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Application of Precise Satellite Positioning for Monitoring the Earth's Environment

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We briefly introduce here a collaborative project named "the application of precise satellite positioning for monitoring Earth's environment" (Project leader, T. Tsuda). The main purpose of this study is concerned with two novel satellite techniques; (1) GPS occultation and (2) satellite gravity missions. The former provides a refractive index profile by analyzing the propagation delay and the bending of GPS radio signals passing through the atmosphere and ionosphere, which can further be utilized to derive water vapor, temperature and electron density. The latter measures the detailed spatial and temporal variations of the precise gravity field of the Earth, from which the distribution of groundwater and deep ocean currents can be inferred. By coordinating a number of universities and research institutes including Kyoto University, NICT, ENRI, MRI, JMA, NAO, the University of Tokyo and so on, this research was conducted from August 2002 to March 2005 as one of the projects on "Challenge to Leading Edge of Science and Technology" with financial support received from the Special Coordination Funds for Promoting Science and Technology (SCF) of MEXT.

In this project we are mainly concerned with the technical and scientific developments of GPS occultation experiments from a mountain-top (Mt. Fuji), an airplane and a low-Earth orbiting (LEO) satellite. We continued airplane experiments using a newly designed GPS receiver, and derived a refractive index profile in the lower troposphere (see Fig. 1). We also promote a GPS occultation mission on a Brazilian LEO satellite; Equatorial Atmosphere Research Satellite (EQUARS) (see Fig. 2) in collaboration with the Brazilian space agency (INPE). The analyzed results are further assimilated into a numerical weather prediction model with global (3D-var) and regional (4D-var) scales at JMA and MRI, respectively, which effectively improves the prediction accuracy.

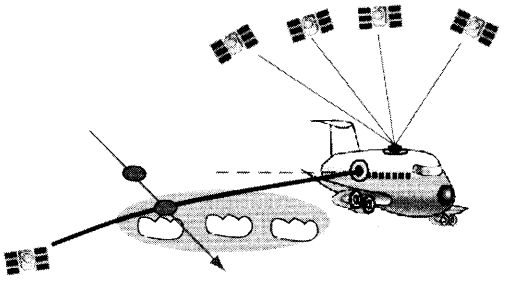

Fig. 1. Schematic diagram of GPS occultation experiment from an airplane..

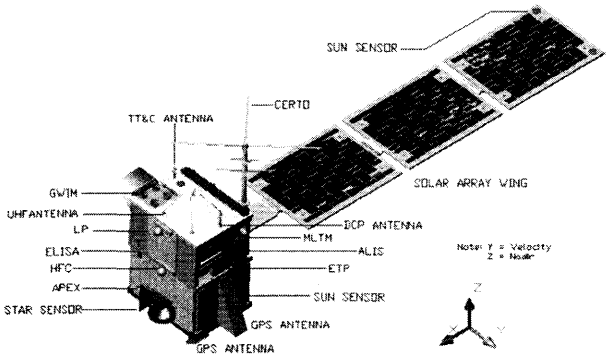

Fig. 2. Concept design of EQUARS. GPS antennas for occultation and POD are displayed in green. Z axis points toward the Earth...