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Non-conjugate aurora and inter hemispheric currents

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We look at large scale auroral features using global imagers to obtain simultaneous pictures of both the southern and northern auroral ovals in the ultra violet part of the spectra. During the years 2001 and 2002 the IMAGE satellite was in a favourable position for imaging the aurora borealis (Northern Hemisphere) and the POLAR satellite with its large field-of-view VIS Earth camera had a sporadic coverage of the aurora australis (Southern Hemisphere). In total 19 hours of simultaneous global imaging from different seasons are analysed searching for non-conjugacy in the night side sector. By non-conjugate aurora we mean auroral features appearing in one hemisphere only, or significant differences in intensity between the hemispheres for the same auroral feature. We suggest that our observed large scale asymmetries can be explained in terms of inter hemispheric currents (IHC). Coherent with our earlier findings, we list three possible candidates for producing such inter hemispheric currents based on observations. 1) Hemispherical differences in the solar wind dynamo due to IMF B_x and tilt angle producing different strength of region 1 currents in the conjugate he mispheres, 2) Hemispherical differences in conductivity controlled by the tilt angle only giving rise to IHC on closed field lines, and 3) Field-aligned current components induced by the penetration of the IMF B_y into the closed magnetosphere. Most of the observed non-conjugate aurora in our dataset can be explained by these candidates only. The IMF B_y penetration candidate is considered closer. We search for evidence in our data that IMF $B_y < 0$ ($B_y > 0$) can induce an IHC producing stronger aurora on the polar boundary in the Northern (Southern) Hemisphere. Also a second IHC component are predicted from the theory, mapping to the equatorward part of the oval and opposite directed along the magnetic field lines. Using a much larger dataset for one hemisphere only, we show whether these predicted currents can be identified from global images. As far as we know, these currents have only been predicted but never observed earlier.