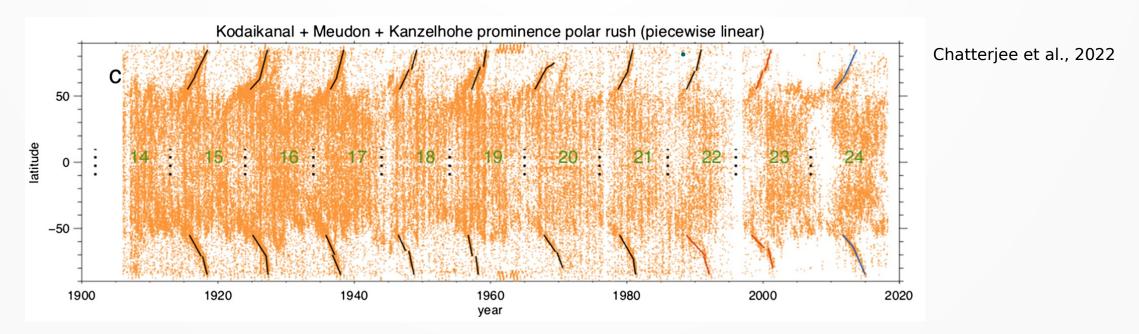
# LSO/KSO Hα prominence catalogue: status report - Setempber 2023

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### Prominences and solar cycle

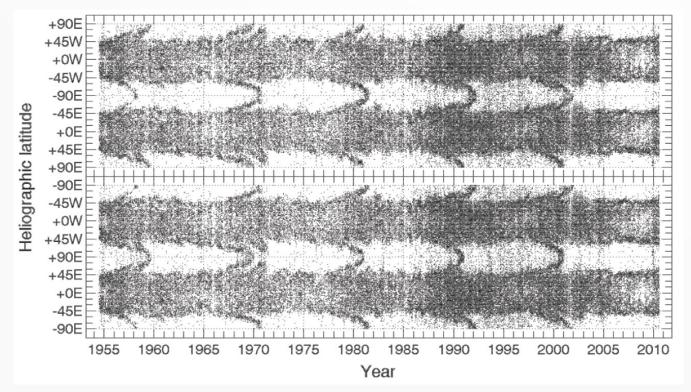
Polar branches of the time-latitude prominence distribution display clearly the solar cycle evolution dependence (e.g., the latest article of Chatterjee et al, 2020, https://doi.org/10.1029/2019EA000666 and many others since the pioneering article of Ricco, 1914, https://ui.adsabs.harvard.edu/abs/1914MmSS....3...17R)



• Solar disk observations of filaments in  $H\alpha$  or Ca II K & H lines were mostly used for these studies with the limited information available close to the poles

## Prominences and solar cycle

 Polar branches of prominences are better followed using the coronagraphic or "quasi/coronagraphic" observations detecting the Hα prominences along the solar limb depicting their polar branches to higher latitudes (e.g. the latest article of Chatterjee et al, 2020, https://doi.org/10.1029/2019EA000666 https://doi.org/10.1029/2019EA000666 or the old work of Rusin et al., 1994 https://ui.adsabs.harvard.edu/abs/1994A%2526A...281..241D).



Minarovjech et al., 1991, CAOSP 41, 175

## LSO/KSO prominence catalogue

- The LSO/KSO H $\alpha$  prominence catalogue:
  - the LSO part: the coronagraphic H alpha prominence observations once per day, 05/1967-08/2009
  - the KSO part: "quasi-coronagraphic" observations of the H alpha prominences once per day, 09/2009 – 12/2022 (and still in progress)
  - cross-calibration using the common data for 08+09/2009 –
    Rybák et al., 2011, CAOSP 41, 133
- Current time-latitude domain of the catalogue:  $[05/1967 12/2022] \& [-90^\circ- +90^\circ]$  and observations are continuing at the KSO

