MINERAL WATERS OF THE CARPATHIAN BASIN
PROGRAMME OF THE XIV. INTERNATIONAL SCIENTIFIC CONFERENCE
Bardejov Spa – 22nd -25th August 2018

CONFERENCE PROGRAM

22nd AUGUST(Wednesday):

17:00 Arrival, Welcome (Bardejov Historic Town Hall),
17:30 - 18:30 City tour (Town Square)
18:30 – 19:00 Accommodation
19:00 Dinner (Hotel Alexander restaurant)

23rd AUGUST (Thursday):

7:00- 8:00 Breakfast (Hotel Alexander restaurant)

8:00 - 9:00 Registration of conference participants

9:00 - 9:15 ***Opening of the conference***
(Lecture room of the hotel Alexander)

LECTURES:

9:15 -9:45 **TOMETZ, Ladislav**; **TOMETZOVÁ, Dana** (TU of Košice): *Hydrogeology of the mineral water resources in Bardejov Spa*

9:45-10:15 **ILYÉS, CSABA,; TURAI, ENDRE; SZŰCS, PÉTER** (University of Miskolc): *Spectral analysis of the hydrologiccycles research*

10:15-10:45 **LÉNÁRT, LÁSZLÓ** (University of Miskolc): *Unsuccessful or incomplete exploration wells of the Bükk mountain thermal karst*

10:45 - 11:15 **MÁTHÉ, ISTVÁN** (Sapientia EMTE – Csíkszereda)**:** *Chemical and microbiological studies on the special aquatic habitats of the Ciomad volcanic complex*

11:15 - 11:30 Coffee break

11:30 - 12:00 **MIKLÓS, RITA** (University of Miskolc): *Potential closure of the thermal water flow paths in the southern foreland of the Bükk Mountains*

12:00 - 12:30 **TOMETZ, LADISLAV; DIRNEROVÁ, DIANA** (Technical University of Košice): *Protective zones of mineral water resources in Bardejov Spa*

12:30 - 13:00 **TOMETZOVÁ , DANA** (TU of Košice): *Utilization of the Bardejov mineral waters for the development of geoturism*

POSTERS:

ZSOMBOR FEKETE, CSABA ILYÉS, ROLAND KILIK, FERENC MÓRICZ, ENDRE NÁDASI, GÁBOR NYIRI, MARCELL SZILVÁSI, PÉTER SZŰCS, ENDRE TURAI, PÉTER VASS, FELICITÁSZ VELLEDITS, BALÁZS ZÁKÁNYI(Miskolci Egyetem): *Geothermal Utilization of Unproductive and Abandoned Wells in Northeast Hungary*

LÉNÁRTLÁSZLÓ (Miskolci Egyetem): *Sources of mineral waters and spas on postage stamps*

TOMETZ LADISLAV, TOMETZOVÁ, DANA (Technical University of Košice): *Natural potable mineral waters of Slovakia*

13:00 - 14:00 Lunch (Hotel Alexander restaurant)

AFTERNOON PROGRAMME

VISIT OF ATTRACTIONS IN BARDEJOV SPA

14:00 - 14:30 Colonnade (mineral waters tasting)

14:30 - 15:00 Visit of the Emperor Elisabeth Memorial Room

15:00 - 16:00 Visit of balneotherapy

EVENING PROGRAMME

16:00 - 19:00 Wellness, walks, relaxation, shopping etc.

(Wellness can be used from 9:00 to 20:30)

19:00 Galla dinner with folk music (Lecture room of the hotel Alexander)

24th AUGUST (Friday):

7:00 - 8:00 Breakfast (Hotel Alexander restaurant)

8:00 - 8:15 Meeting at the bus
8:15 Departure to excursion
9:00 Arrival to Krynica (Poland)
9:00 - 10:00 Attractions of the Krynica Spa, mainly in relation to local mineral waters

10:00 - 10:15 Shopping (Złoty is required for payment in Poland), toilet etc.

10:15 Departure to Złockie

10:30 - 11:00 Złockie - Prof. Świdzińsky mofette

11:00 - 11:30 Szczawnik–The spring behind the church (Źródło Za Cerkwią)

11:30 - 12:30 Visit of the mineral water bottling factory in Muszyna

12:30 - 13:00 Drinking pavilion and mineral spring Antoni

13:00 Arrival to Ľubovňa Spa

14:00 - 15:00 Lunch (Hotel SOREA restaurant)

15:00 - 15:30 Mineral water springs in Ľubovňa Spa

15:30 Departure to Bardejov Spa

17:00 Arrival to Bardejov Spa

17:00 Free program (wellness, walks, relaxation, shopping etc.)

