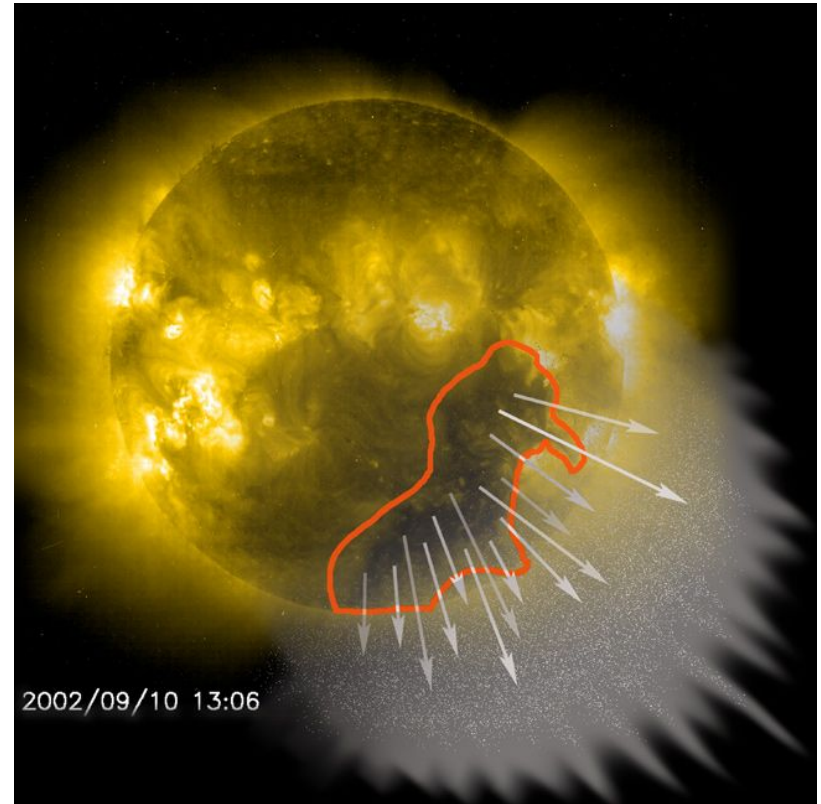


Correlation of coronal hole boundaries and features in surrounding regions

Jessie Wang, Alexandros Koukras

Background - Solar wind

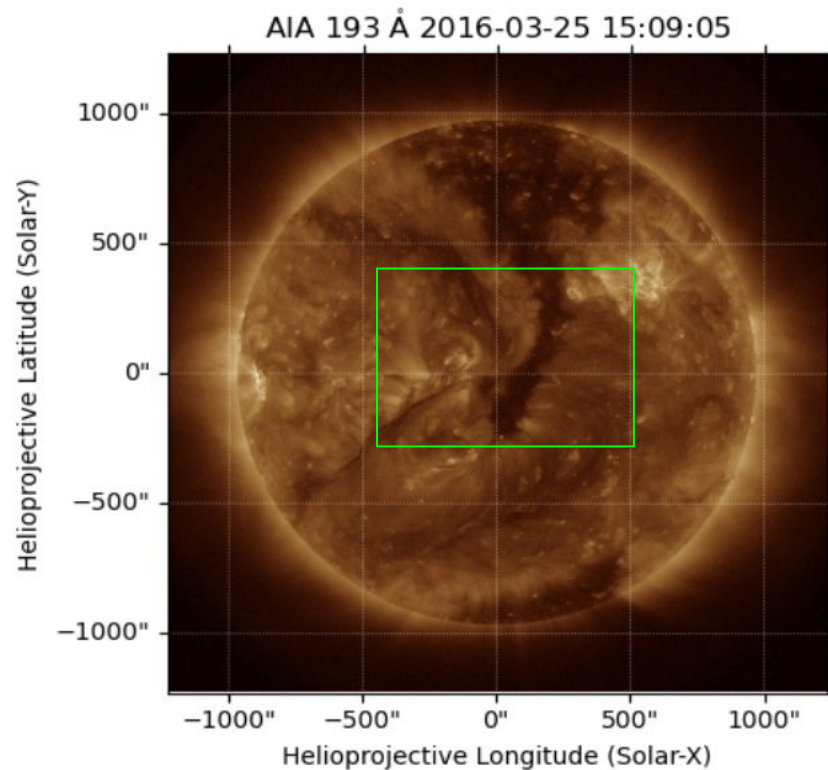
- Flow of charged particles traveling from the Sun's corona outwards
 - Open magnetic field lines allowing plasma to flow outwards
- Fast vs. Slow



[NASA SOHO](#)

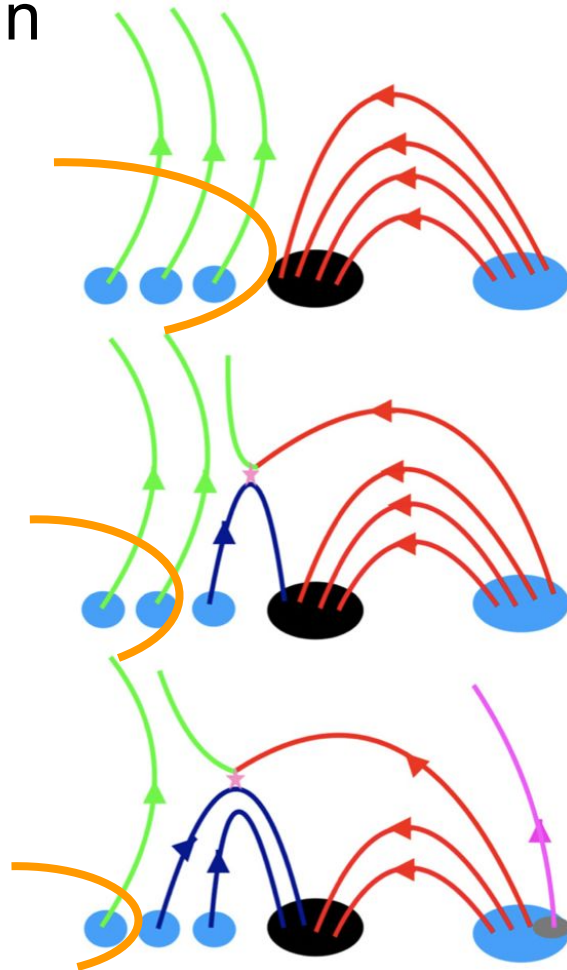
Background - Coronal Holes

- Cooler, less dense region of the Sun
- Open field lines
- Sources of high speed solar streams



