On the generation of turbulence observed in the flank of Earth's magnetosphere

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Turbulence is ubiquitous in boundary layers of the Earth's flank magnetosphere, in association with large-scale eddies generated by the magnetopause Kelvin-Helmholtz instability (KHI) or electromagnetic fluctuations of spatiotemporal scales comparable to or smaller than proton cyclotron period/radius. Turbulence in this region is suggested to play a key role in transport of solar wind plasma into the magnetosphere especially under northward interplanetary magnetic field conditions. However, little is known about how smaller-scale electromagnetic turbulence is generated and whether the turbulence is responsible for the plasma transport or it is in fact a consequence of the mechanism causing the plasma transport. The Magnetospheric Multiscale (MMS) mission, four identical spacecraft launched in March 2015 and flying in formation, has been making plasma and electromagnetic field measurements at very high spatiotemporal resolutions in/around the dayside to flank magnetopause where the KHI or magnetic reconnection as a driver of turbulence can occur. In this study, we analyze and compare an MMS event on 8 September 2015 when KHI vortices were observed along the dusk-flank magnetopause and another event on 8 November 2015 when no KHI but magnetopause reconnection signatures were observed closer to the subsolar point. We reveal properties of turbulence induced by the KHI and discuss the role of the KHI in the generation of electromagnetic turbulence.

Keywords: turbulence, magnetopause, Kelvin-Helmholtz instability, magnetic reconnection

