A New Method of Creating High Latitude Empirical Electrodynamic Models

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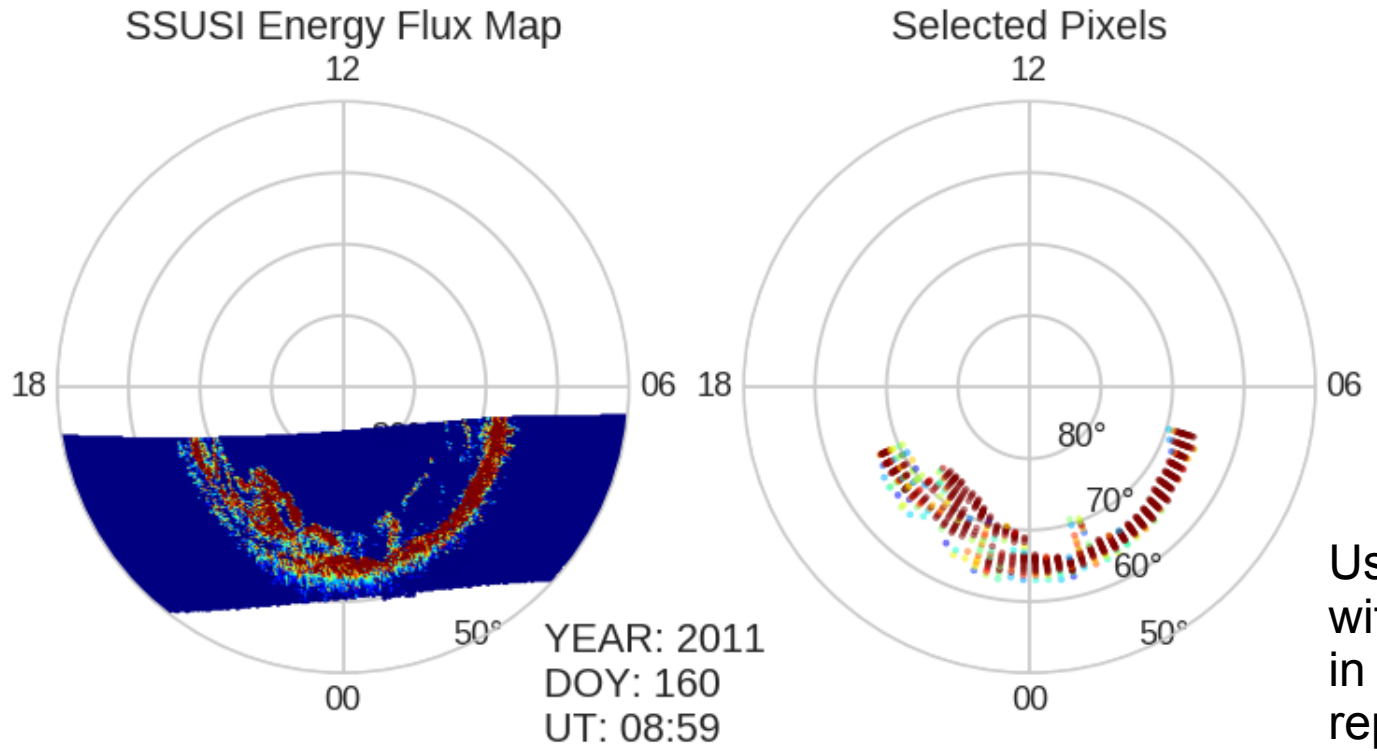
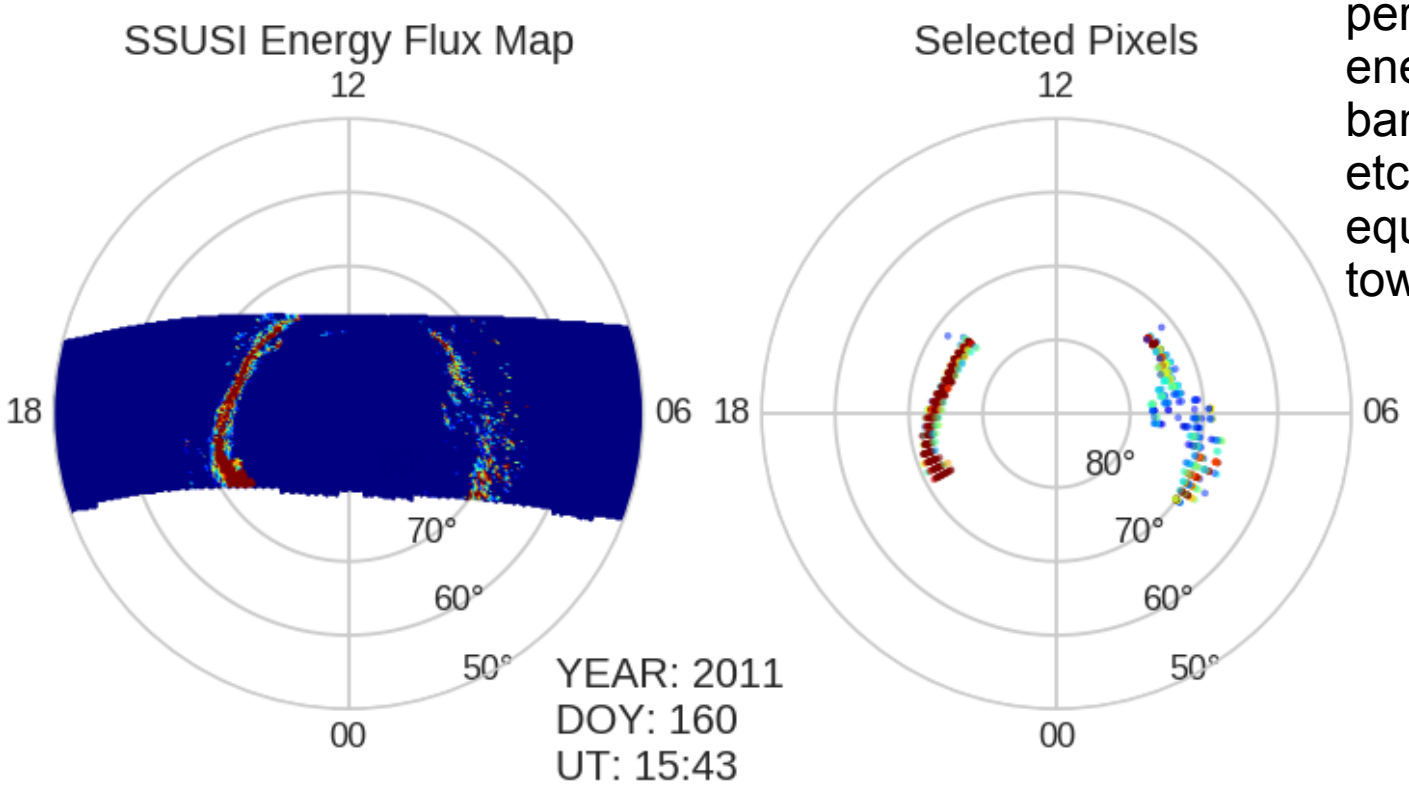
*Did all of the work.

