

CLASP/SJ observation of time variations of Lyman-alpha emissions in a solar active region

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Introduction

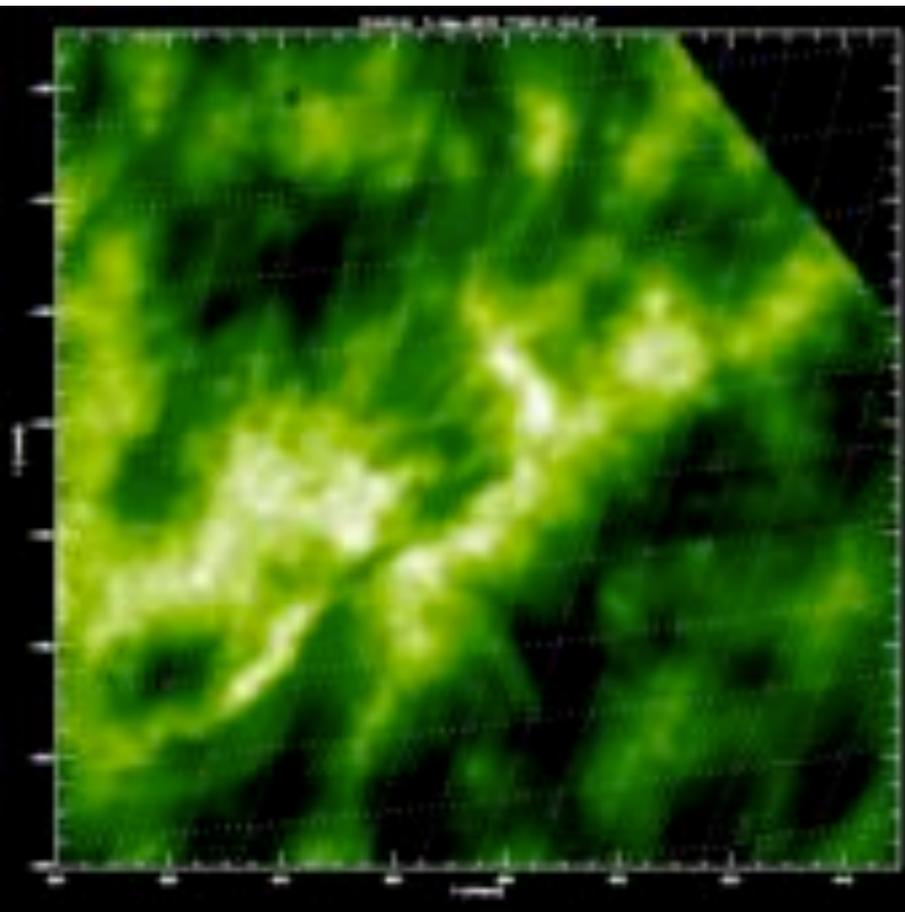
- Studies on active region time variation focused on time scales of ~ 1 min or longer, because of limitations of instruments (i.e., 12 s cadence with SDO/AIA, Aschwanden et al. 2011, White & Verwichte 2012)
- CLASP Slit-jaw observed a low-activity active region NOAA 12405 and the advantage of CLASP SJ is high cadence (0.6 s);
- Kubo san found ubiquitous quasi periodic disturbances inside and outside the active region, and I especially focused on the time variation in active region and compared with coronal structure observed by SDO/AIA to investigate possible contribution to heating



SJ Movies

- I used 4.8 s running averaged images for the analysis to ignore jitter caused by waveplate rotation
- I focused on the time scale <30 s

4.8 s running average

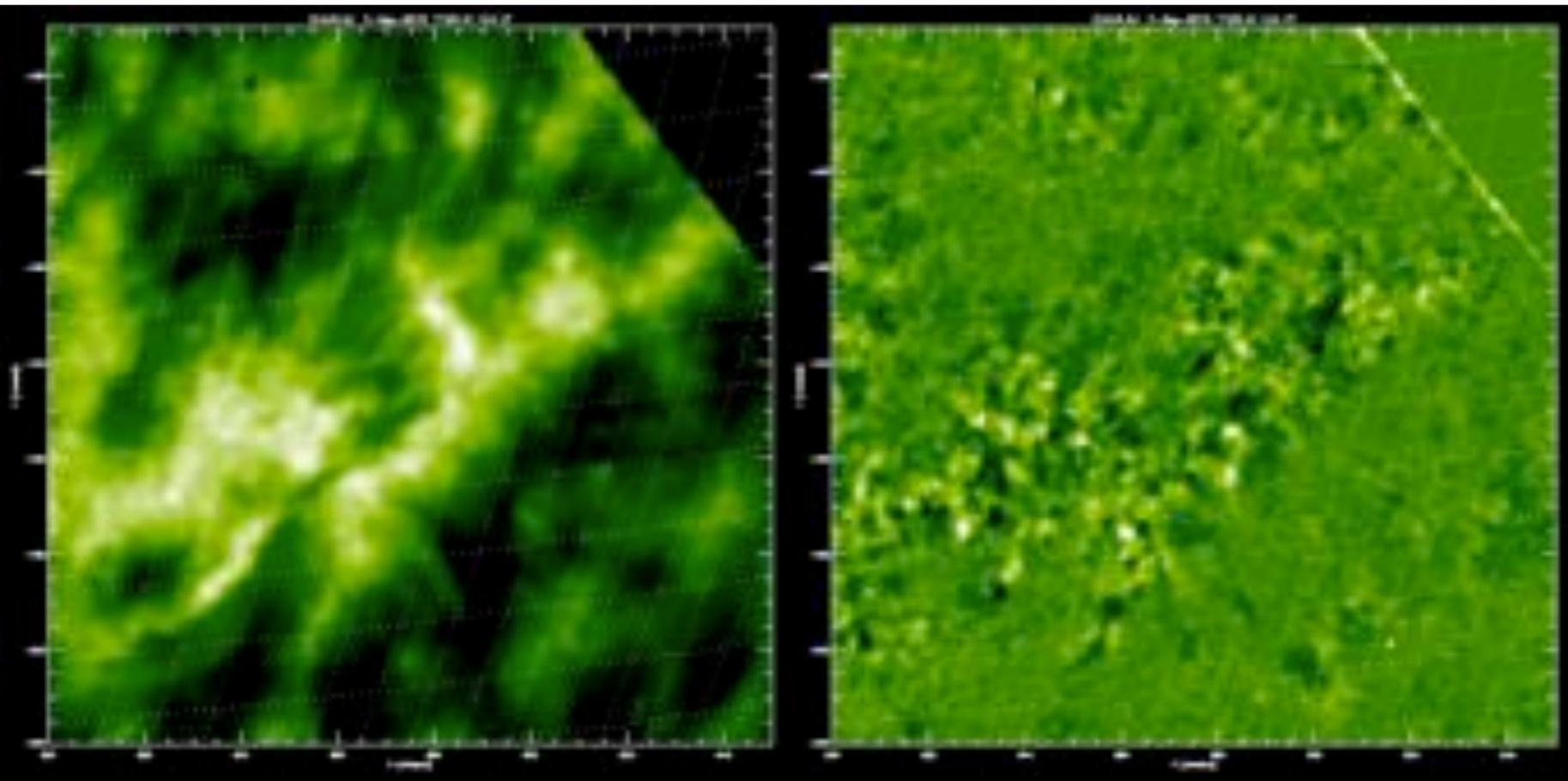


SJ Movies

- I used 4.8 s running averaged images for the analysis to ignore jitter caused by waveplate rotation
- I focused on the time scale <30 s