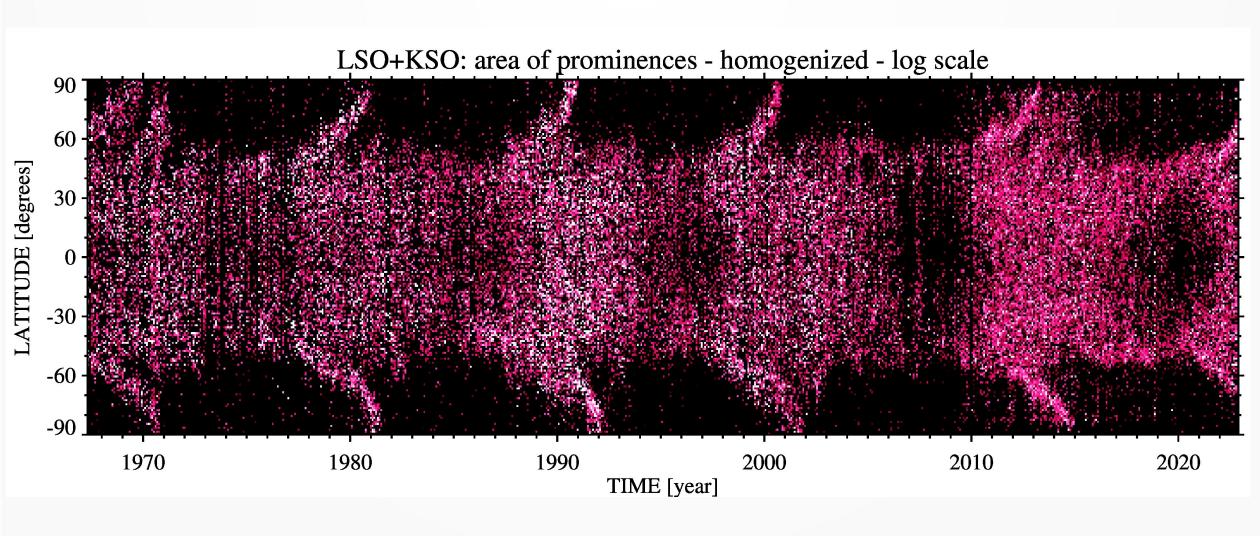
# Data handling

- KSO data: an automatic identification of the prominences and determination of their parameters according to the LSO older catalogue
- LSO+KSO data: homogenization for the filling factor of the observing days in a month

## Time-latitude prom distribution

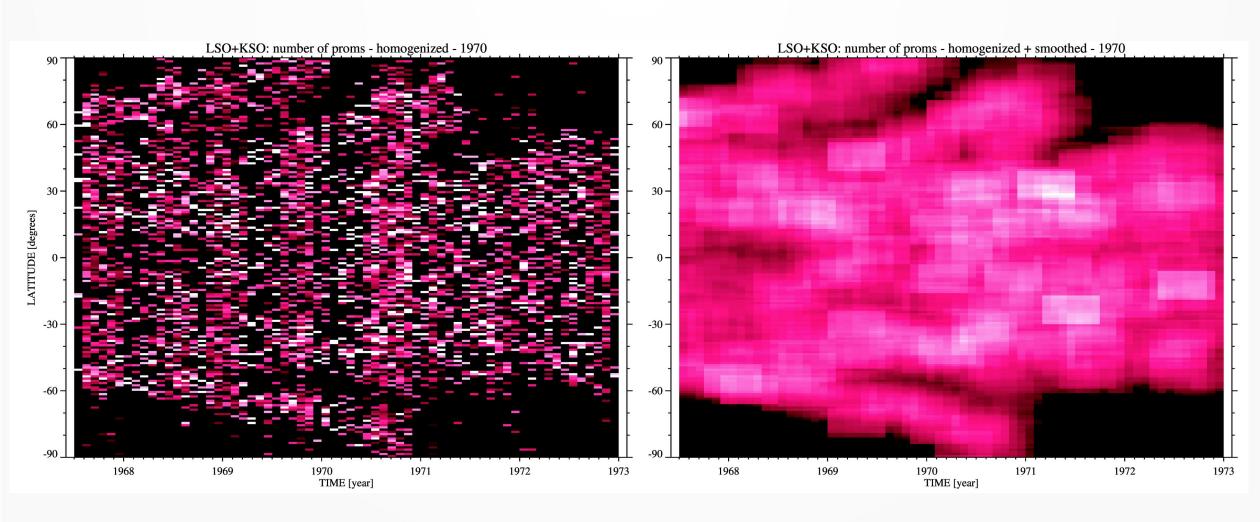
- Time: 05/1967 12/2022, time step: 1 month
- Latitude: [-90°,+90°], latitude step: 10°
- Parameter: prominence area
- Time-latidude distribution: prominence area in the time intervals of a month \* latitude 10° bin
- Optimum dynamic range: area > 20 degrees \* arcsecs, logaritmic scale

