



**Těžba a její dopady
na životní prostředí v**

2. a 3. dubna 2014

v Ostravě, Hotel Harmony

Club Ostrava

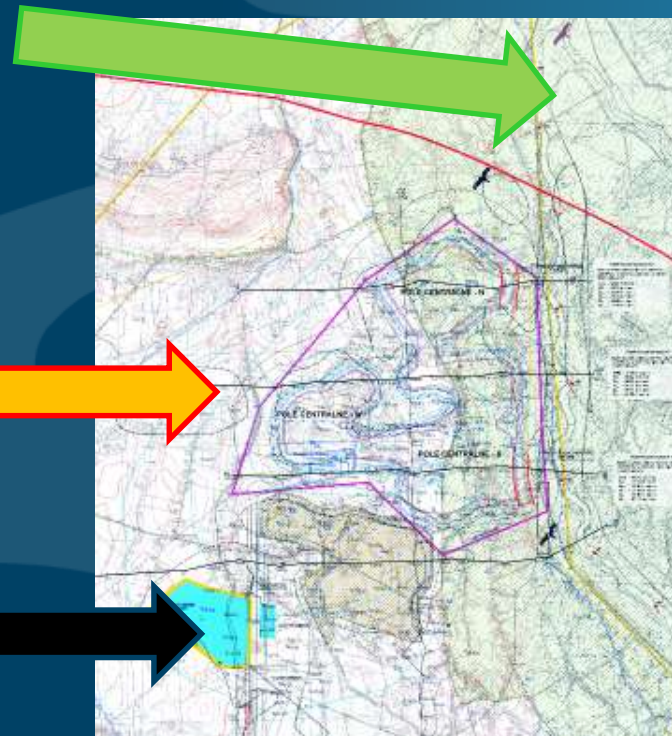
Využití DSS pro řízení nakládání s důlními vodami s ohledem na životní prostředí

RNDr. Pavel Štrof, DHI a.s., Praha

- **Model proudění povrchové a podzemní vody na lokalitě povrchového dolu**
- **Mike Customised komponenty**
- **DSS – MikeSHE v prostředí Mike Customised**

Studie proudění povrchové a podzemní vody na lokalitě povrchového dolu

Natura 2000 area

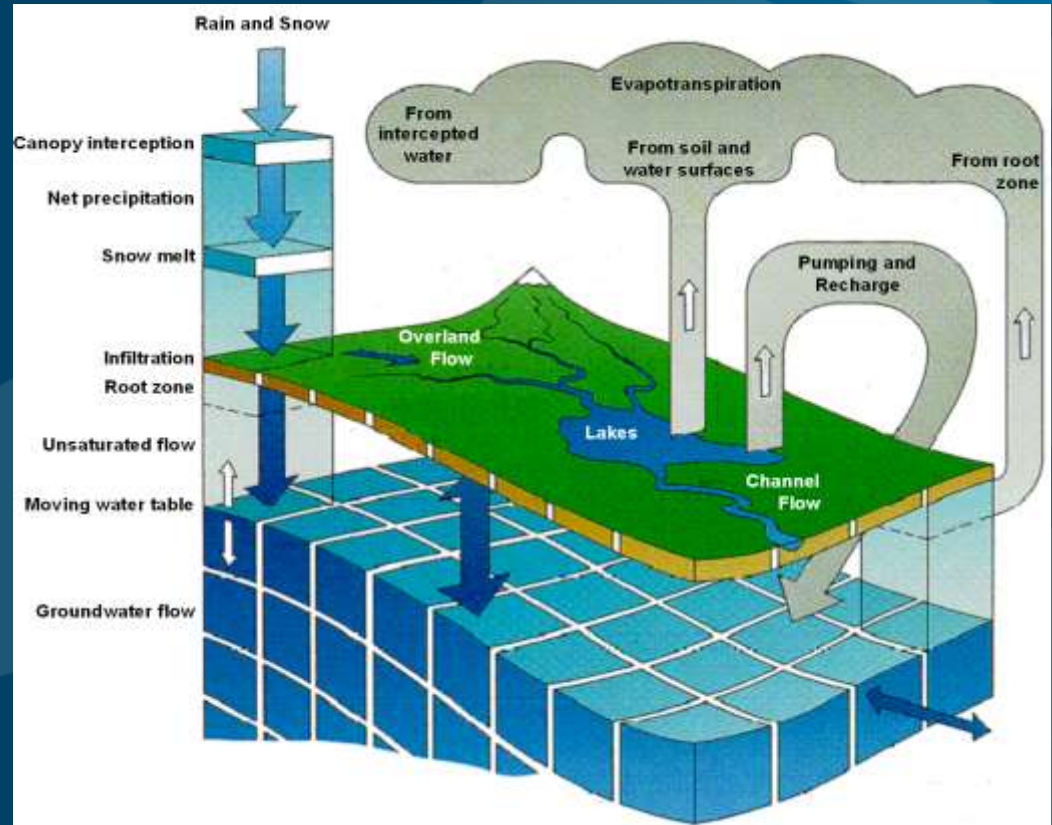


Plánovaný povrchový důl

Stávající povrchový důl

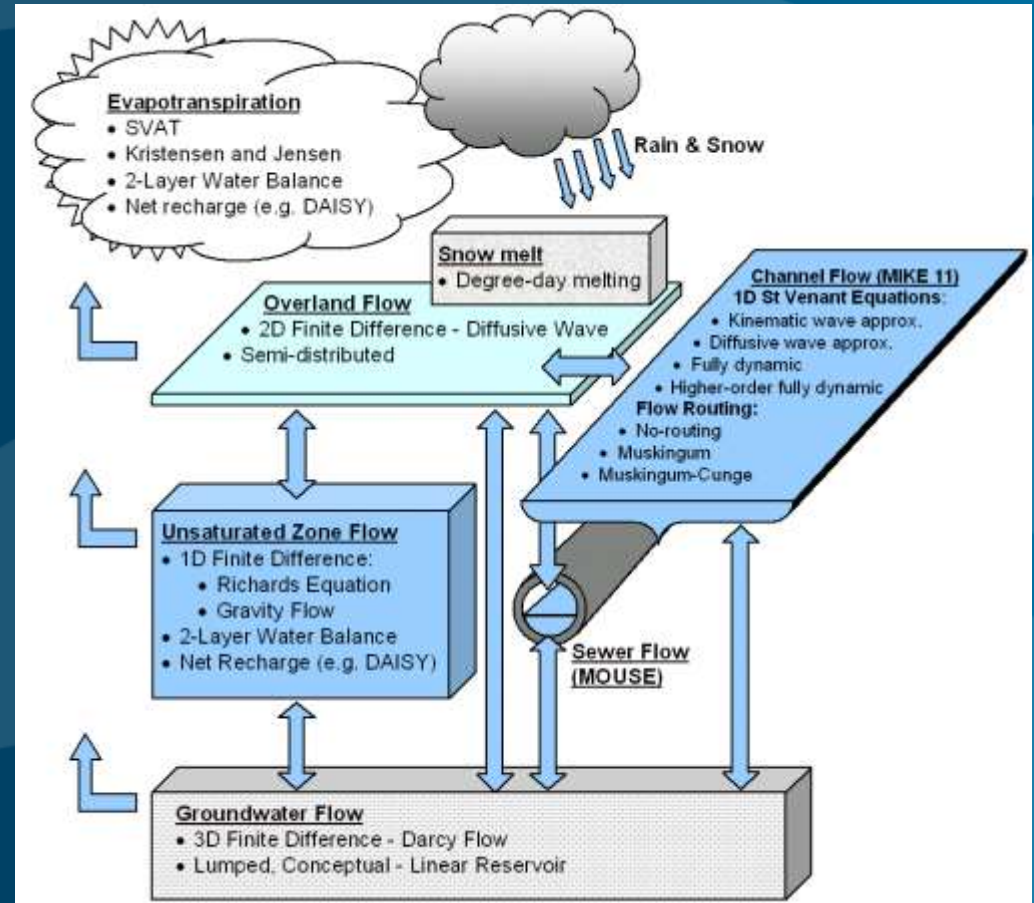
Integrované hydrologické modelové prostředí Mike SHE

