Examples of New HMI Magnetic Data Products/Science

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The Takeaways

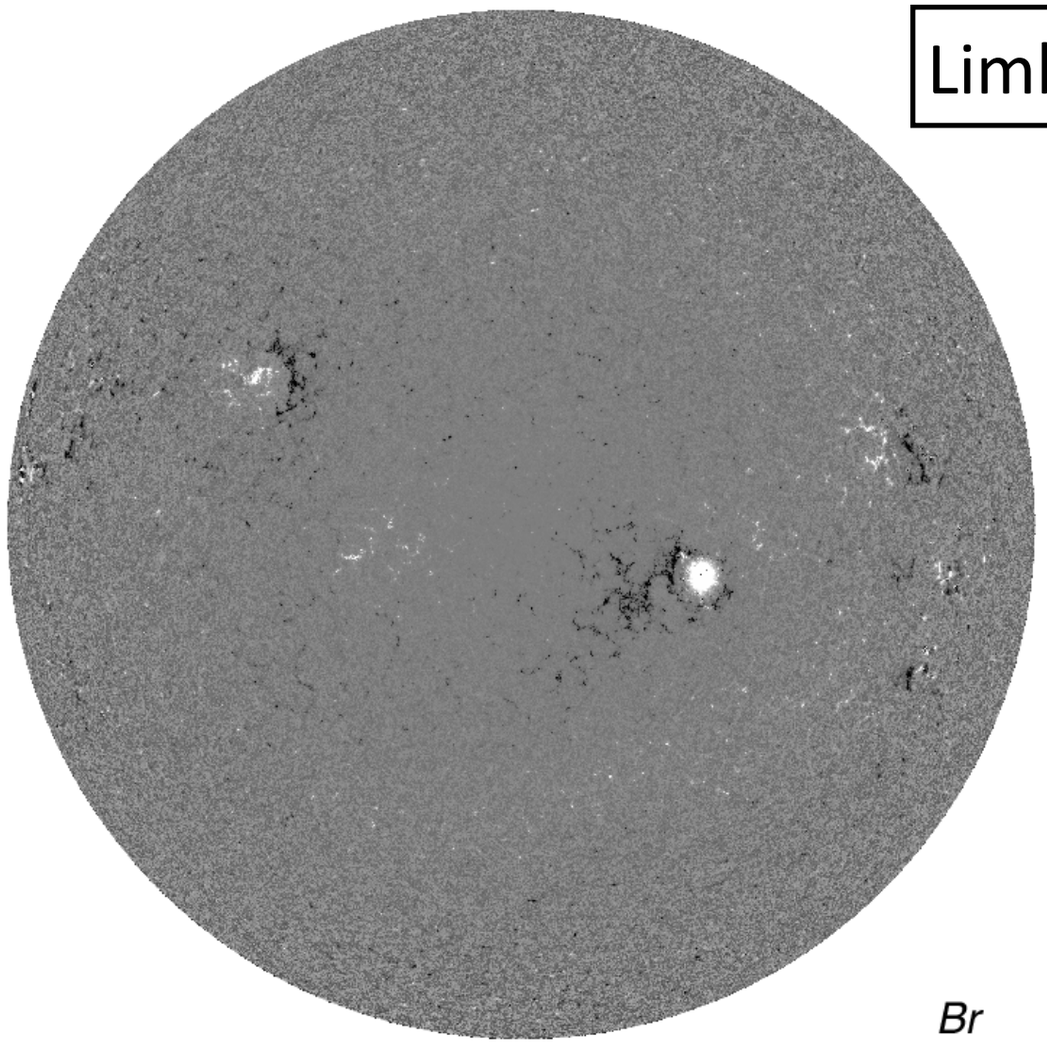
- New HMI data products for new scientific opportunities!
  - e.g. 135s high-cadence vector magnetograms.
- The systematics: what are the effects and how to deal with them?
  - I'll show an example; Aimee will show several.
- Try the data and talk to us!
  - We are working on improving the calibration. Community feedback is crucial.

Going-ons: an Incomplete List

- Full-disk, disambiguated 720s vector magnetograms
- 135s high-cadence vector magnetograms (P6.28)
- Polar field measurements
- LOS and vector synoptic maps & synchronic frames with polar field correction
- Coronal field models (PFSS @ LMSAL; daily MHD @ Stanford; NLFFF @ CCMC)
- Magnetic topology: *Q*-maps (with PSI, P10.11)
- “Electro-grams”; “calibrated” Doppler (with CGEM team)