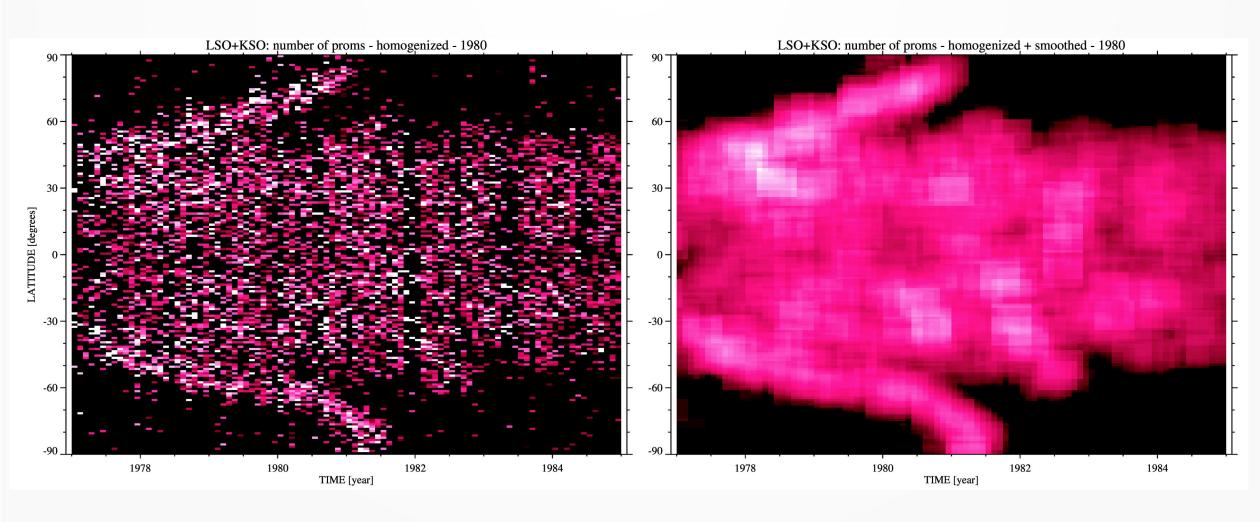
## Time-latitude prom distribution

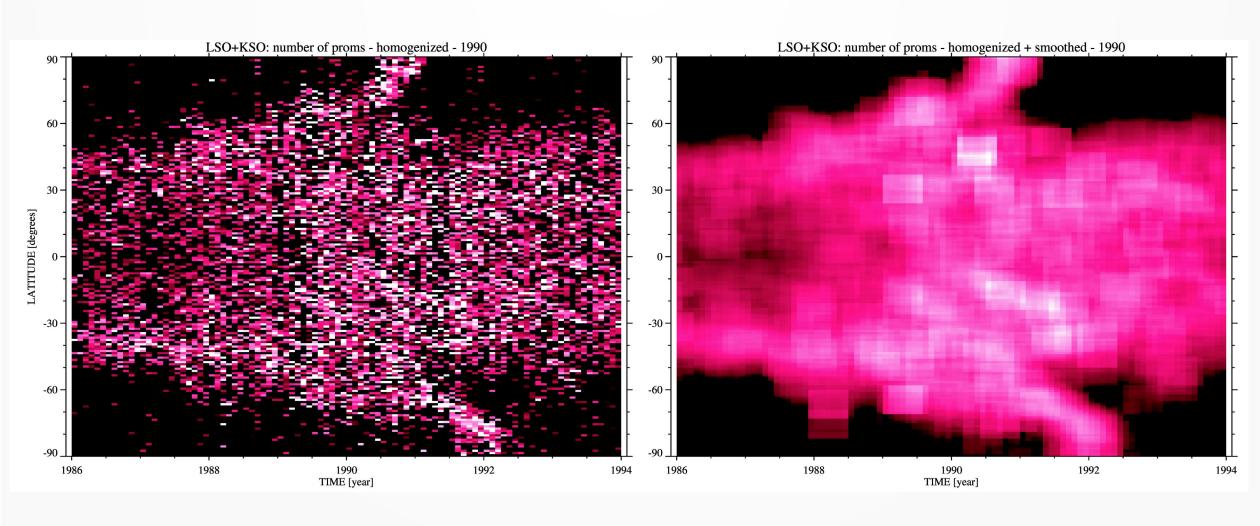


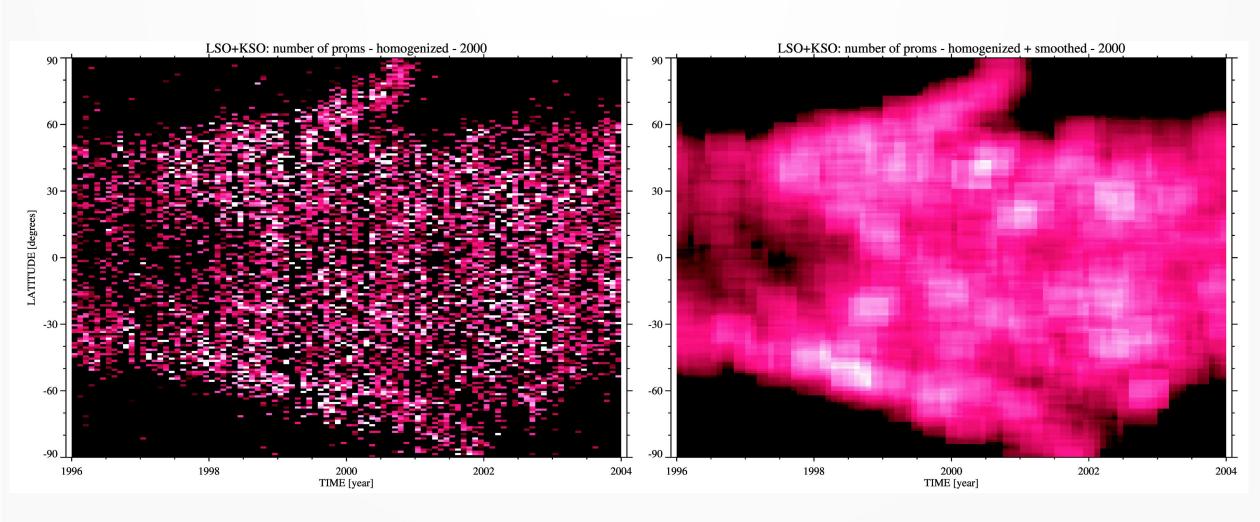
# Polar prom branches

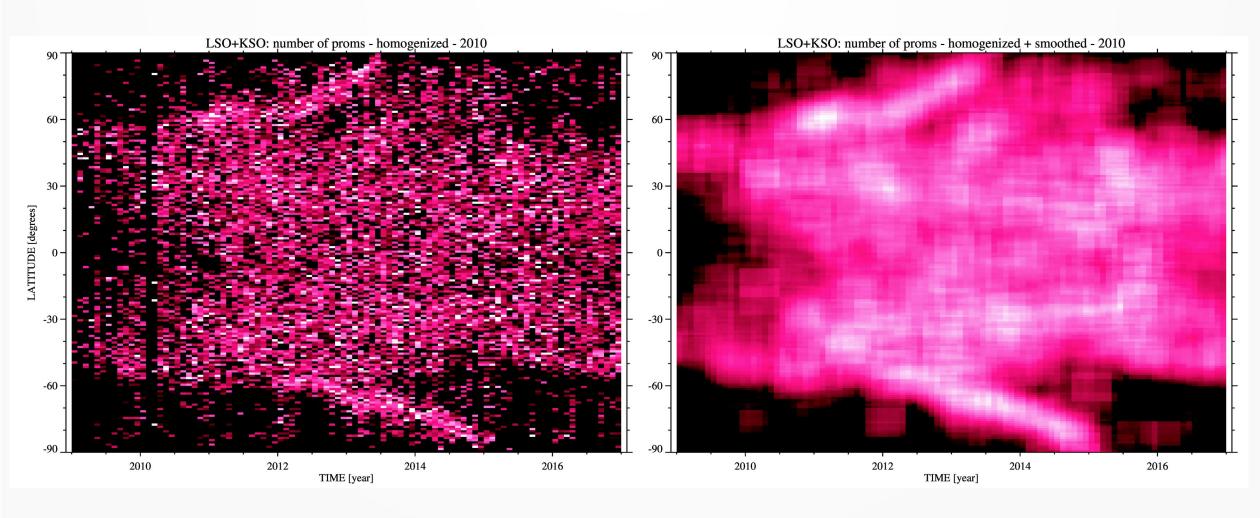
- Arrival time differences between cycles & hemispheres
- The primary and the secondary polar branches
- Variable speed of the poleward motion
- Changes of the poleward motion speed noticeable in the following pictures for the individual solar cycles

