

The Role of the Background Magnetic Field in the Major Eruptions of AR 11429

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Outline

- Purpose
- Data
- Method
- Results
- Conclusions & Future Work

Purpose

- Assess the role of the overlying background magnetic field as a confinement agent that tends to inhibit eruptions.
- How to do it? Calculate the temporal evolution of the magnetic field's decay index (i.e. how fast magnetic field decreases with height) for two major eruptions.

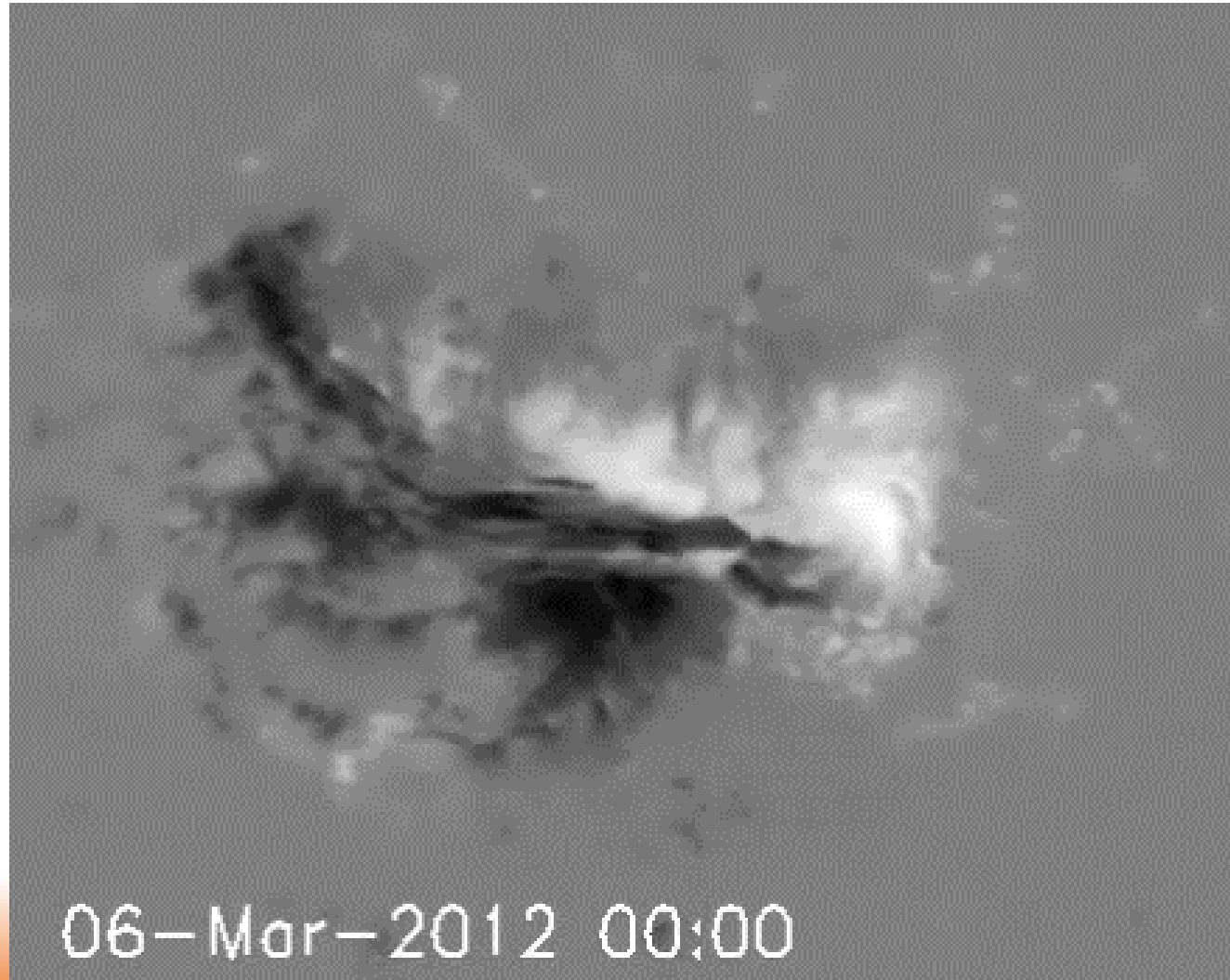
Data

- LOS Magnetograms - HMI
- Images at 131Å (Fe VIII 4×10^5 K) - AIA
- Two major eruptions: 1) X5.4-class flare (AR 11429 on 7 March 2012, 00:02 UT).
2) X1.3-class flare (AR 11429 on 7 March 2012, 01:15 UT).
- Calculate the temporal evolution of the decay index for an interval of about 48 hours that was roughly centered around the initiation times of the two major eruptions

Method

- Tracking the AR 11429 across the disk
- Compute the magnetic field with potential extrapolations
- Determine the computation box for the decay index, n
 $\left(n = -\frac{z}{B} \frac{\partial B}{\partial z} \right)$ calculation
- At each height calculate the decay index in the form of both average values and maps

