

# Can Flux Cancellation Build-up Magnetic Flux Ropes?

Stephanie L. Yardley<sup>1</sup>, Lucie M. Green<sup>1</sup>,  
David R. Williams<sup>1</sup>, Lidia van Driel-  
Gesztelyi<sup>1,2,3</sup> & Antonia Savcheva<sup>4</sup>

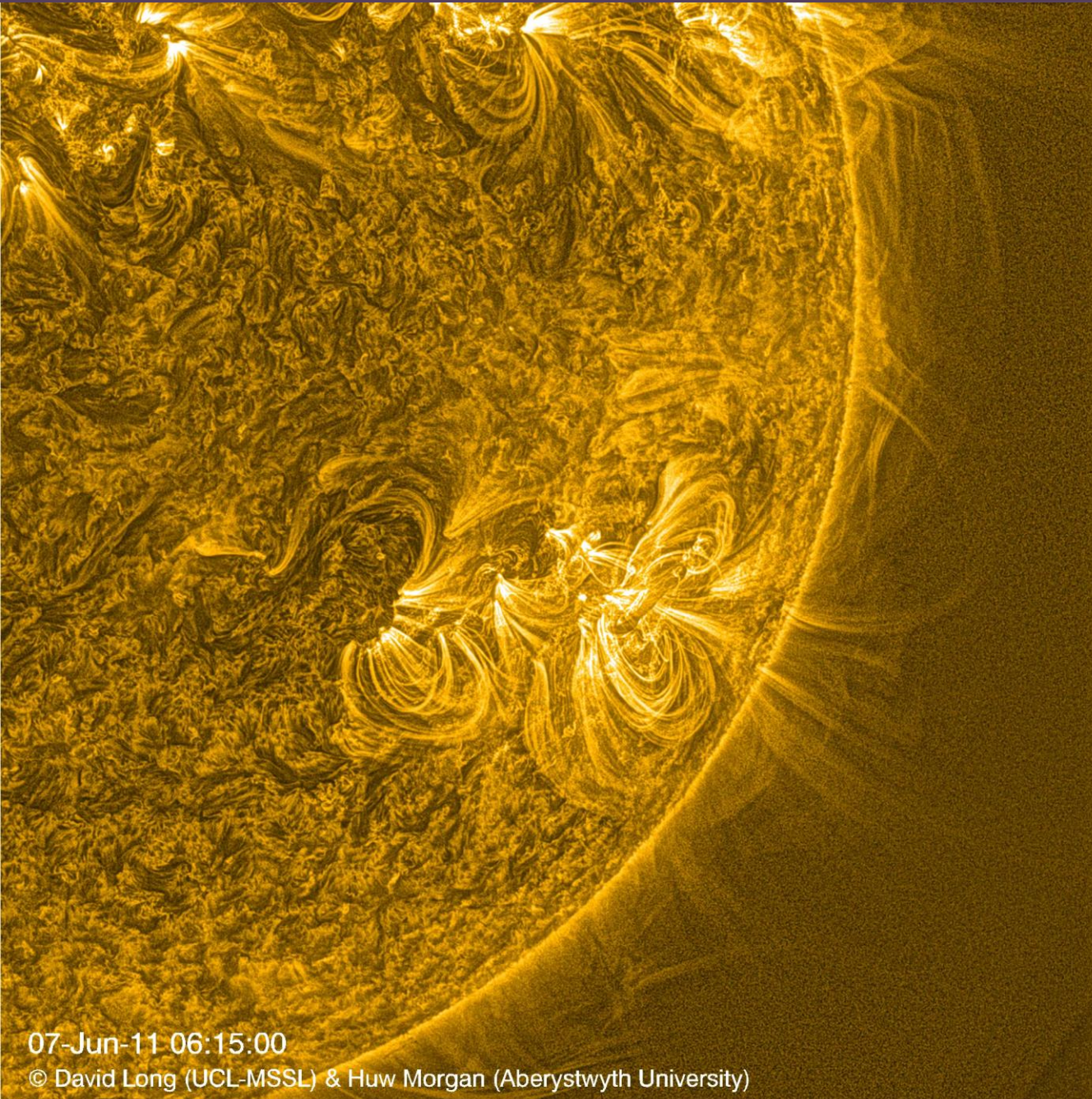
<sup>1</sup>Mullard Space Science Laboratory, University College London

<sup>2</sup>LESIA-Observatoire de Paris

<sup>3</sup>Konkoly Observatory

<sup>4</sup>Harvard-Smithsonian Centre for Astrophysics

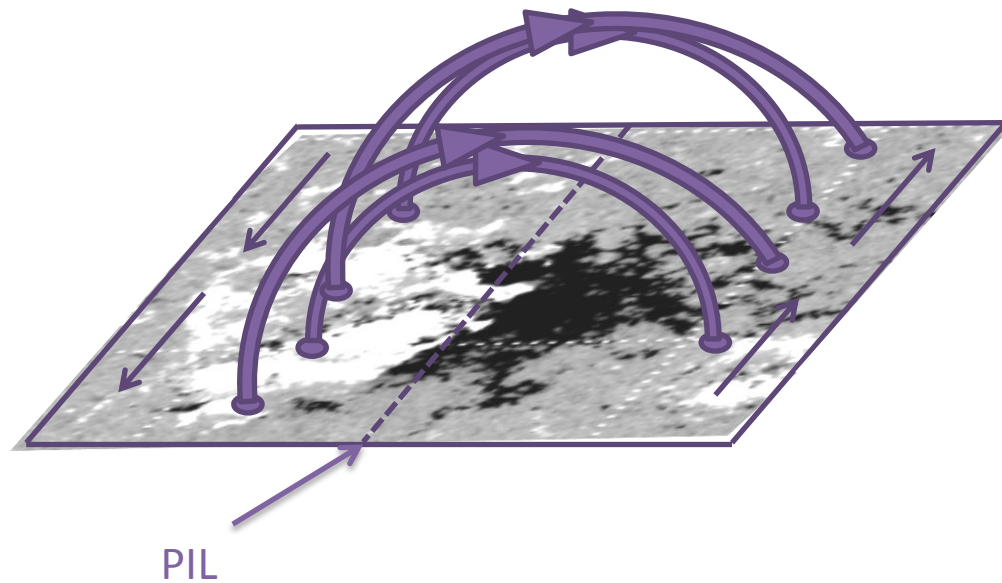




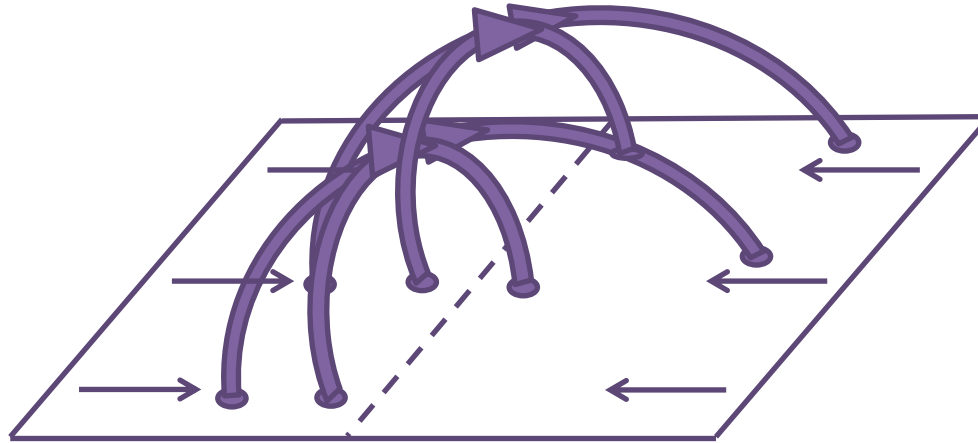
- CME  $\approx 1250 \text{ kms}^{-1}$
- EUV coronal wave
- M2.5 flare
- Filament material

