

Can Particle Precipitation Affect the Magnetic Reconnection Rate?



University of
New Hampshire

Joseph B. Jensen, Joachim Raeder, W. Douglas Cramer

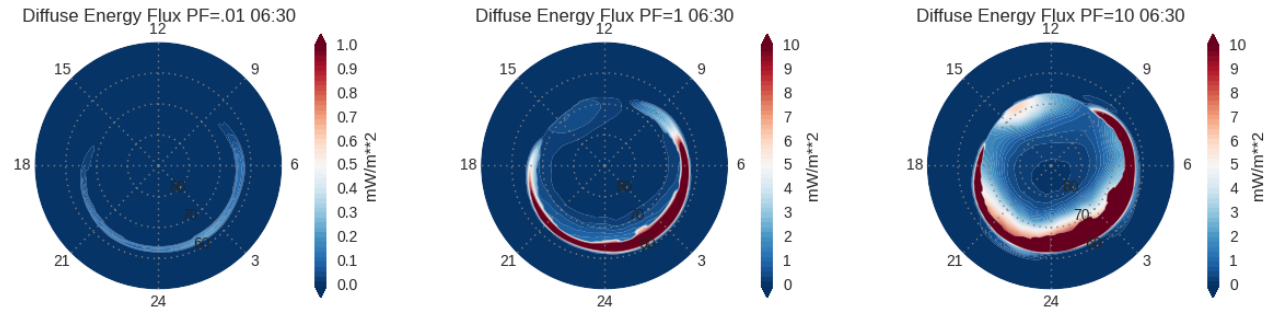
1
Precipitation

2
Ionospheric
conductivity

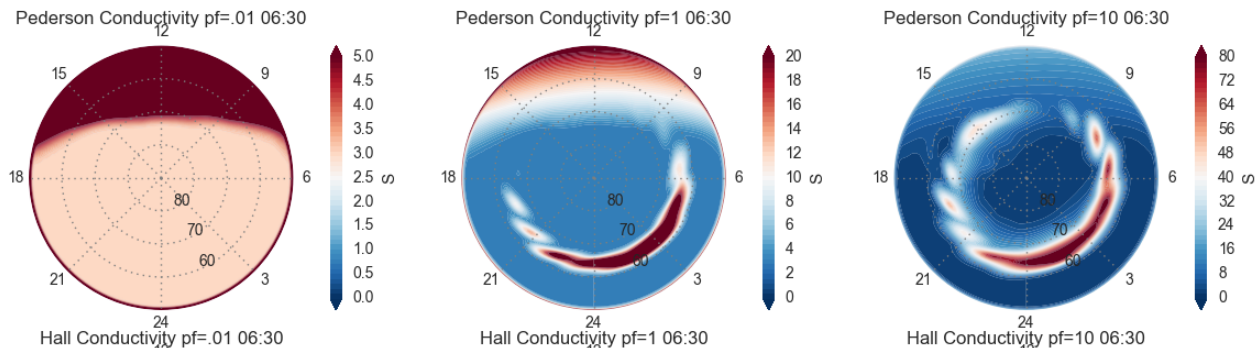
3