General Idea

- Don’t use a grid, but track features
  - Peak or equatorward edge of aurora
  - Convection reversal boundary
- Keep track of characteristics of the features
  - Location
  - Strength
  - Width
  - Etc.
- Do statistics on those characteristics

Used SSUSI data for this demonstration

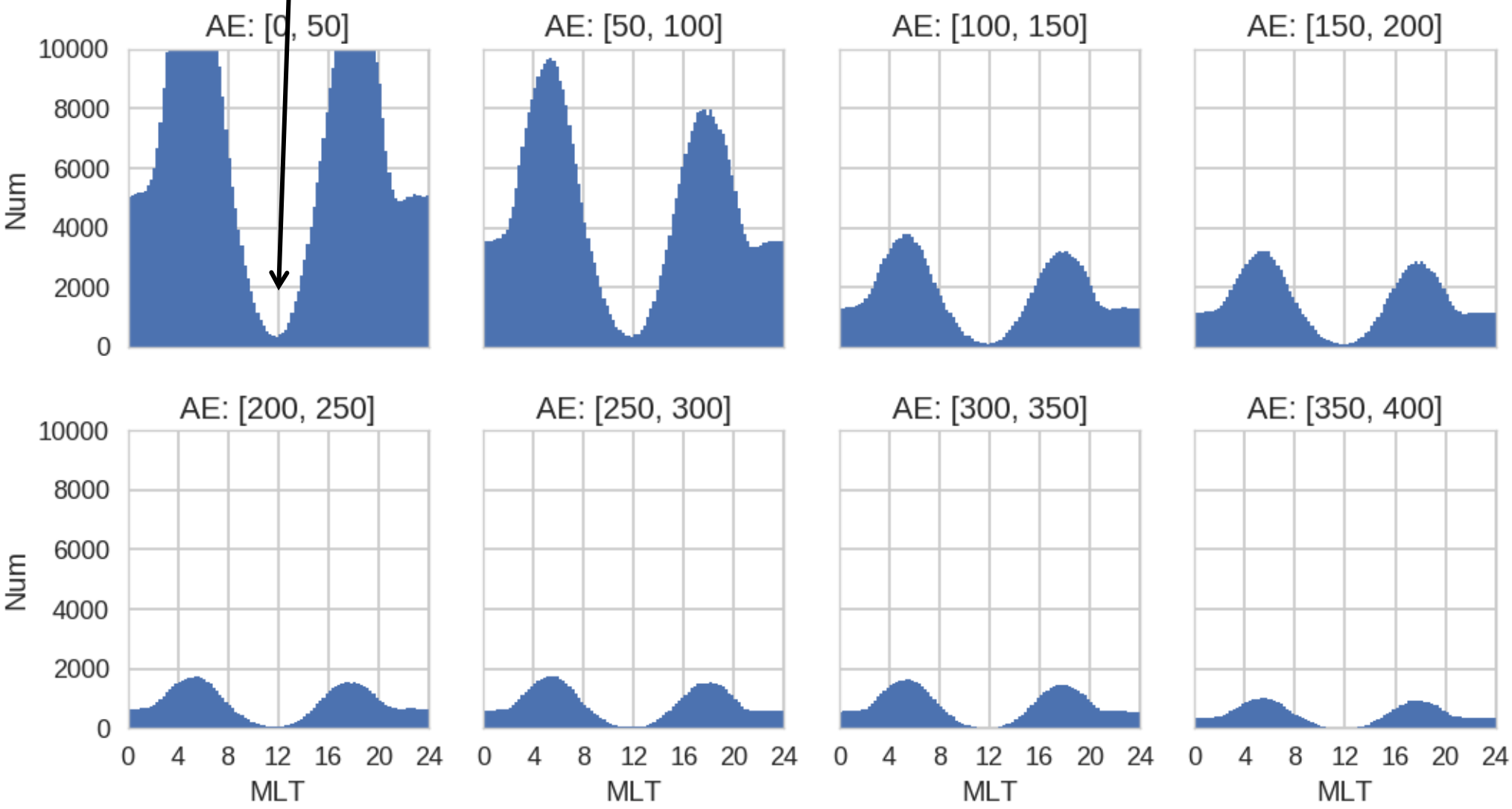




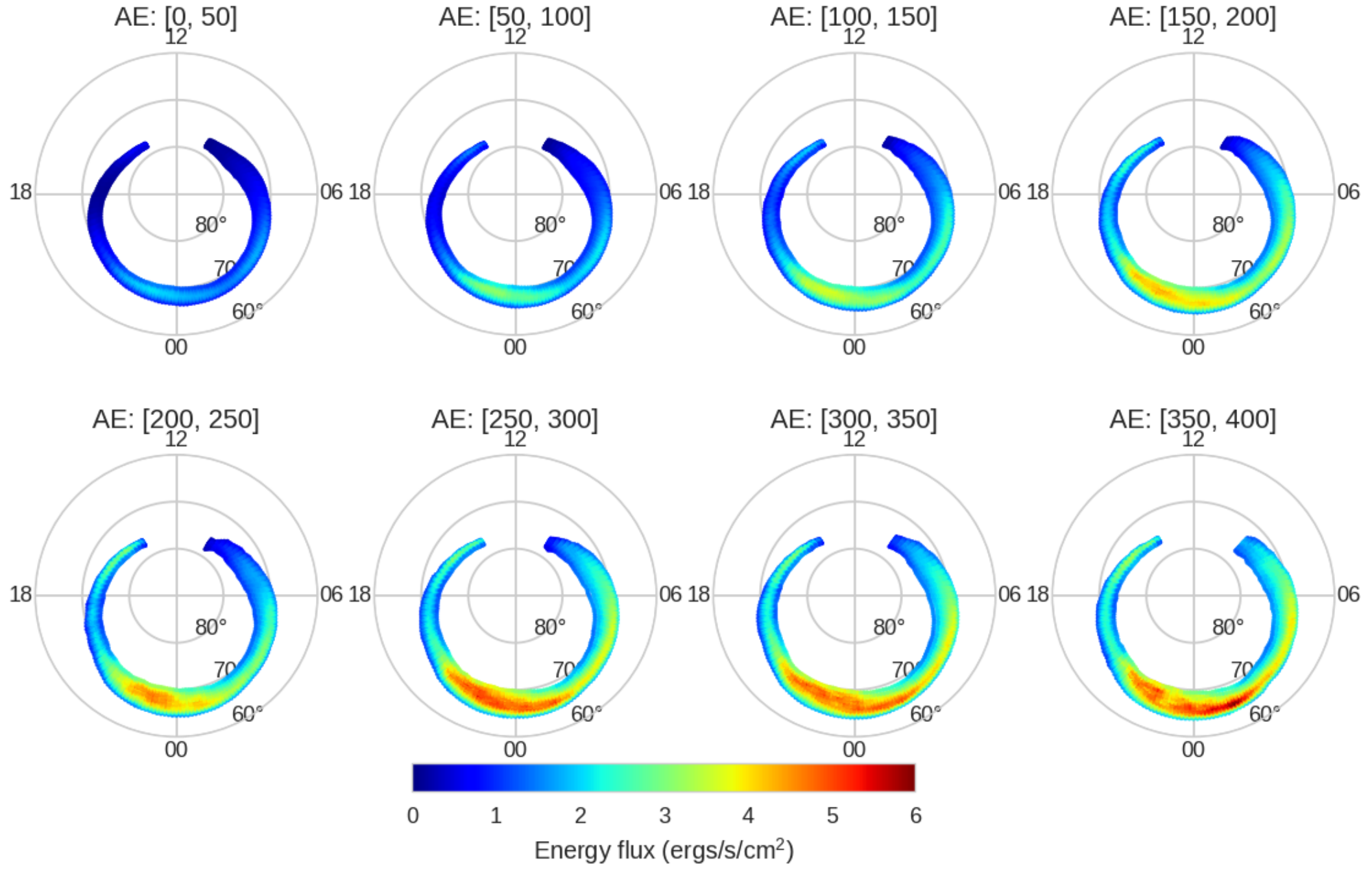
Used 9 locations within auroral oval in each MLT band, representing the percentage of energy within that band (10%, 20%, etc. moving from equatorward edge towards pole.)

