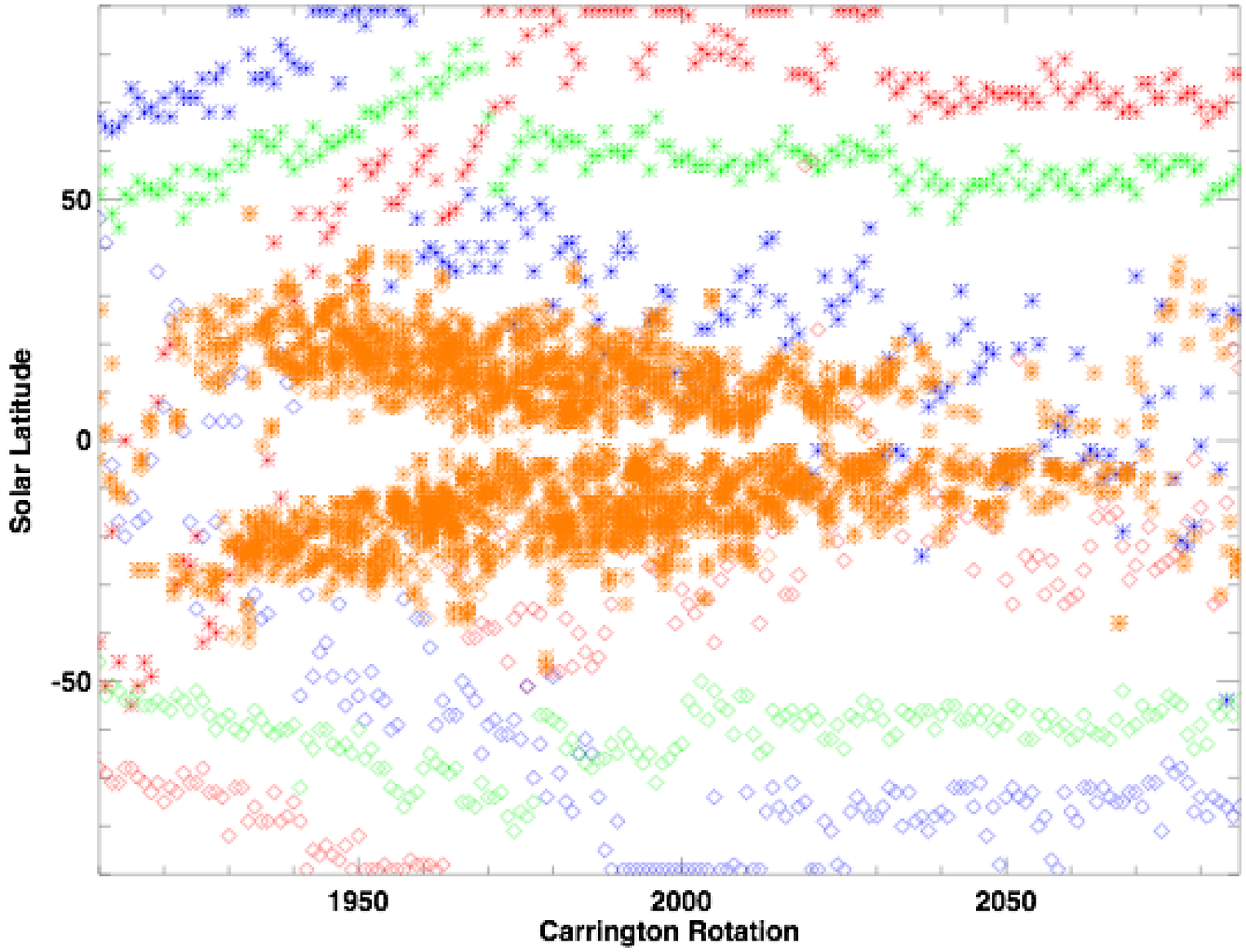
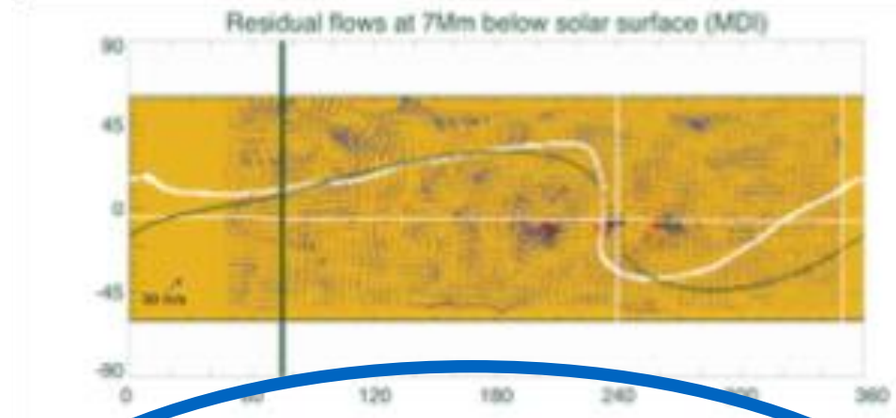
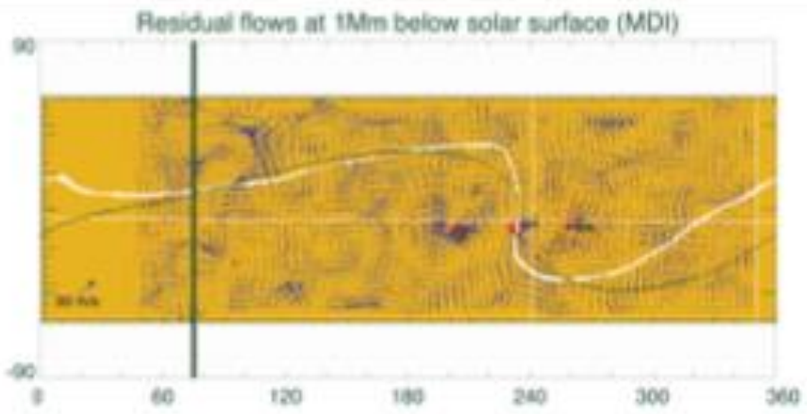
Beyond Sunspots: Studies Using the McIntosh Archive of Global Solar Magnetic Field Patterns

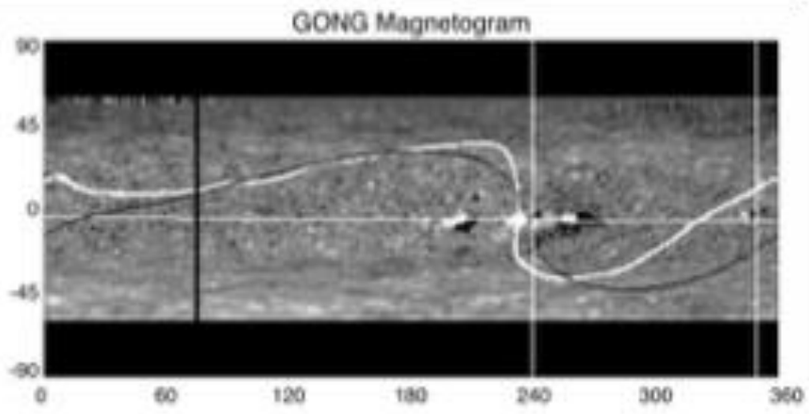


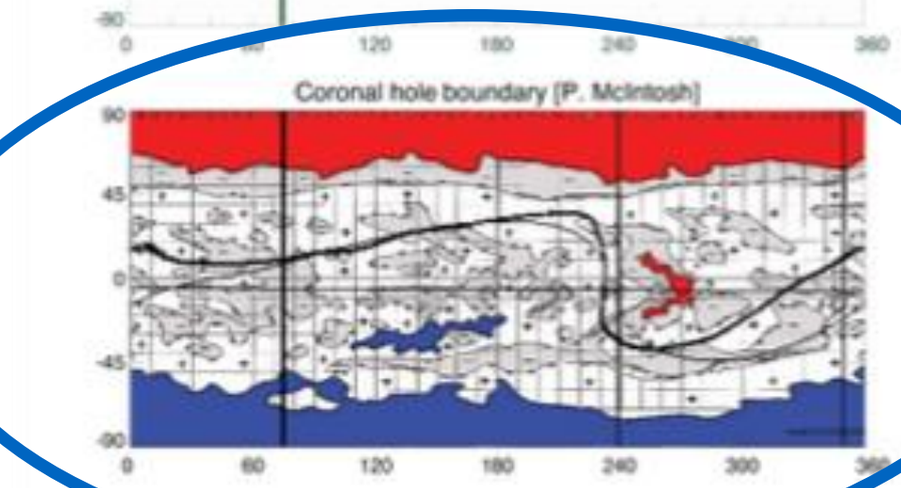
Sarah Gibson, David Webb, Ian Hewins, Robert McFadden, Barbara Emery, Bill Denig