Dinner (Hotel Alexander restaurant)

19:00

ST (Saturday):

25th AUGU

Breakfast (Hotel Alexander restaurant),

8:00 - 9:00

Departing home

9:15

University of Miskolc
Institute of Environmental Management
Institute of Geophysics and Geoinformatics
MTA-ME Geoengineering Research Group

EXAMINATION OF THE HYDROLOGIC CYCLES WITH SPECTRAL ANALYSIS

Csaba Ilyés – Endre Turai – Péter Szűcs

***A KÁRPÁT-MEDENCE ÁSVÁNYVIZEI* XIV. Nemzetközi Tudományos Konferencia**
Bártfafürdő – 2017. augusztus 22-25.

The contents of presentation

1. Daily sampled 110 year long dataset
2. Monthly sampled shallow groundwater
3. The case of Debrecen

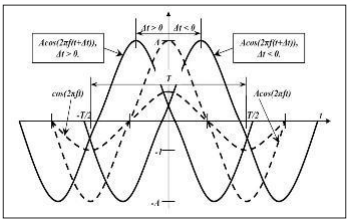
Introduction

- The satisfaction of drinking water and mineral water needs is one of the most important tasks to be solved globally today.
- In the future, the weight of this challenge will, according to some estimates, progressively increase in the context of the climate change.
- The amount of precipitation and its changes in time have an impact on the quantitative and qualitative characteristics of groundwater basins.

1

Daily sampled 110 year long dataset

Methodology



Fourier-spectrums based on the *cos(2πft)* and *sin(2πft)* functions.

The real and imaginary spectrum gives the weights of the sin-cos components.

Search for periodic components in *y(t)* precipitation functions.

$$\cos(t) = \cos\left(\frac{2\pi}{2\pi}t\right) = \cos\left(\frac{2\pi}{T}t\right) = \cos\left(2\pi\frac{1}{T}t\right) = \cos(2\pi f t)$$

$$f = \left(\frac{1}{T}\right)$$ Where, f :frequency, $T=2\pi$: period length

$$A * \cos(2\pi f t + \varphi)$$

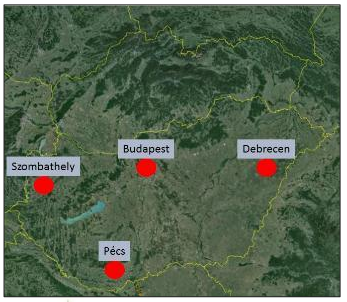
$$Re[F(f)] = \int_{-\infty}^{+\infty} f(t)\cos(2\pi f t)\,dt$$

$$Im[F(f)] = \int_{-\infty}^{+\infty} f(t)\sin(2\pi f t)\,dt$$

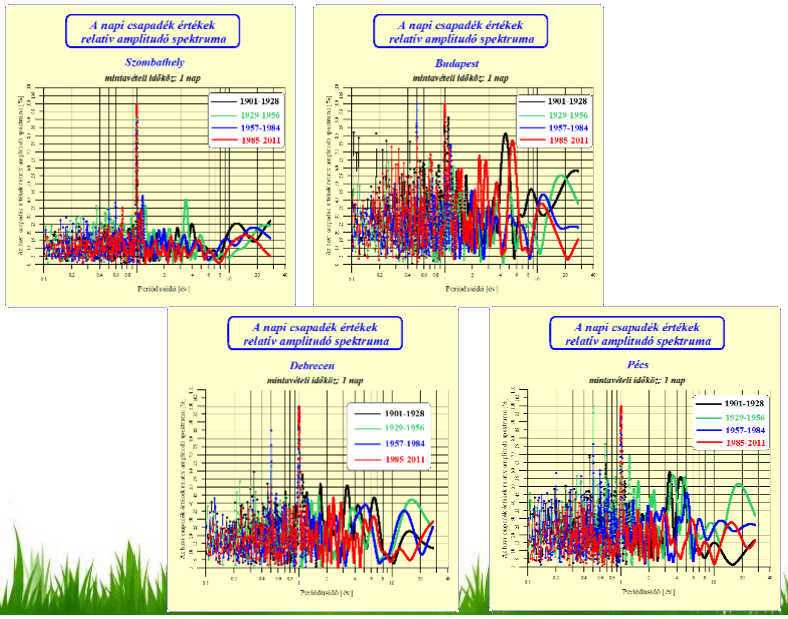
$$F(f) = A(f)e^{j\Phi(f)}$$ Where, A :amplitude, φ: phase angle

