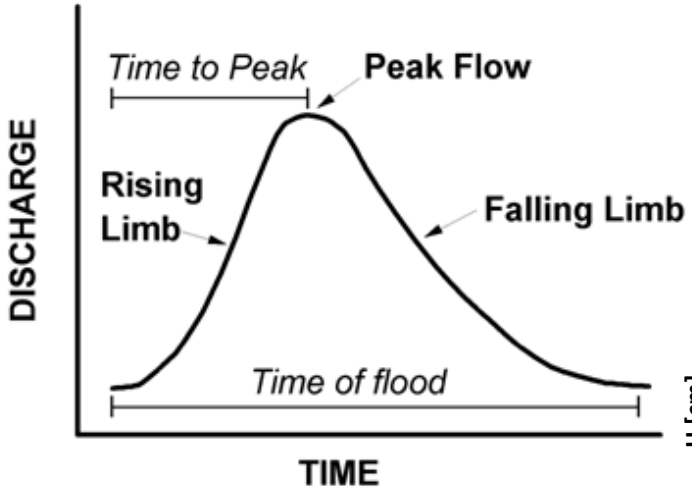


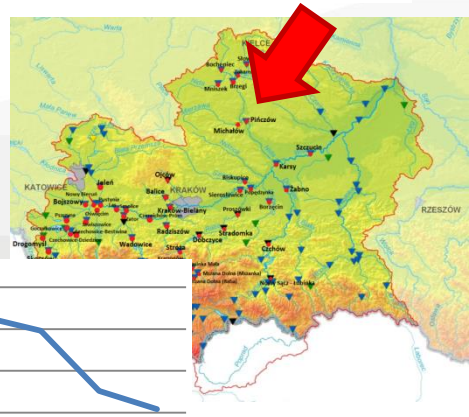
FLOOD HYDROGRAPH

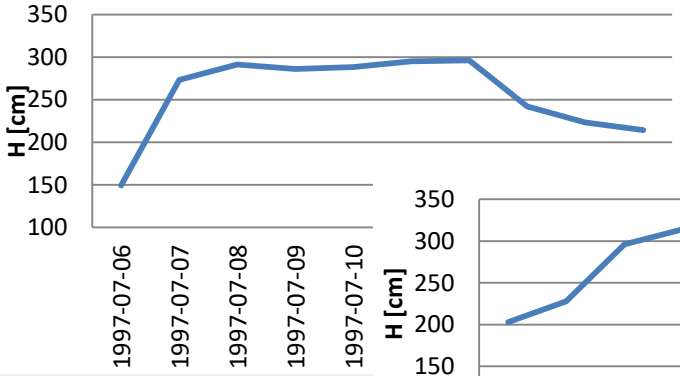


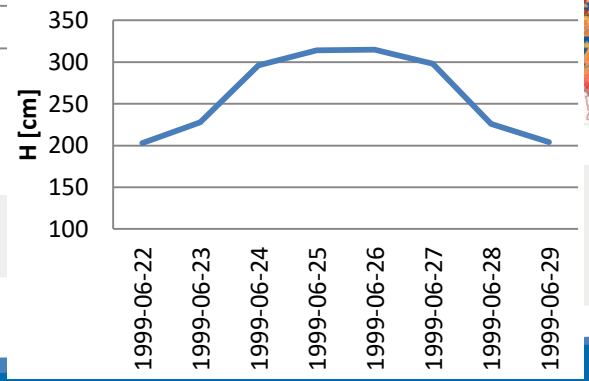


Flood curve shape



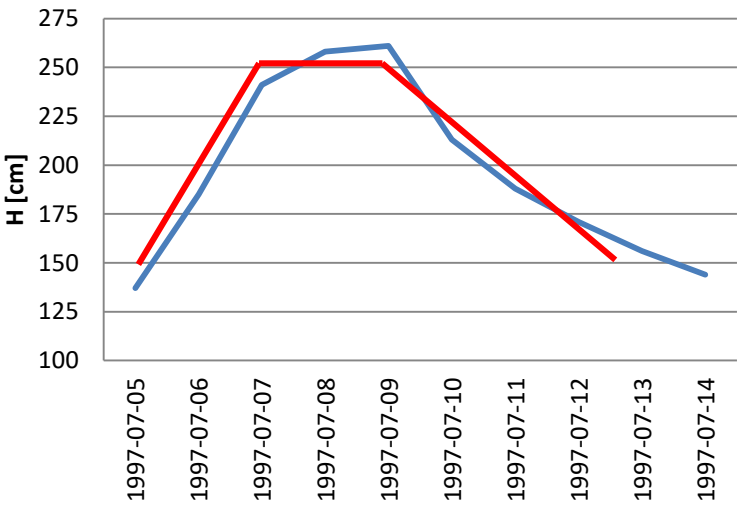


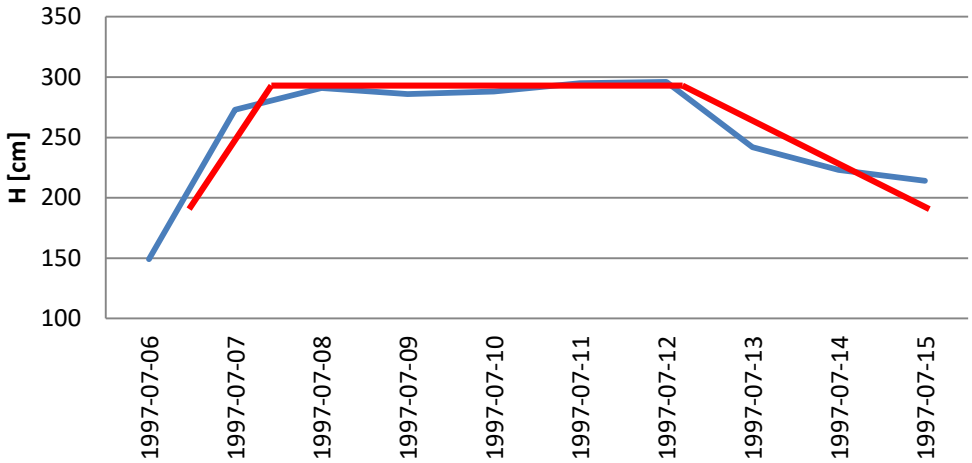




Flood models

Simplication of flood curve shape





Summary

Number of sensors which monitor changes in the levee and compare them with results of numerical simulation

New technical solutions and monitoring techniques

Simulate real processes taking place in nature

http://www.ismop.edu.pl

This work was partially supported by the National Centre for Research and Development (NCBiR) under Grant No. PBS1/B9/18/2013

NEOSENTIO SWECO AGH Akademia Górniczo-Hutnicza im. Stanisława Staszica w Krakowie INFORMATYKA KGIS KHGI