- Deterministický distribuovaný matematický modelovací systém pro účely hydrologie a vodního hospodářství
- Pokrývá celou pozemní fázi hydrologického cyklu



Mike SHE – deterministický fyzikální popis

- 1D kinematic wave in river channels (M11)
- UZ: 2-layer water balance model
- SZ: 1 layer simplification (Boussinesq)
- ET + IC: Kristensen - Jensen
- SM: degree-day factor

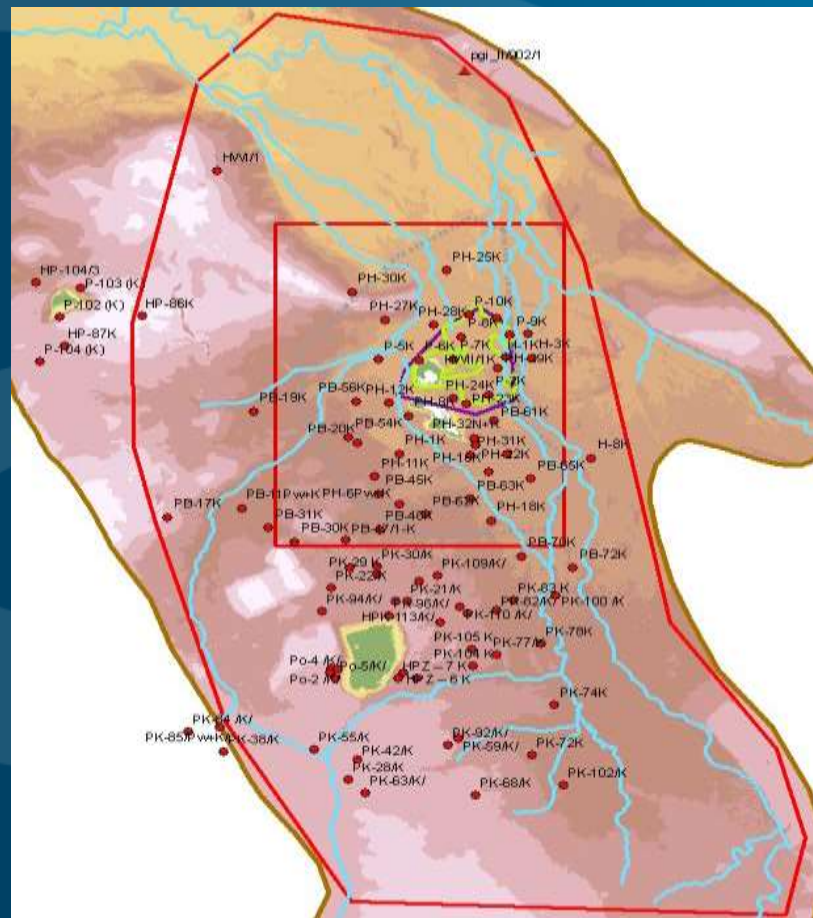
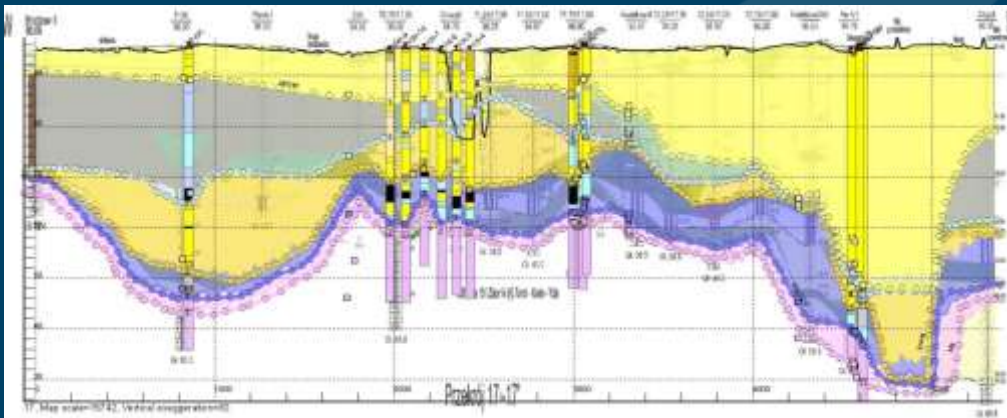


Studie proudění povrchové a podzemní vody na lokalitě povrchového dolu

- Globální model (39km², 100x100m)
- Lokální model (9km², 40x40m)

Groundwater model setup

- 226 drillings descriptions / 19 vertical profiles
- 5 main layers
- about 100 timeseries of groundwater level
- pumping data

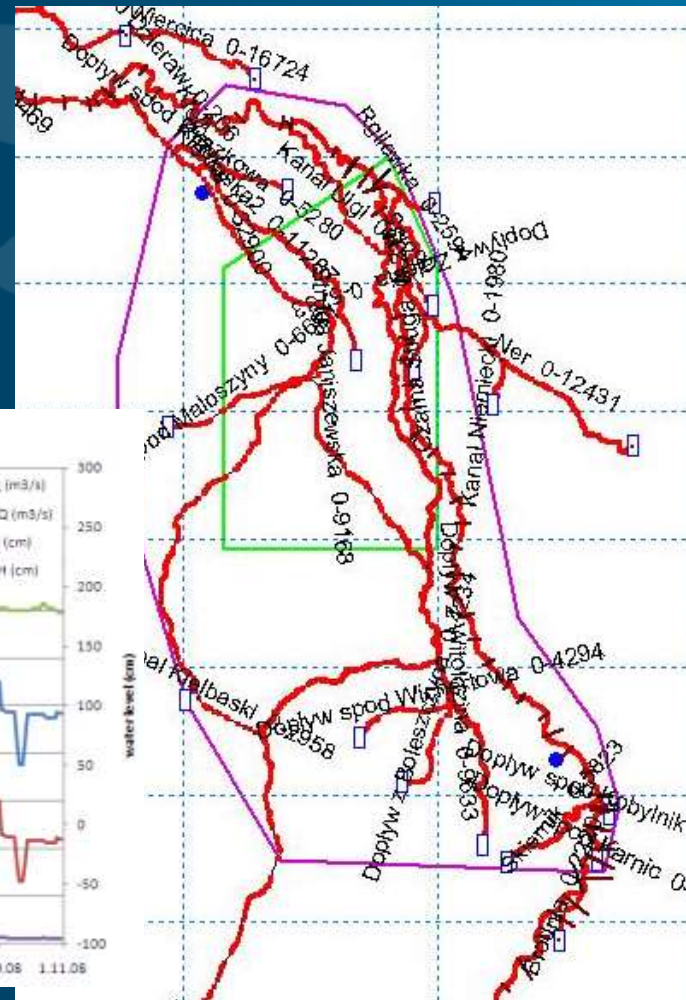
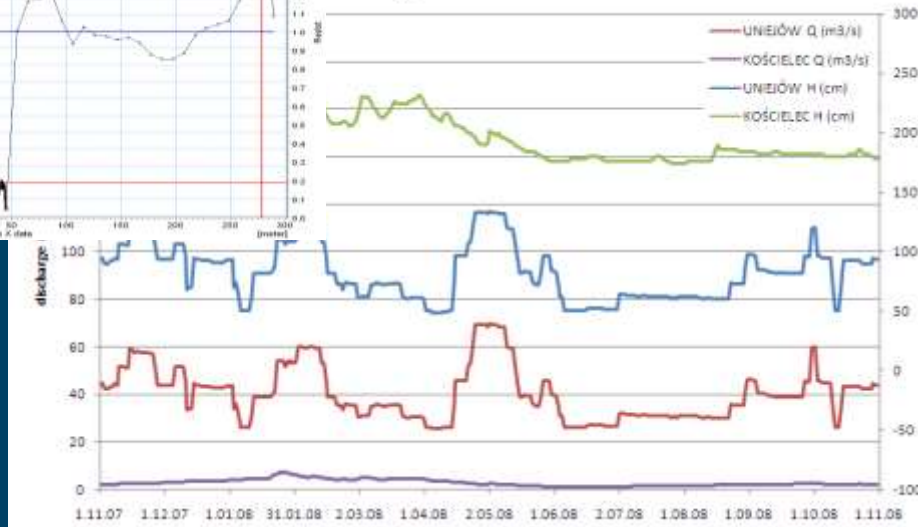


