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Title: Quick spacecraft charging primer

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Quick spacecraft charging primer

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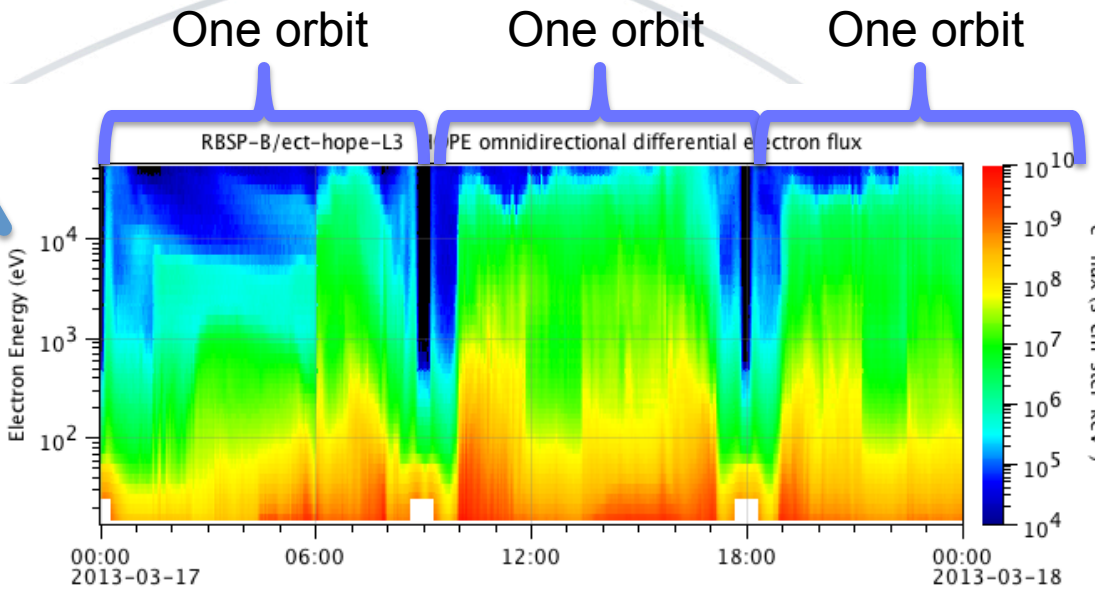
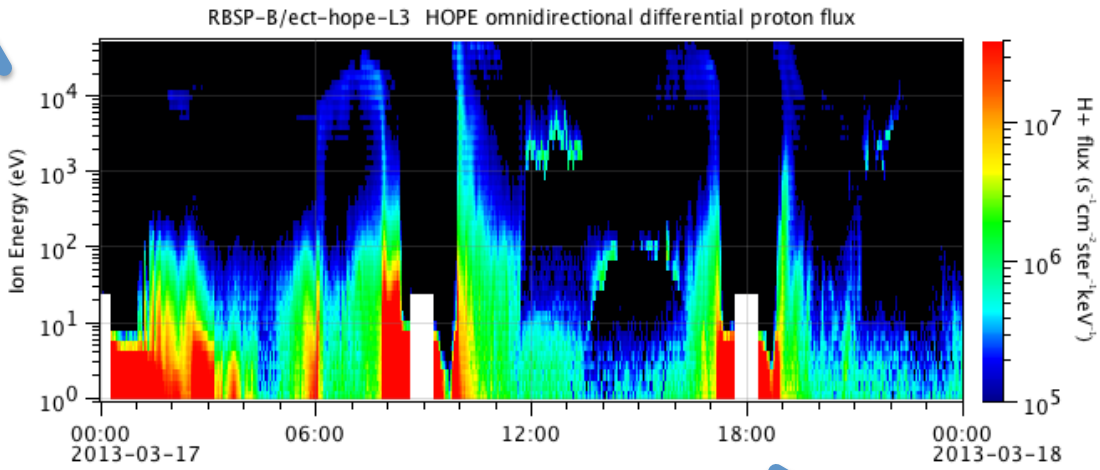
RBSP example



Electron Energy

Particle flux



Proton Energy

Particle flux

TIME

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Charging physics

- Spacecraft and local plasma form a balance
- Often in eclipse the loss of photoelectrons drives the S/C negative relative to the plasma (not necessary or sufficient)
- During times of significant hot (~10keV) electrons their collisions with the spacecraft drive it negative relative to the local plasma
- Less frequently spacecraft can change positive, electron/ion mobility differences often quench this
- A negative spacecraft attracts and accelerates (energizes) ions toward it

