

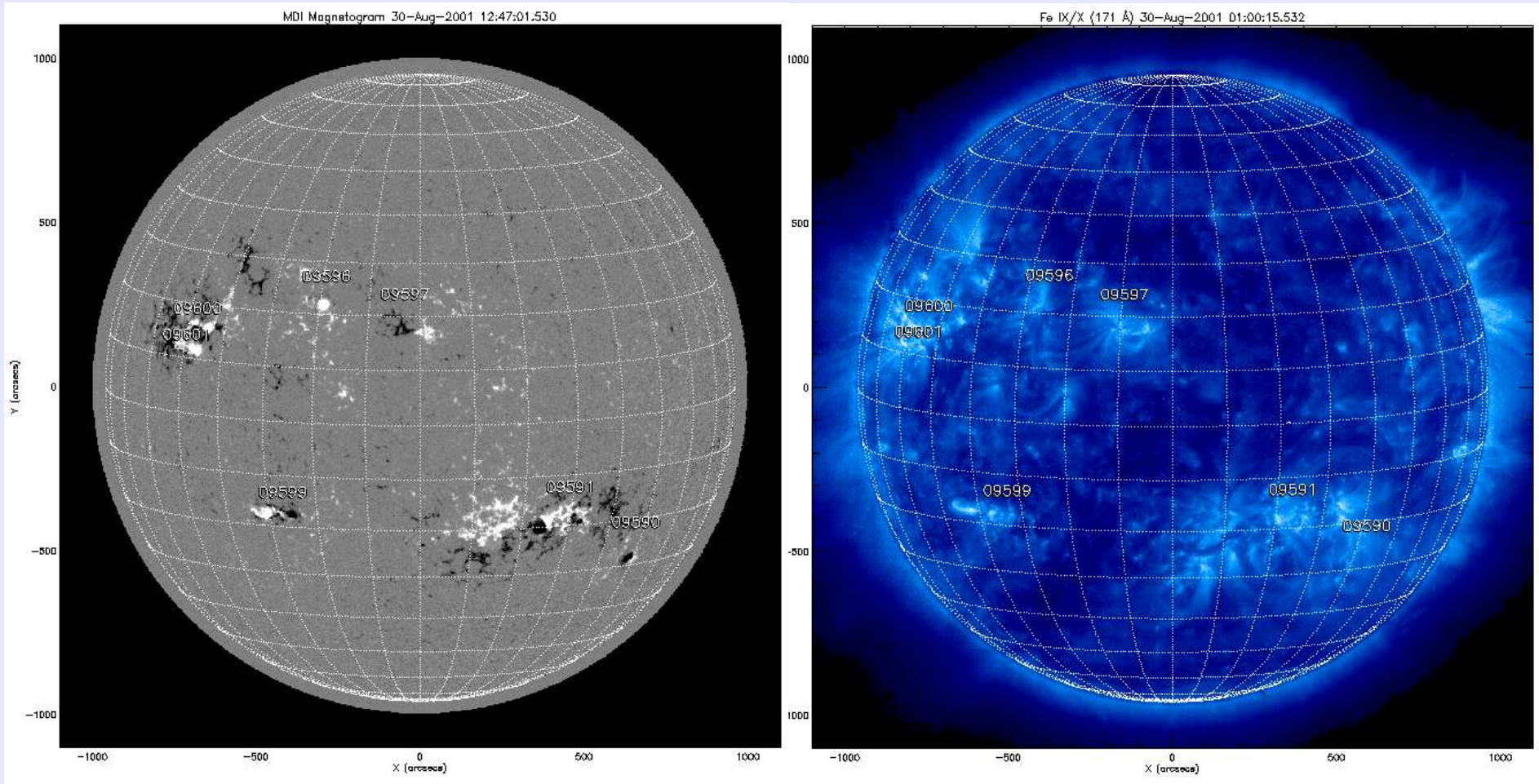
**Observational properties of large
active regions
and consequences of their appearance**

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All magnetic field crossing photospheric boundary influences the corona



Some forms sunspots and collects into active regions, some does not. But it all impacts the corona.

some of those produce energetic events....

www.SolarMonitor.org - Mozilla Firefox

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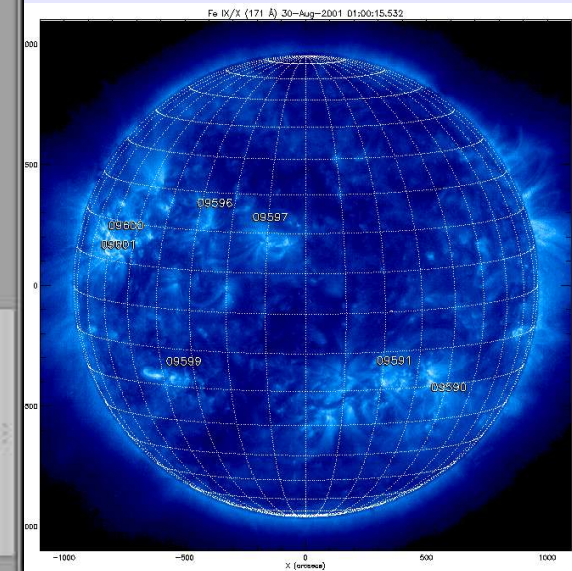
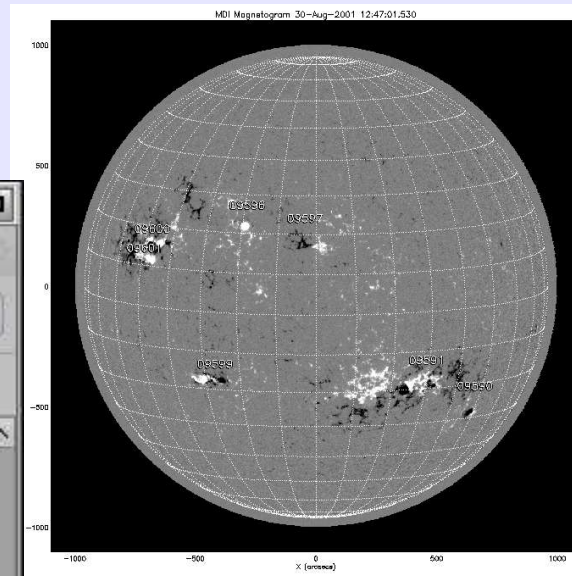
http://www.solarmonitor.org/index.php

Google Main Page - Wikiped...

Today's NOAA Active Regions

Number	Location	Hale	McIntosh	Area	NSpots	Events
09590	S27W55 (690",-486")	α/α	Hax/Hsx	0150/0150	02/03	-
09591	S18W36 (529",-381")	$\beta\gamma\delta/\beta\gamma\delta$	Fki/Fki	0570/0620	26/41	C1.5(04:18) C6.0(06:41) M1.5(17:45) /C6.2(11:08) C1.3(23:37)
09596	N21E15 (-229",230")	β/α	Cao/Hax	0190/0160	02/01	-
09597	N17W05 (79",162")	β/β	Bxo/Dao	0020/0040	09/09	-
09599	S19E23 (-350",-409")	β/β	Dao/Dao	0110/0080	10/03	/C3.4(20:53)
09600	N14E42 (-615",142")	$\beta\gamma/\beta$	Eao/Dao	0280/0170	09/04	/M1.6(05:03) M1.2(12:42) C3.3(18:19) C9.6(20:13)
09601	N09E44 (-650",62")	$\beta\gamma/\beta$	Dao/Dao	0390/0150	08/07	C3.3(00:53) C5.4(01:30) M3.0(20:34) /C7.4(14:37)