River model setup

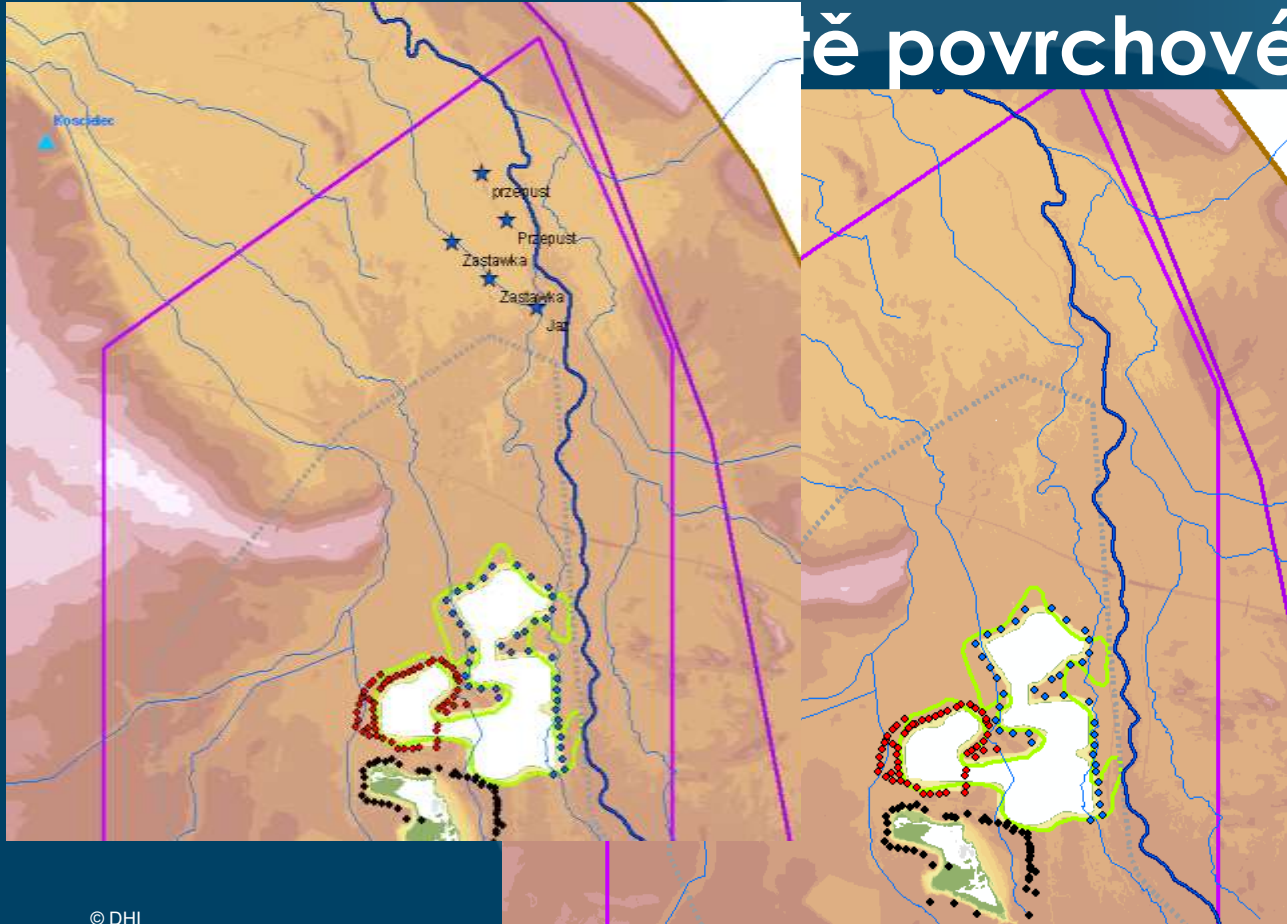
- main rivers and channels
- 254 cross sections
- 4 Q stations



