Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05489, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05489
EGU General Assembly 2008

A slow mode transition region adjoining the front boundary of a magnetic cloud as a relic of a convected solar wind feature: observations and MHD simulations

C. J. Farrugia (1), N. V. Erkaev (2, 3), U. Taubenschuss (4), V. A. Shaidurov (2), C. W. Smith (1), H. K. Biernat (4, 5)

(1) Space Science Center, University of New Hamphsire, Durham, NH 03824, USA, (2) Institute of Computational Modeling of Russian Academy of Sciences, Krasnoyarsk, Russia, (3) Siberian Federal University, Krasnoyarsk, Russia, (4) Space Research Institute, Austrian Academy of Sciences, Graz, Austria, (5) Institute of Geophysics, Astrophysics, and Meteorology, University of Graz, Austria.

We identify a planar, pressure-balanced structure bounded by sharp changes in the dynamic pressure plastered against the front boundary of the magnetic cloud which passed Earth on November 20, 2003. The front boundary of the magnetic cloud (MC) is particularly well-defined in this case, being located where the He^{++}/H^{+} number density ratio jumps from 4 to 10 $\%$ for the first time and the proton plasma beta decreases sharply from $\sim$1 to $\sim$0.001. The feature, estimated to have a length scale $\sim$50 R_E in the Sun-Earth direction, bears close resemblance to a slow mode transition region in that the magnetic pressure decreases, the plasma pressure increases, and their temporal variations are anti-correlated. Using a 2-D MHD simulation we hypothesize that an entropy wave-like feature was encountered by the MC en route to Earth. Our calculations reproduce qualitatively the major features of the observations. Using a simplified geometry suggested by the observations, we find that the lateral deflection speed of the plasma is less than the lateral expansion speed of the MC. We infer that the structure traversed the MC-sheath in $\sim$20 hr, consistent with its crossing of the MC's shock at 0.6 – 0.7 AU. The finding is consistent with the recent paradigm according to which solar wind plasma and magnetic field tend to pile up in front of interplanetary ejecta because the radial expansion of the ejecta hinders the shocked solar

wind plasma from deflecting effectively around the object. Also, the inferred “age” of the layer contiguous to the surface of the MC, the earliest relic of its passage through the inner heliosphere, is in agreement with general estimates.