Evolution of AR 11429



HMI/SDO
B LOS data

Evolution of AR 11429



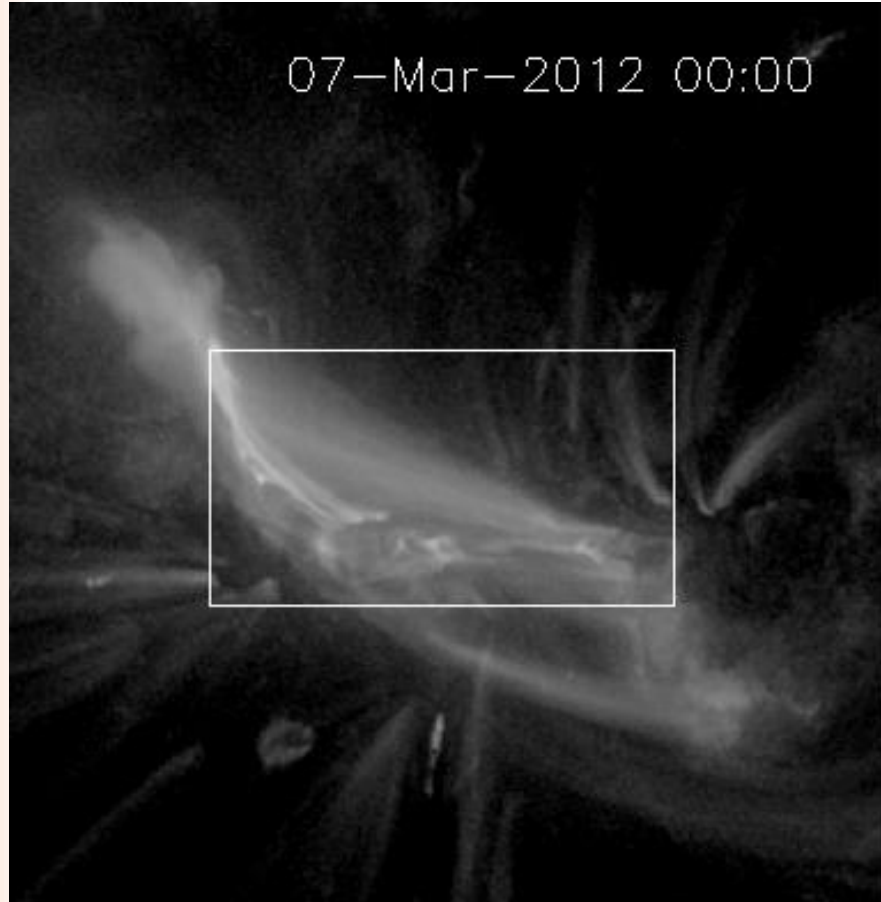
AIA/SDO
131 Å

06-Mar-2012 00:00

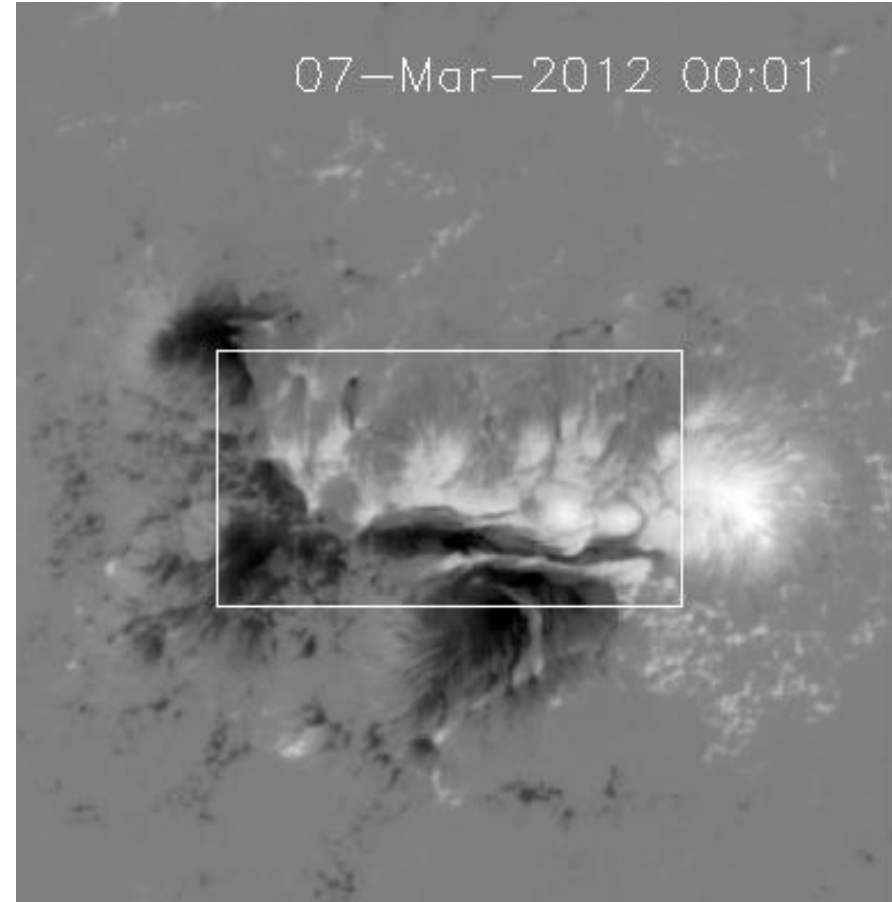
First Event

X5.4-Class Flare

