Magnetically conjugate Auroral Westward Flow Channels (AWFCs) observed by SuperDARN

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Abstract. Auroral westward flow channels (AWFC) are intense, narrow channels of westward drift overlapping the equatorward edge of the auroral oval in the magnetic pre-midnight sector. They are a close relative of the sub-auroral polarisation stream which encompasses polarisation jets, a phenomenon also known as sub-auroral ion drift events. In terms of electric field strength, AWFCs are the strongest manifestation of substorms in the ionosphere. To first order, geomagnetic flux tubes are usually thought to be equi-potentials. Thus we might expect AWFCs will have similar characteristics in magnetically conjugate locations in the Northern and Southern Hemispheres. Here we present magnetically conjugate SuperDARN radar observations of AWFC activity observed during two substorm intervals including multiple onsets during the evening of 30 November 2002. The Northern Hemisphere observations were made with the Japanese radar located at King Salmon, Alaska (57°Λ), and the Southern Hemisphere observations with the Tasman International Geospace Environment Radar (TIGER) located at Bruny Island, Tasmania (–55°Λ). LANL geosynchronous satellite observations of energetic ion and electron fluxes monitored the effects of substorms in the inner magnetosphere (L~6). The radar-observed AWFC activity was coincident with activity observed at geosynchronous orbit, as well as westward current surges in the ionosphere observed by a magnetometer located nearby at Macquarie Island (–65°Λ). Images of the FUV aurora recorded on board the IMAGE spacecraft confirmed the AWFCs overlapped the equatorward edge of the auroral oval. Systematic differences in the characteristics of the two AWFCs probably arose because the magnetic flux tubes were distorted at L shells passing close to the substorm dipolarisation region. Transient differences were attributed to nearby regions of enhanced Pedersen conductivity caused by energetic particle precipitation, and the concomitant development of field-aligned currents and potential drops (Weimer et al., 1985).

Weimer, D. R., Goertz, C. K., Gurnett, D. A., Maynard, N. C., and Burch, J. L.: Auroral zone electric fields from DE 1 and 2 at magnetic conjunctions, *J. Geophys. Res.*, **90**, 7479–7494, 1985.