



Favorable upstream solar wind conditions for hot flow anomalies

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Hot flow anomalies (HFAs) were studied for decades. They can be classified into two groups according to the forming mechanisms. Typical HFAs are created by the interaction of a solar wind tangential discontinuity with the bow shock. The other group, called spontaneous HFAs (sHFAs), exhibits similar changes of plasma parameters but it is not associated with a clear IMF discontinuity. These sHFAs are formed by the interaction of reflected particles with the incoming solar wind in the foreshock region. In this study, we use a list of HFAs from Chu et al. [2017] with motivation to identify similarities and differences in their formation. The list contains 136 HFA events recorded by THEMIS-C during 2007–2009, and for which upstream solar wind conditions were monitored by ACE and Wind. The upstream conditions do not show any obvious difference between typical HFAs and sHFAs. It implies that both two types of HFAs are formed by the same processes, no matter the HFA is related with a discontinuity or not. Both HFA types usually occur under a specific IMF orientation at their upstream regions. The HFAs are more frequently observed when the IMF points to the Sun. This feature shows that HFAs may form by the right-hand polarized resonant ion beam instabilities, but other potential candidates are also discussed in this study.