



InGeoCloudS Experts Workshop

Geohazard management in Slovenia

Jasna Šinigoj



Geological Survey of Slovenia



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Outline

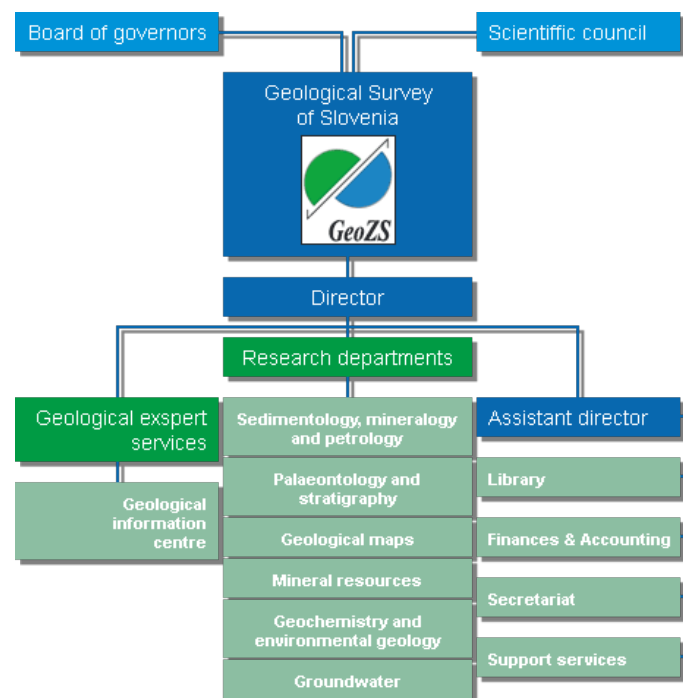
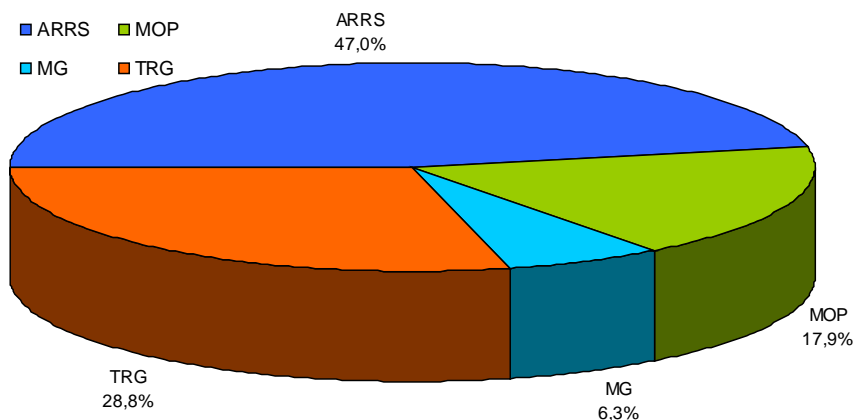
- Geological Survey of Slovenia
- GeoZS existing Services
- Geohazard management in Slovenia
- Geohazard in the cloud



Geological Survey of Slovenia

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- status: public research institute
- founder: Government of R of Slovenia
- objective: to provide and store geoscientific information of the Republic of Slovenia
- 90 employees

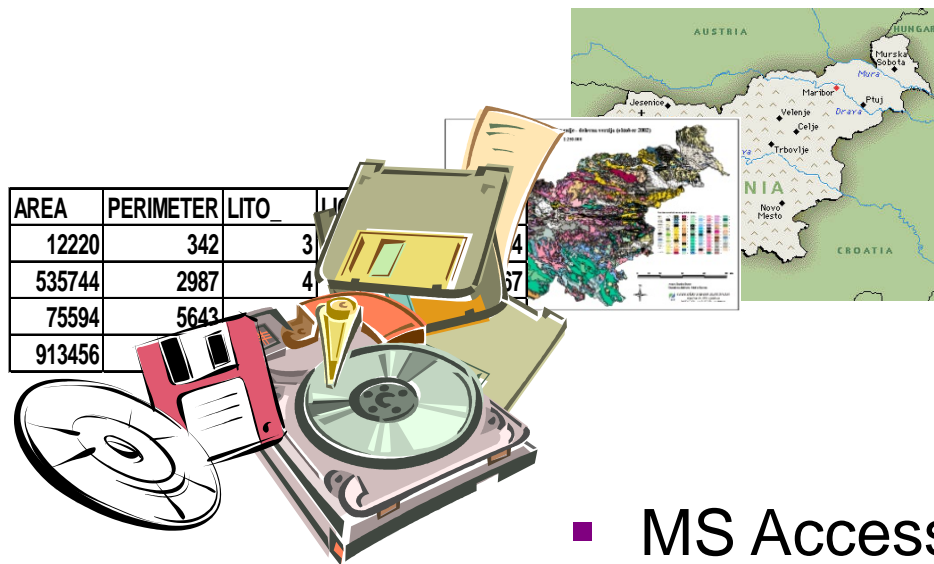




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Software

- ArcInfo
- ArcGIS
- ArcIMS
- ArcView
- AutodeskMAP
- Erdas Imagine
- **Open Source**
 - MapServer
 - GeoNetwork
 - OpenLayers
 - *PostGIS*



- MS Access
- SQL server MS RDBMS
- **Open Source**
 - *PostgreSQL*



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GEOZS existing Services

Currently GeoZS provides view and discovery services for:

- Basic Geological Map 1 : 100.000
- Thematic geological maps of Slovenia

Geološki zavod Slovenije

Vrtine

Mineralne vire

Geohazard

Geohazard Vrhnika

Results

Map Contents

- GeoHazard
 - meja občine Vrhnika
 - parcele zemljiškega katastra
 - Katastrske občine
 - Smrečje
 - Vrhnika
 - državna pregledna karta
 - državna topografska karta
 - DOF050
 - digitalni model reliefa
- Vrtna
- Vodnjak
- Vodnjak črni
- Desetil
- Metolal
- Nitrati

Used services

- ArcIM
- ArcGIS
- Mapse

BASIC GEOLOGICAL MAP OF YUGOSLAVIA

Abstract
Basic geological map of Yugoslavia presents lithological and stratigraphic characteristics of rocks, their relationships, age and other. It is a key to the understanding of the geology of Slovenia. I...

Keywords
geologija, pregledna geologija, geološke enote, tektonika, geološki pojavi, slovenija

1GE GEOZS 1M SURFACE GEOLOGIC STRUCTURE

Abstract
The harmonized geological map of Slovenia is a simplified version of the 1:250 000 scale Geological Map of Slovenia (Buser, 2009), which was compiled using the Basic Geological Map of Slovenia at a s...

