Field-Aligned Current Responses to Changing Solar Indices and Solar Wind Electric Field

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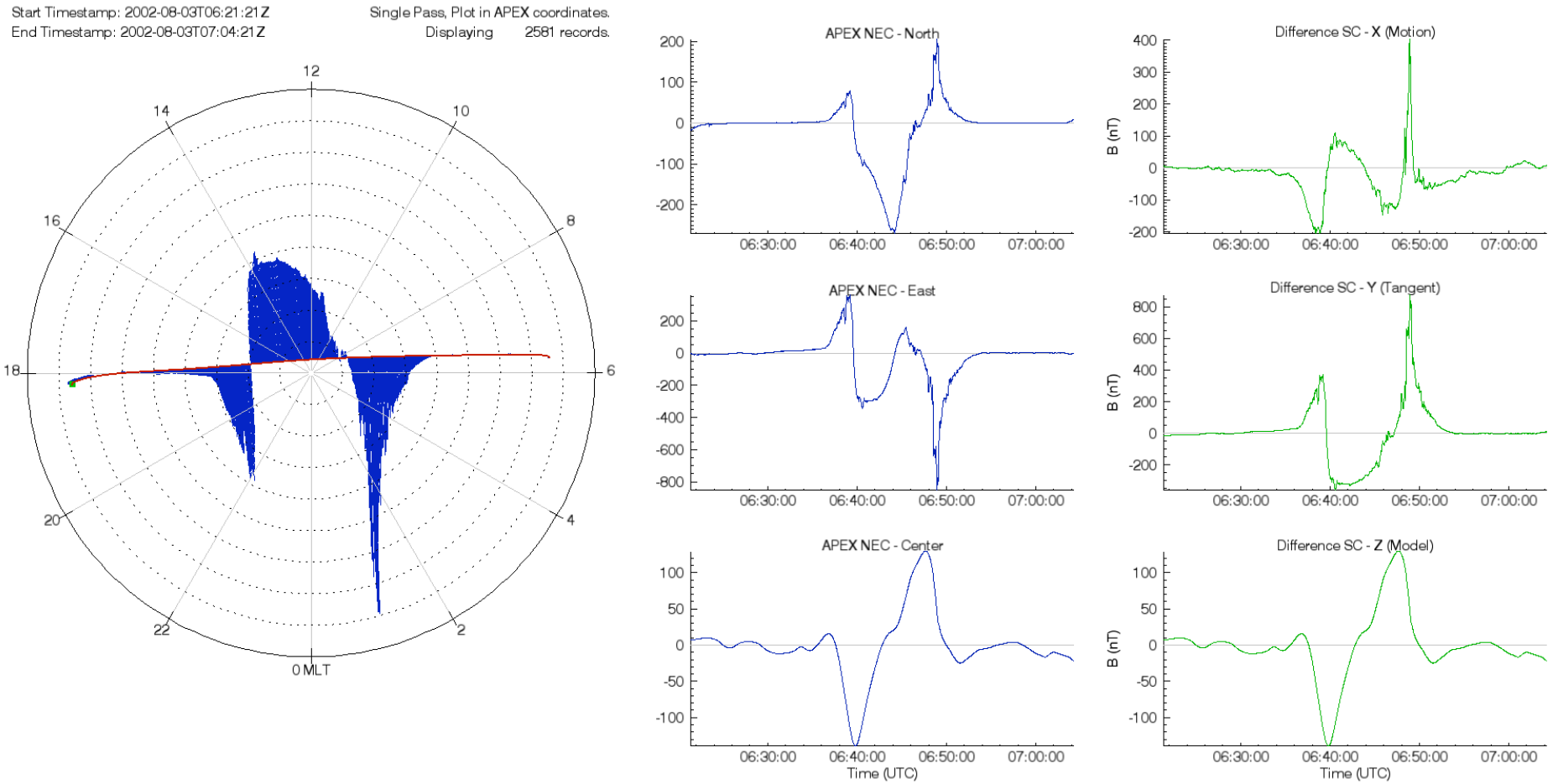
Modeling Field-Aligned Currents