07-Jun-11 06:15:00

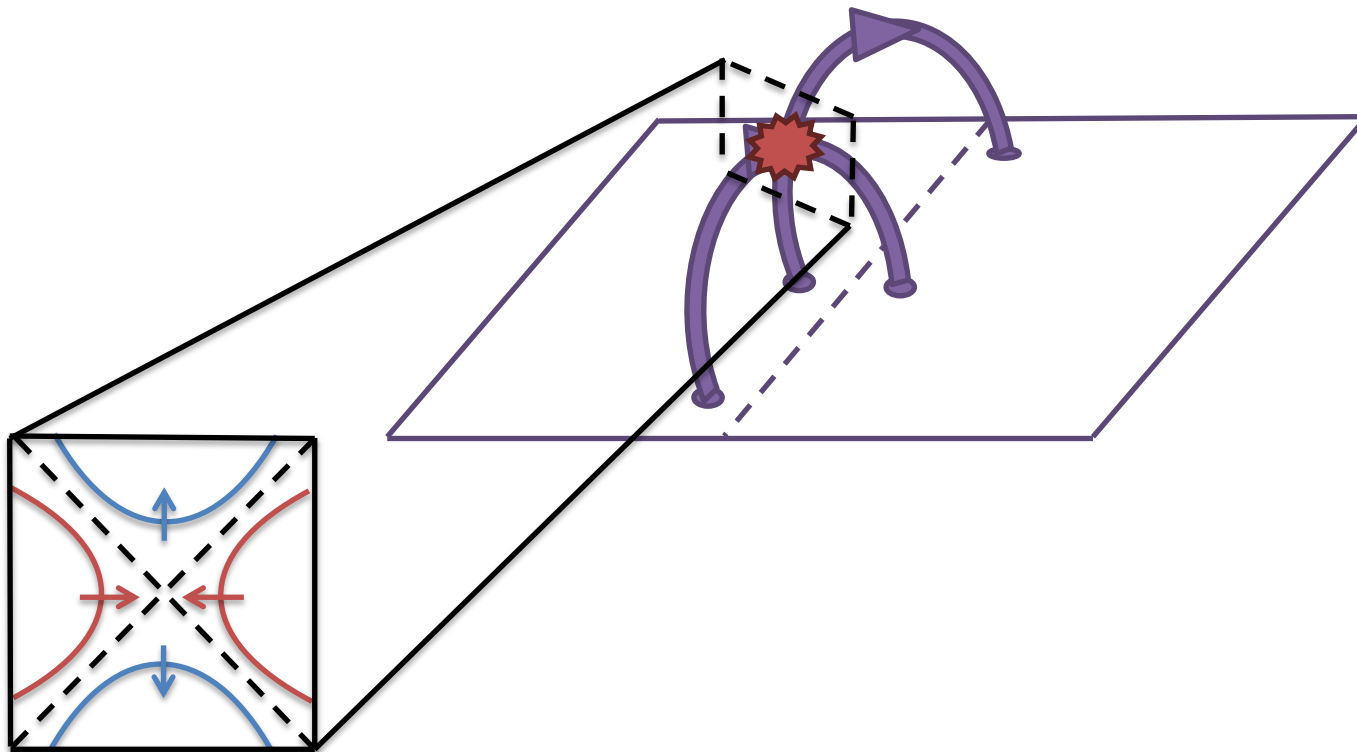
© David Long (UCL-MSSL) & Huw Morgan (Aberystwyth University)



