

Slezská Harta and Olešná Rockfill Dams

Wireless Underground Water Level Measurement Using Loadsensing Datalogging System

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Slezská Harta and Olešná Rockfill Dams Wireless Monitoring

- Introduction
- Description
- Benefits and Challenges
- Results

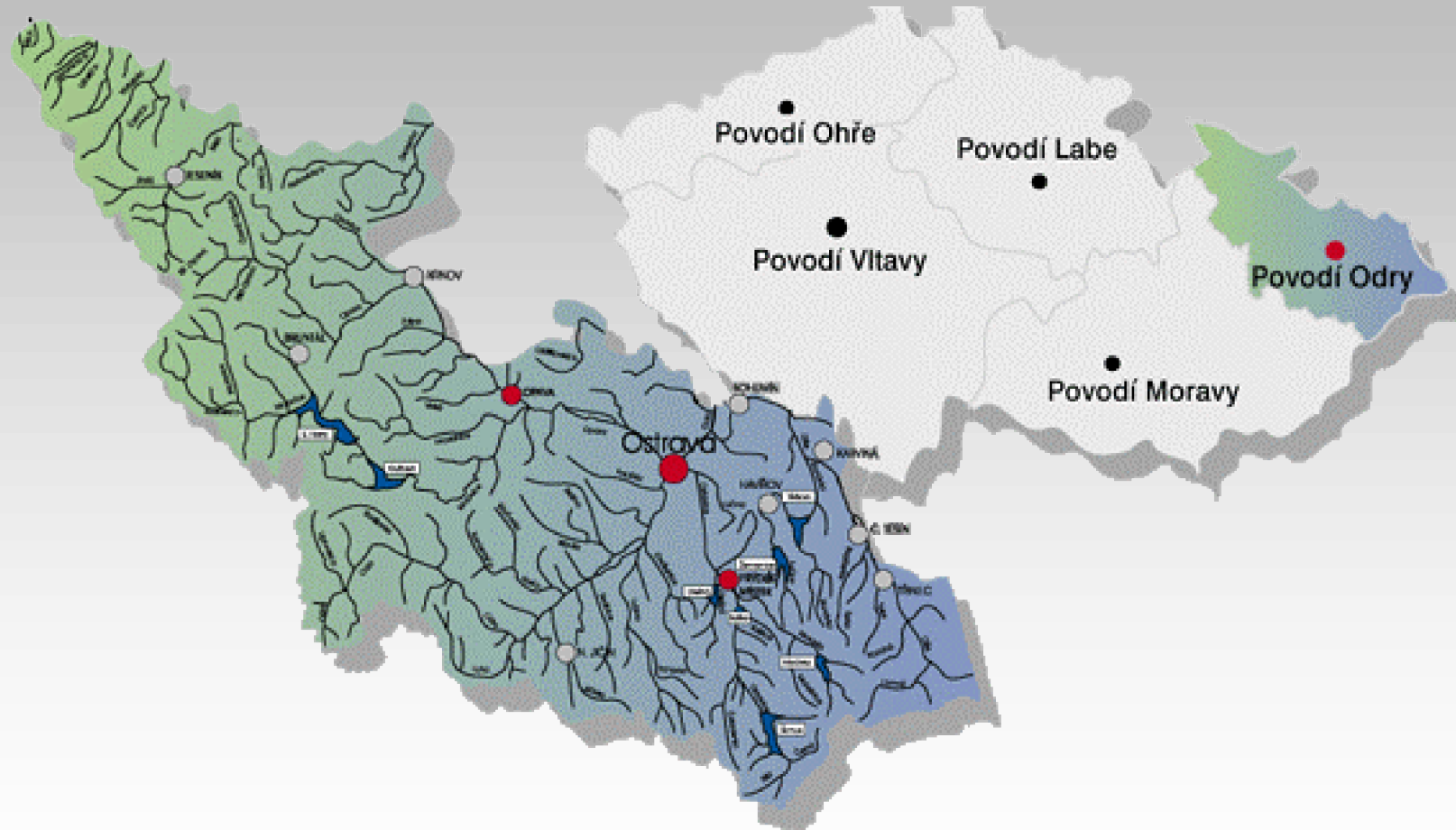
Introduction

- Where the dams are located
- What we measure at dams
- What datalogging system we use

Where the dams are located



Where the dams are located



What we measure at the dams

- Water level in the standpipes
- Water level or water pressure in the inclined boreholes in grouting gallery oriented upstream and downstream from grouting curtain
- Other geotechnical and constructional properties as horizontal deformations, inclinations, total pressures, cracks, displacements,...