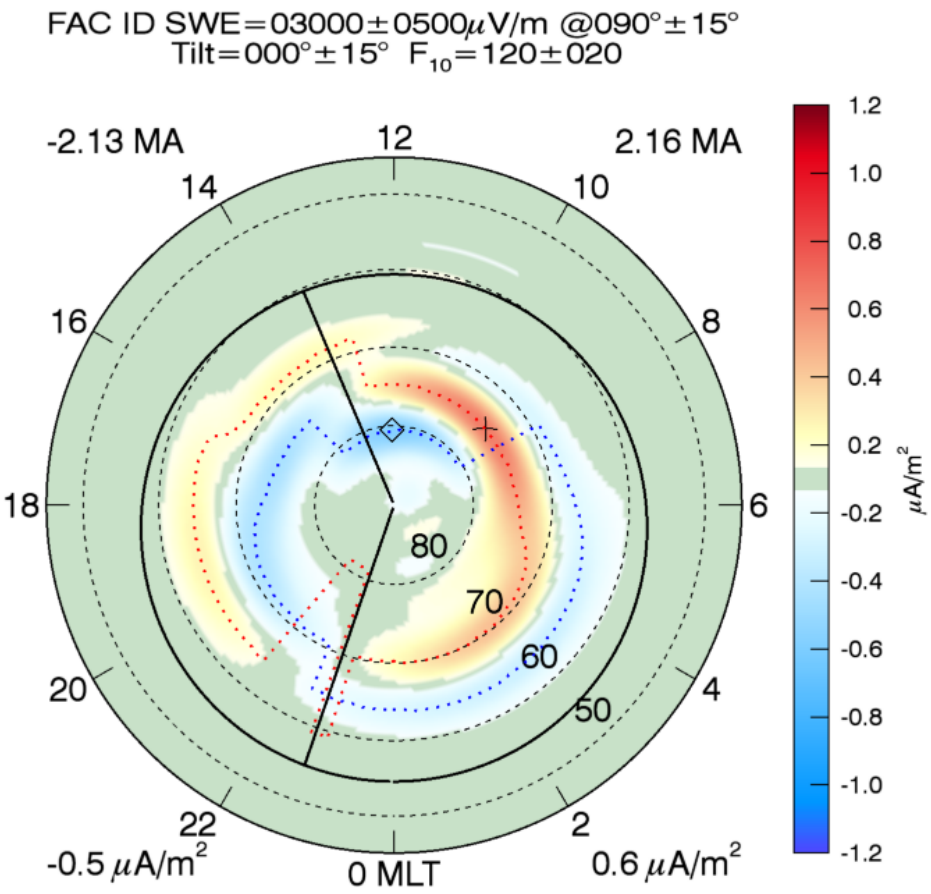
- Magnetometer data from 3 satellite missions is used: CHAMP, Ørsted, and Swarm.
- The International Geomagnetic Reference Field (IGRF) is subtracted from the magnetometer data to get $\Delta\vec{B}$.
- $\Delta\vec{B}$ data is then associated with solar wind data from ACE and solar index data ($F_{10.7}$, $S_{10.7}$, $M_{10.7}$, and $Y_{10.7}$).
- A statistical model for each $\Delta\vec{B}$ direction (North/East or Sunward/Dawnward) using Spherical Cap Harmonic Analysis (SCHA) is developed.
- Finally, use Ampere's law to get current:

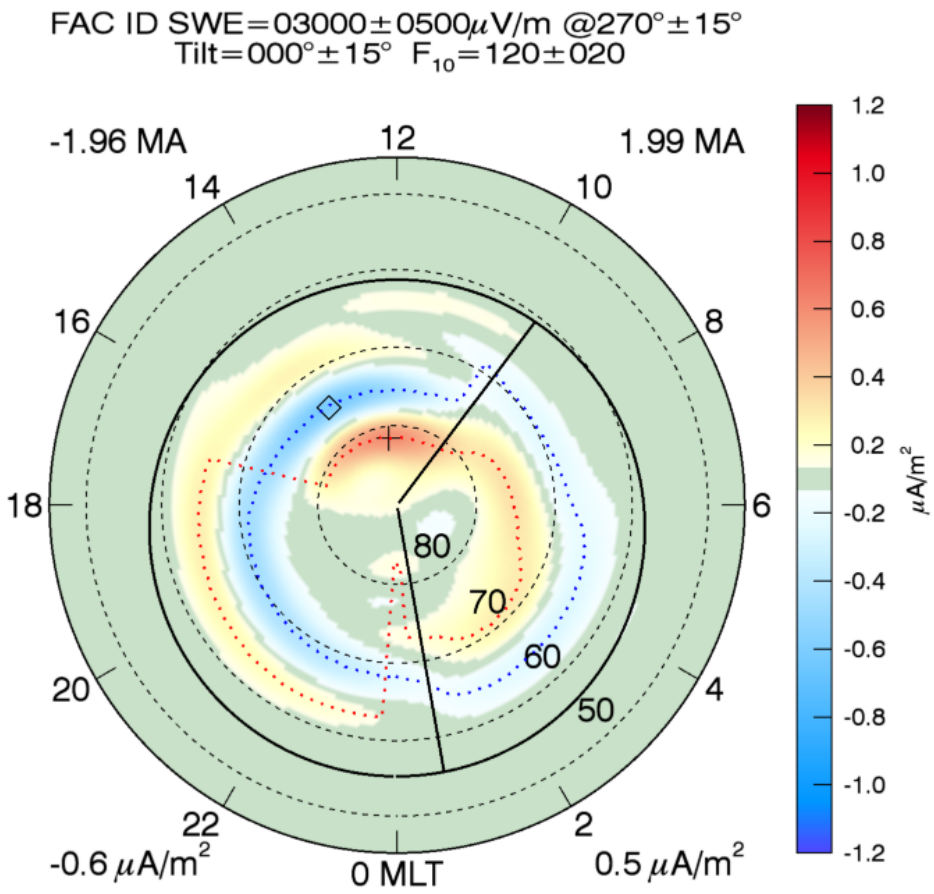
$$\mu_0\vec{J} = \nabla \times \Delta\vec{B}$$