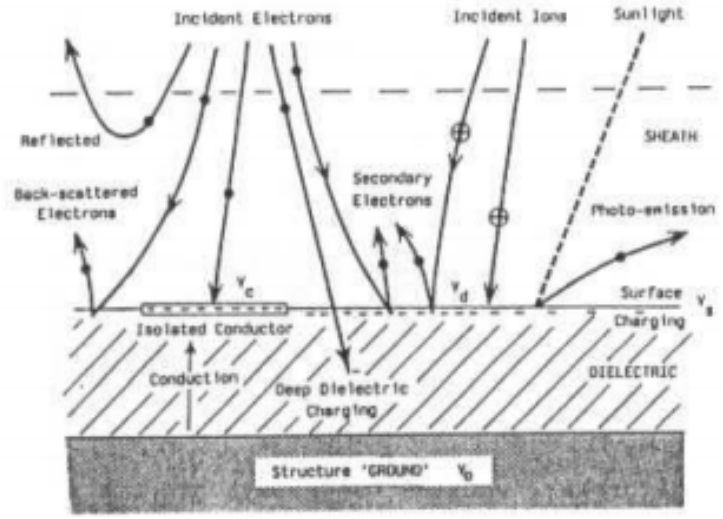
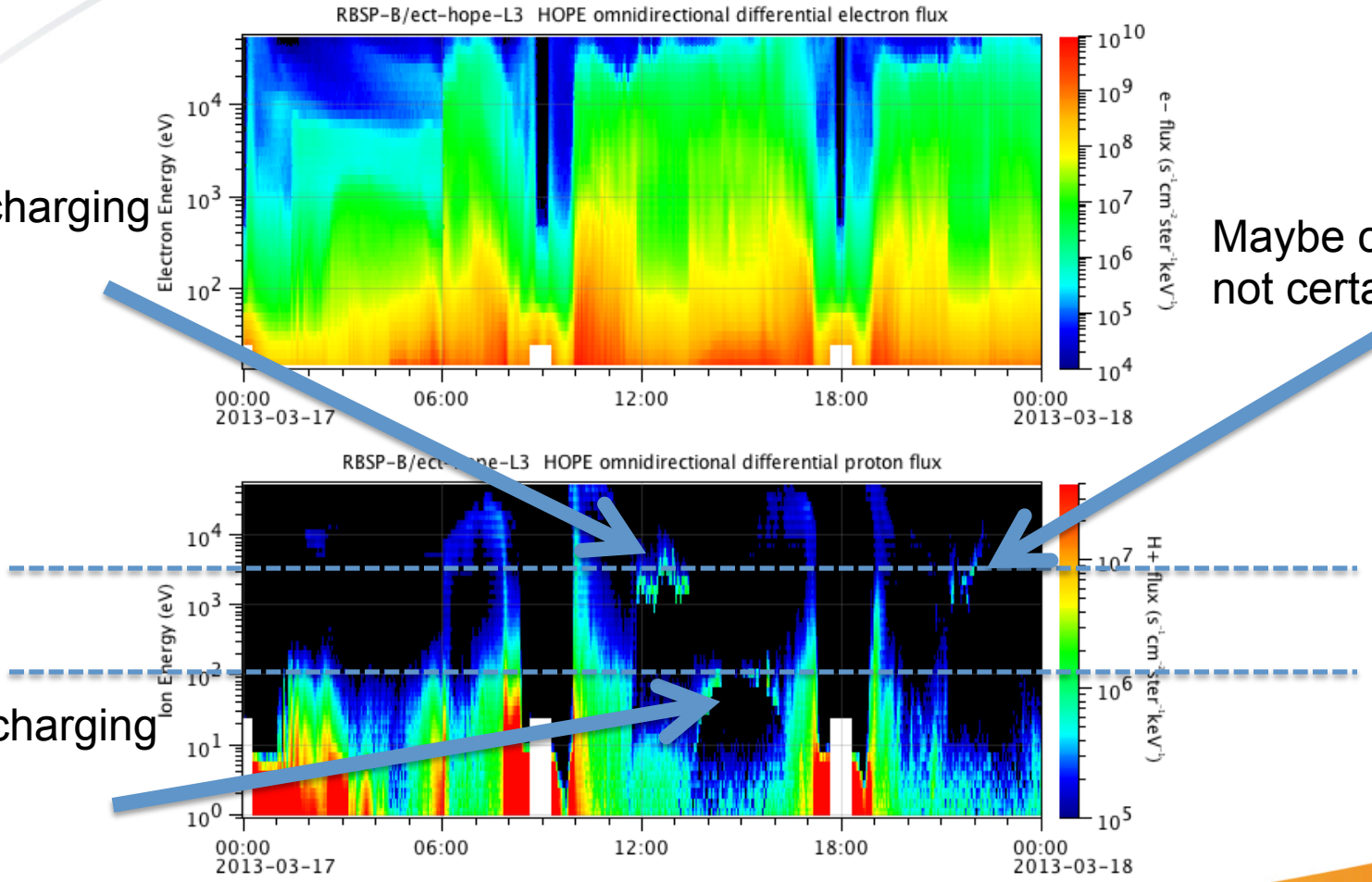