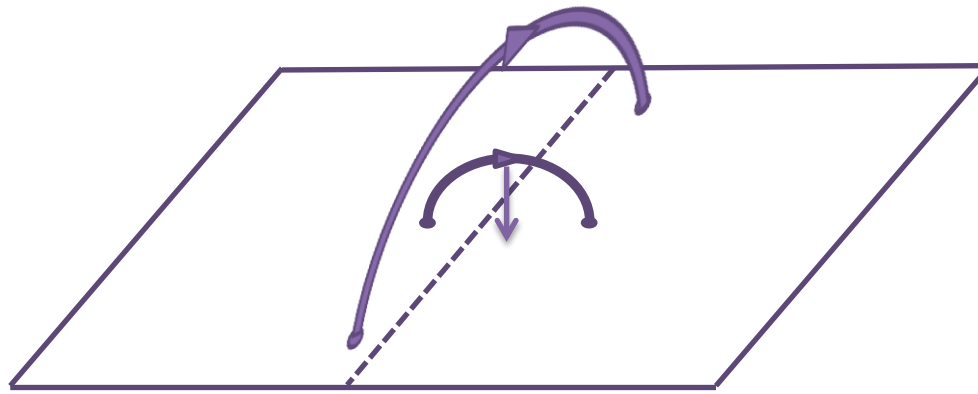
van Ballegooijen & Martens, 1989



van Ballegooijen & Martens, 1989

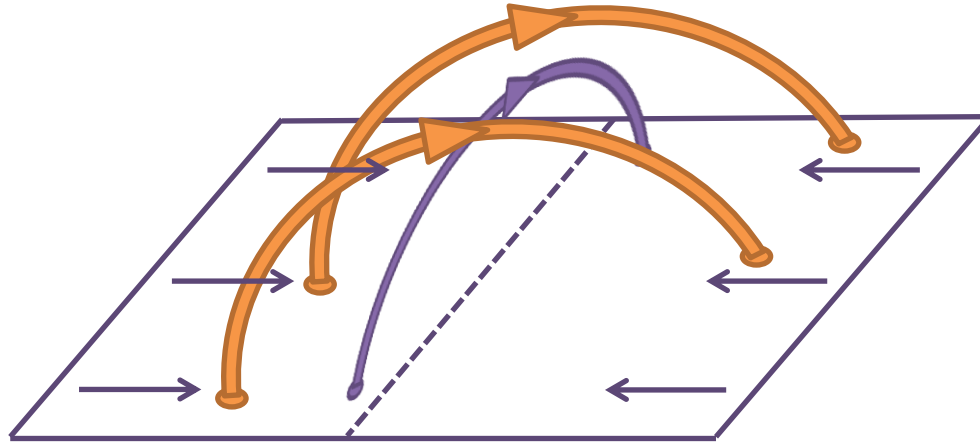


van Ballegooijen & Martens, 1989

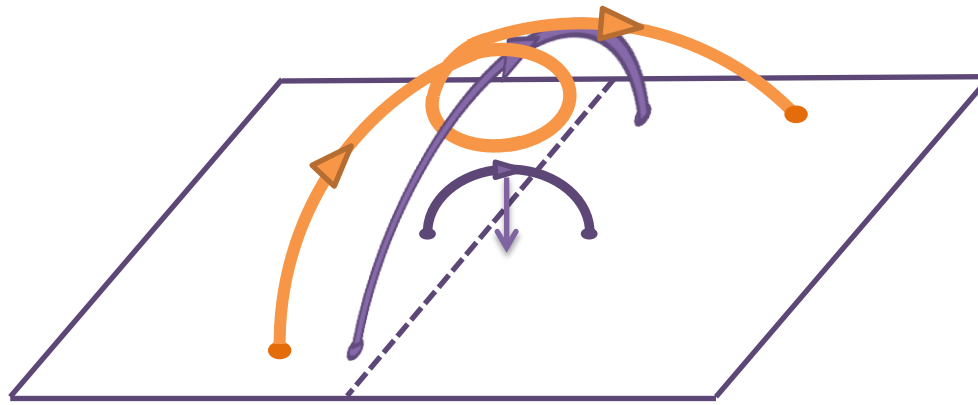


van Ballegooijen & Martens, 1989





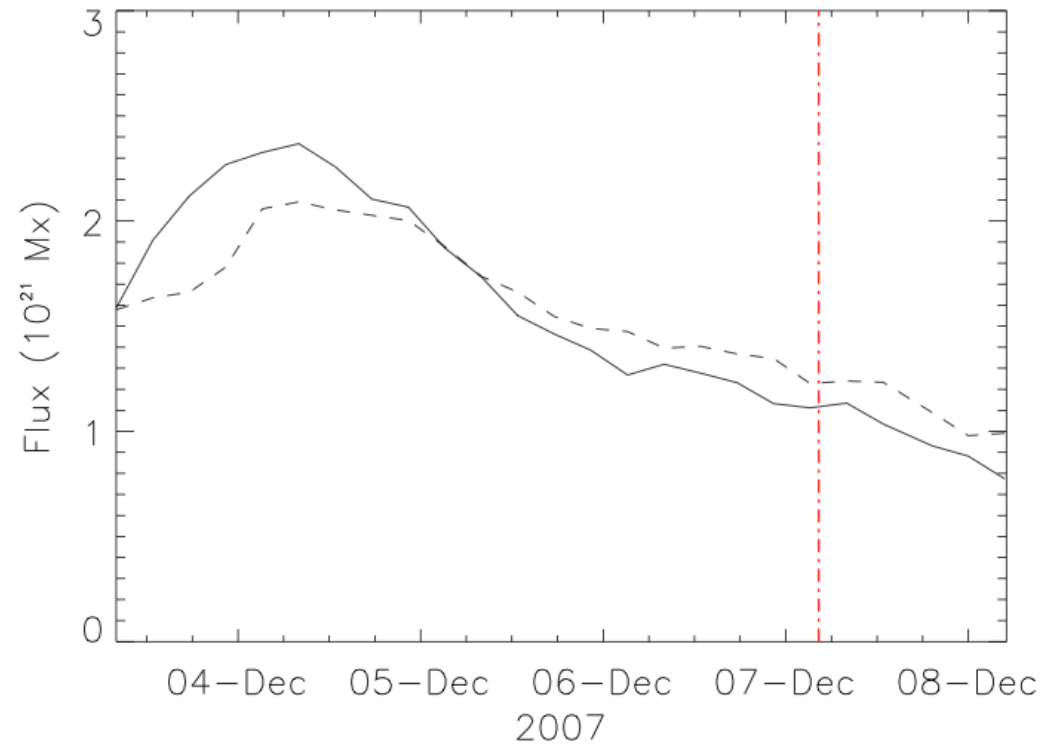
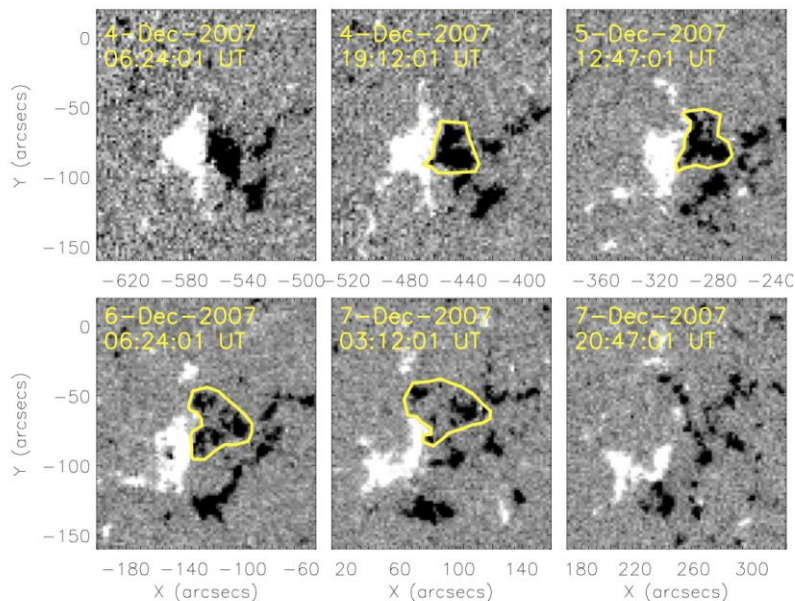
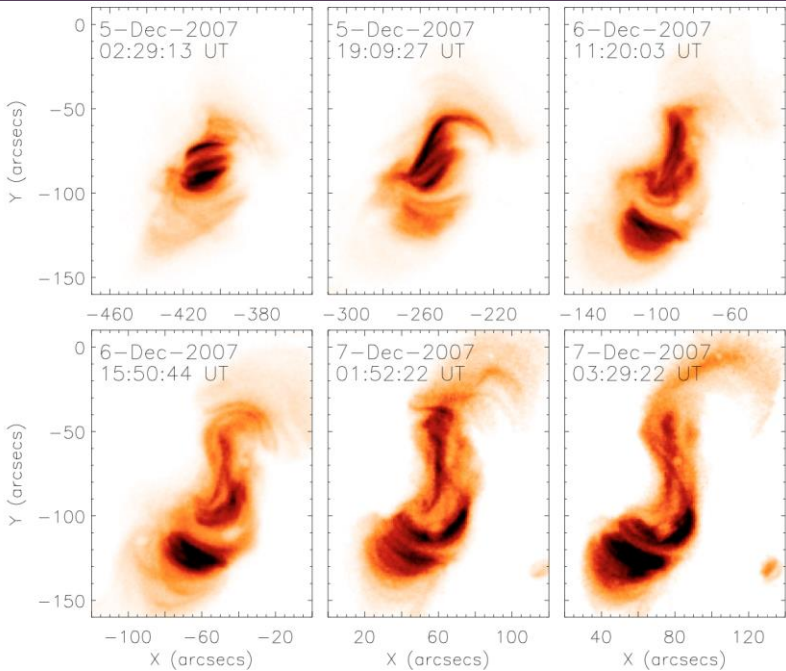
van Ballegooijen & Martens, 1989