What datalogging systems we use

- Campbell Scientific CR510, CR10, CR10X, CR800, CR1000 and CR6
- Geokon LC-1 a LC-2 single, 4 and 16 channel
- Loadsensing wireless LS-G6-VW1

Description

- Water level in the standpipes
- Instruments the client used to use
- Tested wireless instruments

Water level in the standpipe Olešná Dam



Water level in the standpipe Slezská Harta Dam



Instruments the client used to use



- Slezská Harta Geokon LC-1



- Olešná manual measurement

Tested wireless instruments



- Campbell Scientific AVW216 and RF416

Tested wireless instruments



- Geokon GeoNet

Tested wireless instruments



- Loadensing Gateway and LS-G6-VW1 Node

Tested wireless instruments

- **Campbell Scientific**
 - required solar panels and a big battery
 - no memory in the AVW216
- **GeoNet**
 - required repeater at 2.4GHz
 - not solved Internet or LAN connection
 - setting nodes only through the Supervisor
- **Loadsensing**
 - long time battery supply
 - solved Internet or LAN connectivity
 - no need any repeaters - long distance radio
 - antenna can be hidden under the steel top of the borehole
 - easy setting nodes with Android phone and App

Benefits and challenges

- Decision if to dig trenches or use wireless
- Building the Loadsensing system
- Friendly software and data management
- Information of the signal strength
- Information of the lost packets
- Signal from behind the dam body
- Using one special antenna
- Remote approach to Gateway
- Visualisation in Vista Data Vision - real time

Decision if to dig trenches

- Kilometers of dug trenches
- Kilometers of cables to install
- Lightning protection required
- Wireless system solves all above



Building the Loadsensing system

- Olešná dam - December 2018
 - 1 Gateway and 3 VW nodes
 - 3 Geokon Model 4500S VW Piezometers



Building the Loadsensing system

- Slezská Harta Dam - April 2019
 - 1 Gateway and 4 VW nodes
 - already installed Geokon Model 4500S and 4500ALV VW Piezometers



Friendly software and data management



Friendly software and data management

The screenshot displays the LoadSensing Data Server web interface. The browser address bar shows the URL `172.18.32.130/dataserver/network/view/20244`. The page title is "Network: Vodní dílo Olešná". The interface includes a navigation menu with "Networks", "Status", and "Configuration". Below the title, there are sections for "Comments", "Compacted readings CSV files", "Compacted engineering units CSV files", and "Compacted custom CSV files". A "Signal coverage test map" link is also present. The "Nodes" section features a search icon and a table with 3 nodes. The table has columns for "Id", "Name", "Status", "Model", and "Serial". All nodes are currently in "OK" status. At the bottom of the interface, there are buttons for "Change sampling rate" and "Cancel sampling rate changes". The Windows taskbar at the bottom shows the time as 11:32 on 16.10.2019.

Network: Vodní dílo Olešná

/ Networks / 20244

Comments Rezdřátový systém dataloggerů | loadSensing

Compacted readings CSV files [↓ compacted readings 20244 current.dat](#)
+ More

Compacted engineering units CSV files [↓ compacted-eng-20244-current.dat](#)
+ More

Compacted custom CSV files [↓ compacted-custom-readings-20244-current.dat](#)
+ More

[Signal coverage test map](#)

Nodes

All 0 nodes selected of 3

Id	Name	Status	Model	Serial
<input type="checkbox"/> 8001 1h	HV-80-01	OK	LS-G6-VW-1-EU	15830
<input type="checkbox"/> 8011 1h	HV-80-11	OK	LS-G6-VW-1-EU	16039
<input type="checkbox"/> 8012 1h	HV 80 12	OK	LS G6 VW 1 EU	16080

[Change sampling rate](#) [Cancel sampling rate changes](#)

Information of the signal strength

Power

Date	RSSI (dBm)	SF	Freq (MHz)
2019-10-31 03:01:15 CET	-58.0	7	868.300
2019-10-31 04:00:36 CET	-58.0	7	868.850
2019-10-31 04:02:14 CET	-58.0	7	869.525
2019-10-31 05:00:50 CET	-59.0	7	869.525
2019-10-31 06:00:45 CET	-59.0	7	868.500
2019-10-31 07:00:47 CET	-60.0	7	869.525
2019-10-31 08:00:31 CET	-56.0	7	868.300
2019-10-31 09:01:30 CET	-59.0	7	868.500
2019-10-31 10:01:24 CET	-58.0	7	868.850
2019-10-31 11:01:13 CET	-58.0	7	868.100
2019-10-31 11:02:06 CET	-59.0	7	868.300
2019-10-31 12:01:17 CET	-58.0	7	868.100
2019-10-31 13:00:47 CET	-59.0	7	868.850
2019-10-31 14:01:09 CET	-57.0	7	869.050
2019-10-31 15:00:50 CET	-59.0	7	868.500
2019-10-31 16:01:08 CET	-59.0	7	868.500
2019-10-31 17:01:18 CET	-60.0	7	868.500