Number of points in each MLT sector as a function of AE

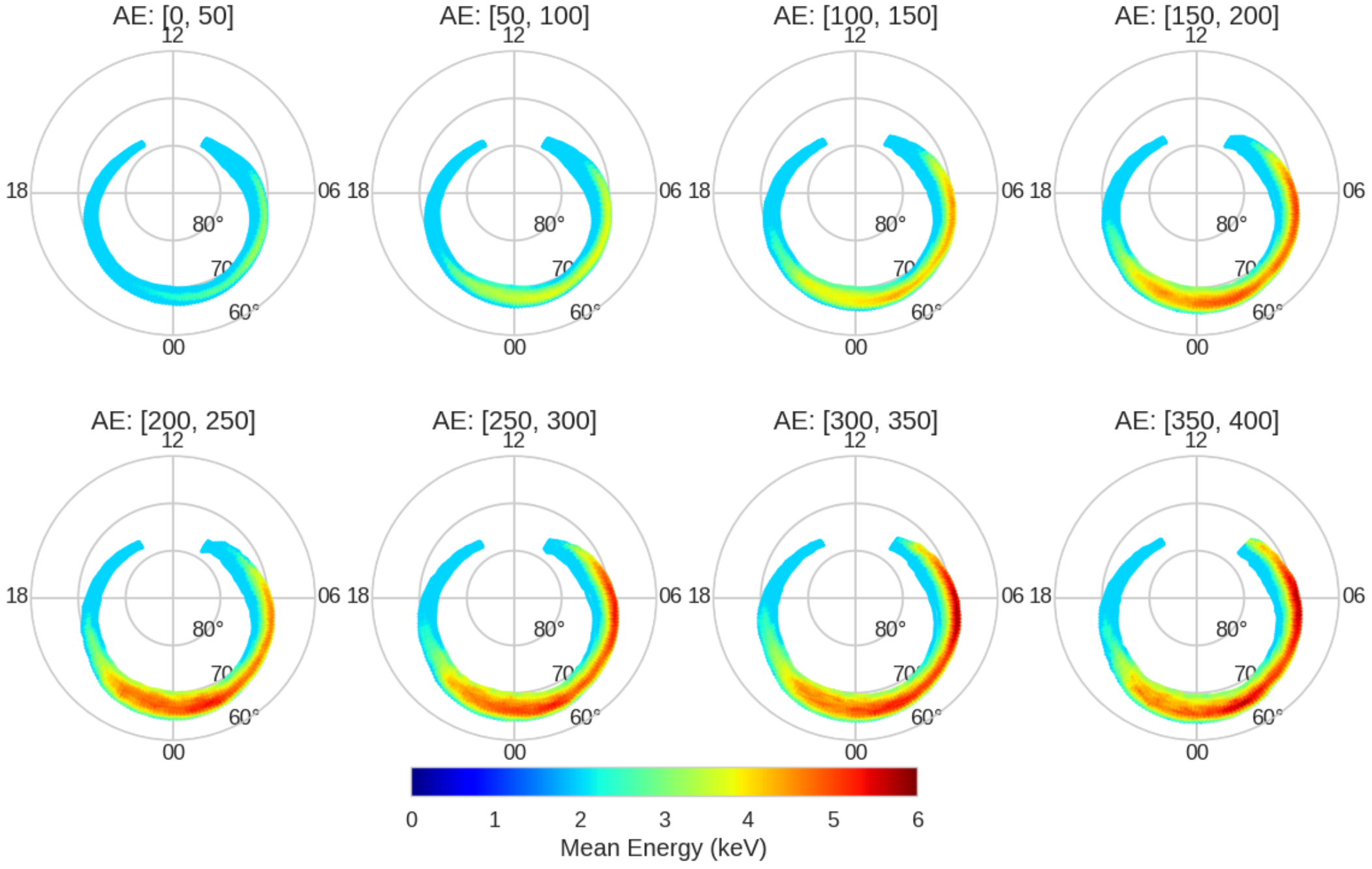
SSUSI not best source of data for cusp!



Raw Model Results (Energy Flux)



Raw Model Results (Average Energy)