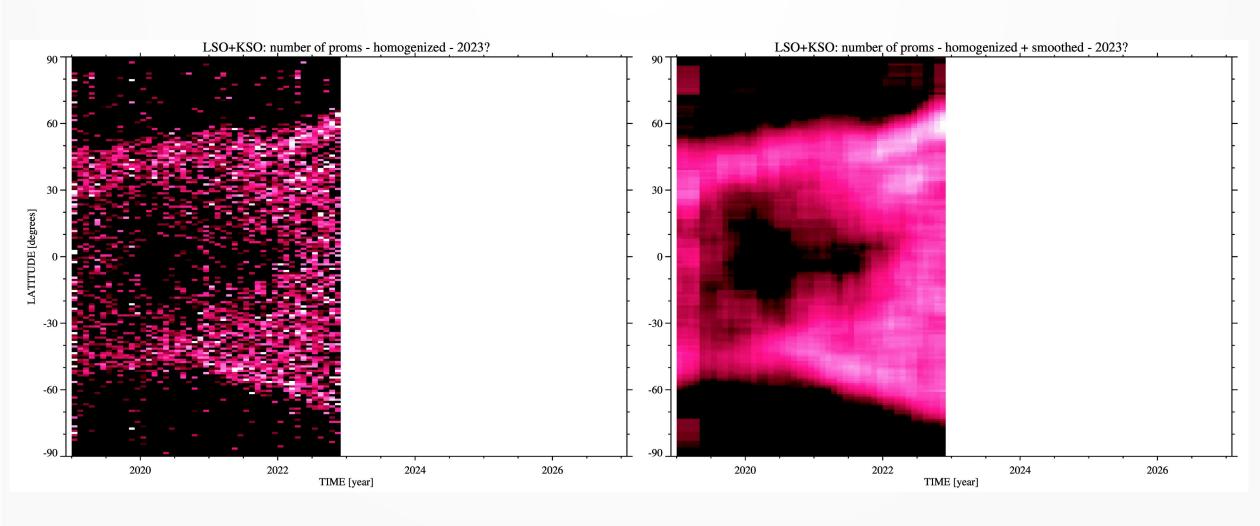








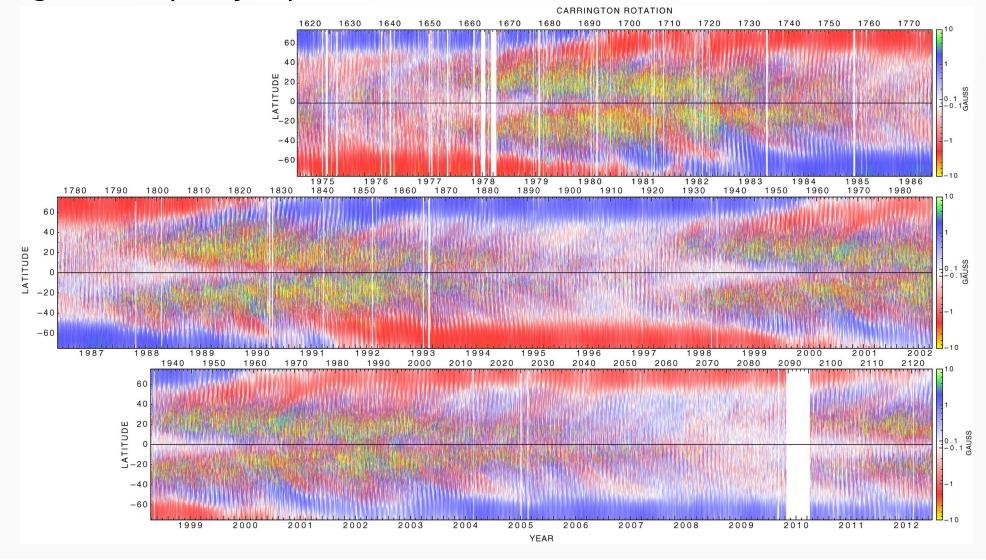




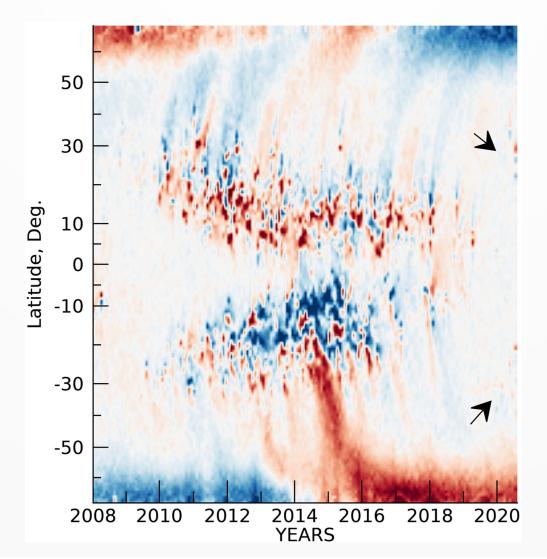
- Our preliminary qualitative results: an attempt to relate the parameters of the poleward motion of the prominences (arrival time, arrival speed, arrival speed changes) to the photospheric emerging magnetic flux and their disperions
  - qualitative MF data only
  - only cycles 21 (~1980), 22 (~1991), 23 (~2000), 24 (~2014)