http://www.solarmonitor.org/full_disk.php?date=20010830&type=seit_00171

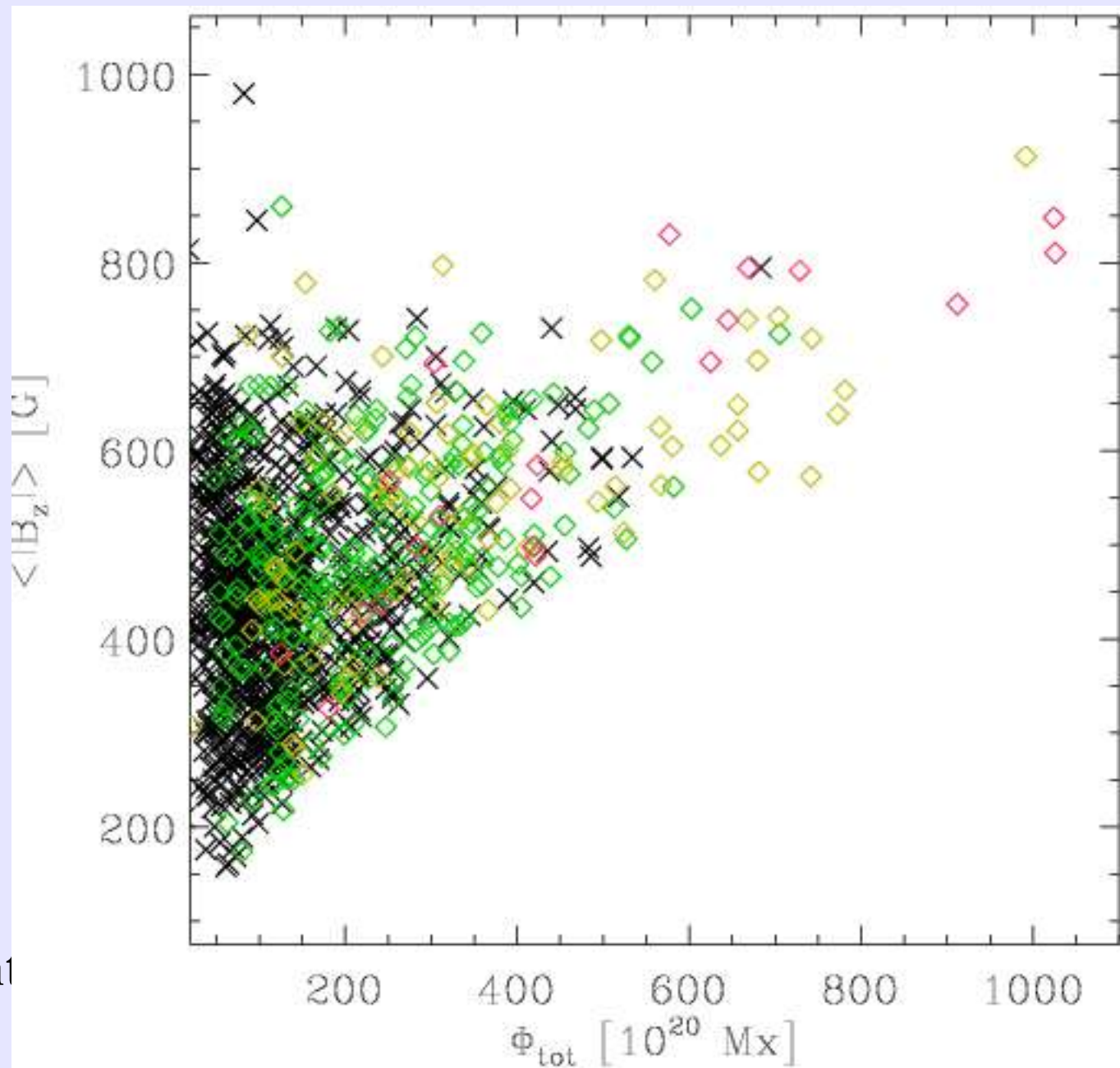


does size really matter?

Properties of Large Active Regions:

A plot of total magnetic flux Φ_{tot} vs. mean vertical flux density $\langle B_z \rangle$, also showing the flaring activity in the 24hr post-observations. Non-flaring regions (X), and flaring regions (\diamond) are shown with the largest flare in any 24-hr period (C, M, X). The points with $\Phi_{tot} \geq 10^{23}$ Mx are region NOAA AR 10486. Data source: IVM Survey QL Data*.

1. If it's big, it will have stronger mean field (exact is caveat instrument limits). Even if it is *not* flare-productive.

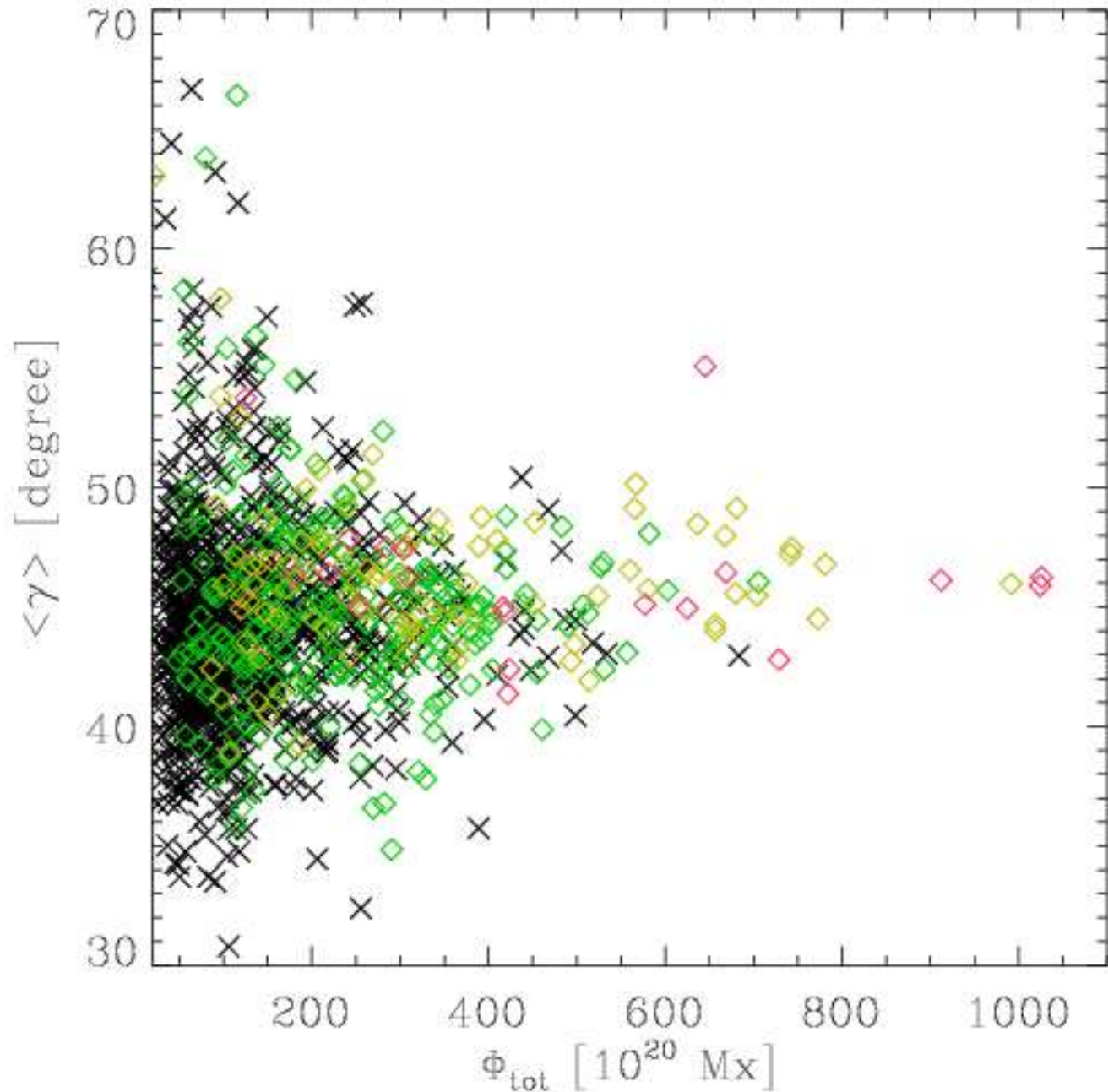


*: available at

http://www.cora.nwra.com/~ivm/IVM_SurveyData/

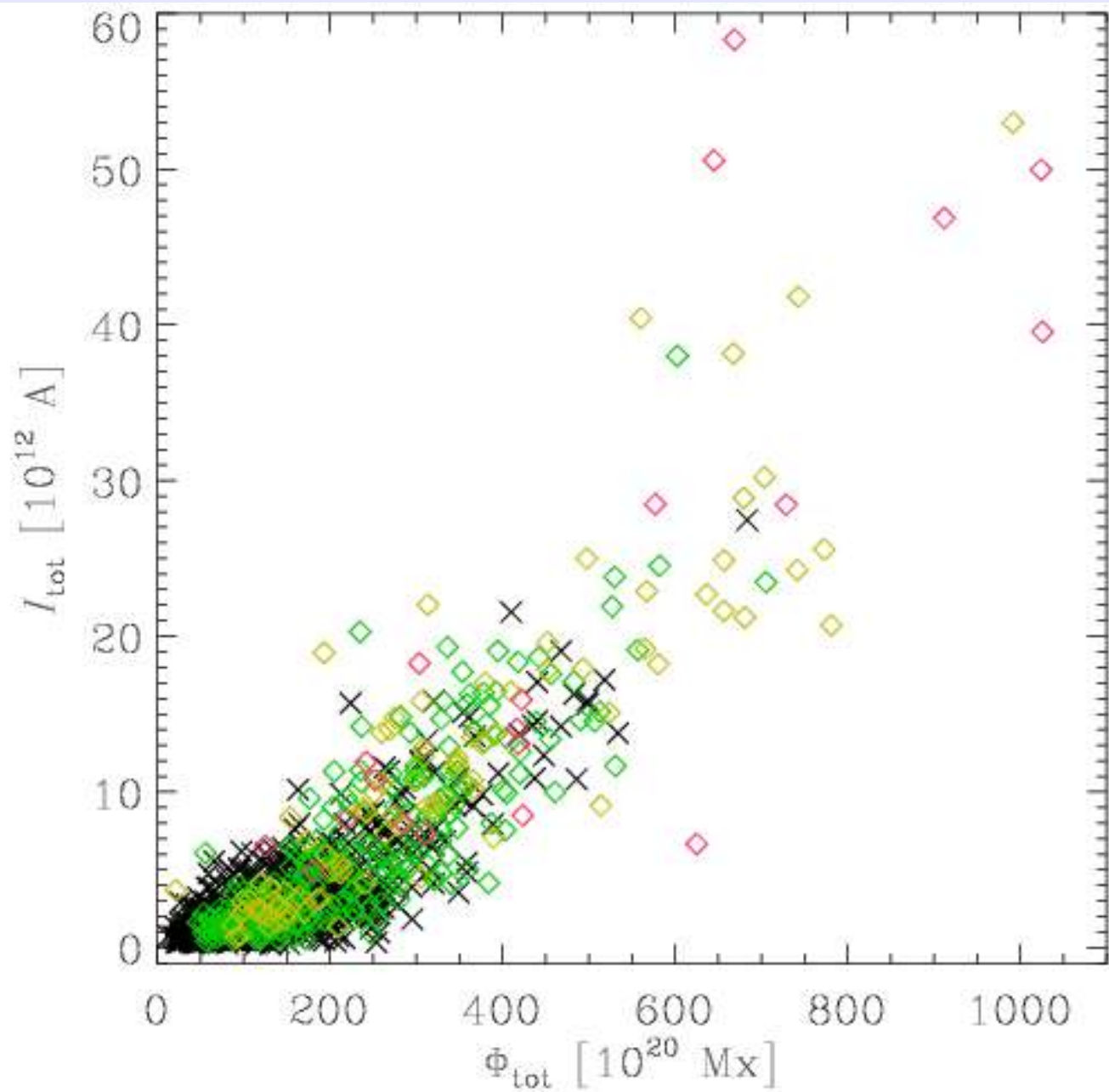
2. But the mean magnetic inclination is not statistically different.

