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Analysis of Properties of Small Transients in the Solar Wind 2007-2009: Wind Observations

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During the solar activity minimum 2007-2009 very few large transients (interplanetary coronal mass ejections, ICMEs) were observed. However, an interesting feature was the frequent occurrence of small transients (few hours' duration), as shown, for example over a two-month interval by Kilpua et al. (2009). In this work we present a comprehensive statistical analysis of small transients over the entire three-year period. Identification crieria are : (i) duration between 0.5 and 12 hours; (ii) low proton temperature; (iii) low proton beta; (iv)
enhanced magnetic field strength; (v) diminished magnetic field variability; (vi) low Alfven Mach number; and (vii) higher-than-average over the three years of the electron-to-proton temperature ratio. In selecting events, we require small transients to satisfy criteria (i)-(iii) and, in addition, they should satisfy at least two of the other four signatures. We compare their properties with those of the solar wind during the same three-year period, and are thus able to isolate a number of features characterizing these small transients during
this solar activity minimum period. We search for small transients using observations acquired by the Wind spacecraft. After removing those which are likely to be Alfvenic strctures, we
find 131 examples, about 81 percent of which lie in the slow solar wind (< 450 km/s). We present six case studies to illustrate various interesting aspects of these configurations. We then give statistical results on the whole assembly. The average duration is about 4.3
hours, while 99 events (76 pervent) are shorter than 6 hours. The maximum magnetic field is about twice that of the average solar wind value, the proton beta is about four times smaller
than ambient, and the Alfven Mach number is about one half of the average value.