Magnetospheric
convection

4
Magnetic
reconnection rate

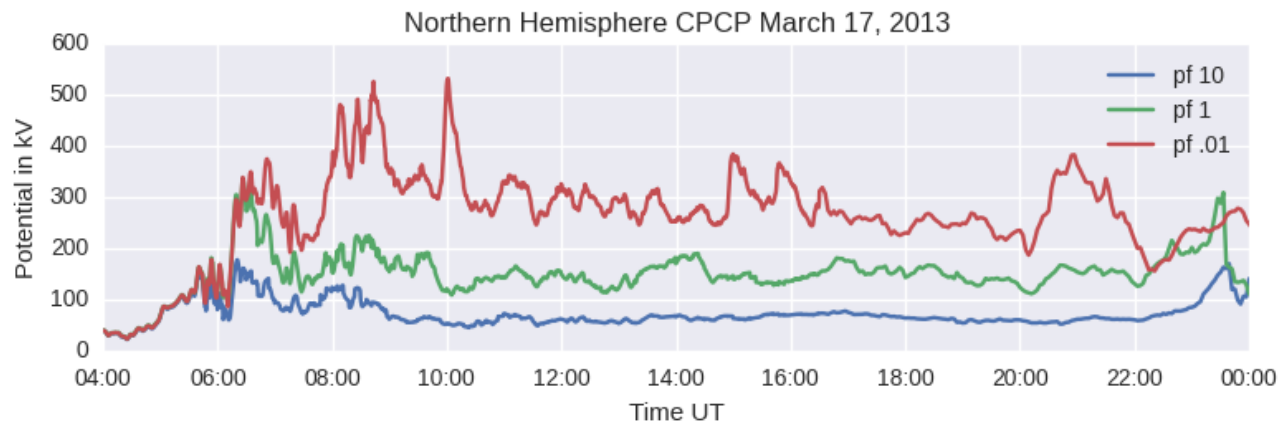
- Three simulations with three different precipitation factors .01, 1, and 10. All other model inputs were left the same



- Conductivities enhanced due to precipitation, in high precipitation