Background - Magnetic field of the Sun

- Reconnection of magnetic field lines when in close proximity
- Interchange reconnection
 - Interaction between closed and open magnetic field lines
 - Potential source of the slow solar wind

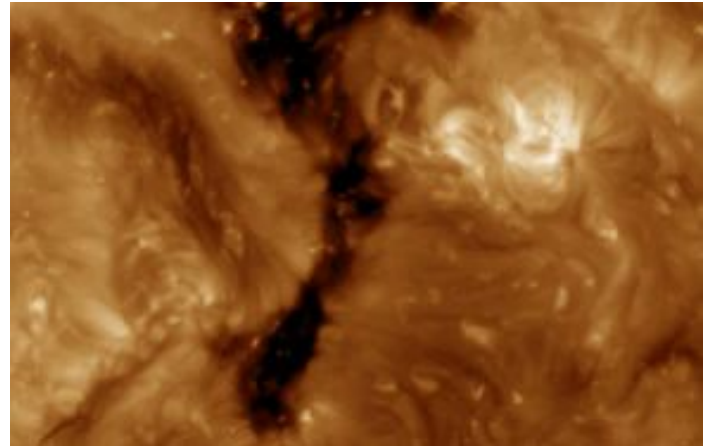
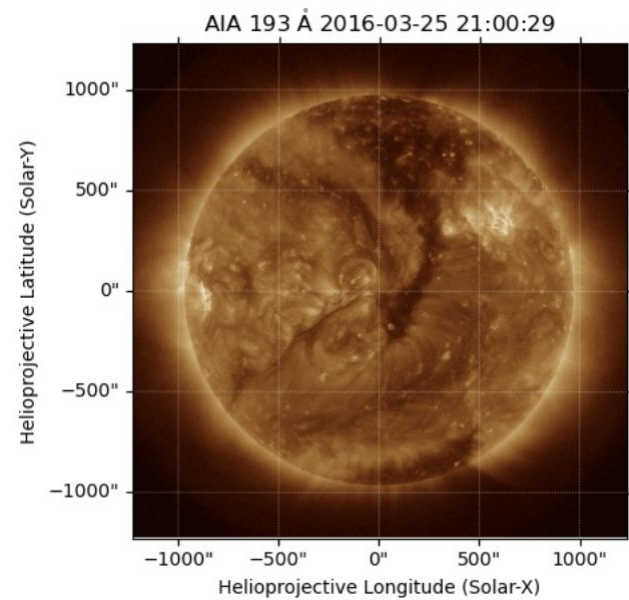


Goal of analysis

- Investigate if there is any connection between movements of the coronal hole boundary and surrounding region
 - Potential signatures of interchange reconnection at coronal hole boundaries

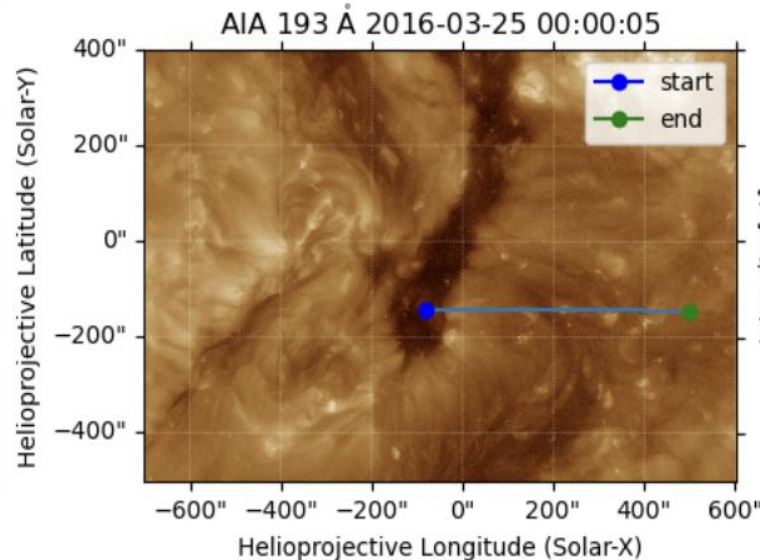
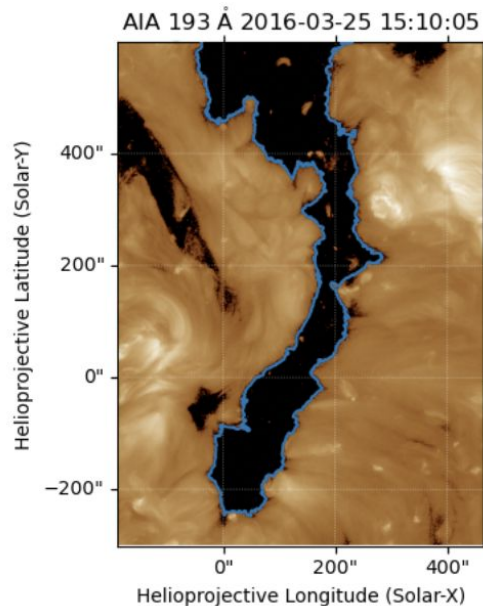
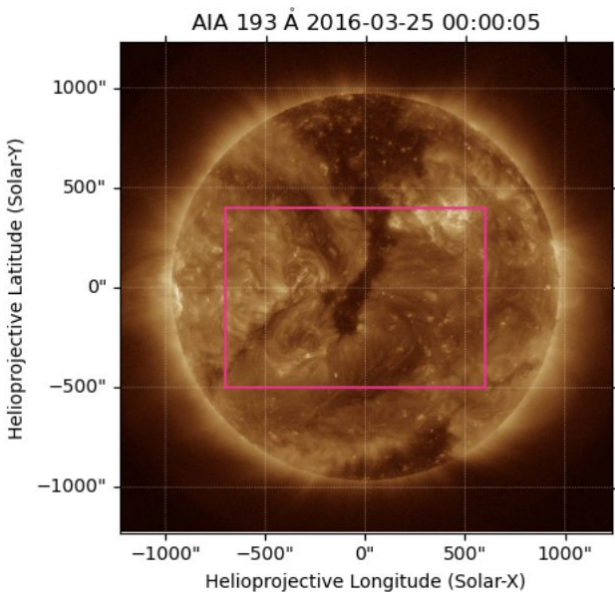
AIA Data