4.8 s running average

[4.8 s r.a.] - [30 s r.a]



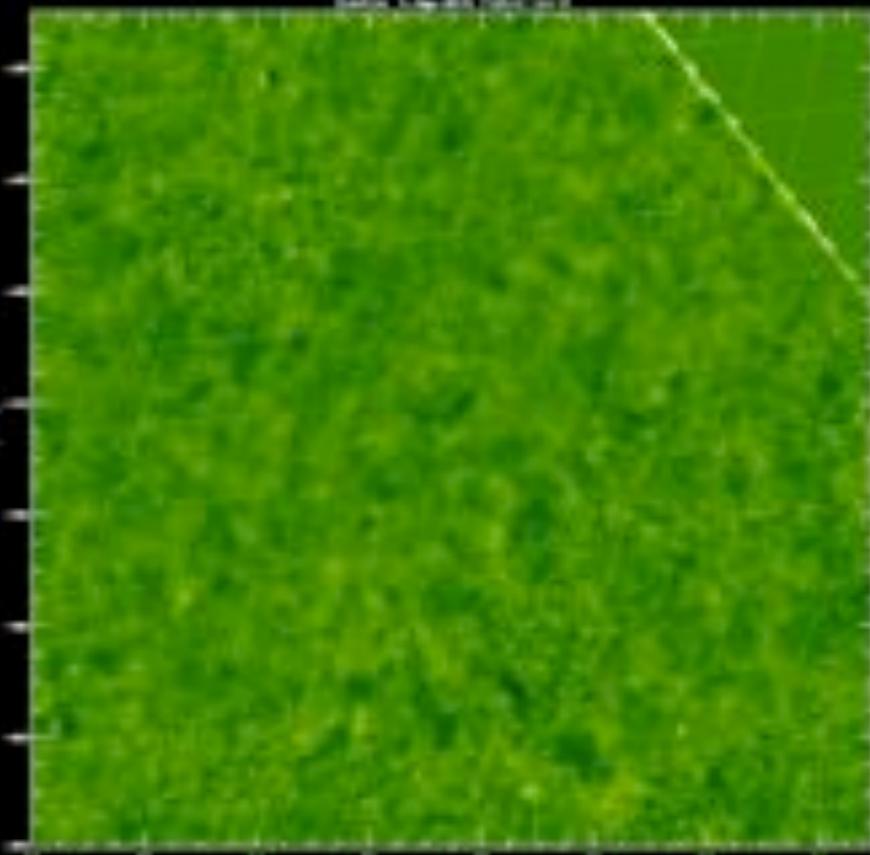
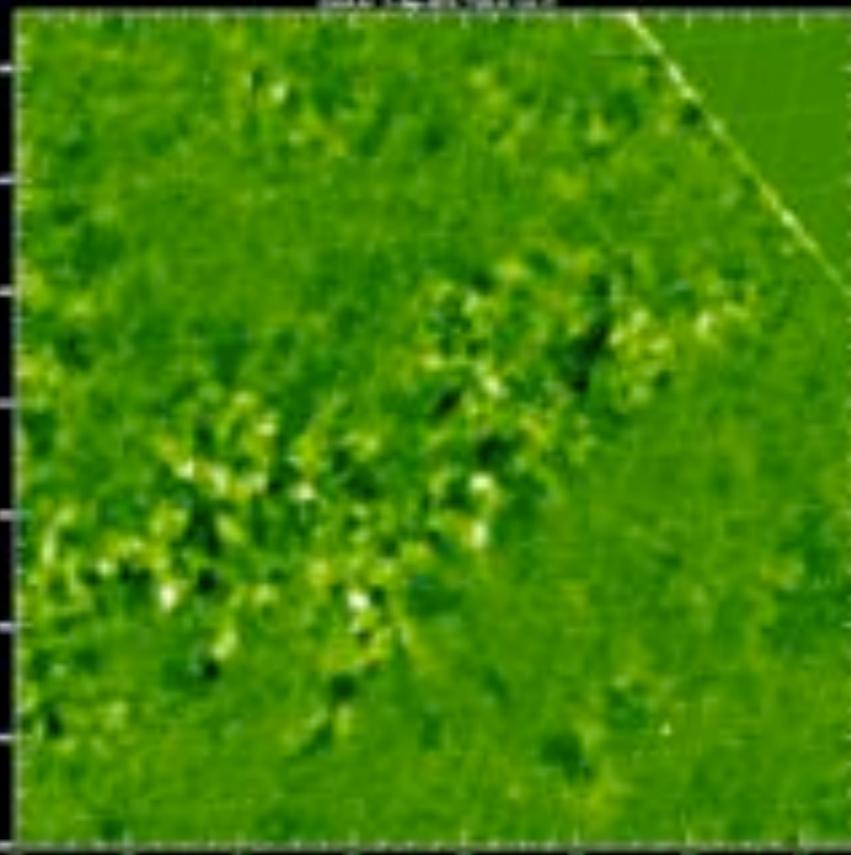
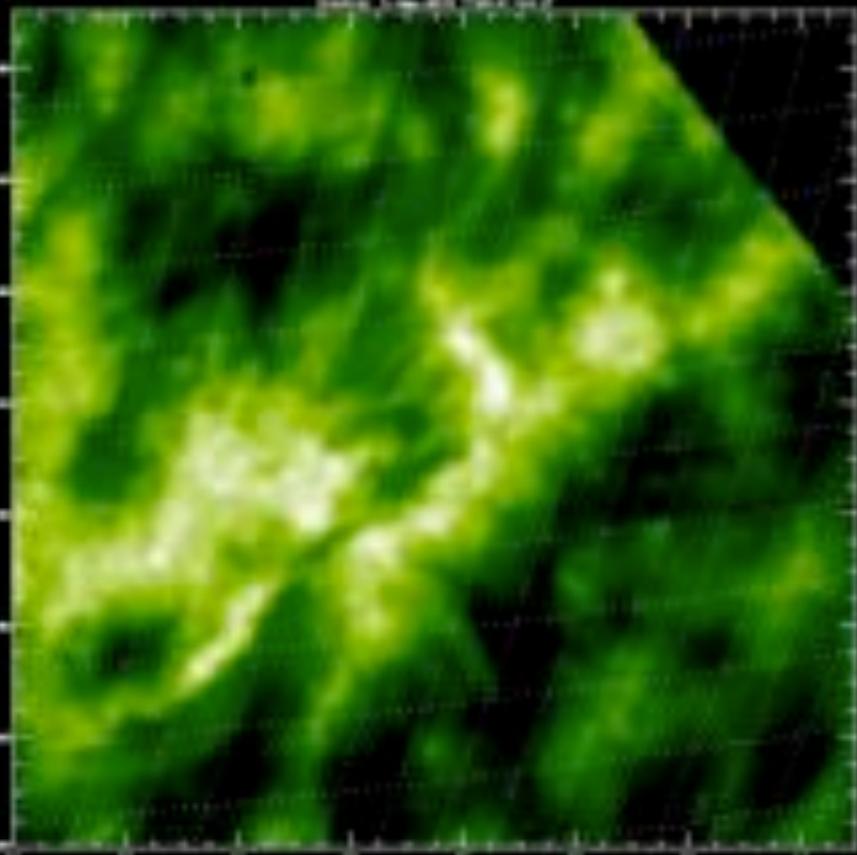
SJ Movies