Discharge and water level data



Studie proudění povrchové a podzemní v povrchovém dole



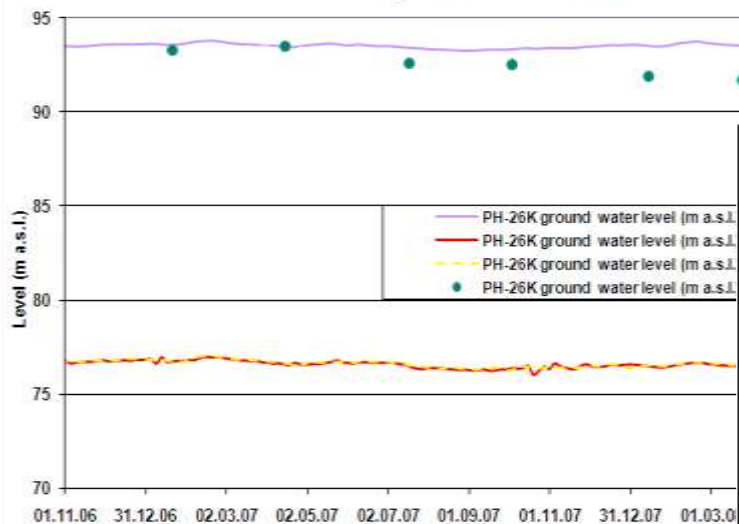
Simulace 3 variant

- 0) Aktuální stav
- 1) Odtěžení plného rozsahu
- 2) Jako 1) plus opatření

Studie proudění povrchové a podzemní vody na lokalitě povrchového dolu

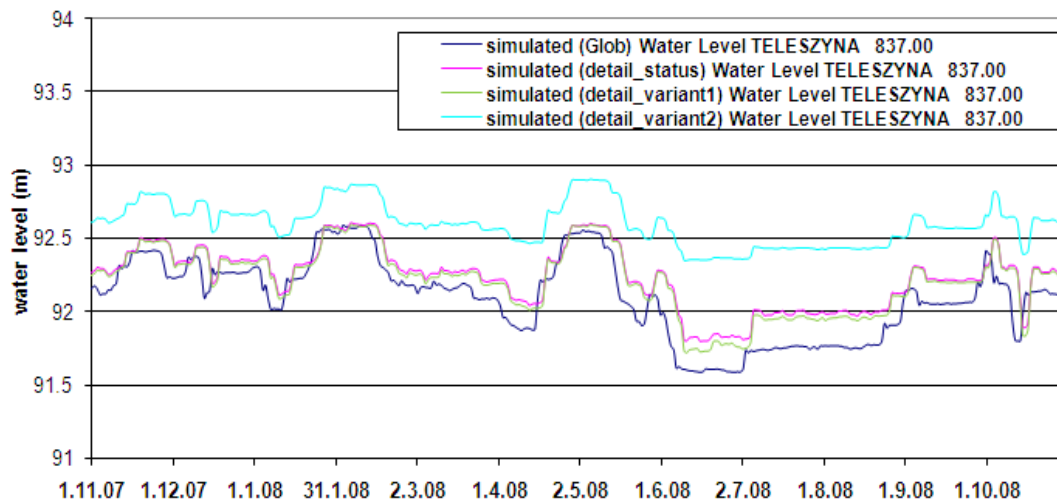
- Výsledky simulací
Časové řady

Ground water level measured and simulated,
piezometer PH-26K



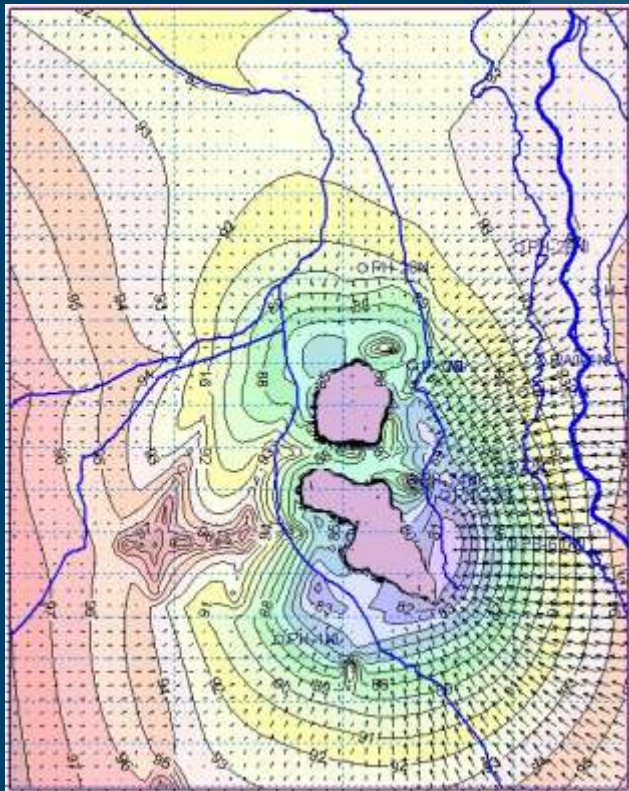
Pokles hladin ve vybraných bodech

Simulated daily water level - Teleszyna



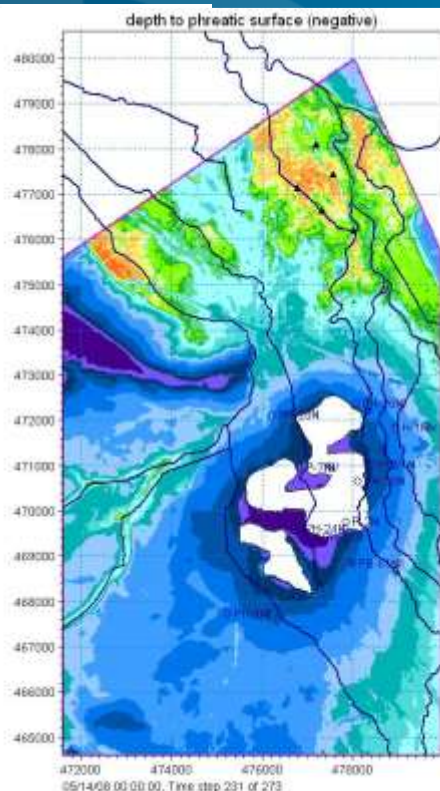
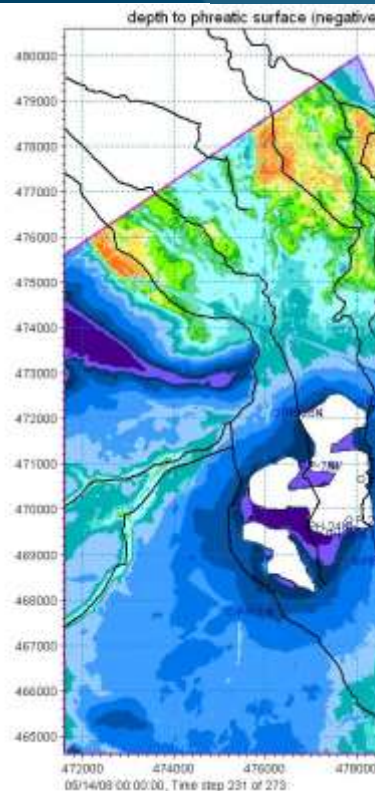
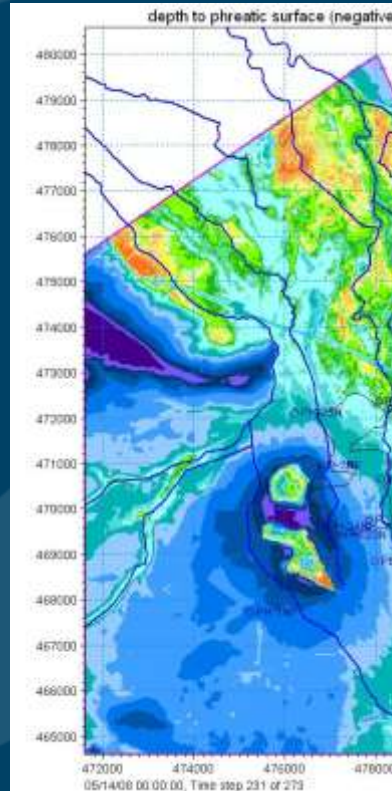
Pokles hladin v tocích

Studie proudění povrchové a podzemní vody na lokalitě povrchového dolu



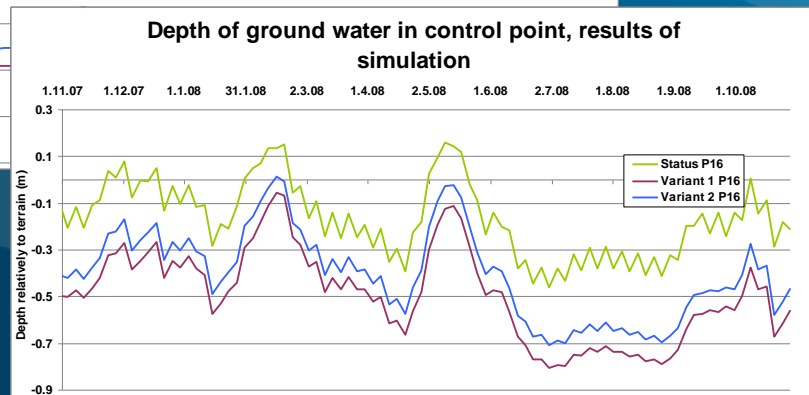
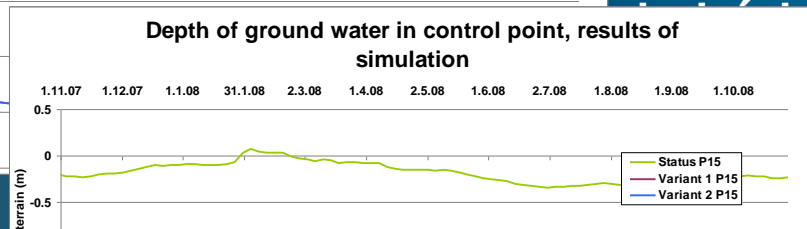
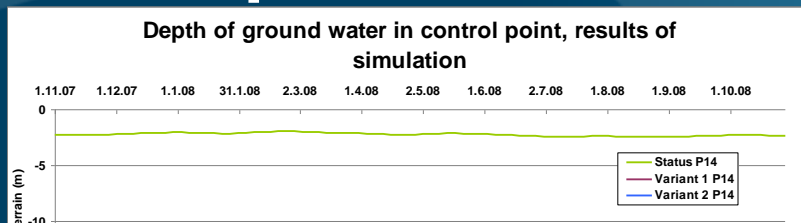
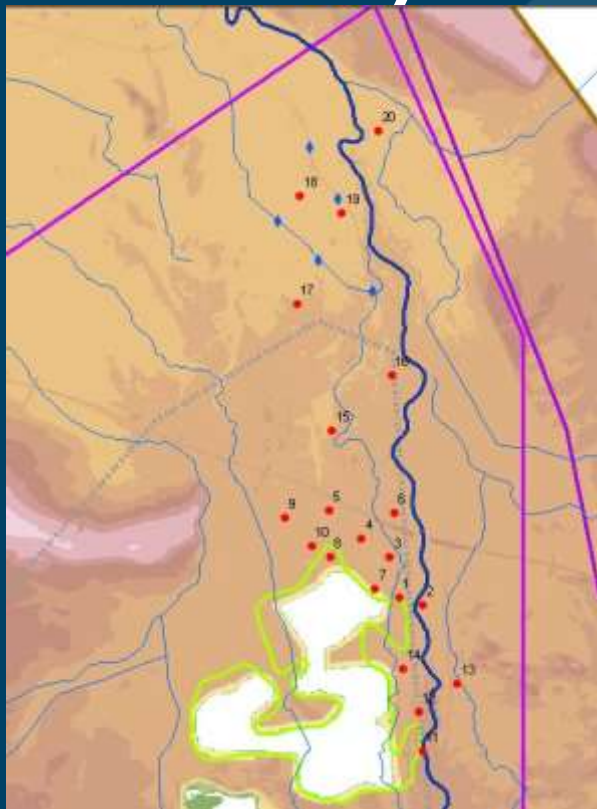
© DHI

