



## **Research on time variability of geopotential in the context of precise comparison of clocks within the Polish OPTIME system**

Dorota Marjańska (1), Albin Czubla (2), Tomasz Olszak (1), Aleksander Brzeziński (1), and Dominika Staniszevska (1)

(1) Warsaw University of Technology, Warsaw, Poland (dorota.marjanska@pw.edu.pl), (2) Central Office of Measures, Warsaw, Poland (albin.czubla@gum.gov.pl)

The OPTIME system is a research infrastructure linking metrology laboratories in Poland: Central Office of Measures (GUM) in Warsaw (with caesium clocks), National Laboratory of Atomic, Molecular and Optical Physics in Toruń (with optical clocks), and Astrogeodynamic Observatory of the Space Research Centre PAS located in Borowiec (with an active hydrogen maser and a caesium fountain).

When comparing precise time-standard clocks and interpreting frequency differences, a crucial problem is to account for the corresponding difference in the gravity potential. Here we will present the theoretical basis for determination of the gravity potential based on the definition and implementation of the PL-EVRF2007-NH height frame and then perform an analysis of its time variability. This analysis will include determination of gravitational potential differences related to the effects of tidal phenomena and resulting from the use of different solid Earth and ocean tidal models, local and global. In addition, we will consider also the time-variable non-tidal effects related to polar motion, atmospheric mass redistributions as well as local and global hydrological mass fluctuations based on selected hydrological models and local observations of groundwater changes.

By taking into account the underlying physical processes we decided to select for analysis two years of observations: 2010, when floods were reported on the territory of Poland, and 2015, in which there was a hydrogeological drought with a hitherto unrecorded intensity.