

# Renaissance of the torsion balance measurements

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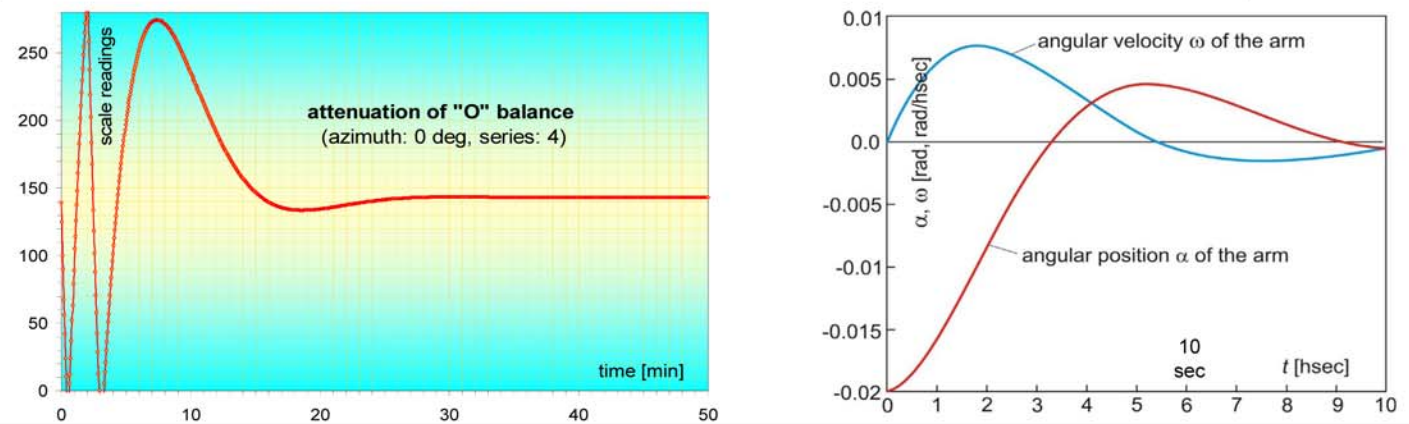
## The necessity of the new torsion balance measurements

Several problems of the geodetic applications of torsion balance measurements required performing new torsion balance measurements. For that reason an Eötvös-Rybár (Auterbal) torsion balance was reconstructed and modernized. The scale reading has been automatized and its accuracy has been improved by CCD sensors. Calibration and processing of field measurements were computerized to meet today's requirements. The former and the new torsion balance measurements provide a good possibility to detect the lateral underground mass inhomogeneities and find the geological fault structures for the geoscientists. Based on the gravity gradients there is a possibility to interpolate deflection of the vertical values, to determine the fine structure of the geoid forms and it is possible to reconstruct the potential field of gravity applying the 3D algorithm of inversion method. To reach the linearity of gravity gradients between the former torsion balance stations new measurements need to perform.

