Active Longitudes over Three Solar Cycles

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Outline

- Irradiance synoptic image maps
- Longitudes of peak chromospheric activity
  - Current solar cycle
  - Previous solar cycles
- Photosphere, Transition Region, and Corona
Synoptic Image

Example from V.V. Zharkova

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Synoptic Time Series

From DeToma, White, & Harvey (2000)
Synoptic Irradiance

Ca II K image from Meudon Observatory March 6, 2003

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Synoptic Irradiance

Color scale is relative to lowest activity within each Carrington Rotation

Peak activity drifts in Carrington longitude from one rotation to the next.

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Rise of Cycle 23

Same time range as DeToma et al. image series of rising phase of cycle 23.
Magnetic Activity and Irradiance
Descending Solar Cycle “Map”

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Highlight most active longitudes
Highlight peak activity per CR
Highlight peak activity per CR
Select peaks from 2004-2005
Linear fit to 2004-2005
Apply derived period mod 360
Active longitude persists

Two active longitudes present (13 day period)
Active longitude persists

Two active longitudes present (13 day period)
New activity is 180 degrees away from previous active longitude

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Are all solar cycles the same?
Apply same fit to previous cycle
Apply same fit to two cycles ago

from Svalgaard & Wilcox (1975)
Active Longitude Histograms

Histogram could be improved by excluding rising phases.

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Other Irradiance Datasets?

- Photosphere
  - TSI
- Transition Region
  - Lyman alpha (H I 121.6 nm)
  - He II 30.4 nm
- Corona
  - Fe IX 17.1 nm
Sunspot darkening not as long-lived as active network.
Transition Region (Ly-α)
Lyman alpha with fit

Period is within 1 sigma of the MgII result.
Long-term Lyman alpha
Corona Fe IX (17.1nm)

SDO will greatly improve this data record!

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Summary

- Irradiance time series data can be viewed as a synoptic map.
- Activity with a period of 26.4 days is seen in the descending phase.
- Activity at this same longitude band as been persistent during the last 3 solar cycles.
Backup Slides
F10.7 cm

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Transition Region HeII

Carrington Rotation Time Series

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Full SOHO SEM time series