

Long-term prediction of karst water recovery process based on two different approaches in a former mining area, Transdanubian Range, Hungary

Kamilla Modrovits¹, András Csepregi², József Kovács¹

© Authors. All rights reserved

¹Department of Geology, Eötvös Loránd University, Budapest, Hungary

²Hydrosys Ltd, Budapest, Hungary



EGU2020: Sharing Geoscience Online

05/05/2020

The study area

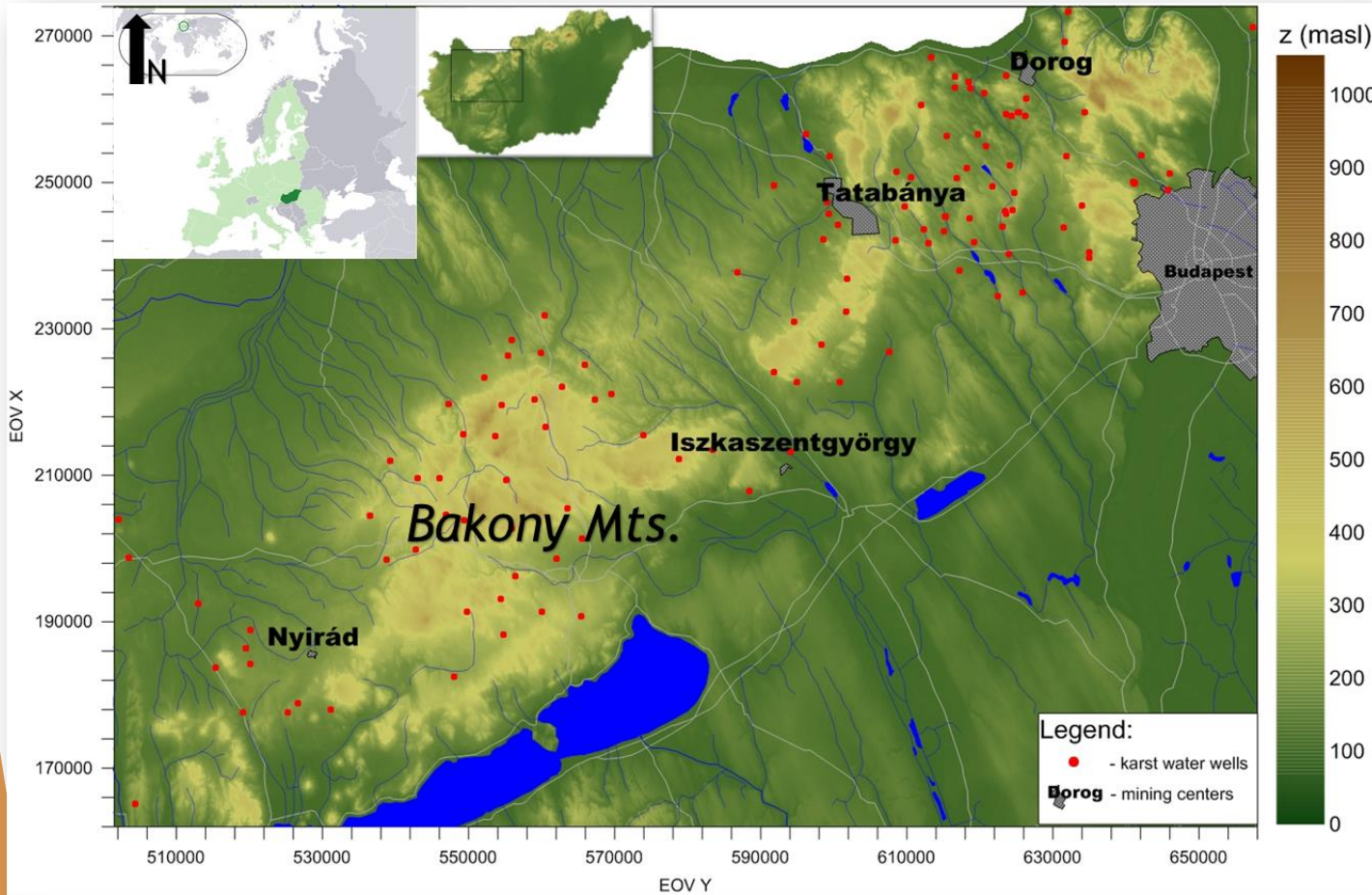


Fig. 1: The locations of the mining centers and the investigated wells in the Transdanubian Range

Main karst reservoir of the Transdanubian Range (>10000 km²):

Mining of coal and bauxite, under the karst water level, between 1950-1990.