1. Full Disk 720s Vector Data

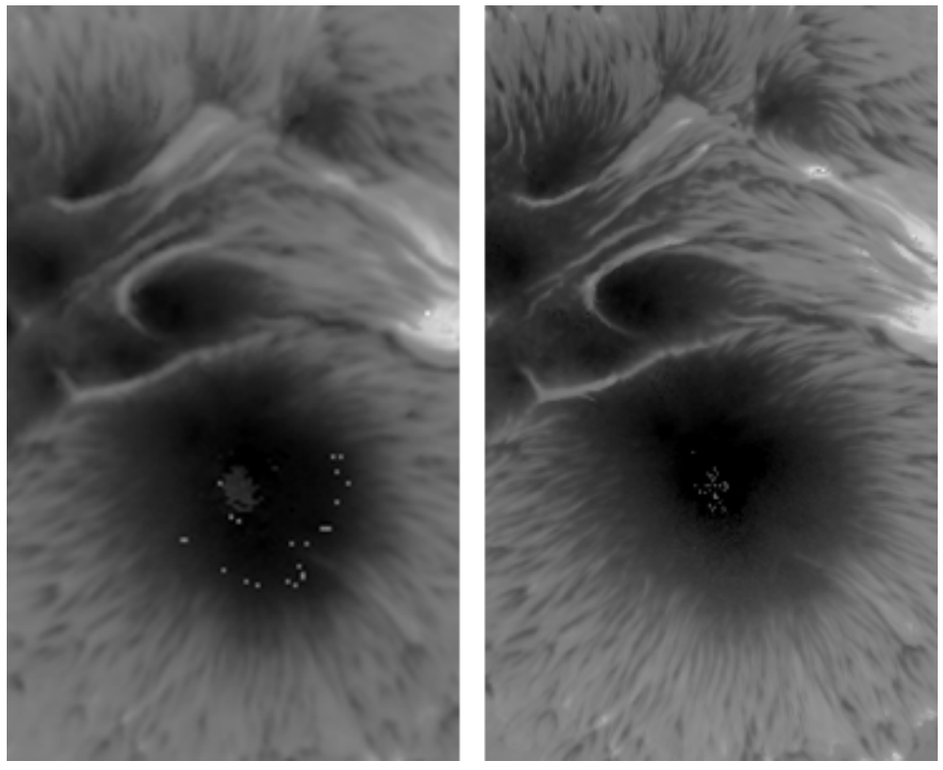
- Fully disambiguated, available for the entire mission
- Software: SSWIDL modules (hmi_disambig.pro, hmi_b2ptr.pro); JSOC export tools (hmib2ptr, resize, maproj, im_patch, aia_scale…)



