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Long water-tube tiltmeter in Geodynamic Laboratory in Ksiaz, Poland

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The long water-tube tiltmeter installed in Ksiaz Geodynamic Laboratory, situated in Low Silesian region of Poland, consists of two perpendicular tubes 65 and 83 meters-long, partially filled with water. The idea of measurements is based on phenomenon of hydrostatic equilibrium. The luni-solar forces as well as other large-scale geodynamic phenomena generate water level variations in hydrodynamic system of tubes. Changes of water level show variations in inclination of the equipotential surface. These changes are measured with the help of interference technique. Interference method allows achieving the nanometer-level of accuracy of measurements of water level variations. Due to the properties of the applied He-Ne laser, the method of measurements has characteristic of absolute measurements technique. By taking into account length of the tubes, we could reach the internal sensitivity of the measurement system close to 1 microarcsecond. The basic properties of the water-tube tiltmeter, such as high resolution of measurements and lack of instrumental drift, opened additional possibilities of geodynamic investigations. The long water-tube tiltmeter made possible measurements of non-tidal plumb line variations associated with systematic, seasonal or long-periodic effects, as well as the variations generated by the Earth free oscillations during the large Sumatra-Andaman catastrophic earthquake of 26 December 2004 (Kaczorowski M., 2006, in. Earthquake Source Asymmetry, Structural Media and Rotation Effects, eds. R. Teisseyre, M. Takeo and E. Majewski, Springer-Verlag, Berlin Heidelberg, 493-520). Since 2004, the differential method for elaboration of observations which eliminates the instrumental drift was introduced. Removal of the drift enables investigation of the non-tidal plumb line variations. During two years 2004-2005 we could observe substantial plumb line variations which took place in the autumn-winter and winter-spring transition periods.