Sample Satellite Pass

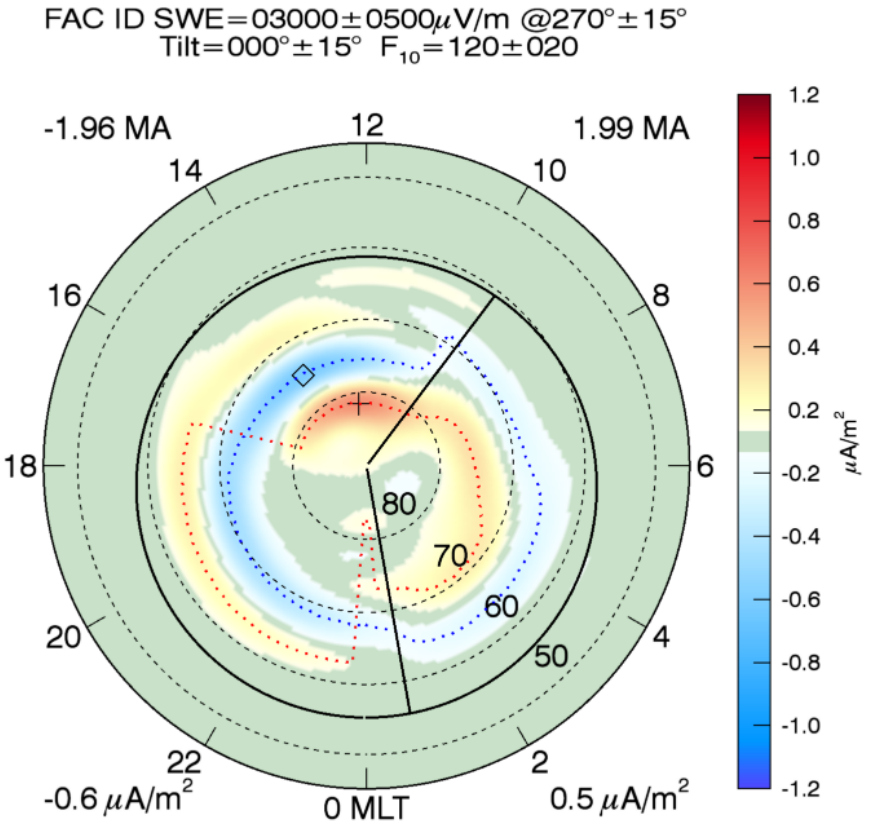


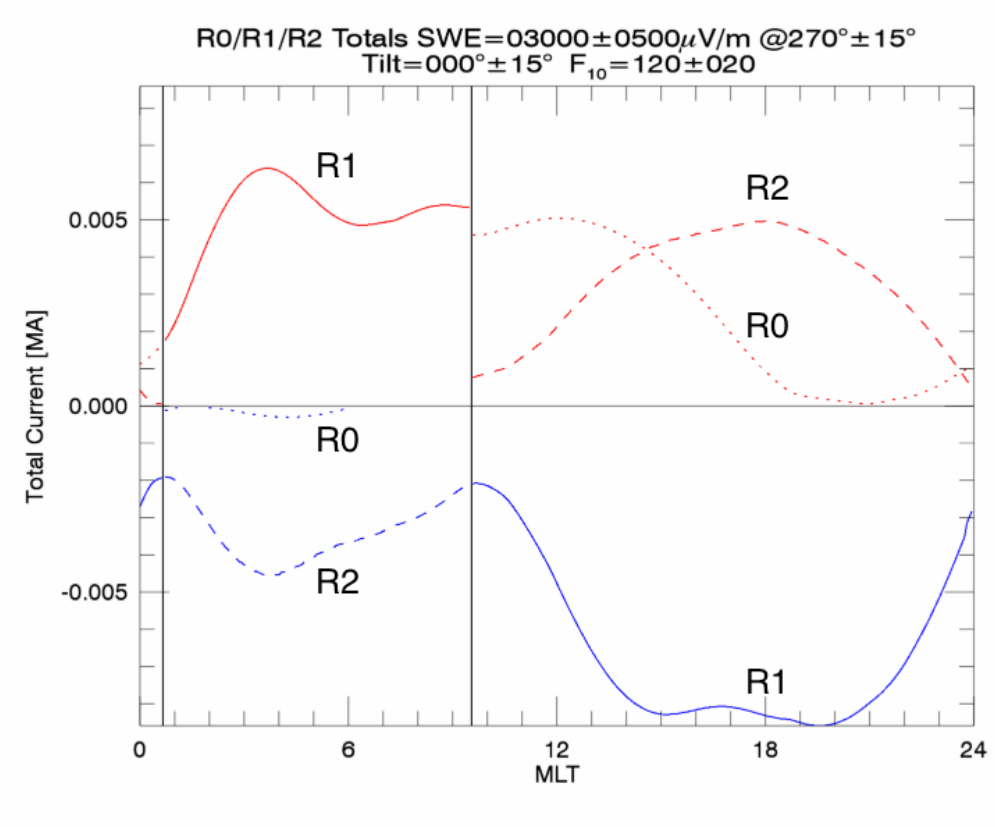