- Data used:
 - 193 Å passband
 - 160 images taken over 24 hours, cadence of 9 minutes
 - 03/25/2016 - 03/26/2016



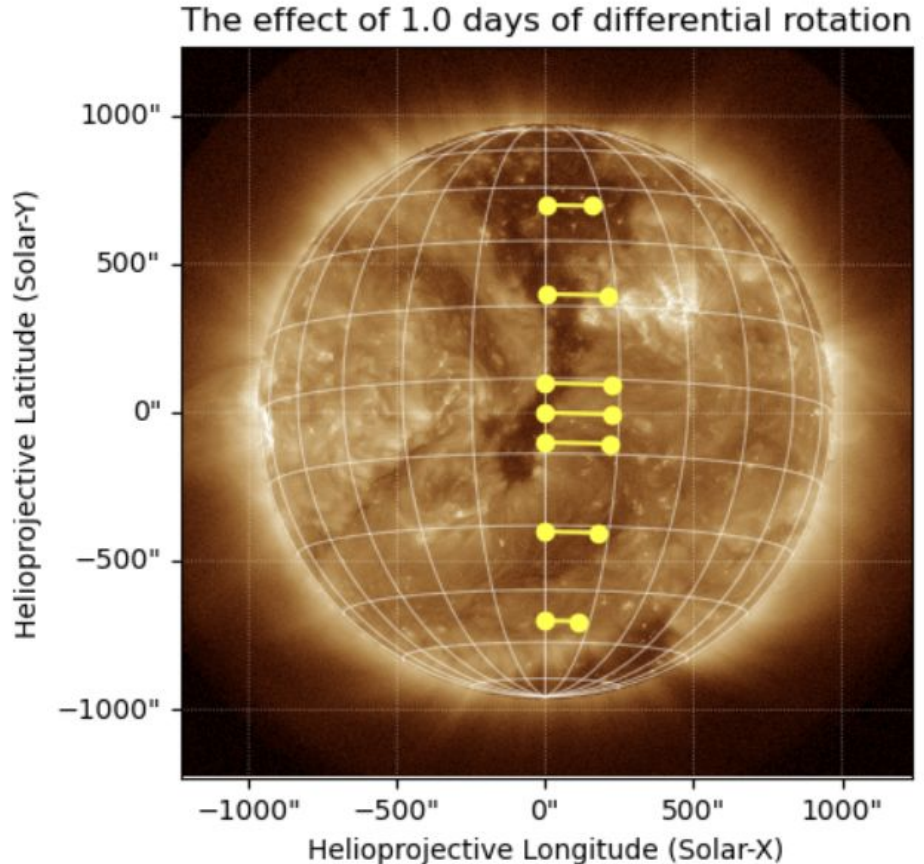
Methodology - Determining placement of cut

- Submap including coronal hole
- Found contour of coronal hole with specified threshold for intensity
- Chose start of longitudinal cut to begin inside coronal hole