  - The qualitative magnetic field BKG data (MFs) from figures only:
    - Magnetic Supersynoptic Chart for 1974 to 2012, R. Ulrich, http://obs.astro.ucla.edu/images/supersynoptic\_18-cr1617\_2124.jpg
    - Supersynoptic map for Cycle 24 based on GONG data, A. Pevtsov et al., J. Space Weather Space Clim. 2021, 11, 4

https://doi.org/10.1051/swsc/2020069

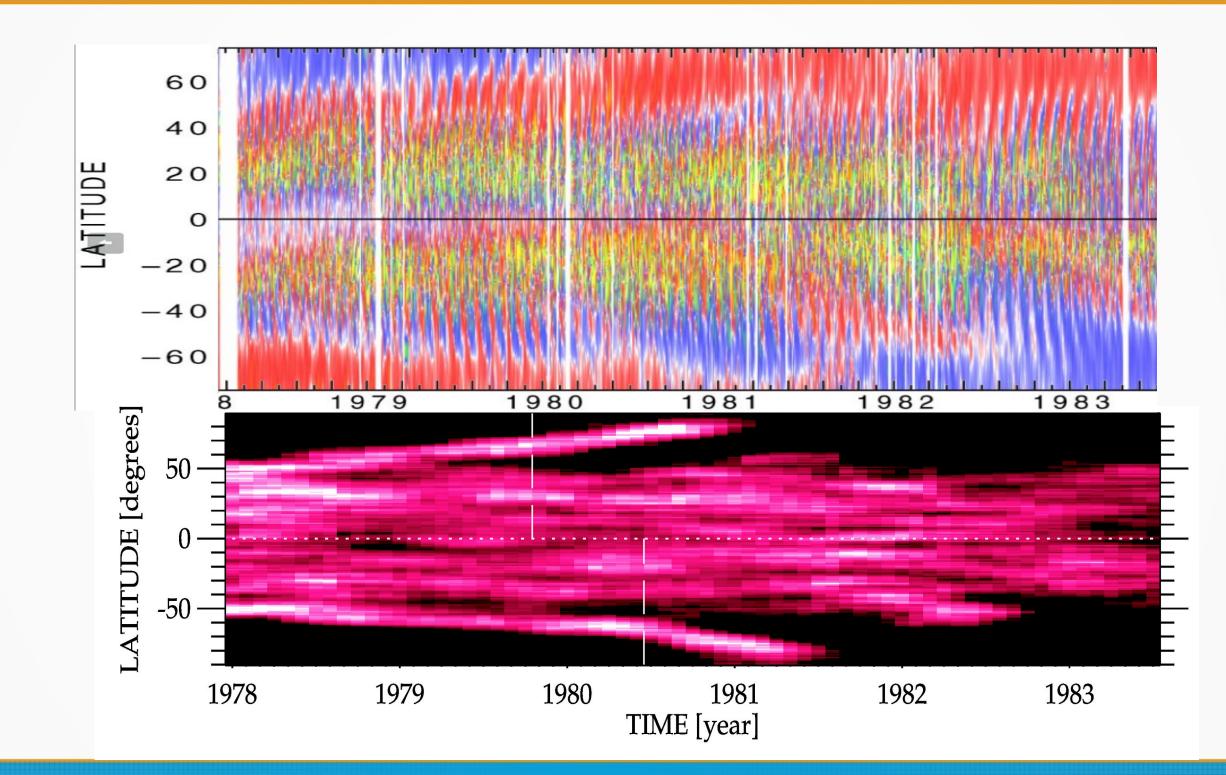
Magnetic Supersynoptic Chart for 1974 to 2012, R. Ulrich

