Small-scale deformation of the bow shock

K. Jelínek, Z. Němeček and J. Šafránková

Charles University, Faculty of Mathematics and Physics, Prague, Czech Republic
(jana.safrankova@mff.cuni.cz)

The prediction of the bow shock location is a proof of our understanding of the processes governing the solar wind – magnetosphere interaction. However, the models describing the bow shock location as a function of upstream parameters are based on a statistical processing of bow shock crossings observed by a single spacecraft. Such crossings locate the bow shock in motion, i.e., in non-equilibrium state and this fact can be a source of significant errors. We have identified about 200 bow shock crossings observed by a closely (< 1 R_E) spaced INTERBALL-1 and MAGION-4 spacecraft and divided them into two groups. The crossings in the first group were observed by one spacecraft only and the bow shock spent a long time between them. In such cases, the bow shock location is known with an error determined by the spacecraft separation along the bow shock normal and this location can be directly compared with the model. The crossings in the second group were observed by both spacecraft. We have estimated the bow shock speed and used it as a measure of a deviation of the observed bow shock location from the equilibrium position. The results of our analysis are compared with predictions of bow shock models. We have carefully analyzed all these crossings with motivation to find the source and way of the bow shock motion. Our results suggest that often a small-scale deformation of the bow shock front is the most appropriate interpretation of observations.