Φ_{tot} vs. mean magnetic inclination angle (from the vertical), γ .



Φ_{tot} vs. “total unsigned vertical current I_{tot} ”.

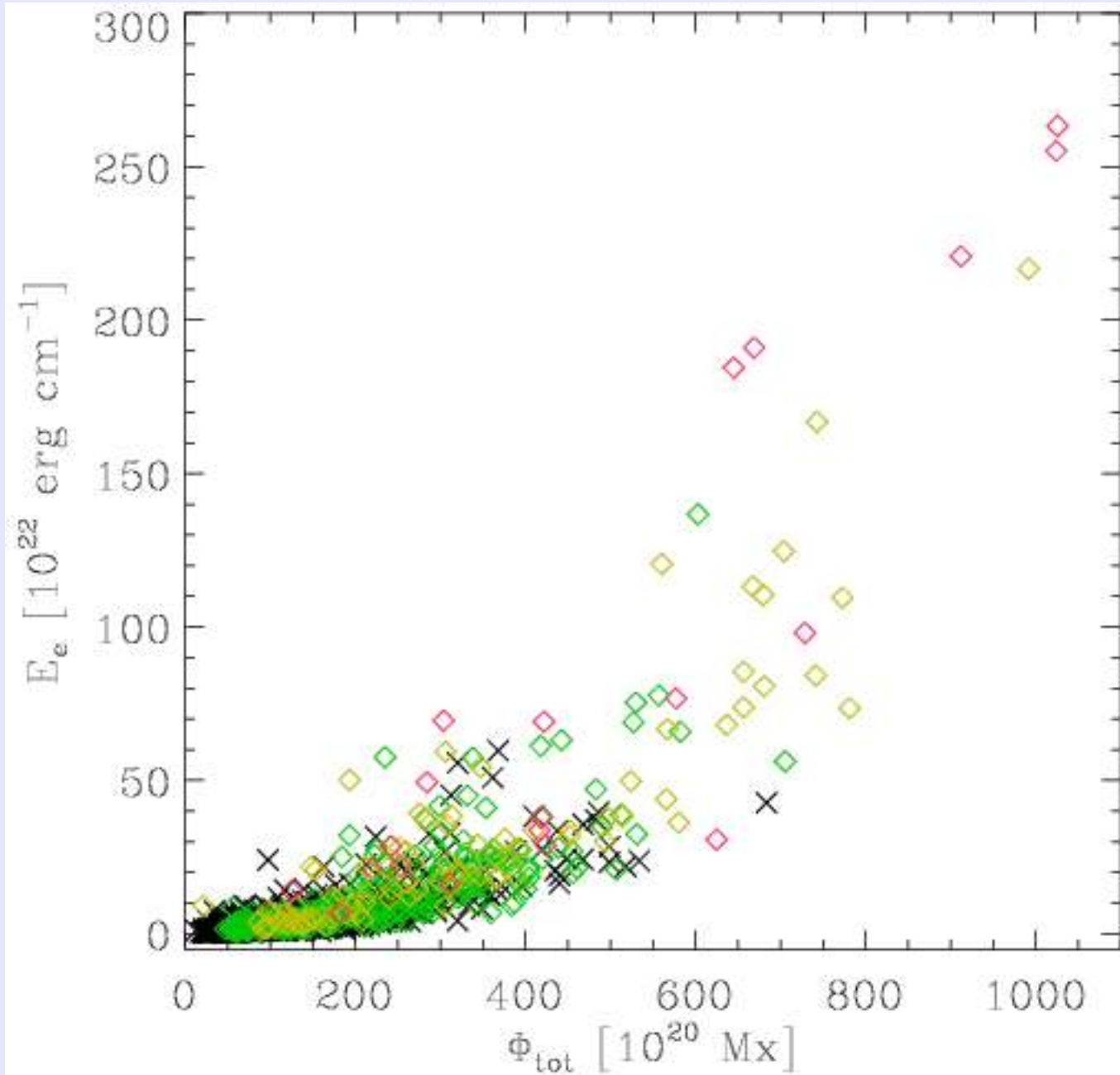
3. If it's big, it will carry vertical current. Even if it is *not* flare-productive.

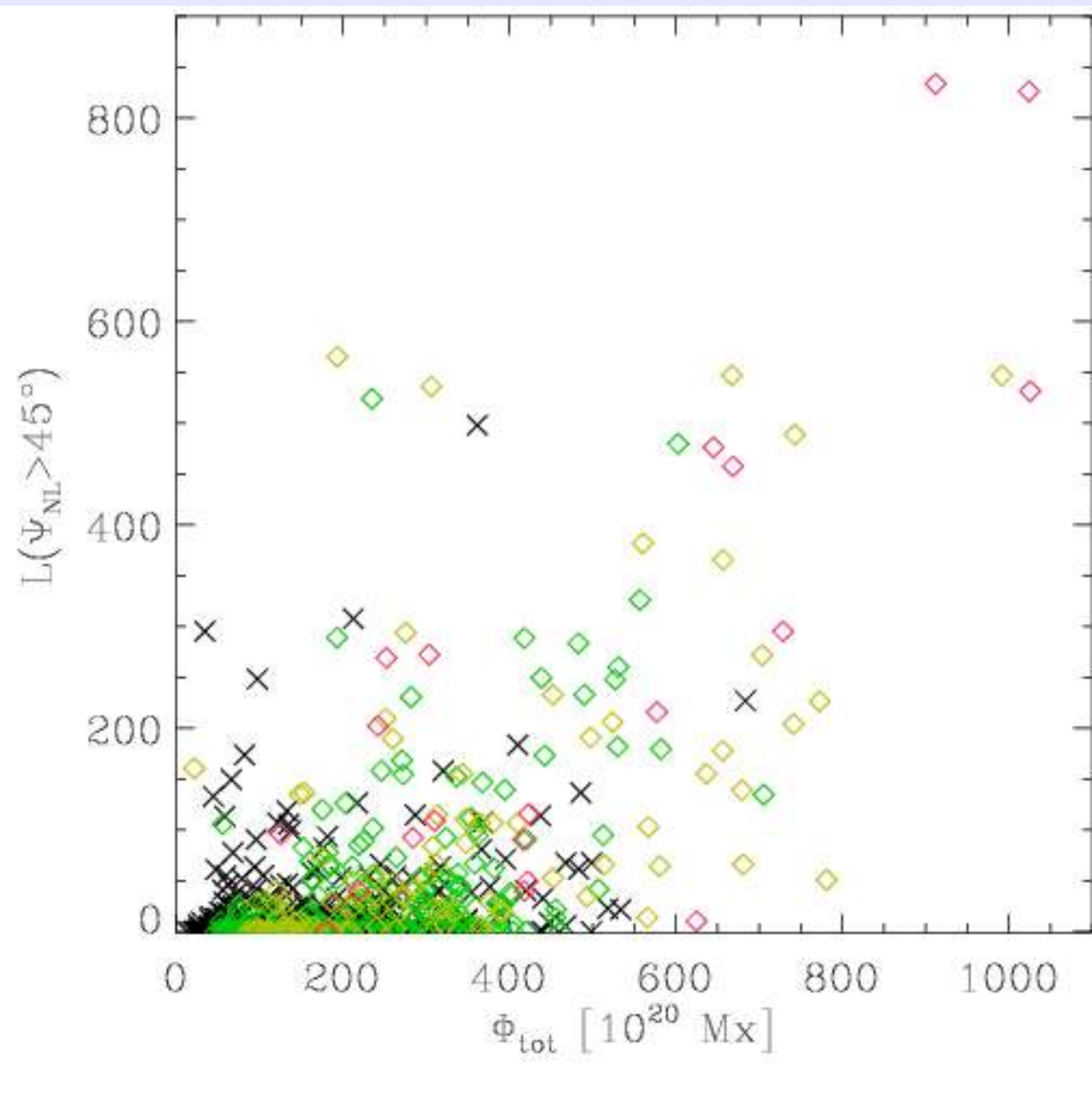


Φ_{tot} vs. “excess magnetic energy”:

$$(B_{observed} - B_{potential})^2 / 8\pi.$$

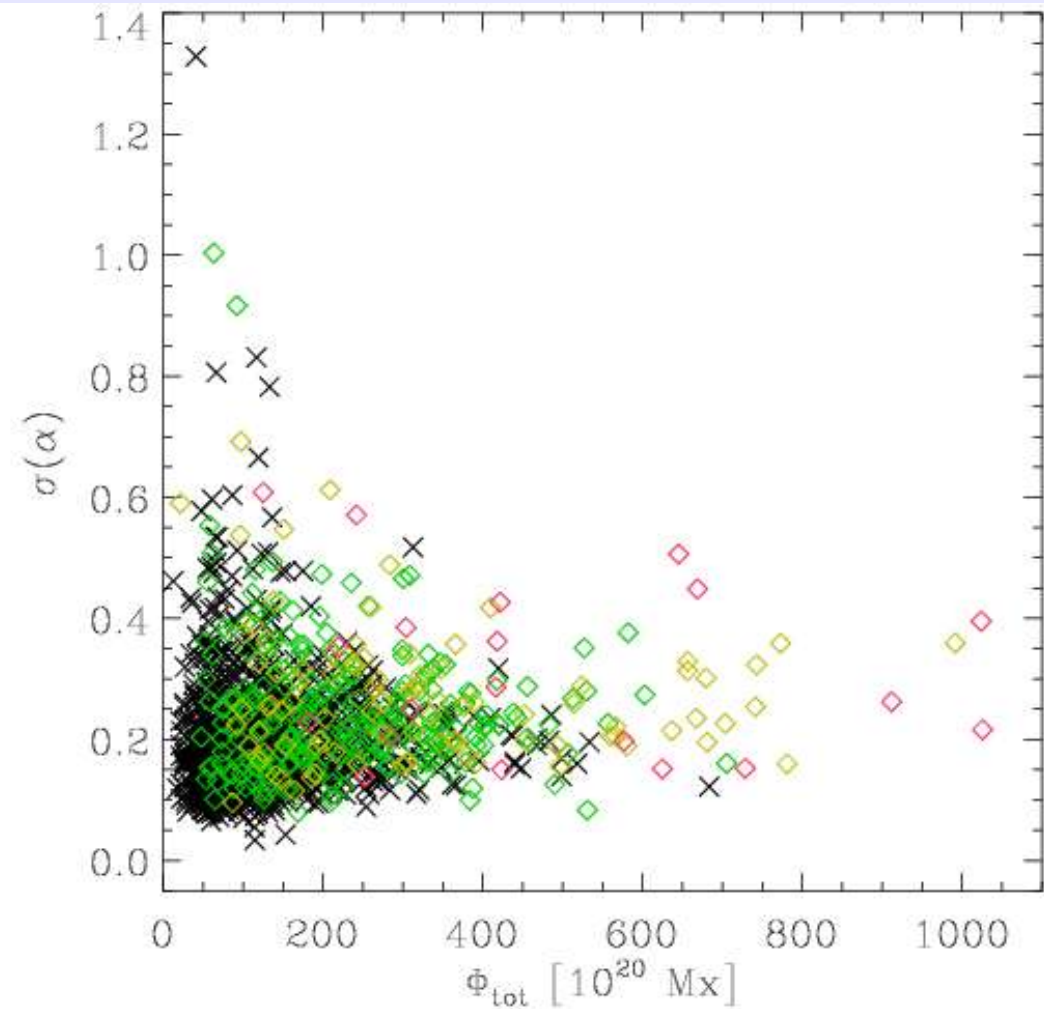
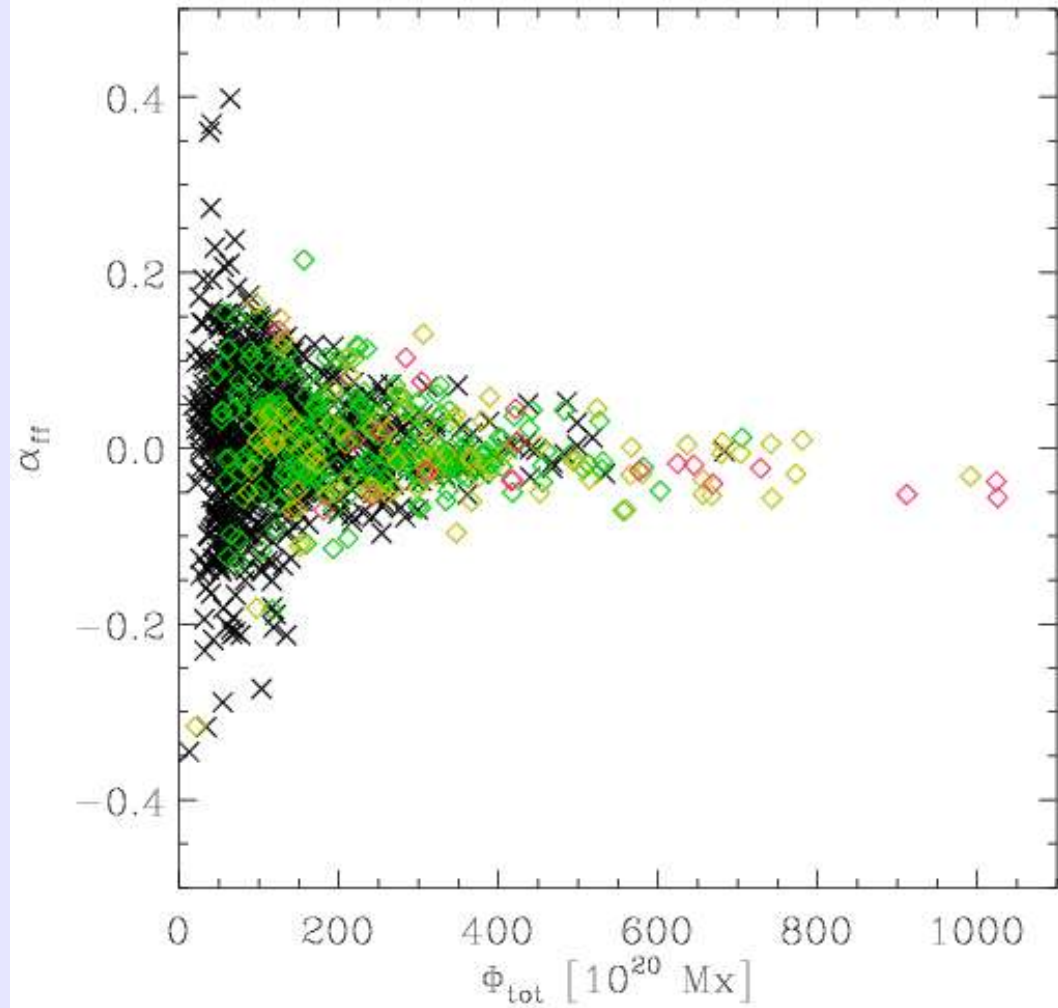
4. The largest active regions all indicate significant energy storage beyond the potential field.