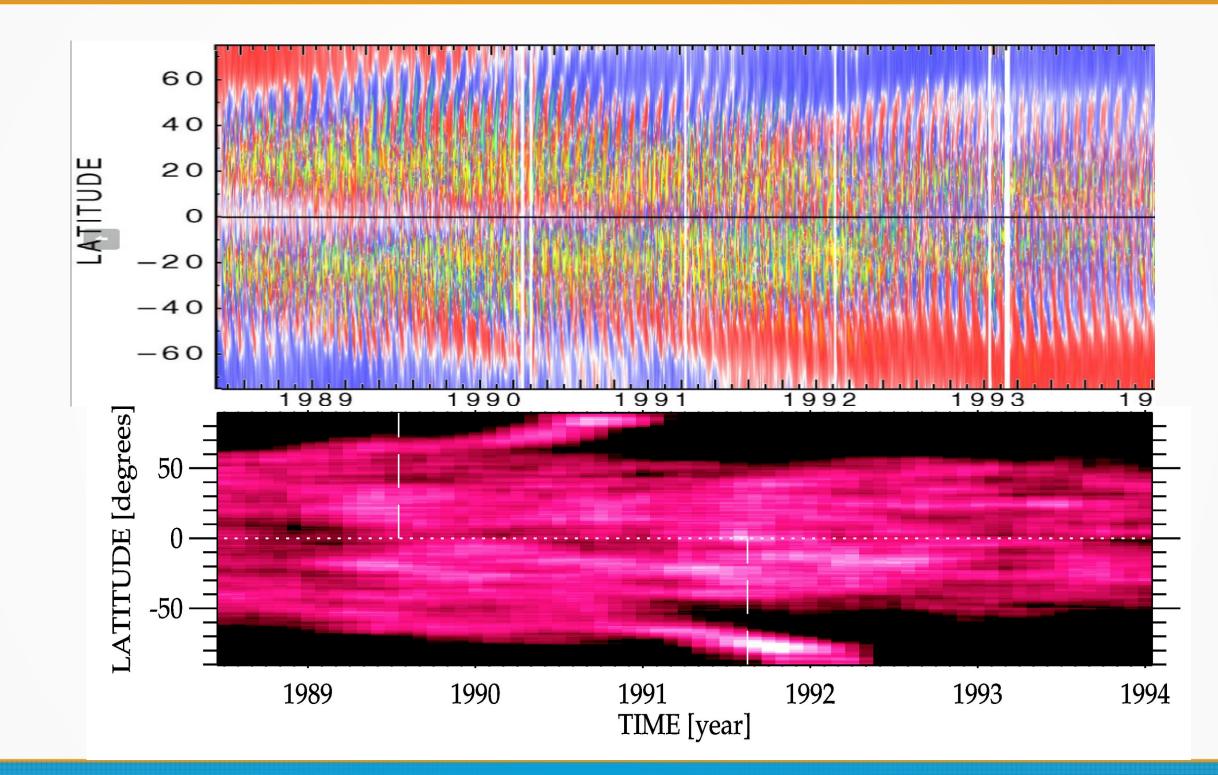


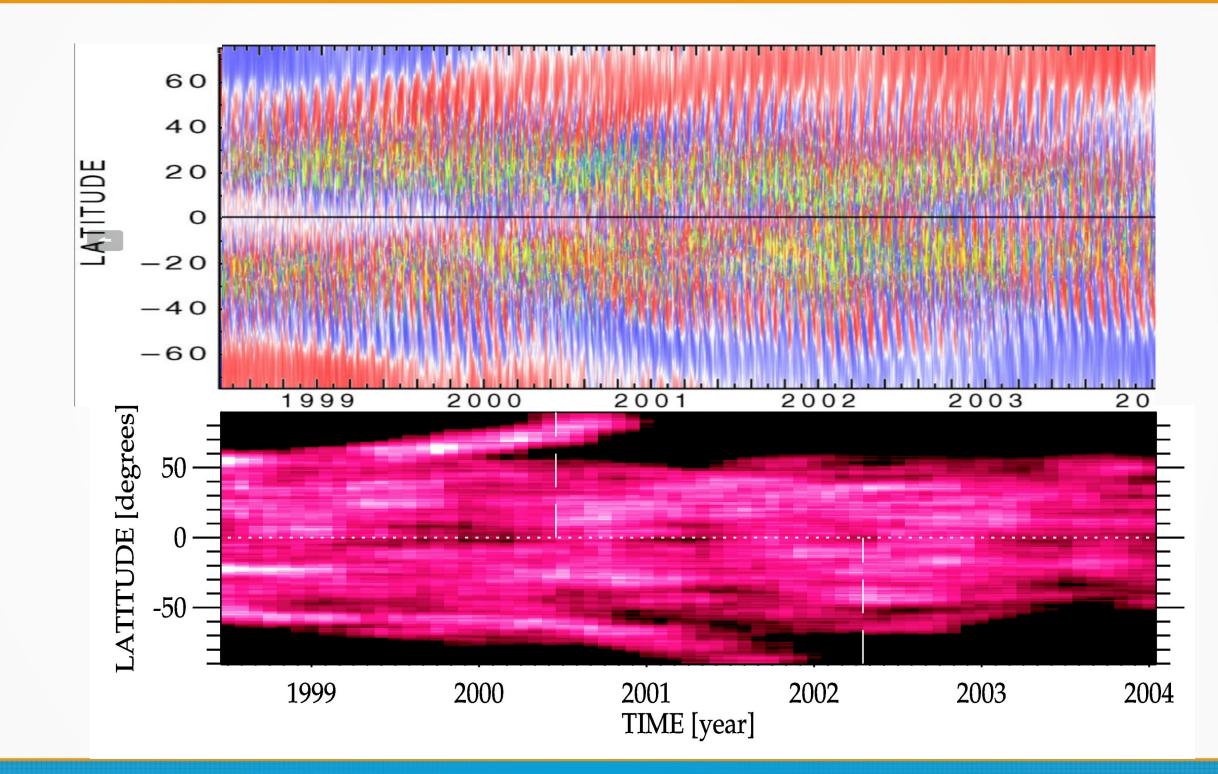
Supersynoptic map for Cycle 24 based on GONG data, A. Pevtsov et al.