van Ballegooijen & Martens, 1989

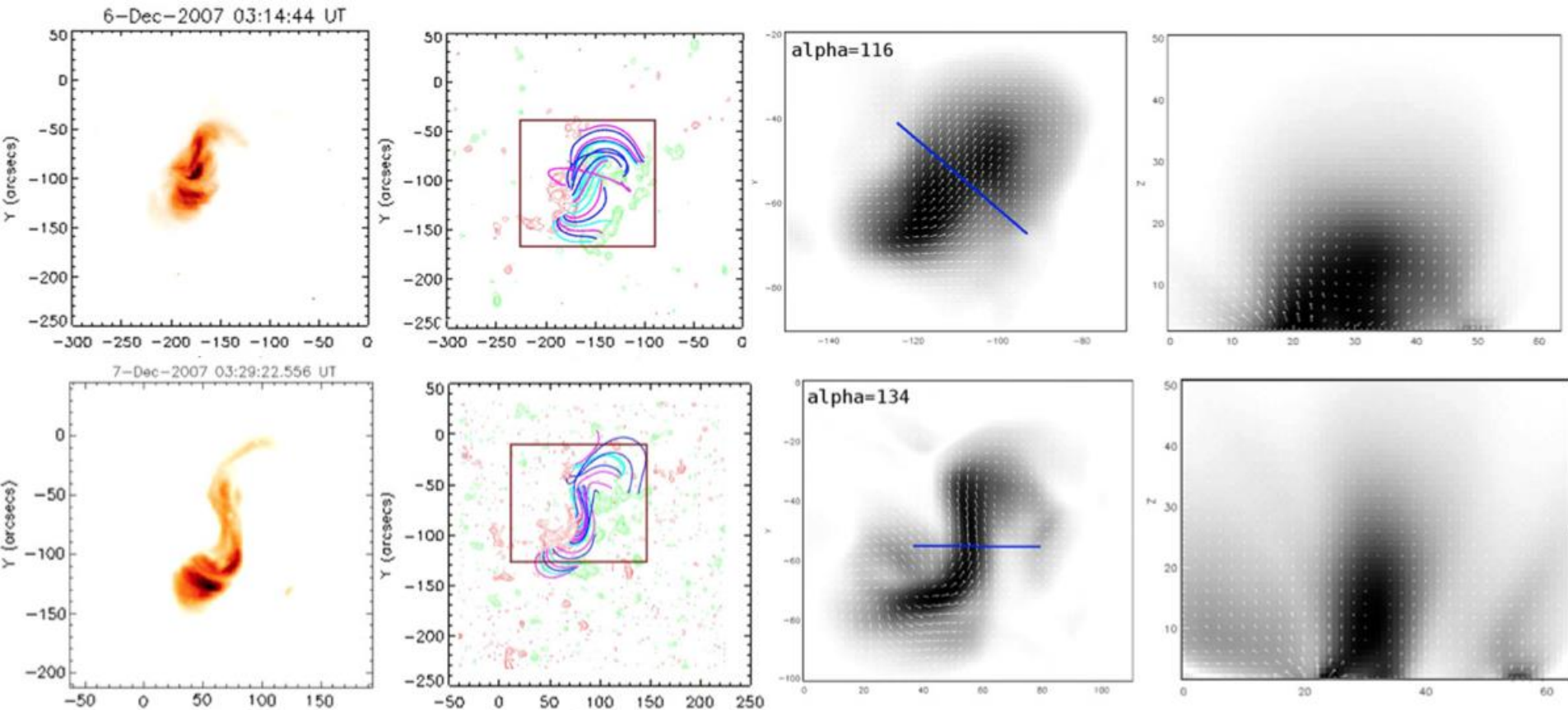


# Flux rope configuration



$\approx 34\%$  ( $7.1 \times 10^{20}$  Mx) of the AR flux cancels over a 2.5 day period