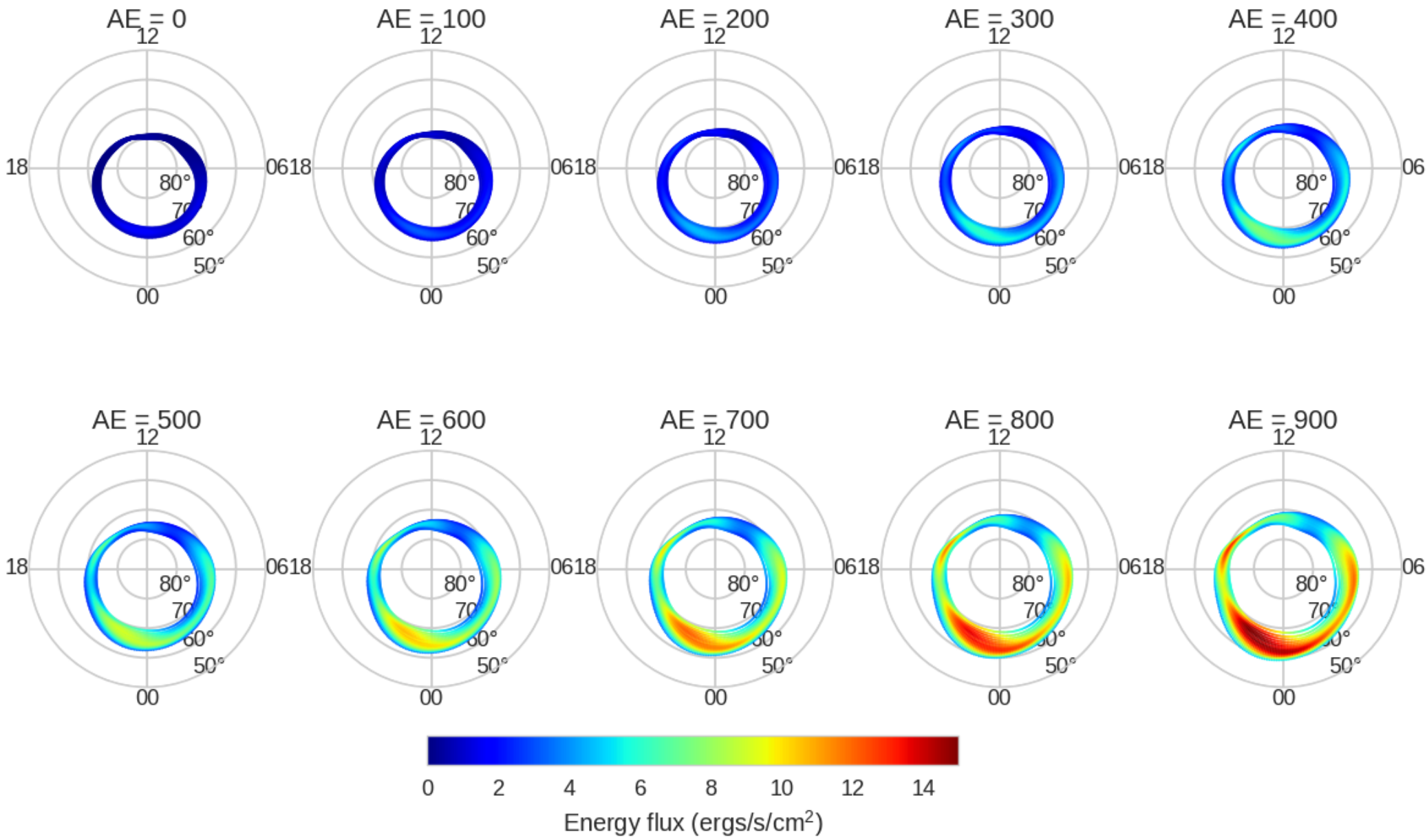


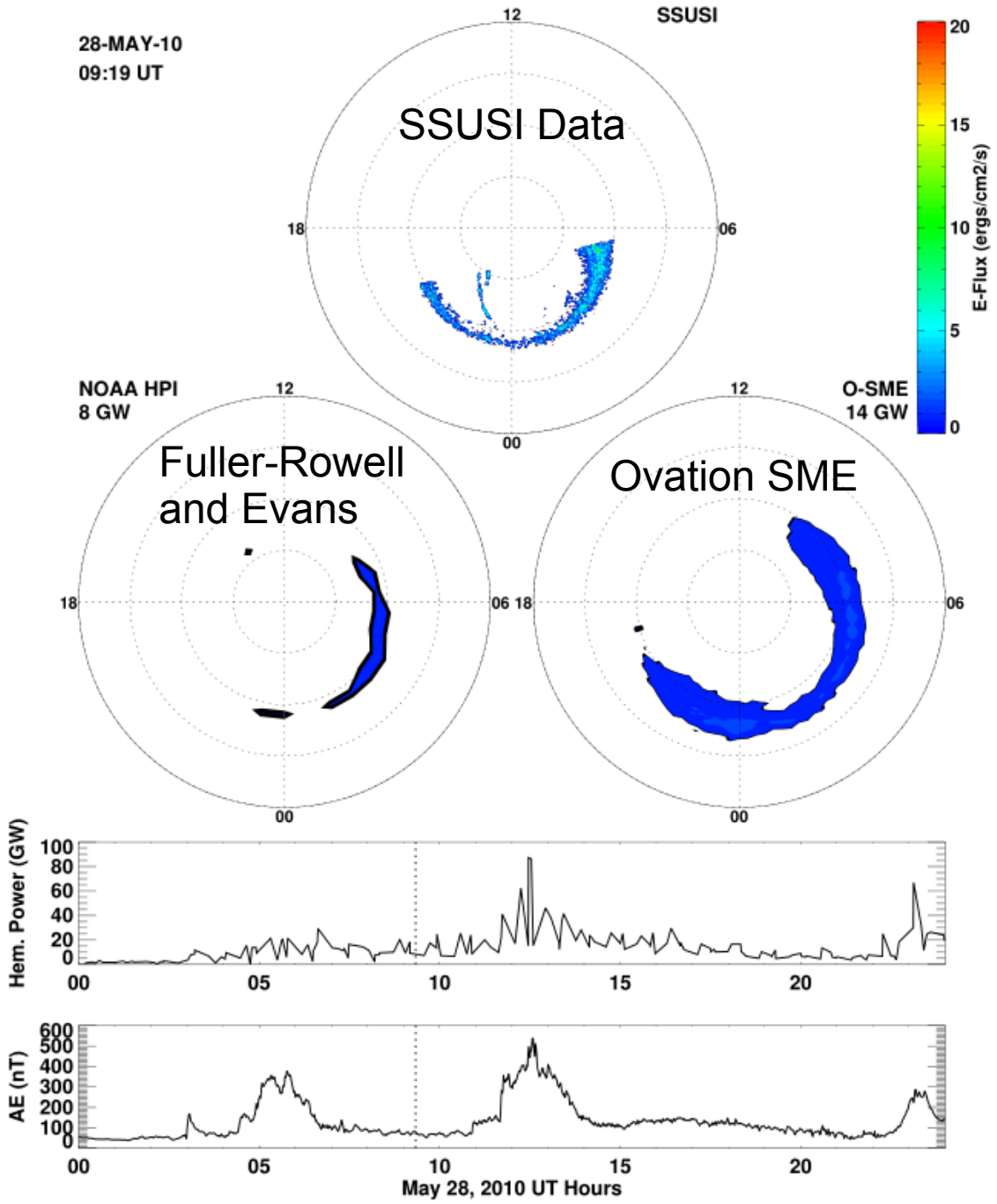
If more time…

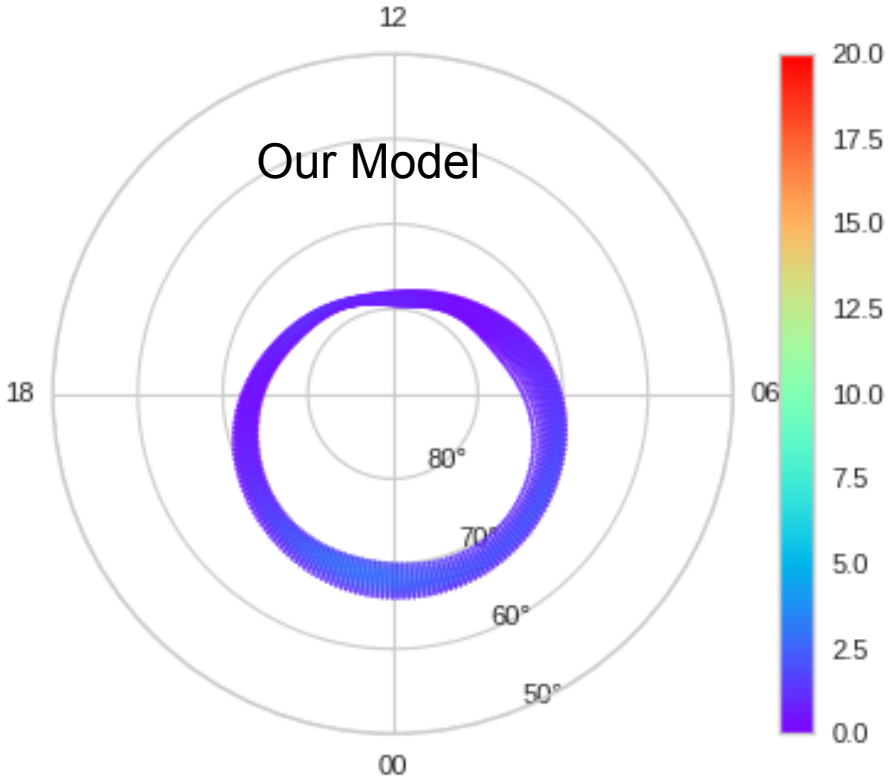
Small Problem?

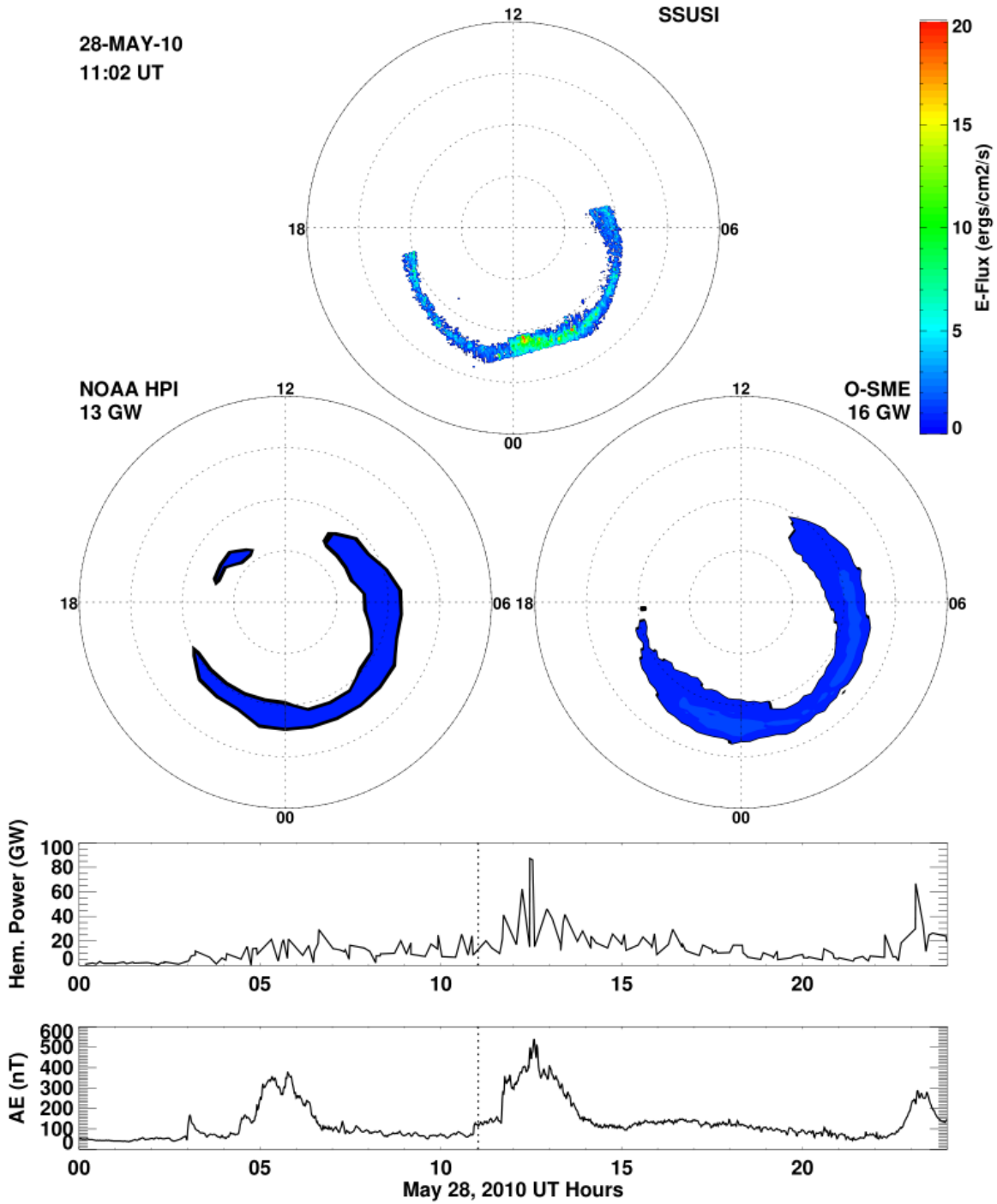
- Studies have shown that the hemispheric power increases linearly with AE
- This model doesn't
  - For first ~4 bins, it is linear (locations, strengths), but above AE ~200nT, strengths increase, but not at the same rate
  - Why is this the case?
    - Statistics?
    - Actual physics?
- What happens if we force the model to be linear?
  - For each of the points, fit linearly to first 4 bins, then extrapolate to higher AEs

