IMAGE FUV – Data products and analysis techniques

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MSSL
Overview of IMAGE FUV

• Far ultraviolet imager (120-190 nm)
• Three cameras
  – Wideband Imaging Camera (140-190 nm) – 256x256 px
  – 2x Spectral Imagers – 128x128 px
    • SI12 - Doppler shifted Ly-\(\alpha\) proton aurora (120 nm)
    • SI13 - Electron aurora (130 nm)
• Spin period of \(~2\) min
• Images obtained over \(~10\) s (WIC) or 5 s (SI) of each spin
Obtaining auroral images
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IMAGE Orbits

- 2000-2002: good northern coverage
- 2004-2005: good southern coverage
Example data

• 2001-01-10 movie
Pointing

- Where on Earth is each pixel pointing.
- Pointing is less reliable during the following times
  - 2001: 8th June – 21st Aug (159-233)
  - 2002: 21st May – 22nd Aug (141-234)
  - 2003: 9th June – 16th Aug (160-228)
- After 2002, spin axis began to cone – pointing is less reliable
Pointing

• 2005-07-09 movie
Pointing

• 2005-04-30 movie
Limitations

• WIC and SI13 do not reject dayglow
  – Automated dayglow removal is somewhat suspect

• Narrow channels mean dim aurora not always clear in SI12 and SI13
Analysis techniques using IMAGE FUV data
Plotting the data

- Plot of each channel
- Keograms
- Average intensity line plots

- Good for case studies, not so good for statistical analysis

From Grocott et al. (2004)

From Imber et al. (2007)

From Forsyth et al. (2009)
Data products and analysis

- Location of the open-closed field-line boundary
  - Boakes et al. (2009)
- Radius of the auroral oval
  - Milan et al. (2009)
- Detection of the isotropy boundary and it’s relationship with field-line stretching
  - Blockx et al. (2005)
- Average emitting particle energy and auroral energy flux
  - Hubert et al. (2001)
OCB determination
Boakes et al. (2008)

- Poleward boundary of auroral oval is proxy of OCB
- Determine OCB from adapted method of Carbary et al. (2003)
- Comparison of OCB proxies at different wavelengths showed variations in OCB location with MLT
- SI12 fit gave better agreement with DMSP in predawn sector
- WIC/SI13 gave better agreement with DMSP everywhere else
Radius of the auroral oval
Milan et al. (2009)

• Find the intensity of SI12 in a circle centred on 85° MLAT, -2° MLON
• Radius of highest intensity indicates radius
• Statistically correlated with Sym-H and open-flux content
• Easier to determine than OCB
Isotropy Boundary and field-line stretching
Blockx et al. (2005)

- Transition from bounce-trapped to pitch-angle scattered ions
- Corresponds to b2i boundary in DMSP data
- Corresponds with field-line stretching at geosynchronous orbit
- Maximum in SI12 MLT profile gives similar results
- Results are valid for 00 MLT ± 4 MLT
Auroral energy flux
Hubert et al. (2001)

• Determined detector efficiency versus auroral particle energy
• Ratio of SI13-WIC gives electron energy
• Proton flux determined directly from SI12 based on aurora models
• Dependant on models and model inputs, particularly proton energy