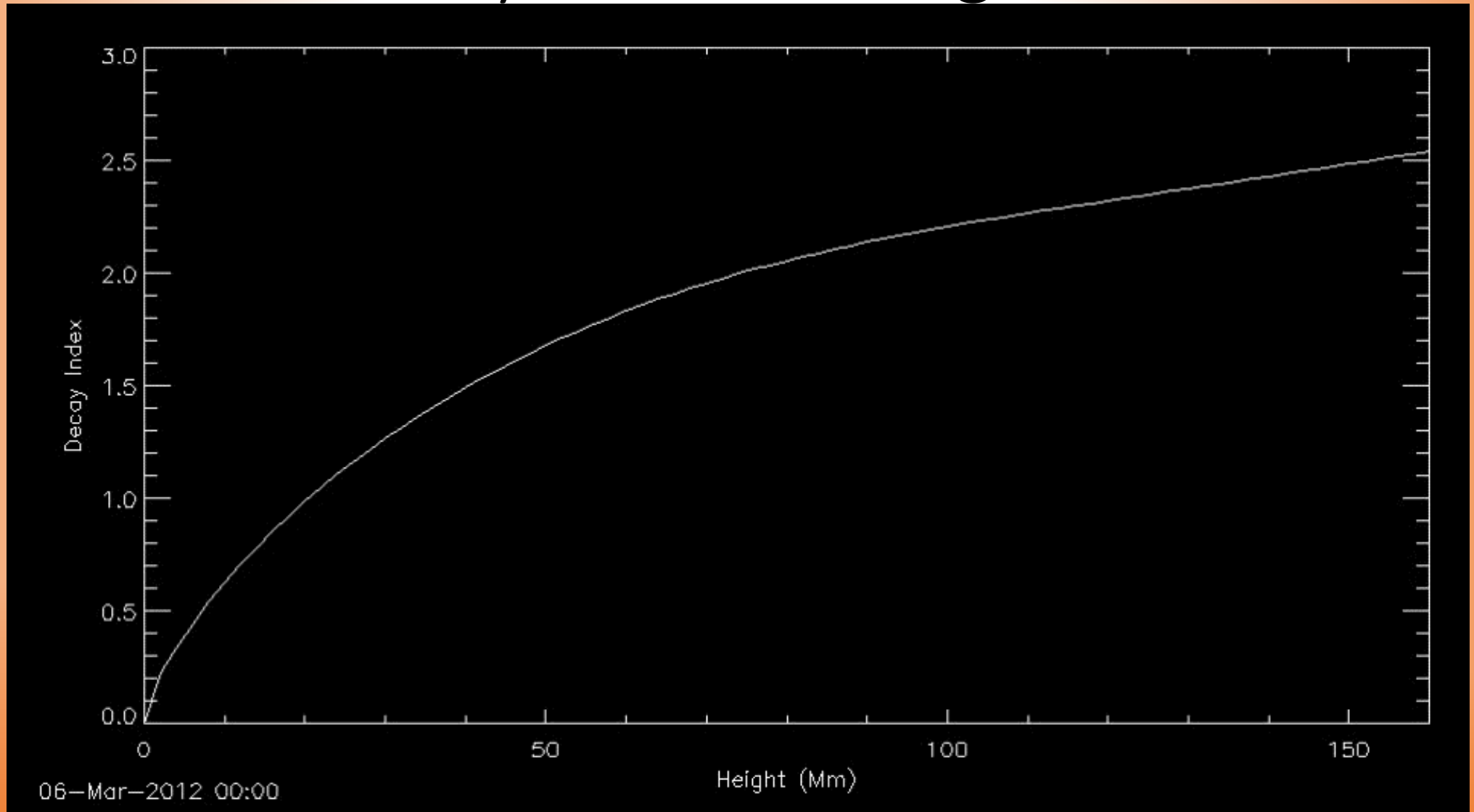
First X5.4-Class Flare at 131 Å



Magnetic field just before the first flare

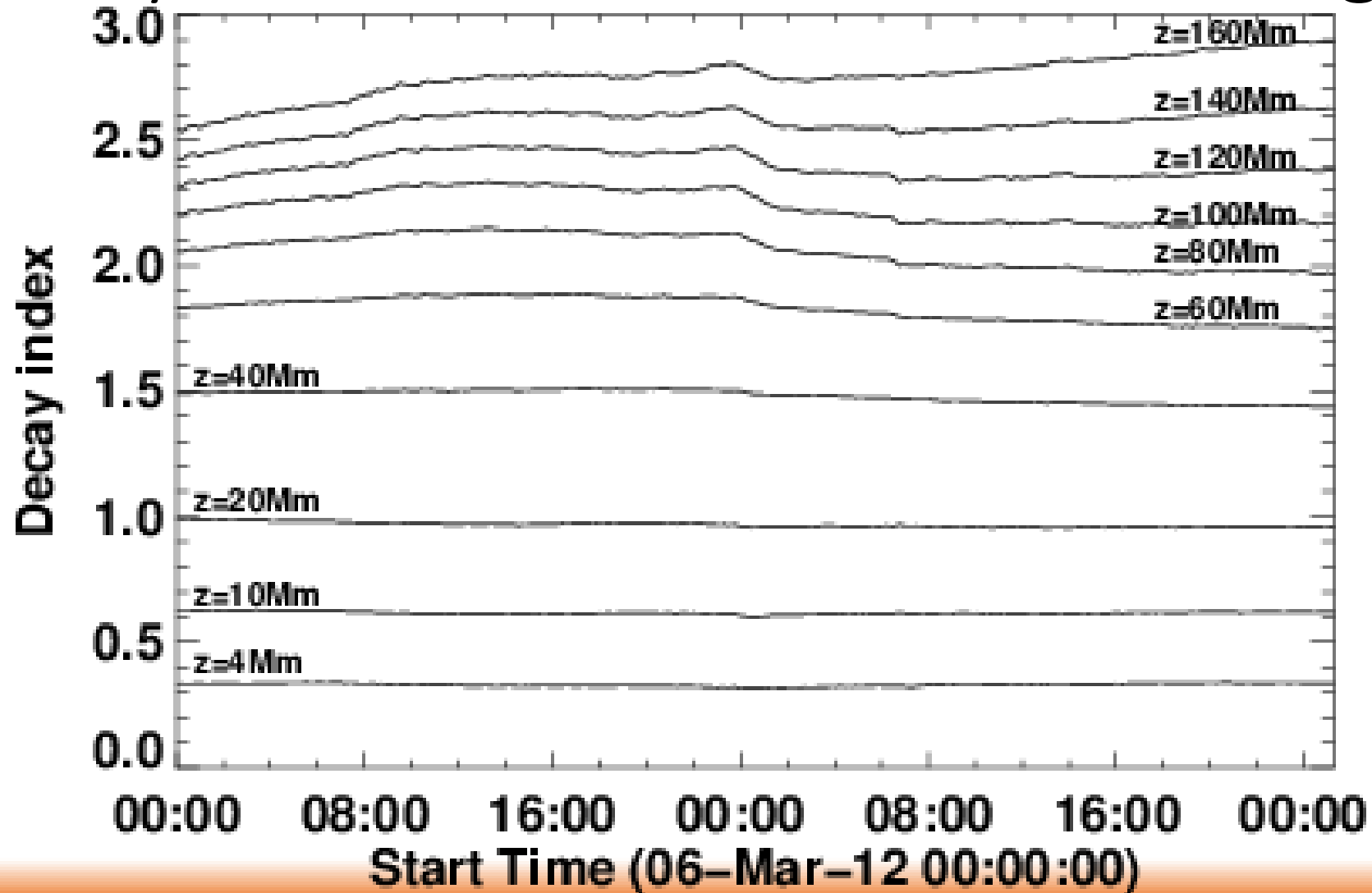


First Event Decay Index vs Height



First Event