Field-Aligned Current Maps



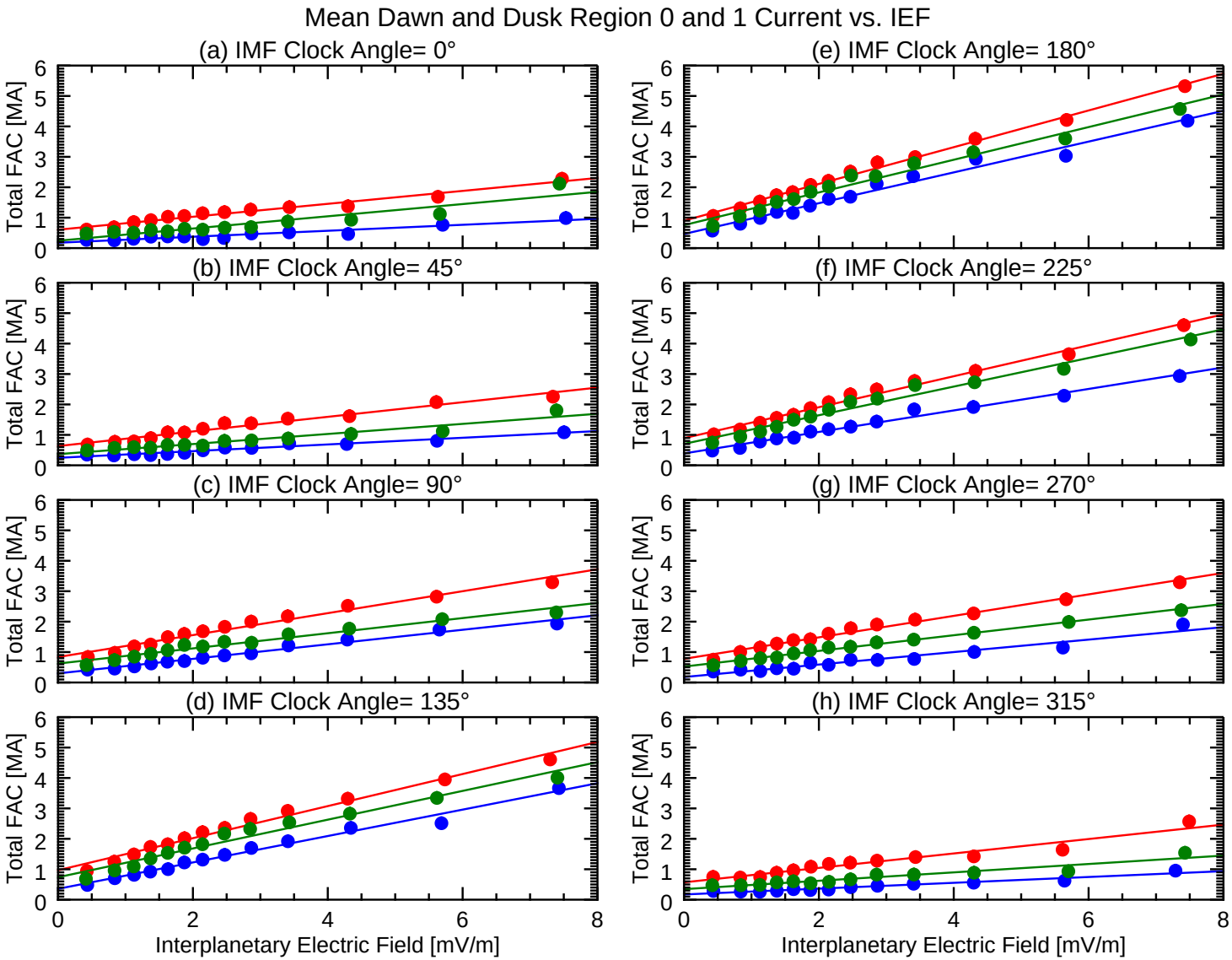


Region Totaling

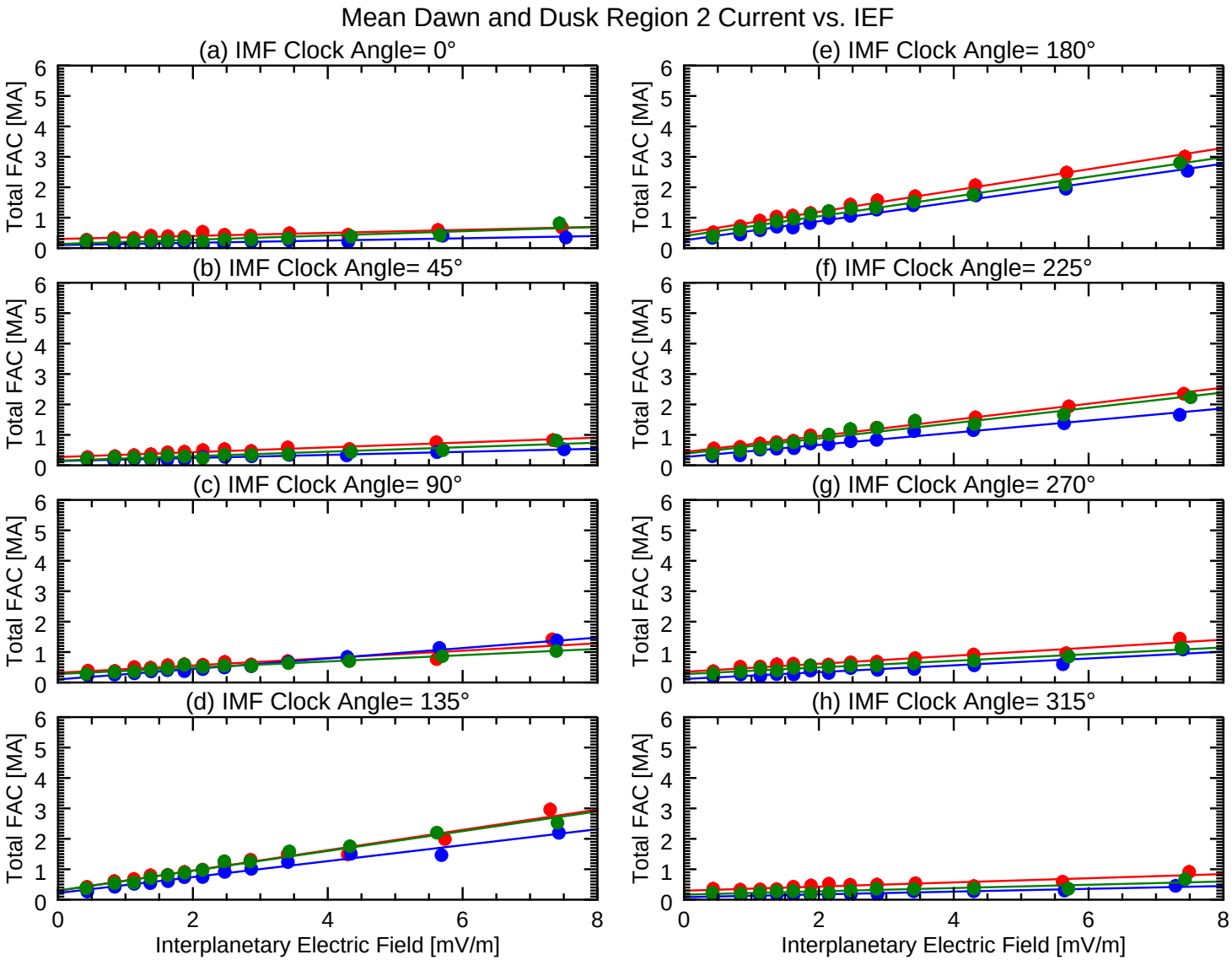