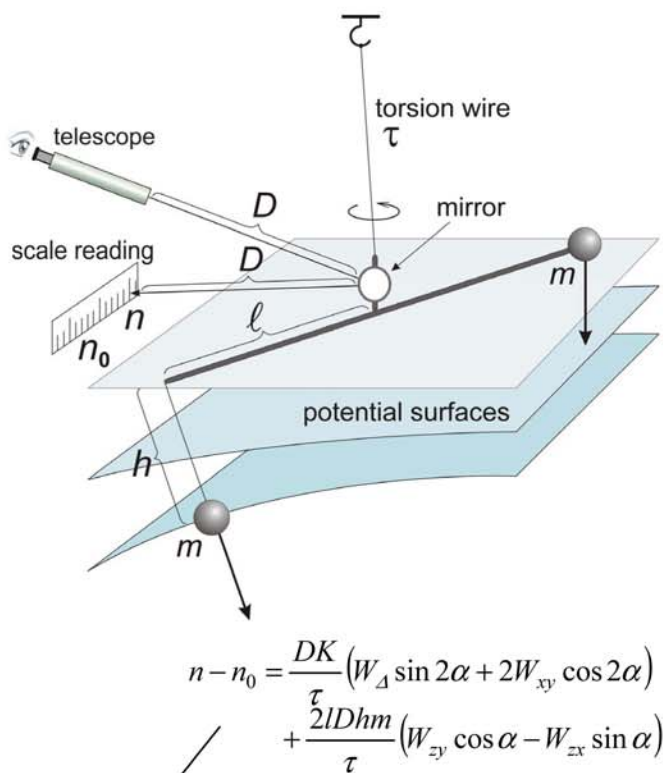
## Reconstruction and modernization



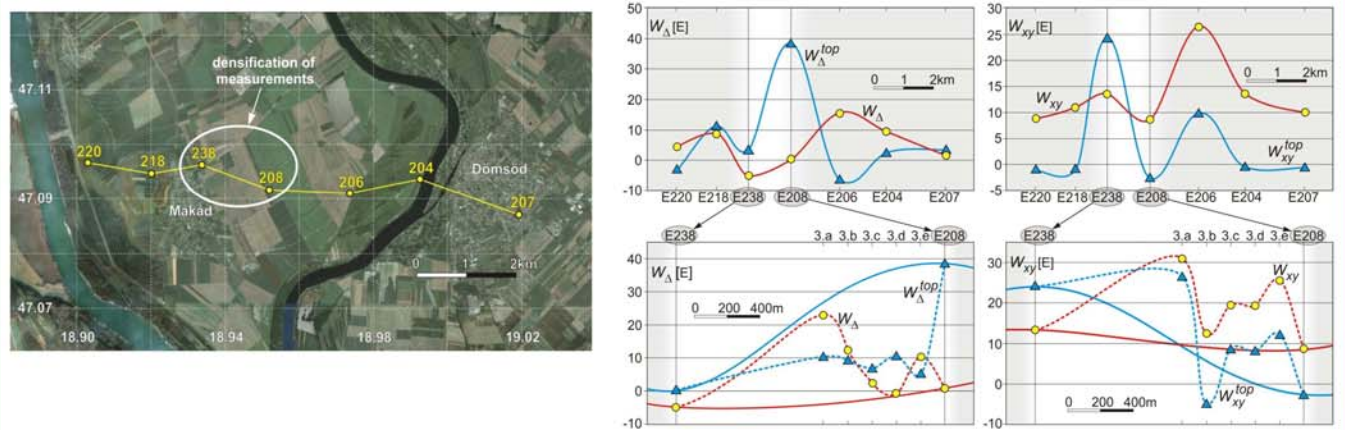
## Reducing the measurement time applying the CCD sensors and Navier-Stokes eq.



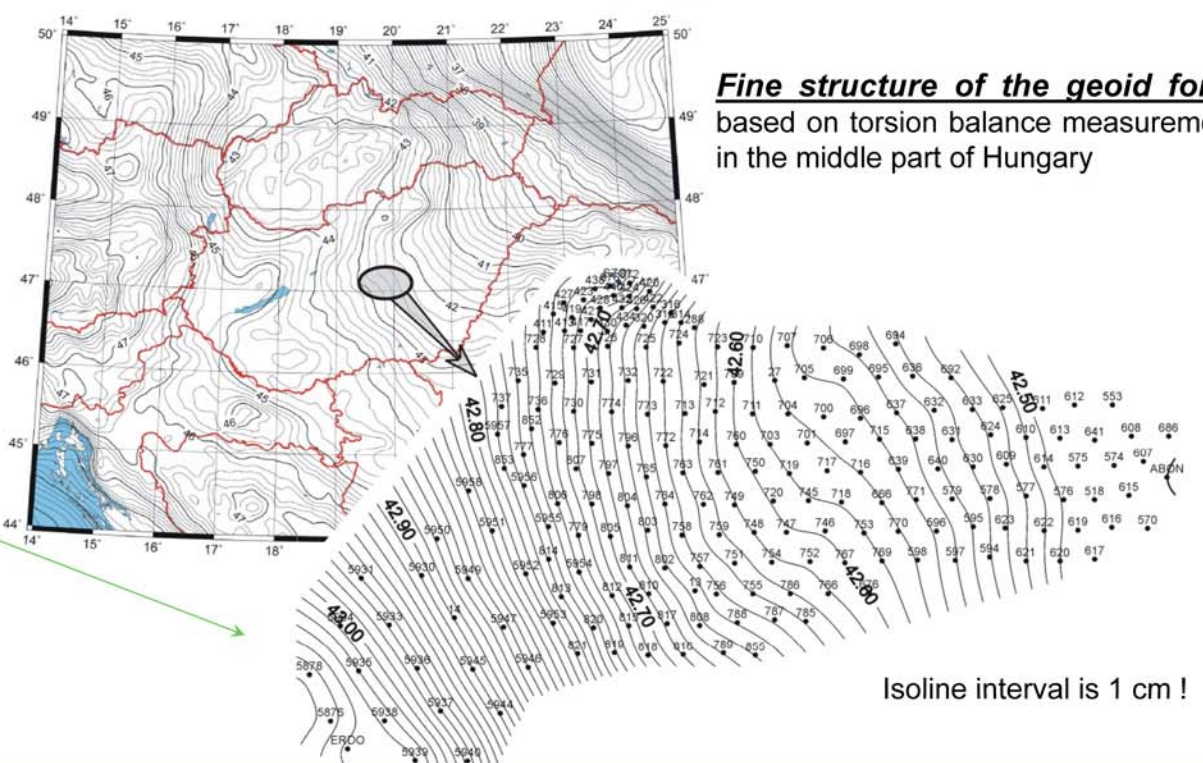
## Base principle of the torsion balance:



## New torsion balance measurements were made to study the linearity of g gradients



## Fine structure of the geoid forms based on torsion balance measurements in the middle part of Hungary



Eötvös tensor:

$W_{xx}$	$W_{xy}$	$W_{xz}$
$W_{yx}$	$W_{yy}$	$W_{yz}$
$W_{zx}$	$W_{zy}$	$W_{zz}$

- interpolation of deflection of the vertical
- determination of local geoid forms
- determination of gravity and gravity anomalies mainly for geophysical purposes
- determination of vertical gradients
- inversion reconstruction of the 3D potential function

## Summary

After an interruption of half a century, torsion balances are operated again in Hungary. Following the renovation and modernization of an Auterbal and an E54 balance, measurements are taking place on two sites: in the Mátyás cave and at the southern part of the Csepel island. Gravity gradiometry was introduced by Lorand Eötvös by creating his famous instrument in the beginning of the 1900s, but nowadays it is playing important role in geodesy again. Torsion balance measurements will be important and indispensable data source for the determination of small wavelength gravity field and the fine structure of geoid features in Hungary. A group of professionals has been formed again who have the intent to continue the scientific efforts of Lorand Eötvös, are able to renovate and modernize obsolete instruments, and have the field experience to continue torsion balance measurements.