

Vitalizing Four Solar Cycles of Kitt Peak Synoptic Magnetograms

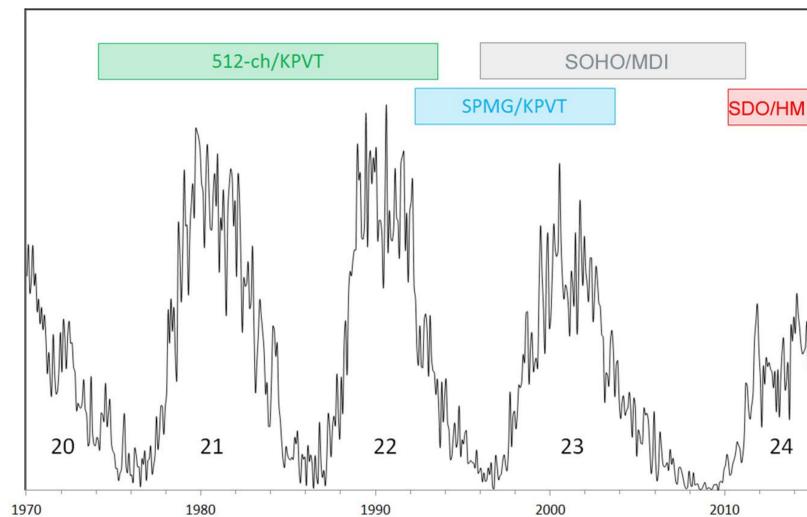
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Quick Take-Away

- 45 years of daily LOS magnetograms are available.
- Improving signal and image geometry
- Standardizing the data files.
- Creating a homogeneous magnetic catalog.

Instruments & Coverage

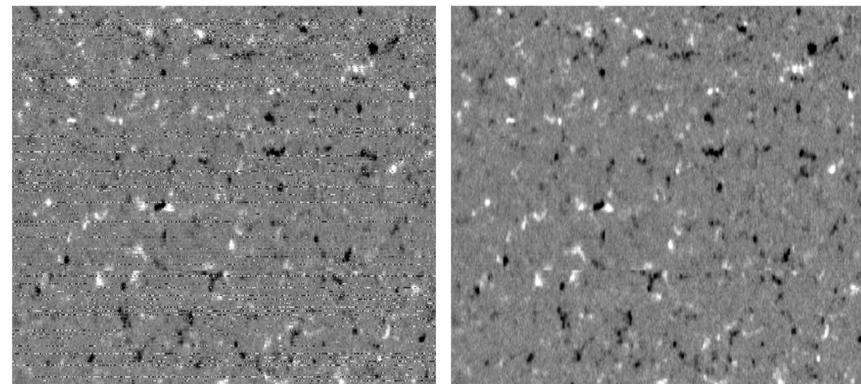
- 40 channel: 1/1970 – 3/1974.
- 512 channel: 1/1974 – 4/1993.
- SOHO/MDI: 4/1996 – 4/2011.
- SDO/HMI: 4/2010 – present.



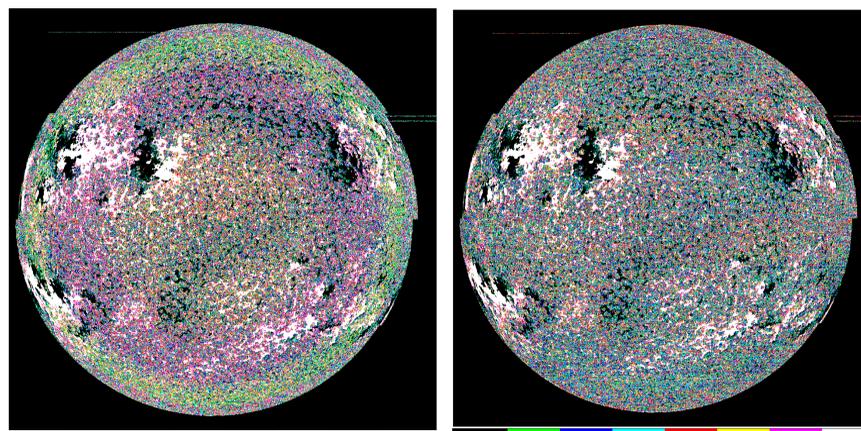
1. Monthly sunspot number shown with cycle number and time coverage of Kitt Peak magnetograms by instrument.