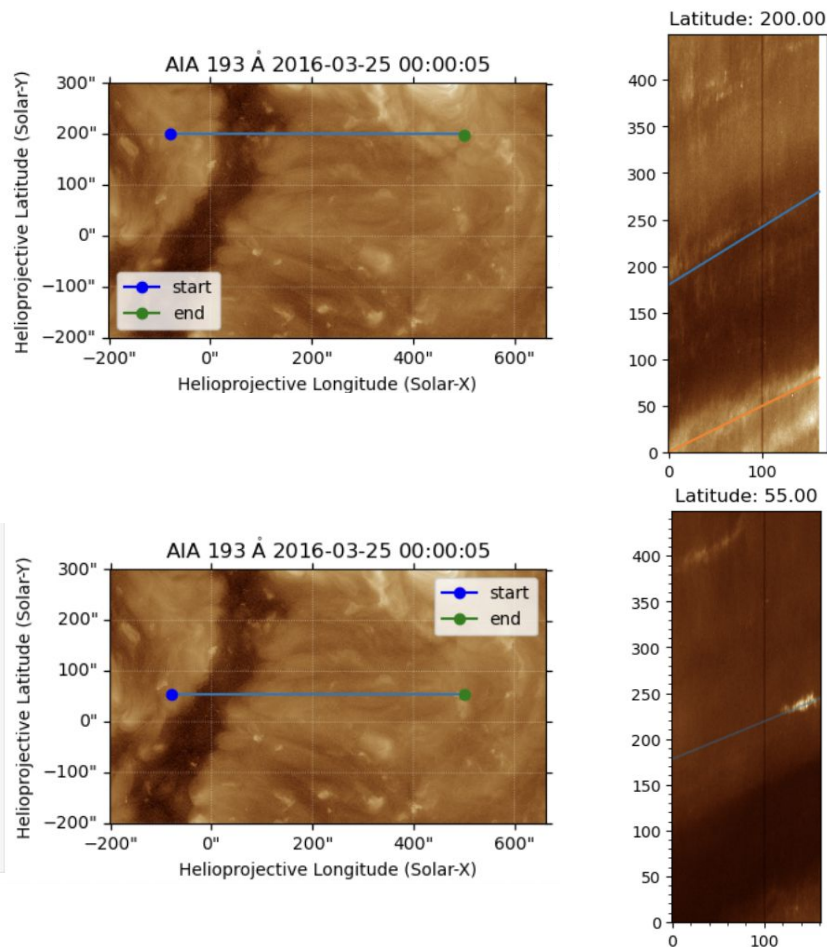


Methodology - Differential Rotation

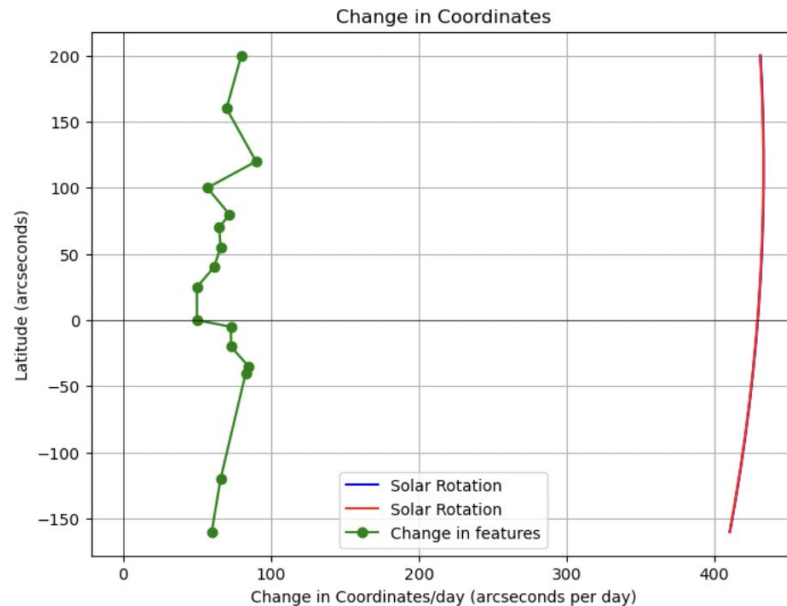
- Shifted coordinates of submap and cut to account for the differential rotation of the Sun



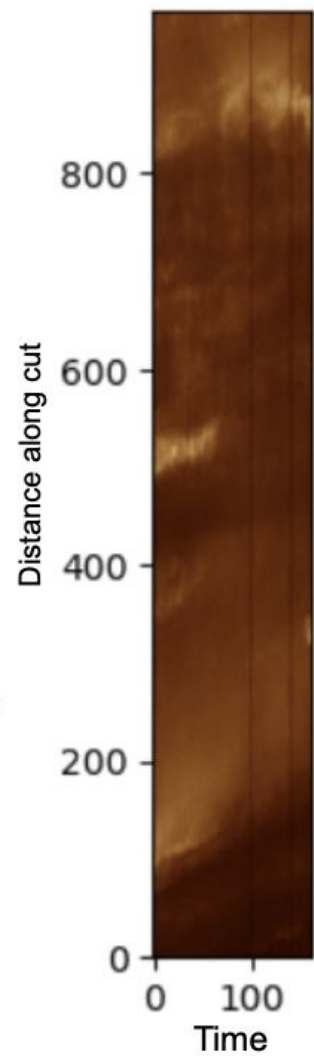
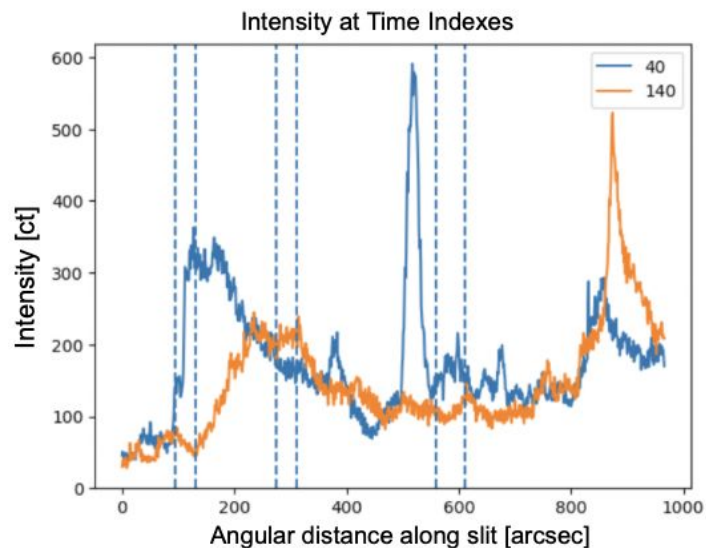
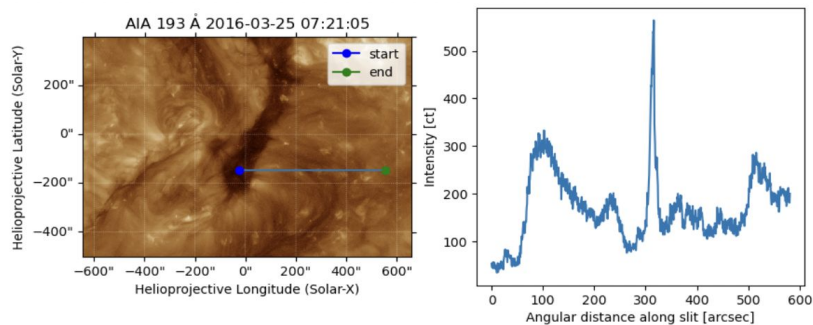
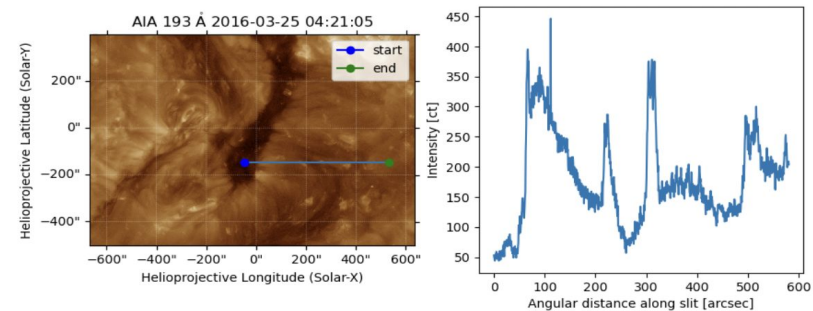
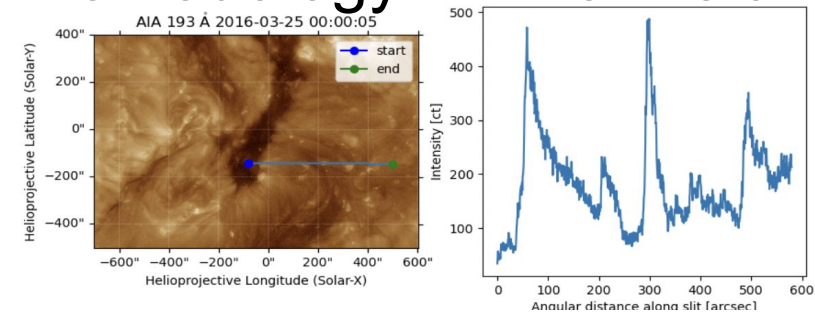
Methodology - Differential Rotation



