RECENT RESULTS ON THE BURSTY BULK FLOWS AND THEIR OPTICAL SIGNATURES

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As known the bursty flows provide a major contribution to the Earthward convection in the high-beta plasma sheet region of the magnetotail, many studies have been recently done to address their origin and characteristics. Based on more physical definition of the BBF, statistical results show that the BBFs occurrence frequency is more uniformly distributed between 40-50 Re and transition region between current sheet and dipole, penetration of some BBFs down to 6.6 Re has been directly observed. In many studies the BBFs are now confirmed to be the plasma bubbles, the underpopulated plasma tubes with a smaller plasma tube invariant pV^{γ}.
Ground signatures of isolated BBFs have been carefully searched by many authors. Optical signatures have been positively identified but were shown to be of various kind, including the auroral streamers as well as pseudobreakups and other kinds of localised activations. Auroral streamers are of major importance providing the information on the BBF lifetime and dynamics. A systematic longitudinal displacement between the ionospheric footpoints of plasma sheet spacecraft and the BBF optical signature was observed indicating that optical signatures are not due to direct precipitation of particles from the BBF proper, but are associated with BBF westward flank only. They are probably formed by field-aligned electron acceleration in the streamer-associated upward FAC region. A limited confirmation now exists that streamer-associated 3D current system is of the same sense as SCW-associated or zone 1 type field-aligned current systems. Many different methods show the characteristic scale of the BBF to be about 0.5-1 h MLT wide in the ionosphere and about 2-4 Re in the plasma sheet. A picture of BBFs emerging from these results corresponds to the powerful (up to tens kV in one jet) sporadic narrow plasma jets propagating in the tail as plasma bubbles which are probably born in the impulsive reconnection process. Little definitive theory still exists concerning the formation of BBFs, their propagation and stopping in the near tail, but we now know for sure that the BBFs could penetrate to the Earth as close as to 6.6 Re and transport in that way a considerable amount of the magnetic flux and material to the near tail.