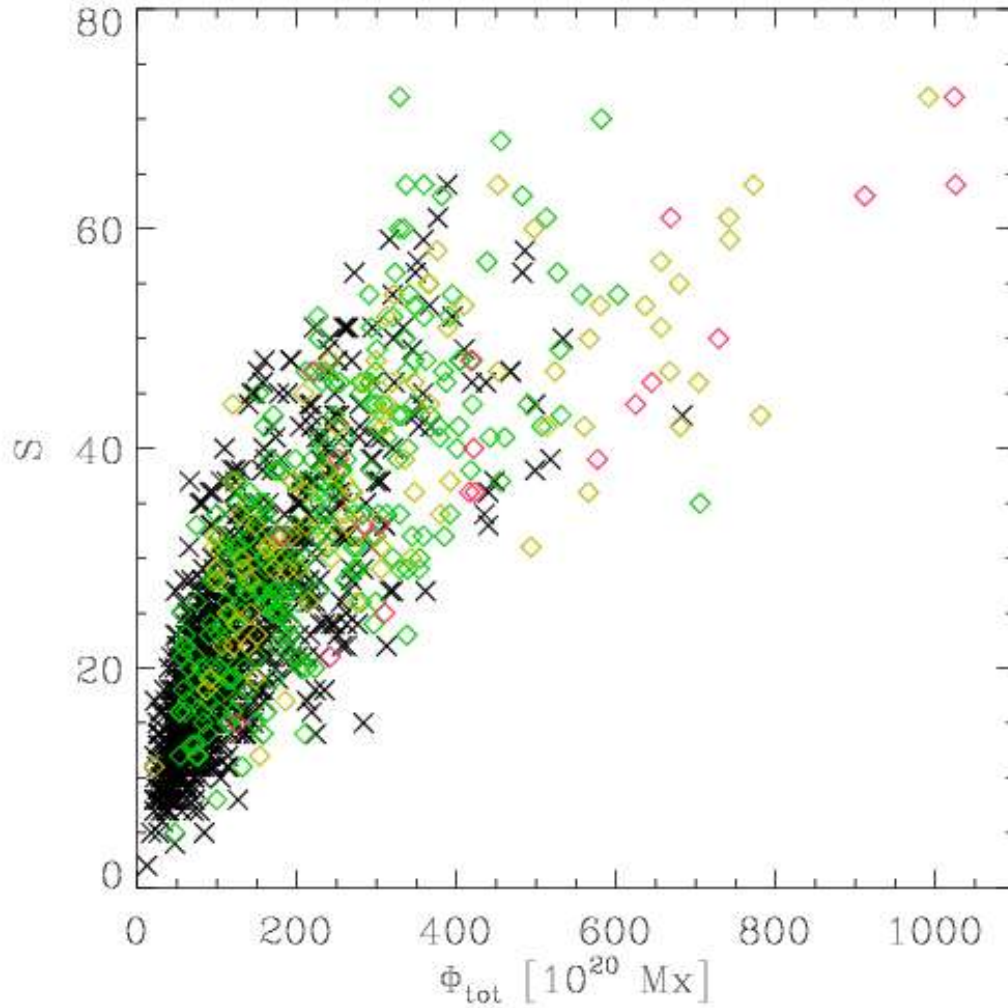




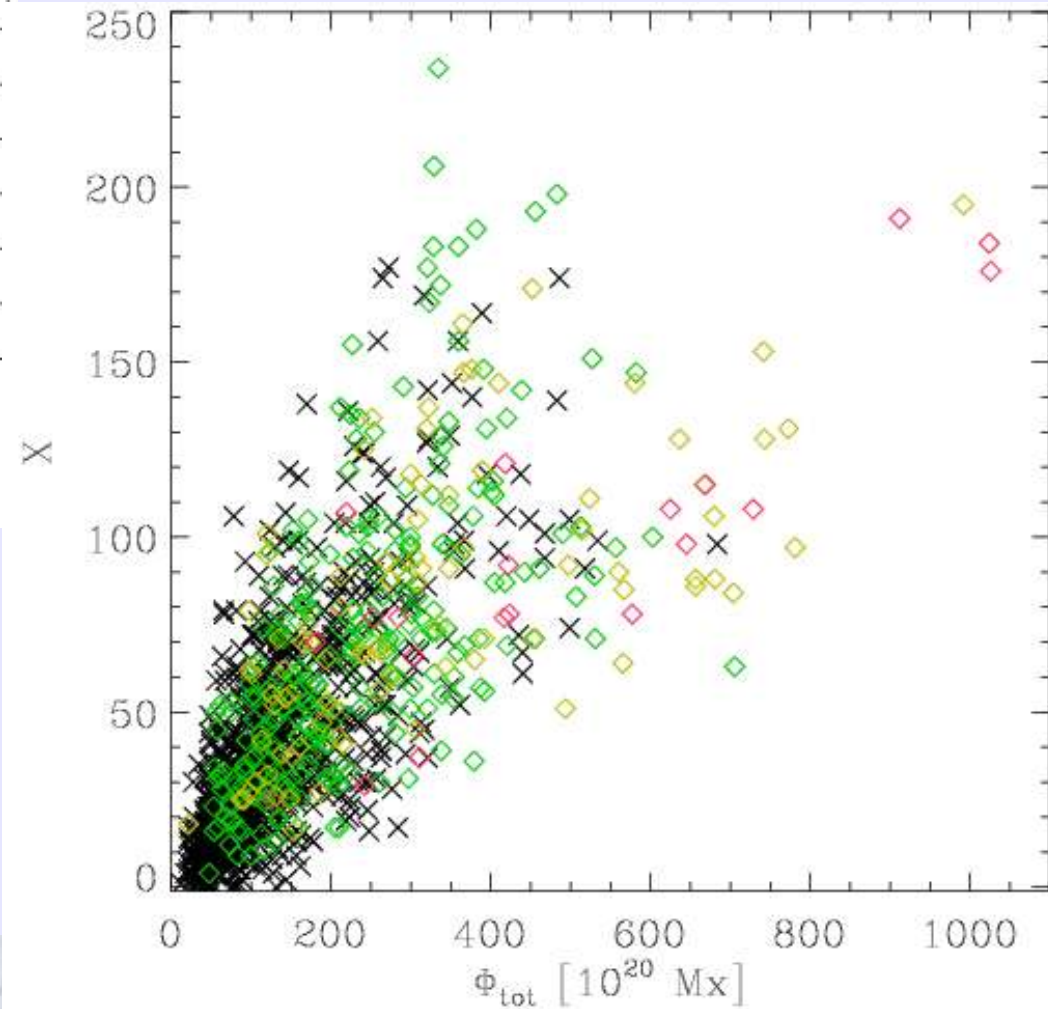
5. Only *extremely* large active regions guarantee large lengths of strong neutral-line shear (deviation from potential).

6. Large active regions tend toward $\alpha_{\text{best}} = 0$.
This is due to the broad distribution of $\alpha = J_z/B_z$ present.