- Confirming changes in features were not from differential rotation
- No observable trend from high to low latitudes

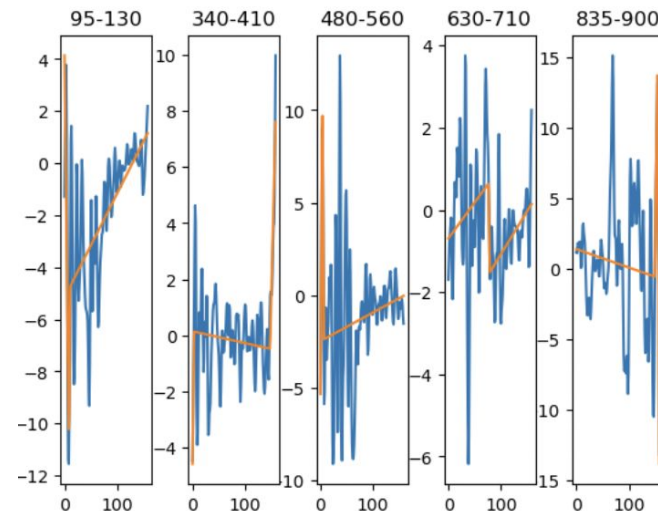
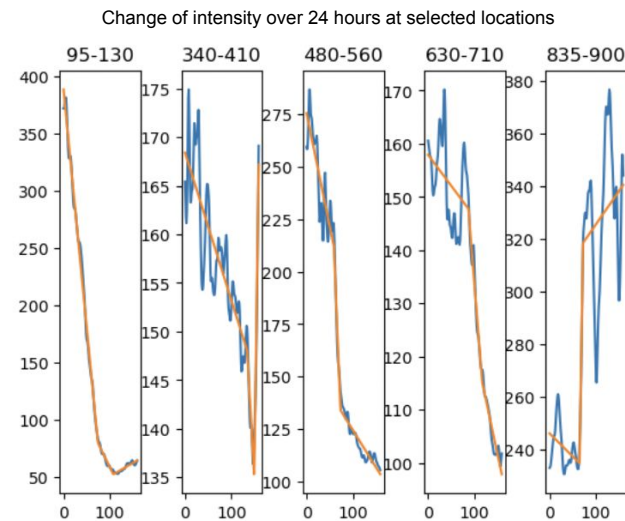
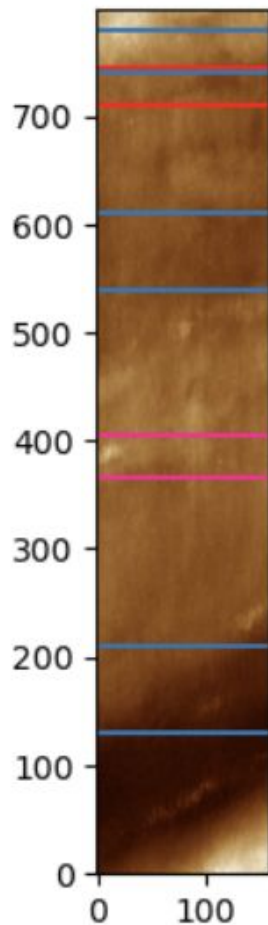


Methodology - Time Distance Plots

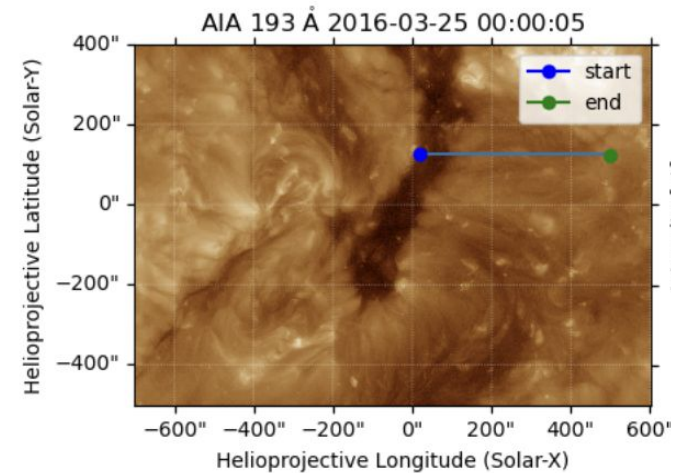


Methodology - Processing Data

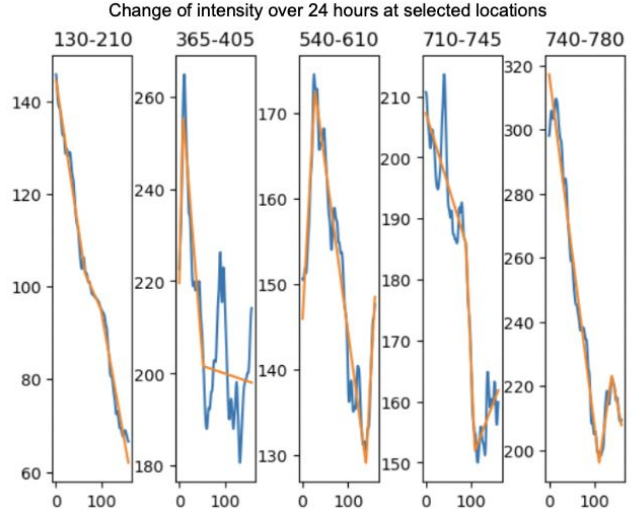
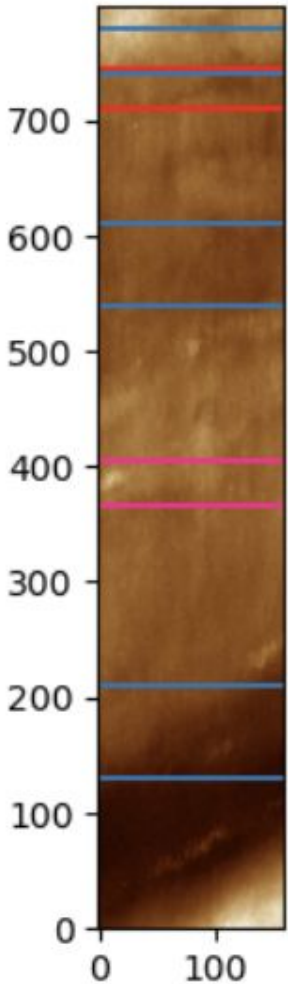
- Used time distance plots to identify darkening/brightening in features close to the boundary over time
- Calculated change in intensity in those regions
- Applied linear fits to the change and rate of change of intensity