Keywords
geologija, stratigrafija, površinska geologija, onnegeology, onnegeology - Europe, 1G-E, usklajena geologija, usklajena starost, usklajeni podatki, usklajena geneza, usklajena struktura, Struktura geologija, prelom, struktura, Slovenija, geologija



GEOZS existing Services

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- WMS/WFS status at GeoZS
 - Mapserver 5.4.2
 - Currently available layers through WMS/WFS (60)
 - Hydrological data layers (9)
 - Geological data (2)
 - Basic geology map (48)
 - Mineral resources (1)

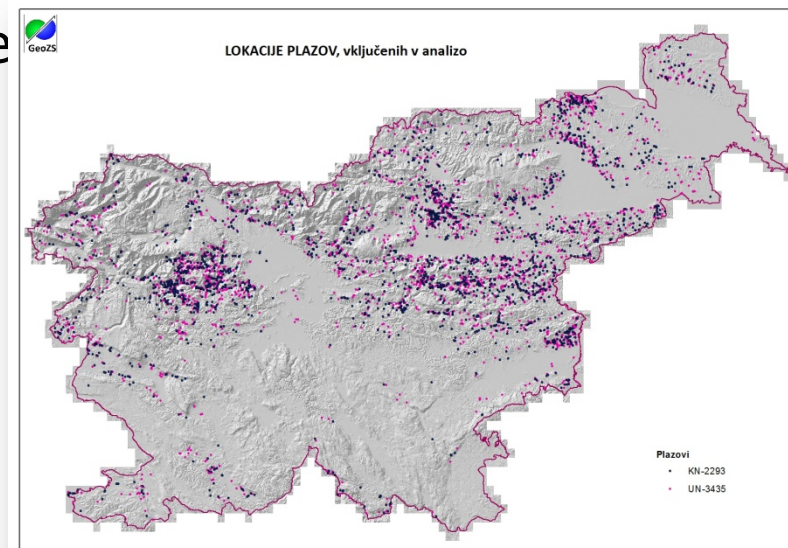
HYDROGEOLOGICAL DATA	
Groundwater bodies	
Hydrogeological map IAH	
Hydrogeological map LAWA	
Litho-geochemical map	
Vulnerability	
Infiltration map	
Evapotranspiration map	
Karavanke Groundwater bodies	
Wells	
Springs	WMS GetMap request with default Mapserver configured styling
	WMS GetFeatureInfo request in text/plain format
	WMS GetFeatureInfo request in text/html format
GEOLOGICAL DATA	
Lithostratigraphic units	
Major faults	



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Landslides in Slovenia

- Estimation ~ 7.000 – 10.000 LS in Slovenia
- Damage ~ 2 M€ / per year
- No national programme to fight against LS
 - Administration of the RS for Civil Protection and Disaster Relief, Ministry for environment, Municipalities
- Geohazards will be included in spatial planning
- No central national landslide database

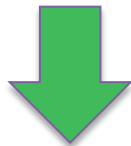




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“National” landslide database

- Data from different sources
- 3,500 landslide events in national landslide database, Ministry of Defense - Administration of the Republic of Slovenia for Civil Protection and Disaster Relief
- Slovenian Roads Agency, Environmental agency RS, Ministry for environment, Municipalities
- Two ongoing project – GeoZS collected ~ 3000
 - Geoazard for 14 Municipalities
 - Masprem - an early warning system that will predict the areas where the probability of triggering of landslides will be increased due to higher precipitation levels



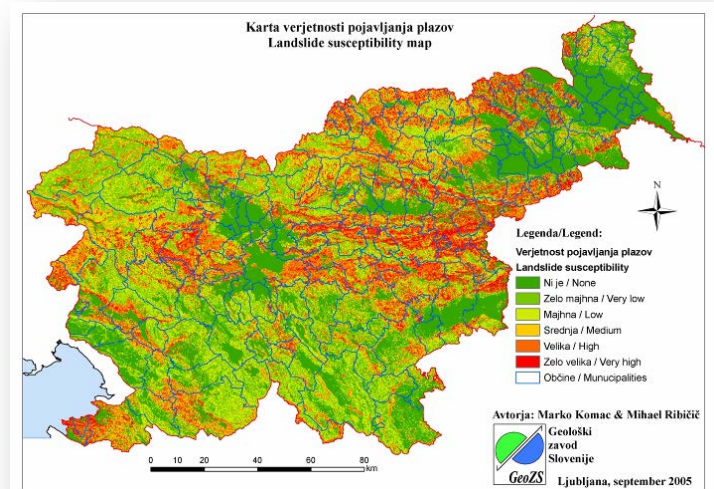
6,500 landslide events



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Landslide susceptibility map

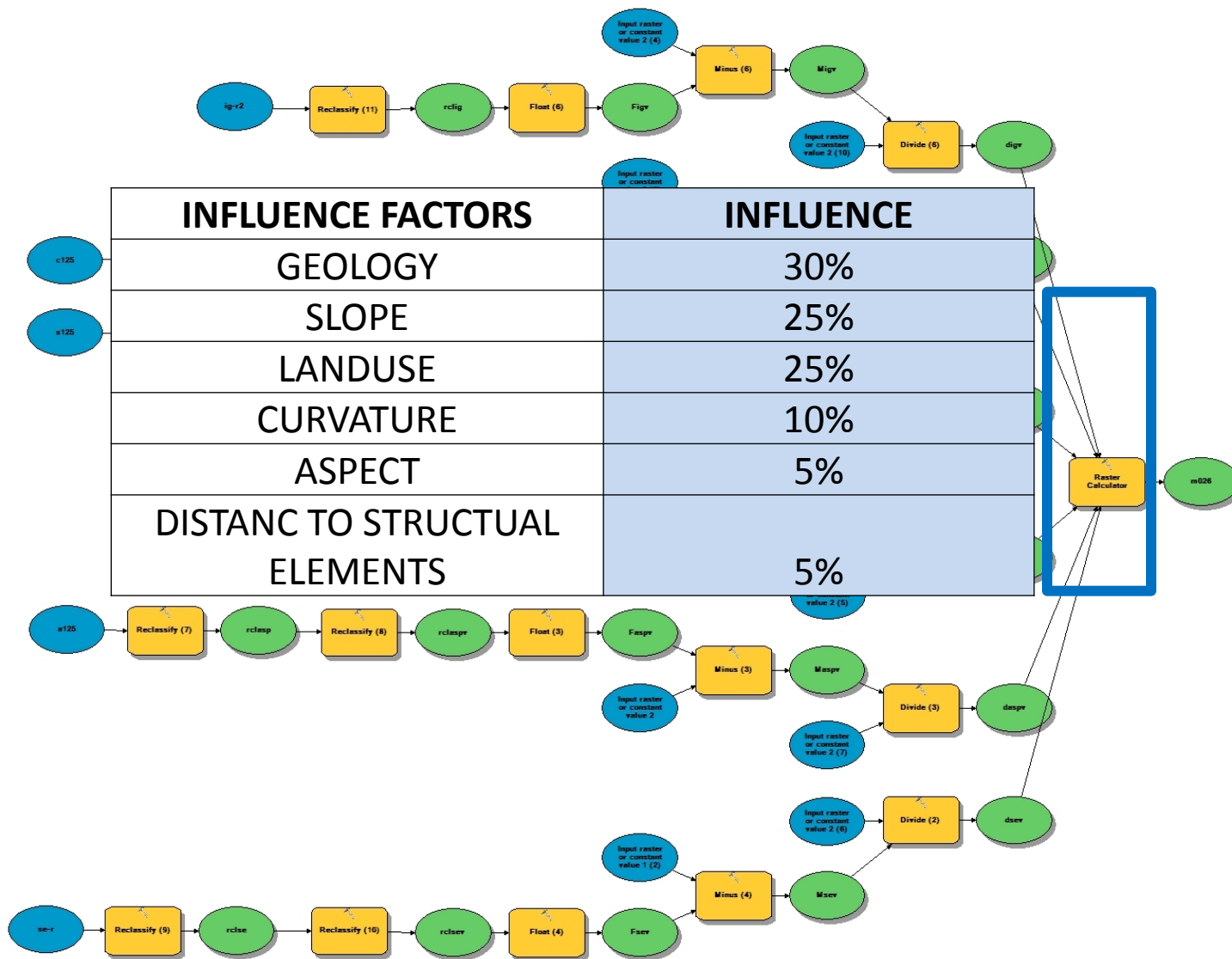
- Spatial analyses / GIS / statistical method
- Linear weighted model of spatio-temporal factors:
 - Geology (EG)
 - Morphology (slope, curvature, aspect, elevation)
 - Landuse (CORINE)
 - Distance to surface waters, structural el.
- Grid 25x25 and 12,5x12,5
- Scale 1.250.000