- I used 4.8 s running averaged images for the analysis to ignore artificial intensity change caused by waveplate rotation
- I focused on the time scale <30 s

4.8 s running average

[4.8 s r.a.] - [30 s r.a]

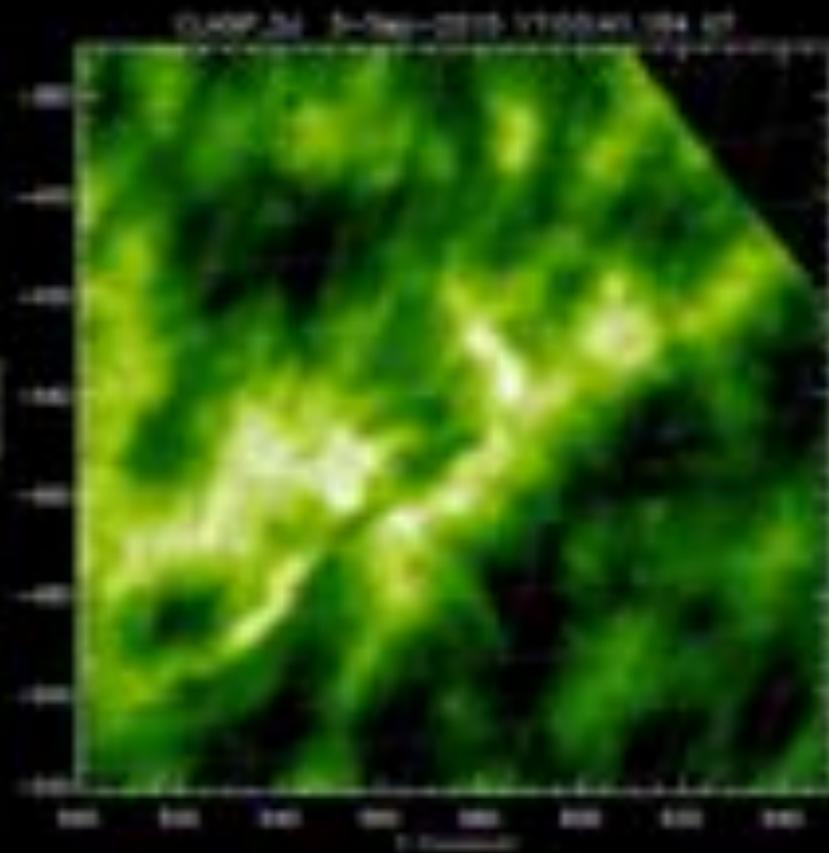
[4.8 s r.a.] / [30 s r.a]



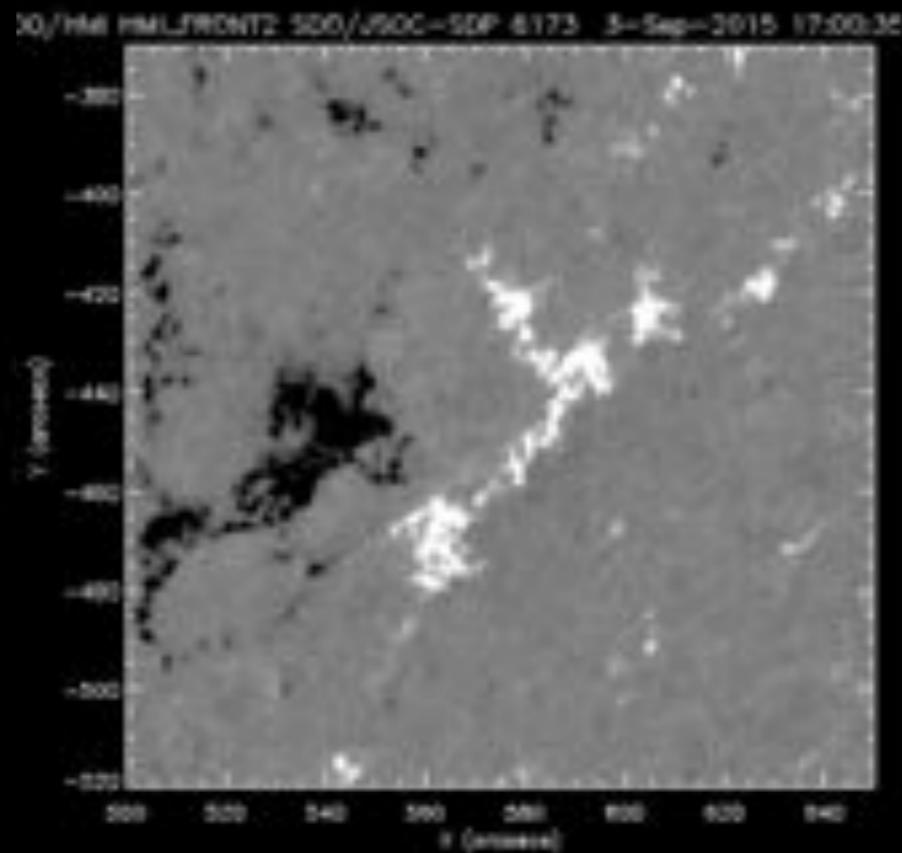
- SJ images are almost stable, but we can see many transient events by looking at differential images: $\sim 5''$ or smaller spatial scale
- Time variations are more at higher intensity pixels