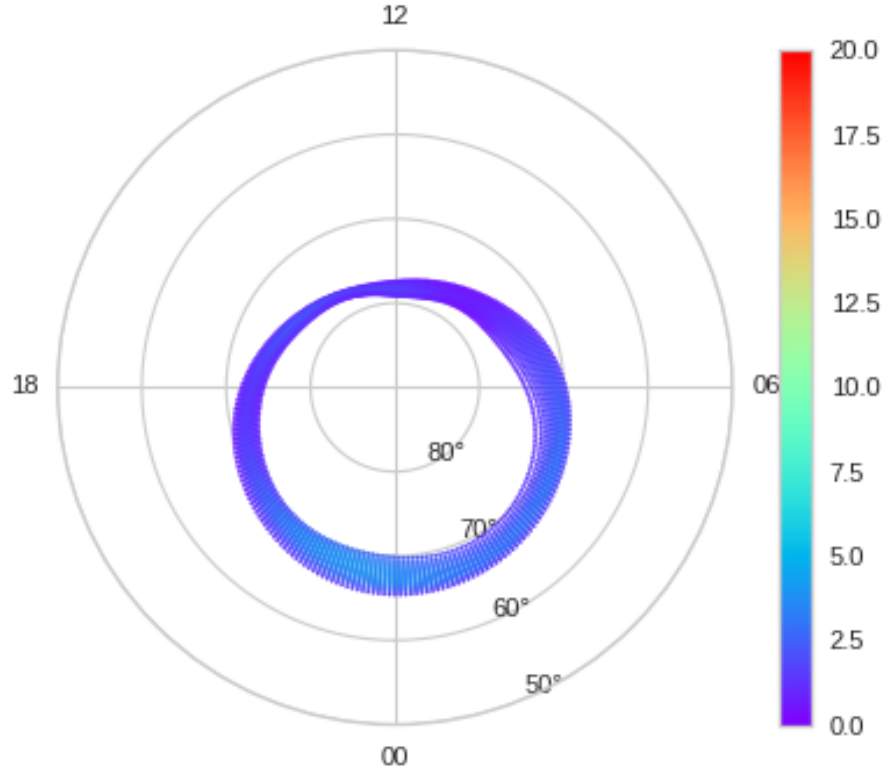
Linear Model Results (Energy Flux)

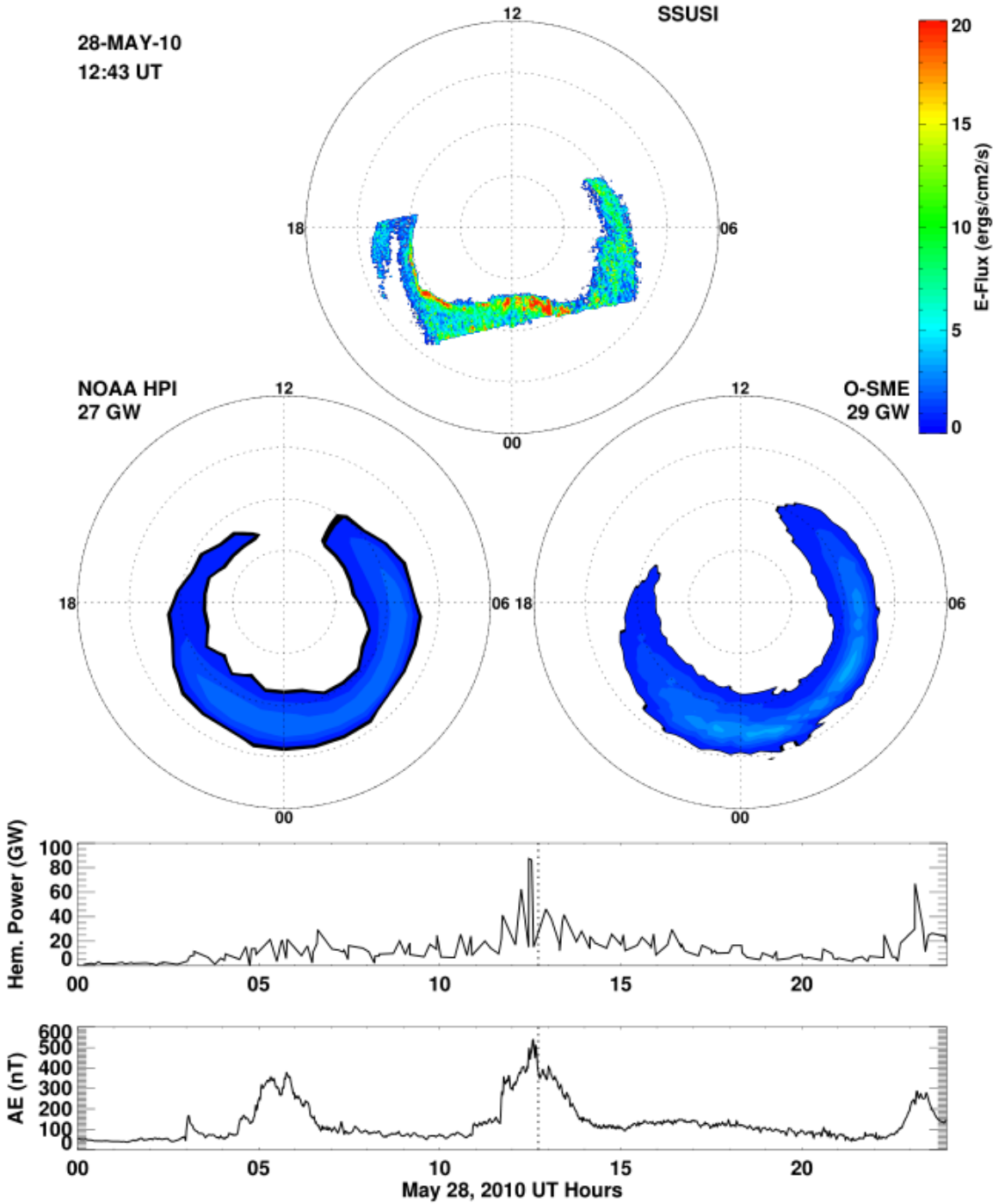


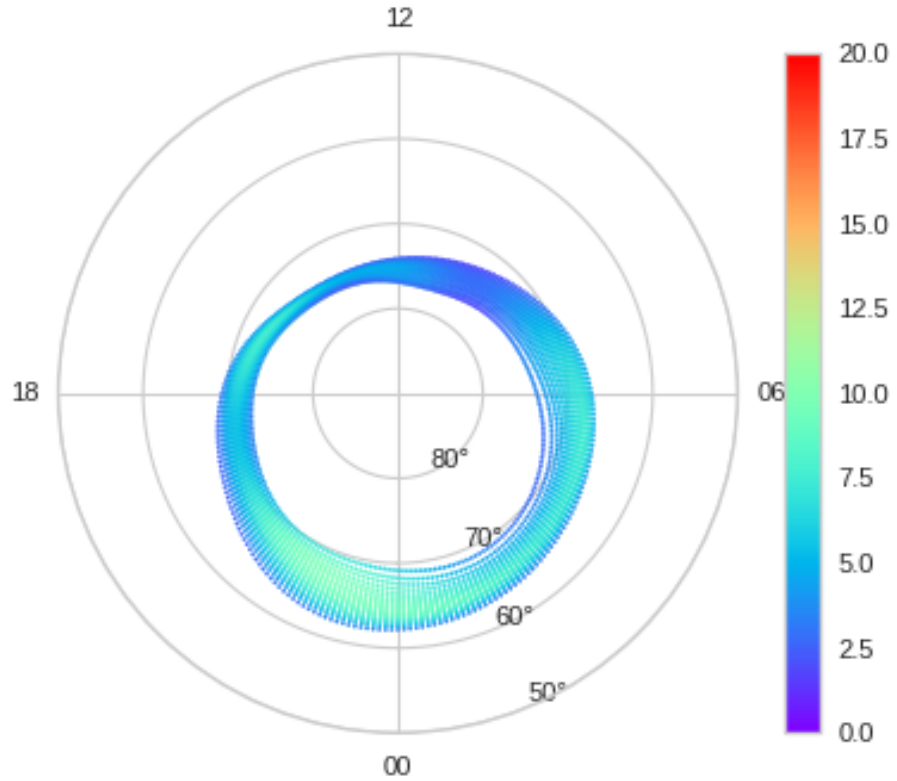

28-MAY-10
09:19 UT
SSUSI
SSUSI Data
E-Flux (ergs/cm2/s)
NOAA HPI
8 GW
Fuller-Rowell
and Evans
O-SME
14 GW
Ovation SME
Hem. Power (GW)
AE (nT)
May 28, 2010 UT Hours