case it dominates the conductivity due to photoionization



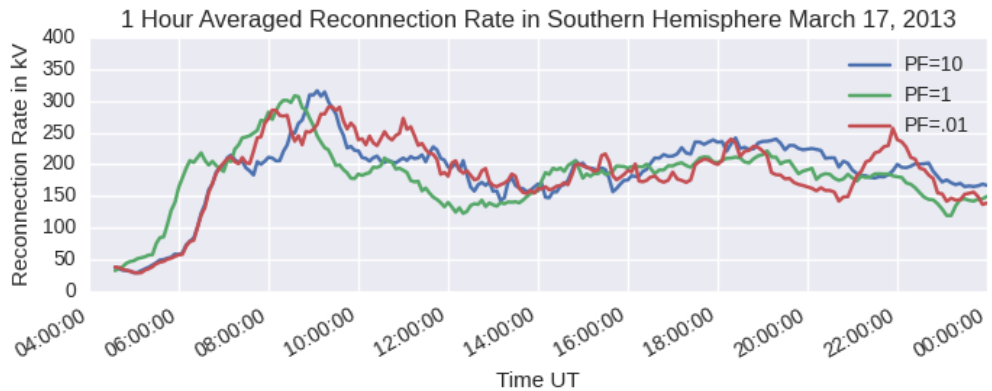
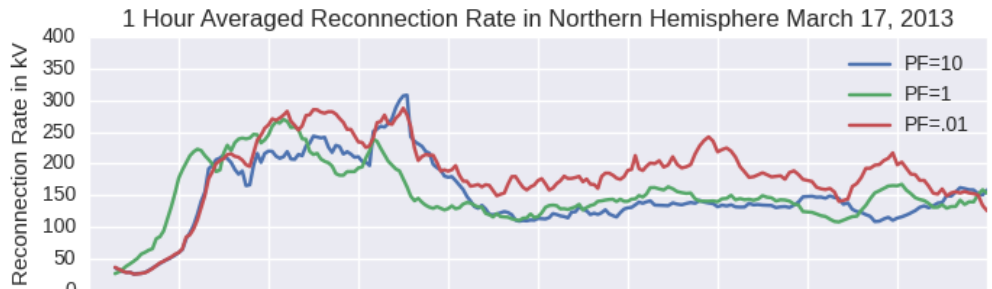
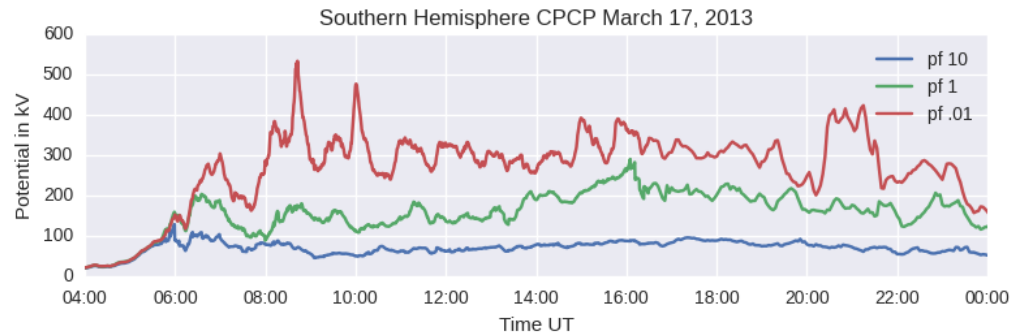
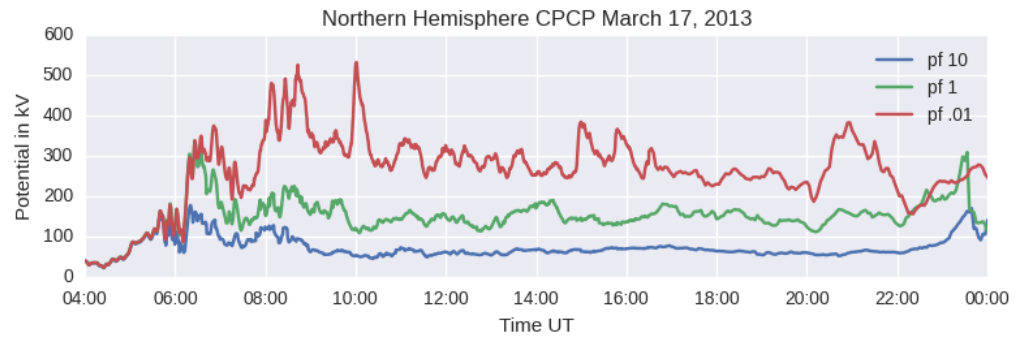
- CPCP is directly affected by enhanced conductivities