Figure 4. Currents which control surface charging *(after Wrenn and Sims, 1993).*

RBSP example



S/C frame charging to ~2000V

Maybe charging, not certain

S/C frame charging to ~100V

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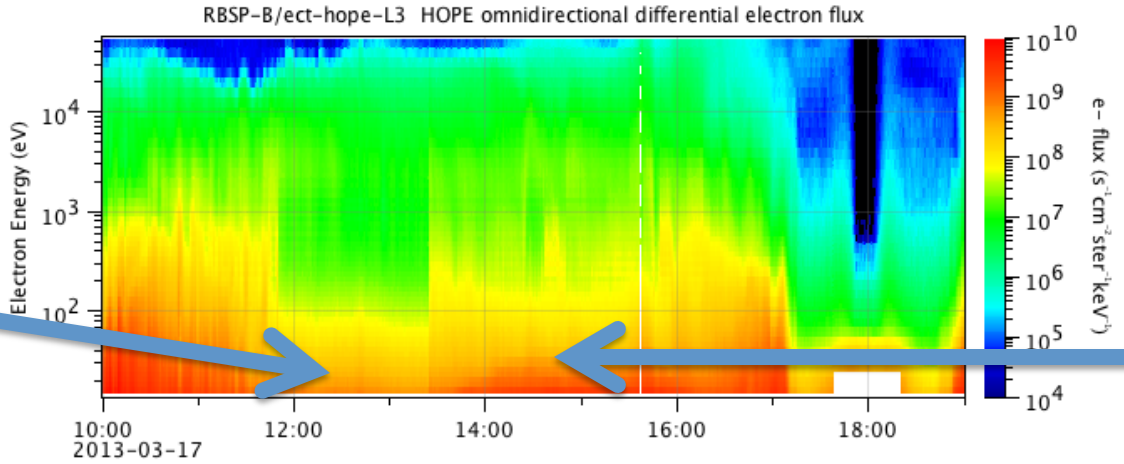
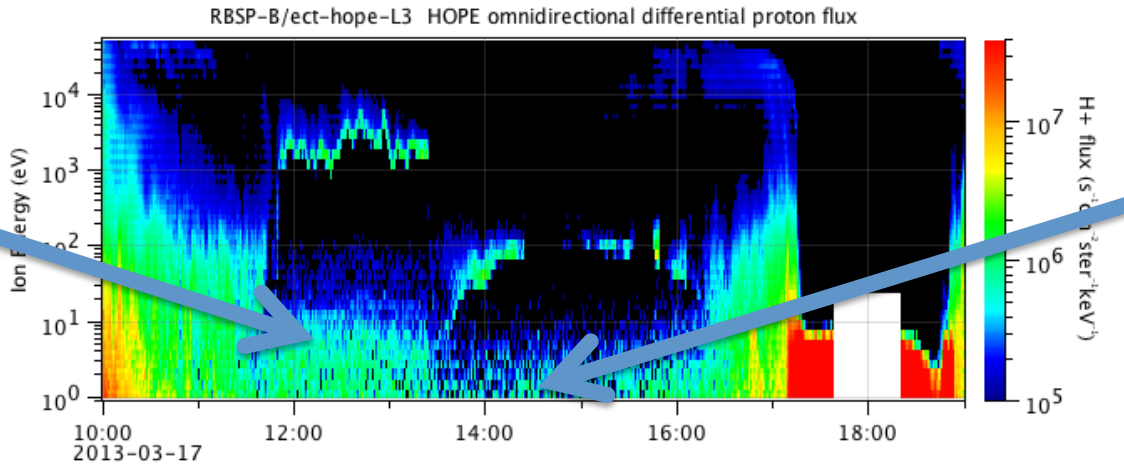
RBSP example

Changed due to charging



Enhanced due to charging

Depleted under charging, but this is intense charging



Depleted under charging

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Identifying charging

- Mostly done in ion spectrograms
  - Look for a very sharp, about 1 channel wide, line of ions and a depletion below relative to times before and after
- Automatic detection has been tried (e.g. M. Thomsen) with moderate success.
  - This was done from a data file standpoint not an imaging processing standpoint
  - New tools and insight may improve either version