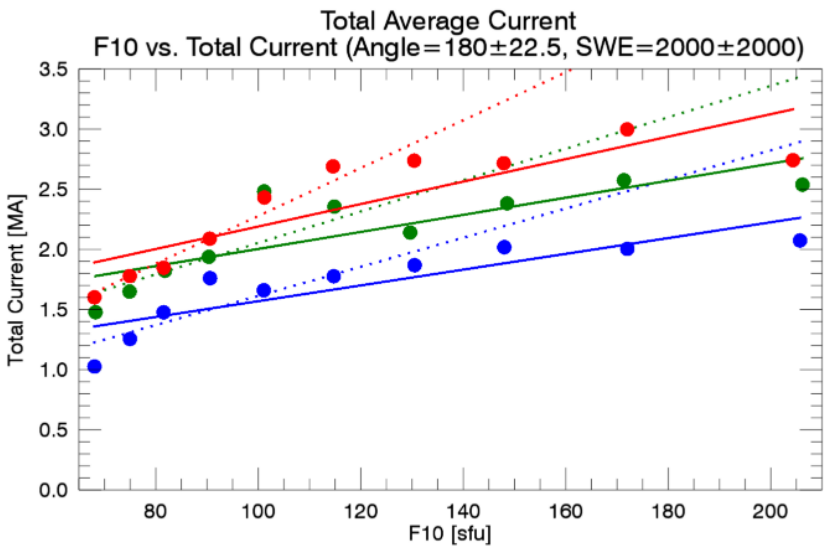
IEF/SWE Response

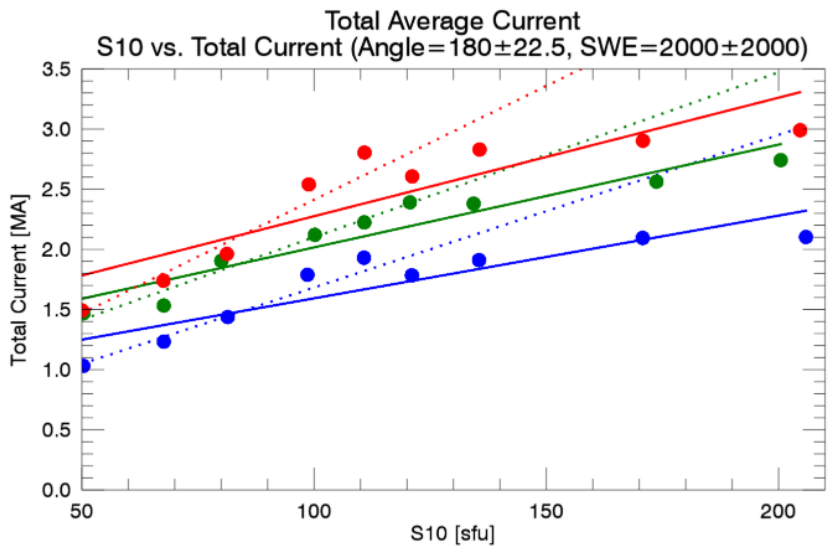