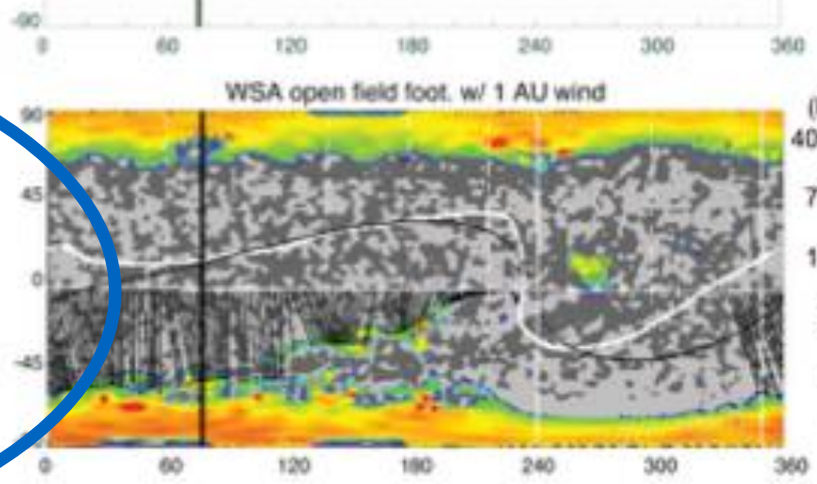
Whole Heliosphere Interval

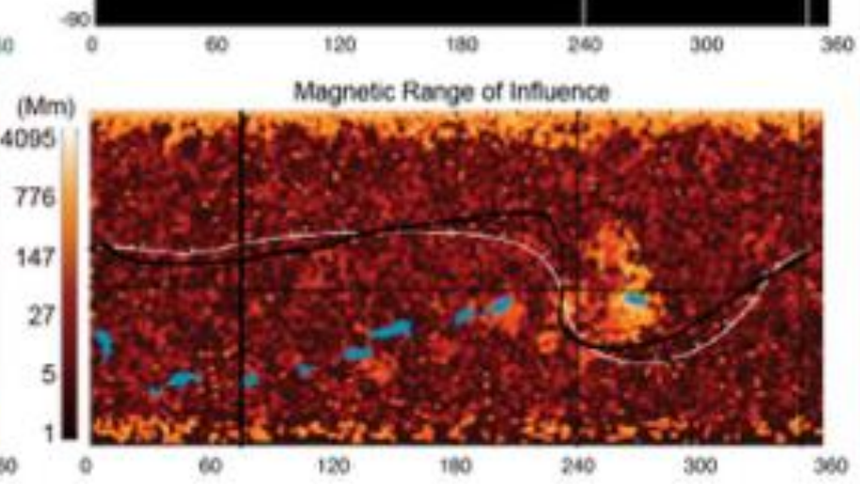


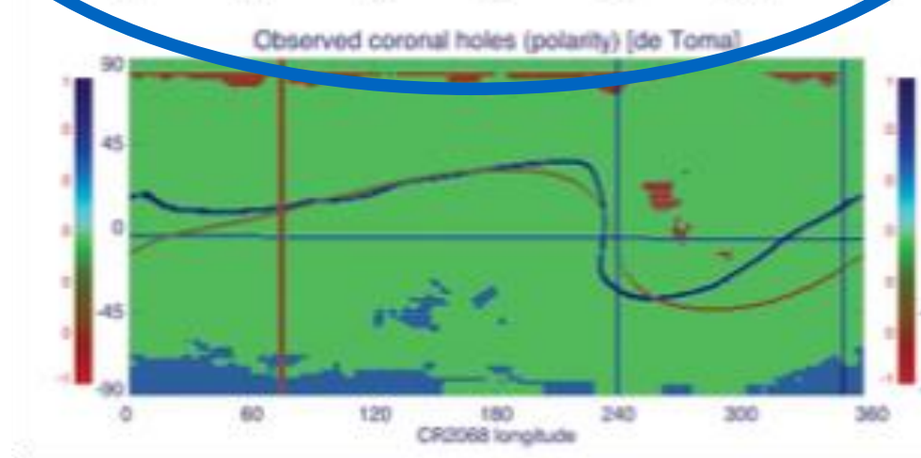


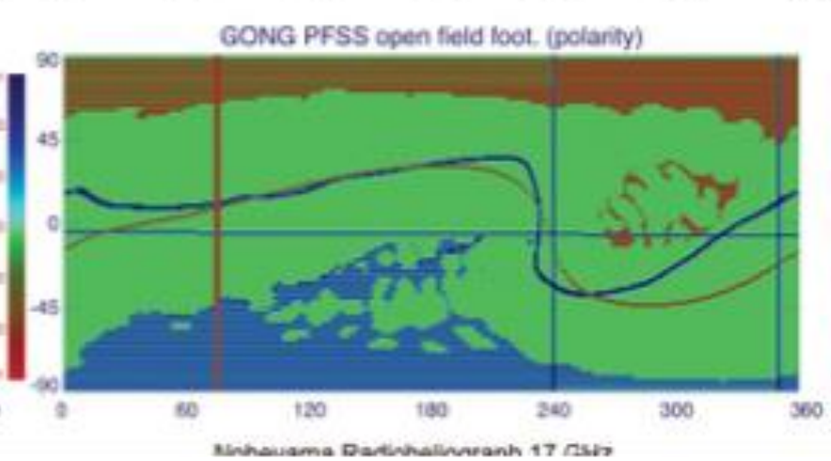


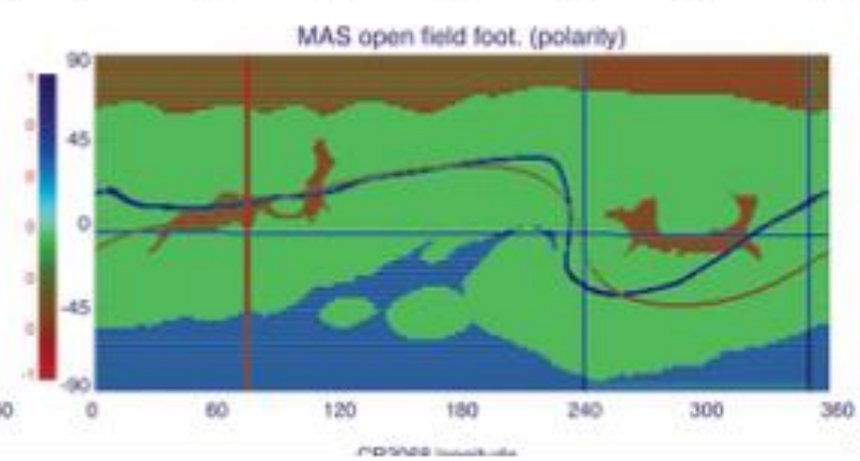










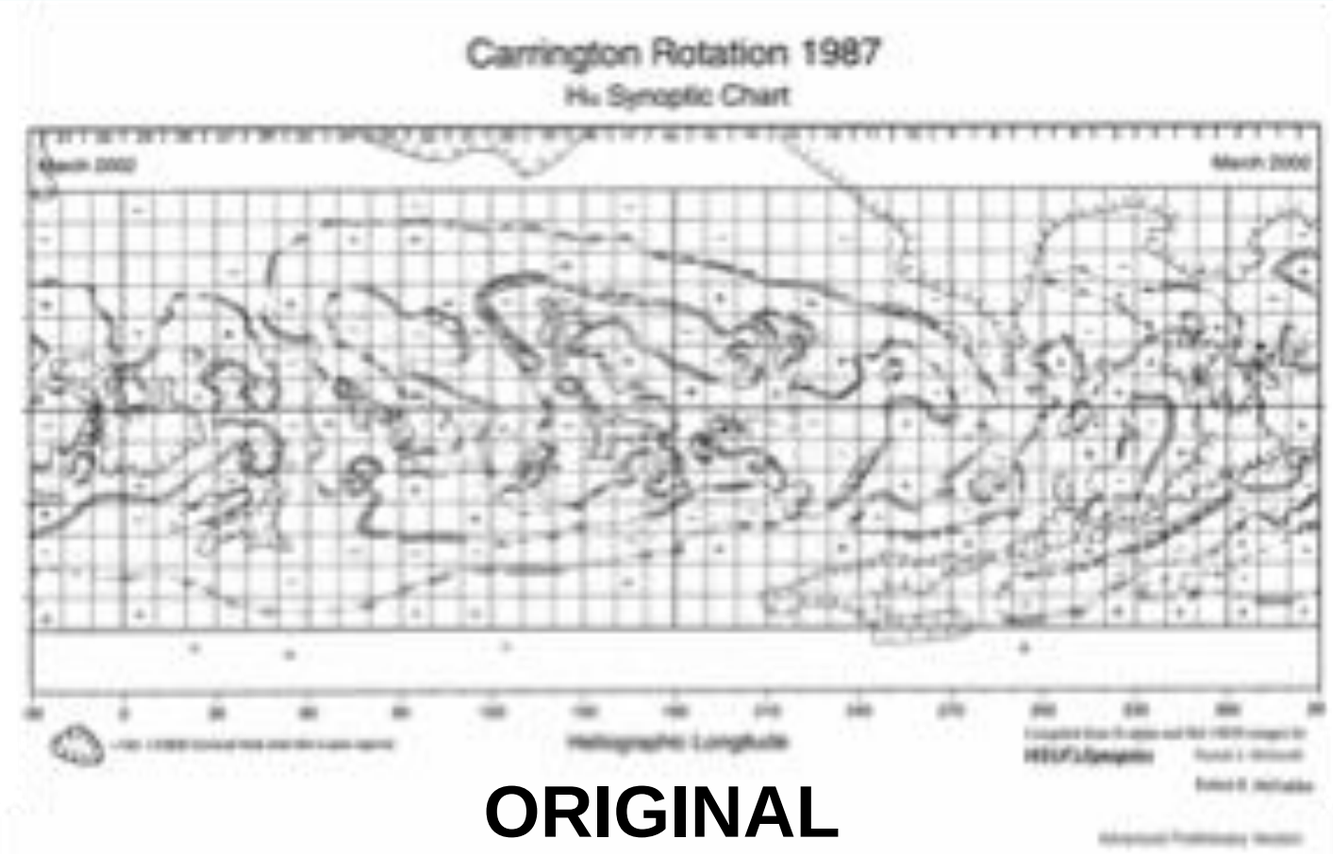


McIntosh Archive: 44 years of solar observations

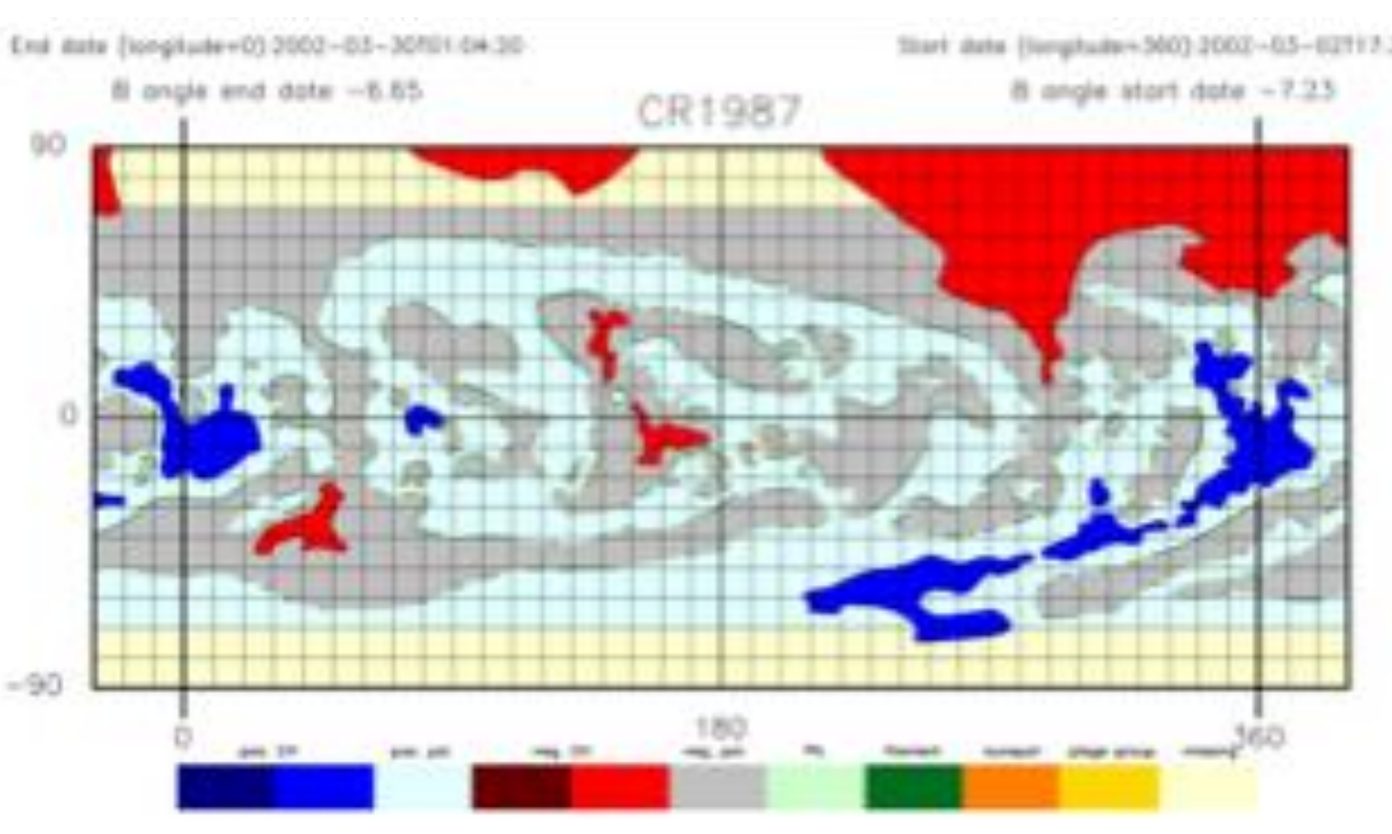
Unique and consistent set of solar Carrington maps drawn by Pat McIntosh

