Modification of the magnetosheath due to the high-speed jets propagation.

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Plasmoids, defined as plasma entities with a higher anti-sunward velocity component than the surrounding plasma, have been observed in the magnetosheath in recent years. Among other denominations, plasmoids are also called “magnetosheath jets” and can be classified by transient localized enhancements in dynamic pressure. Propagating through the magnetosheath, jets do not only affect the magnetopause and magnetosphere. Jets pushed slower ambient magnetosheath plasma out of their way. As a result, plasma moves around the jets, and it is slowed down or could even be pushed in the sunward direction. Consequently, jets may create anomalous flows and be a source of additional turbulence. Using the magnetosheath measurements by the Magnetospheric Multiscale (MMS) and THEMIS spacecraft, and comparing several criteria, we have identified several thousand events in the wide range of bow shock distances. Previous statistical studies have shown that jet occurrence is almost exclusively controlled by the angle between the IMF and the Earth–Sun line (cone angle), and jets are predominantly observed when this cone angle is small. However, high-speed jets downstream of the quasi-perpendicular bow shock are very common. Our statistical analysis shows differences of jets evolution in the quasi-parallel and quasi-perpendicular magnetosheath regions. We discuss their properties, nature and relation to anomalies regions in the magnetosheath.