



Alfvénic solar wind powers substorms

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Alfvénic solar wind fluctuations (ALFs) are known to modulate geomagnetic activity. We have examined high-latitude geomagnetic activity over the solar cycle 23 and found out that increase of solar wind Alfvénicity enhance both auroral substorm intensity and substorm frequency. Alfvénic solar wind fluctuations are found throughout the solar cycle, but they are fastest, most frequent and geo-effective in the declining phase of the cycle, when the number of high-speed streams at the Earth's vicinity increases rapidly. We find a rapid transition from the predominance of slow (< 400 km/s) ALFs in 2002 to fast (> 600 km/s) ALFs in 2003, in coincidence with the rapid increase of substorm activity from late 2002 to early 2003. The Alfvénicity of solar wind increased by 40% from 2002 to 2003. After the transition the fast ALFs occur twice per solar rotation while in previous year only four fast ALF intervals were detected. Increase of solar wind Alfvénicity by 40% from 2002 to 2003, and transition from slow to fast Alfvén fluctuations coincide with the increase of auroral substorm intensity by 28% and substorm frequency by 43%.