# Temperature and Humidity Monitoring with GPS Occultation and the Contribution to the Global Earth Observation System of Systems (GEOSS)

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Last year (2005), we started a new 3-year research project "Temperature and Humidity Variability Analyses with GPS occultation" (project leader, T. Tsuda) funded by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). In this document, we describe the background, overview, and current status of the project.

We have earlier conducted research projects under collaborations with many research organizations such as Japan Meteorological Agency (JMA), Meteorological Research Institute (MRI) under JMA, National Institute of Information and Communications Technology (NICT), Electric Navigation Research Institute (ENRI), American University Cooperation for Atmospheric Research (UCAR), and Brazilian National Institute for Space Research (INPE). In those projects, we have conducted studies to develop and utilize the GPS occultation technique. This technique is to measure atmospheric refractivity profiles using the path bending and phase delay of the radio waves transmitted from the Global Positioning System (GPS) satellites. The refractivity is then used to derive the humidity and temperature of the atmosphere. One of the many achievements of the projects is that it has been demonstrated that the GPS occultation can improve weather forecast. Also, it has been shown that the technique provides a unique opportunity to study the tropical and sub-tropical atmospheric phenomena that have fine vertical structures.

In order to further pursue these two features, we have started the present research project under collaboration with NICT and MRI. The entire funding, under which our project is supported, is aimed at constructing the Global Earth Observation System of Systems (GEOSS) proposed multilaterally in the Earth Observation Summit. The "System of Systems" indicates its strategy to closely coordinate distributed efforts for better environmental monitoring.

Our project consists of three sub-projects and can be summarized as follows: we will (1) develop new retrieval techniques with NICT, (2) assimilate GPS occultation in regional weather forecast models with MRI, and (3) validate and scientifically analyze the occultation measurements.

In sub-project (1) NICT has been developing a full-spectral inversion code, which will improve the accuracy of refractivity retrievals. In sub-project (2) MRI has been developing new assimilation techniques and has demonstrated the improvement of the regional forecast. In sub-project (3), we are making observational validations and scientific analyses of the atmosphere in the tropics and Asian monsoon region. Also, we are developing a new technique to integrate GPS occultation data. This is to process the data from COSMIC/FOMOSAT-3 constellational observation, in which recently-launched six satellites will provide unprecedented high-frequency, high-spatial-density atmospheric soundings. The data will be expected to significantly improve weather forecasts and monitoring of the Earth's atmosphere. Figure 1 shows a map of expected global distribution of GPS occultation measurements in 24 hours. One can see the very high observation density from this figure.

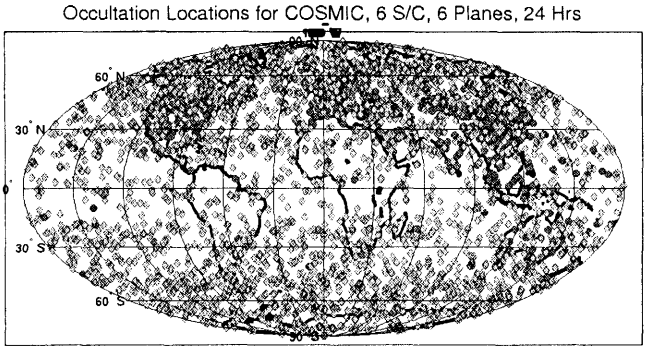


Figure 1. Expected GPS occultation events within 24-hours with COSMIC/FOMOSAT-3 GPS occultation measurements.