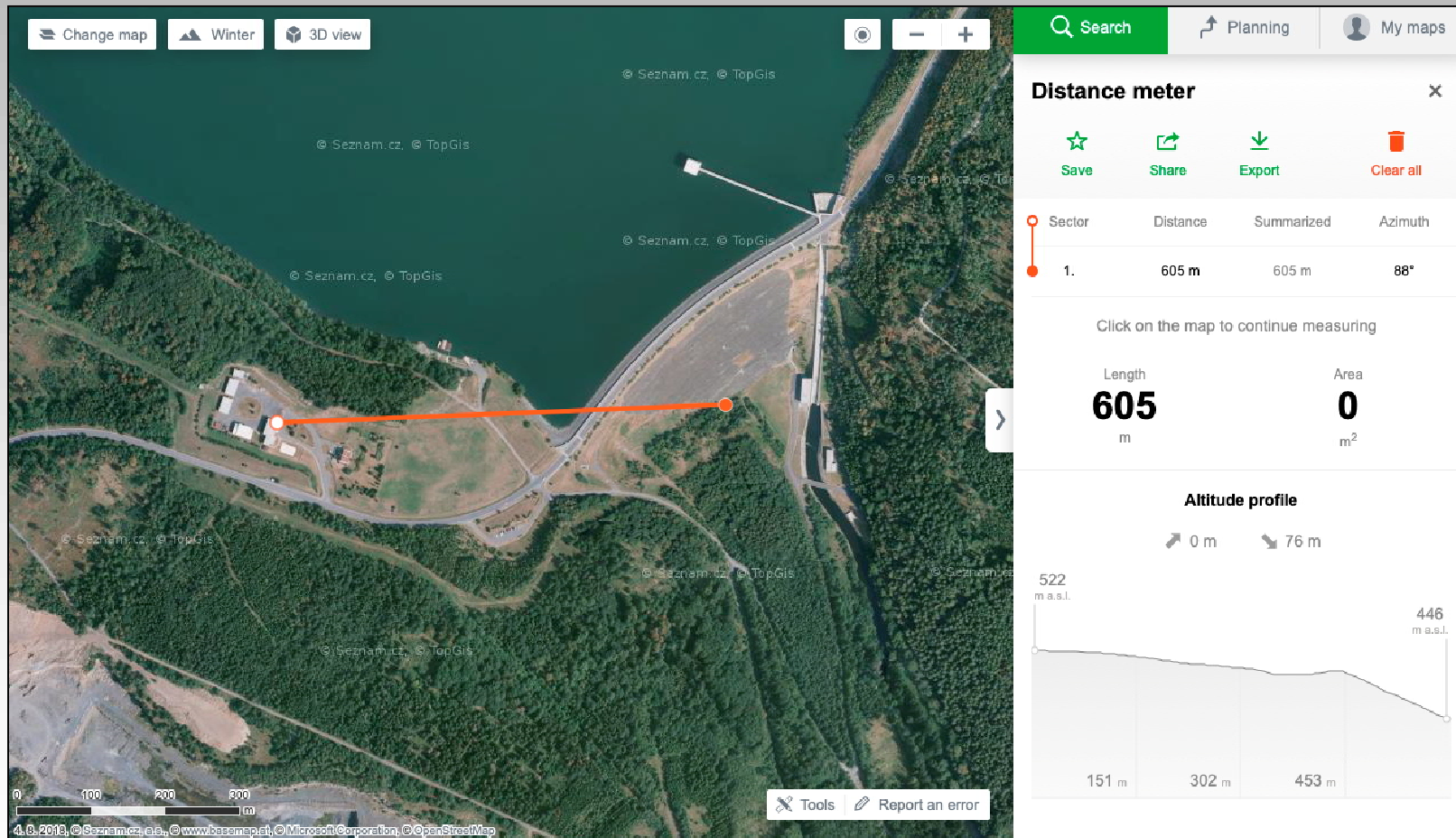
Information of the lost packets

The screenshot shows a web browser window with the following content:

- Browser Tab:** Loadensing Data Server
- Address Bar:** 172.18.32.130/dataserver/node/view/8001
- Status Section:**
 - Status: Ok
 - Last status change date: 2019-07-08 11:01:12 CEST
 - Monitoring status emails: ✓ Yes
 - Messages received: today: 22 0
 - Messages received: 1 day ago: 27 0
 - Messages received: 2 days ago: 28 0
 - Messages received: 3 days ago: 27 0
 - Messages received: 4 days ago: 28 0
 - Messages received: 5 days ago: 27 0
 - Total number of messages since gateway installation: 8983 1 219
- Note:** all messages not received are stored in the node, and can be retrieved with the Android app
- Power Section:**