7. Large active regions inherently have more “sources”, which can allow a greater number of magnetic connections.

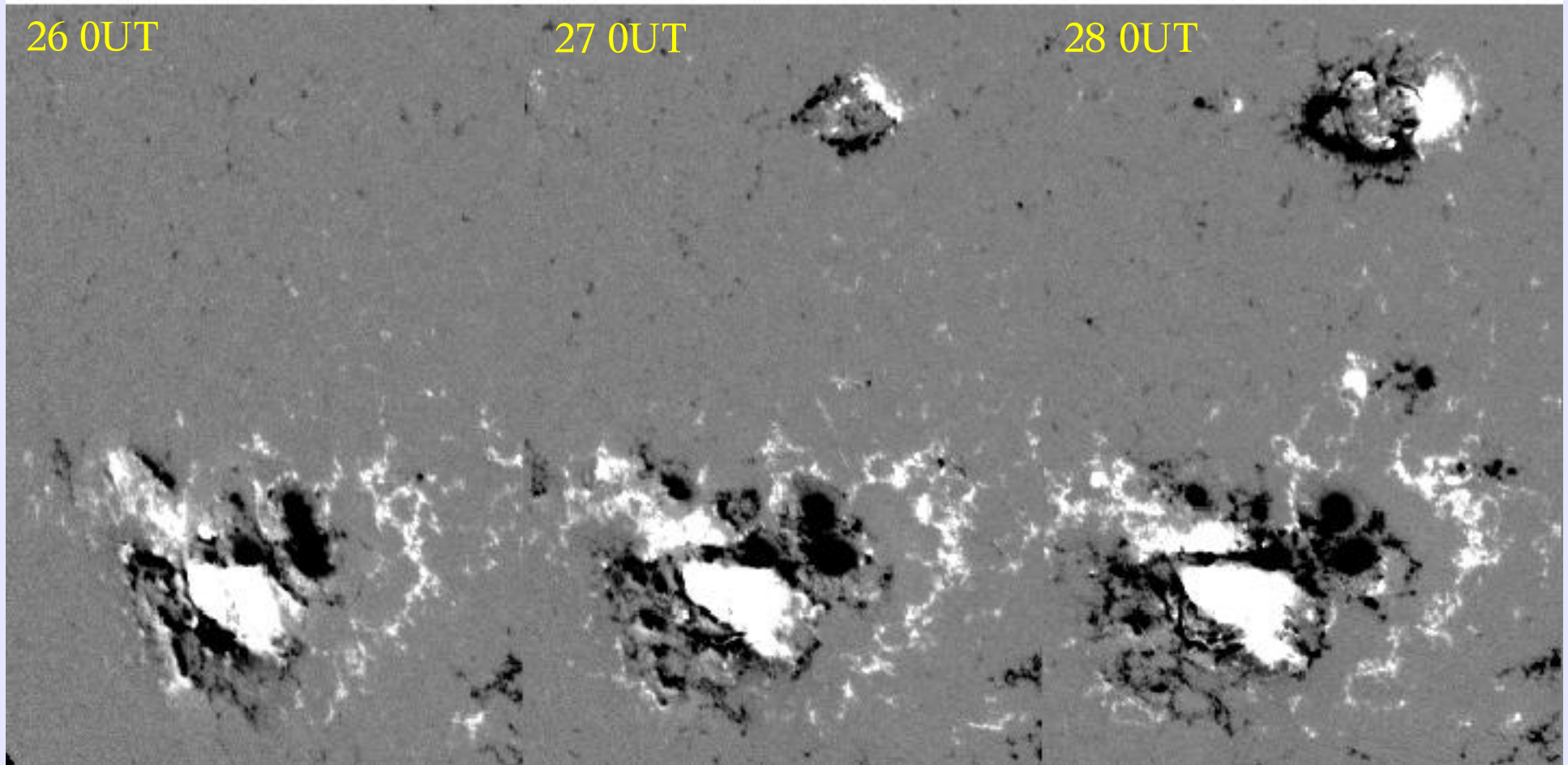


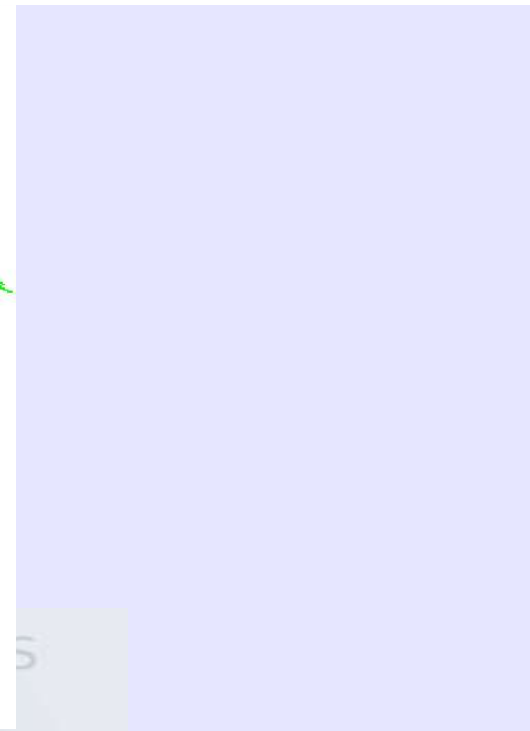
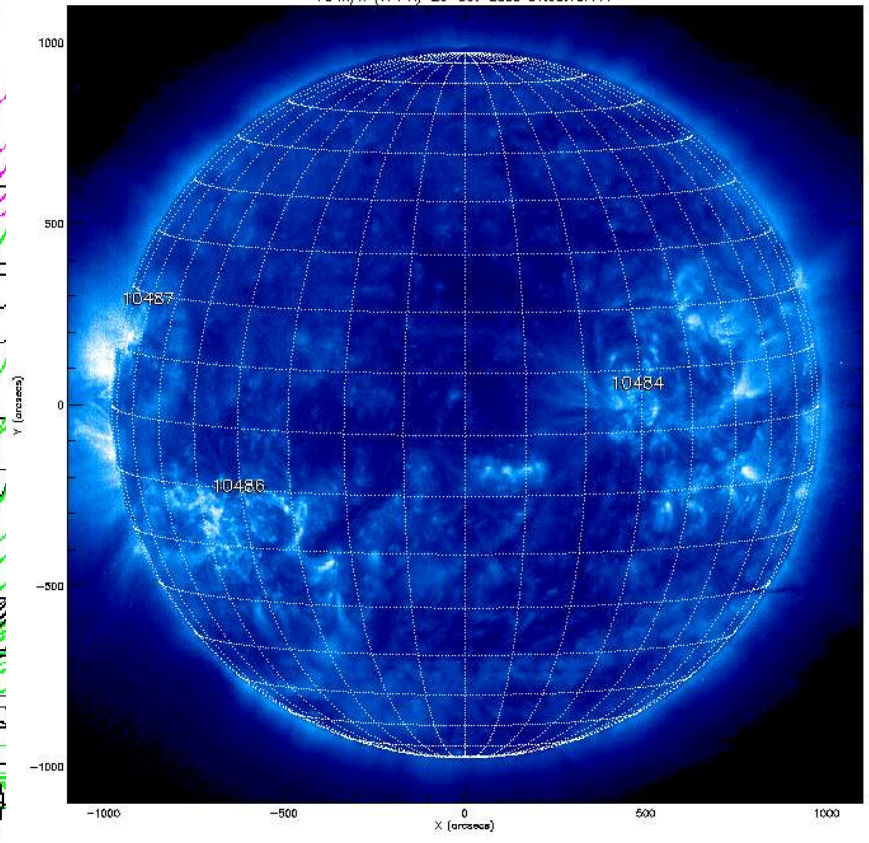
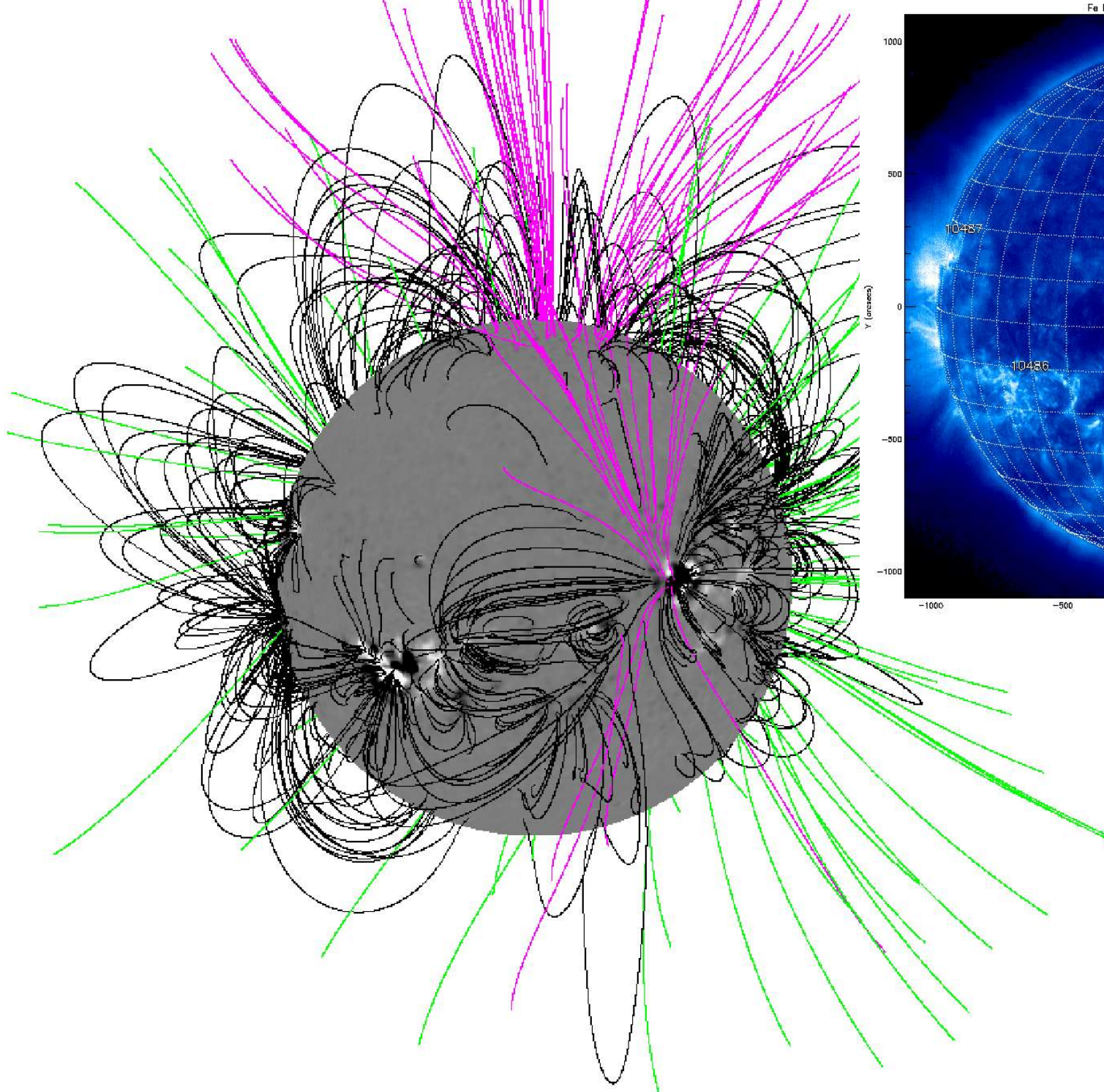
Impacts of a large active region appearance:
AR 10488, October 2003.

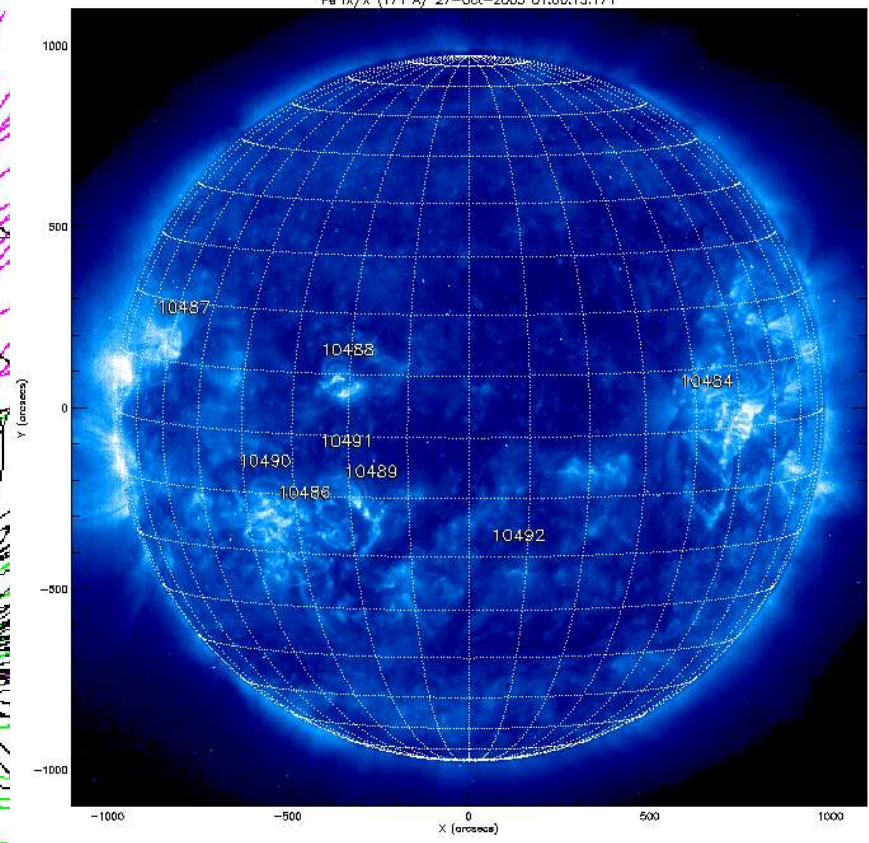
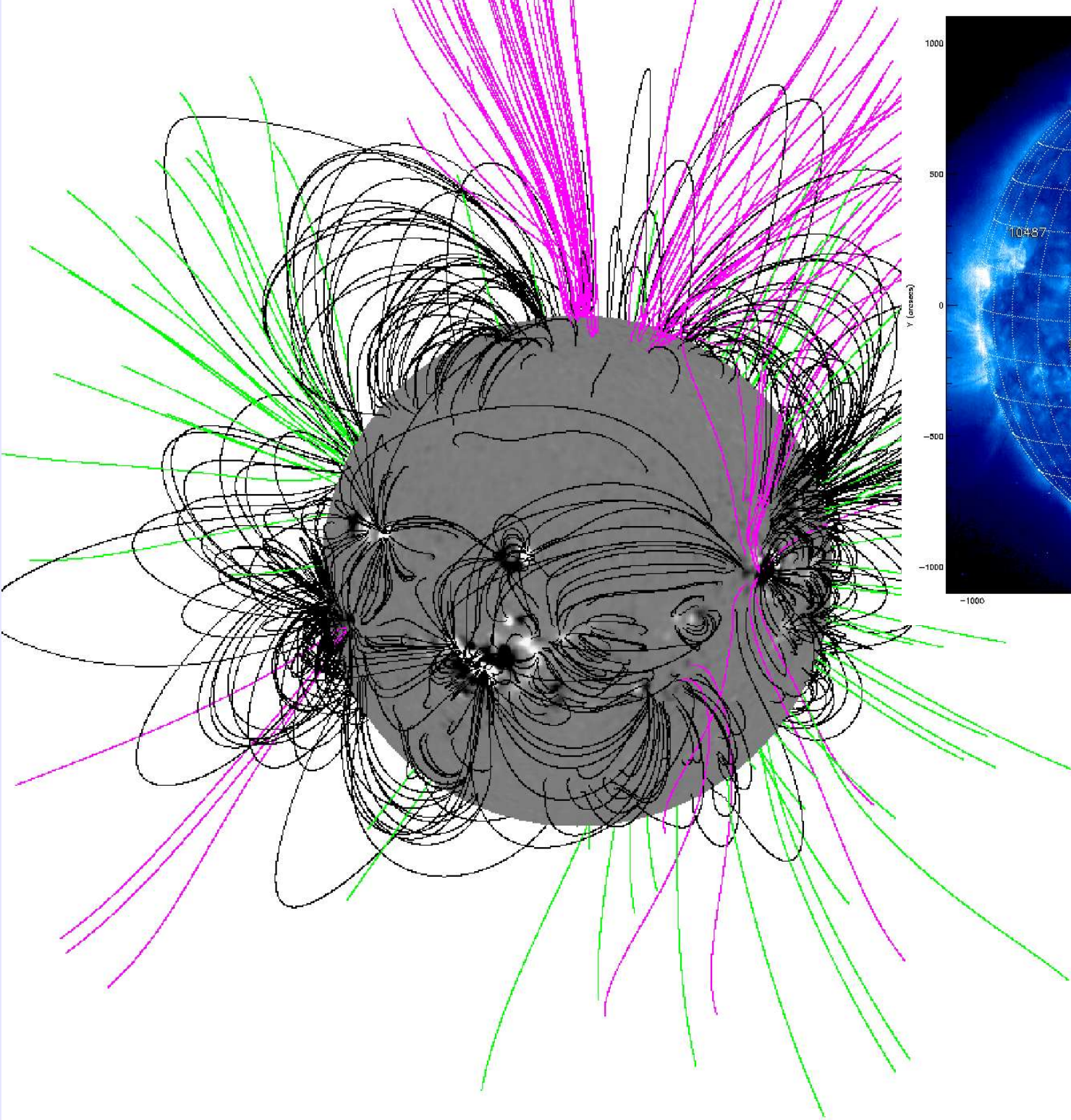
$> 3 \times 10^{22}$ Mx in < 48 hr