Daily sampled 110 year long dataset

- The registration interval for each city divided into four equal periods.
- To determine how spectral information changes in each period.
- To find the climate change relation as to whether the length of the precipitation cycles is actually shortened.
- From the four cities in Szombathely the stability of the cycles, while in Budapest time variability is the highest.
- The variability of the spectra calculated for Debrecen and Pécs is similar between Budapest variability.



Daily sampled 110 year long dataset



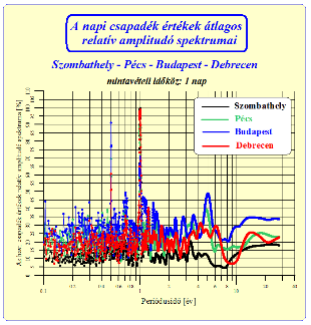
Daily sampled 110 year long dataset

- The table shows that the 1 year, 0.5 years, 0.7 years, and 0.3-0.4 years can be detected in the rainfall data series of all four cities,
- The 1.23 year long cycle is in the series of three cities (Debrecen, Budapest and Pécs),
- However, it cannot be detected in Szombathely at the westernmost location.

No.	Debrecen (relative weight)	Budapest (relative weight)	Pécs (relative weight)	Szombathely (relative weight)
1.	1 year (99.1%)	0.5 year (91.2%)	1 year (90.1%)	1 year (99.7%)
2.	0.5 year (60.8%)	1.01 year (71%)	0.5 year (69.7%)	0.5 year (26.0%)
3.	1.22 year (40.3%)	0.71 year (49.6%)	0.7 year (39.9%)	1.15 year (24.2%)
4.	0.73 year (33%)	5.03 year (49%)	4.84 year (39.3%)	0.71 year (21.0%)
5.	0.3 year (32.7%)	1.1 year (46.6%)	0.46 year (39.3%)	1.05 year (20.9%)
6.	4.22 year (31.2%)	1.15 year (45%)	0.4 year (37.3%)	0.37 year (20.9%)
7.	1.67 year (29.8%)	0.3 year (43.7%)	1.23 year (35.7%)	3.32 year (20.4%)
8.	6.09 year (29.6%)	1.37 year (43.4%)	0.29 year (35.5%)	0.87 year (20.2%)
9.	3.56 year (26.6%)	1.23 year (40.3%)	3.43 year (31.9%)	0.64 year (20.1%)
10.	14.2 year (25.8%)	0.54 year (40%)	1.51 year (31.2%)	23 year (18.7%)

Daily sampled 110 year long dataset

- The length of the one-year cycle exactly how many day long it is in the four time intervals for each city,
- The last line shows the extent of the change (the difference between the maximum and the minimum value).
- The largest is the case here in Budapest (18.7 days), while in Szombathely the smallest (1.5 days).
- If the rainfall cycles were actually shortened in countrywide terms, then the highest value must have been in the 1901-1928 period for all four cities and the lowest in the 1985-2011 period.
- This is not true for any city, so the shortening of precipitation cycles is not verified by our analysis.

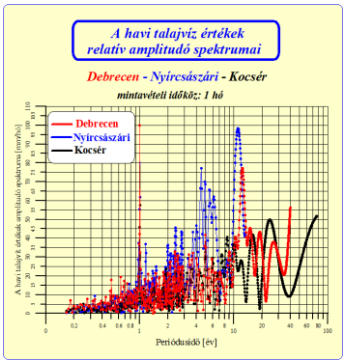


Time interval	Debrecen [day]	Budapest [day]	Pécs [day]	Szombathely [day]
1901-1928	366.6	366.5	366.8	365.4
1929-1956	364.4	349	363.7	364.4
1957-1984	364.6	367.7	366.9	365.5
1985-2011	366.6	366.9	365.7	365.9
extent	2.2	18.7	3.2	1.5