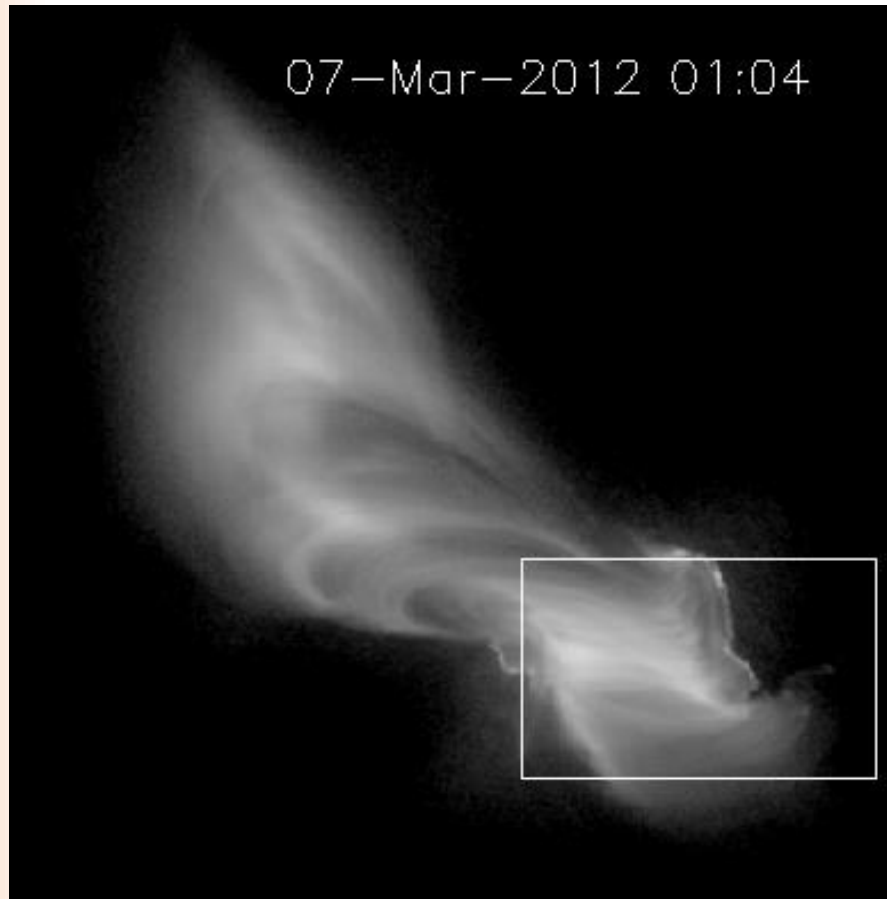
Decay Index vs Time @ Selected Heights



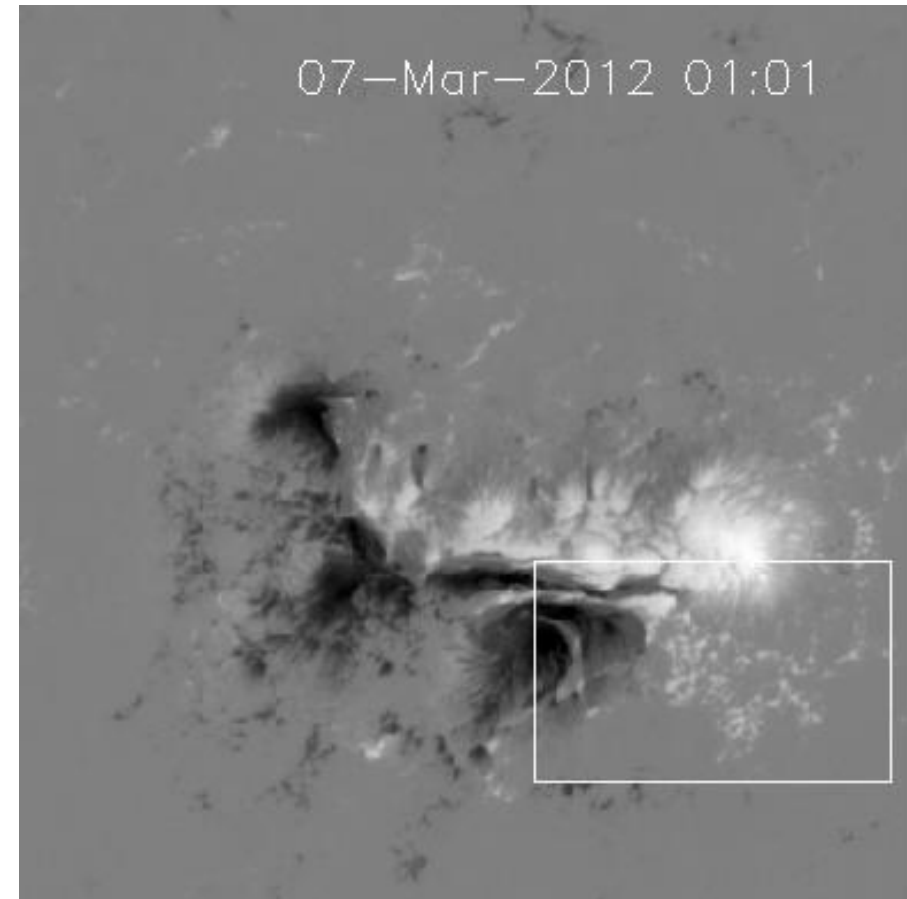
Second Event

X1.3-Class Flare

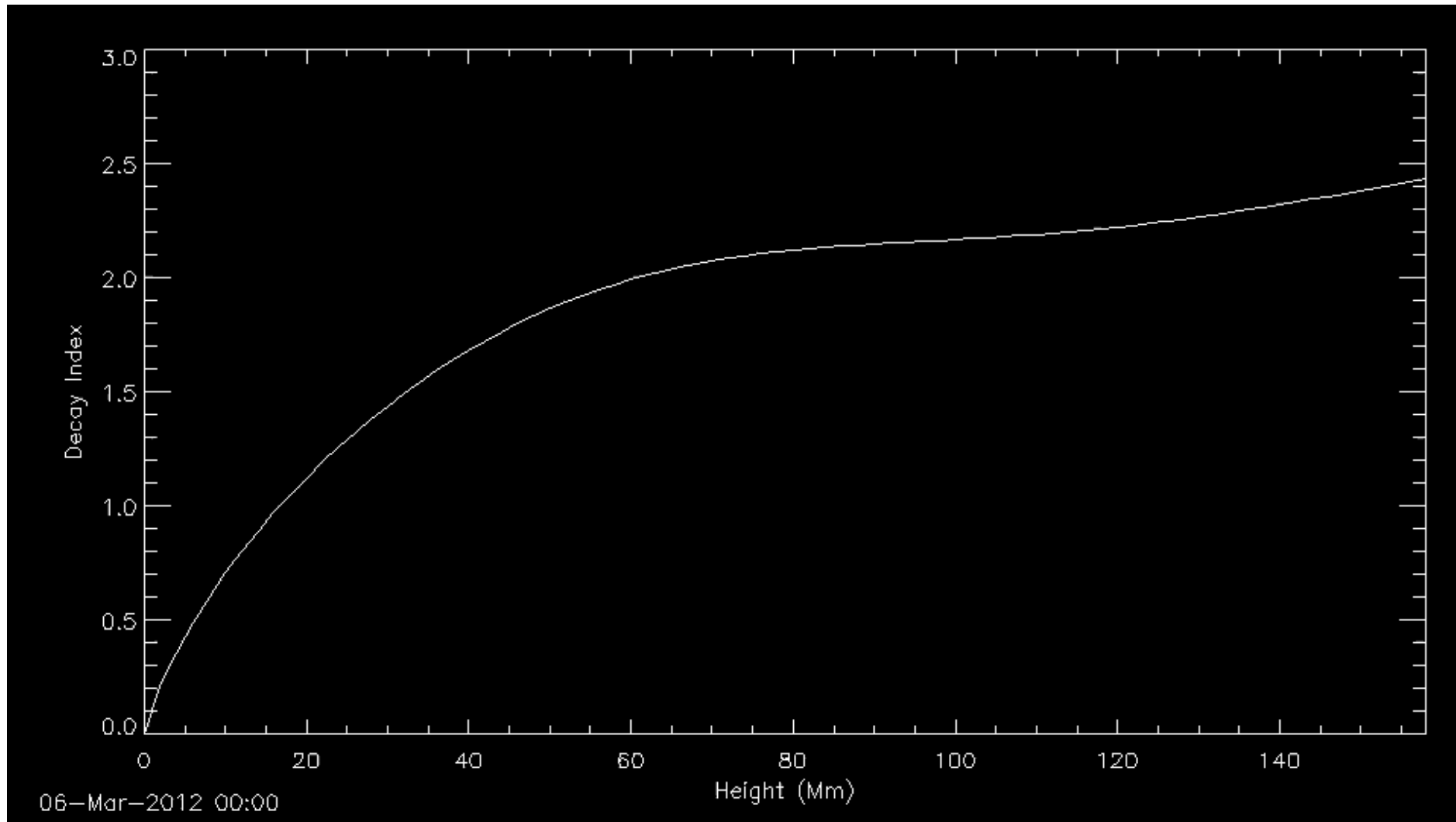
Second X1.3-class flare at 131 Å