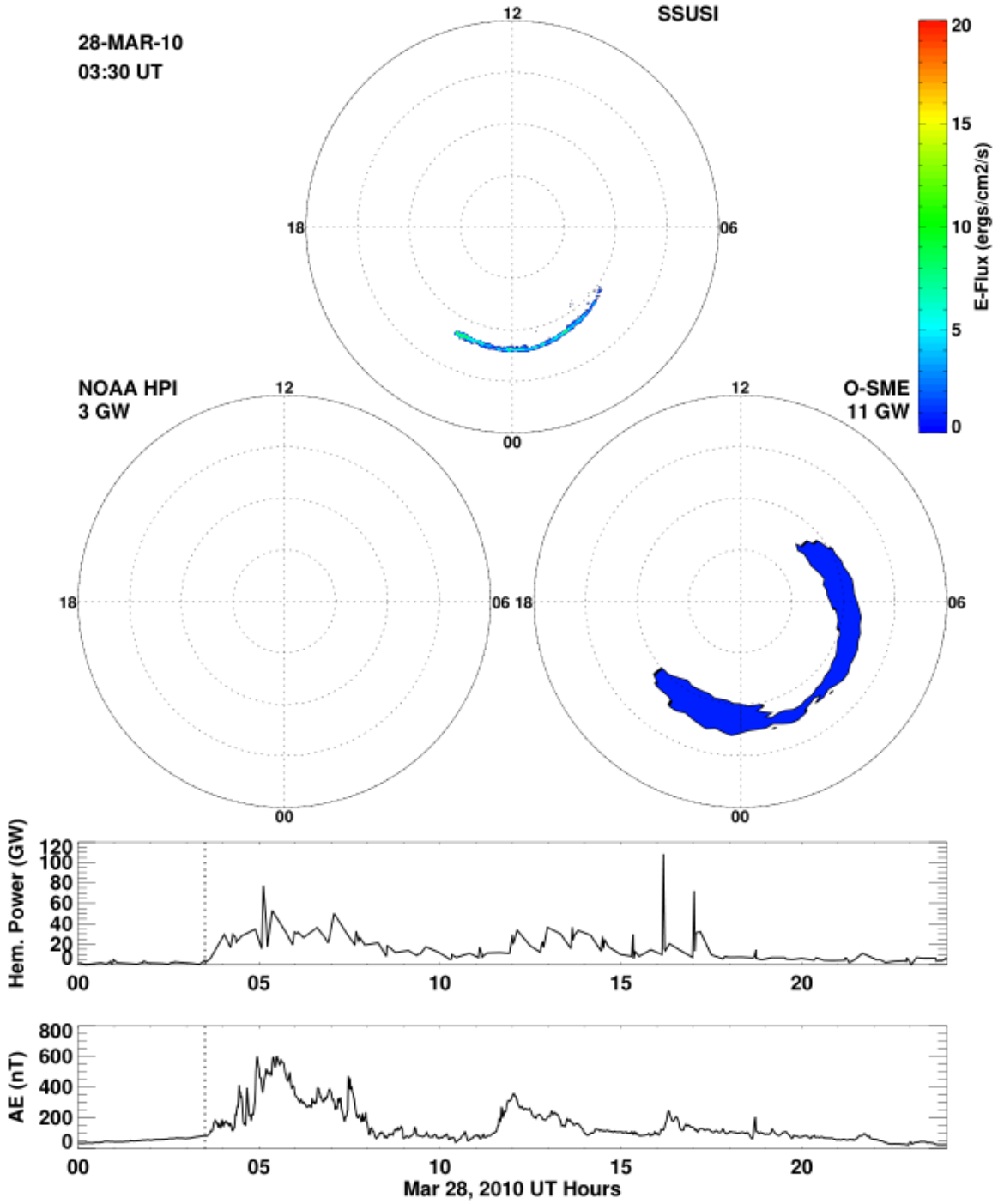

Our Model
80°
70°
60°
50°

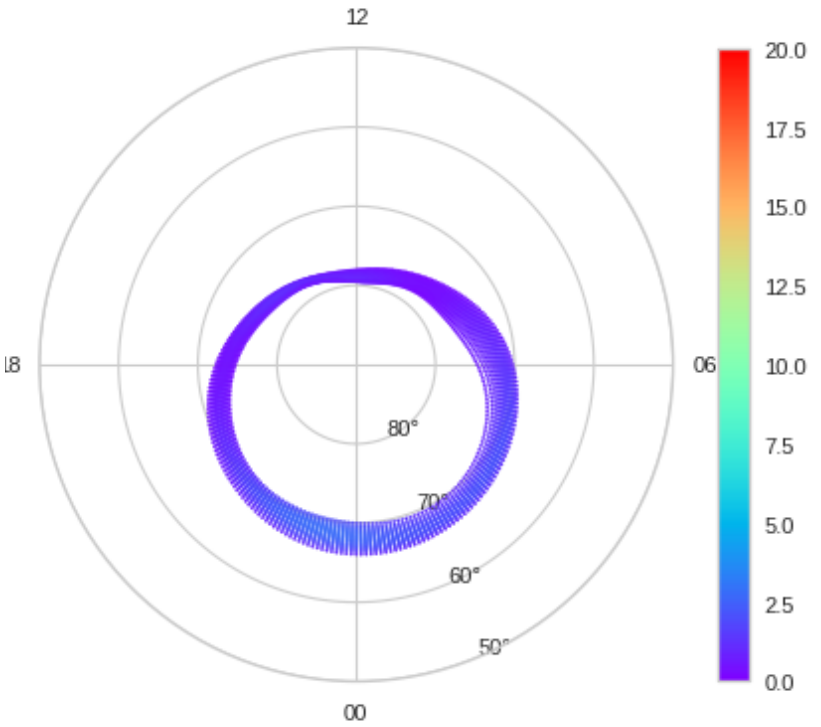

28-MAY-10
11:02 UT
SSUSI
E-Flux (ergs/cm2/s)
NOAA HPI
13 GW
O-SME
16 GW
Hem. Power (GW)
AE (nT)
May 28, 2010 UT Hours

