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Testing the role of magnetic clouds for solar open flux transport on the Sun

Benoit Lavraud (1), Mathew Owens (2), and Alexis Rouillard (3)

(1) CESR/CNRS/Université de Toulouse, Toulouse, France (lavraud@cesr.fr), (2) Imperial College, London, UK, (3) NRL, Maryland, USA

We investigate a means to determine the direction of solar open flux transport that results from the opening of magnetic clouds (MCs) by interchange reconnection at the Sun. Our method is based on previous knowledge of (1) the locations and magnetic polarities of emerging MC footpoints, (2) the hemispheric dependence of the helicity of MCs, and (3) the occurrence of interchange reconnection at the Sun being signaled by unidirectional suprathermal electrons inside MCs. Combining those observational facts in a statistical analysis of MCs during solar cycle 23 (period 1995-2007), we show that solar open flux transport associated with MCs during the rise phase of the cycle was predominantly equatorward. This suggests that coronal mass ejections play a significant role in the process of solar coronal magnetic field reversal over solar cycles. The expected signatures are, however, not clearly observed during the declining phase. This latter fact points to the need for additional open flux transport modes, at least during the declining phase. These results will be further constrainable when the rise phase of solar cycle 24 occurs.