Magnetic field just before the second flare

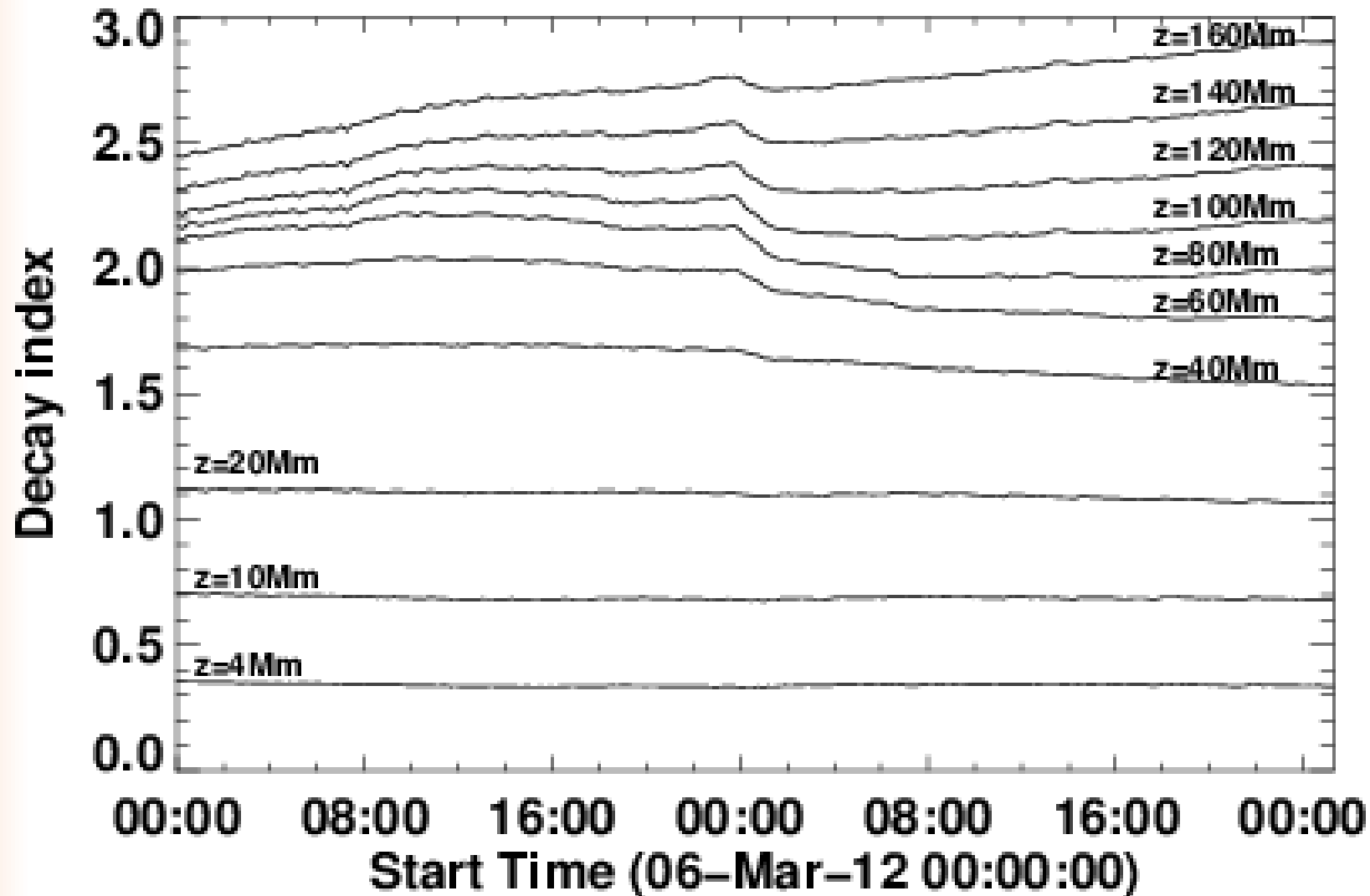


Second Event Decay Index vs Height

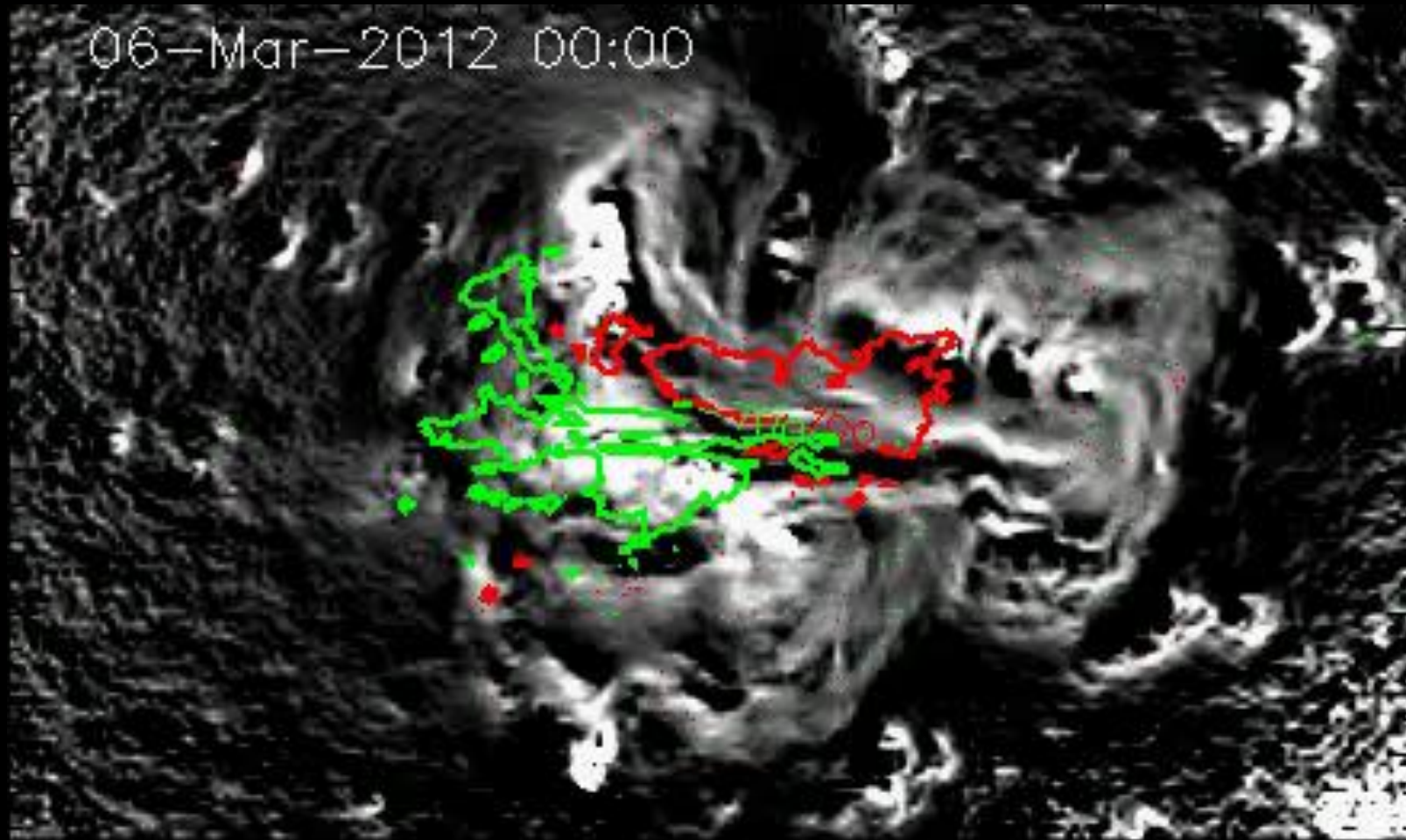


Second Event

Decay Index vs Time @ Selected Heights