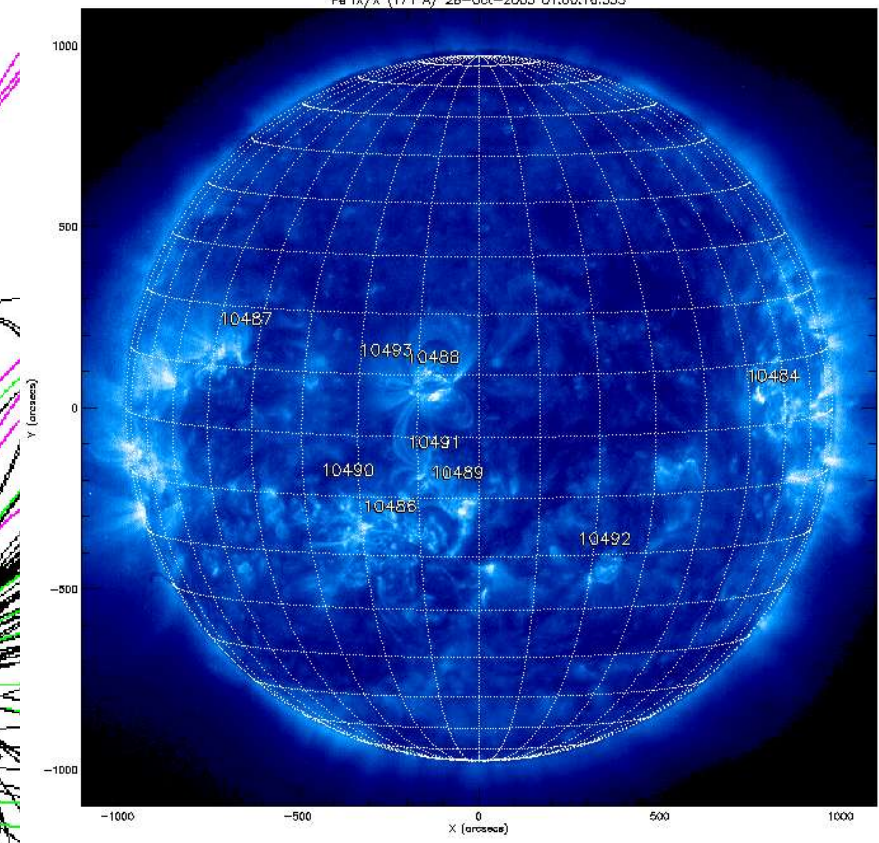
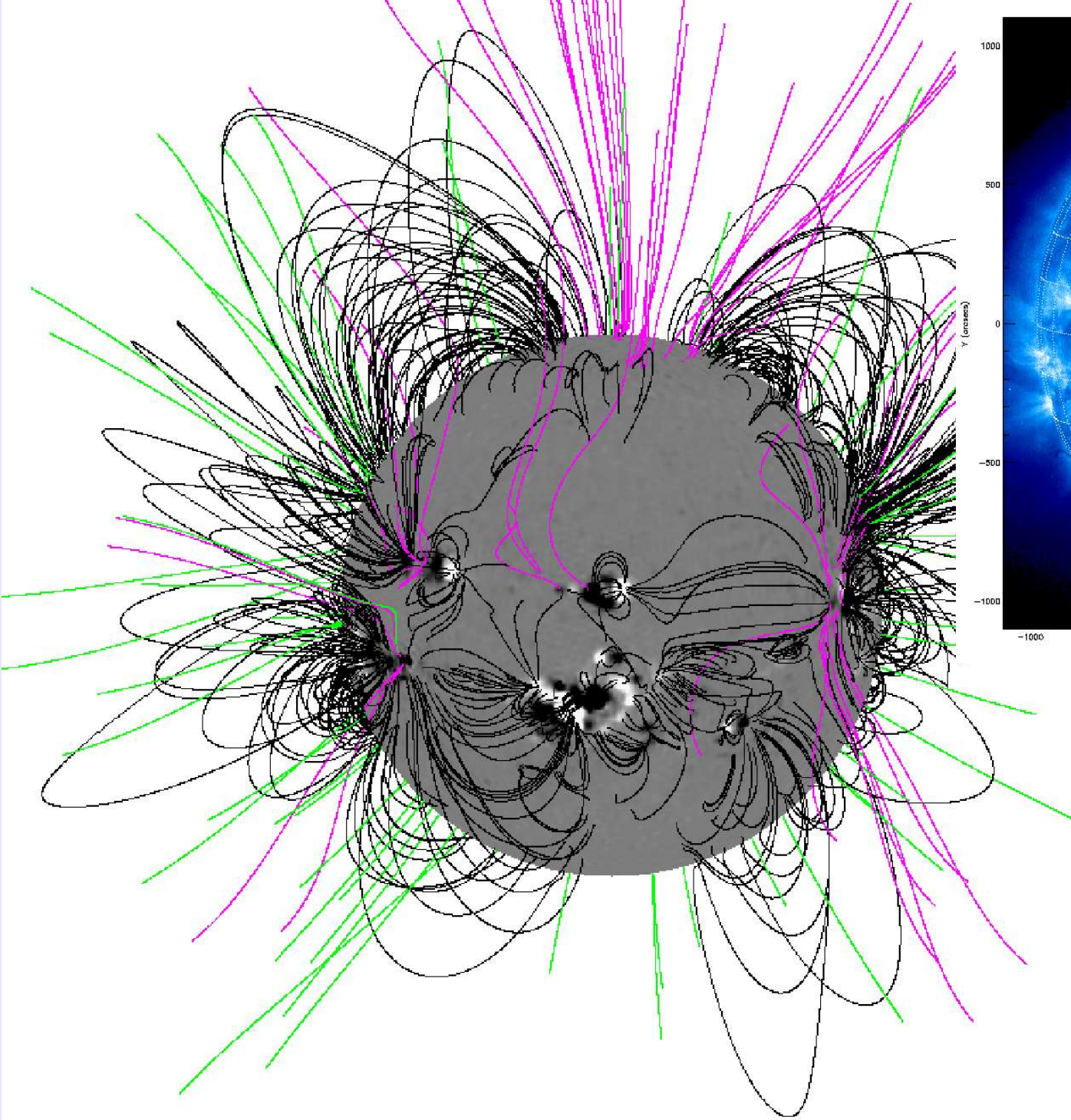
(kinda gives you pause for long-range prediction capability, eh?)

