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A superposed epoch analysis of geomagnetic storms

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Abstract. A superposed epoch analysis of geomagnetic storms has been undertaken. The storms are categorised via their intensity (as defined by the *Dst* index). Storms have also been classified here as either storm sudden commencements (SSCs) or storm gradual commencements (SGCs, that is all storms which did not begin with a sudden commencement). The prevailing solar wind conditions defined by the parameters solar wind speed (v_{sw}), density (<rho>$_{sw}$) and pressure (P_{sw}) and the total field and the components of the interplanetary magnetic field (IMF) during the storms in each category have been investigated by a superposed epoch analysis. The southward component of the IMF, appears to be the controlling parameter for the generation of small SGCs (-100 nT< minimum *Dst*\leq-50 nT for\geq4 h), but for SSCs of the same intensity solar wind pressure is dominant. However, for large SSCs (minimum *Dst*\leq-100 nT for \geq4 h) the solar wind speed is the controlling parameter. It is also demonstrated that for larger storms magnetic activity is not solely driven by the accumulation of substorm activity, but substantial energy is directly input via the dayside. Furthermore, there is evidence that SSCs are caused by the passage of a coronal mass ejection, whereas SGCs result from the passage of a high speed/ slow speed coronal stream interface. Storms are also grouped by the sign of B_z during the first hour epoch after the onset. The sign of B_z at t=+1 h is the dominant sign of the B_z for \sim24 h before the onset. The total energy released during storms for which B_z was initially positive is, however, of the same order as for storms where B_z was initially negative.

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