IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Gravity and Fundamental Physics (1)

Author: Dr. Benny Rievers
ZARM, University of Bremen, Germany

Dr. Meike List
DLR (German Aerospace Center), Germany
Dr. Stefanie Bremer
German Aerospace Center (DLR), Germany
Mr. Florian Wöske
Center of Applied Space Technology and Microgravity, Germany

EVALUATING ATMOSPHERIC DENSITY WITH MICROSCOPE DATA

Abstract

In April 2016 the French satellite MICROSCOPE was finally launched after more than 15 years of preparation. The main mission goal was a test of the weak equivalence principle to an accuracy of 10^{-15} by means of two high-precision accurate differential accelerometers.

After an initial evaluation of a small part of the acquired data the determination of the Eötvös parameter η characterizing the relative difference in test mass free-fall acceleration has already been improved by one order of magnitude compared to what has been achieved by means of torsion balance experiments. Further improvements are expected from an evaluation of the complete data sets as well as improved characterization of major noise drivers.

After completion of the main scientific measurements in late 2018, CNES opened up the remaining mission time for additional experiment ideas. Following an international proposal with French, German and Dutch contributions an aeronomy experiment was one of the dedicated task chosen for MICROSCOPE during its remaining mission lifetime mainly limited by the availability of cold gas.

We present the details of the experiment and highlight our approach for an evaluation of the accelerometer data to extract information on the atmospheric density. We employ a high precision orbit propagation approach to estimate the magnitude of non-gravitational forces and to subsequently filter the measured acceleration to determine the fraction of the total acceleration that can be credited to drag. We furthermore discuss our approach on the estimation of accelerometer bias and scale factors as well as first results from the obtained data sets.