Br

Umbrae

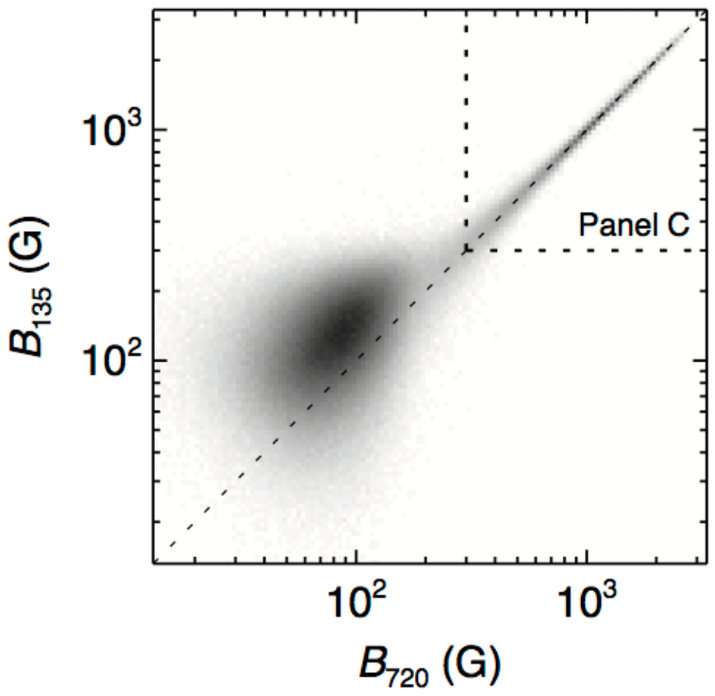
AR12192

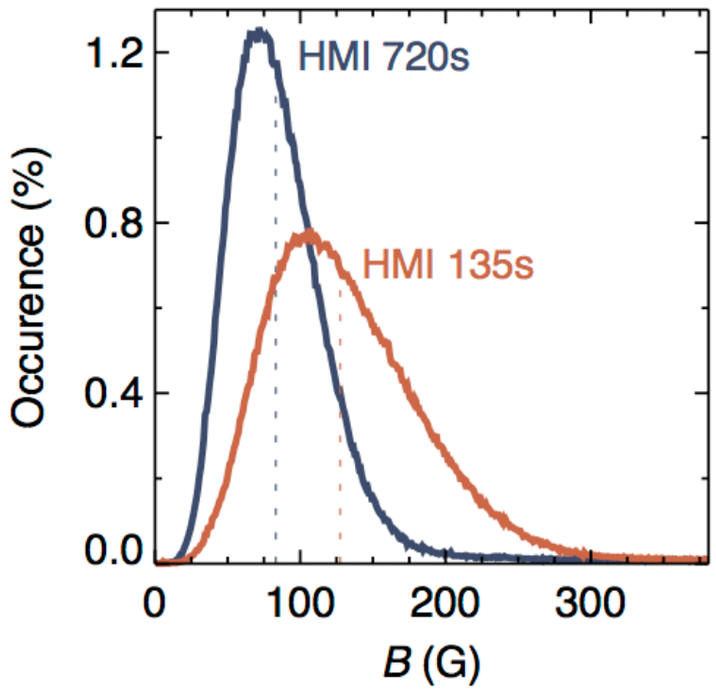


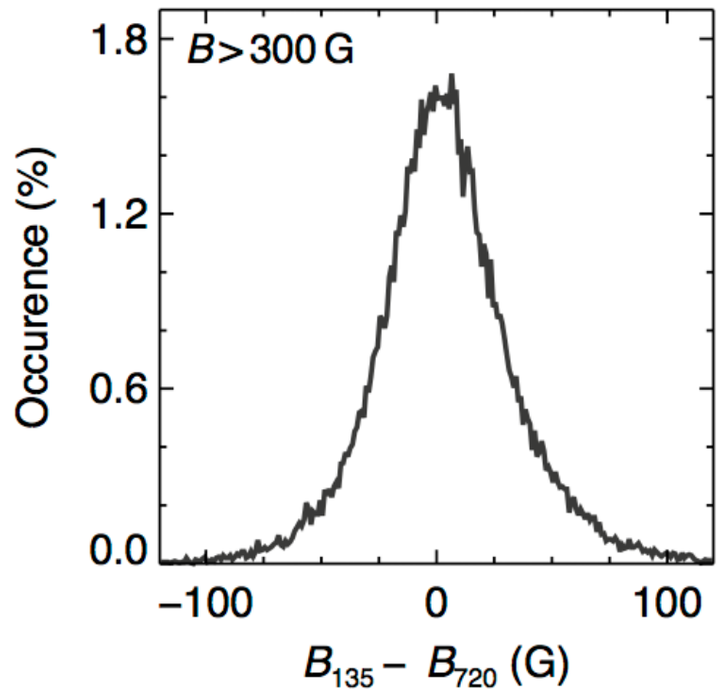
SDO/HMI Hinode/SP

2. High-cadence 135s Vector Data

- 135s cadence with ~5 min averaging; test series created for AR11158
- Noise characteristics as expected; strong field (B > ~300 G) consistent with 720s data
- Good for eruption-related study: we can <u>assess the systematic effects empirically</u>

