Ionospheric flow fluctuations at mid-latitudes during storms as seen by SuperDARN-Van Allen Probes-Arase conjunctions

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The recent Super Dual Auroral Radar Network (SuperDARN) observations show that ionospheric flow fluctuations of the mHz or lower frequency range appear even in the subauroral to mid-latitude region during magnetic storm times. An interesting feature of the flow fluctuations is that they appear to propagate azimuthally either westward or eastward, and occasionally bifurcate toward the both directions. Taking a closer look with high spatial resolution measurements provided by the radars reveals that those flow fluctuations consist of meso-scale patchy structures of ionospheric convection with a significant latitudinal flow component and a longitudinal scale of ˜1h MLT. The azimuthal propagation properties strongly suggest that westward-drifting ions and eastward-drifting electrons of tens of keV in the inner magnetosphere can be the moving sources responsible for excitation of MHD waves seen by the radars at the ionospheric footprint. However, only few observations in the magnetosphere have been reported on the source of the waves at the subauroral to mid-latitudes. Recent observations in the inner magnetosphere by the Arase satellite and the Van Allen Probes have provided a good opportunity to examine their magnetospheric counterpart in further detail. On the basis of in-situ measurement of ring current particles and the magnetic field in the inner magnetosphere, we discuss the generation mechanism of the observed flux tube fluctuations in terms of resonant or non-resonant processes.