Date	RSSI (dBm)	SF	Freq (MHz)
2019-10-31 03:01:16 CE I	-58.0	7	868.300
2019-10-31 04:00:36 CET	-58.0	7	868.850
2019-10-31 04:02:14 CET	-58.0	7	869.525
2019-10-31 05:00:50 CET	-59.0	7	869.525

Signal from behind the dam body



Using one special antenna

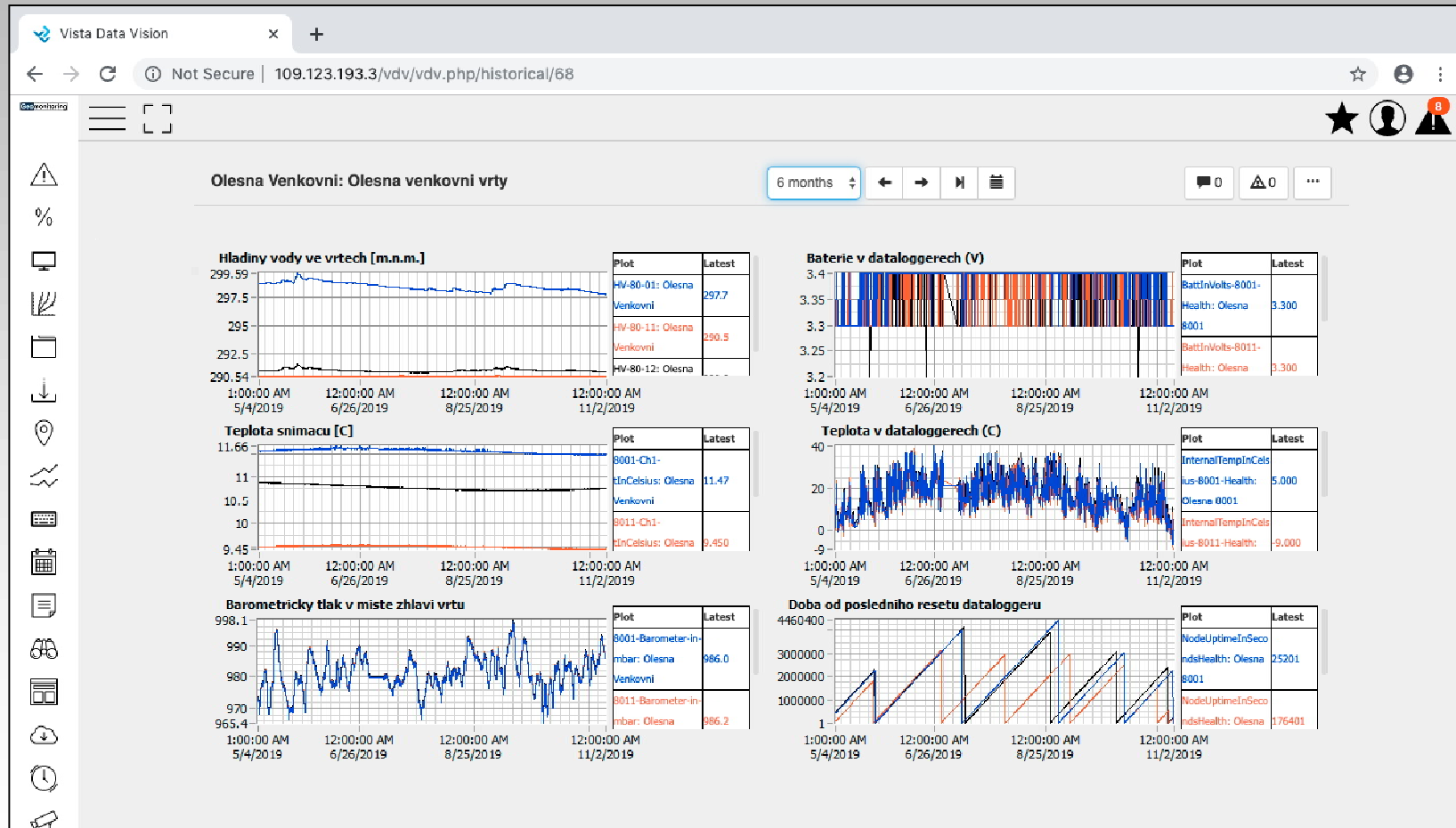


Geomonitoring

Remote approach to Gateway

- GPRS modem
 - built in GPRS modem
 - static and open IP address
 - through Worldsensing server and dynamic IP
- LAN connection (safe for the client)
 - directly from LAN in the place of installation (Slezská Harta and Olešná Dams)
 - through RDP (OpenVPN) to LAN (Slezská Harta and Olešná Dams);

Visualisation in Vista Data Vision



Visualisation in Vista Data Vision



Results

- Connected only to the client LAN
- Signal through steel covers
- Signal without direct visibility
- Built-in reference barometer
- Pilot projects has been just extended at Olešná Dam



Geomonitoring

Thank you...