Comparison to other wavelengths

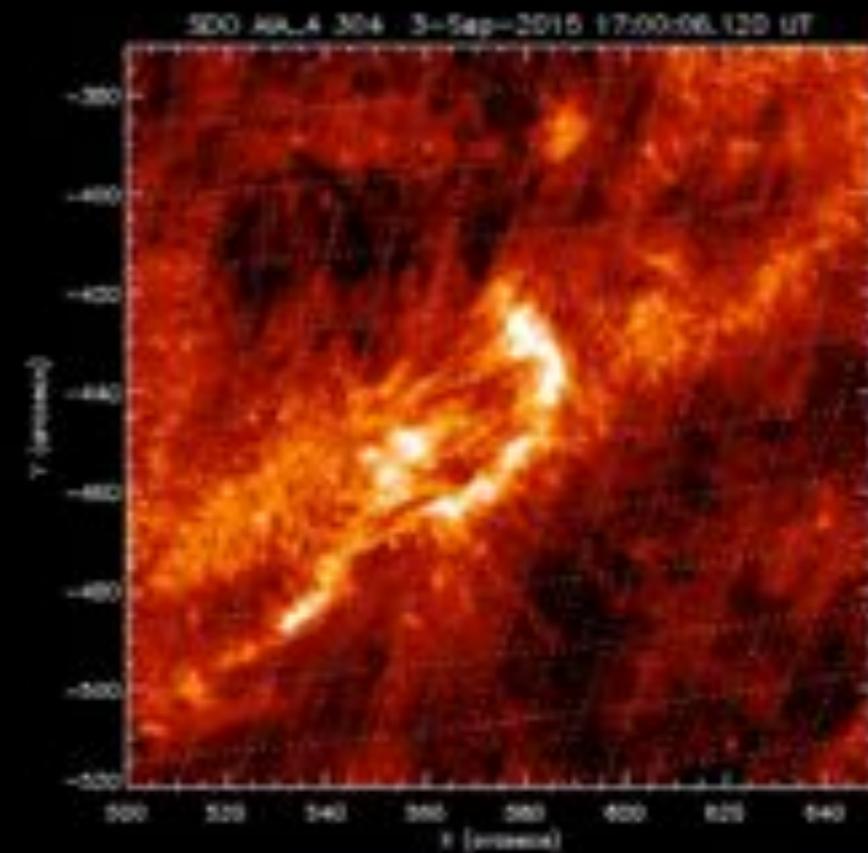
CLASP SJ



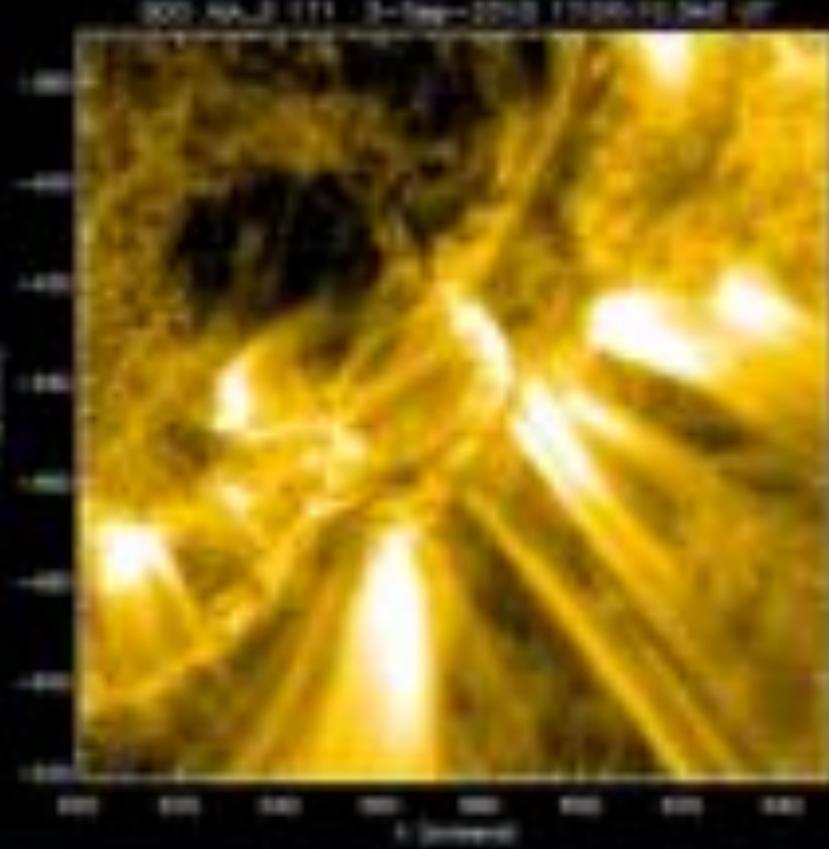
HMI LOS magnetgram



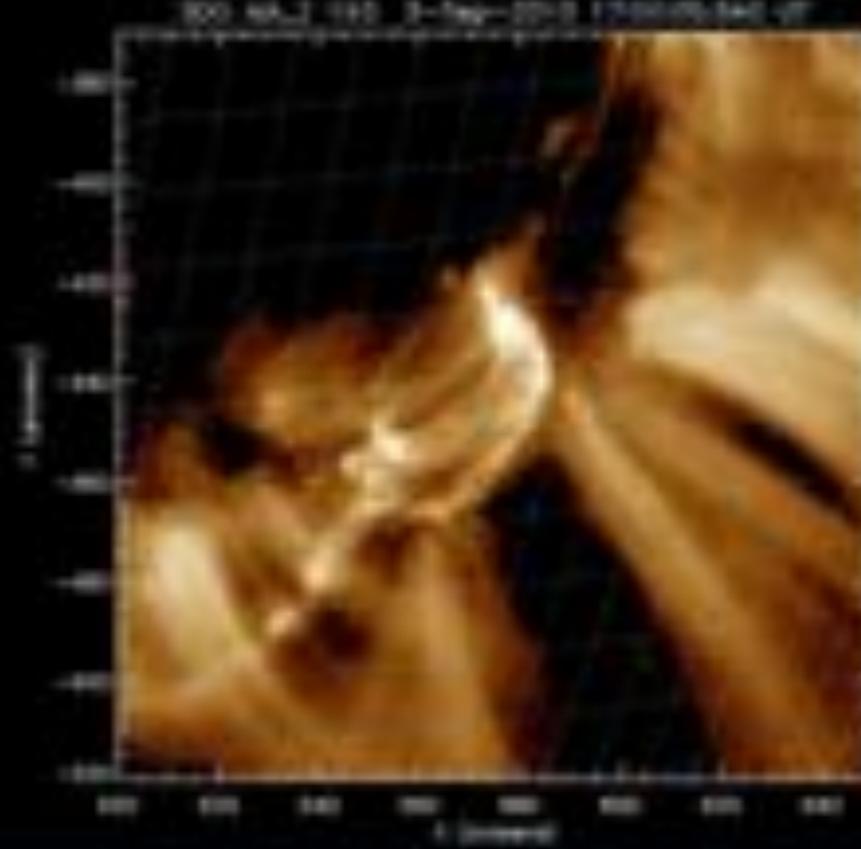
AIA 304 Å



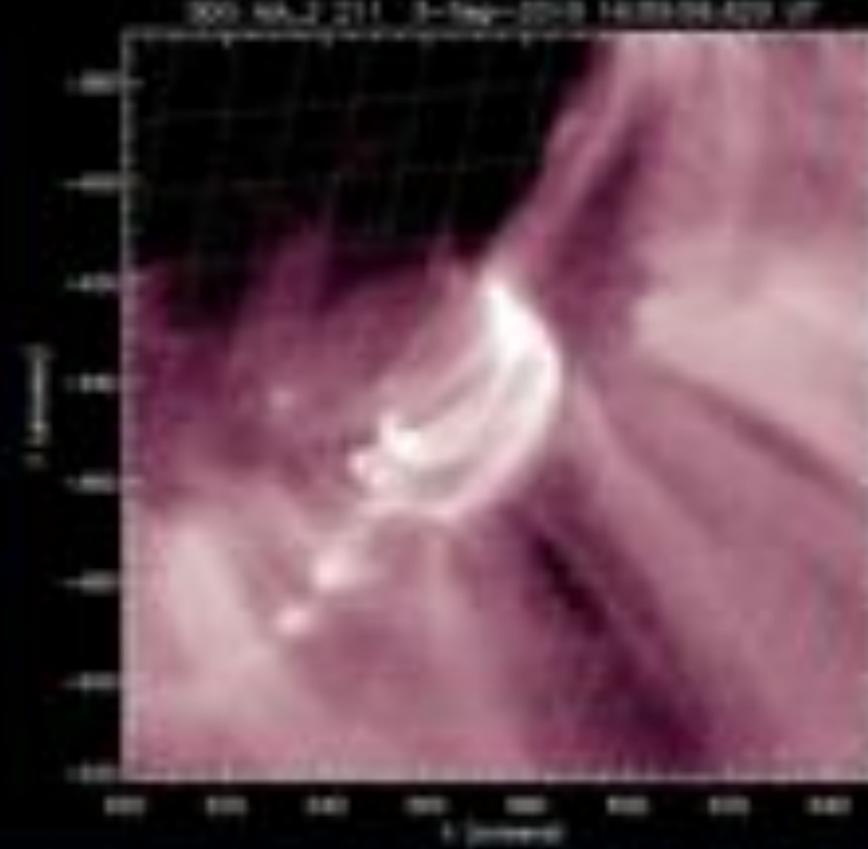
AIA 171 Å



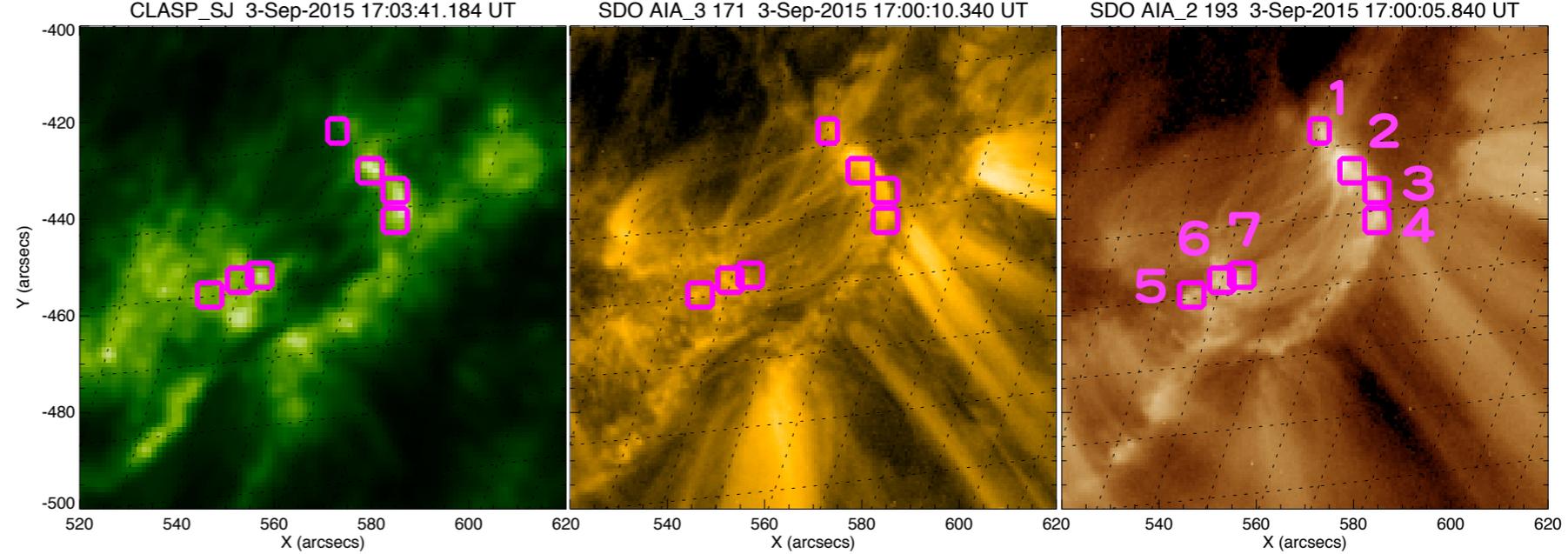
AIA 193 Å



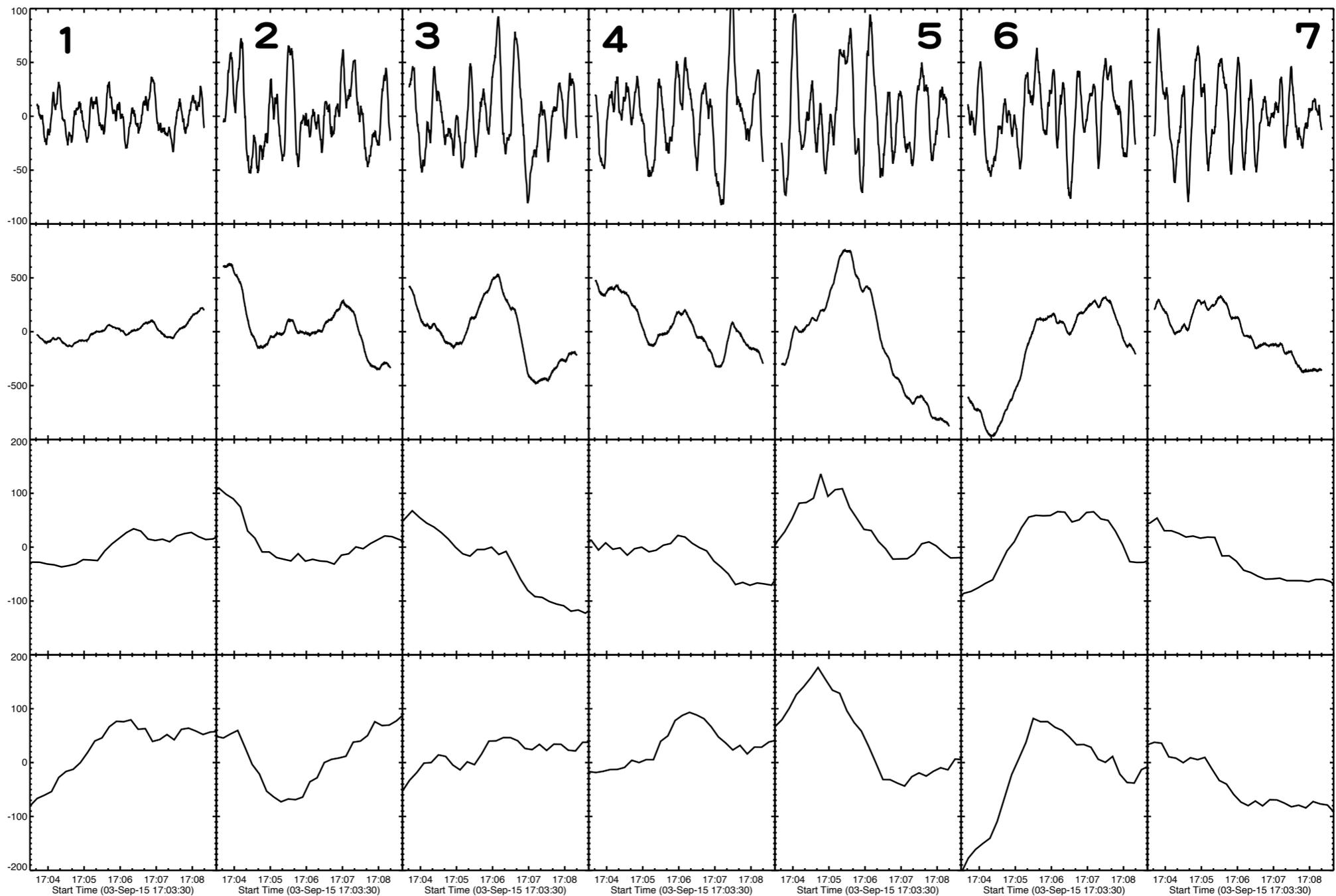
AIA 211 Å



Lightcurves of Hot loop footpoints



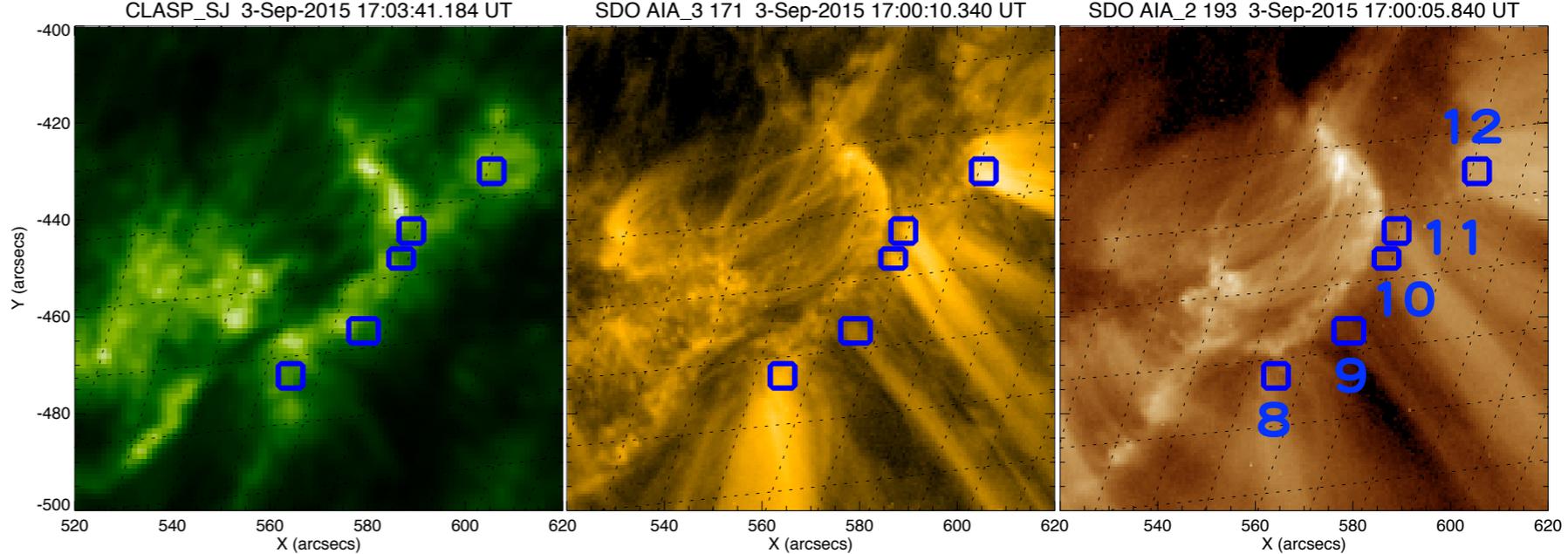
SJ