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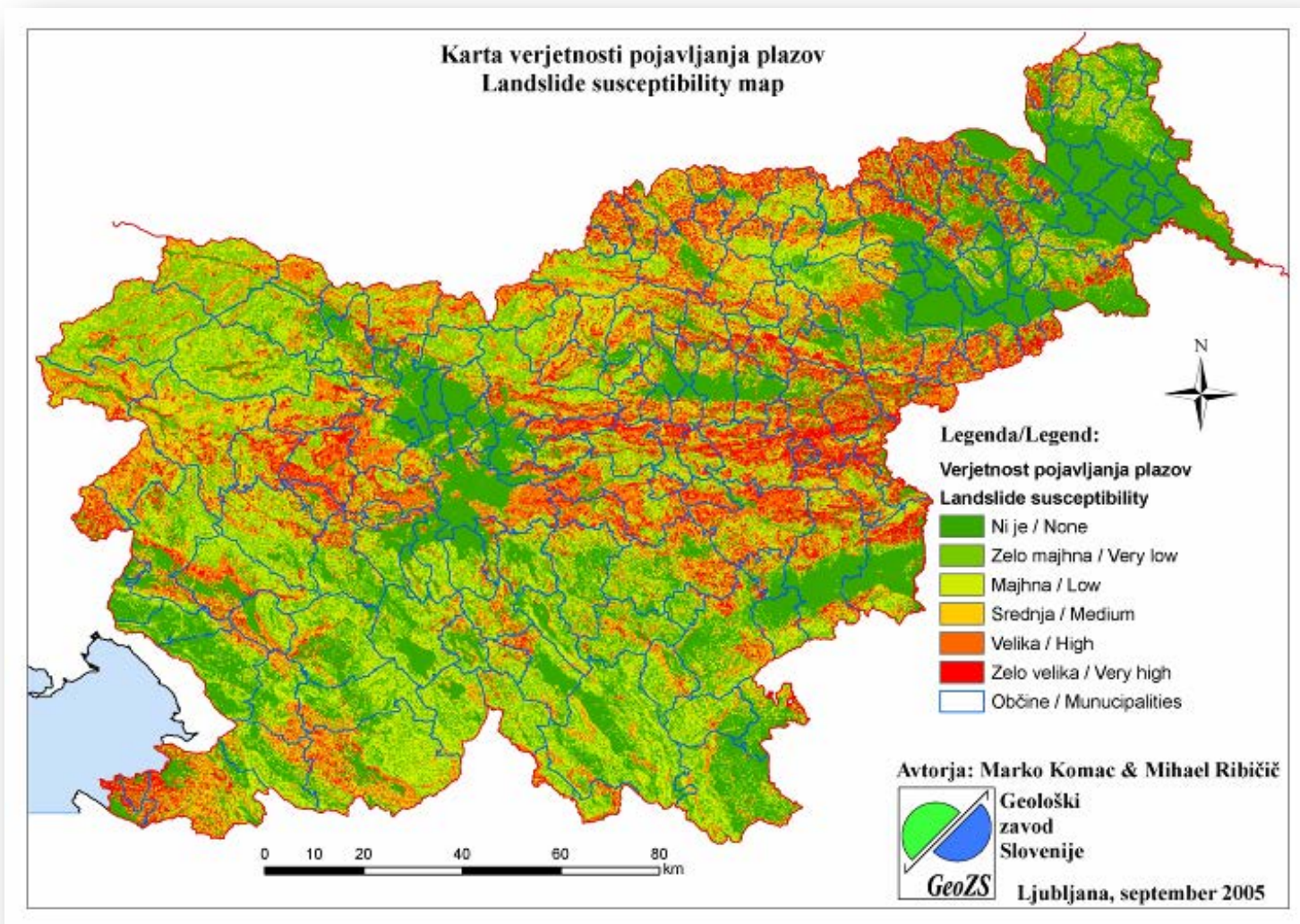
Landslide susceptibility map





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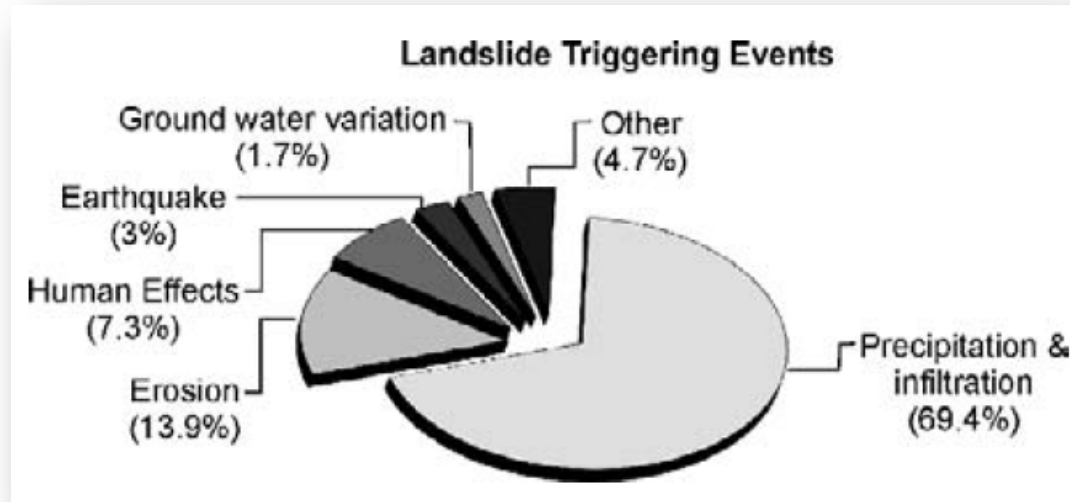
Landslide susceptibility map