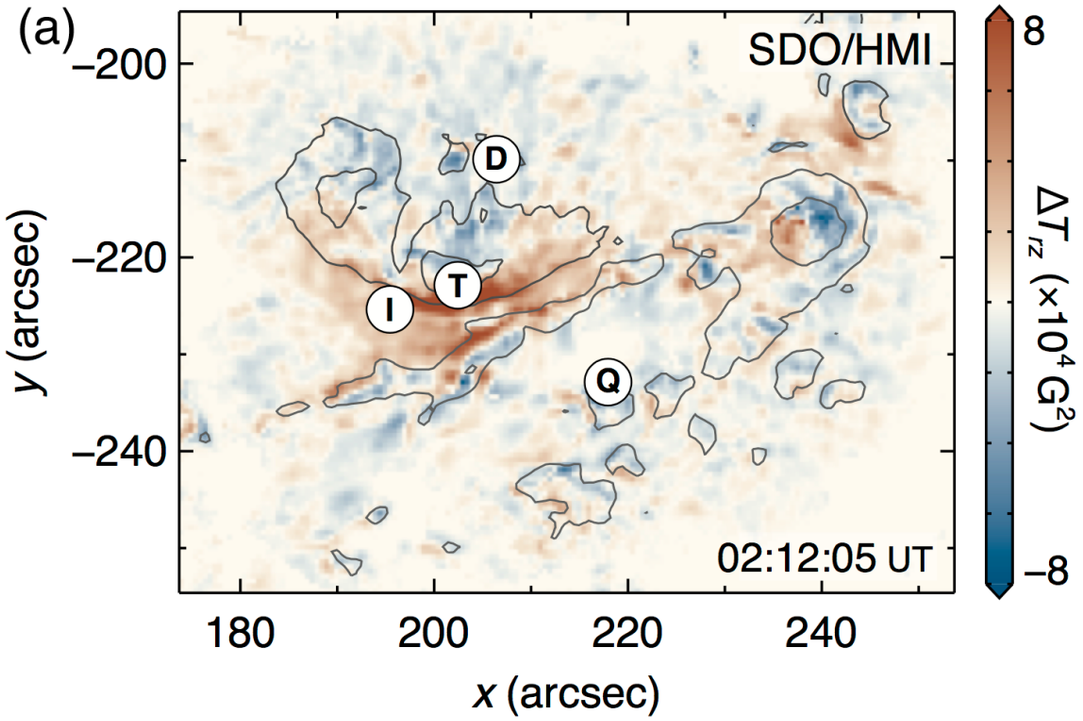




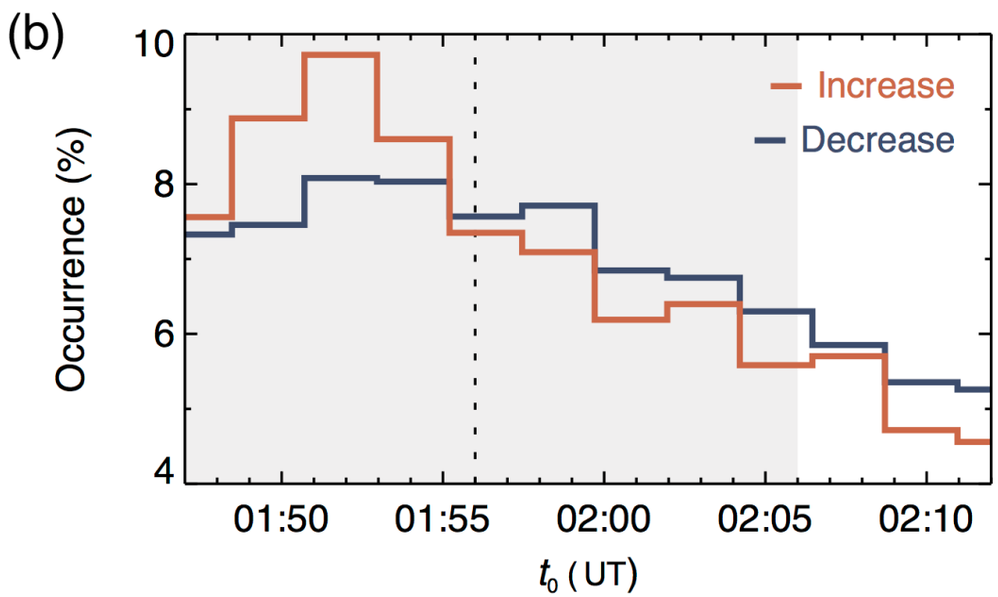


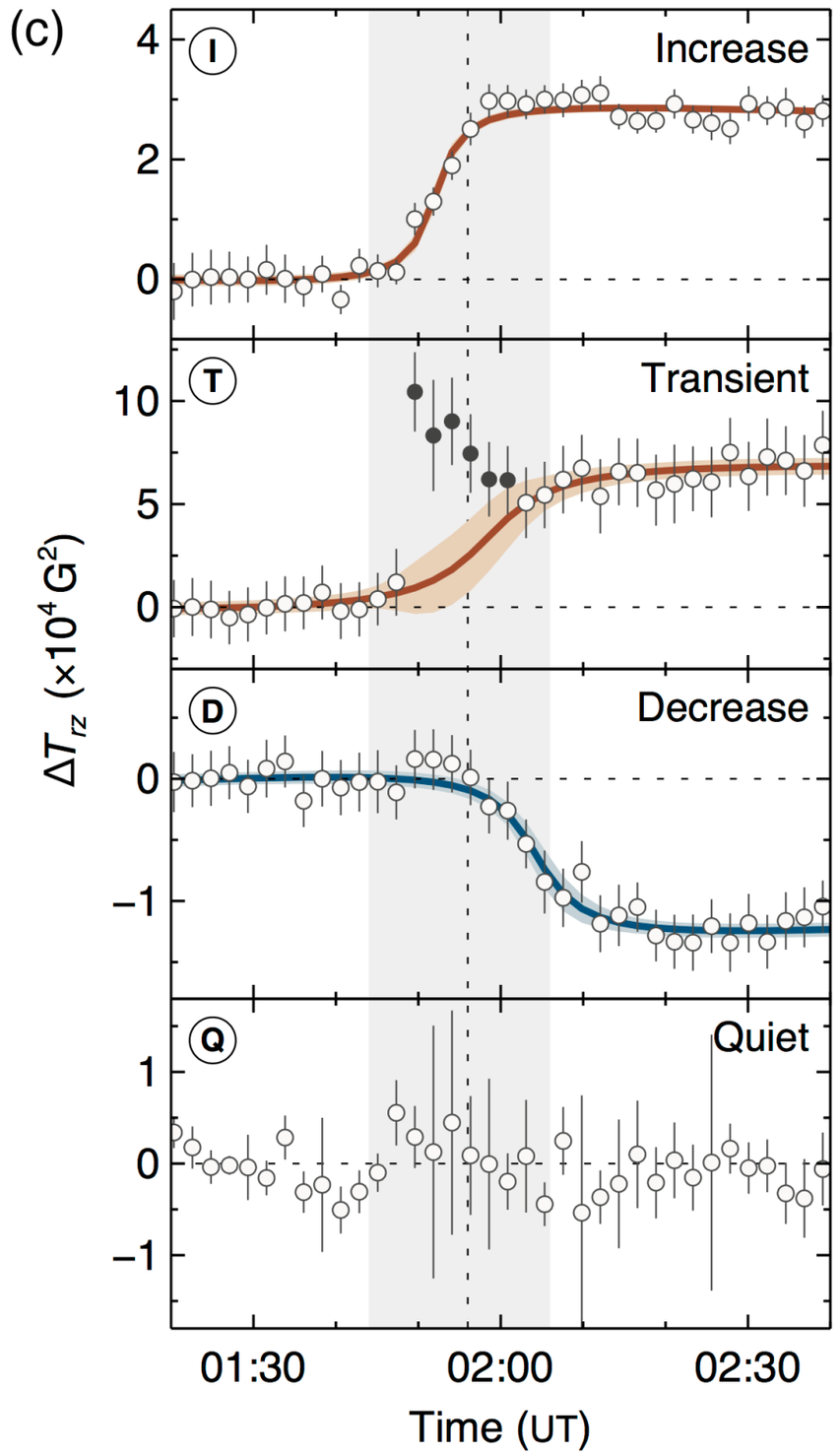
Sun et al. 2016 (P6.28)

