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Airborne GPS downward-looking occultation experiment in 2003

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GPS occultation observation can provide atmospheric refractive index profile by continuously measuring Doppler shift in carrier phase from occultation GPS satellite. As a novel technique, mountain-based GPS occultation method (downward-looking; DL) is developed to estimate tropospheric water vapor profile below a receiving point with aid of temperature results from another observations. Research Institute for Sustainable Humanosphere (RISH), Kyoto University and Meteorological Research Institute (MRI), Japan performed observational campaigns at the top of Mt. Fuji (altitude: 3776 meters) in cooperation with NASA/JPL in the both summer of 2001, 2002. In this method, ionospheric effect can be removed by dual-frequency observation in GPS signal, and it is required to continuously observe Doppler shift in carrier phase from GPS satellite with a negative elevation angle at the top of a high mountain. Currently, it is expected to expand observational height range with a higher receiving point than a mountain-based DL observation. Therefore, we aim to perform airborne-based DL observation. Since a minimum of observational height range depended on signal tracking sensitivity of GPS receiver, we further developed a purpose-built GPS receiver system for airborne-based DL experiments. To accomplish airborne-based DL observation, it is required to estimate precise aircraft velocity with an accuracy of several mm/s in post-processing along to a flight course in order to distinguish between atmospheric propagation effect and aircraft velocity from observed Doppler shift data. For this subject, we use a GPS/INS system, which included ring laser gyros (for measuring angular velocities in three components) and accelerometers (for measuring accelerates in three components), and set up it on the experimental aircraft (Beachcraft B99 airliner) of the Electronic Navigation Research Institute (ENRI). Using these equipments, we performed flight experiments of airborne-based DL observation in October 2003 and in February 2004. As a result, we recognized that our GPS receiver system continuously tracked occultation signal with a minimum elevation angle of -3 degrees at a flight level of about 6 kilometers. In presentation, we will show initial results of airborne-based DL experiments, i.e. performance of a purpose-built DL receiver, data acquisition status, and so on.