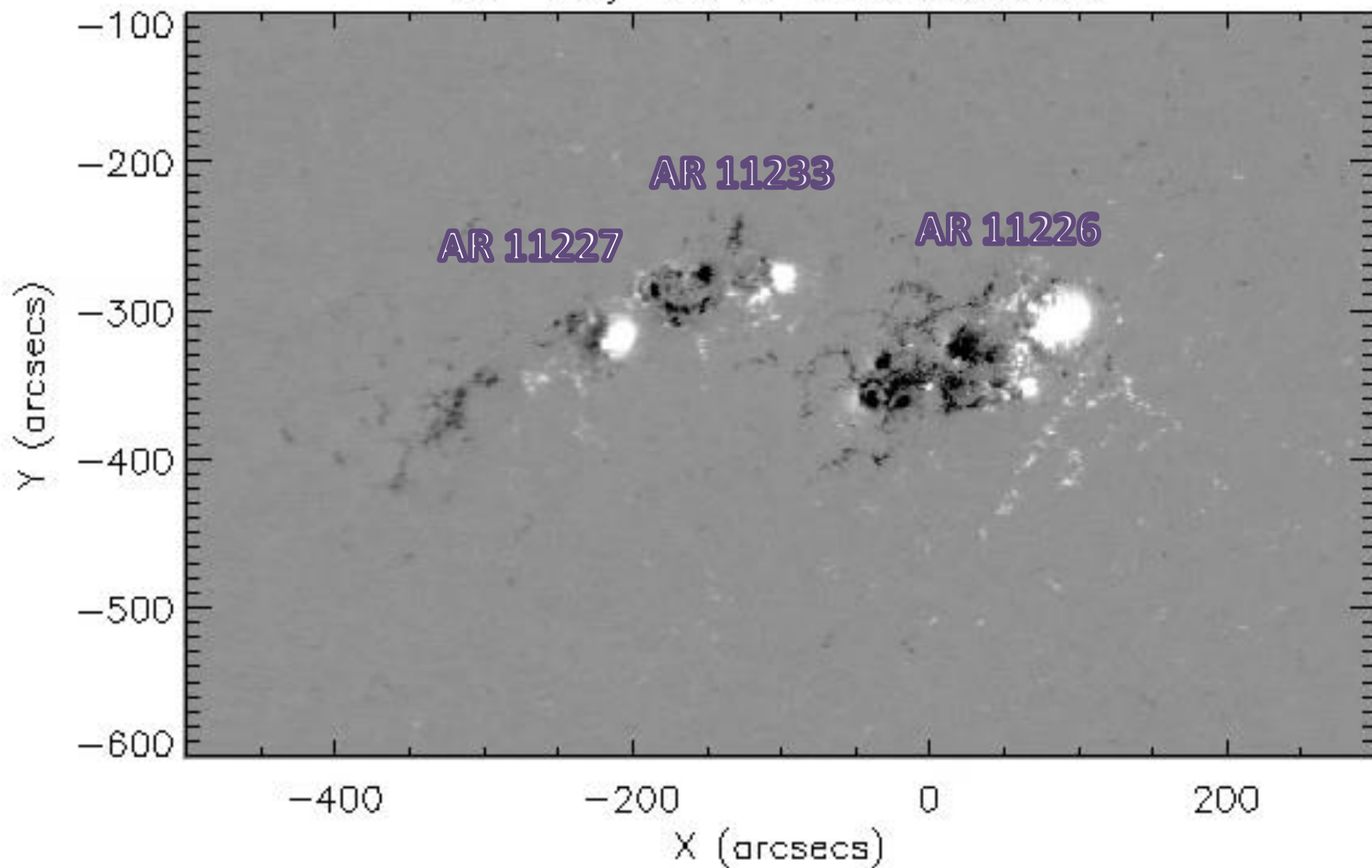
## Flux Rope Insertion Method



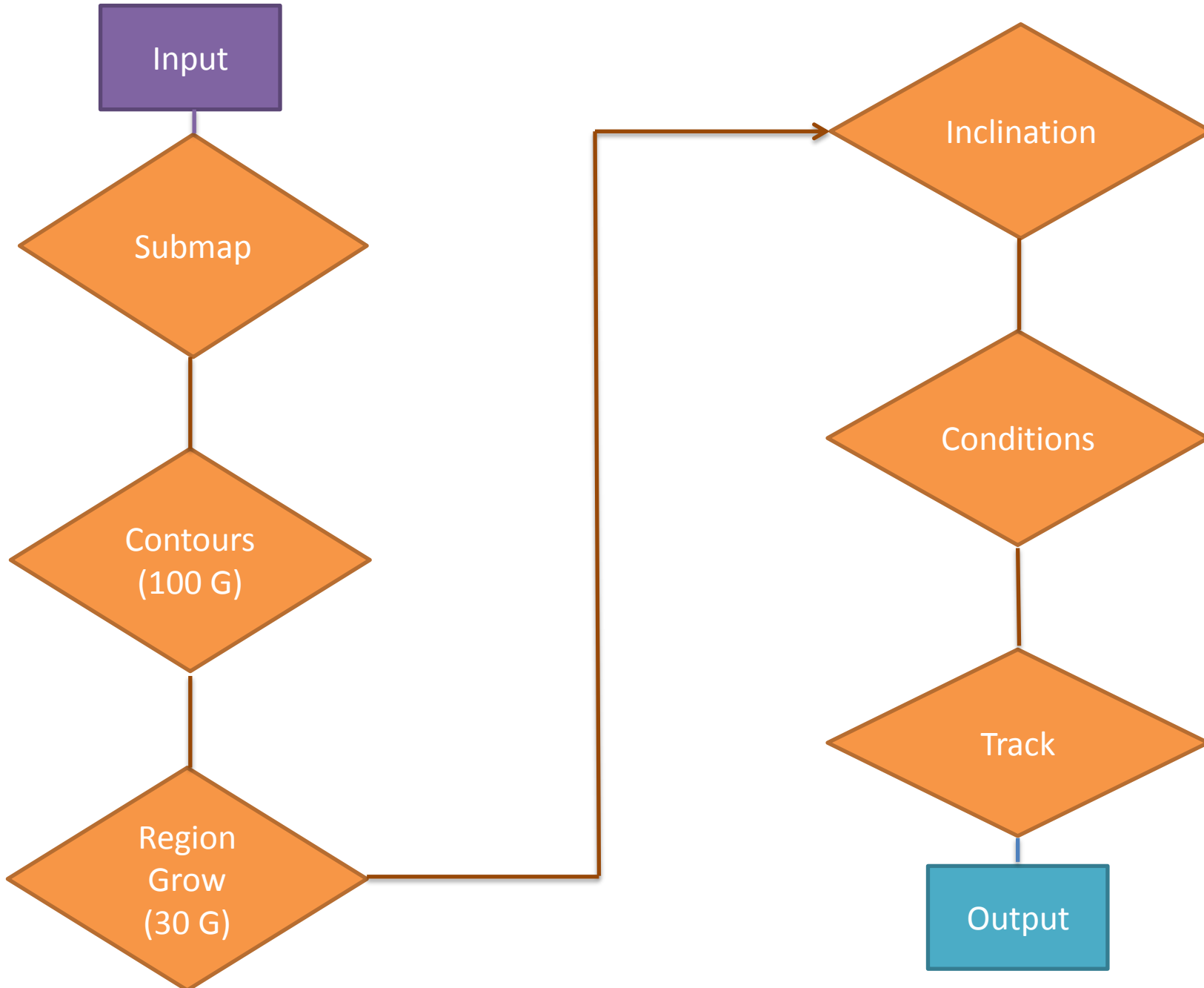
Flux rope contains 30 – 50 % of the AR flux