Rychlostní pole GW



Úroveň hladiny GW

Studie proudění povrchové a podzemní vody na lokalitě povrchového dolu



edky simulací
ěny hladin GW v
bodech

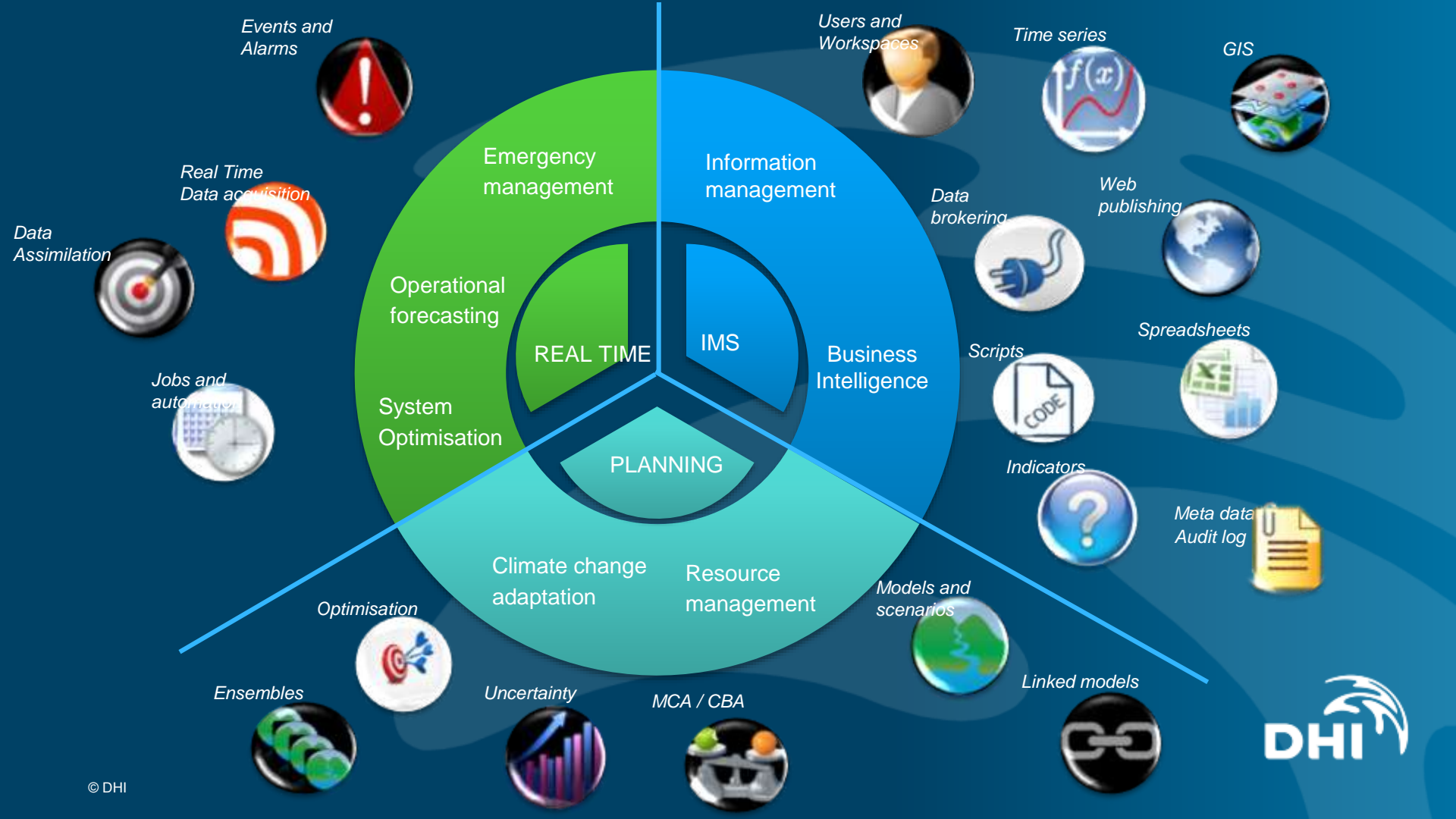
Studie předána v papírové podobě

- Řada statistických grafů a map
- Hodnoceny 3 varianty
- Změny vstupů → nový modelový výpočet → nová papírová studie

Digitální zpráva

MIKE CUSTOMISED Funkční komponenty





MIKE CUSTOMISED Struktura a terminologie



Products

Our standard products – the starting point for our client solutions:



IMS - Information Management Systems



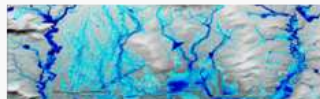
WISYS - ArcGIS-based water information system



Planning - Investment planning and decision support



GeoFES - Emergency management planning and operations



Real Time - River operations and early warning



Flood Toolbox - Flood risk management and support in implementation of the EU Floods Directive



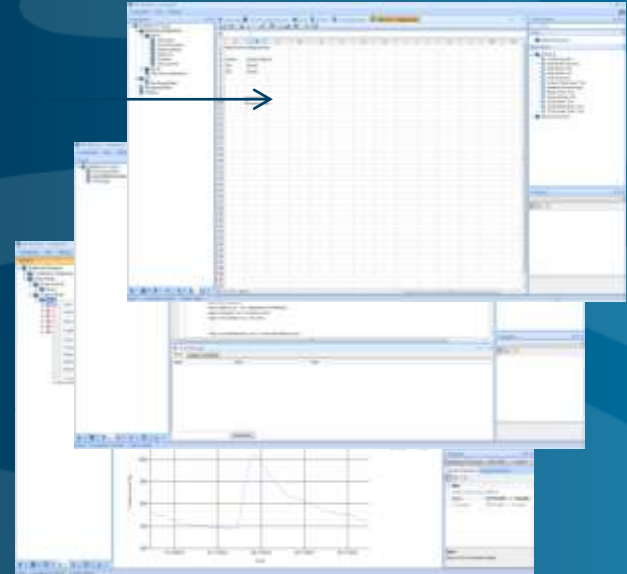
DIMS.CORE - Data integration and business processes

Component UI (Scientific View)

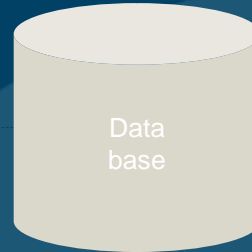
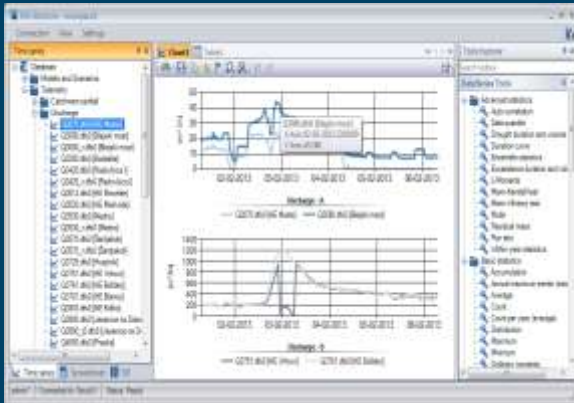
Maps
(GIS)



Spreadsheets



Time series



Data
base

Open architecture (API)