Quality Improvements for KPVT data

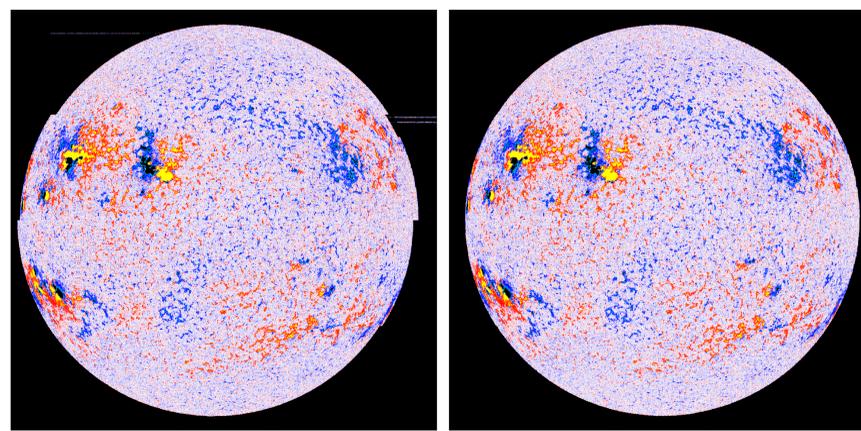
- Convert to standard FITS and SolarSoft formats.
- Reduce noise.
- Remove instrumental zero biases.
- Edit tape recording errors.
- Correct for curved and tilted slit, refraction, and guiding errors.
- Edit out poor quality observations.



2. Central section of 1974 February 1 magnetogram. Left is original data. Right is corrected for noise. Range is ± 60 G.



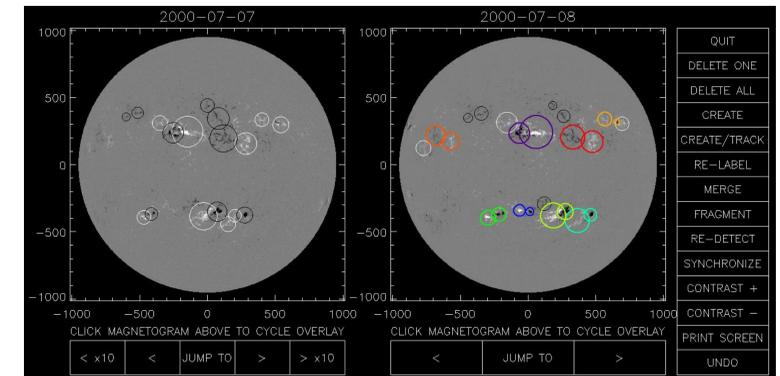
3. 1979 June 2 magnetogram. Left is original data. Right is corrected for zero bias offsets caused by intensity and Doppler crosstalk. Range is ± 20 G with a color table that emphasizes small offsets.



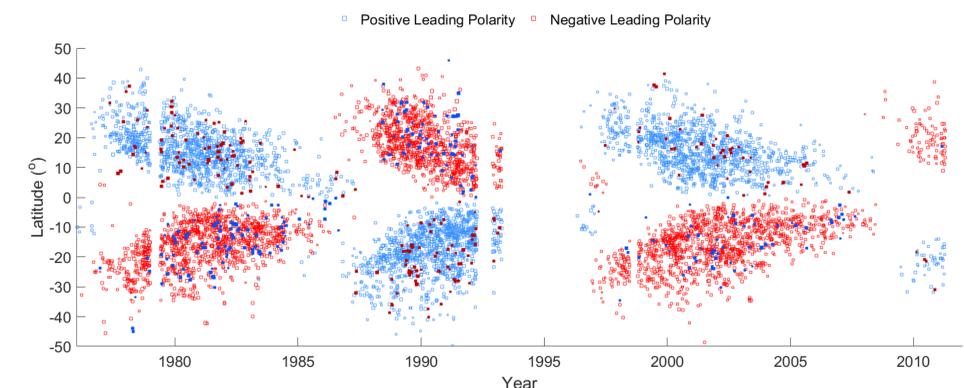
4. 1979 June 2 magnetogram. Left is bias corrected data. Right is same but geometrically corrected for tape playback errors, curved and tilted spectrograph slit, refraction, and guiding errors. Range is ± 200 G with a color table that emphasizes small signals.

Magnetic Catalog

- Bipolar Active Region Detection (BARD) code.
- Detection of region is performed automatically.
- Students supervise pairing and labeling.
- SOHO/MDI and KPVT/512 are finished.



5. Interface of the BARD code's human verification module applied to SOHO/MDI LOS disk magnetograms.



6. Detected ARs on KPVT/512 and SOHO/MDI LOS magnetograms. Circles (squares) denote ARs with positive (negative) leading polarity. Marker size is proportional to AR flux. Solid markers indicate anti-hale ARs.

Expected Results

- Open, homogeneous archive of LOS magnetograms.
- Replace old, biased diachronic synoptic maps.
- Add daily synchronic synoptic maps.
- Open catalog of tracked active regions.

Acknowledgements

This work utilizes data obtained by the NSO Integrated Synoptic Program (NISP), managed by the National Solar Observatory, which is operated by the Association of Universities for Research in Astronomy (AURA), Inc. under a cooperative agreement with the National Science Foundation. In addition to base funding from NSF, NASA and NOAA provided substantial support of the Kitt Peak synoptic observations. A. M-J is funded by a NASA grand challenge grant and is very grateful to George Fisher and Stuart Bale for their support at the University of California - Berkeley, and Phil Scherrer for his support at Stanford University.

