Geophysical Research Abstracts
Vol. 20, EGU2018-2545, 2018
EGU General Assembly 2018

Forces acting on the bursty bulk flow plasma

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The fate of bursty bulk flows (BBFs) as they reach the inner magnetosphere is unclear. To understand the BBF dynamics in the inner tail, we need to know what forces act on the BBF plasma. The relation between the magnetic and thermal plasma pressure gradient forces determines if that plasma is accelerated or braked. Recently Cluster multi-point measurements were used to determine the magnetic force on the BBF plasma. It was shown that the magnetic tension force was consistently directed towards Earth, whereas the magnetic pressure gradient force increased in magnitude closer in to Earth, and was all the time directed tailwards. This resulted in a net acceleration for X_GSE < -14 R_E, while the magnetic force braked the plasma closer to Earth. With the high-quality MMS particle data it is possible to also determine the local plasma pressure gradient, and add an important piece of the puzzle. We will present an example of the full fluid force (both pressure gradient and magnetic force) on a BBF event in the inner magnetosphere. It is shown that the local pressure gradient at the front of the BBF flow channel is directed oppositely to the magnetic force, and is greater than it, therefore braking the BBF plasma. This indicates that local pressure enhancements associated with the BBF flow may be important in determining the fate of BBFs in the inner magnetosphere.