



## **Occurrence, solar cycle evolution and effects of Alfvénic fluctuations**

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We examine solar wind intervals with Alfvénic fluctuations in 1995-2011. The annual number, the total annual duration and the average length of ALFs vary over the solar cycle, having a maximum in 2003 and a minimum in 2009. ALFs are most frequent in the declining phase of solar cycle, when the number of high-speed streams at the Earth's vicinity is increased. We found a rapid transition after the maximum of solar cycle 23 from ALFs being mainly embedded in slow wind until 2002 to ALFs being dominantly in fast wind since 2003. Cross helicity of the solar wind increased by 30% from 2002 to 2003, and maximized typically 4-6 hours before solar wind speed maximum. The number of substorms increased by about 40% from 2002 to 2003, and the annual number of substorms closely follows the annual cross helicity. This emphasizes the role of Alfvénic fluctuations in modulating substorm activity. The predictability of substorm frequency and size would be greatly improved by monitoring solar wind Alfvénic fluctuations in addition to the mean values of the solar wind magnetic field, velocity or particle density.