- CPCP has been considered an indicator of the magnetic reconnection rate, but we see in this case it performs poorly in indicating magnetic reconnection rate.

- The three different simulations appear of similar magnitudes for some times and changes of up to 40% at others, much different than the previous behavior

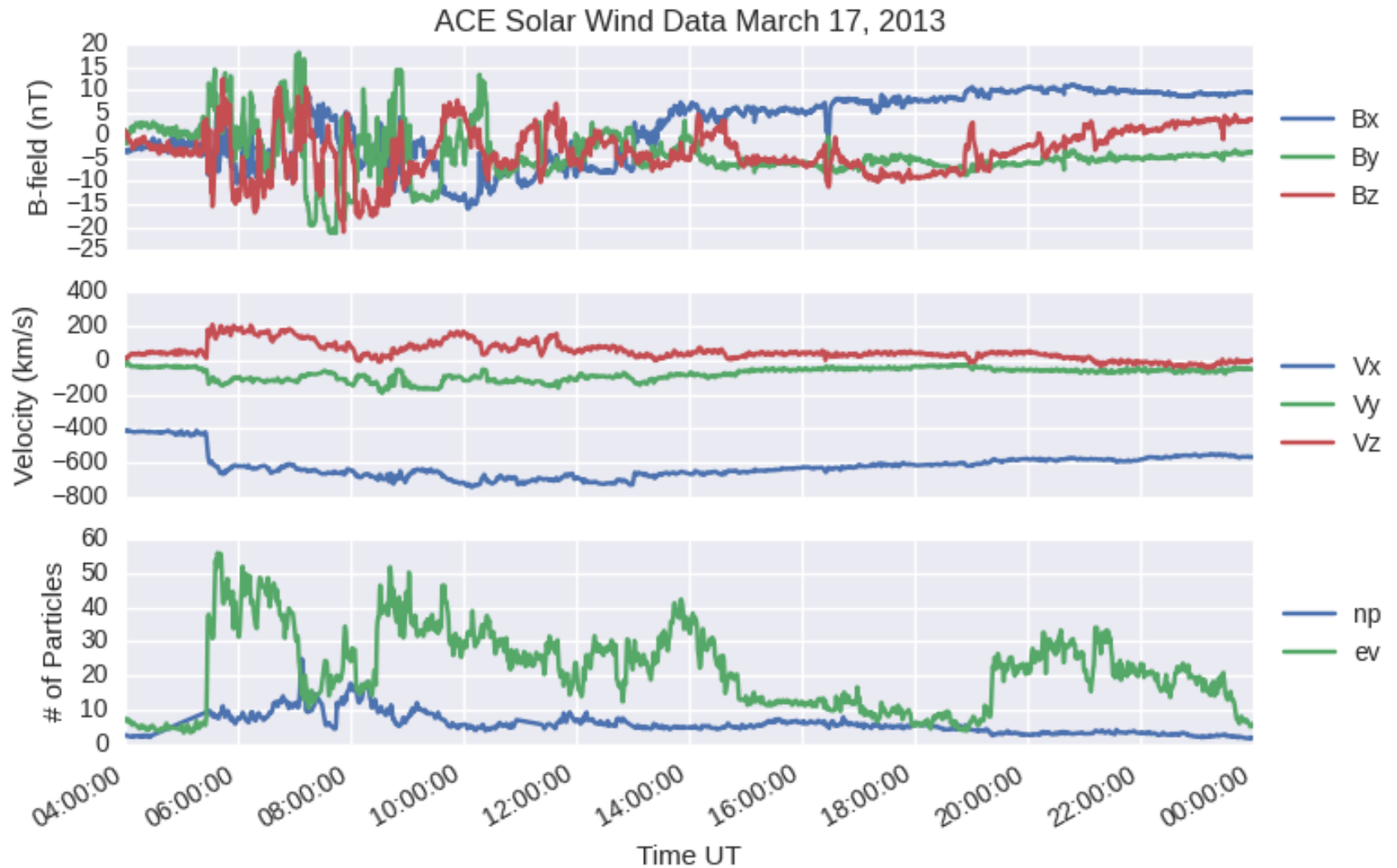
- North south asymmetries in reconnection rate, sometimes differences of up to 50 kV?



Questions

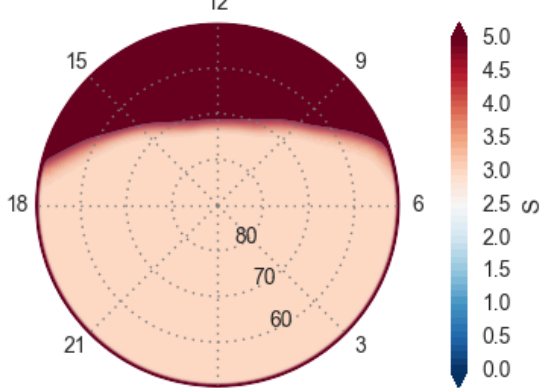
- The CPCP and magnetic reconnection are different, why?
- There is a north-south asymmetry in calculation of the reconnection rate, why?