# Neighbouring ARs

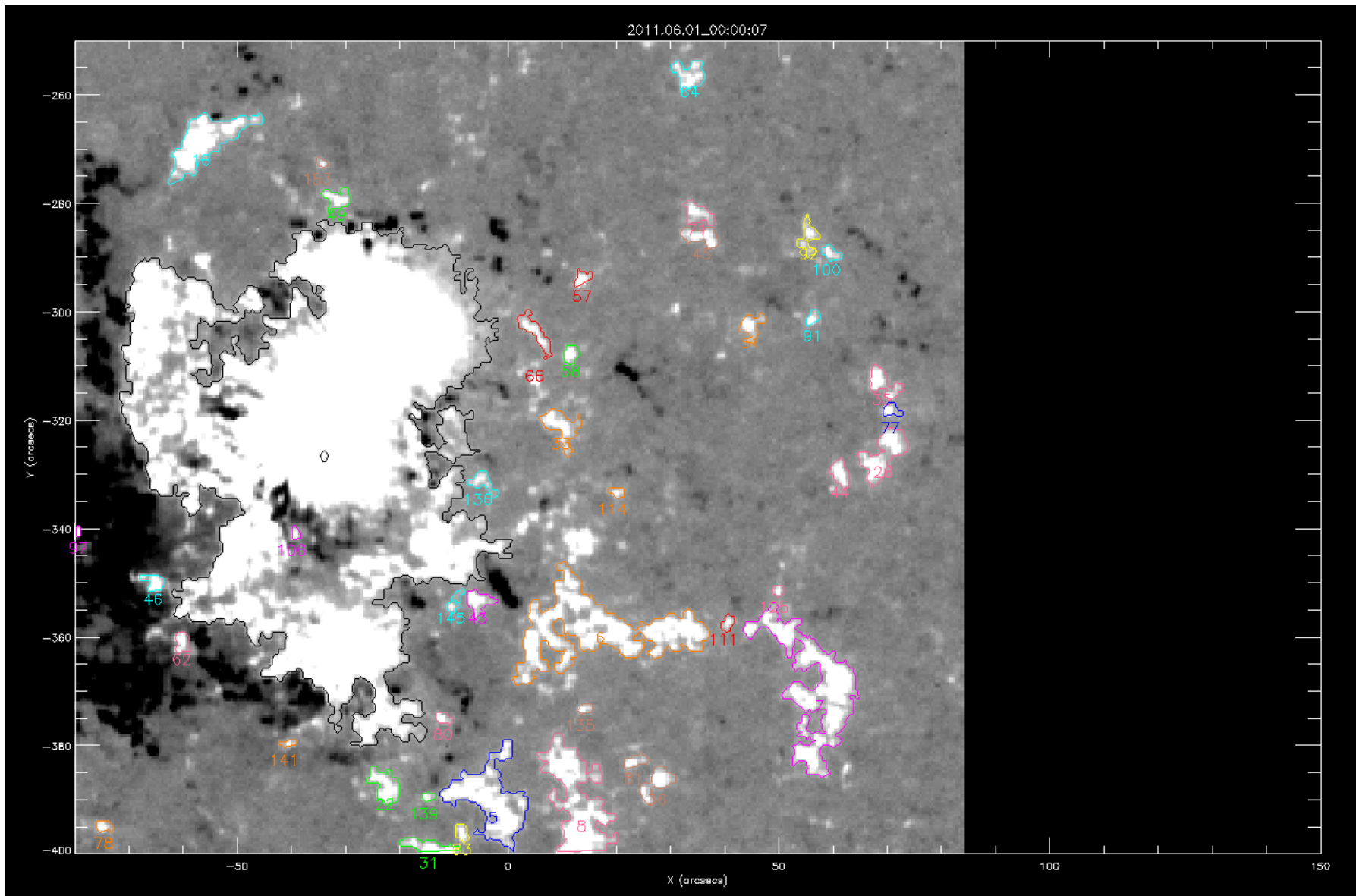
31-May-2011 00:00:40.400



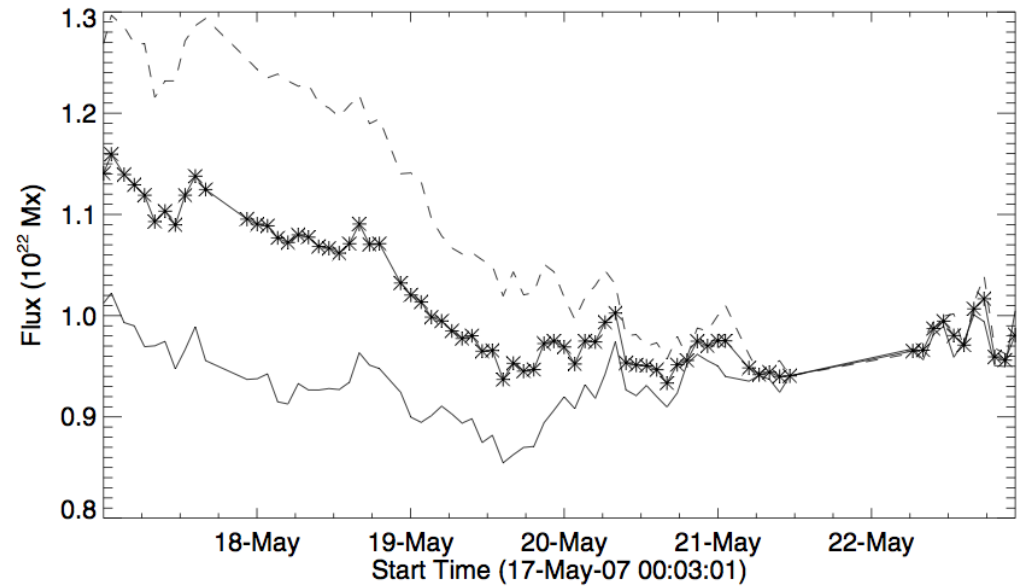
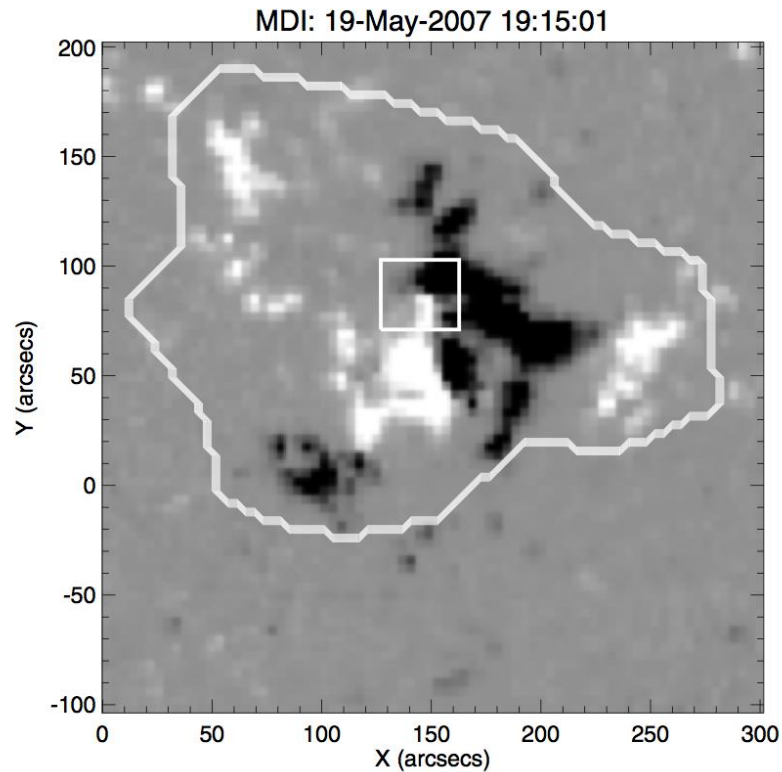
# Magnetic Flux Algorithm