Based on H-alpha, He 10830, and photospheric magnetic observations

Mapping large-scale coronal features over four solar cycles

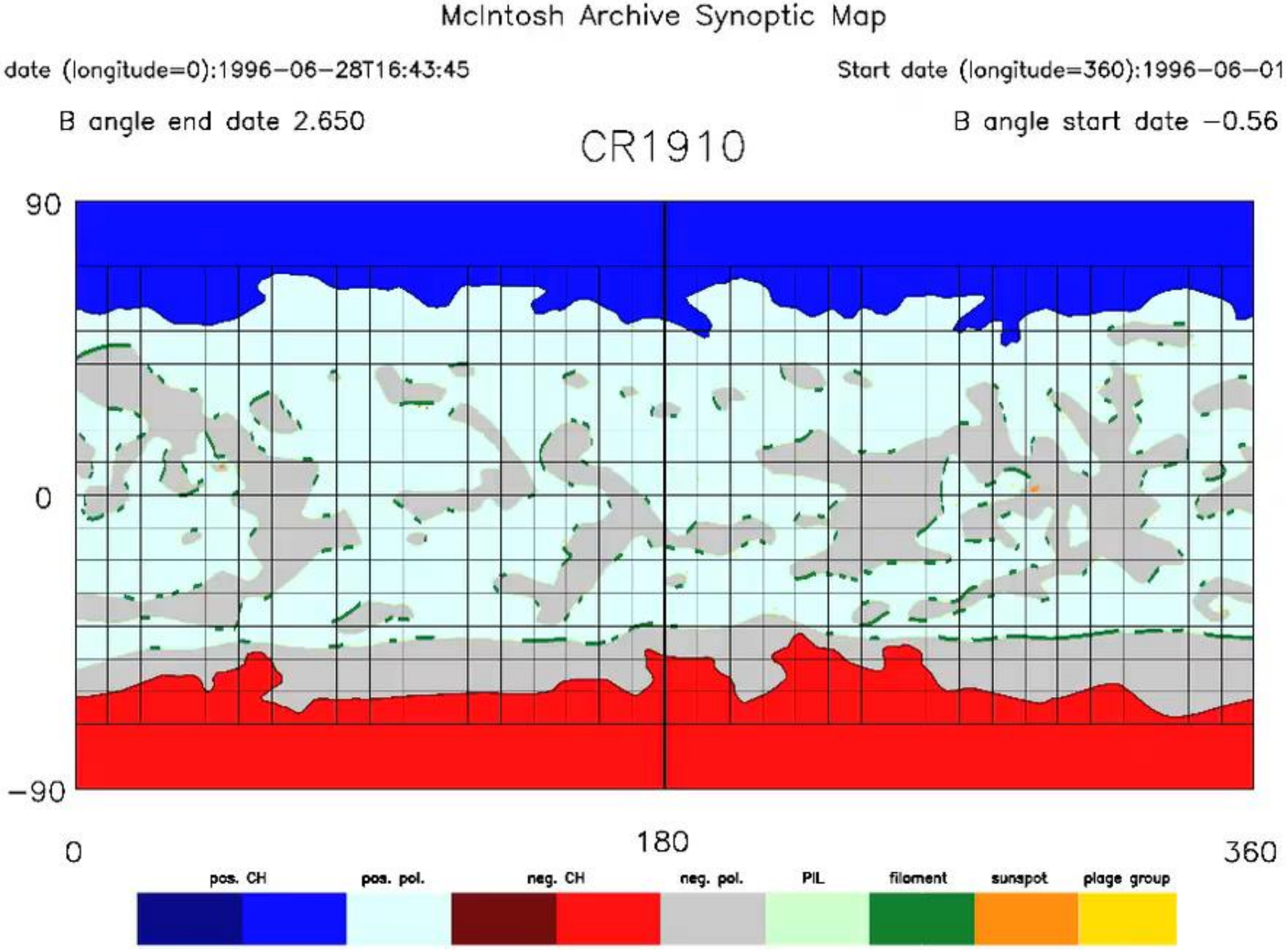


ORIGINAL

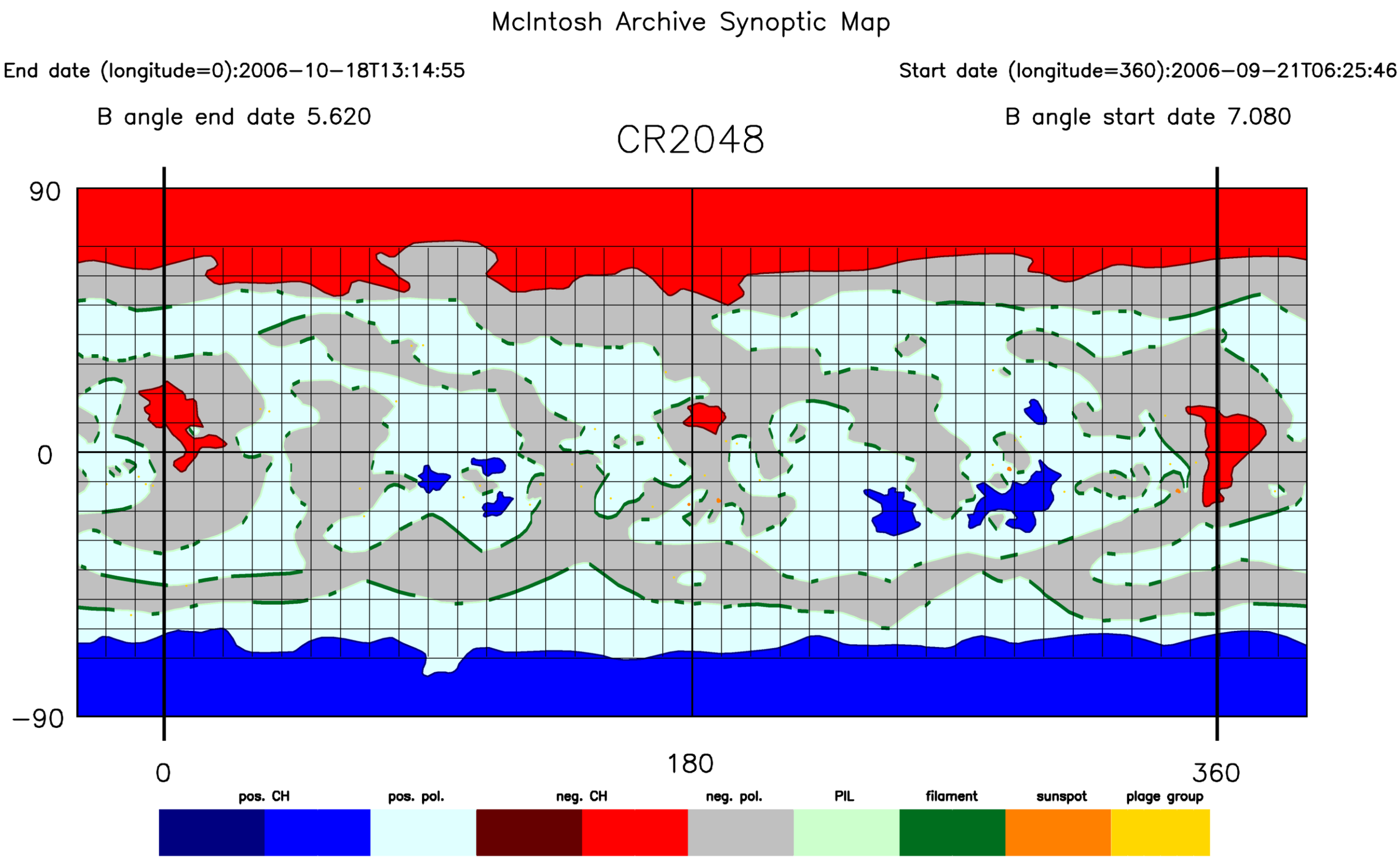


DIGITIZED

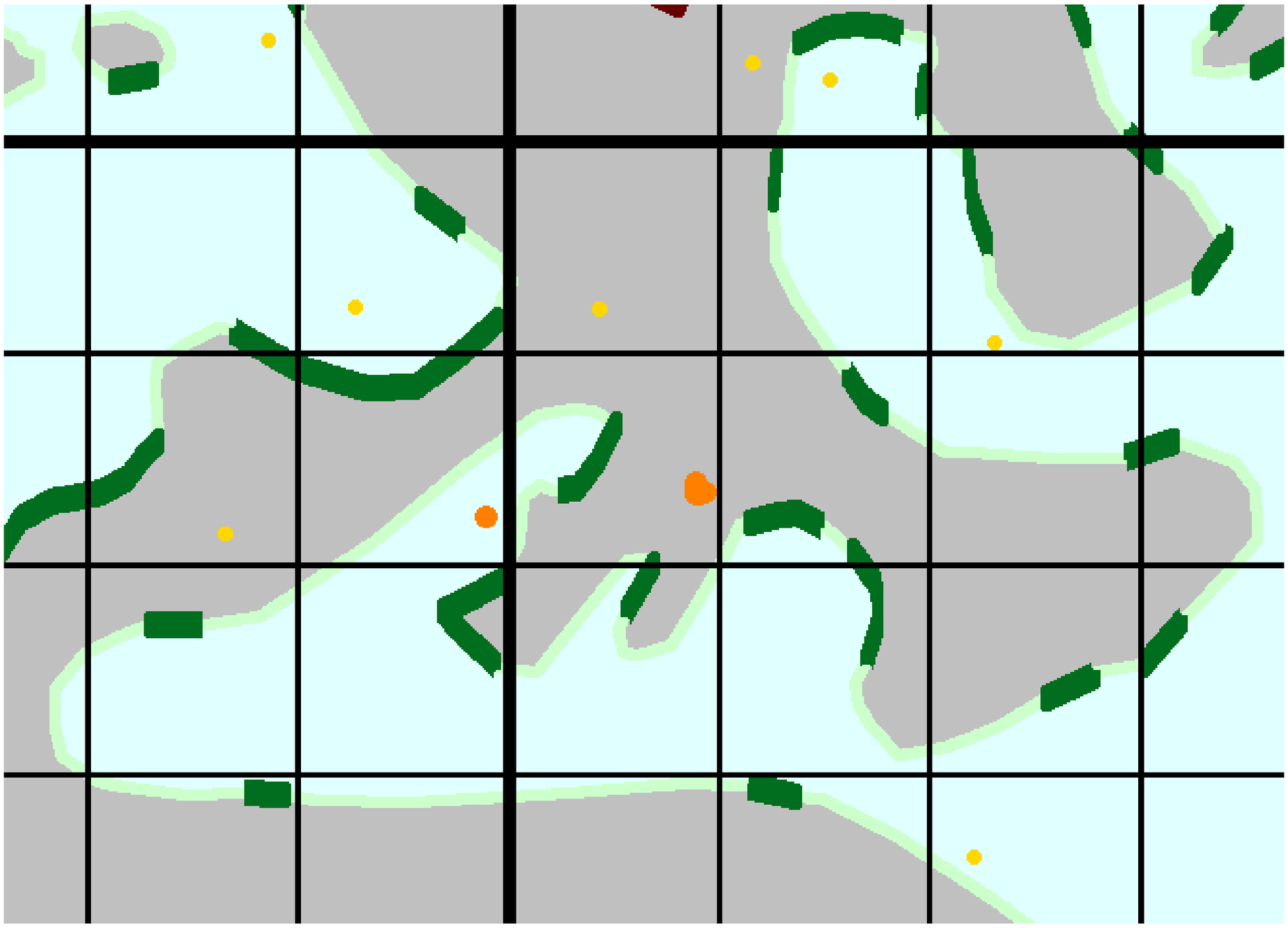
