



Solar wind control of the local time of substorm onset

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We use solar wind and interplanetary magnetic field data, along with satellite global auroral imagery, to investigate what controls the magnetic local time (MLT) of substorm onset. We find that substorm onsets occur over a wide range of MLTs (18 – 4 hrs), with a typical MLT (mode) of 23 hrs. In agreement with previous studies, IMF B_Y , acts to move the onset to an earlier/later local time in the northern hemisphere and a later/earlier local time in the southern hemisphere, depending on the sign of B_Y , consistent with a twist of the conjugate magnetic field line. This effect explains a small fraction of the observed MLT variation (~ 1 hr), but cannot account for the tendency of onset to be often displaced to earlier (< 23 hrs) or later (> 23 hrs) MLTs in both hemispheres. We also inspect the relationship between solar wind V_Y and onset MLT, which also has a small, but measurable effect on the local time of substorm onset. This effect acts in the same sense in the northern and southern hemispheres, moving onset to earlier times for positive V_Y and later times for negative V_Y . We find that a function relating both B_Y and V_Y to onset MLT produces a better fit than a function based on either parameter alone.