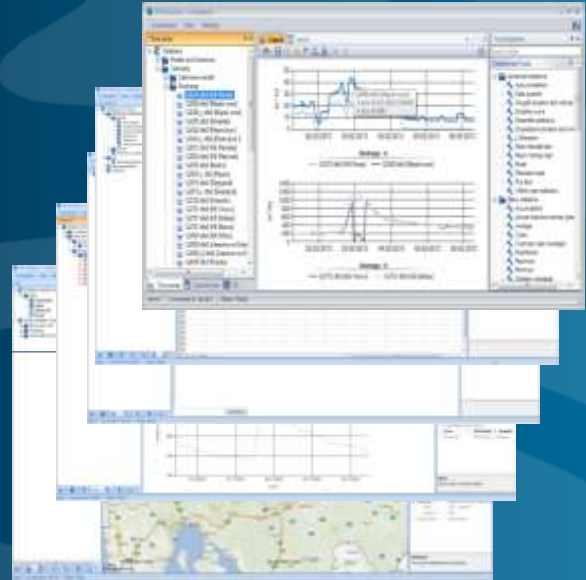
Add User tools

Different users – Different views

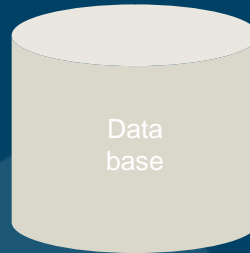
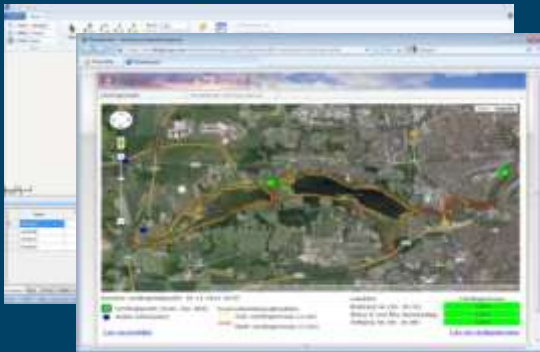
Operator view (product)



Scientific view (components)

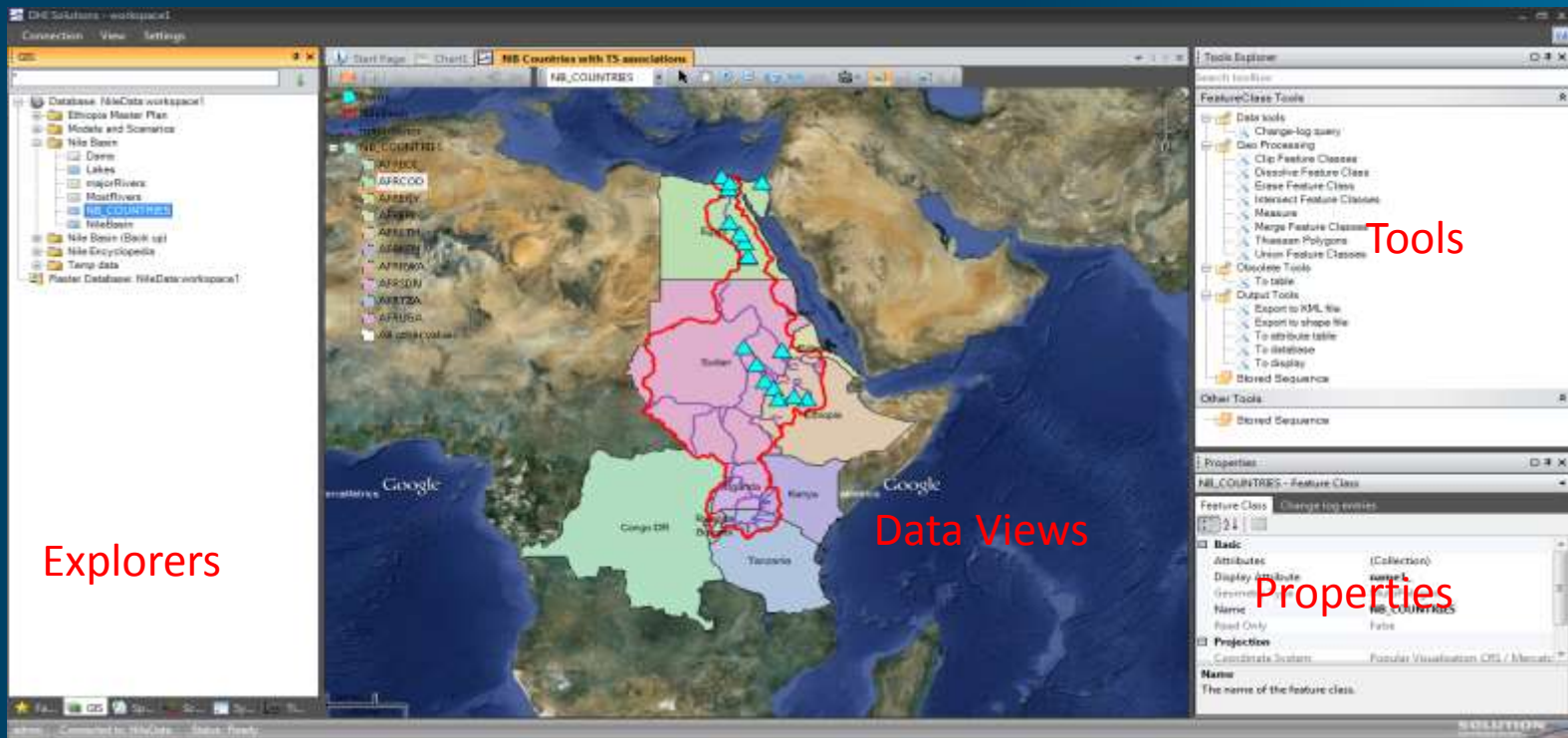


Tailor made view (client solution)



Standard Windows UI for each Component (GIS Manager)





Explorers

Tools

Data Views

Properties

Dashboard
(web
publishing)

Time
series

GIS

Indicators

Scenarios

Scripting

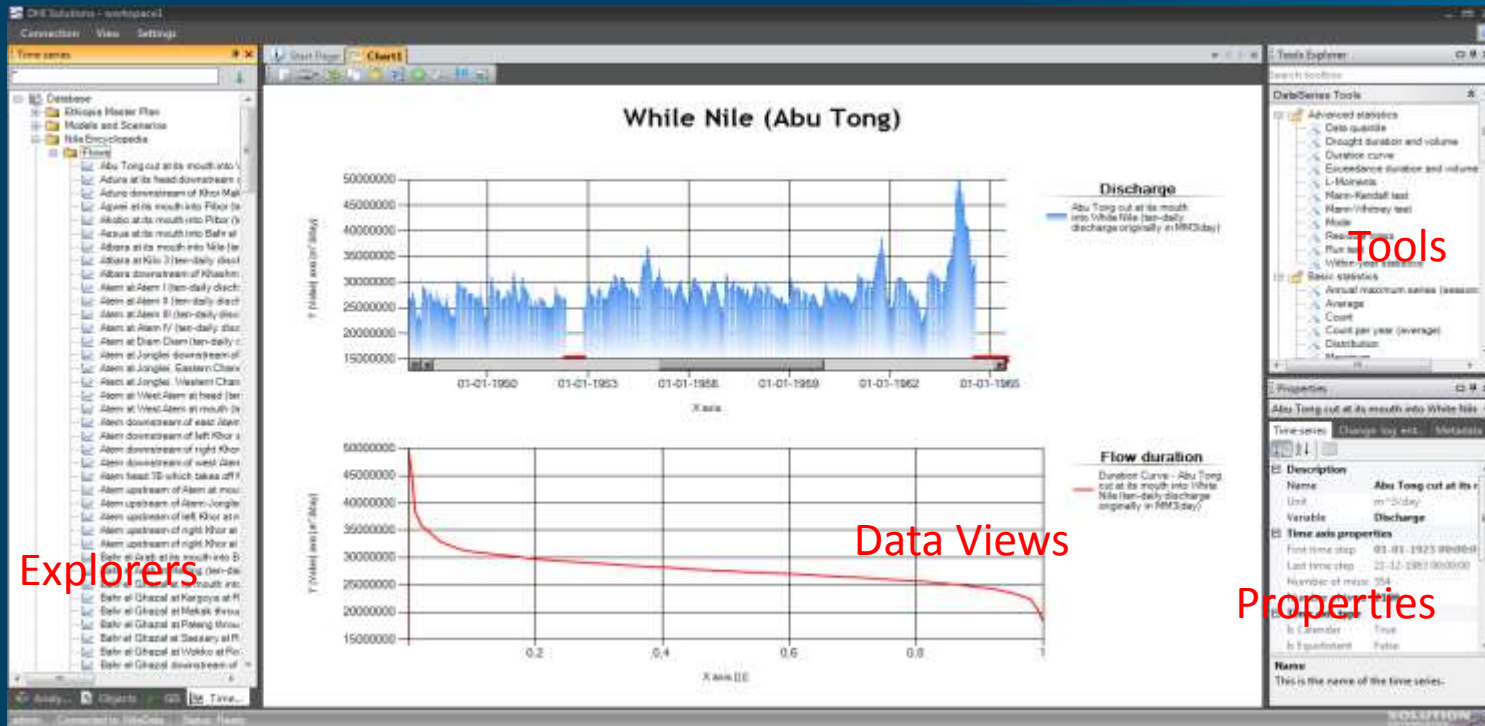
Meta data

Work
spaces

Spread-
sheets



Standard Windows UI for each Component (Timeseries Manager)



