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The adiabaticity along the MESSENGER orbit

The paper "Plasma pressure in Mercury's equatorial magnetosphere derived from MESSENGER observations" provides an initial explanation for the plasma pressure distribution in the nightside equatorial region. For simplicity, adiabatic particle transport is assumed. The purpose of this supporting document is to test the validity of the approach by computing the adiabaticity at the locations where the observations were made. In specific, we computed the adiabaticity parameter $\kappa = \sqrt{R_{\min}/\rho_{\max}}$, where $R_{\min}$ is the minimum curvature radius of the magnetic field line and $\rho_{\max}$ is the maximum proton Larmor radius [*Büchner and Zelenyi*, 1989]. The regime of adiabatic transport is given by $\kappa > 3$ [*Delcourt and Martin*, 1994]. We computed the adiabaticity numerically with the magnetospheric magnetic field model referenced in the paper [*Alexeev et al.*, 2010; *Anderson et al.*, 2011] and show the parameter κ in Fig. S1 color-coded as function of magnetic local time and latitude. In the nightside equatorial region sampled by MESSENGER, the calculations yield $2<\kappa<4$. This is near the limit of validity for the guiding-center-drift assumption, but should allow a first investigation of the MESSENGER observations. However, the result also indicates that non-adiabatic features may be important and should be considered in the future.

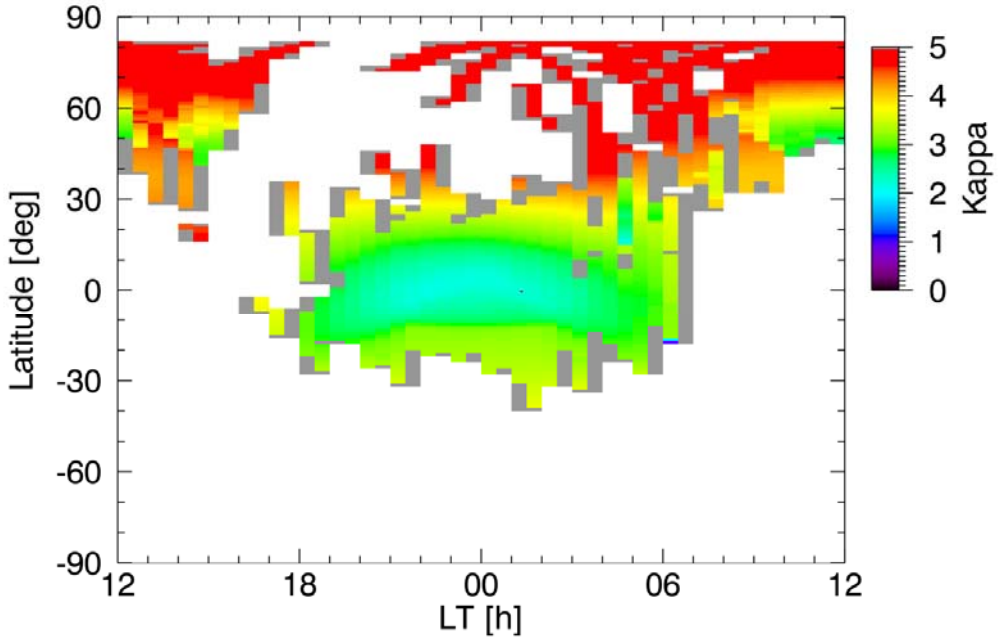

Fig.S1: The adiabaticity parameter κ along the MESSENGER orbit as function of magnetic local time and latitude.

References

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