Uses: eruption-related field change



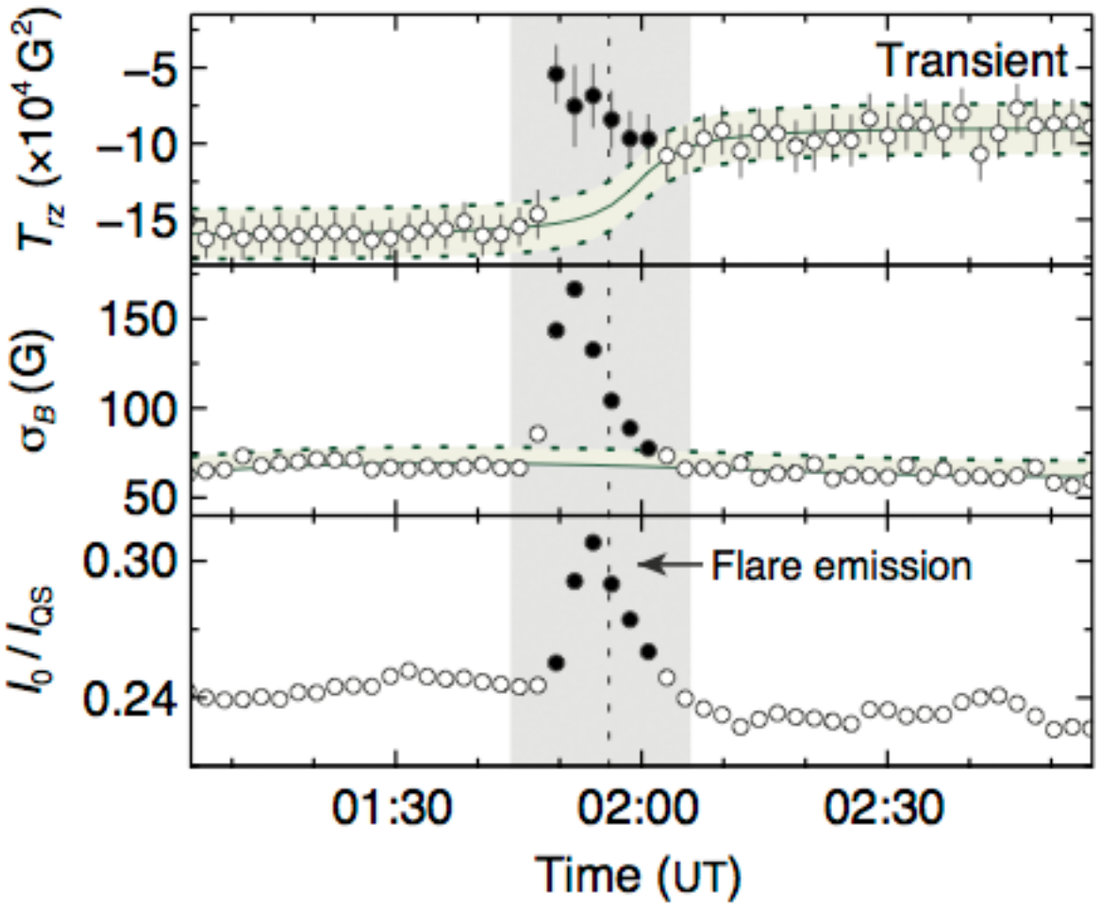
$$T_{rz} \simeq (B_h^2 - B_z^2) / 8\pi$$