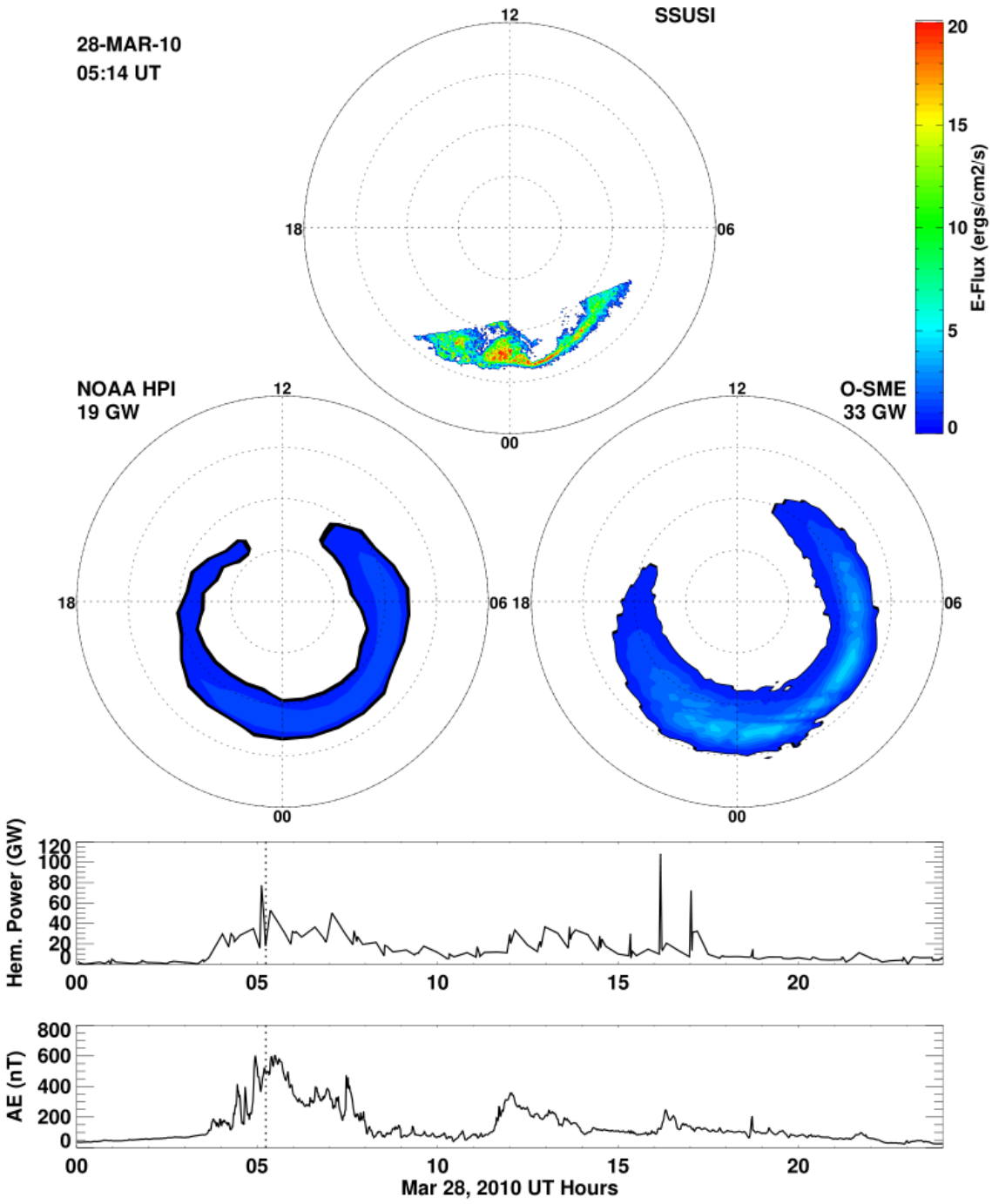

80°
70°
60°
50°

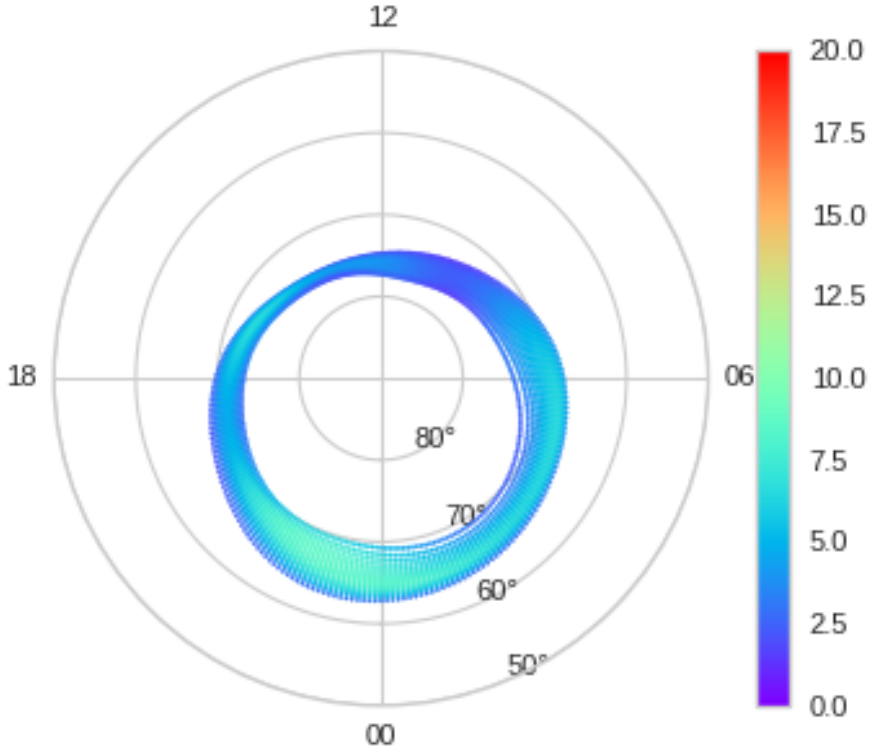

28-MAY-10
12:43 UT
SSUSI
E-Flux (ergs/cm2/s)
NOAA HPI
27 GW
O-SME
29 GW
Hem. Power (GW)
AE (nT)
May 28, 2010 UT Hours

