IAF EARTH OBSERVATION SYMPOSIUM (B1)
Interactive Presentations - IAF EARTH OBSERVATION SYMPOSIUM (IP)

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RADIOPHYSICAL RELATIVISTIC GRAVIMETER

Abstract

In 2016, for the first time in the world, a differential radiophysical (relativistic) gravimeter was created in the framework of a contract between NSAU and JSC "RPC "KURS", which was calibrated at the NSC "Metrology Institute" in Kharkov with reference to a reference ballistic gravimeter and issued a certificate. In the framework of these measurements, the ability to measure the value of the acceleration of gravity with an accuracy of no less than 100 Gal was confirmed. In recent years, the possibility of measuring at the level of Gal units has been demonstrated. To achieve such results, the key point was the using a highly stable hydrogen frequency standard. Differential radiophysical (relativistic) gravimeter has the following distinctive features: - autonomy of functioning; - independence of measurements from external inertial accelerations of the carrier; - the measurement error depends only on the stability of the frequency standard; - the distance between receivers does not exceed one meter. Currently, the ACES scientific experiment is conducting on ISS using a highly stable frequency standard. One of the scientific problems solved by this project is to test the relativistic effect of the gravitational shift of the frequency of electromagnetic radiation. For this purpose, it is assumed using the data reset channels located on the ISS to transmit to the ground information receiving points a highly stable frequency value, which will be generated on board the ISS by the ACES module, where the gravitational frequency shift will be measured. The main disadvantages of this experiment are: - the need to take into account the Doppler frequency shift, which is significantly larger in magnitude than the gravitational shift and which is associated with high-precision measurements of the coordinates and velocity of the ISS; - the impossibility of the global monitoring of the Earth gravitational field. It is proposed to place on board the ISS a differential radiophysical gravimeter, which has a mass of not more than 10 kg, power consumption not more than 500 watts. and its cost is no more than 100 thousand Euros and can implement the tasks of such gravitational missions as GOCE, the cost of which for the EU was within 500 million Euros.