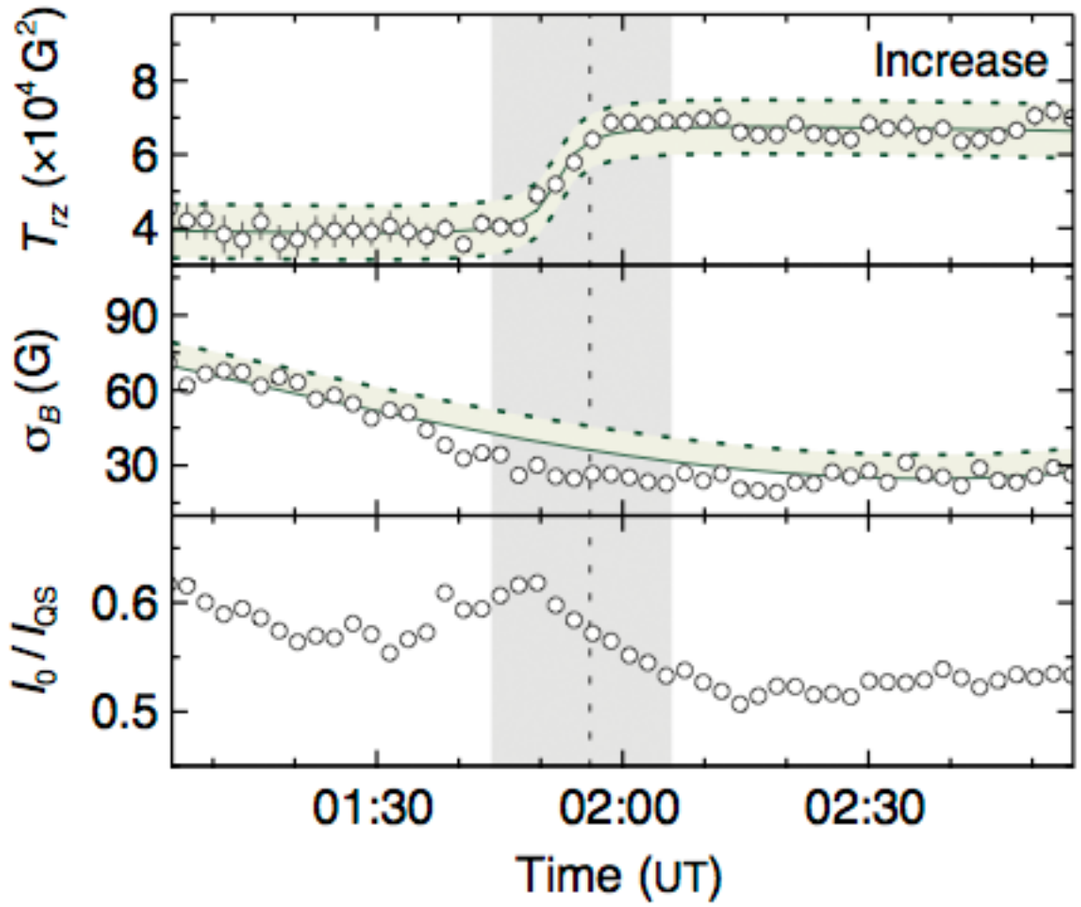




Sun et al. 2016 (P6.28)