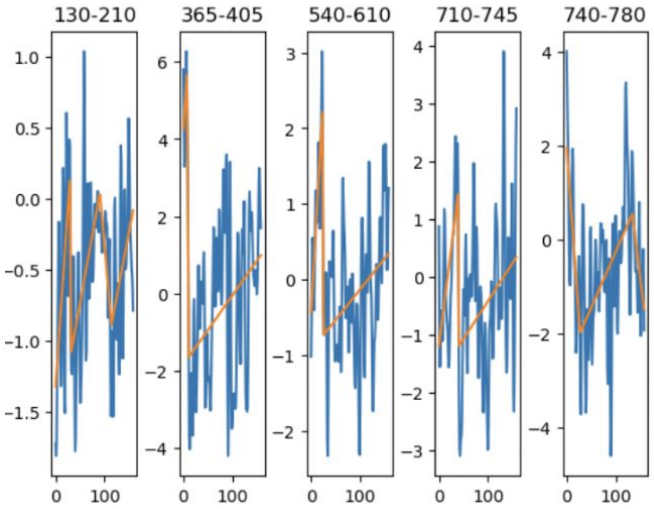
Results



Lat:125



Rate of change of intensity over 24 hours at selected locations

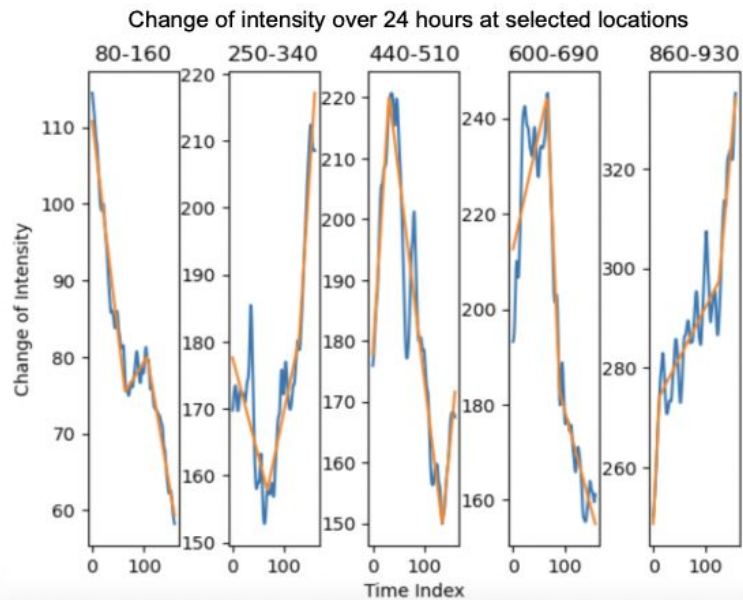
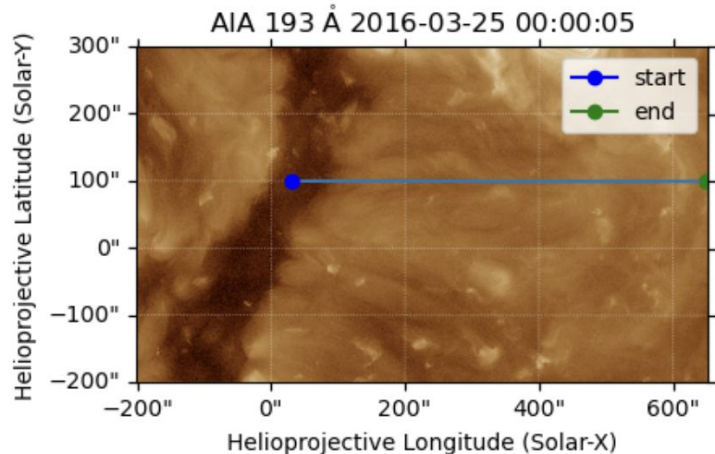
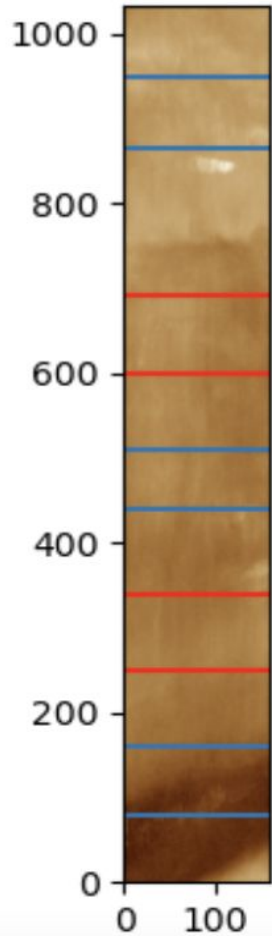


Rate of Change of Intensity at varying times

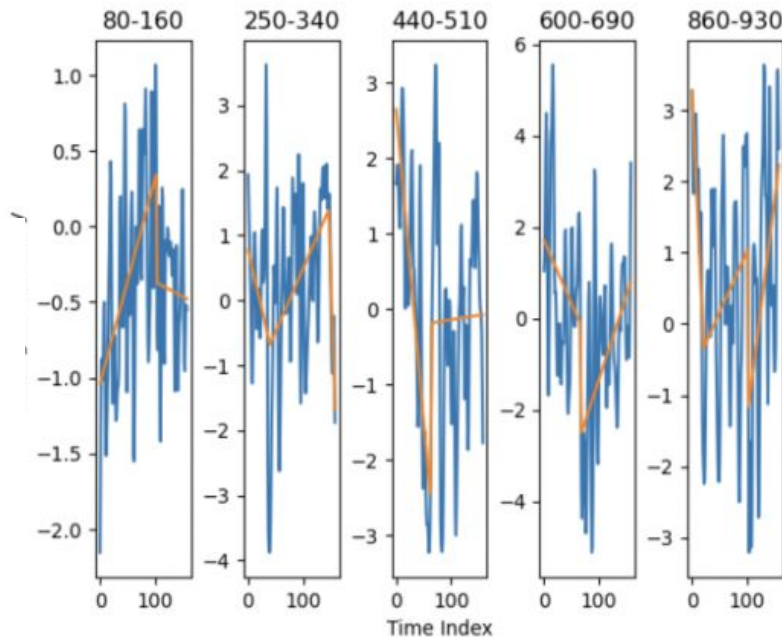
Time Index Position	15	50	140
130-210	0.052	0.019	0.018
365-405	-0.69	0.058	0.054
540-610	0.12	0.0039	0.061
710-745	0.066	0.11	0.032
740-780	-0.18	0.024	-0.076