So far SC23 digitized and archived



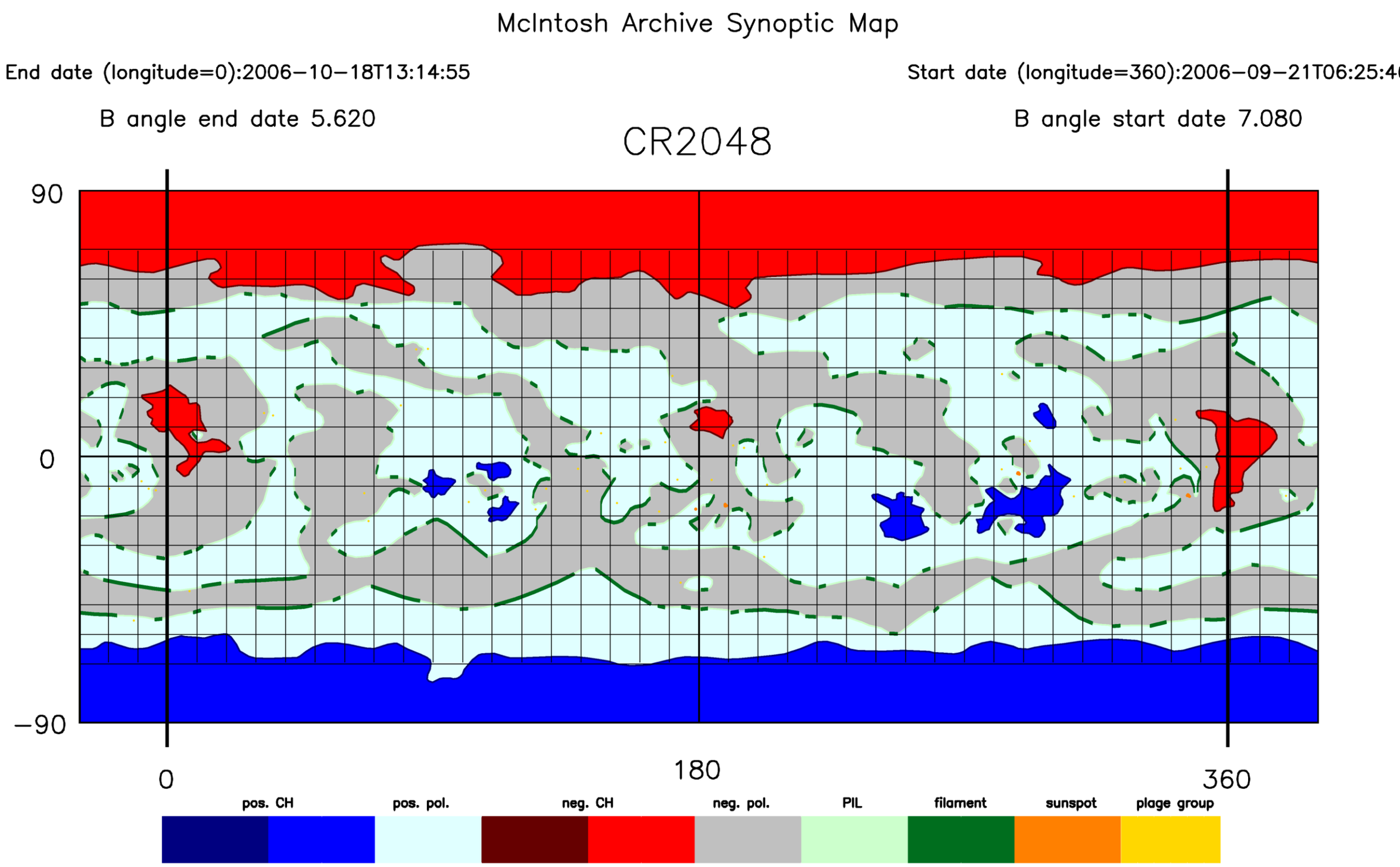
Sunspots, plage, coronal holes, filaments



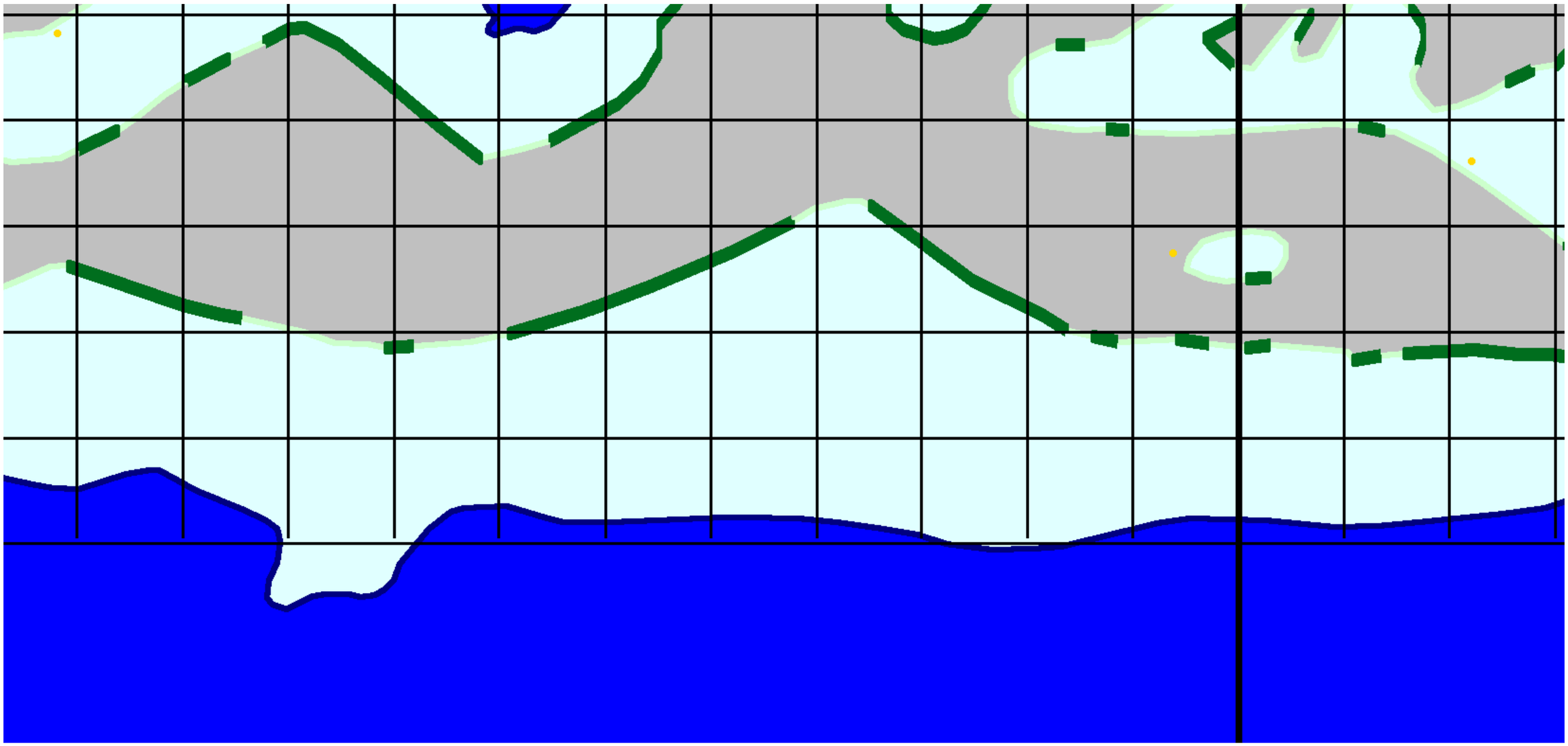
Sunspots, plage, coronal holes, filaments



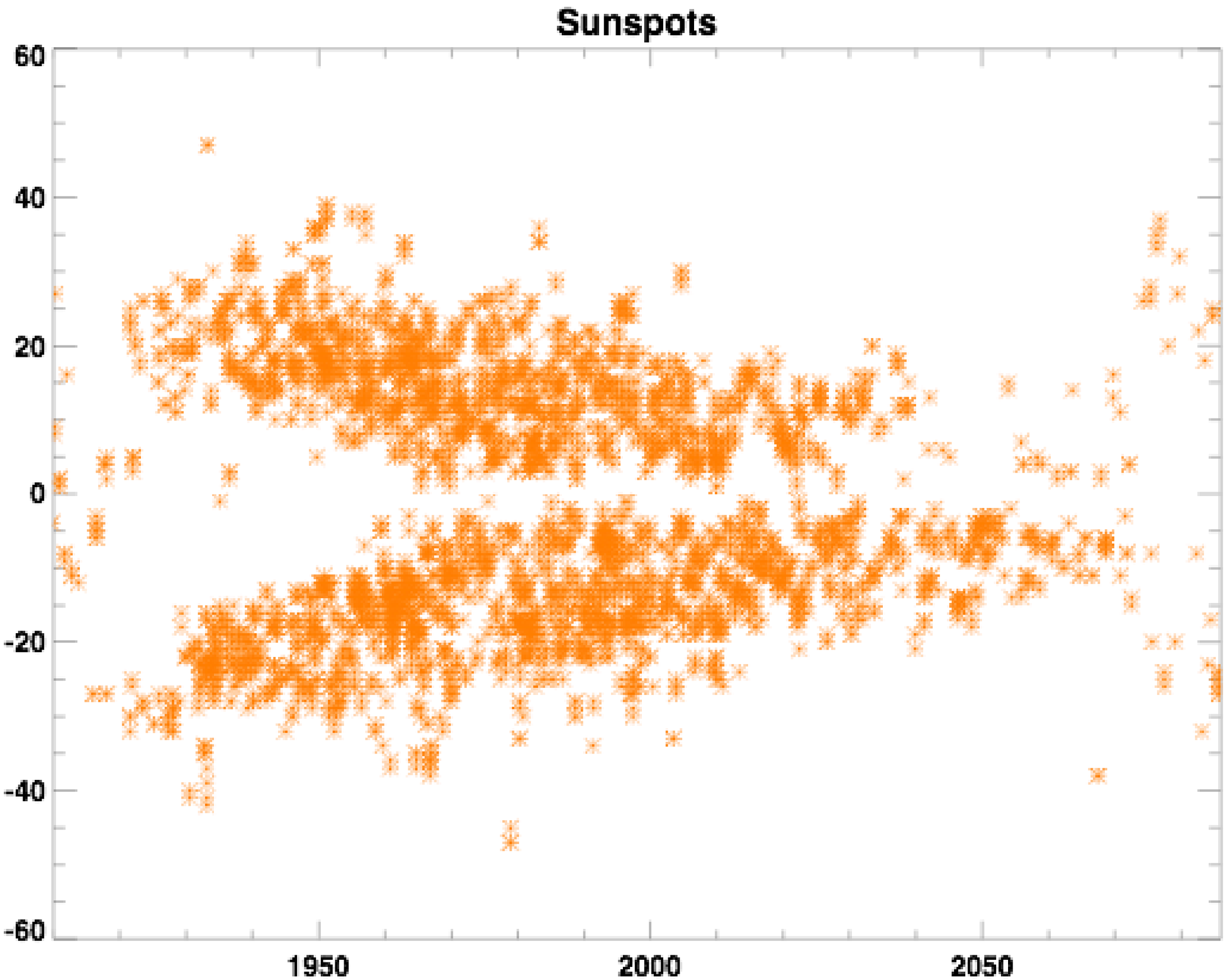
Sunspots, plage, coronal holes, filaments