Science of Systematics: flare-transients from WL emission

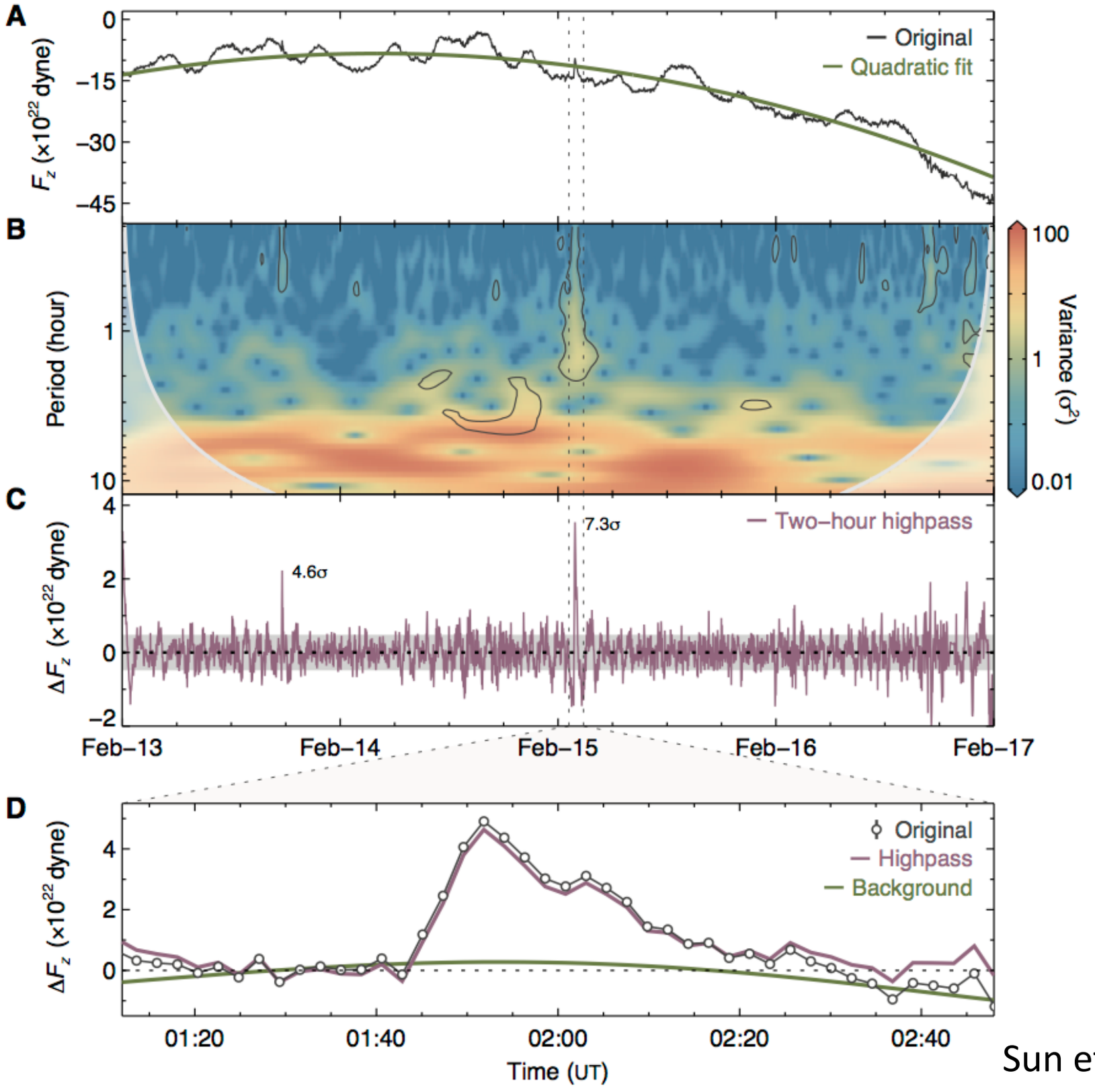




- Identifying flare-transient pixels (spatially and temporally resolved)

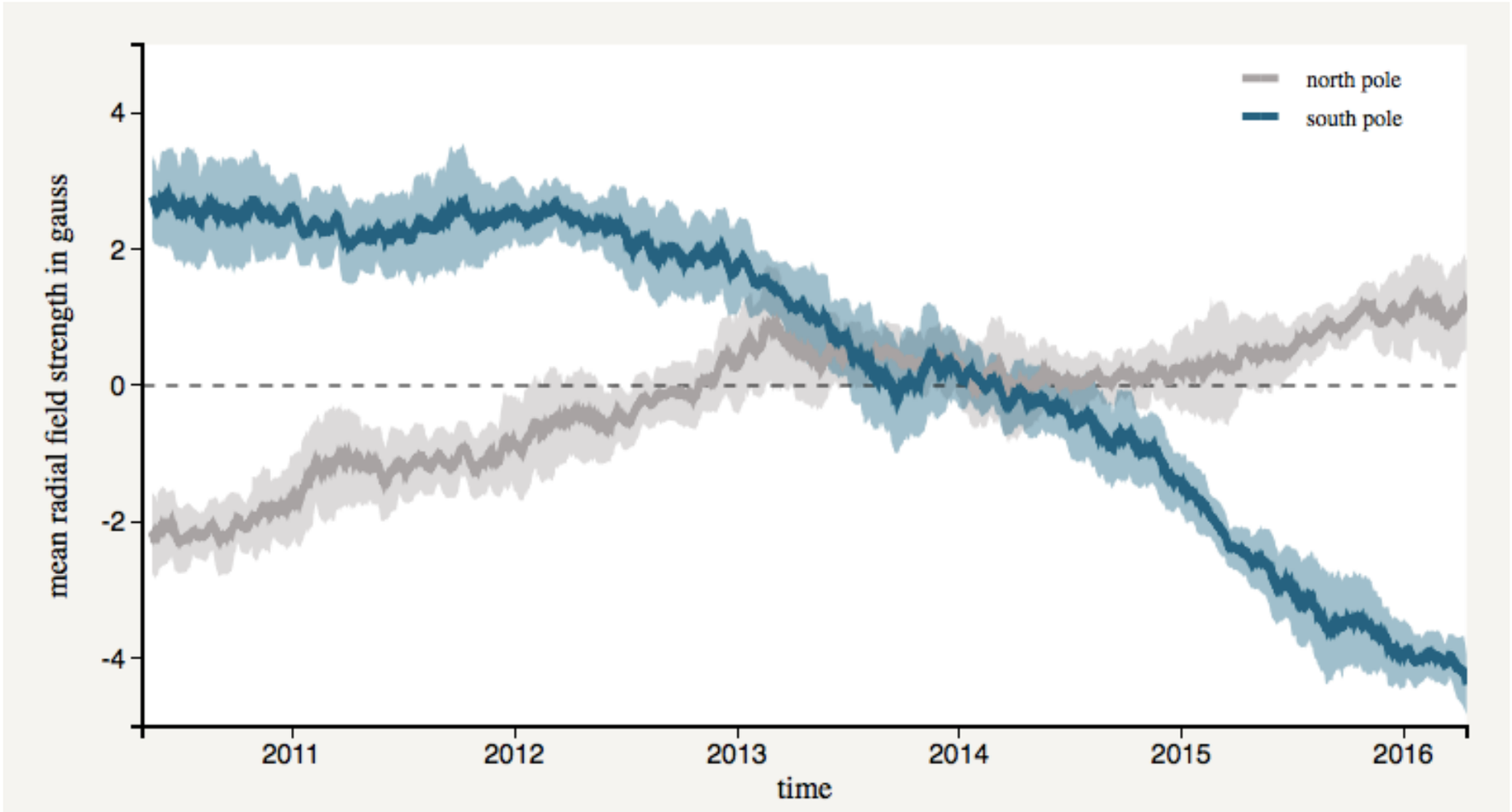
Sun et al. 2016 (P6.28)