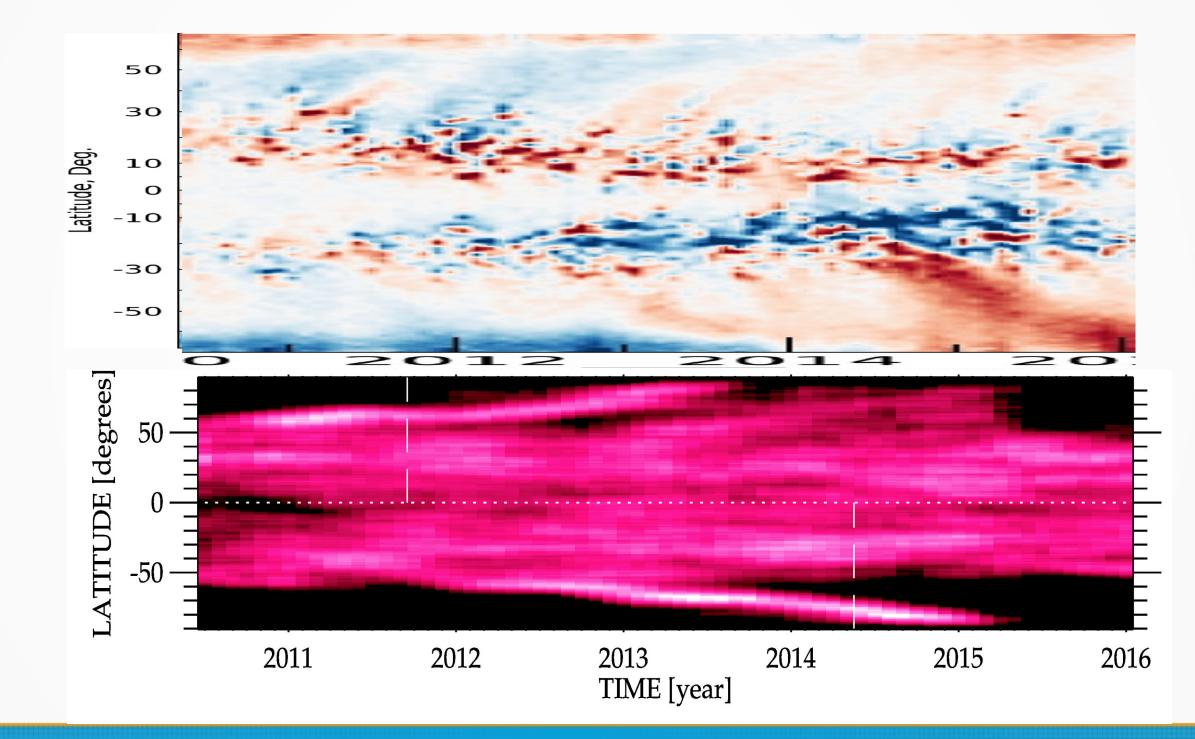


 A qualitative graphical comparison of the time-latitude distribution of the prominences and the MF BKG data shown separately for the individual cycles 21-24







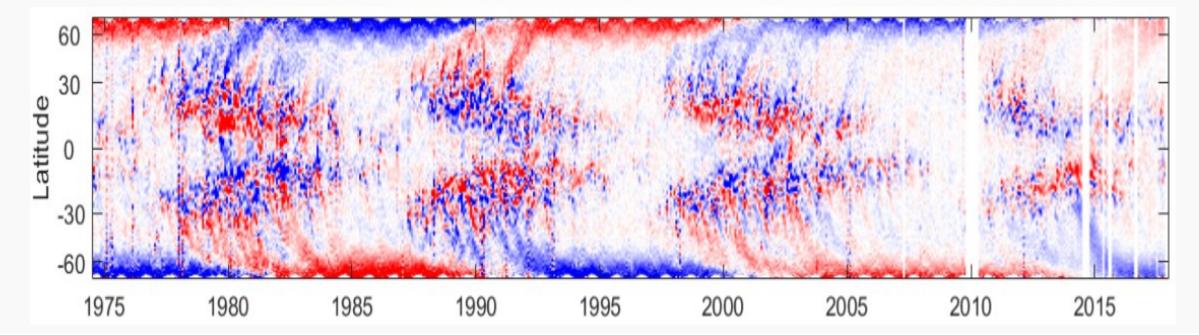


# Summary

- The prominence primary polar banch pole arrival time and the MF pole reversal moments are coupled
- The arrival speed and the changes of this speed seem to be in relation to the surges of the photospheric emerging magnetic flux and their disperions: the speed of the prominence poleward motion might be correlated to the amount of the new magnetic flux dispersed from the emerged active regions

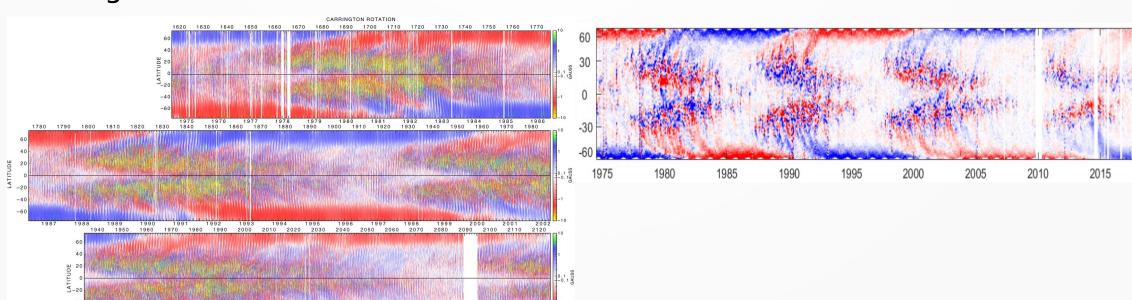
## Idea and MF data

- Idea: moving forward from the qualitative to the quantitative analysis of the prominence poleward motion timing and speed and parameters on the photospheric emerging magnetic flux surges and their disperion
- A promising data sets of the homogenized MF data: Virtanen, I. and Mursula, K. A&A 626, A67 (2019) – data of WSO, MWO, Kitt Peak, SOLIS/VSM, SOHO/MDI, SDO/HMI



### Data extend and format

- A promising data sets of the homogenized MF data: Virtanen, I. and Mursula, K. A&A 626, A67 (2019) if possible:
  - updated to present
  - also in the form of the Ulrich's data: each Carrington rotation with a longitude - latitude 3D MF flux data



#### Future?

- 1/ An analysis for determination of possible quantitative relations derived between the polar prominence branches timing and parameters and the MF emergence
- 2/ In case of the solid resulting quantitative relations derived between the polar prominence branches parameters and the MF emergence:
  - an estimation of the MF pole reversals for the cycle 20 using the LSO/KSO prominence catalogue (i.e. for the solar cycle **before** start of photospheric patrol magnetographic measurements)
  - a possible extension of information on the MF reversals back to 1880 using the available solar disk H alpha prominence observations and their catalogues

## In fine

- Your interest in the proposed research project and cooperation in the analysis of data would be welcome
- A brief email reply with your opinion would be nice to receive