Geophysical Research Abstracts
Vol. 13, EGU2011-12000, 2011
EGU General Assembly 2011


# Direct density measurements in Venus' atmosphere by combined drag and torque techniques

Håkan Svedhem (1), Michael Müller (2), Ingo Müller-Wodarg (3), Pascal Rosenblatt (4), and Sean Bruinsma (5)

(1) ESA/ESTEC, Research and Scientific Support Dep., Noordwijk, Netherlands (hsvedhem@rssd.esa.int), (2) ESA/ESOC, Darmstadt, Germany, (3) Imperial College, London, UK, (4) Royal Observatory of Belgium, Uccle, Belgium, (5) CNES/GRGS, Toulouse, France

Information on the atmospheric density in the altitude range 150-200 km in the atmosphere of Venus is difficult to gather remotely. The Pioneer Venus Orbiter Neutral Mass Spectrometer measured gas densities in the equatorial upper atmosphere in-situ, but no such measurements have ever been made in the polar regions of Venus. The Venus Express spacecraft on its orbit approaches the planet in the northern polar region, but is not equipped with a mass spectrometer instrument for in-situ gas density measurements. By reducing the pericentre altitude the total mass density can however be measured in situ by monitoring the orbital decay caused by the drag on the spacecraft by the atmosphere via direct tracking of the Doppler signal on the telecommunication link. Such measurements have been performed with Venus Express several times during the last year as part of the Venus Express Atmospheric Drag Experiment (VExADE). The results indicate a large variability within only a few days and have led to questions if these variations are real or within the uncertainty of the measurements.
A completely different and independent measurement is given by monitoring the torque asserted by the atmosphere on the spacecraft. This is done by monitoring the momentum accumulated in the reaction wheels during the pericentre pass and at the same time considering all other perturbing forces. This requires the spacecraft to fly in an asymmetric attitude with respect to the centre of gravity, centre of drag and the velocity vector. This technique has proven very sensitive, in particular if the asymmetry is large, and offers an additional method of measuring atmospheric densities in-situ that previously had not been explored with the Venus Express spacecraft. Similar measurements have been done in the past by Magellan at Venus and by Cassini at Titan. During 2009 and 2010 a few campaigns, with altitudes going as low as 165 km, were held. The highest density measured was 7.7 10-12kg/m3 which is significantly less than earlier models predict. The results largely confirm the density measurements by the VExADE drag measurements and added to the confidence in the results from these measurements. Additional combined measurements, where the asymmetry is increased by rotating the solar panels, are planned for 2011. Results and future measurements will be presented at the meeting.