Explorers

Data Views

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(web publishing)

Time series

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Custom made UI – an example



The screenshot displays a GIS application window with a map of Australia. A network diagram is overlaid on the map, showing a series of blue lines representing pipes. The network starts from a single source on the left and branches into two parallel paths, each ending in a vertical stack of three nodes: a green triangle (Reservoir), a red circle with a vertical line (Pump), and another green triangle (Reservoir). The diagram also includes a cyan line representing a tank and a red circle with a vertical line representing a pump. The interface includes a left-hand sidebar with a tree view of data layers, a top toolbar, and a bottom spreadsheet window.

The spreadsheet window, titled "System Properties", shows a table with the following structure:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Save Run																
2																	
3																	
4		Diameter	Roughness	Type	Descr 1	Descr 2	Descr 3	Photo 1	Photo 2								
5		Pipe 1															
6		Pipe 2															
7		Pipe 3															
8		Pipe 4															
9																	

Dashboard
(web publishing)

Time series

GIS

Indicators

Scenarios

Scripting

Meta data

Work spaces

Spread-sheets



Open interfaces - An expandable and open development platform



DSS Front-end

Shell

Explorers

Scenarios Explorer

Time series Explorer

GIS Explorer

...

Data Views

Scenario View

Time series View

Map

...

Application

Modules

Scenario

Ensemble Modeller

Model Linker

Optimizer

Analysis

MCA

CBA

Time series

Quality

Data Acquisition

Spreadsheet

GIS

Scripting

Document

System Administration

...

Tools

Resample

Union

Gap Filling

Intersect

Mean

...

Model Tools

MIKE 11 Adapter

MIKE BASIN Adapter

... Adapter

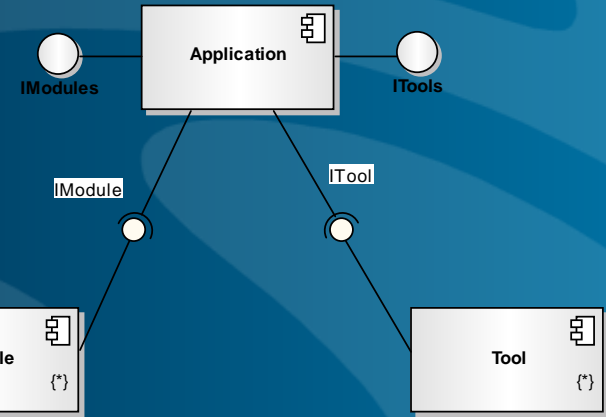
MIKE 11

MIKE BASIN

...

DSS Database (PostgreSQL)

PostGIS



Řešení s užitím MIKE CUSTOMISED





- Components
- IMS
- Planning
- REAL TIME
- DIMS.CORE
- FTB
- WISYS
- GeoFES



Solutions for mine water management



Design

- Monitoring (hydrology and biology)
- Water Surplus and Scarcity Risks
- Mine Flooding
- Mine Dewatering
- River and Stream Diversions



Operations

- Real Time Compliance Monitoring
- Mine Water Information & Management
- Sediment Management
- Real Time Forecasting and Early Warning



Closure

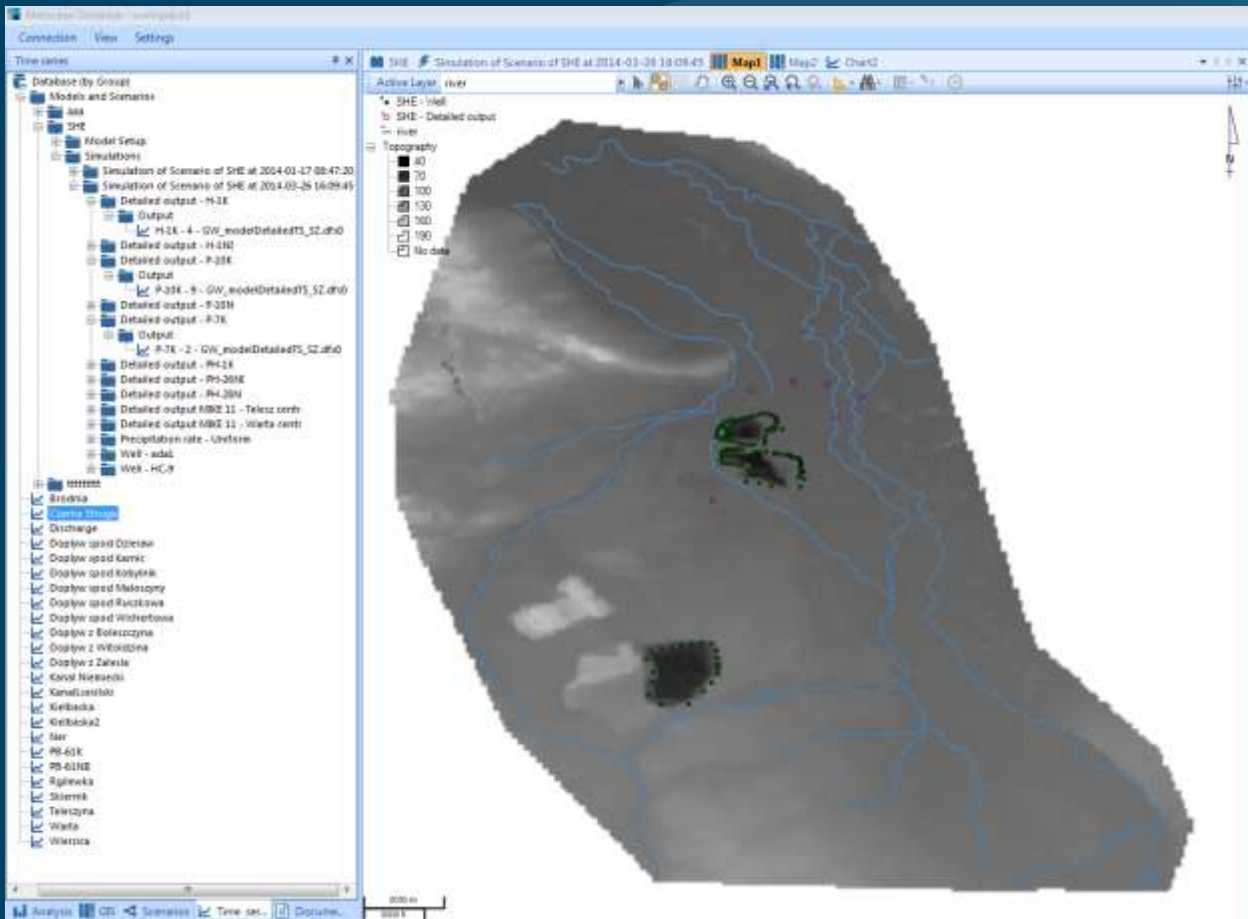
- Mine Rehabilitation Hydrology
- Wetland and Stream Restoration
- Acid Mine Drainage
- Climate Change Impact Assessment

Solutions for mine water management



- Higher regulatory confidence
- More efficient planning
- Reduced downtime
- Improved compliance
- Cost effective solutions
- Short payback times (high ROI)

