

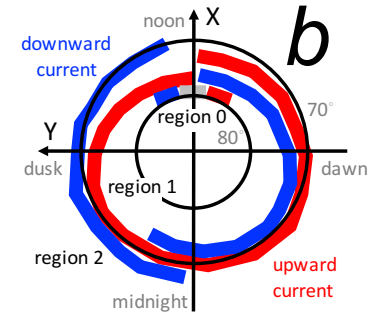
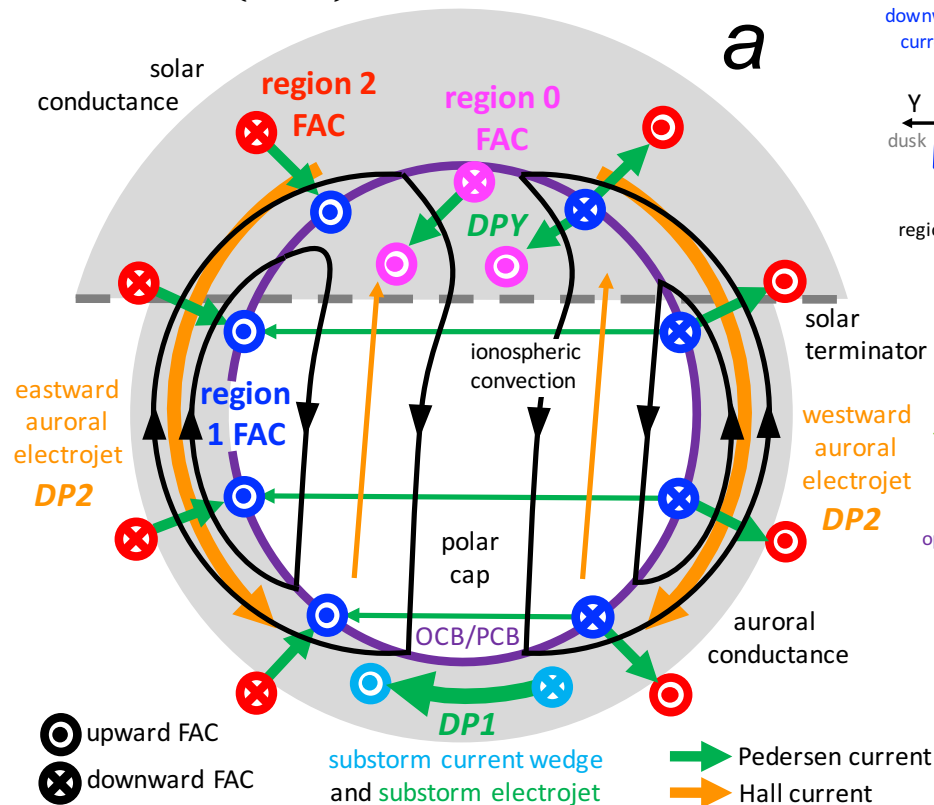
Magnetospheric flux throughput in the Dungey cycle during 2010

We identify the sequence of convection states in the Dungey cycle for the duration of 2010

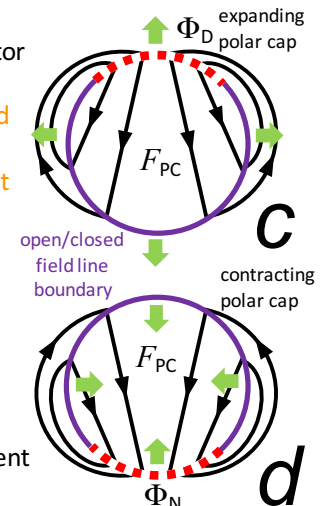
We use AMPERE observations of the R1/R2 field-aligned currents to quantify the polar cap flux and examine this in the context of the expanding/contracting polar cap model

We then use superposed epoch analyses to determine the average sequence of events during isolated substorms and substorms with driven phases – periods of balanced dayside and nightside reconnection – including the influence of dayside driving on the intensity of the substorms and the open flux in the system

Milan et al. (2017)



Iijima and Potemra (1976)



Gowley and Lockwood (1992)