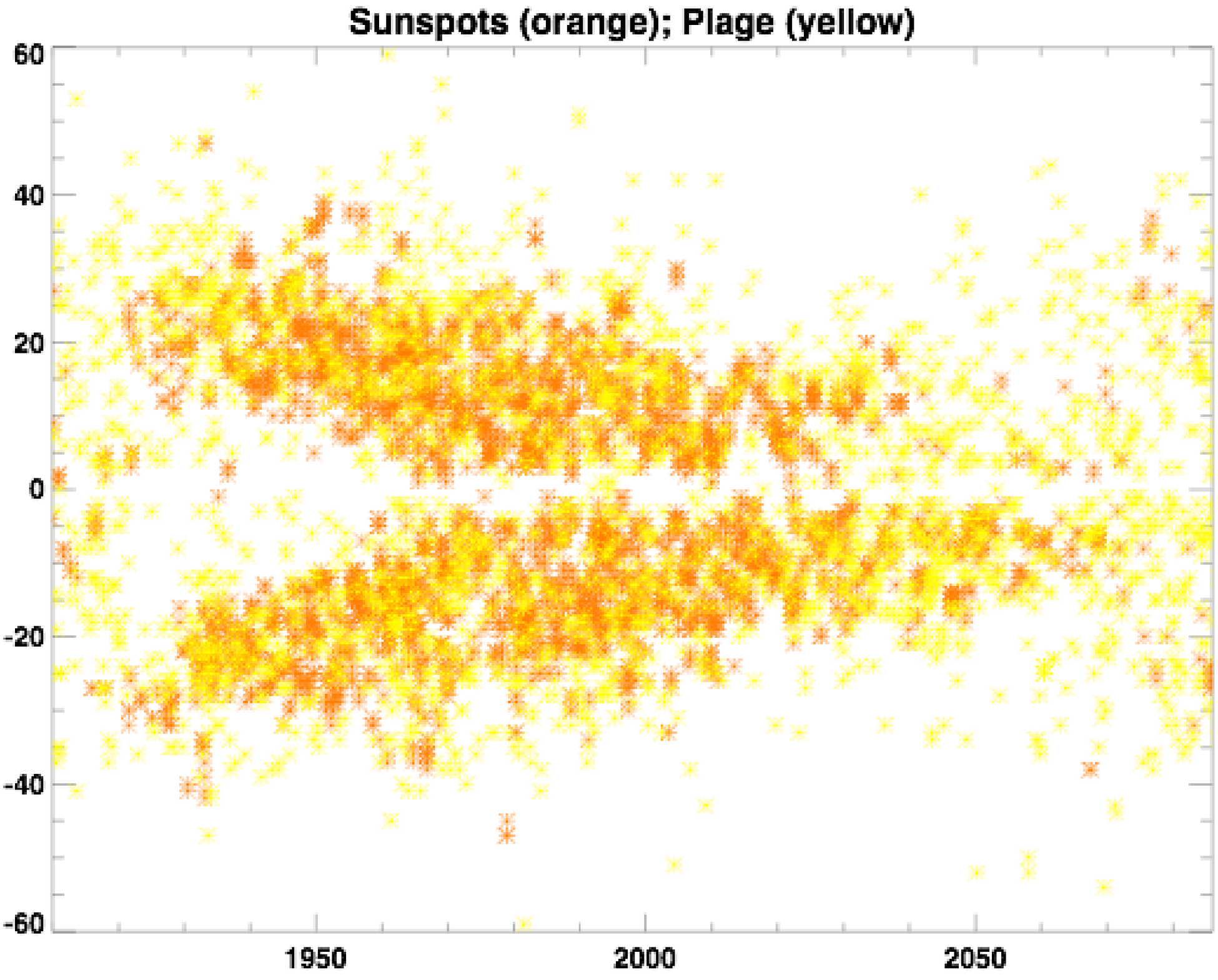
Sunspots, plage, coronal holes, filaments



