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Correlation analysis of field-aligned currents measured by Swarm

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The orientation of field-aligned current sheets (FACs) can be inferred from dual-spacecraft correlations of the FAC signatures between two Swarm spacecraft (A and C), using the maximum correlations obtained from sliding data segments. Statistical analysis of both the correlations and the inferred orientations shows clear trends in magnetic local time (MLT) which reveal behaviour of both large and small scale currents. The maximum correlation coefficients show distinct behaviour in terms of either the time shift, or the shift in longitude between Swarm A and C for various filtering levels. The low-latitude FACs show the strongest correlations for a broad range of MLT centred on dawn and dusk, with a higher correlation coefficient on the dusk-side and lower correlations near noon and midnight. The current sheet orientations are shown to broadly follow the mean shape of the auroral boundary for the lower latitudes corresponding to Region 2 FACs and that these are most well-ordered on the dusk side. Together with these correlation trends, individual events have also been sampled by higher altitude spacecraft in conjunction with Swarm (mapping both to region 1 and 2), showing that two different domains of FACs are apparent: small-scale (some tens of km) which are time variable and large-scale (>100 km) which are rather stationary. We investigate further how these FAC regimes are dependent on geomagnetic activity, focusing on high activity events. The trends found here for different activities are compared to effects seen in the ground magnetometer signals (dH/dt).