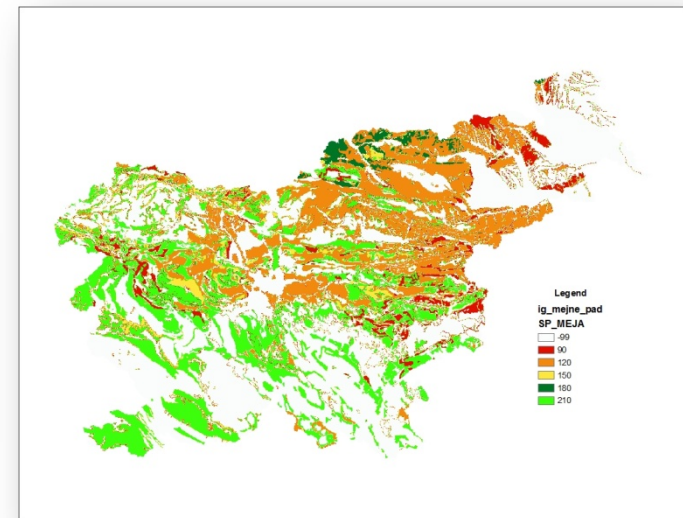
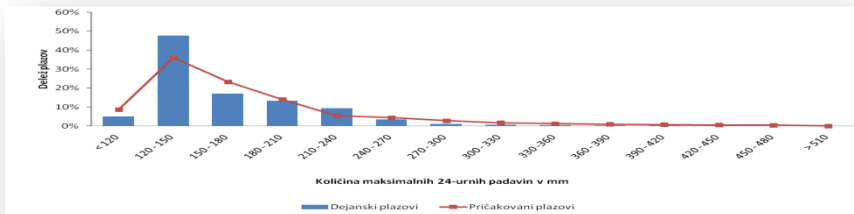
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Landslide triggering events



Intensive short- and long-duration rainfall often triggers landslides, causing substantial damage to property and even the loss of human lives.

- Susceptible areas prediction – rainfall
- to define rainfall thresholds above which landslides can occur.





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Landslide triggering potential map due rainfall forecast

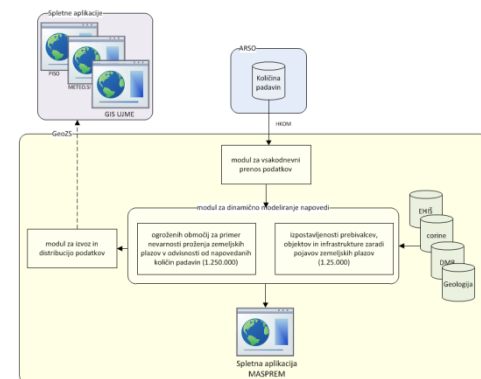
GeoZS is building an early warning system that will be based on:

- past landslide events,
- Geology
- weather (rainfall) forecast

The system will predict (in a best possible way) the areas where the probability of triggering of landslides will be increased due to higher precipitation levels.

The endangered zones will be predicted using the combination of

- the landslide susceptibility model,
- Precipitation
- landslide triggering threshold values.



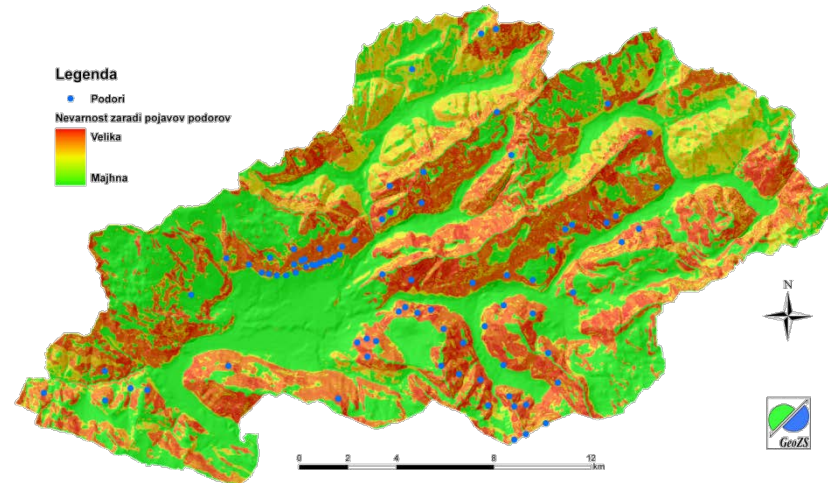
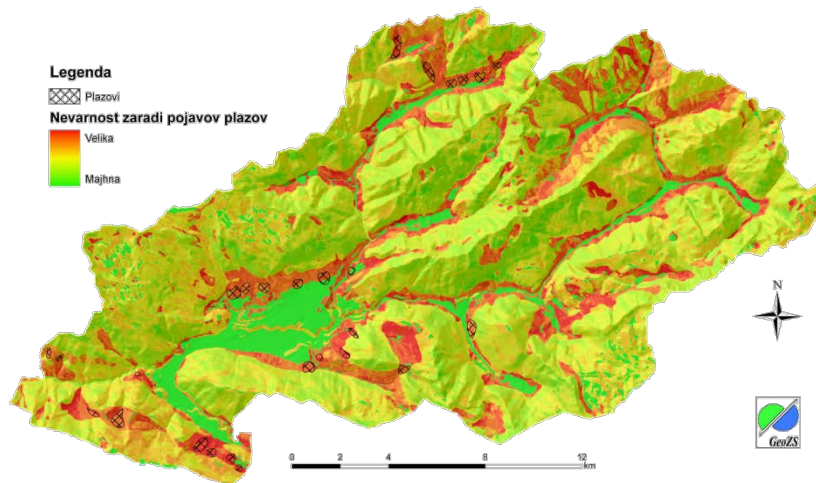


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Landslide susceptibility map

Methodology development for landslide and rockfall susceptibility definition at scale 1 : 25.000

- Pilot project “Geohazard”
- 14 municipalities
- Results will be used in spatial planning





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GeoZS / Geohazard / cloud computing

GEOZS application for geo-spatial use to be provide in the cloud computing infrastructure

- Geo-hazards data dissemination at 1/25.000 and 1/250.000 scale
 - effective access to the location of landslides and landslide susceptibility map. The service will be available in WMS and WFS.
- Dissemination of landslide triggering potential map due rainfall forecast
 - the areas/zones where the probability of triggering of landslides will be increased due to higher precipitation levels
 - on daily basis



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GeoZS / Geohazard / cloud computing

	locations of landslides
Nature of the data	dynamic, frequently updated
Data Maintenance	add new/update data,
Format of raw data	Postgres
Format of geospatial data	PostGis,
Constraints of access for data	Public data, data only for authorities
Data Model	localization of landslides, source, type...