Mining centers:

Nyirád, Iszkaszentgyörgy, Vicinity of Tatabánya (several smaller centers), Dorog Basin.

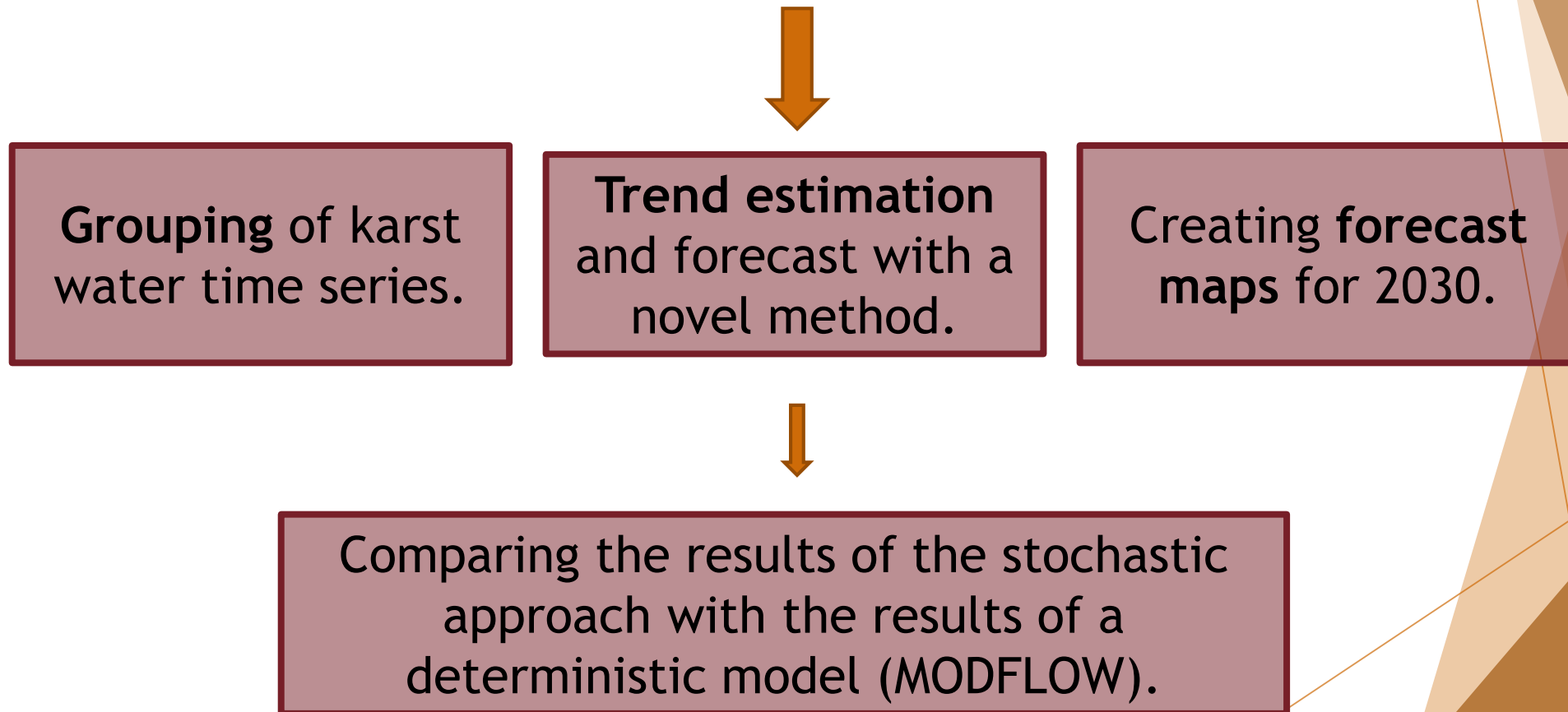
Mining stopped in the beginning of 90s, the recovery of the karst system began.



Economical and technical engineering problems.

Main goals

To understand the behaviour of a regional karst aquifer and the recovery process.



