

Preliminary report of absolute gravity measurement with A-10 at National Defense Academy

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1. Introduction

A portable absolute gravimeter, A-10 produced by Micro-g Solutions, Inc., was introduced in the National Defense Academy (NDA) in December, 2004. This is the first production of A-10 and the only A-10 type gravimeter in Japan at Feb., 2006.

Main part of A-10 system consists of two cylindrical units (dropping unit and base unit) having about 50 cm diameter and 90 cm height. The A-10 system can be used in the field observations due to 12 V DC power supply and about 100 kg total weight. Here, we report the preliminary measurement with A-10 gravimeter at NDA.

2. Specification of the A-10 system

In A-10 system, the gravity value is calculated by the acceleration of the freely falling test mass. A freely falling reflective test mass is dropped in a vacuum and this causes optical fringes to be detected at the output of an interferometer. This signal is used to determine the local absolute gravitational acceleration. This process is repeated until the required accuracy is achieved statistically. The measurement is totally controlled by the software attached in the system. This software also calculate the correction of the gravity by the earth tide, ocean load, polar motion and atmospheric pressure.

3. Measurement of gravitational acceleration at NDA

Measurement is carried out in a laboratory of NDA located the east end in Miura Peninsula, where the Kanto loam layer the sedimentary rock of Quaternary overlays on the base rock which consist of the mudstone and tuff. Measurement points are east longitude 139-degree 43'13.08", north latitude 39-degree 15'23.4" and altitude is 88 m. The fall interval of the corner cube reflector is 1 to 5 seconds, and 1,000 to 10,000 falls are done by one measurement which takes several to two days. The results are summarized as about 979,749,500 micro gal for January, 2005, 979,749,490 micro gal for June, about 979,749,460 micro gal for October to December, and 979,749,430 micro gal for January and February, 2006.

4. Future subject

Although the measurement accuracy on the specification of A-10 is 10 micro gal, the measurement in NDA has errors of 10-30 micro gal. The scatter of about 20 micro gal is seen for day of measurement in one or two weeks. Systematic decay of measured gravity for one year is found, which is opposite tendency predicted by recent vertical change around Miura Peninsula (1-4 mm/year subsidence). The details of the tendency is not clarified in the present, although the change may be occurred by change of the mechanism of the gravimeter with the passage of time or by change of the oceanic environment near NDA. Other mechanical troubles, such as poor cable contact, and the bugs of software are also found and must be improved. Measurement of the absolute gravitational acceleration less than 20 micro gal errors are expected by introducing better method for the tidal correction and so on.