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GeoZS / Geohazard / cloud computing

	landslide susceptibility map 1/25.000 scale
Nature of the data	static
Data Maintenance	seldom updated as changes in a model are needed
Format of raw data	Postgres
Format of geospatial data	PostGis,
Constraints of access for data	Public data, data only for authorities
Data Model	value of susceptibility



InGeoCloudS
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GeoZS / Geohazard / cloud computing

	landslide susceptibility map 1/250.000 scale
Nature of the data	static
Data Maintenance	seldom updated as changes in a model are needed
Format of raw data	Postgres
Format of geospatial data	PostGis,
Constraints of access for data	Public data
Data Model	value of susceptibility



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GeoZS / Geohazard / cloud computing

	landslide triggering potential map due rainfall forecast
Nature of the data	dynamic, streaming,daily
Data Maintenance	Synchronization with web-services, ftp exchange files,
Format of raw data	Postgres
Format of geospatial data	PostGis,
Constraints of access for data	Public data, data only for authorities
Data Model	model to provide



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International cooperation

GeoZS has recently concluded 6, and is currently partner in 7 INTERREG or EU funded projects which include GIS:

- 1. eWater – Multilingual cross-border access to ground water databases, eContent plus project,**
2. ClimChAlp - Climate Change, Impacts and Adaptation Strategies in the Alpine Space, Interreg IIIB Alpine space,
3. Transthermal, Geothermics of the Eastern and Southern Alps, Interreg IIIA,
4. OneGeology -eContent plus project,
5. AdaptAlp, Adaptation to Climate Change in the Alpine Space, Alpine Space Transnational Cooperation Programme,
6. AlpWaterScarcity; Water Management Strategies against Water Scarcity in the Alps, Alpine Space TCP,



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International cooperation

- 1. INCOME - Improved management of contaminated aquifers by integration of source tracking, monitoring tools and decision strategies, Life+ project,**
2. Safeland - Living with landslide risk in Europe: Assessments, effects of global change, and risk management strategies, FP7,
3. SARMa - Sustainable aggregate resource management – South East Europe Transnational Cooperation Programme
- 4. Terrafirma - ESA GMES project aimed at improving safety and reducing economic loss by measuring terrain motion from satellite radar data,**
- 5. EuroGeoSource - EU Policy Support System for sustainable supply of Europe with energy and mineral resources**
6. PanGeo
7. I2GPS



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Environmental Data Viewer - INCOME

Project INCOME (Life+ project) is intended for the establishment of an effective management of contaminated aquifers. One objective is to develop a decision making support system (DSS).

The Environmental Data Viewer, which is a collection of basic data for the management of water resources of Ljubljana, and which is dedicated to the professional and the general public

Pregledovalnik okoljskih podatkov

- SLOJI
 - REGISTER ONESNAŽEVALCEV
 - KEMIJSKI PODATKI
 - HIDROGEOLOŠKI OBJEKTI
 - Hidrogeološki objekti - tehnični podatki
 - Gladina podzemne vode
 - KARTOGRAFSKE PODLAGE
 - TOPOGRAFSKE PODLAGE

Koordinate YX: 483081.45 , 111262.90

0 1 2 3 4 km

OPOZORILA NAVODILA REZULTATI

Izdelava: GeoZS | Oblikovanje: ENKI komunikacije



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Environmental Data Viewer - INCOME

Pregledovalnik okoljskih podatkov



- Vrtina
- Opazovalna vrtina
- Vodnjak
- Vodnjak črpališča pitne vode
- Vodnjak črpališča tehnološke vode
- Prostorska porazdelitev
- Atrazin I. 2010 (0-0,1 µg/l)
- Desetilatrazin I. 2010 (0-0,1 µg/l)



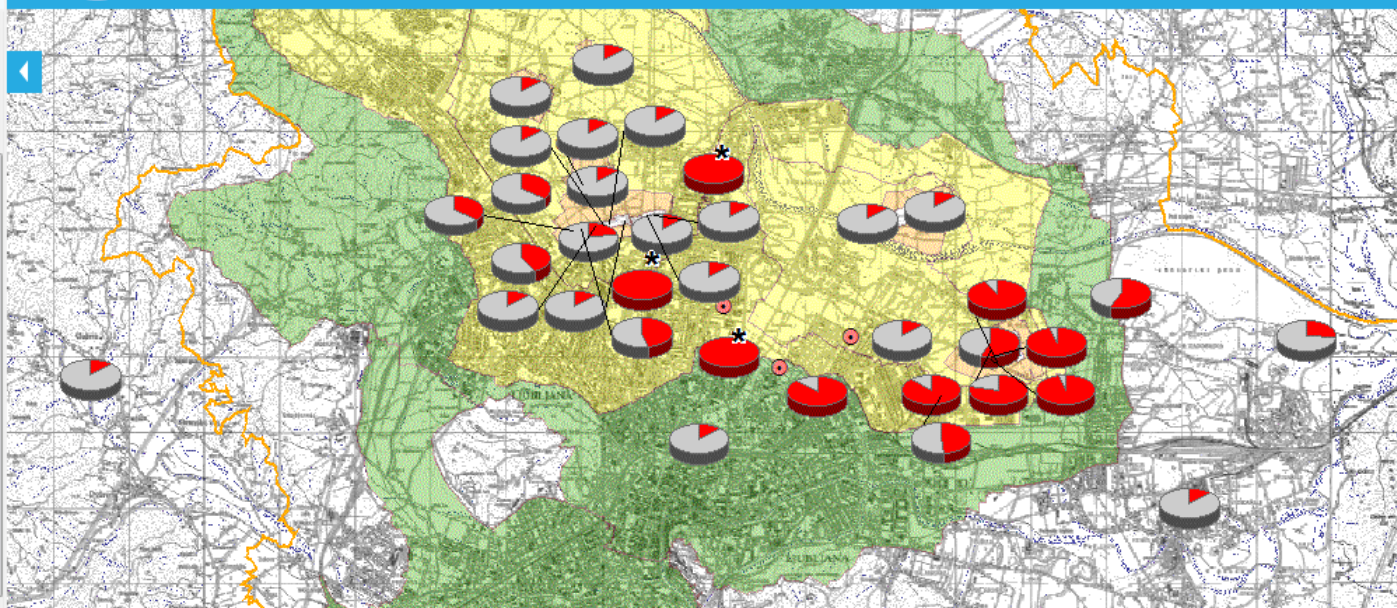
- Povprečna vrednost (* prekoračena mejna ostanek)
- Krom 6+ I. 2010 (0-50 µg/l)



- Povprečna vrednost (* prekoračena mejna ostanek)
- Metolaklor I. 2010 (0-0,1 µg/l)
- Nitrati I. 2010 (0-50 mg/l)



- Povprečna vrednost (* prekoračena mejna ostanek)



Koordinate YX: 454994.85 , 101910.62

0 ¼ ½ 1 1.5 2 km

OPOZORILA

NAVODILA

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INCOME
Skrb za vodo



ZRCSAZU
Znanstveno-inovacijski center
Gosposvetske akademije znanosti in umetnosti

AGENCIJA RS ZA OKOLJE



Izdelaiva: GeoZS | Oblikovanje: ENKI komunikacije



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Environmental Data Viewer - INCOME

Pregledovalnik okoljskih podatkov



- Vrtina
- Opazovalna vrtina
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- Vodnjak črpališča pitne vode
- Vodnjak črpališča tehnološke vode
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Povprečna vrednost (* prekoračena mejna
ostanek

- Krom 6+ I. 2010 (0-50 µg/l)