# Magnetic Flux Algorithm

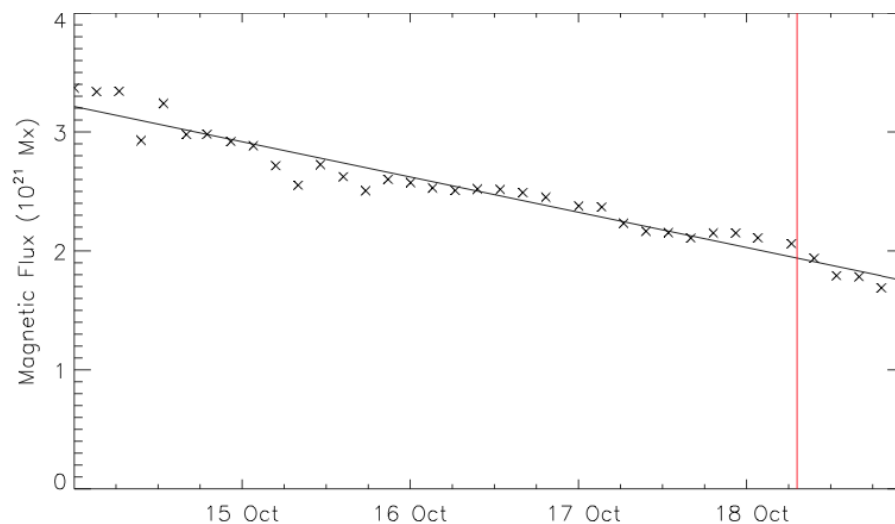
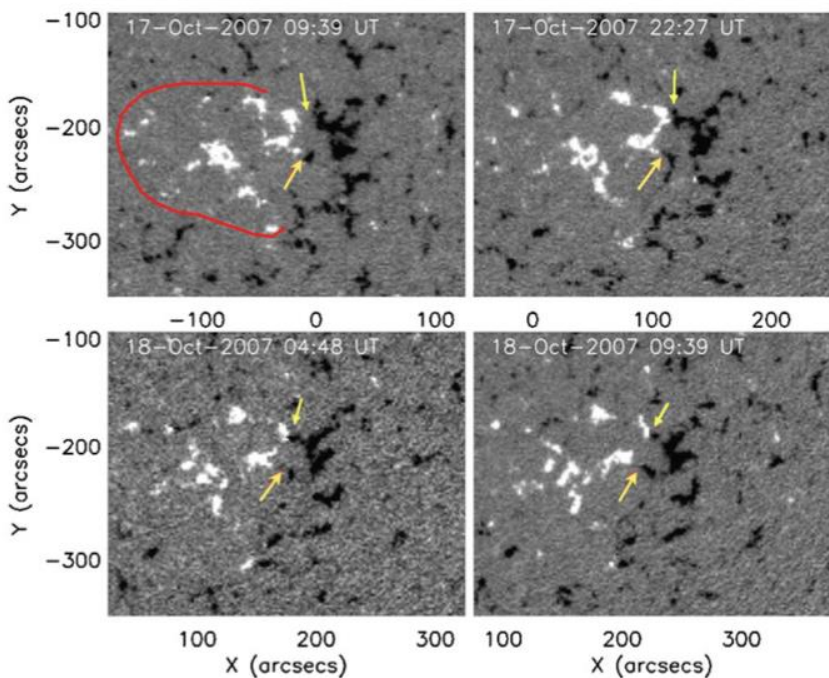
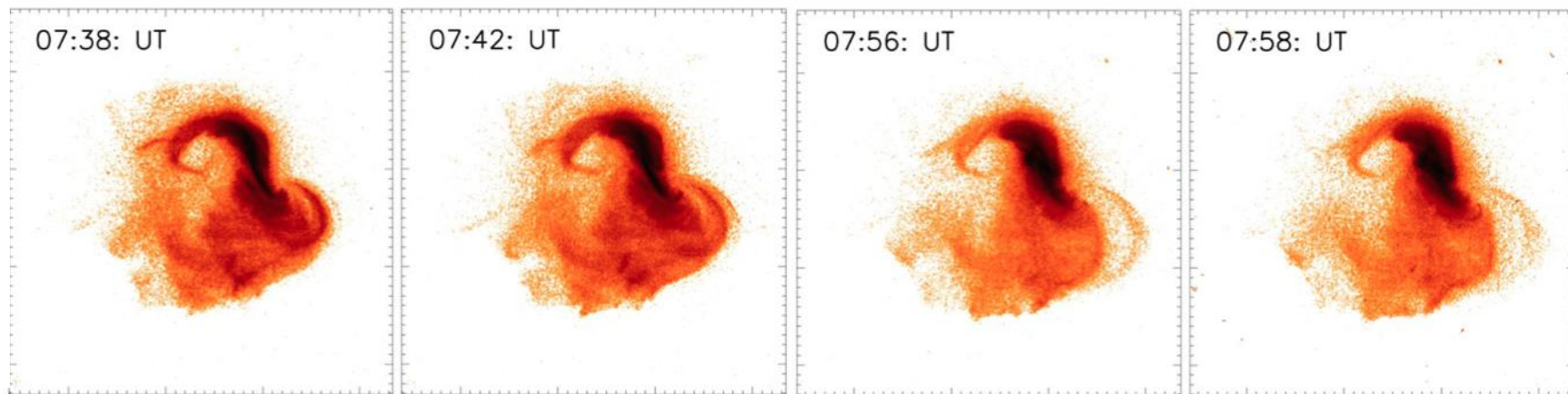






$\approx 10\%$  ( $1 \times 10^{21}$  Mx) of the AR flux cancels over a 24 hour period