Steve Milan*, Jenny Carter, Harneet Sangha, Gemma Bower

University of Leicester, UK

*also at Birkeland Centre for Space Science, Bergen, Norway

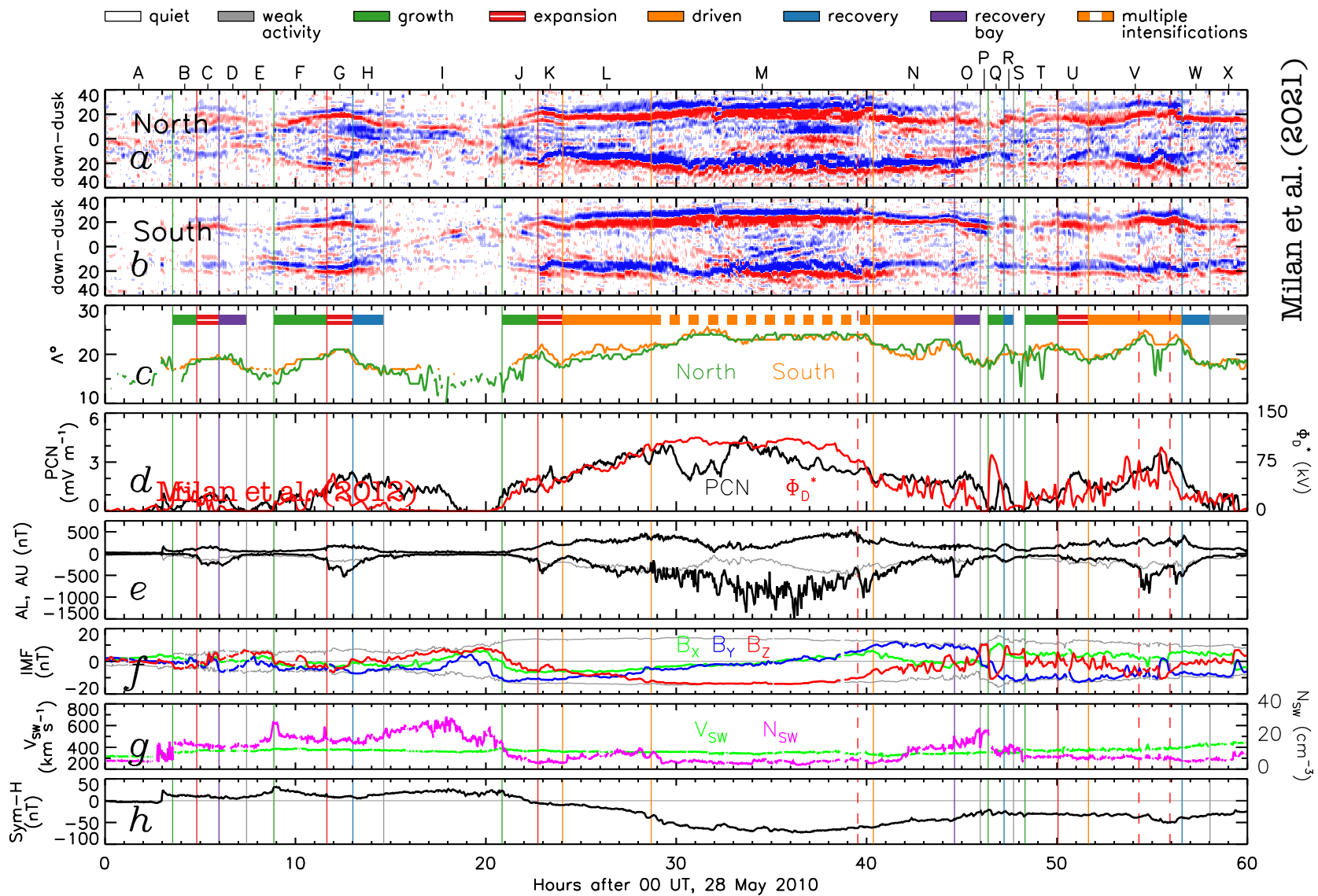
steve.milan@le.ac.uk

Brian Anderson

Johns Hopkins University Applied Physics Laboratory, USA

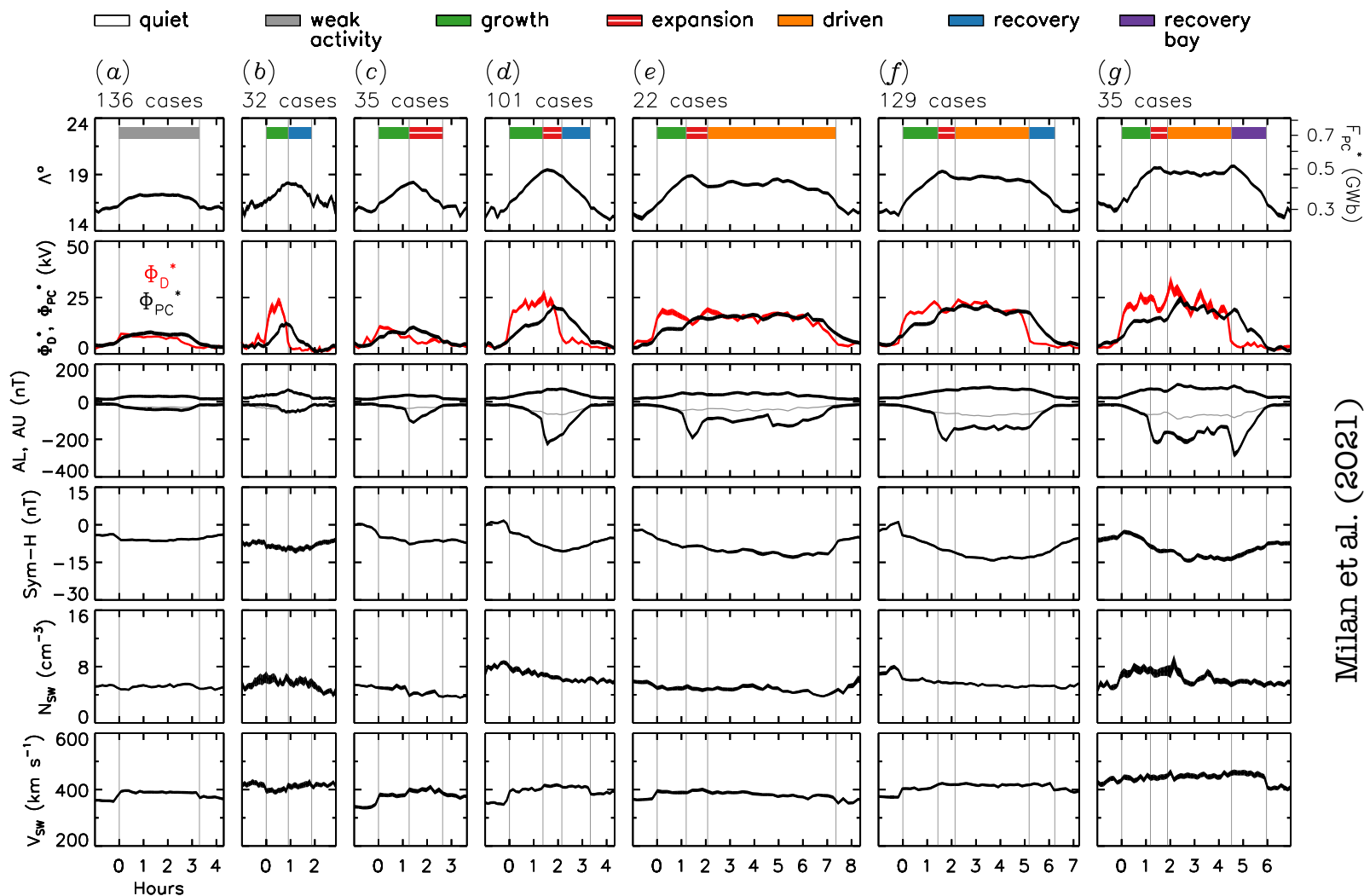


Convection state definitions



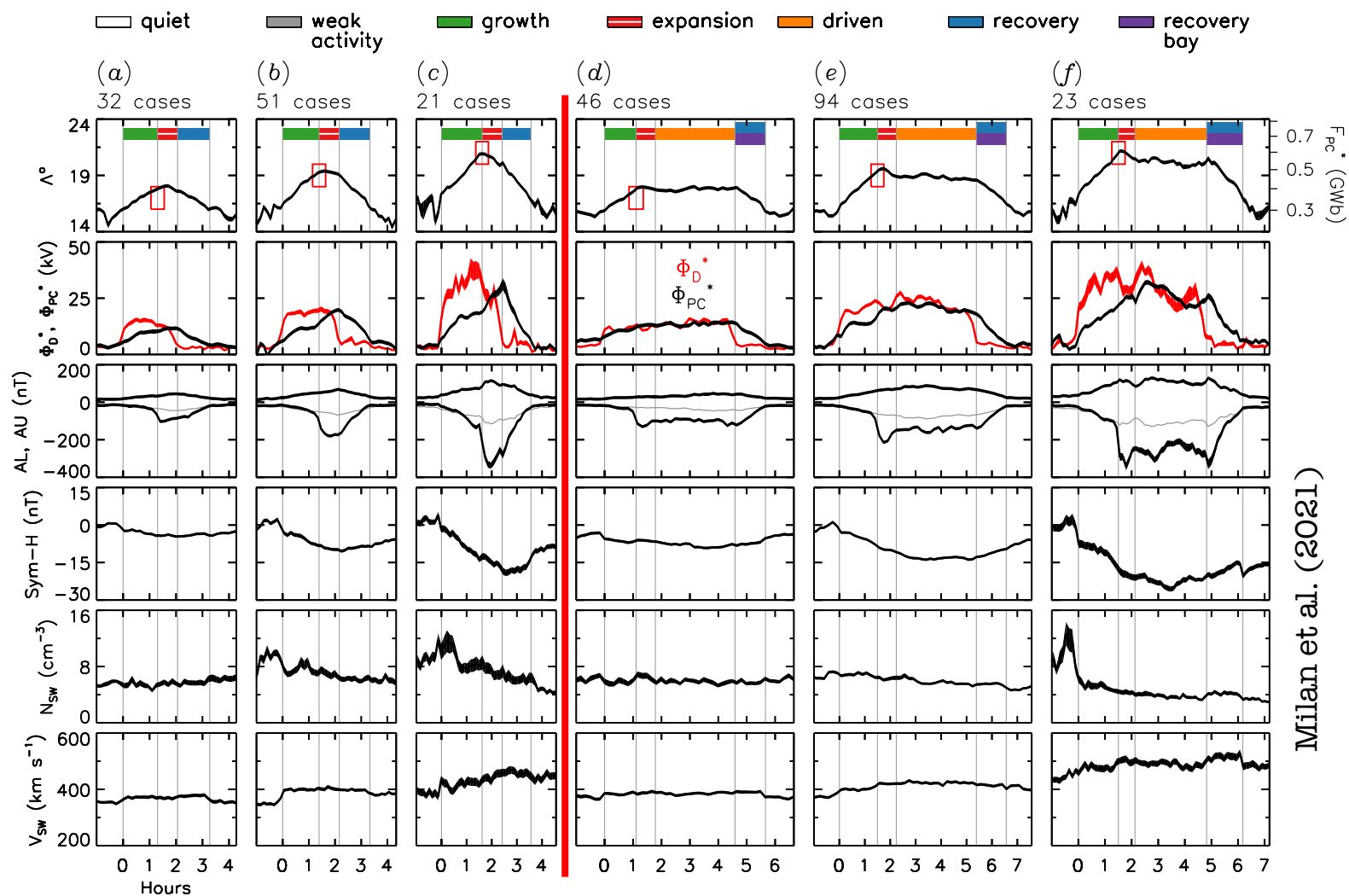
An example of convection state identification for 60 hours in May 2010 – the full analysis included the whole of 2010 – including (a, b) keograms of AMPERE FACs, (c) radius of the R1/R2 FACs (proxy for F_{PC}), (d) dayside reconnection and PC index (proxy for transpolar voltage), (e) AU and AL, (f) the IMF, (g) the solar wind, and (h) the Sym-H index

Sequence statistics



Superposed epoch analyses of different sequences of convection state, including (d) “classic” isolated substorms (growth, expansion, recovery phases), and (f) substorms with periods of quasi-balanced reconnection after the expansion phase (“driven phases”). Dayside reconnection occurs during the growth, expansion, and driven phases; nightside reconnection occurs during the expansion, driven, and recovery phases. Nightside reconnection typically balances dayside. The transpolar voltage is a running mean of the dayside and nightside reconnection rates.

Sequence statistics



Examining the characteristics of isolated substorms (left) and driven-phase substorms (right), dependent on the open flux at the time of expansion phase onset. More strongly-driven growth phases result in lower-latitude onsets, more intense substorms, and lower Sym-H. The the nightside reconnection rate during expansion and driven phases equals the dayside reconnection rate during the preceding growth phase. The substorm segues from expansion to driven phase if the IMF remains southwards; the recovery phase begins once the IMF turns northwards.