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Analysis of a fast flow series associated with a substorm event detected by MMS

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In July 2017, the MMS constellation was evolving in the magnetotail with an apogee of 25 Earth radii and an average inter-satellite distance of 10 km (i.e. at electron scales). On 23rd of July around 16:19 UT, MMS was located at the edge of the current sheet which was in a quasi-static state. Then, MMS suddenly entered in the central plasma sheet and detected the local onset of a small substorm as indicated by the AE index (~ 400 nT). Fast earthward plasma flows were measured during about 1 hour starting with a period of quasi-steady flow and followed by a saw-tooth like series of plasma jets. This plasma transport sequence ended up by a flow reversal still occurring close to the magnetic equator. Thanks to the unprecedented MMS measurement capability, these different phases are analyzed in terms of wave activity, current signatures, particle acceleration and heating. The origin of these two phases of plasma transport is discussed.