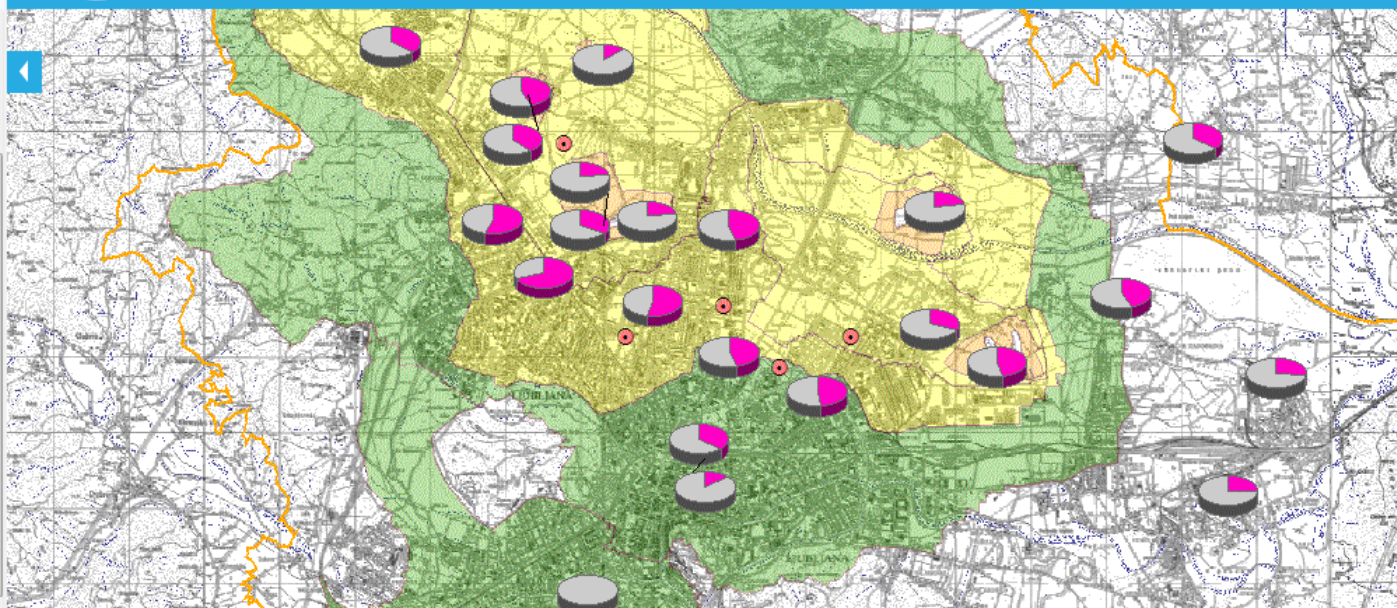
Povprečna vrednost (* prekoračena mejna
ostanek

- Metolaklor I. 2010 (0-0,1 µg/l)

- Nitrati I. 2010 (0-50 mg/l)



Povprečna vrednost (* prekoračena mejna
ostanek



Koordinate YX: 454212.33 , 99842.52

0 ¼ ½ 1 1.5 2 km

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NAVODILA

REZULTATI



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Skrb za vodo



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AGENCIJA RS ZA OKOLJE



Izdelava: GeoZS | Oblikovanje: ENKI komunikacije



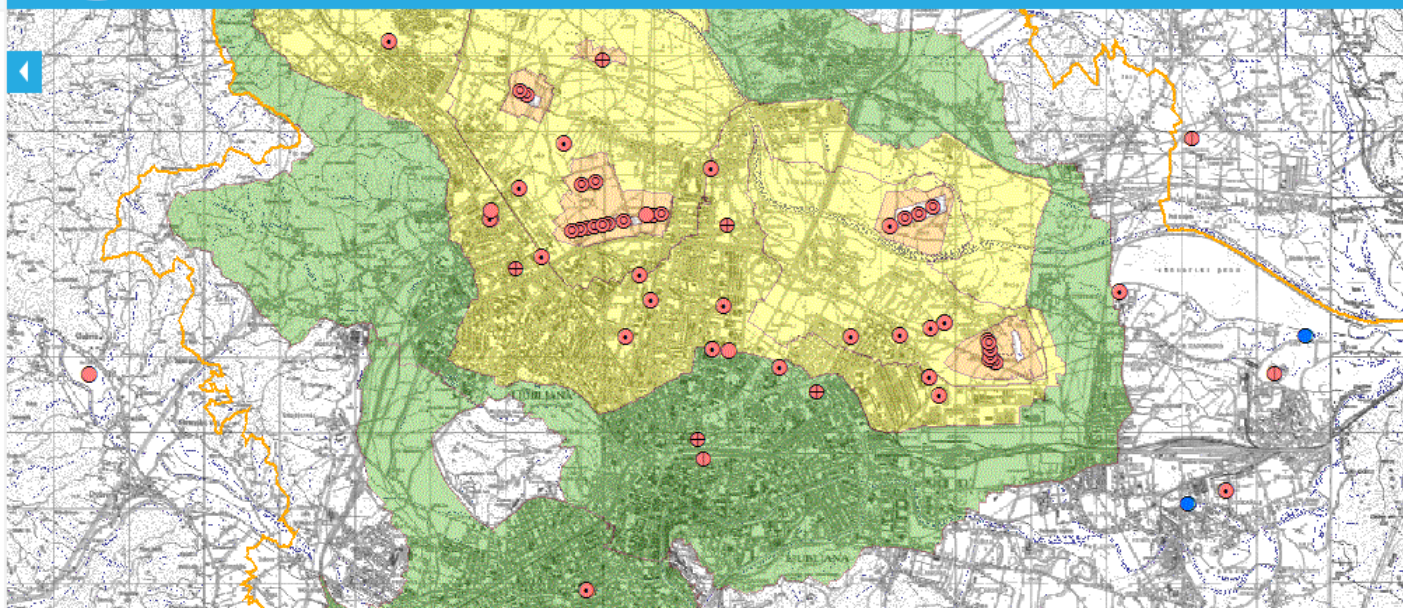
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Environmental Data Viewer - INCOME

Pregledovalnik okoljskih podatkov



- SLOJI
 - REGISTER ONESNAŽEVALCEV
 - KEMIJSKI PODATKI
 - Kemijske analize
 - Izvir
 - Kanal
 - Vrtina
 - Opazovalna vrtina
 - Vodnjak
 - Vodnjak črpaljšča pitne vode
 - Vodnjak črpaljšča tehnološke vode
 - Prostorska porazdelitev
 - HIDROGEOLOŠKI OBJEKTI
 - KARTOGRAFSKE PODLAGE
 - TOPOGRAFSKE PODLAGE



