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Kelvin-Helmholtz vortex identification: A survey on Cluster using the magnetopause transition parameter

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Observations of low density faster than sheath (LDFTS) population at the flank magnetopause are thought to be associated with mixed-up plasma within the Kelvin-Helmholtz vortices. The technique has been previously employed to identify vortices with single-spacecraft such as Geotail observations and Double Star TC-1 spacecraft. However, the abundance of the events identified by LDFTS technique at the dayside magnetopause, and their spatial distribution are not fully in agreement with some simulation which suggest that the dawn flank is a better candidate for KHI vortices. Accordingly, there have been postulations as to whether a thinner magnetopause at the dusk flank, and or velocity patterns in the presence of a plasma depletion layer (PDL), might be responsible for observation of LDFTS where a rolled-up vortex might not be expected. We present a survey of Cluster observations to tackle the understanding of the KHI vortex identification criteria, where two questions are taken into account: 1) Whether the plasma is observed in the boundary layer, and 2) Whether the flow velocity is driven by the KHI only. We utilise the magnetopause transition parameter, to eliminate the arbitrary choice of density, time interval of the observations, and possible presence of the PDL from the LDFTS method. We find that our modified method identifies a more realistic percentage of faster-than-sheath population as candidates for rolled-up vortices. The survey results also show a dawn-dusk asymmetry, with the dawn flank being more favourable for the development of KHI.