30 s r.a.
subtracted



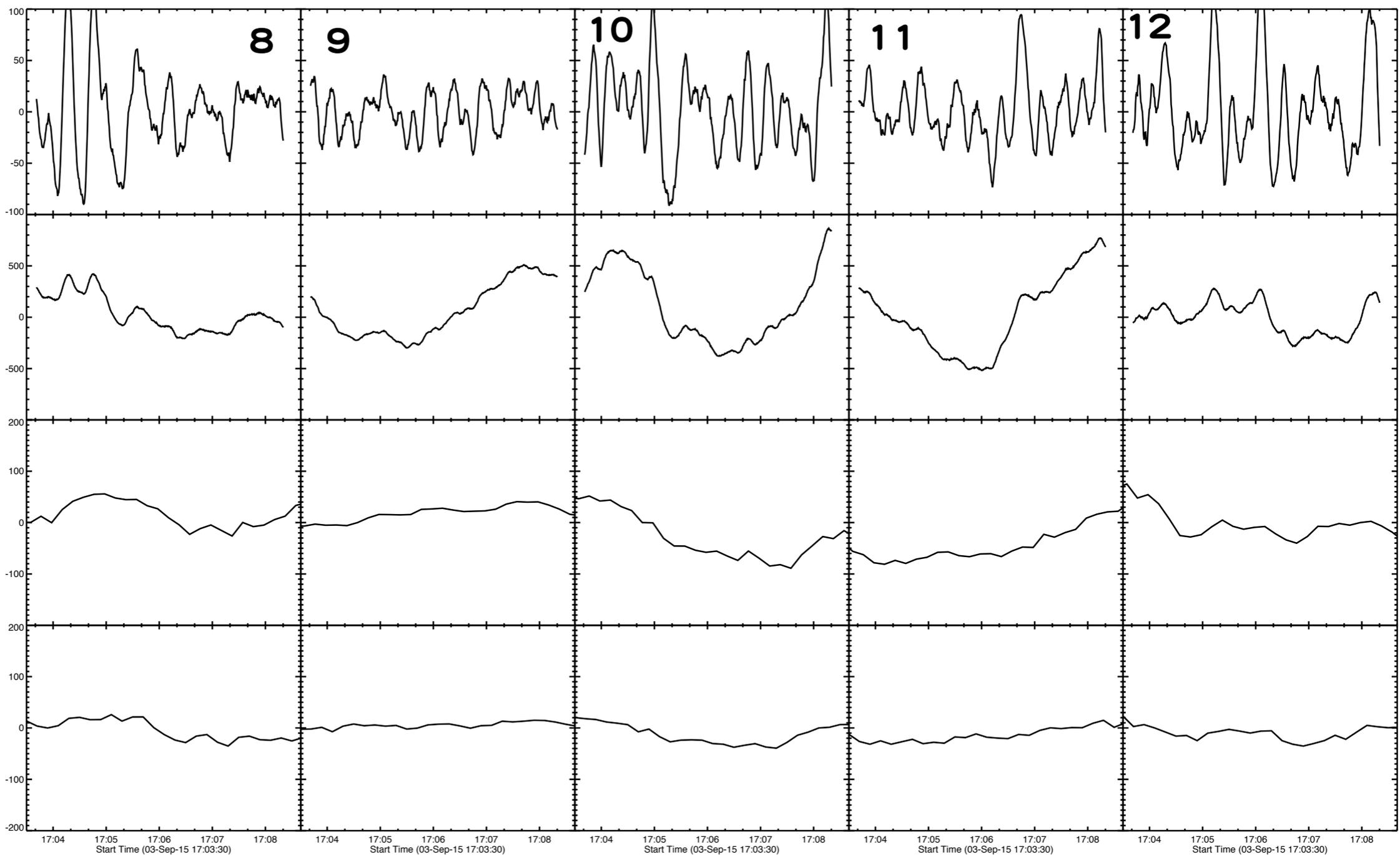
AIA
171 Å

AIA
193 Å

Lightcurves of Cool footpoints

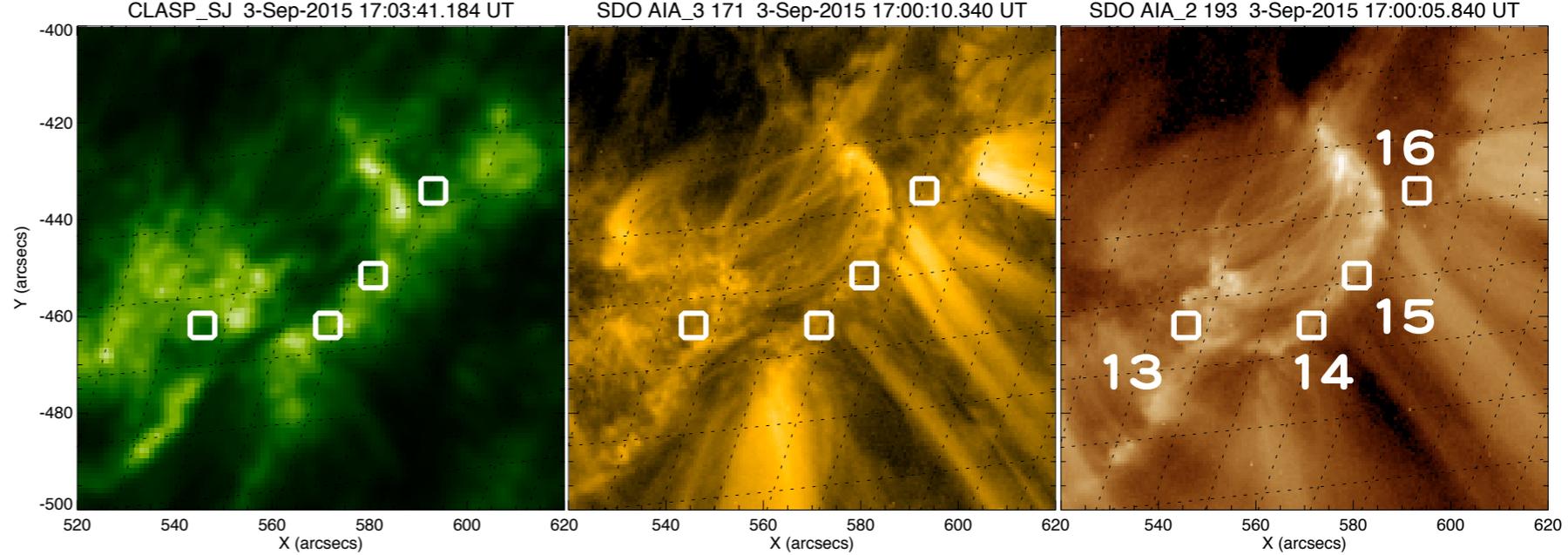


SJ
30 s r.a.
subtracted

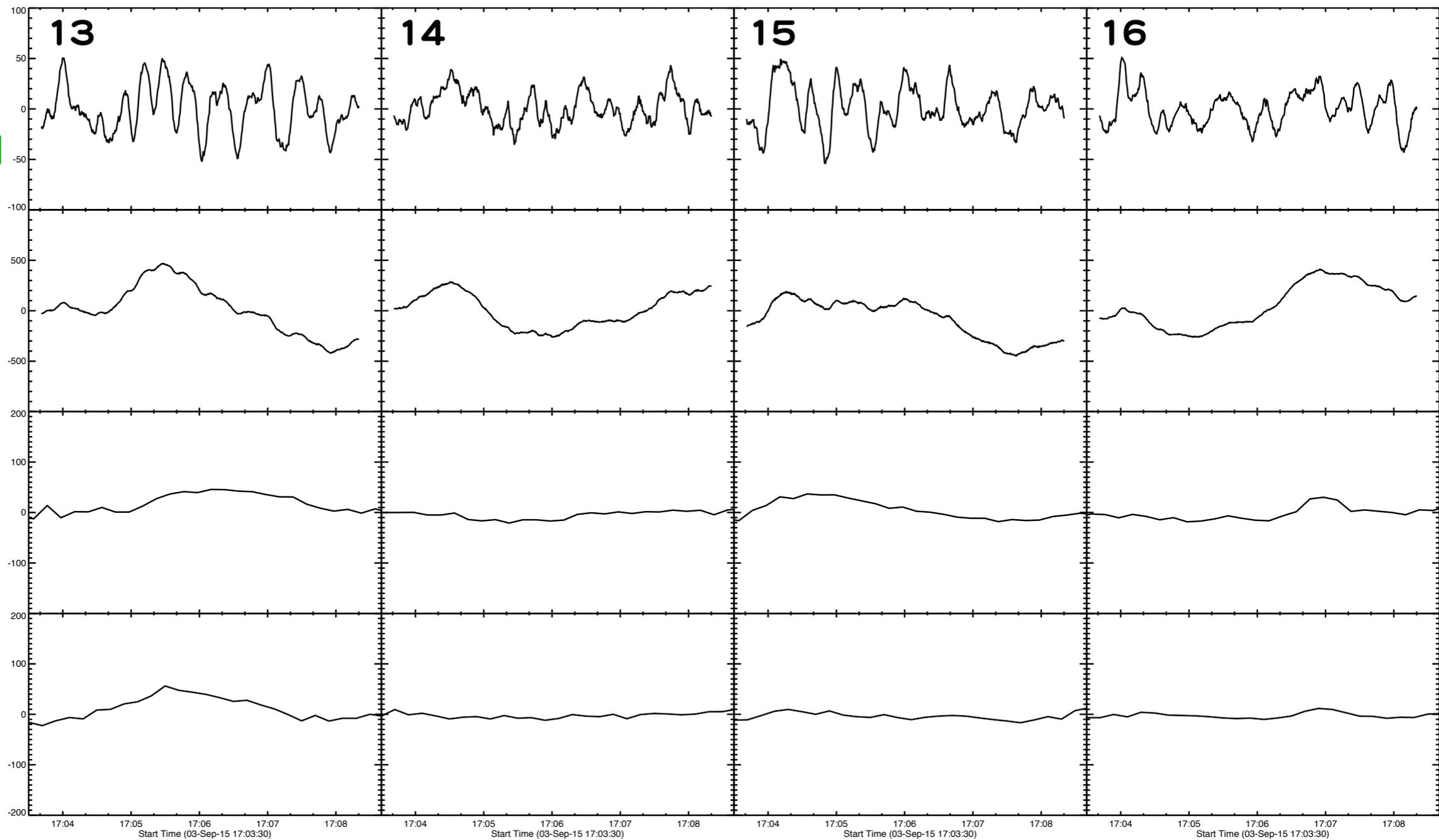


Lightcurves

Non loop areas



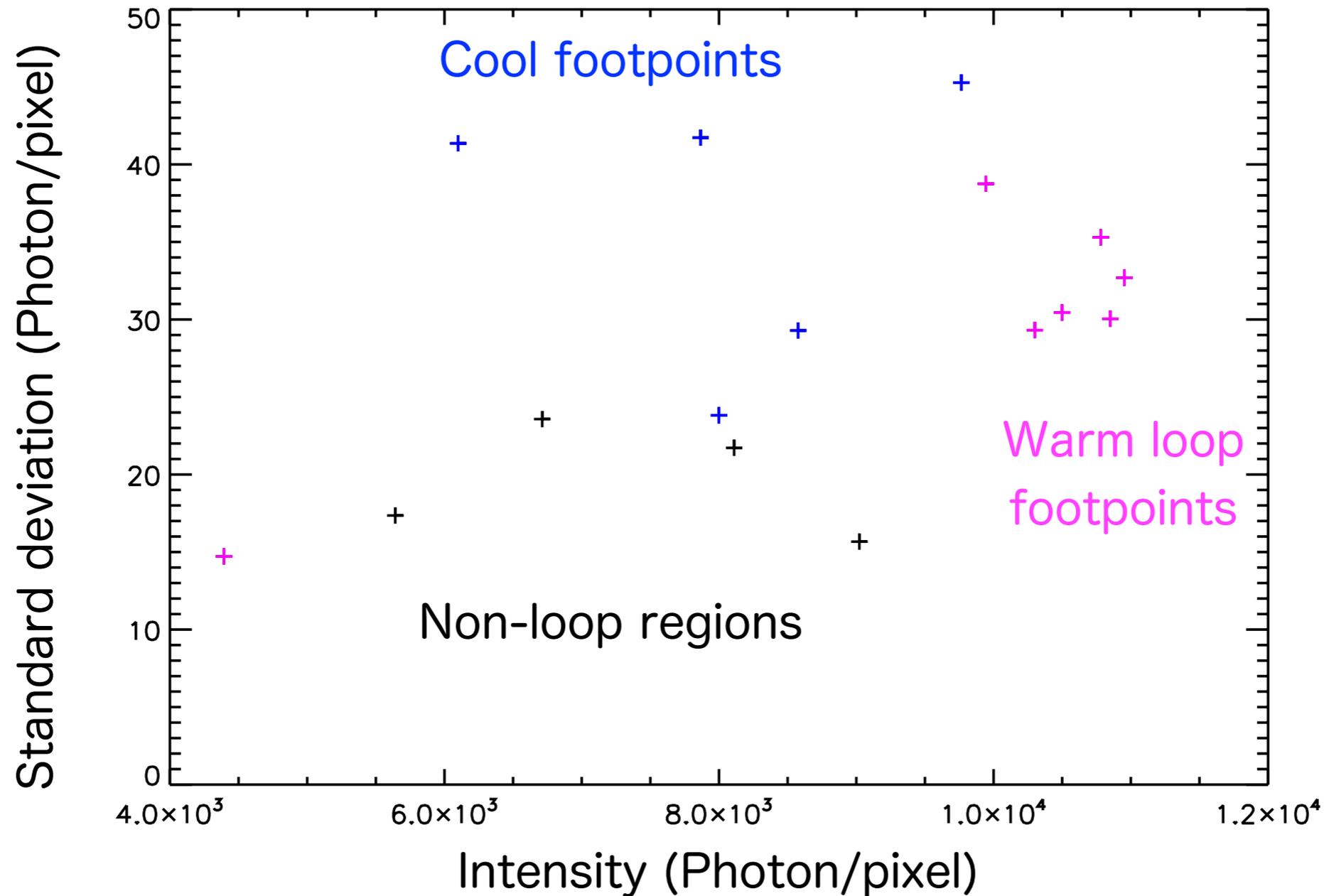
SJ
30 s r.a.
subtracted



Discussion

- At warm loop footpoints
Large time variations of CLASP SJ and AIA 193 Å & 171 Å
- At cool footpoints
Time variations of CLASP SJ and AIA 171 Å, not much for 193 Å
- No clear correlation is seen between Ly α 4.8-30s time scale variation and coronal emissions
- In the non-loop regions, time variations of AIA 193 Å & 171 Å are very small
- In the non-loop regions, although Ly α intensities are similar to those of the cool footpoints,
Ly α time variations look lower than footpoint regions

Ly α intensity vs time variation



- Warm loop footpoints have more intensities compared to the cool footpoints
- Although time variations are more in the footpoint regions, no significant difference is found between cool and warm footpoints
- This suggests that this phenomenon may contribute to heat the corona up to AIA 171 Å temperature (~ 0.63 MK), but does not contribute to heat the corona from < 1 MK to ~ 1 MK

Summary

- The investigation of <30 s time scale time variation of the Chromosphere using the high cadence CLASP/SJ Lyman-alpha images
- Basically the time variations are more in the areas with high intensities
- By comparing the coronal structure observed by SDO/AIA, we found that the footpoint regions have more time variations, but no significant dependence on the loop temperature
- It is suggested that these time variations may contribute to heat the loops to the moderate temperature (<0.6 MK), but not to the warm temperature (>1 MK)