
Studying the impact of the active region dynamics on the solar wind variability

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Résumé

Active regions on the Sun are known as being the birthplace of powerful energetic events like flares and coronal mass ejections (CMEs). However, active regions are also suspected to influence quasi systematically the solar wind, a continuous stream of charged particles originating from the solar atmosphere. Solar wind properties are fundamental in space weather predictions at Earth, and yet have a high variability that remains to be explained. The slow and dense solar wind is the most variable of all, and is suspected to take its sources nearby active regions. Interchange reconnection, between close and open magnetic field, occupies a central place in that problem because it provides a free way for the plasma and energy initially confined into closed active region loops to be released into the solar wind. The main triggering mechanism is believed to come from magneto-convection at the solar surface essentially, which forces a perpetual reconfiguration of the magnetic topology at larger scale. Another cause could be a change in the local plasma properties such as the plasma beta parameter, as during non-thermal equilibrium (TNE) cycles for instance. TNE cycles arise from an imbalance between plasma heating and radiative cooling in the corona, and exhibit hourly-long periods that could match with some of the periodicities that have been detected farther up in the slow solar wind. To answer this problem we must then have a global approach going from the lower solar atmosphere up to the corona and heliosphere, that necessitates the use of multi-instrument observations (from both space and the ground) combined with state-of-the-art numerical modelling. In this contribution, I will bring together some of the first pieces to this puzzle, by emphasising on preliminary works conducted within the CROSSWIND ANR project and by presenting future perspectives.

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