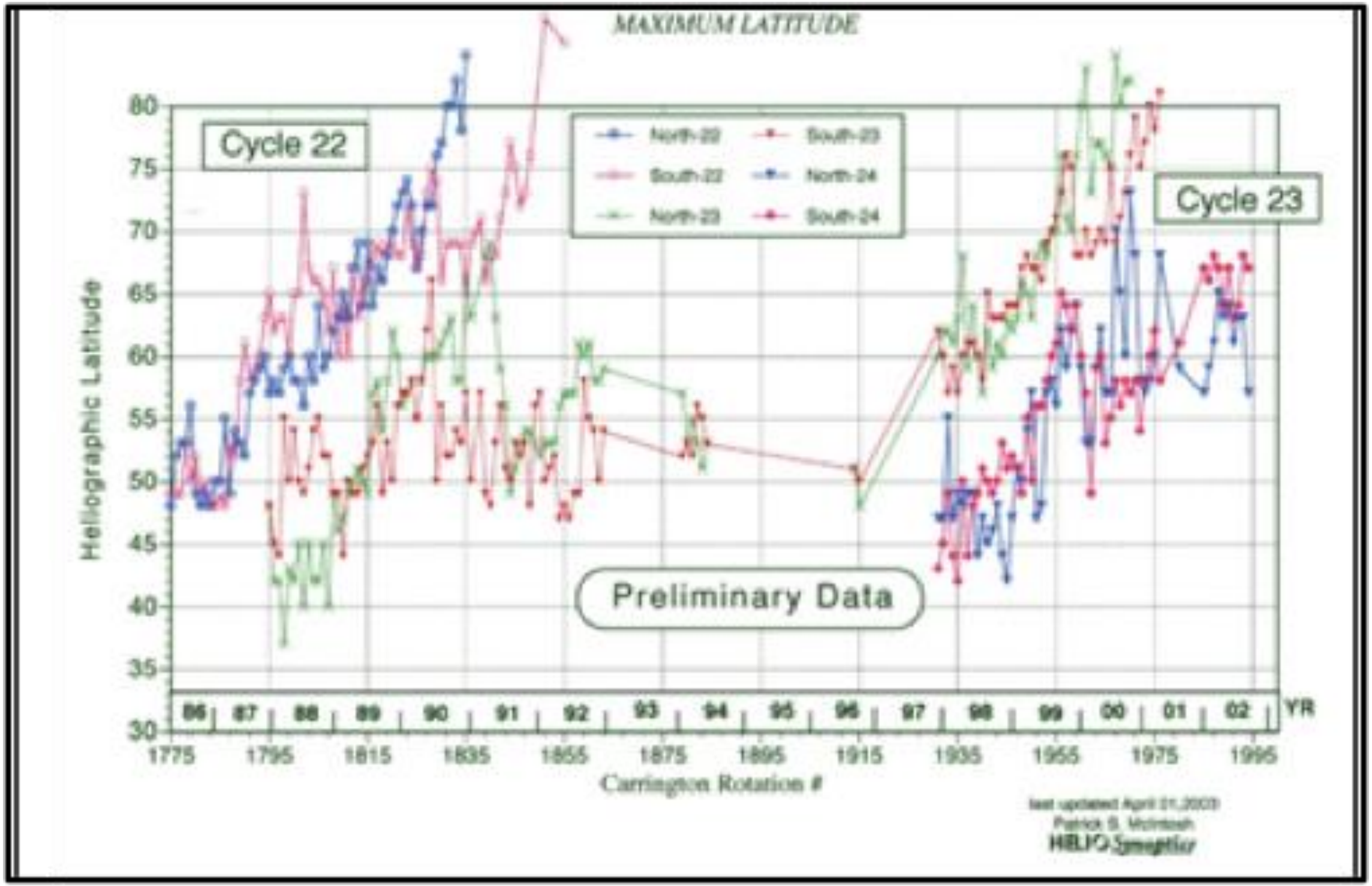
Digital analysis: Sunspots



Digital analysis: Sunspots, plage

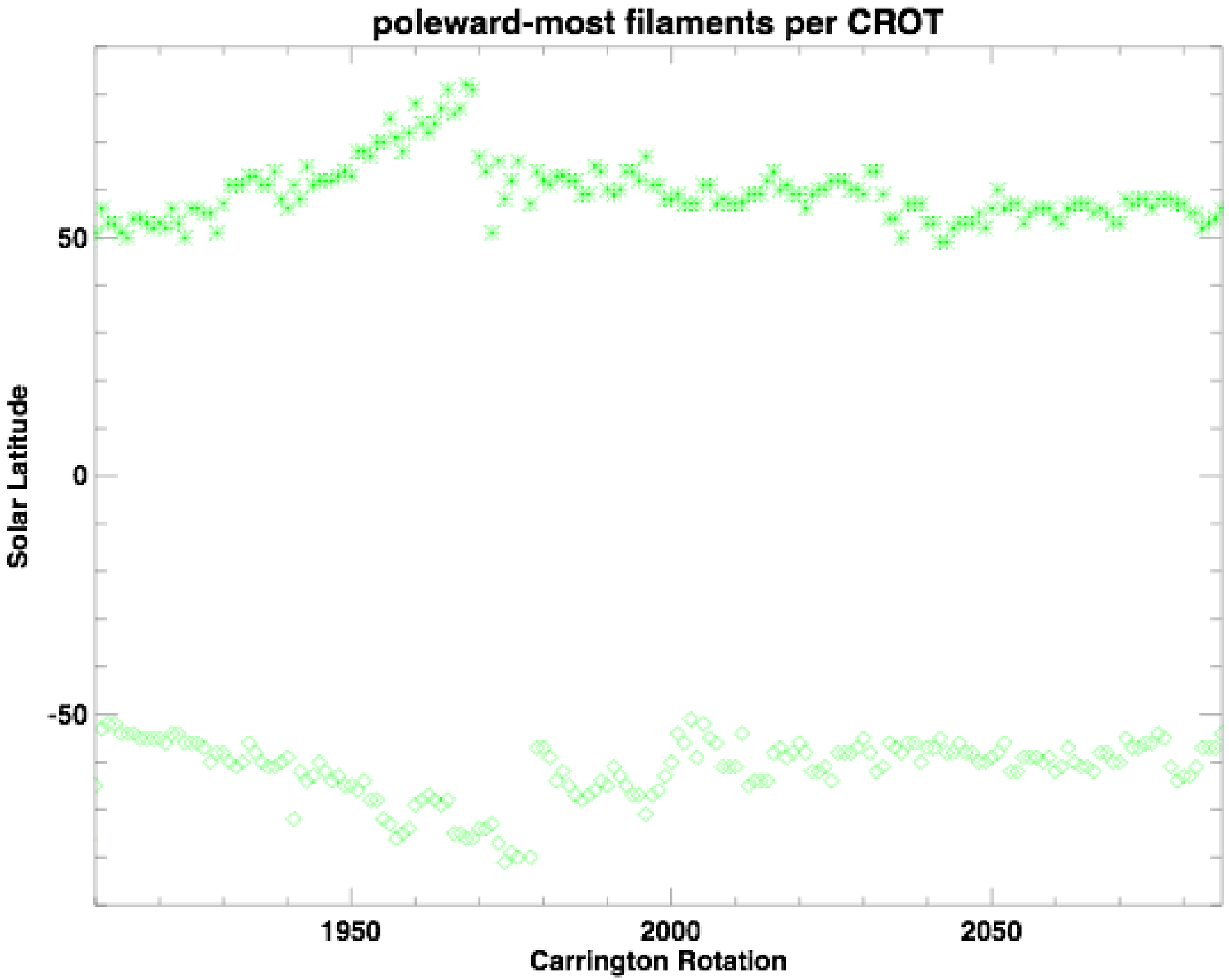


Filaments: rush to the poles

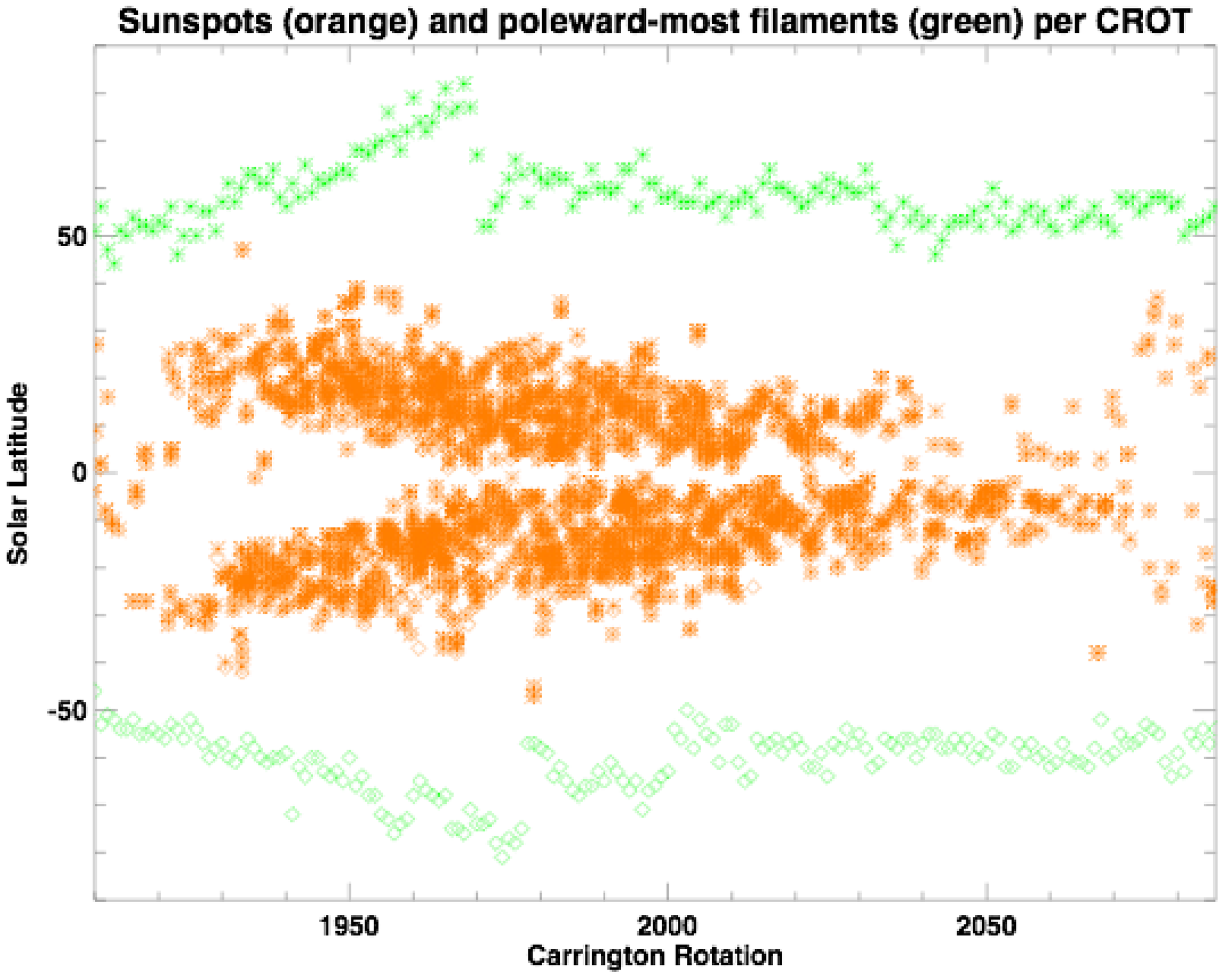


Location of the maximum latitudes of PCFs during SCs 22 and 23 as previously tracked on McIntosh synoptic maps.