Results

Cluster analysis

- 94 wells (1995-2015) → 3 groups → spatial separation
- Group 1: 17 wells, SW (vicinity of Nyirád), minimal water level fluctuation
- Group 2: 60 wells, NE (vicinity of Dorog, Tatabánya, Iszkaszentgyörgy), minimal water level fluctuation
- Group 3: 17 wells, W of Bakony Mt., significant water level fluctuation

Trend estimation

- 10 different growth and logistic type model (K -treshold), 107 wells
- ▶ in 89.24% of the cases → $R^2 > 0.9$
- ▶ Best fitting functions: so called „Richards” (29.91% of all cases) and „63%” (28.04% of all cases)

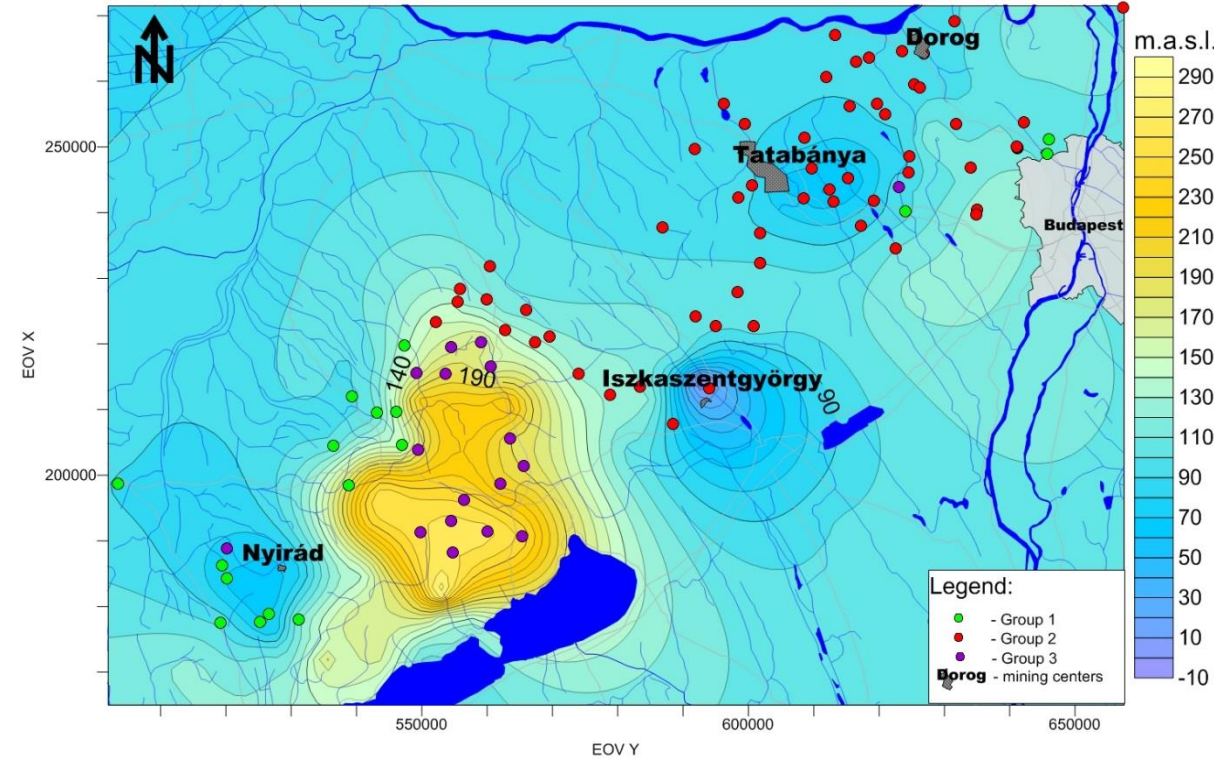


Fig. 2.: The locations of the wells in different groups on the water level map in 1990

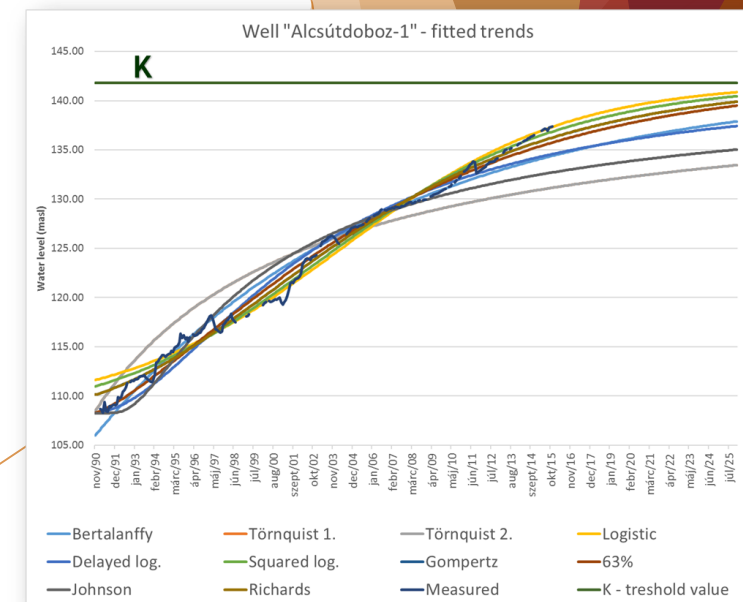


Fig. 3.: Growth curves fitted on the monthly average karst water levels of the Alcsútdoboz-1 well