Ace Solar Wind Parameters

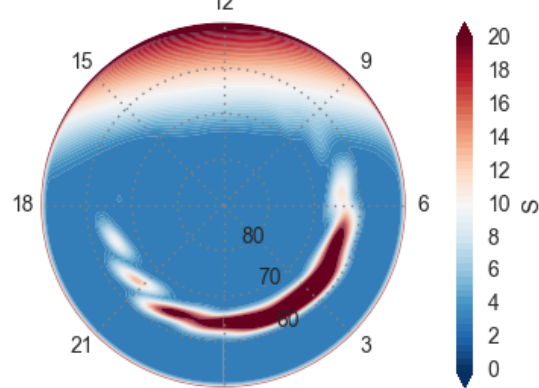


Pederson and Hall Conductivity

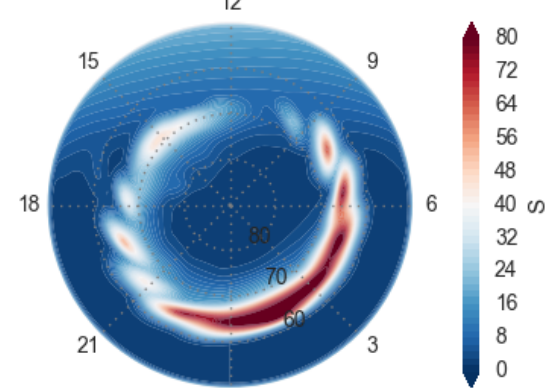
Pederson Conductivity pf=.01 06:30



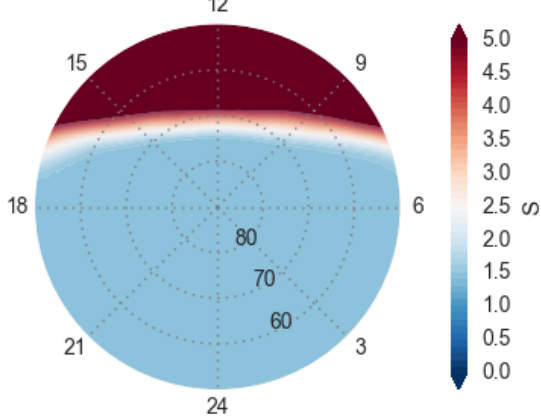
Pederson Conductivity pf=1 06:30



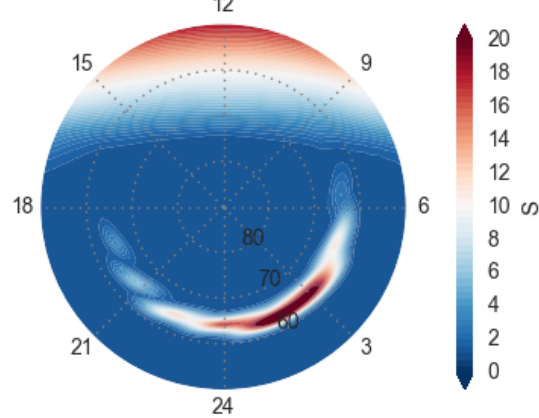
Pederson Conductivity pf=10 06:30



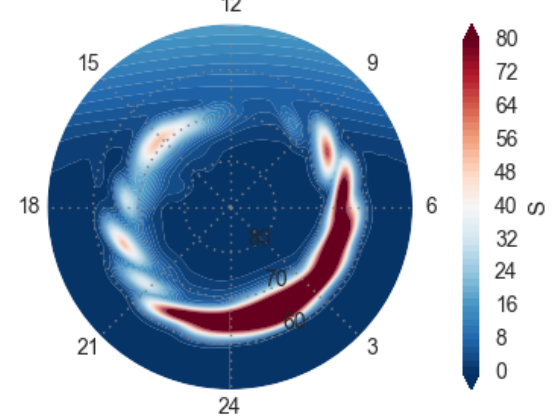
Hall Conductivity pf=.01 06:30



Hall Conductivity pf=1 06:30



Hall Conductivity pf=10 06:30



Hesse *et al* method for calculating reconnection rate

- Originally used for solar corona, but is extensible to any magnetic field and does not require topologically distinct field lines.
- Sum up parallel electric field over all field lines and the difference between the maximum and minimum gives reconnection rate
- Reference is,

Hesse, M., T. G. Forbes, and J. Birn (2005), On the Relation between Reconnected Magnetic Flux and Parallel Electric Fields in the Solar Corona, *Astrophys. J.*, 631(2), 1227–1238, doi:10.1086/432677.

Magnetopause Location

10 Minute Average Magnetopause Location March 17, 2013

