Geophysical Research Abstracts
Vol. 17, EGU2015-2337, 2015
EGU General Assembly 2015

Planetary Radio Interferometry and Doppler Experiment (PRIDE) for Planetary Atmospheric Studies

Tatiana Bocanegra Bahamon (1,2,3), Giuseppe Cimo (1), Dmitry Duev (1), Leonid Gurvits (1,2), Guifre Molera Calves (1), and Sergei Pogrebenko (1)

(1) Joint Institute for VLBI in Europe (JIVE) Delft, Netherlands (t.m.bocanegrabahamon@tudelft.nl), (2) Department of Astrodynamics and Space Missions, Delft University of Technology, The Netherlands (t.m.bocanegrabahamon@tudelft.nl), (3) Shanghai Astronomical Observatory, China

The Planetary Radio Interferometry and Doppler Experiment (PRIDE) is a technique that allows the determination of the radial velocity and lateral coordinates of planetary spacecraft with very high accuracy (Duev, 2012). The setup of the experiment consists of several ground stations from the European VLBI Network (EVN) located around the globe, which simultaneously perform Doppler tracking of a spacecraft carrier radio signal, and are subsequently processed in a VLBI-style in phase referencing mode. Because of the accurate examination of the changes in phase and amplitude of the radio signal propagating from the spacecraft to the multiple stations on Earth, the PRIDE technique can be used for several fields of planetary research, among which planetary atmospheric studies, gravimetry and ultra-precise celestial mechanics of planetary systems.

In the study at hand the application of this technique for planetary atmospheric investigations is demonstrated. As a test case, radio occultation experiments were conducted with PRIDE having as target ESA's Venus Express, during different observing sessions with multiple ground stations in April 2012 and March 2014. Once each of the stations conducts the observation, the raw data is delivered to the correlation center at the Joint Institute for VLBI in Europe (JIVE) located in the Netherlands. The signals are processed with a high spectral resolution and phase detection software package from which Doppler observables of each station are derived. Subsequently the Doppler corrected signals are correlated to derive the VLBI observables. These two sets of observables are used for precise orbit determination. The reconstructed orbit along with the Doppler observables are used as input for the radio occultation processing software, which consists of mainly two modules, the geometrical optics module and the ray tracing inversion module, from which vertical density profiles, and subsequently, temperature and pressure profiles of Venus' atmosphere were derived.

The demonstration of the capability of PRIDE as a radio science instrument for planetary atmospheric studies is developed in the framework of the upcoming ESA's JUICE mission to study Jupiter's system.