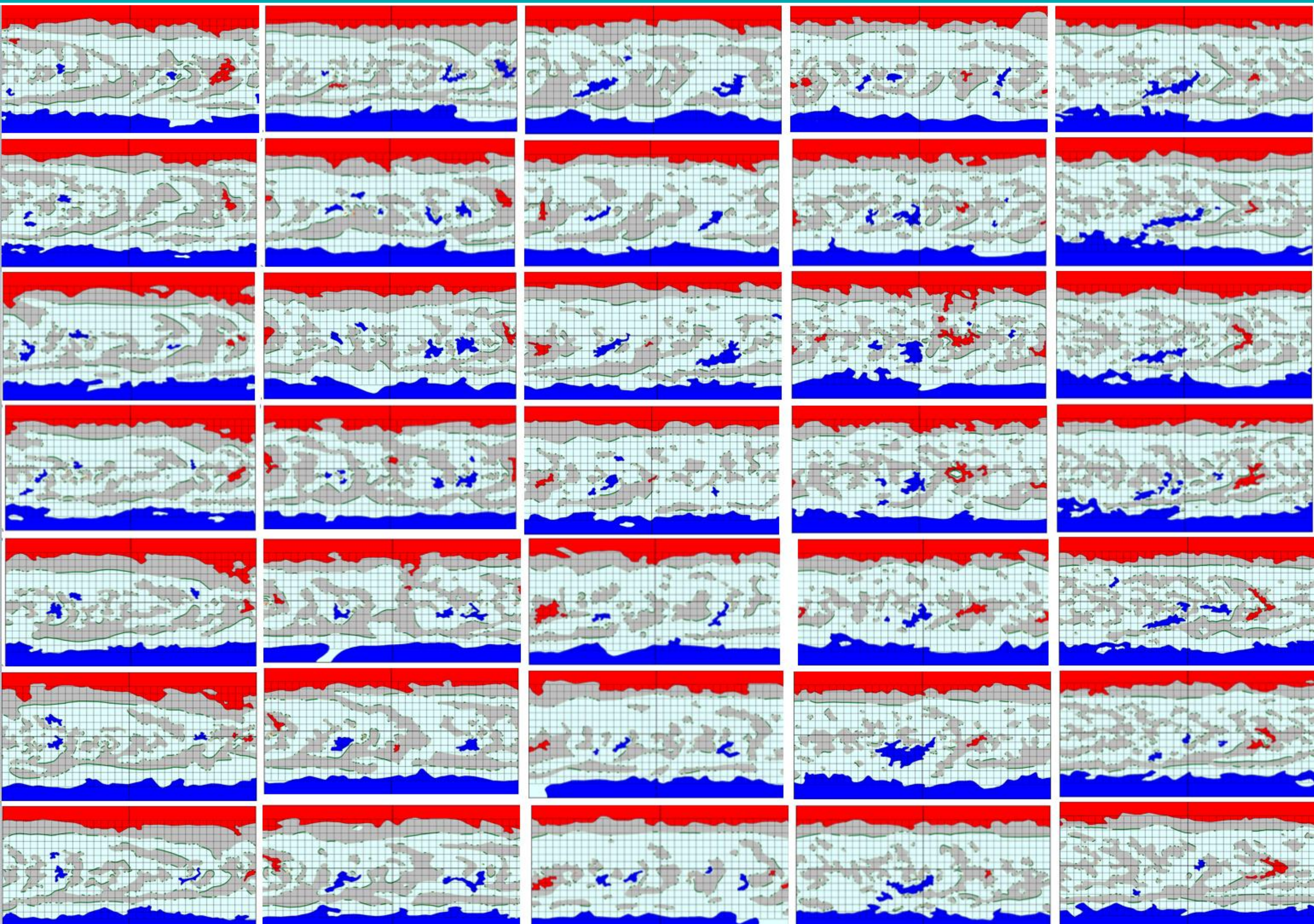
Digital analysis: Poleward filaments



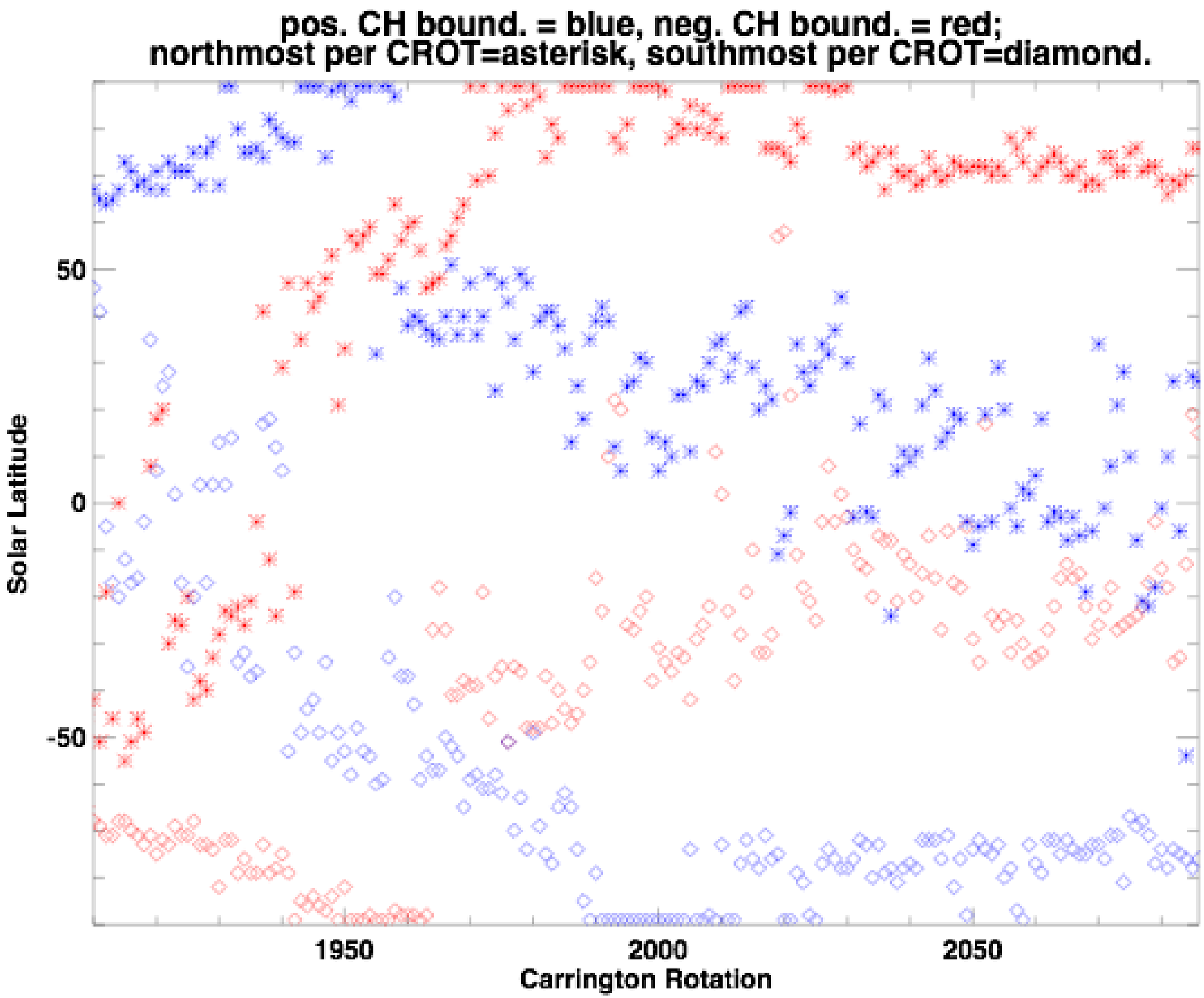
Digital analysis: Sunspots, poleward filaments



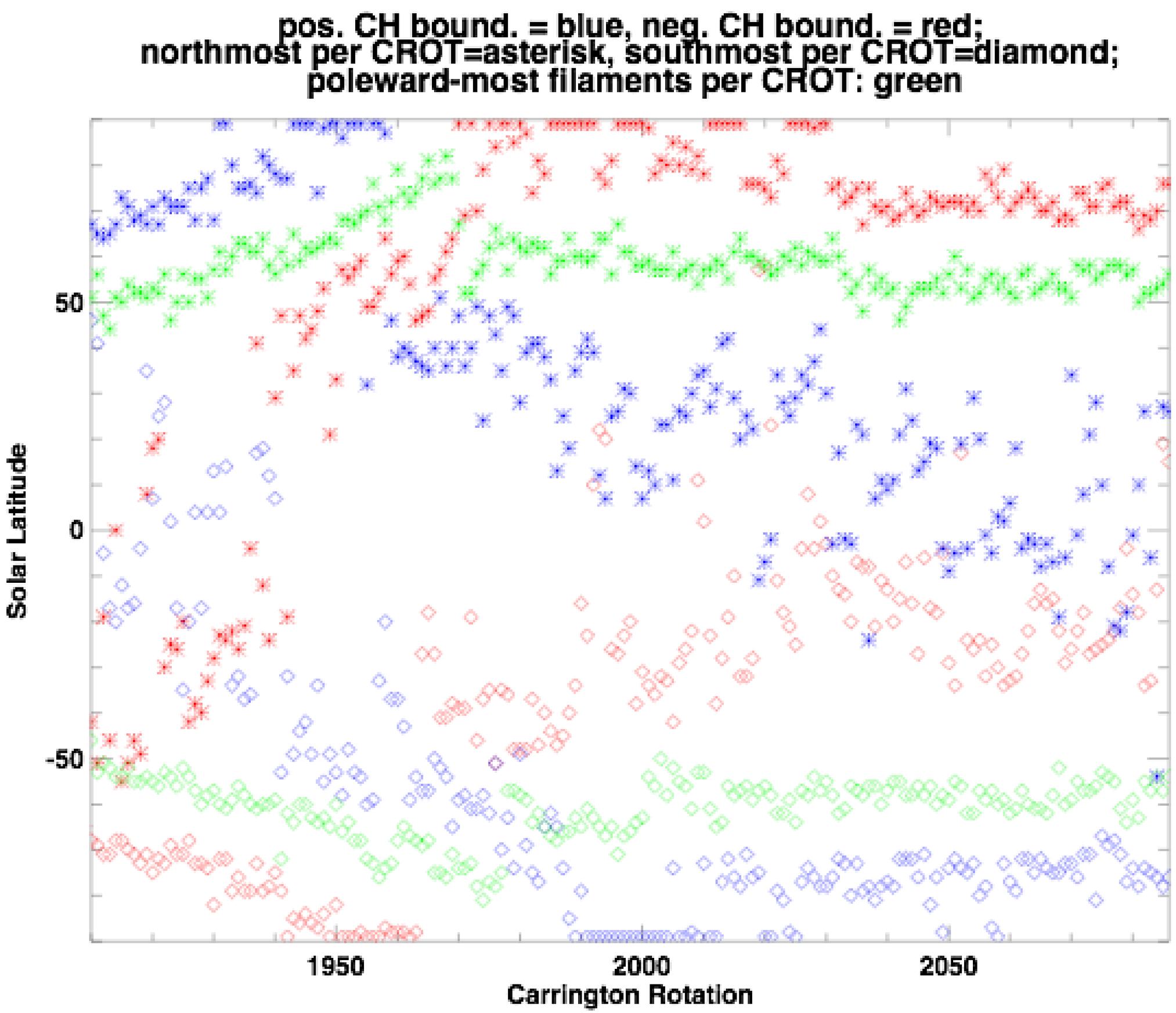
Coronal holes



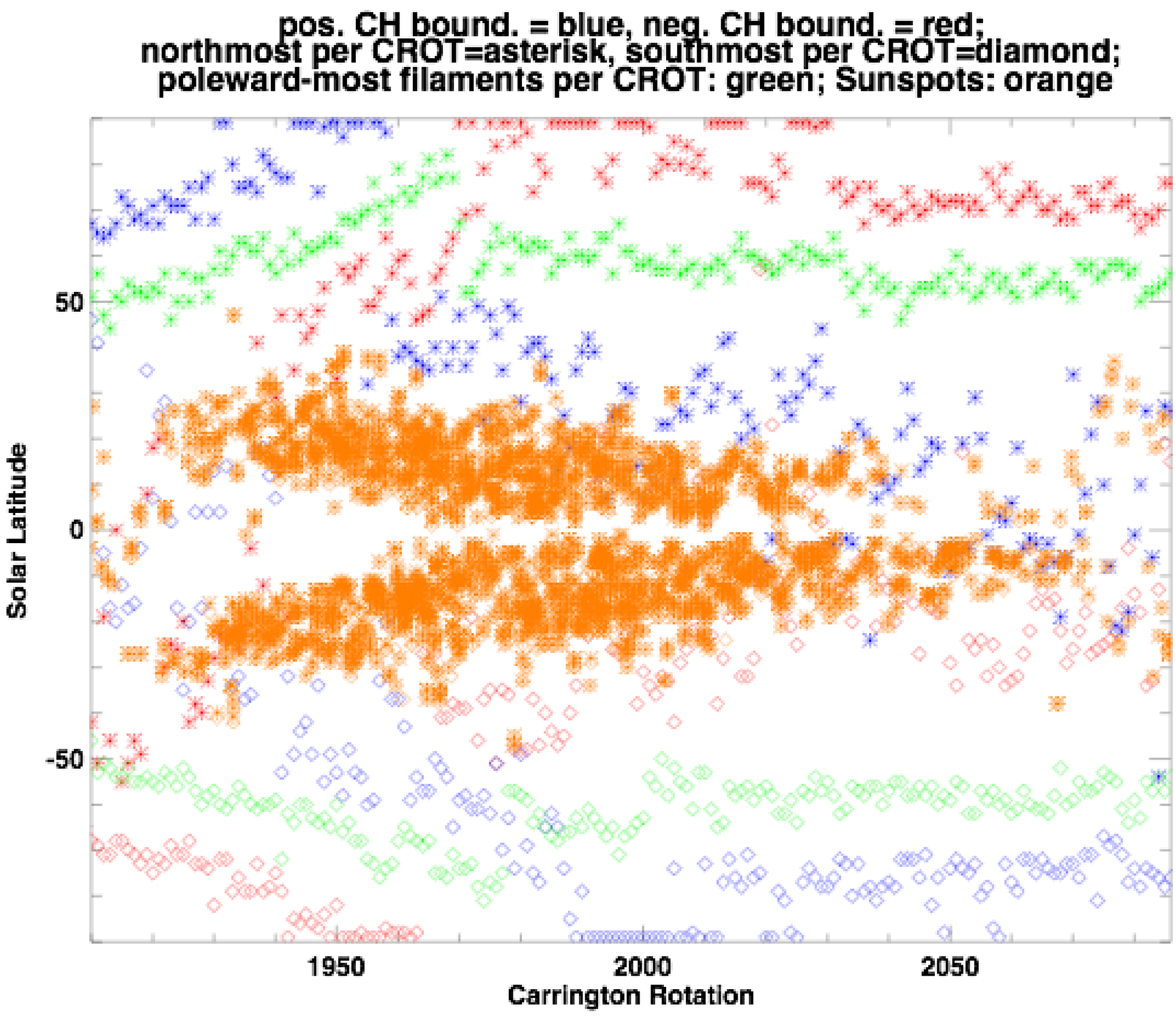
Digital analysis: Coronal holes (polar and low-lat)