Results

Lat:100

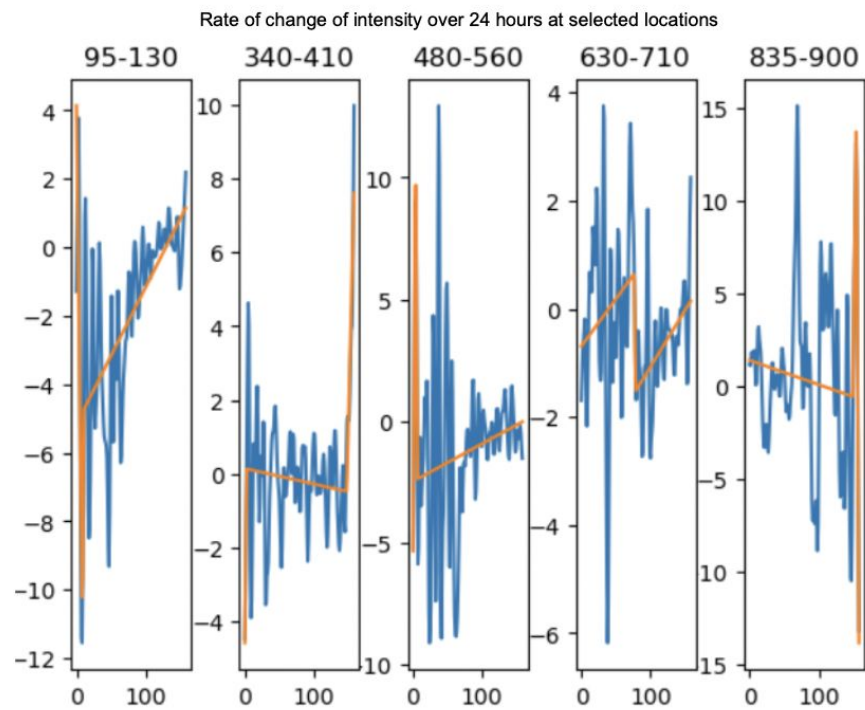
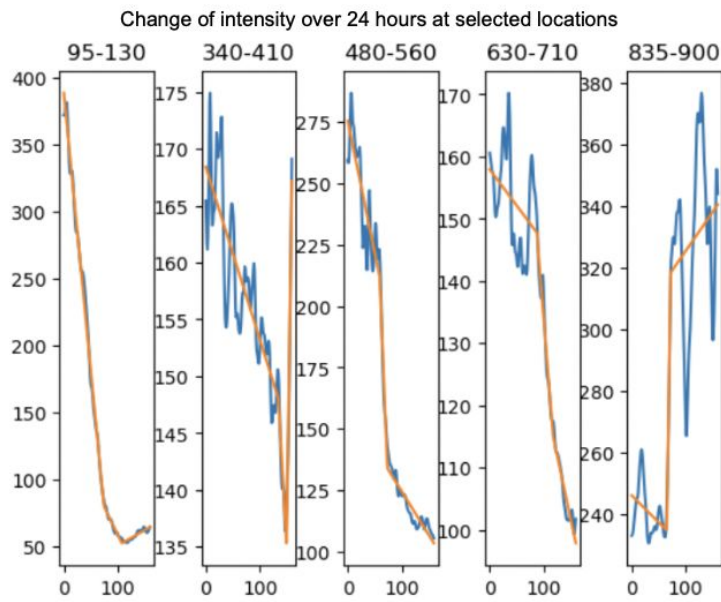
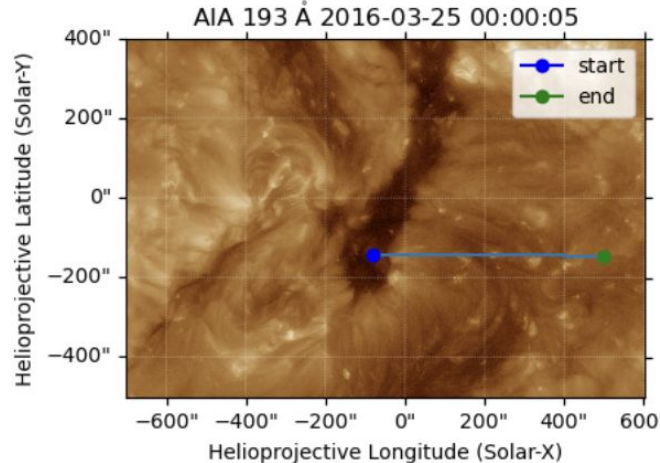
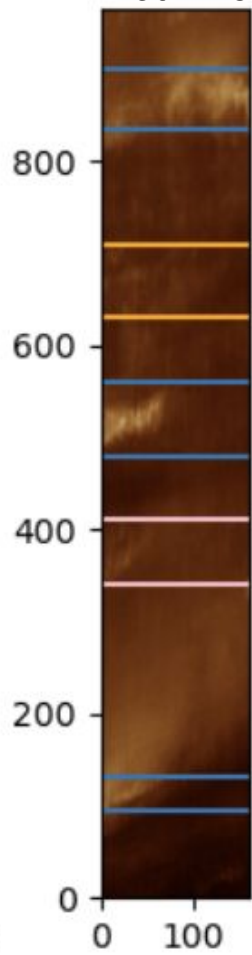