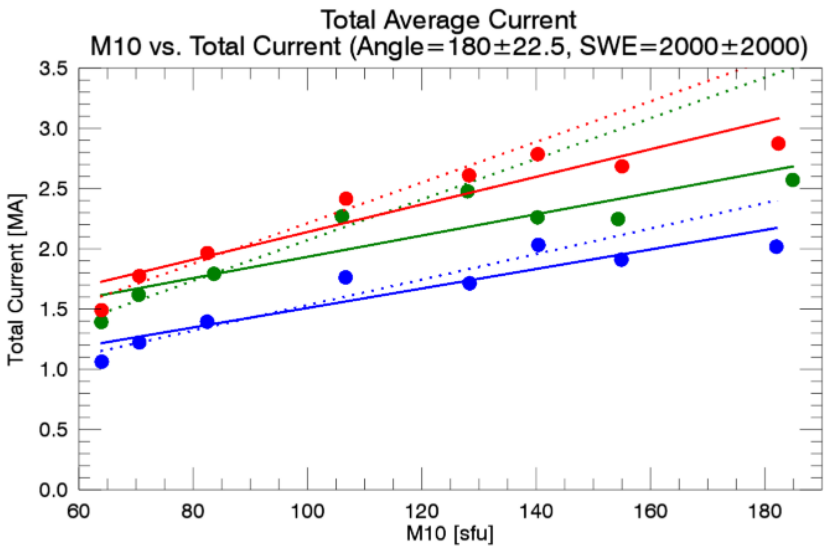
IEF/SWE Response

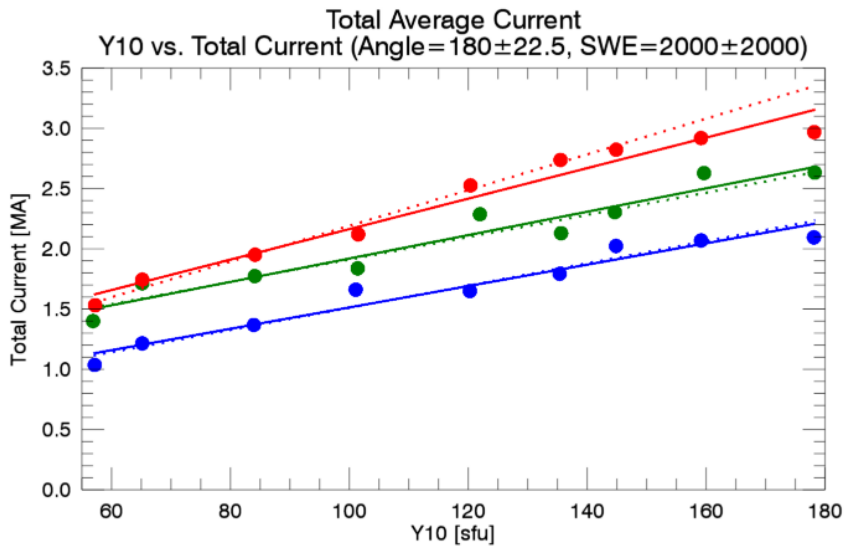