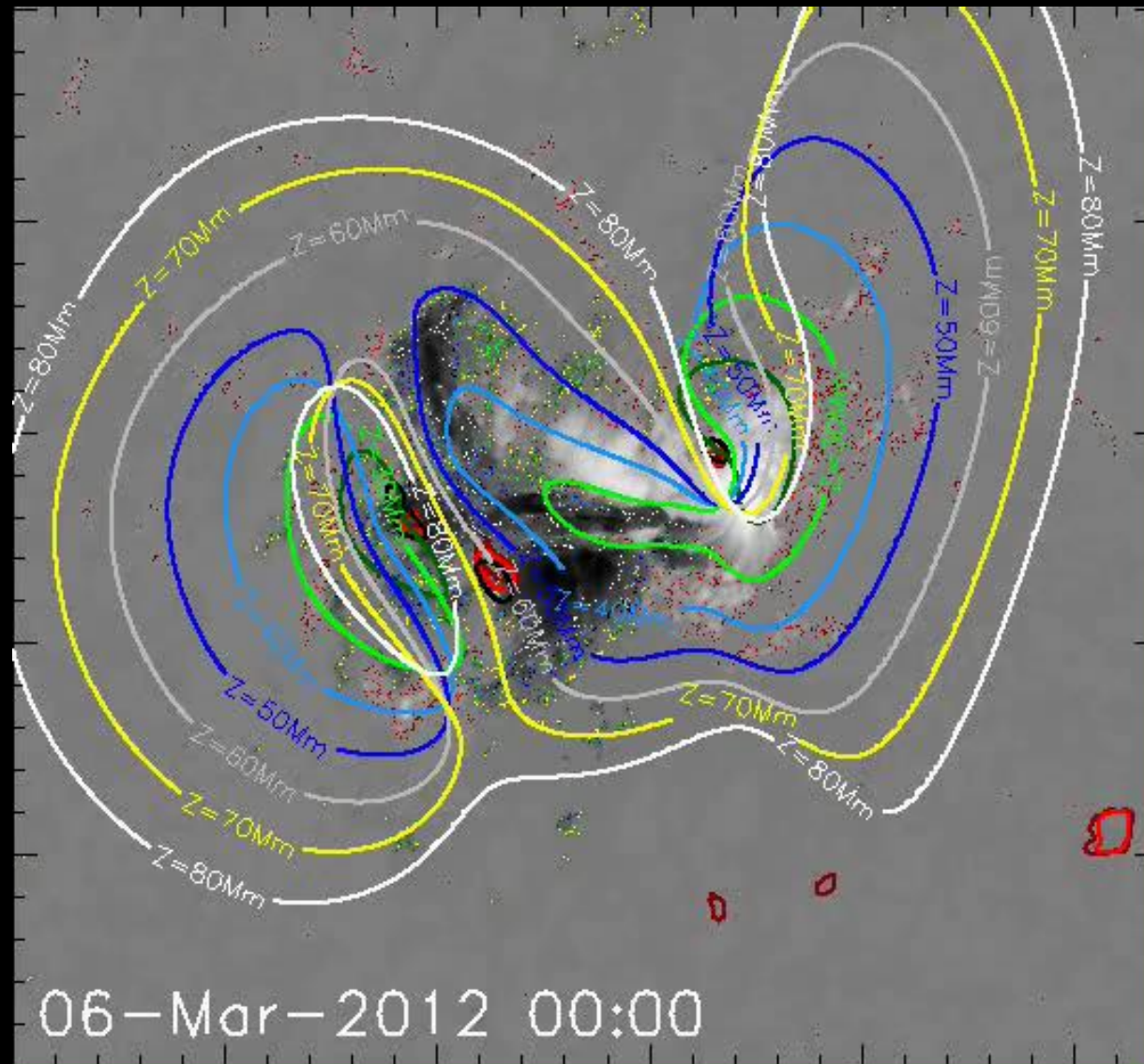
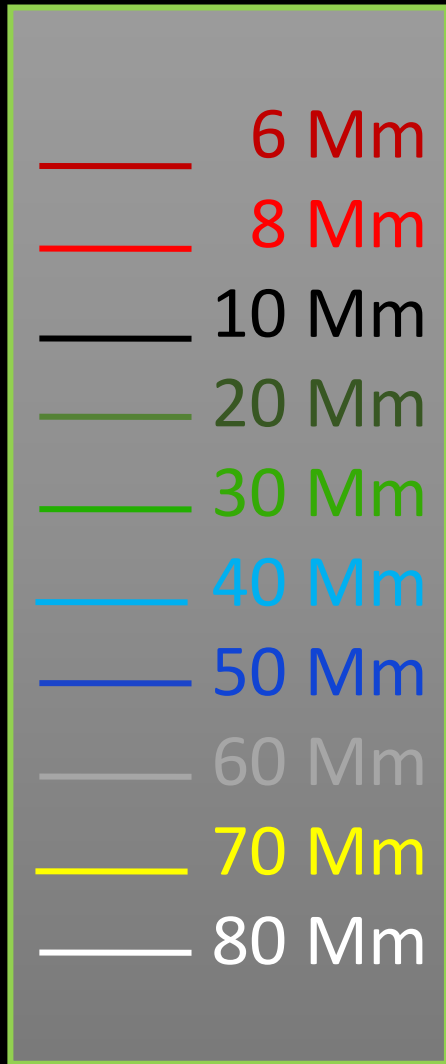
Map of the Decay Index at Height $z=2\text{Mm}$



— 700 G
— -700 G

Decay Index vs Height Isocontours

$z=6-80$ Mm



$n=1.5$

Conclusions

- The temporal variation of decay index is generally small
- Decay index over the areas of the source regions of the CMEs has been strong throughout the time series
- Torus instability may play an important role in the genesis of the two major eruptions

Future Work

- ✓ Comparison of our results with results from NLFFF extrapolations
- ✓ Calculation of the decay index of background magnetic field along oblique directions