Rate of change of intensity over 24 hours at selected locations



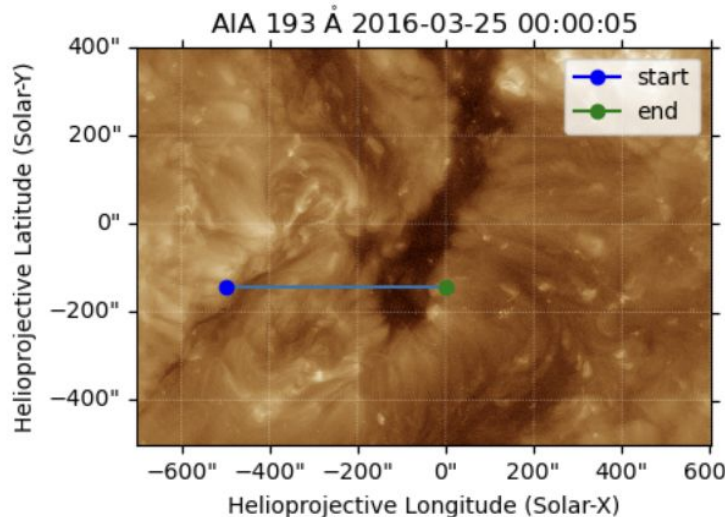
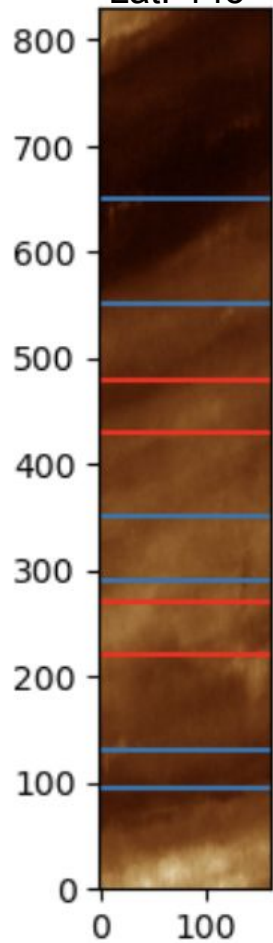
Results

Lat:-145

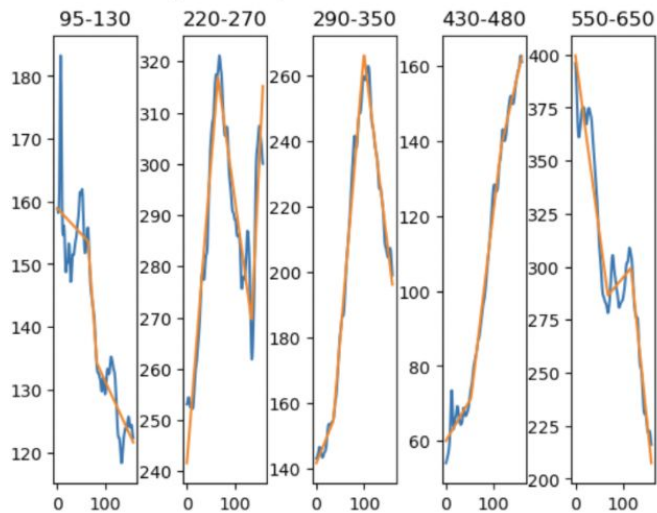


Results

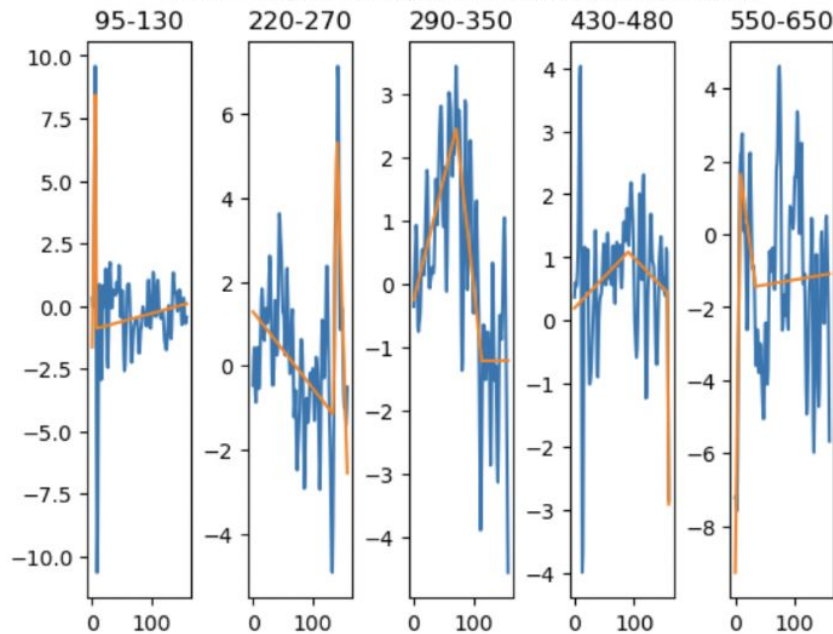
Lat:-145



Change of intensity over 24 hours at selected locations



Rate of change of intensity over 24 hours at selected locations



Breakpoints in change of intensity in terms of time in regions along cuts at 3 latitudes

Position along cut Latitude	40	80	120	160	200	240	280	320	360	400	440	480	520	560	600	640	680	720	760	800	840	880
125				63.8						8.5				27.3				87.9	110.2			
100			63.7				67.3					31.5				65.8						12
-145R			74.3						133.9				73.3				87					72.1
-145L			64.2			67.9		135.5			35.5				52.4							

Breakpoints in rate of change in intensity in terms of time in regions along cuts at 3 latitudes

Position along cut Latitude	40	80	120	160	200	240	280	320	360	400	440	480	520	560	600	640	680	720	760	800	840	880
125				29.6						11				25.2				40.2	27.3			
100			102.7				40					62.6				66.3						101.7
-145R			10.5						2.69				6.6				78.5				149	
-145L			5.5			134.7		71.9		90.7				34								

Conclusions

- Breakpoints in change of intensity at coronal hole boundary and neighboring regions occurred at similar time index
 - The rate of change of intensity at the boundary and in neighboring features showed possible correlation
- To the left of the coronal hole:
 - correlation between the breakpoints in change of intensity
 - no clear correlation between rate of change
- Possible signs of interchange reconnection to the right of the coronal hole