2 **Monthly sampled** shallow groundwater dataset

Monthly sampled shallow groundwater dataset

No.	Debrecen (relative weight)	Nyírcsászári (relative weight)	Kocsér (relative weight)
1.	1 year (100%)	1 year (100%)	1 year (100%)
2.	12.3 year (77.3%)	11.1 year (98.3%)	24.2 year (49.9%)
3.	15 year (45.4%)	4.5 year (77.2%)	15.8 year (41.9%)
4.	18.9 year (43.2%)	4.9 year (70.1%)	8.5 year (40.6%)
5.	5 year (41.7%)	5.5 year (65.8%)	10.1 year (37.2%)
6.	10.5 year (40.7%)	6.2 year (62.1%)	5 year (32.6%)
7.	26.6 year (38.1%)	4 year (46.8%)	7.5 year (31.4%)
8.	9 year (32.9%)	2.4 year (45.5%)	6 year (29.5%)
9.	2.4 year (32.9%)	2.8 year (43.5%)	12 year (28.3%)
10.	3.7 year (32.2%)	3.7 year (43.2%)	1.9 year (23.7%)
11.	3.3 year (31.4%)	0.98 year (37.4%)	3.7 year (23.6%)



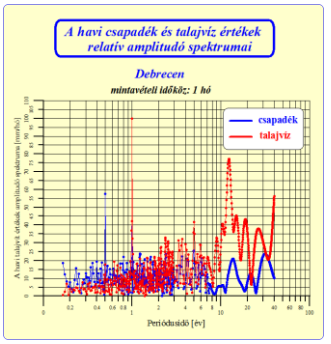
Monthly sampled shallow groundwater dataset

- The spectra of the monthly sampled shallow groundwater level time series were calculated.
- The interval of 110 years between 1901 and 2011 in two neighboring (Debrecen, Nyírcsászári) and a far (Kocsér) location.
- 1 year, 3.7 years, 5 years and 11-12 years can be detected in the time series of the groundwater level in all three location.
- In the case of Debrecen and Nyírcsászár which are close to each other, a cycle of 2,4 years is also appeared as a common cycle, but this cycle is no longer visible in Kocsér area.

3 The case of Debrecen

The case of Debrecen

- From the precipitation and the change of ground water level data a 1 year, 2.4 years, 3.67 and 5 year cycles can be detected (shown with red color).
- The 12.3 year cycle in the groundwater spectrum can be detected in the precipitation timeline of 13.7 years, while the 26.6 year groundwater cycle is also higher at 31.5 years.



The case of Debrecen

- Two long-term cycles can be detected in the time series of both parameters, but they do not occur exactly with the same period of time.
- The 12.3 year cycle in the groundwater spectrum can be detected in the precipitation timeline and a cycle of 13.7 years in the shallow GW,
- While the 26.6 year precipitation cycle in the groundwater levels is also higher at 31.5 years.

Debrecen No.	precipitation (relative weight)	shallow GW (relative weight)
1.	1 year (100%)	1 year (100%)
2.	0.5 year (57.6%)	12.3 year (77.3%)
3.	4.92 year (25.5%)	15 year (45.4%)
4.	1.23 year (24%)	18.9 year (43.2%)
5.	31.5 year (23.8%)	5 year (41.7%)
6.	2.39 year (23.6%)	10.5 year (40.7%)
7.	3.67 year (22.4%)	26.6 year (38.1%)
8.	1.62 year (22.2%)	9 year (32.9%)
9.	0.8 year (22.1%)	2.38 year (32.9%)
10.	6.08 year (21.4%)	3.67 year (32.2%)
11.	13.7 year (21.1%)	3.33 year (31.4%)

Conclusions

- Daily sampled precipitation:
  - The analysis of the 110-year rainfall time series of daily sampling shows that there are probably regional deterministic reasons behind Hungary's 1 year, 0.5 year, 0.7 and 0.3-0.4 years cycles.
  - The fluctuation of the spectrum is the smallest in Szombathely, while in Budapest it is the largest
- Shallow GW levels:
  - 1 year, 3.7 years, 5 years and 11-12 years can be detected in all three GW location, so presumably there are regional deterministic reasons behind it.
- Debrecen rainfall and GW level:
  - 1-year, 2.5-year, 3.7-year and 5-year cycles appear in the time series of both parameters, therefore these cycles are caused by deterministic effecting both the periodic changes in the precipitation and ground water levels.

Acknowledgement

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Thank You for Your Attention!

Water WiseWays