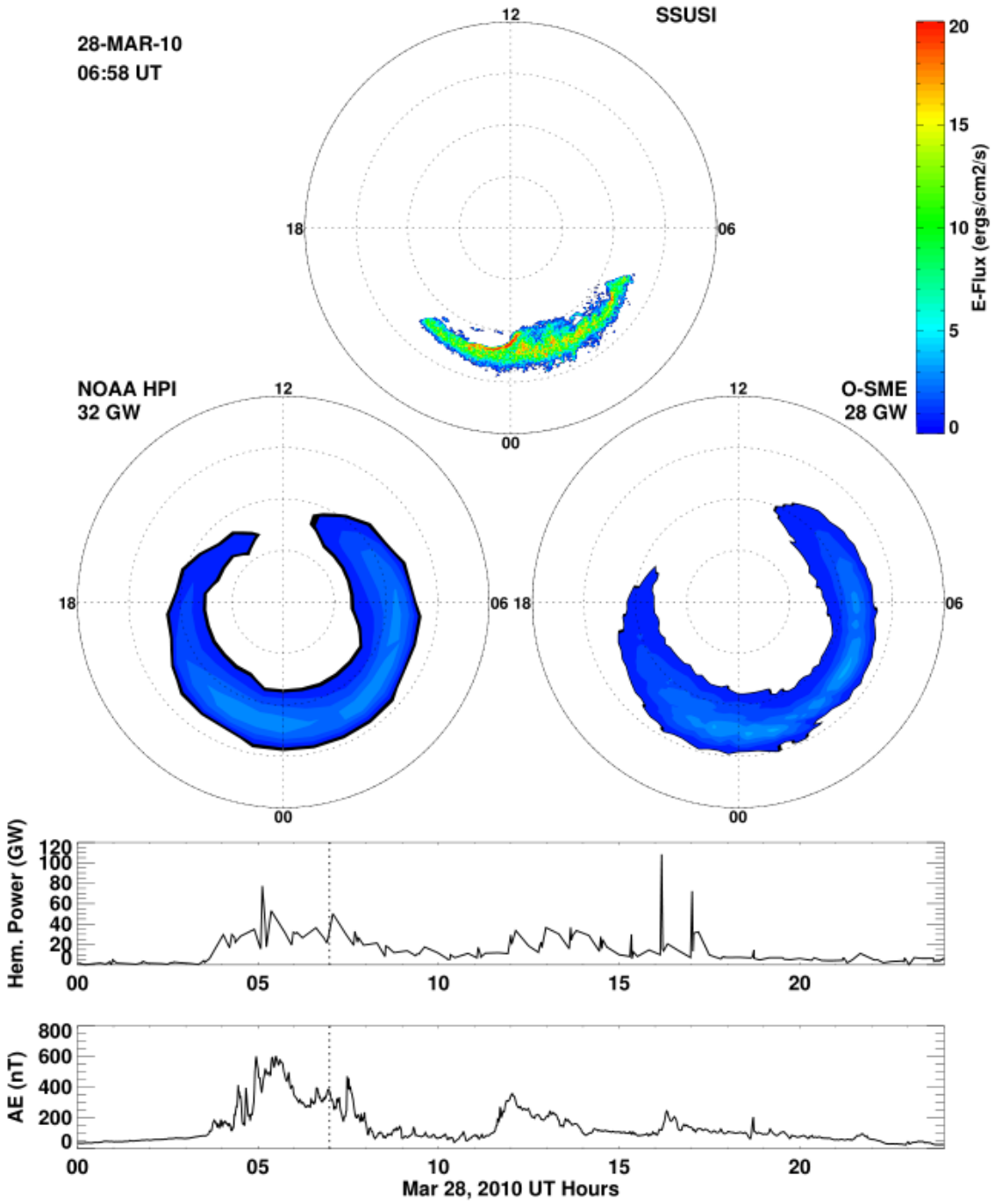

80°
70°
60°
50°

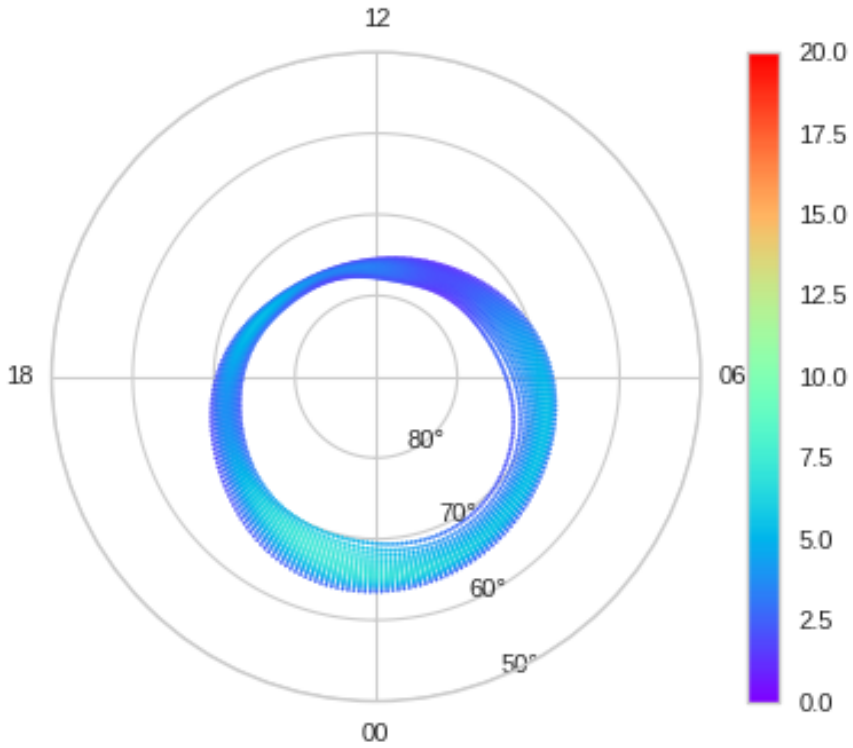

28-MAR-10
03:30 UT
SSUSI
E-Flux (ergs/cm2/s)
NOAA HPI
3 GW
O-SME
11 GW
Hem. Power (GW)
AE (nT)
Mar 28, 2010 UT Hours

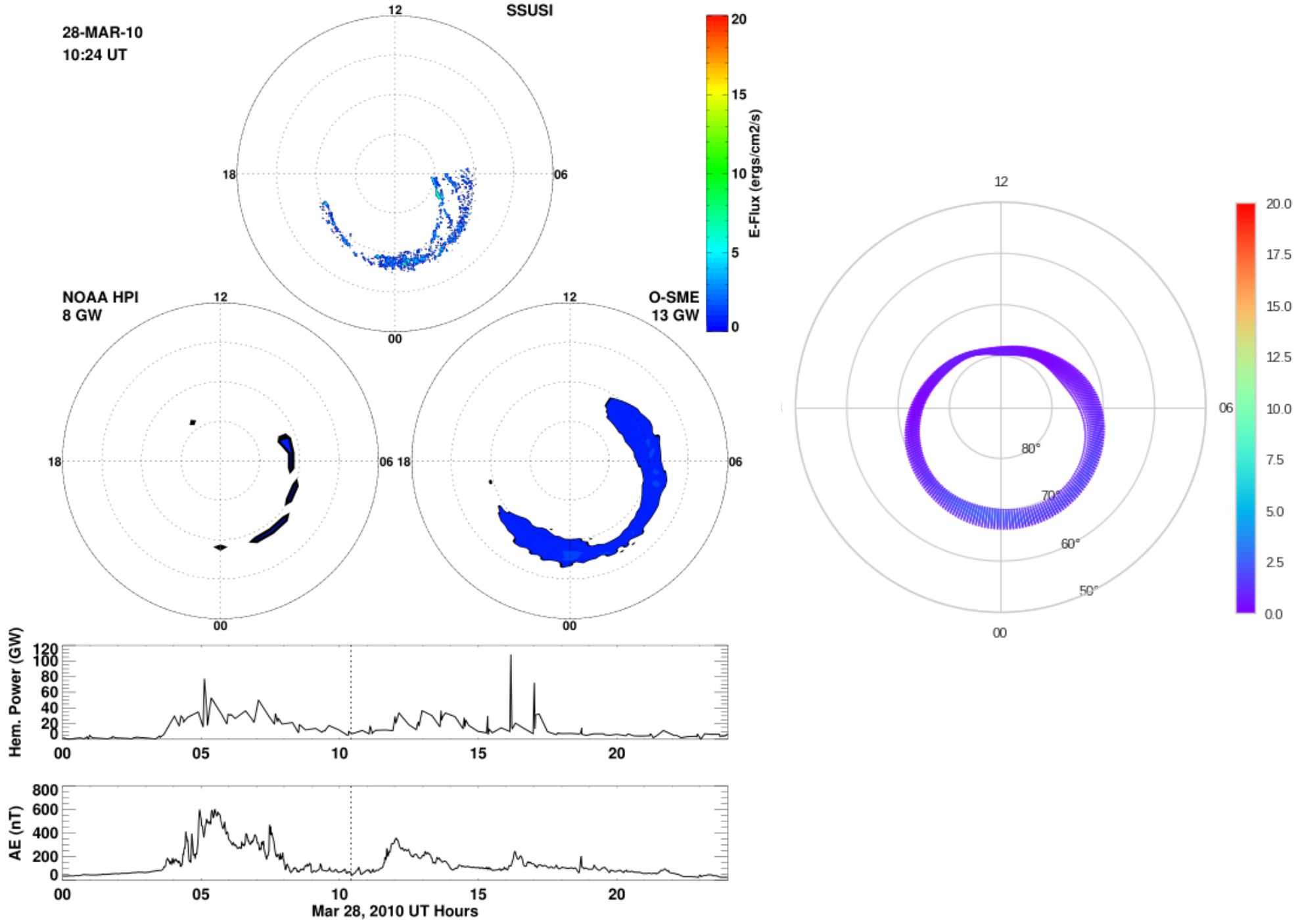

80°
70°
60°
50°


28-MAR-10
05:14 UT
SSUSI
E-Flux (ergs/cm2/s)
NOAA HPI
19 GW
O-SME
33 GW
Hem. Power (GW)
AE (nT)
Mar 28, 2010 UT Hours


80°
70°
60°
50°


28-MAR-10
06:58 UT
SSUSI
NOAA HPI
32 GW
O-SME
28 GW
E-Flux (ergs/cm2/s)
Hem. Power (GW)
AE (nT)
Mar 28, 2010 UT Hours


80°
70°
60°
50°


28-MAR-10
10:24 UT
SSUSI
E-Flux (ergs/cm2/s)
NOAA HPI
8 GW
O-SME
13 GW
Hem. Power (GW)
AE (nT)
Mar 28, 2010 UT Hours

Summary

- We have created a **simple** auroral model based on:
  - AE
  - Feature tracking based on where energy is being deposited in latitude
    - Keep track of locations, energy flux, and average energy
- Not really linear, but we need to figure out why
  - Non-linearity shows motion of the maximum energy input
  - Is this physical?
- How to do this better? Can we track features even better?