Geophysical Research Abstracts
Vol. 13, EGU2011-10658, 2011
EGU General Assembly 2011

The Influence of Gravity on the Evolution of the Kelvin-Helmholtz Instability around Venus

Michael Zellinger (1,2), Ute Möstl (1), Nikolai Erkaev (3), Helfried Biernat (1,2)

(1) Space Research Institute, Graz, Austria (michael.zellinger@edu.uni-graz.at), (2) Institute of Physics, University of Graz, Graz, Austria, (3) Institute of Computational Modelling, Russian Academy of Sciences, Krasnoyarsk, Russia

The solar wind flow around the ionosphere of unmagnetized planets induces various processes at the boundary layer between the solar wind and the ionospheric plasma. In principal, such a flow configuration is thought to be unstable with regard to the Kelvin-Helmholtz instability.
Observations of Pioneer Venus Orbiter (PVO) gave rise to the idea that this instability might lead to the formation of so-called plasma clouds, which consist of ionospheric particles and thus could contribute to the planetary loss. Recently, the magnetometer of Venus Express (VEX) observed vortices in the magnetic field, giving again rise to the question of the origin of such structures.
We present a numerical study of the 2D Kelvin-Helmholtz instability and its vortices, where an initial plasma configuration appropriate for the situation around unmagnetized planets is assumed. We solve the set of ideal MHD equations numerically with the TVD Lax-Friedrichs algorithm. Our density profile is such that the mass density increases toward the lower plasma layer (i.e. the ionosphere). A dense ionosphere leads to smaller growth rates of the instability and thus has a stabilizing effect for the boundary layer. Moreover, we include source terms in the equations, enabling us to study the influence of gravity.
Our results show that gravity affects the evolution of the KH instability. However, the effect is not very significant. We thus conclude that the density increase towards the planet stabilizes the boundary layer around Venus more than gravity.