Monitoring Earth's environments with GPS receiving system and micro accelerometer on LEO satellites

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http://www.rish.kyoto-u.ac.jp/radar-group/Earth_Monitoring/

We propose the mission plan to monitor the Earth's environments with a micro-satellite which has a GPS receiving system and a micro accelerometer on board. This micro-satellite launched on a low Earth orbit (LEO) of 300 -- 800 km can provide the following Earth observations: (1) the Earth's gravity field which is derived from the precise positioning and is useful for understanding the water cycling within the atmosphere, hydrosphere, cryosphere, and ocean quantitatively; (2) fluctuations in density of neutral atmosphere in the thermosphere estimated from the atmospheric drags; (3) vertical structures of temperature and water vapor in the neutral atmosphere and those of electron density in the ionosphere by GPS occultation technique; (4) the sea surface height and velocity of waves by GPS reflection. In addition, a network of multiple micro satellites enables to monitor the Earth's environments with high temporal and spatial resolutions and is expected as a new Earth observation system for the global warming, water resources, space weather, and so on. For this purpose, we are developing the micro accelerometer and high efficient GPS receiving system for the micro satellite. Adopting the laser interferometer, the onboard accelerometer will achieve a small size and lightness less than 5 kg and have a wide dynamic range property with a high resolution of 10E-11 m/s/s and a self-calibration system. On the other hand, the GPS receiving system consists of a receiver unit and antennas for the GPS occultation and reflection measurements and the precise orbit determination. The receiver unit has a multi-antenna inputs and can record phase and amplitude of very weak GPS radio waves which are arrived from the occulting GPS satellite or reflected on the ocean surface with a high sampling rate more than 50 Hz. We plan to save its weight (now 5.6 kg) and develop lightweight and small high gain antenna for GPS occultation and reflection. We are also developing softwares and ground systems for quasi-realtime processing of the satellite orbit determination and derivations of parameters concerning the Earth's environments from observed data.