Results

Forecast maps and comparison

→ Data: forecasted water levels for Jan. 2030 based on time series from 107 karst water monitoring wells

(1) with trend estimation

(2) with MODFLOW modeling

→ Comparing the values estimated by the two methods

- similar spatial distribution of water levels

→ BUT!

- Higher water levels in the central areas predicted by trend analysis (max. 20-30 m).

- In the NE part, however, the deterministic forecast gives higher expected water levels (max. 5-10 m).

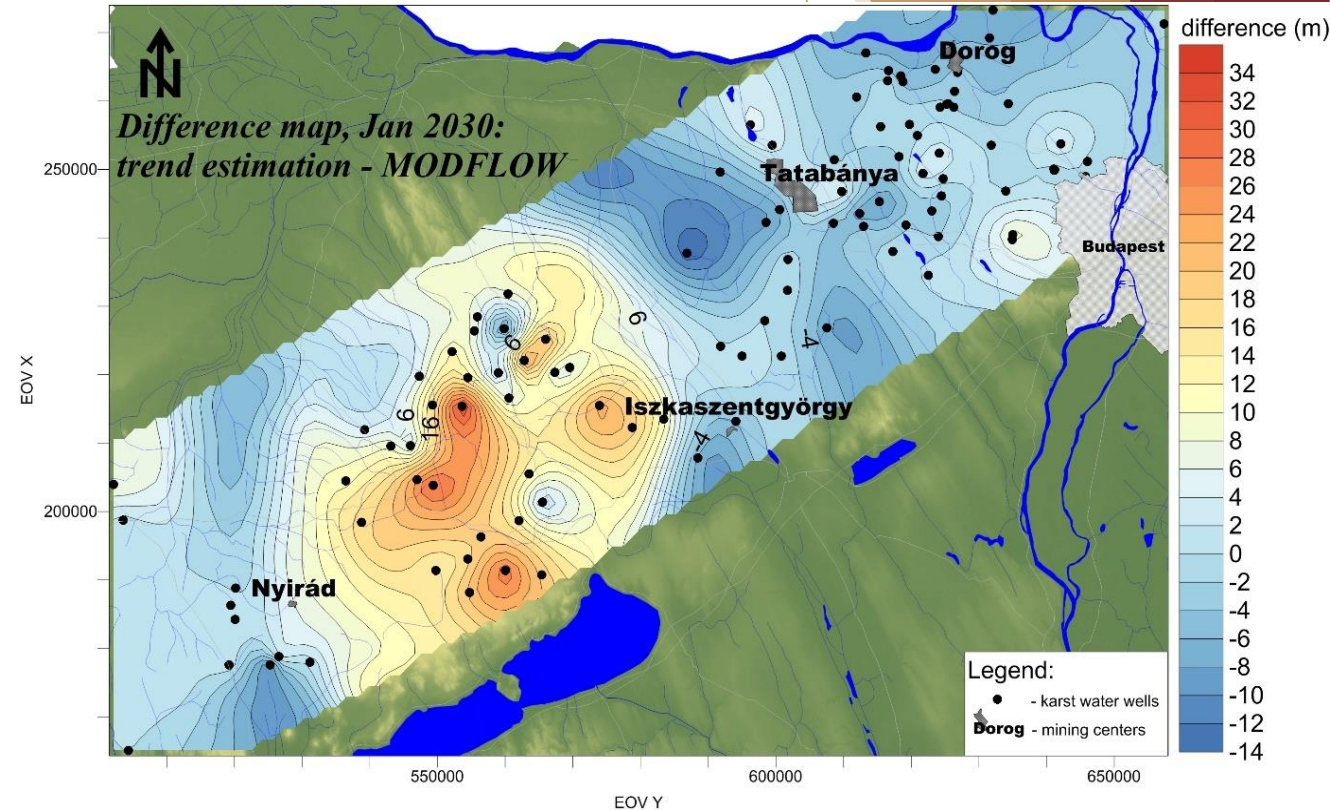


Fig. 4.: Map of difference between the water levels estimated by trend estimation and MODFLOW for Jan. 2030