DSS – MikeSHE v prostředí Mike Customised



- Modelování
Scénáře a varianty

DSS – MikeSHE v prostředí Mike Customised

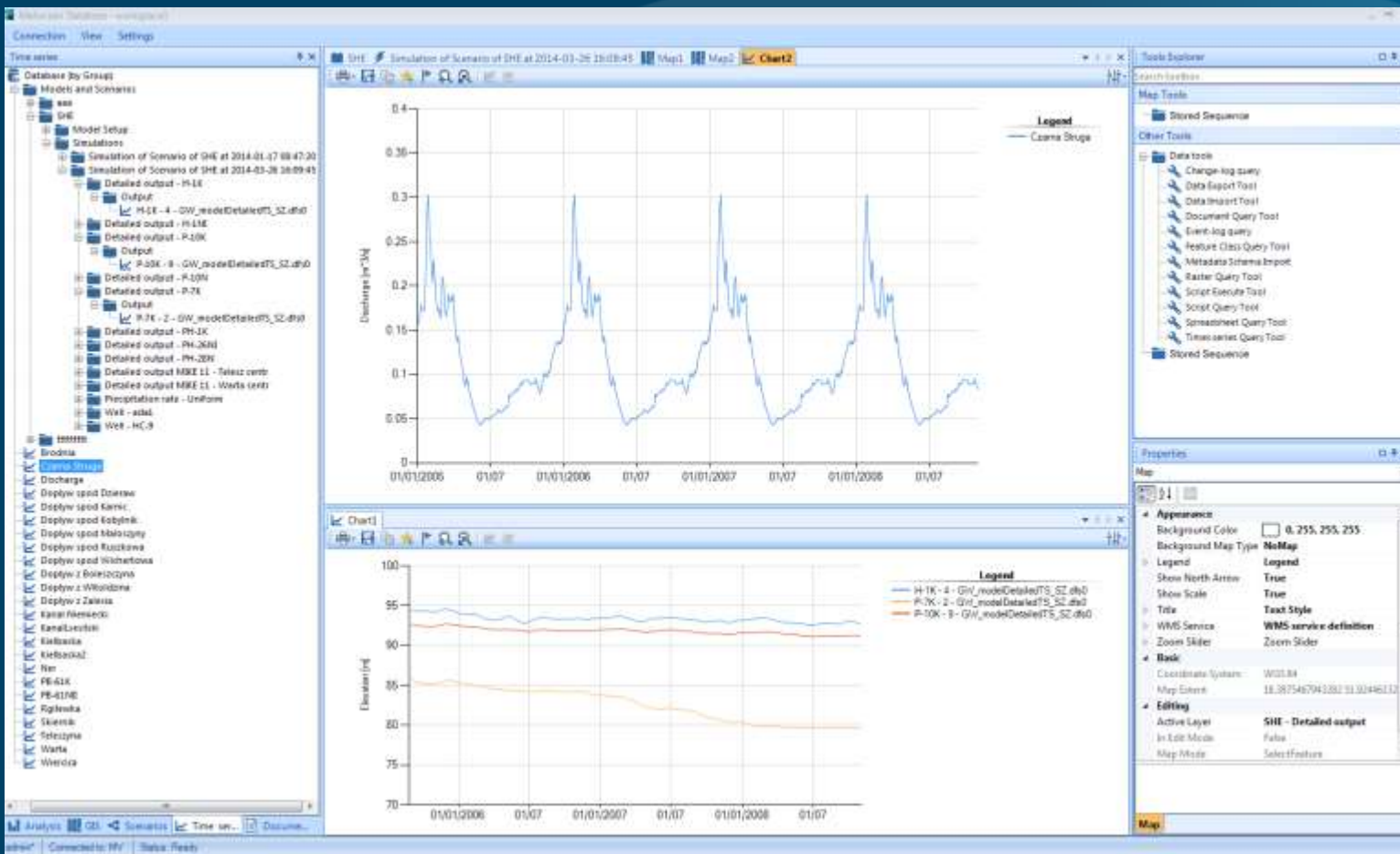
The screenshot displays the MikeSHE software interface. On the left, a tree view shows the project structure under 'Models and Scenarios'. The main window is titled 'SHE - Well' and contains a map of a well location. Below the map is a table listing model objects and their counts.

Name	Count	Type
Detailed output	9	Model Object Group
Well	124	Model Object Group
Detailed output MKE II	3	Model Object Group
Precipitation rate	1	Model Object Group
GW_model_WM	1	Other Output Data
GW_model_BP	1	Other Output Data
GW_model	1	Other Output Data

At the bottom, a chart titled 'Simulation of Scenario of SHE at 2014-01-26 16:09:45' shows 'Precipitation (mm/year)' on the y-axis (0 to 5) against time on the x-axis (1992 to 2007). The legend indicates 'Precip_of_m_90-08-ds0-1-effective.avg'.

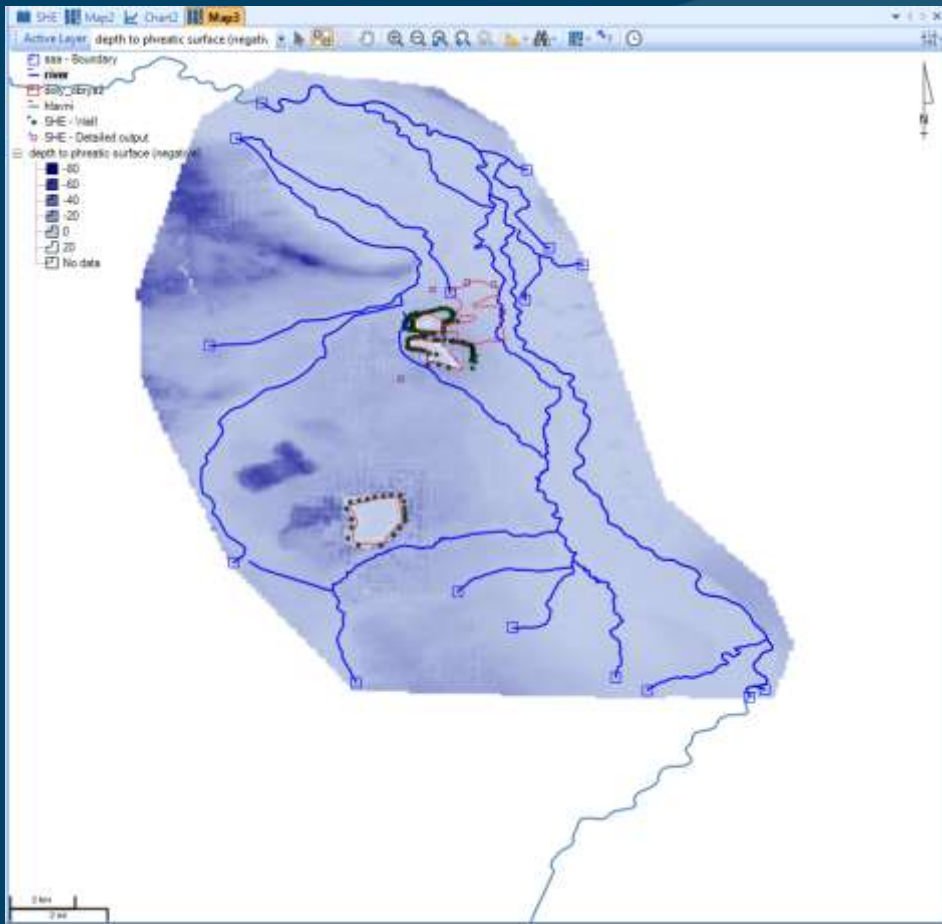
Modelování
Řízení
podmínek
výpočtů

DSS – MikeSHE v prostředí Mike Customised



Modelování
Časové
řady
Zobrazení
výsledků

DSS – MikeSHE v prostředí Mike Customised



- Modelování
Mapy
Zobrazení
výsledků

DSS – MikeSHE v prostředí Mike Customised

- IS pro řízení nakládání s důlními vodami
- Interaktivní pohledy do databáze IS
 - Operátor, manažer, veřejnost
- Scénáře a varianty
- On-line zpracování dat monitoringu v reálném čase
- Uživatelská rozšiřitelnost funkcionalit pomocí skriptování
- Rozhraní pro komponenty třetích stran
- Podpora DHIGroup

Děkuji za pozornost

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