Koordinate YX: 453839.69 , 101668.41

0 0.4 0.8 1.2 1.6 2 km

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AGENCIJA RS ZA OKOLJE



Izdelaava: GeoZS | Oblikovanje: ENKI komunikacije



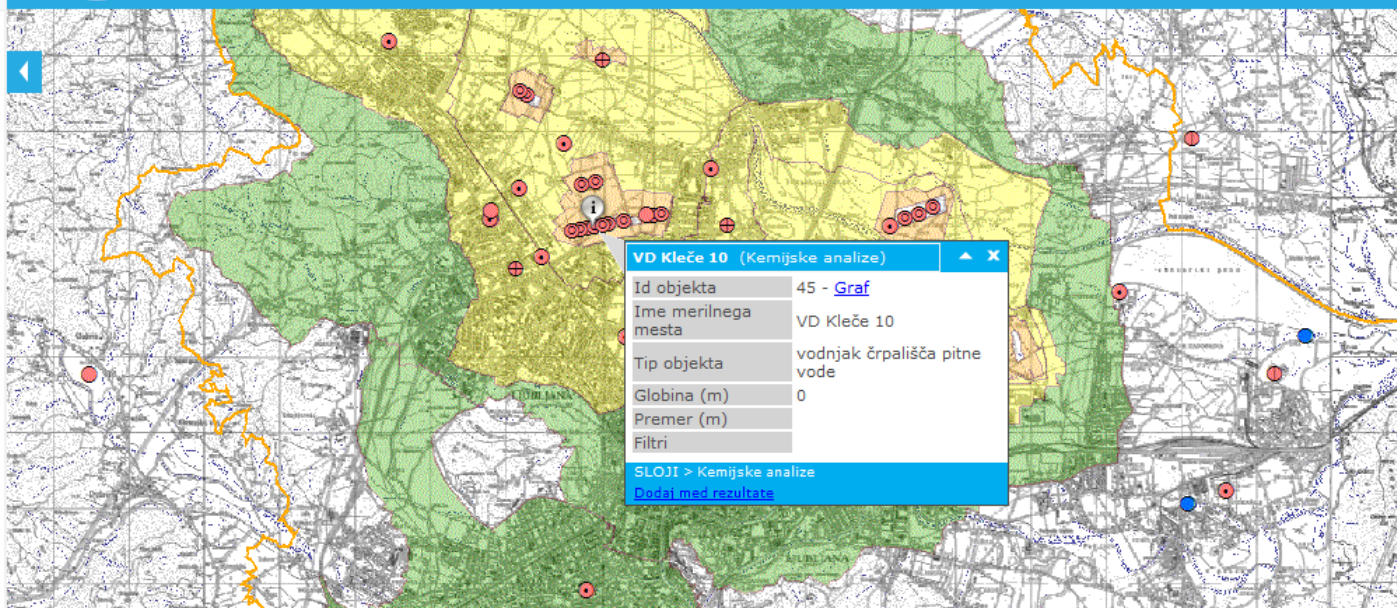
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Pregledovalnik okoljskih podatkov



- SLOJI
 - REGISTER ONESNAŽEVALCEV
 - KEMIJSKI PODATKI
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 - HIDROGEOLOŠKI OBJEKTI
 - KARTOGRAFSKE PODLAGE
 - TOPOGRAFSKE PODLAGE



Koordinate YX: 461161.90 , 104761.25

0 ¼ ½ 1 1.5 2 km

OPOZORILA

NAVODILA

REZULTATI



INCOME
Skrb za vodo



ZRCSAZU
Znanstveno-raziskovalni center
Gosposvetske akademije znanosti in umetnosti