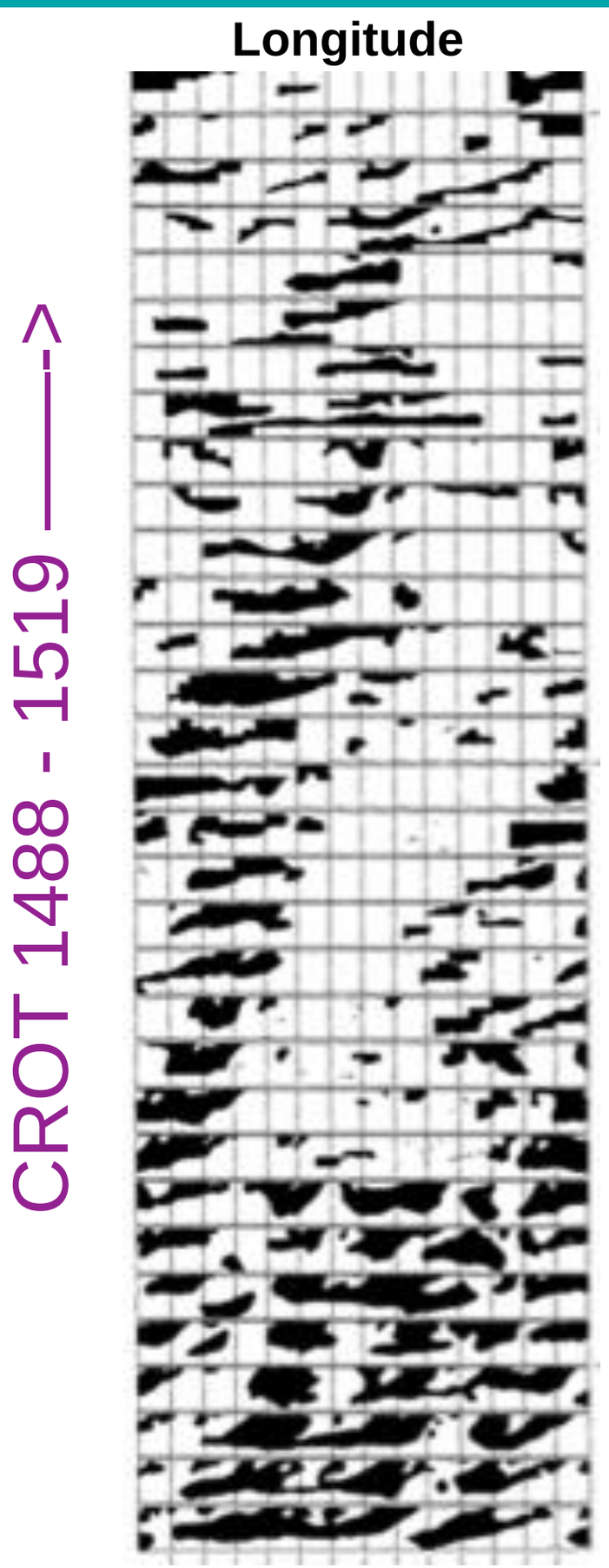
Digital analysis: Coronal holes, filaments



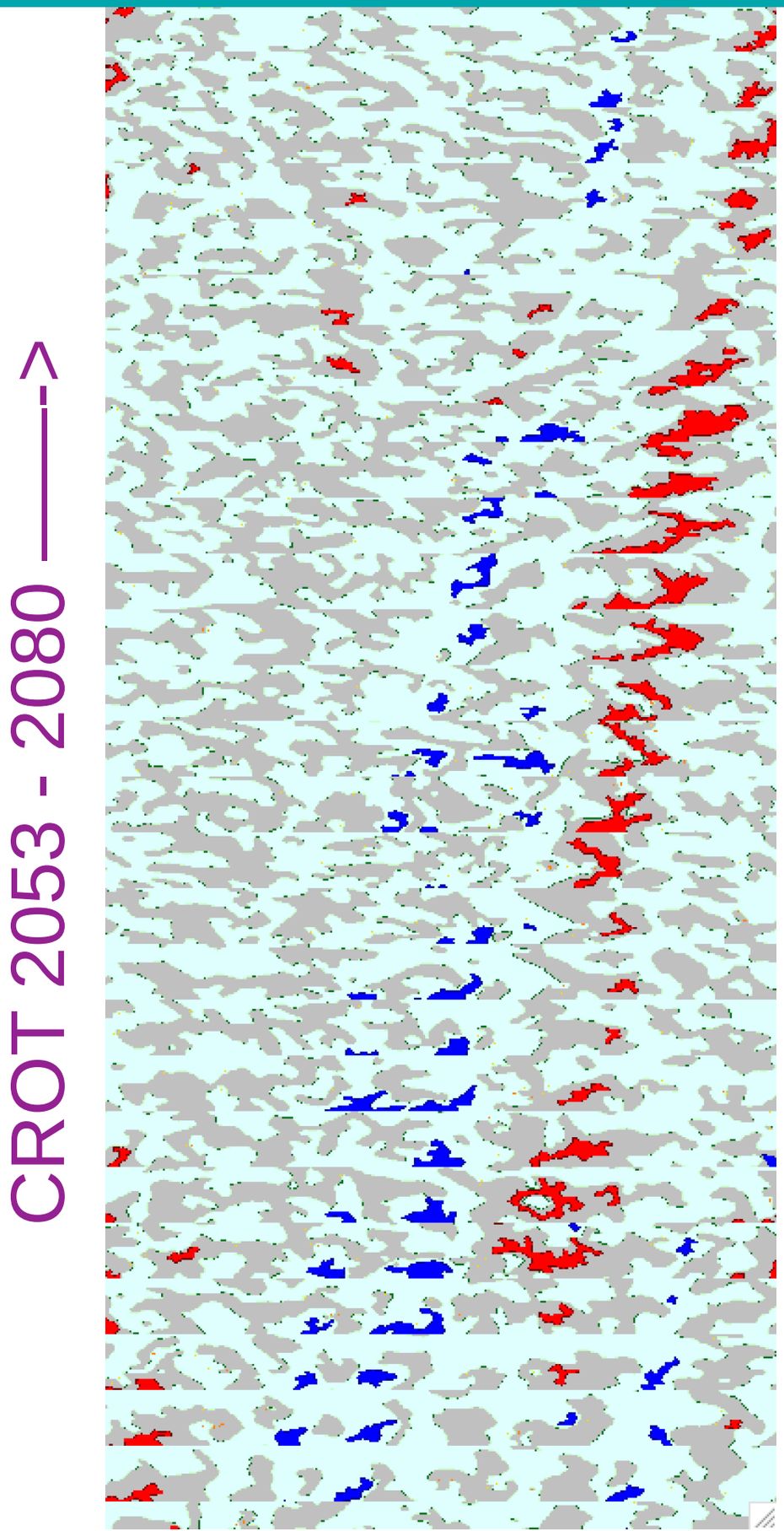
Digital analysis: Coronal holes, filaments, sunspots



Stack plots



(McIntosh & Wilson, SP, 1985; McIntosh 2003)



North Polar Zone: N30-N70

Equatorial Zone: S20-N20

South Polar Zone: S30-S70

CROT 1910 - 2086

June 1996 - July 2009

0 - 360 longitude

0 - 360 longitude

0 - 360 longitude

Conclusions

- **Current status and future plans**
  - Cycle 23 digitized set publicly available by December 2016 (announcement in Solar News)
  - Seeking funding to complete the digitization of Cycles 20-22
- **Future science applications:**
  - Coronal hole rotation — where are they rooted?
  - Sunspot-filament-coronal hole correlations (evolution study)
  - Active longitudes/long-lived low-latitude coronal hole/periodic solar wind forcing of geospace
  - Historical case study context

The May 1967 great storm and radio disruption event

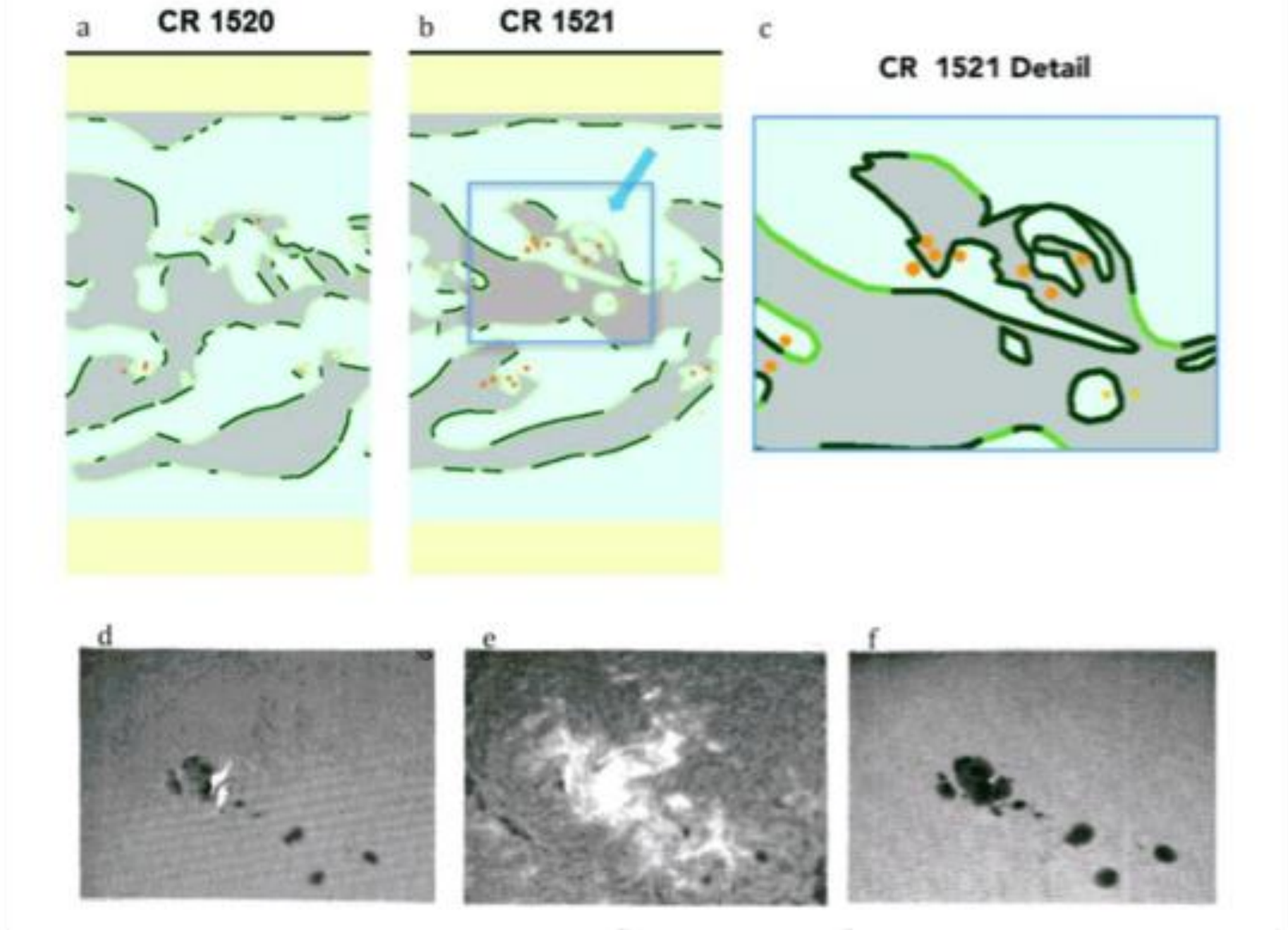


Figure 4 **from Knipp et al. (SWxJ, 2016) shows newly digitized maps in SC 20 zooming in on the evolution of "one of the greatest activity complexes of SC 20" (*e.g.*, McIntosh, UAG-70, 1979). The blue box (b) highlights AR 8818, enlarged in (c), which produced a great white-light, proton flare on 23 May 1967. Orange dots are sunspots, images of which are shown in (d) the H wing; (e) H center line; (f) white light. This event had serious space weather implications (Knipp et al., 2016). The 1967 dates centered on these maps are 24 April (CR 1520) and 20 May (CR 1521).**