Systematics: orbital-velocity-related periodicity



Sun et al. 2016 (P6.28)

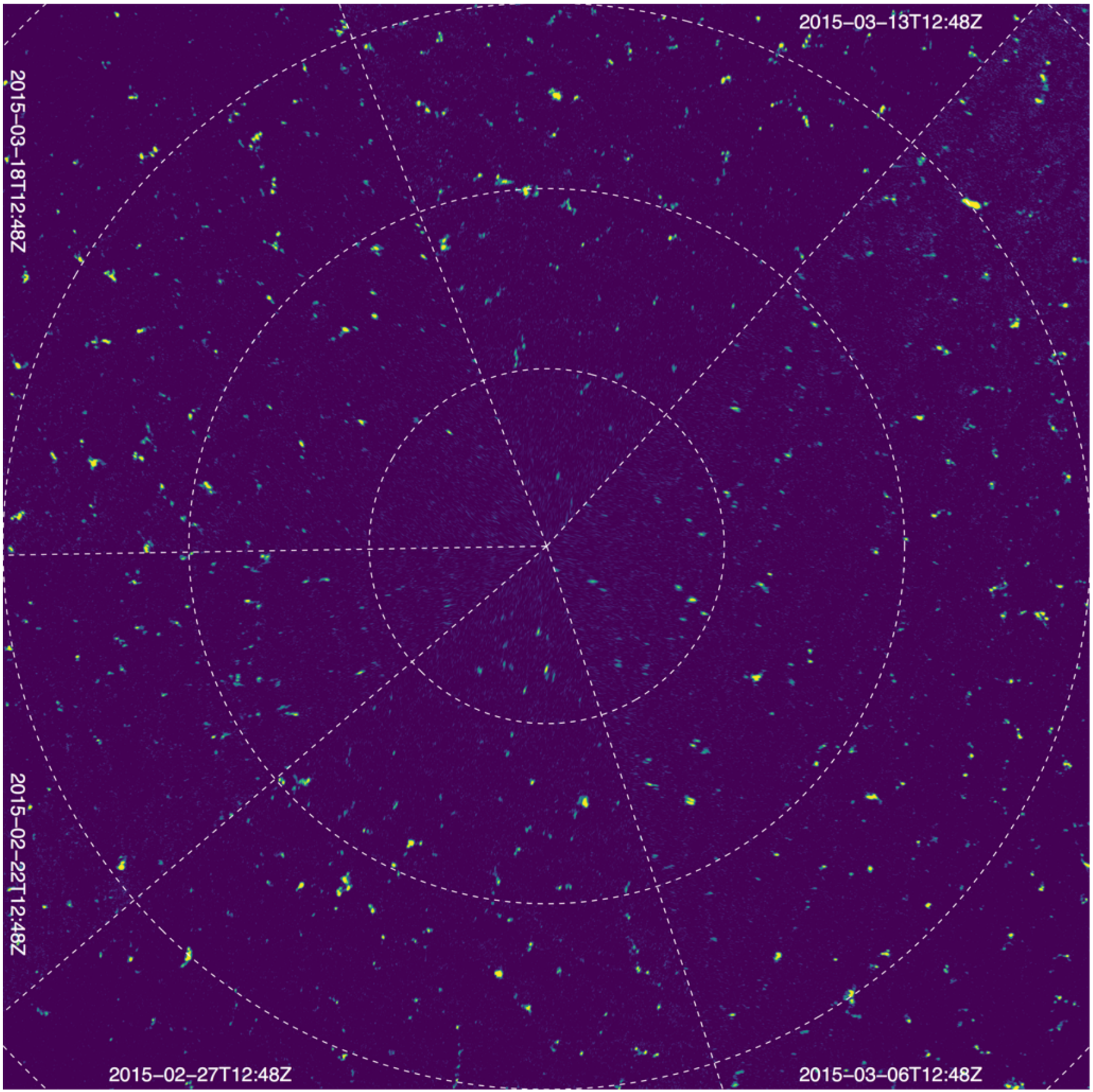
3. Polar Field



- HMI LOS result agrees well with WSO and other cycle proxies
- Cycle 25 may be similar to 24; N/S extremely out of phase so far

http://jsoc.stanford.edu/data/hmi/polarfield/

Sun et al. 2015



- Vector polar field from HMI: many elements have polarization > 5σ after 96 min <u>deep averaging</u>
- What is the true open flux from the polar region?

Sun et al. 2015

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