Solar Index Response

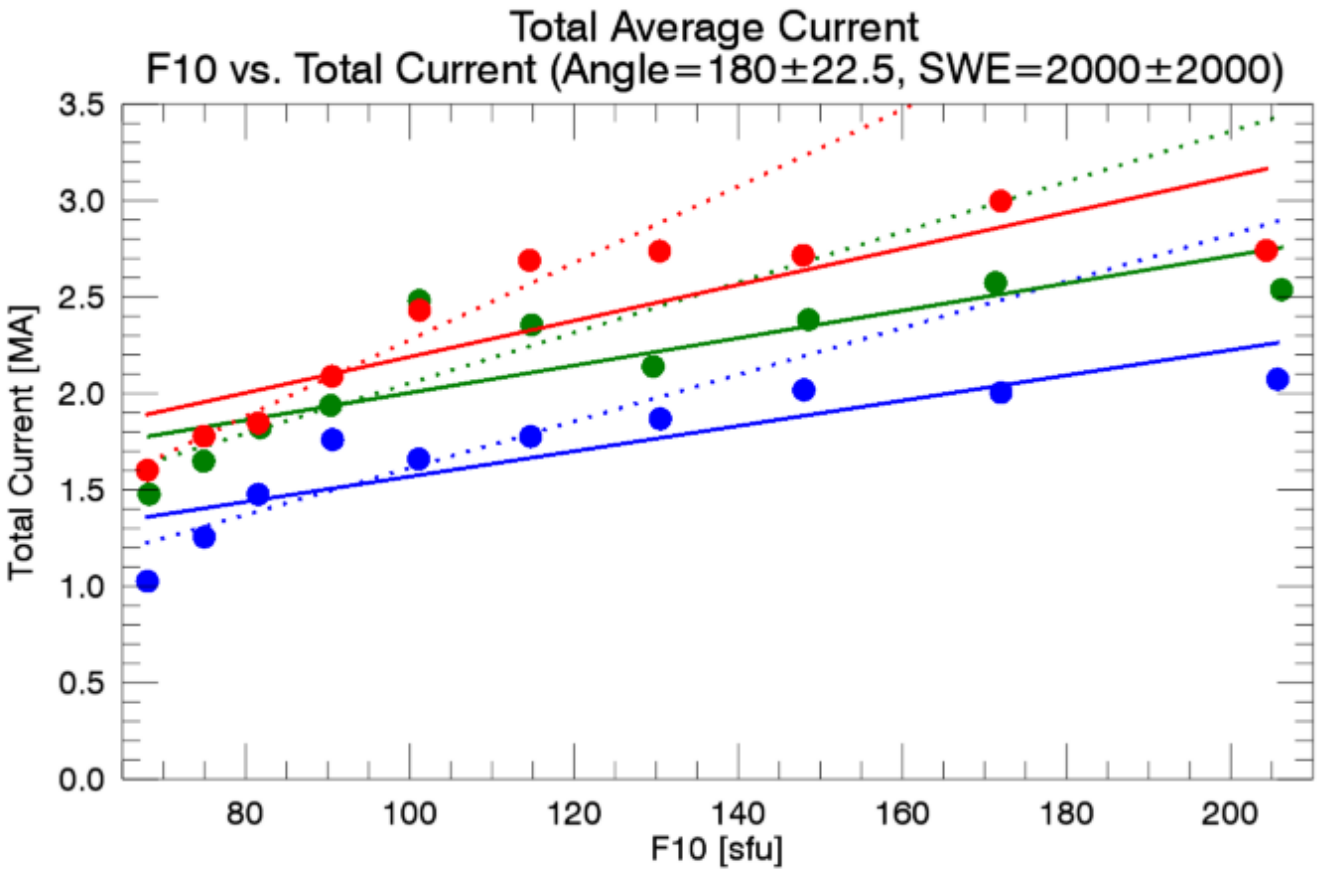




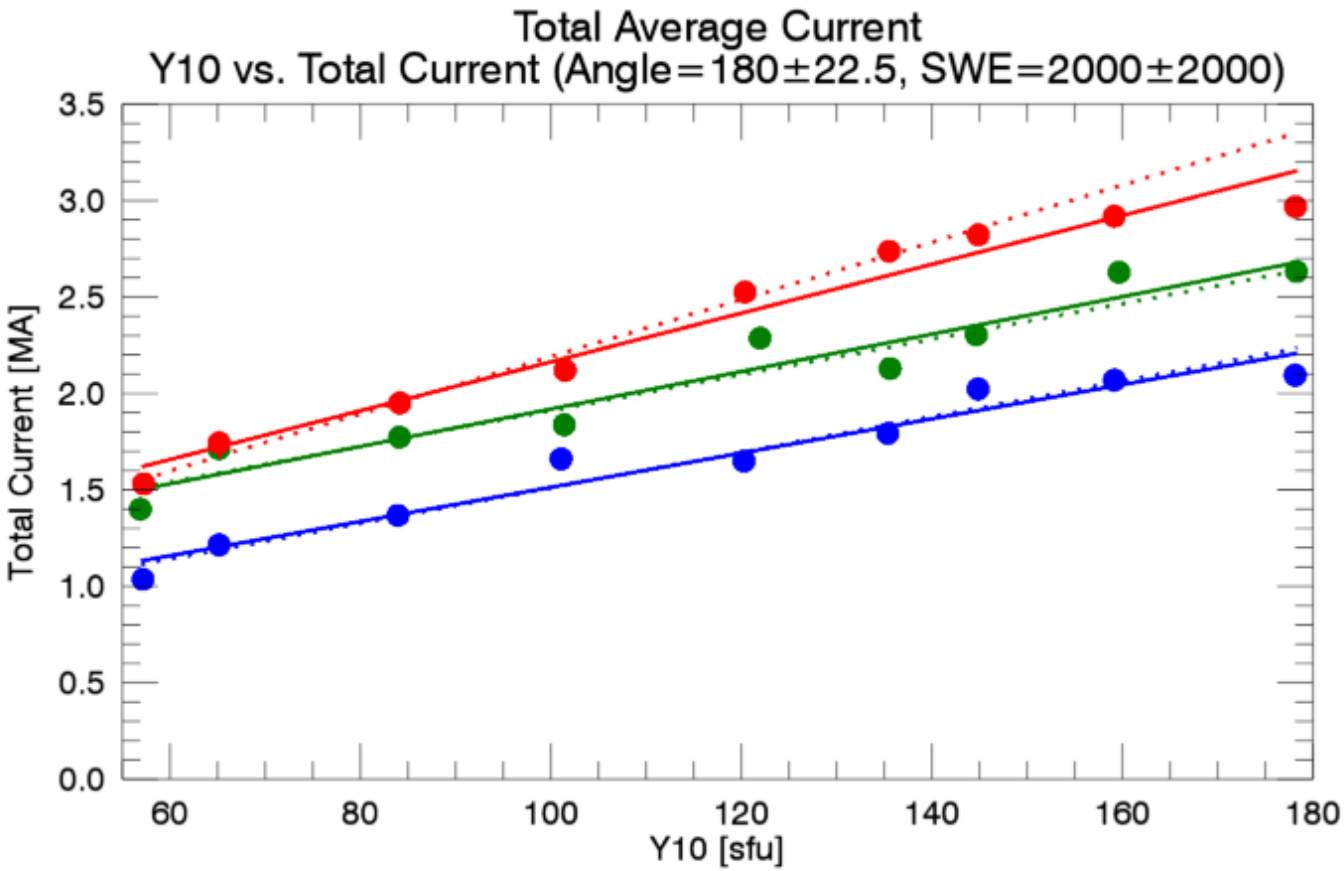




Solar Index Response



Solar Index Response



Questions?

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