Three-dimensional PIC simulations of the terrestrial magnetosphere: impact of the IMF rotation

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The dynamics of the magnetosphere is analyzed with the help of three dimensional self- consistent global particle-in-cell (PIC) simulations, as the solar wind is in a low Mach number regime. The purpose of this study is to focuss on the deep changes which take place within the magnetosphere as the interplanetary magnetic field (IMF) progressively rotates from northward to southward direction. Two successive temporal phases can be identified as the IMF rotates respectively (a) from North to Dawn dusk(DD), and (b) from Dawn-Dusk to South, where quite different changes are observed in the inner magnetic field configuration within meridian/equatorial planes with a certain time delay. These changes are analyzed in detail and can be used as temporal and local indexes for identifying different "signatures" of events which can be posssibly related with substorm signatures (in such low solar wind flow conditions). Expected signatures such as (i) magnetic pile up, (ii) current disruption (in the nearby tail region), (iii) a drastic transition dipolar-tail B field in the nearby-tail, (iv) formation of X-point reconnection region both in nearby tail and at the subsolar point are evidenced. Present results show that main changes take place successively and mainly during the second half of the IMF rotation (DD to South). Consequences in the internal electron/ion current flows are also analyzed in association with the changes of the inner magnetic field.