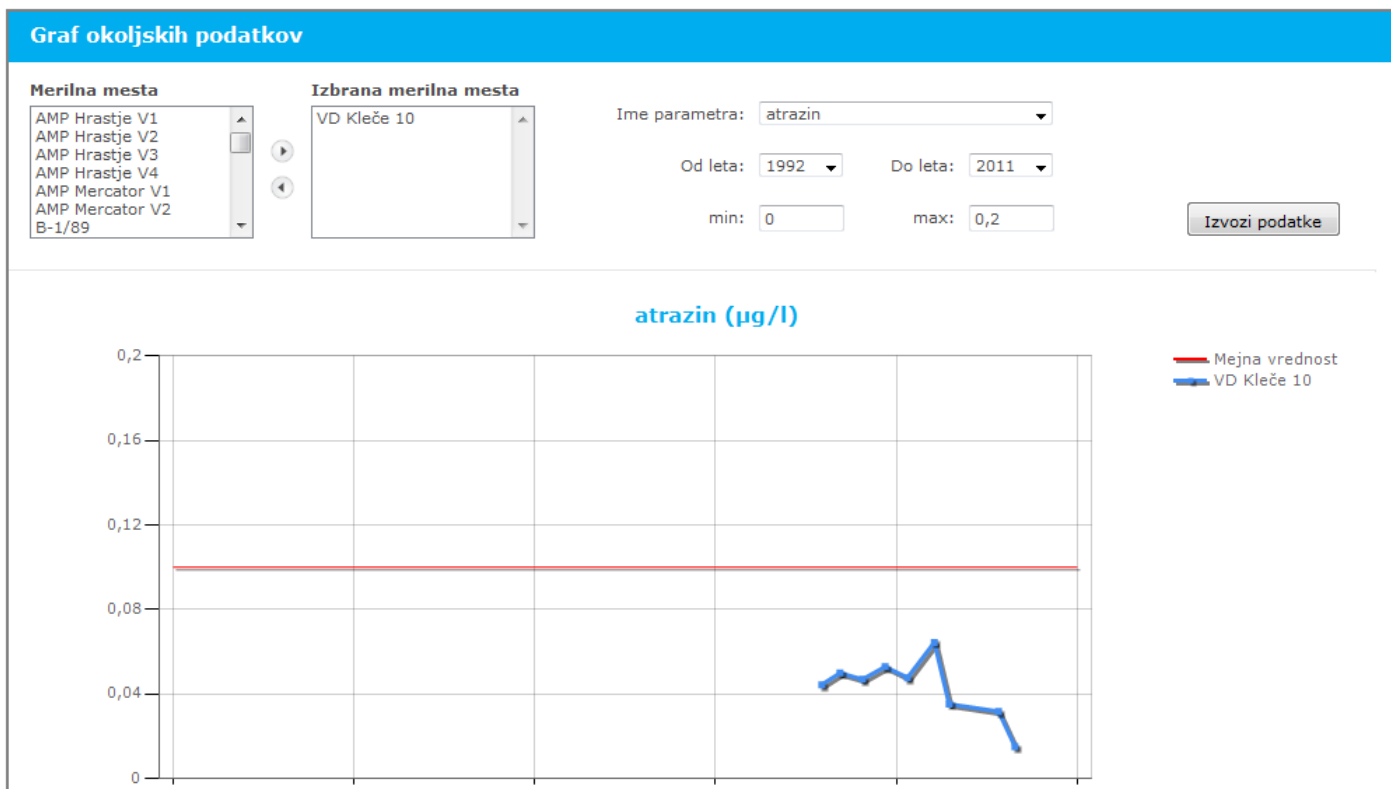
AGENCIJA RS ZA OKOLJE



Izdelava: GeoZS | Oblikovanje: ENKI komunikacije



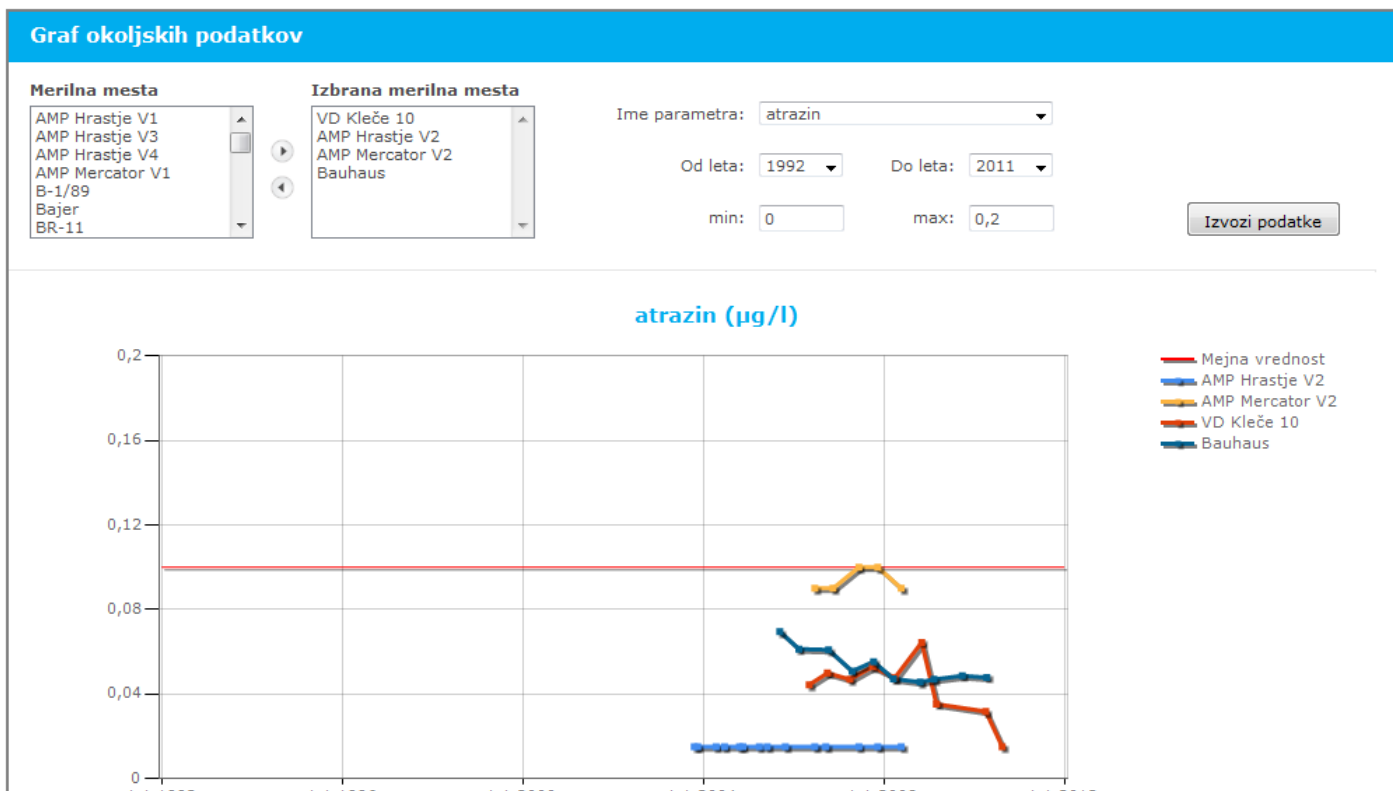
Environmental Data Viewer - INCOME





Environmental Data Viewer - INCOME

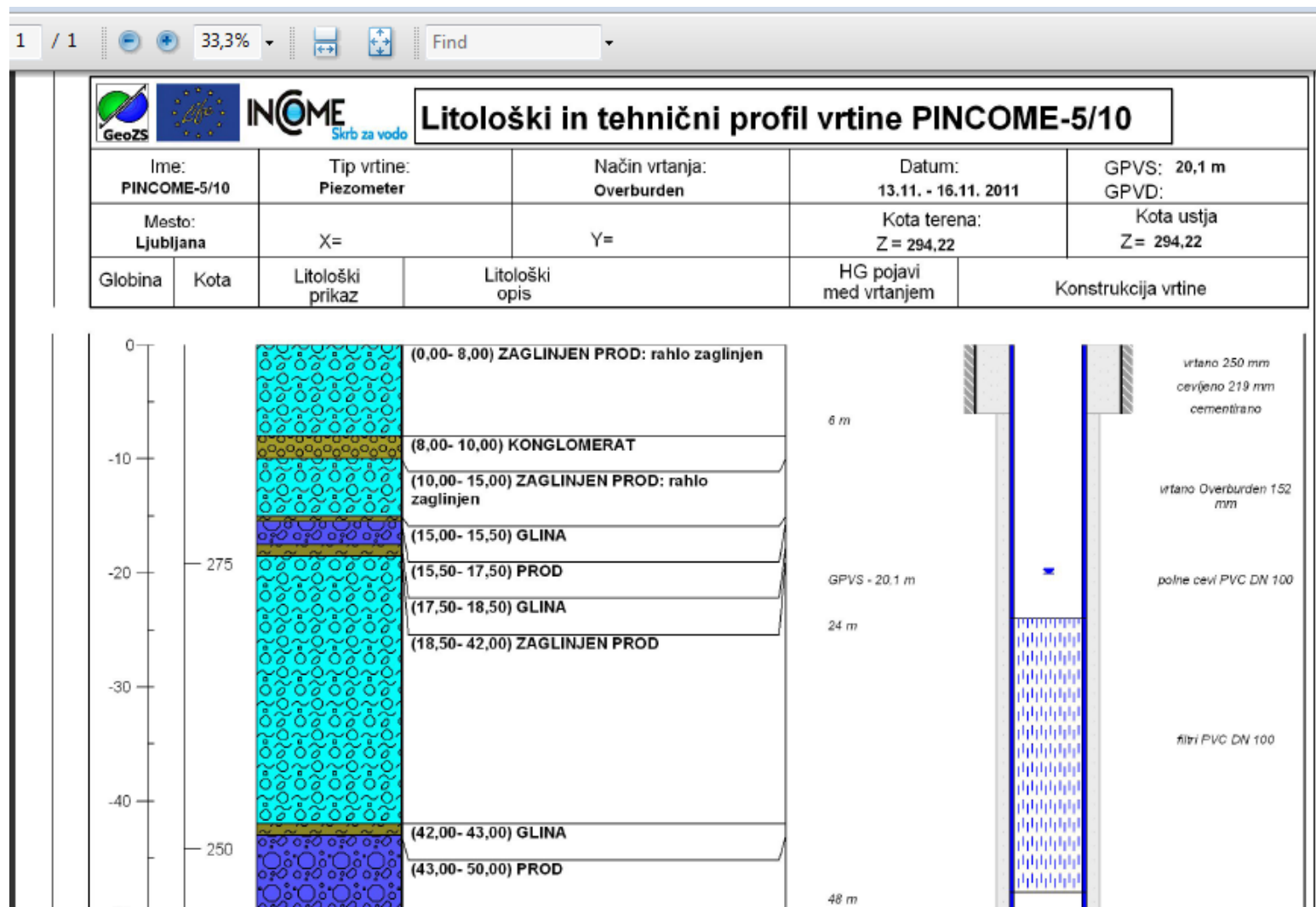
InGeoCloudS





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Thank you!