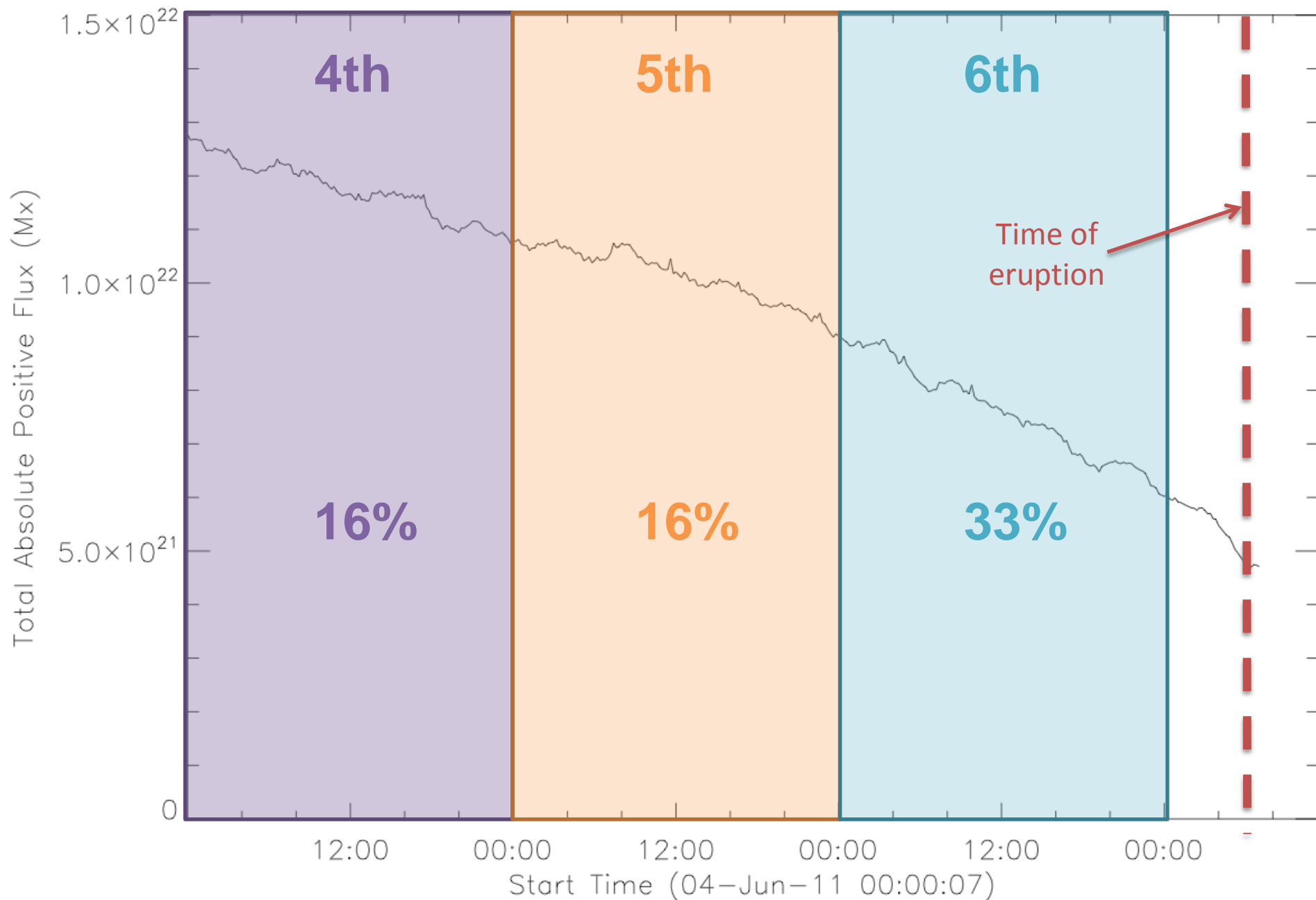
# Previous Work



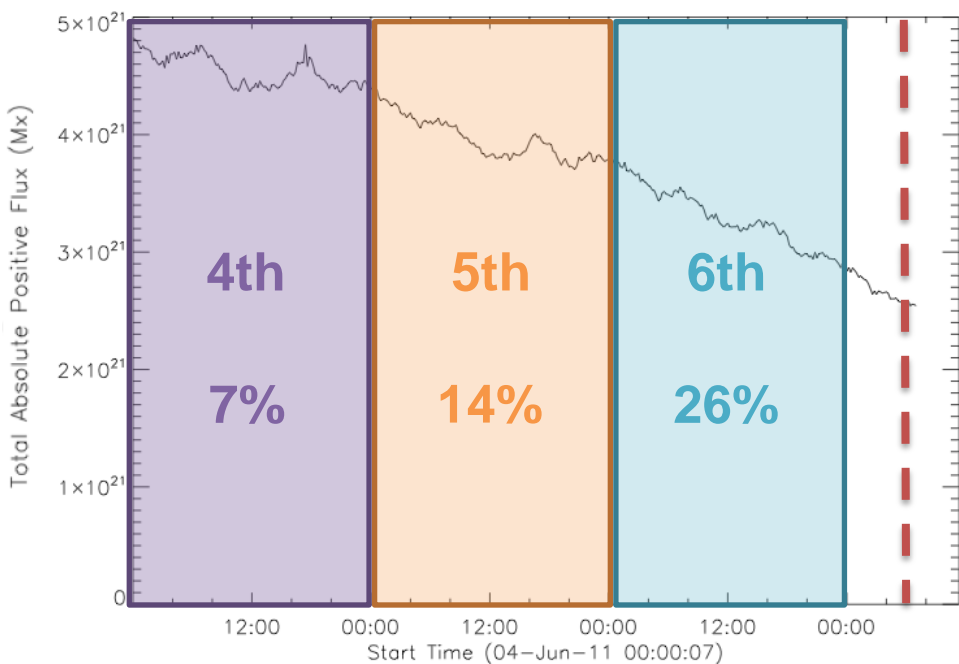
$\approx 10\%$  ( $1 \times 10^{21}$  Mx) of the AR flux cancels per day

# Results

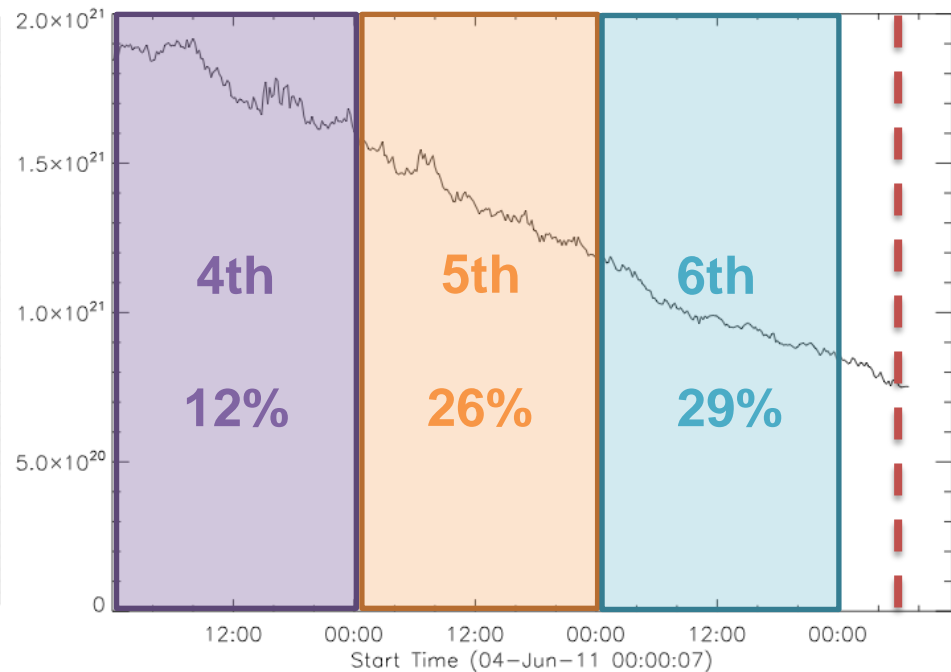
Total absolute positive magnetic flux – AR 11226

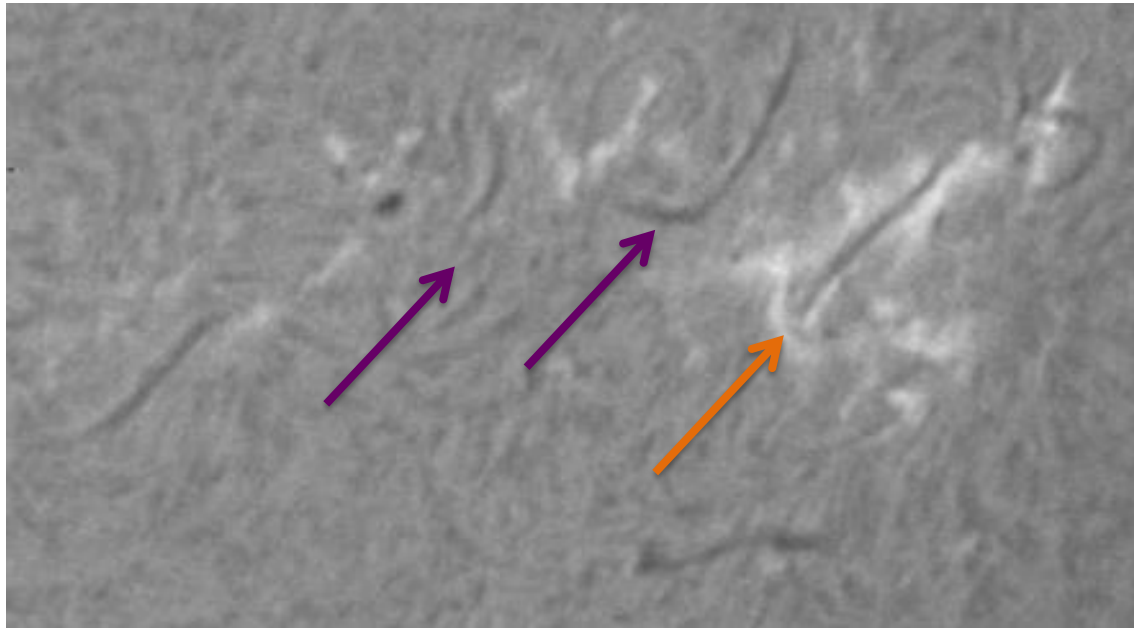


## AR 11227



## AR 11233





Active Region	Total Flux Cancelled
11227	$1.91 \times 10^{21} \text{ Mx}$
11233	$1 \times 10^{21} \text{ Mx}$
<b>11226</b>	<b><math>6.73 \times 10^{21} \text{ Mx}</math></b>



- Flux cancellation is important in the formation of flux ropes and filaments
- Automated magnetic flux algorithm to quantify flux cancellation
- Equivalent to an entire medium sized AR flux built into the flux rope
  - **$6.73 \times 10^{21}$  Mx over 3 days!**
- Full vector magnetic field data required
- NLFFF modelling

