Low-frequency magnetic field fluctuations in Venus' solar wind interaction region: Venus Express observations

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We present wave properties of low-frequency magnetic field fluctuations in Venus' solar wind interaction region based on the measurements made on board the Venus Express spacecraft. The orbit geometry is very suitable to investigate the fluctuations in Venus' low-altitude magnetosheath and mid-magnetotail and provides an opportunity for a comparative study of low-frequency waves at Venus and Mars. The spatial distributions of the wave properties, in particular in the dayside and nightside magnetosheath as well as in the tail and mantle region, are similar to observations at Mars. As both planets do not have a global magnetic field, the interaction process of the solar wind with both planets is similar and leads to similar instabilities and wave structures.

We focus on the spatial distribution of the wave intensity of the fluctuating magnetic field and detect an enhancement of the intensity in the dayside magnetosheath and a strong decrease towards the terminator. For a detailed investigation of the intensity distribution we adopt an analytical streamline model to describe the plasma flow around Venus. This allows displaying the evolution of the intensity along different streamlines. It is assumed that the waves are generated in the vicinity of the bow shock and are convected downstream with the turbulent magnetosheath flow. The concept of freely evolving or decaying turbulence is in good qualitative agreement with the observations, as we observe a power law decay of the intensity along the streamlines. The observations support the assumption of wave convection through the magnetosheath, but reveal at the same time that wave sources may not only exist at the bow shock, but also in the magnetosheath.