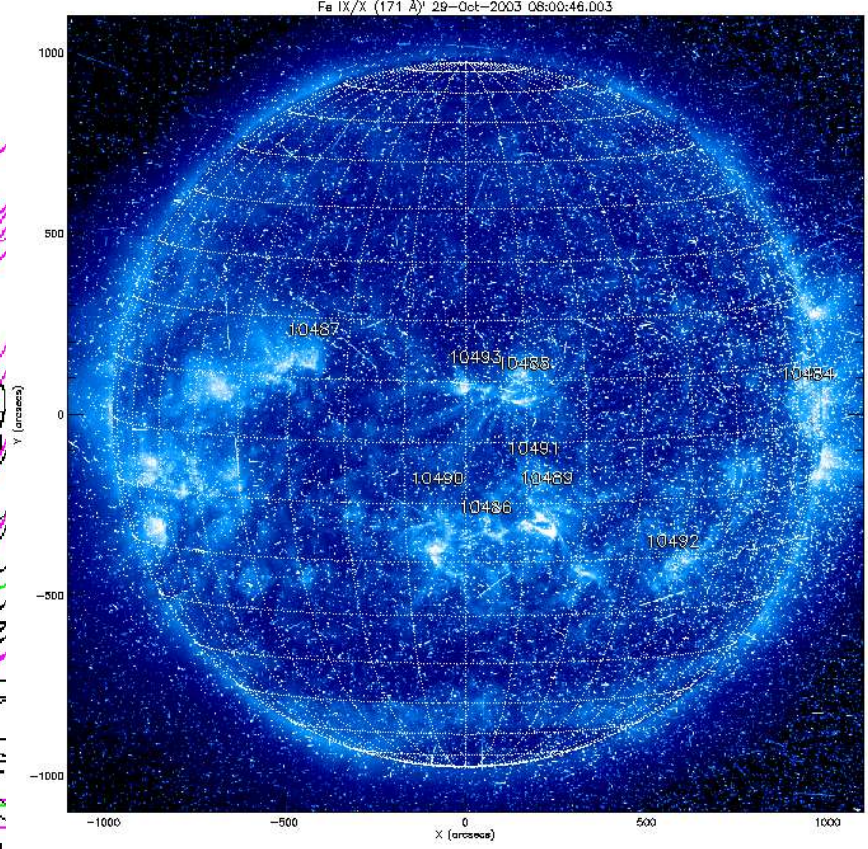
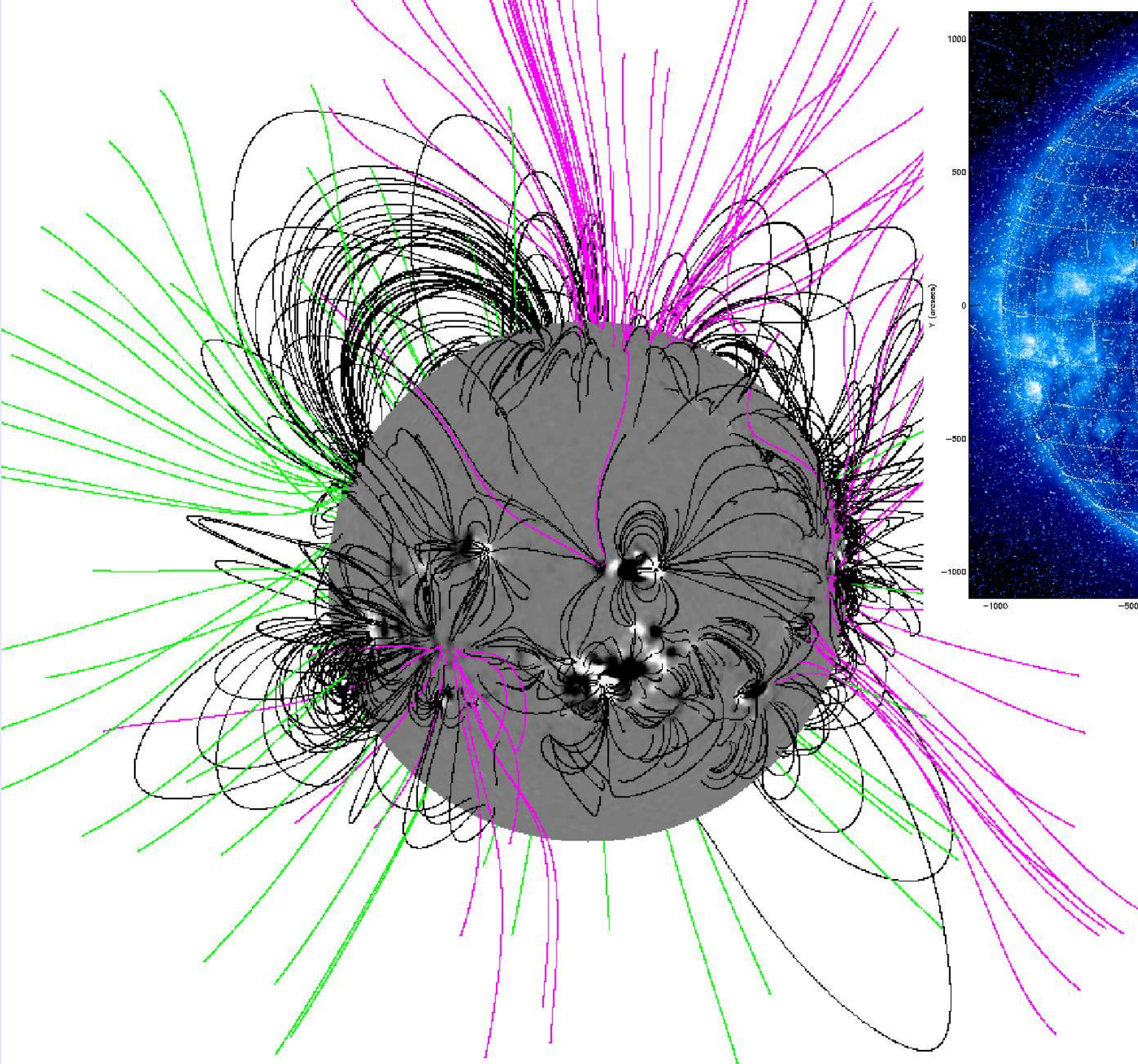
(compare AR 10486, $> 10^{23}$ Mx at around the same time)

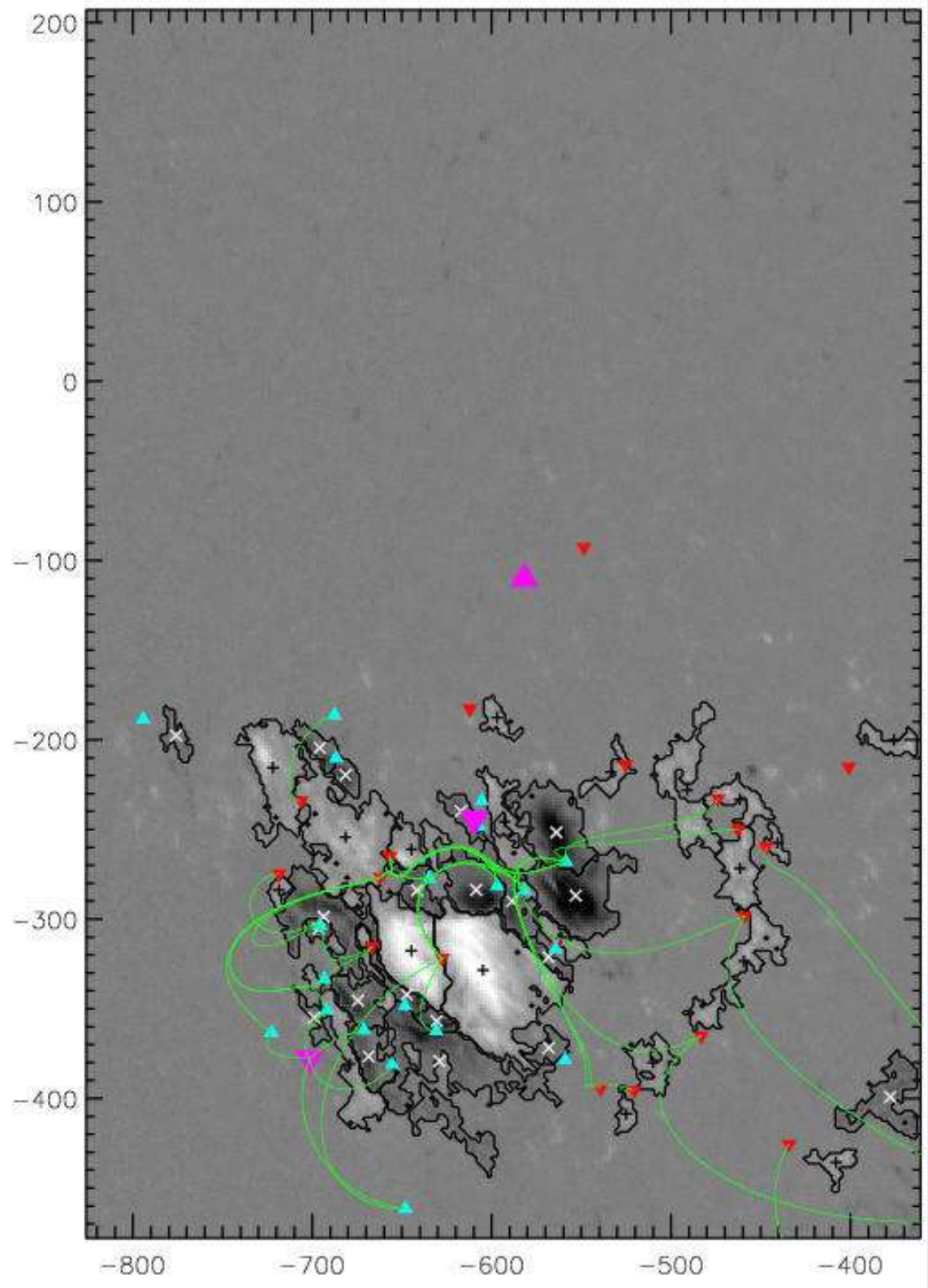
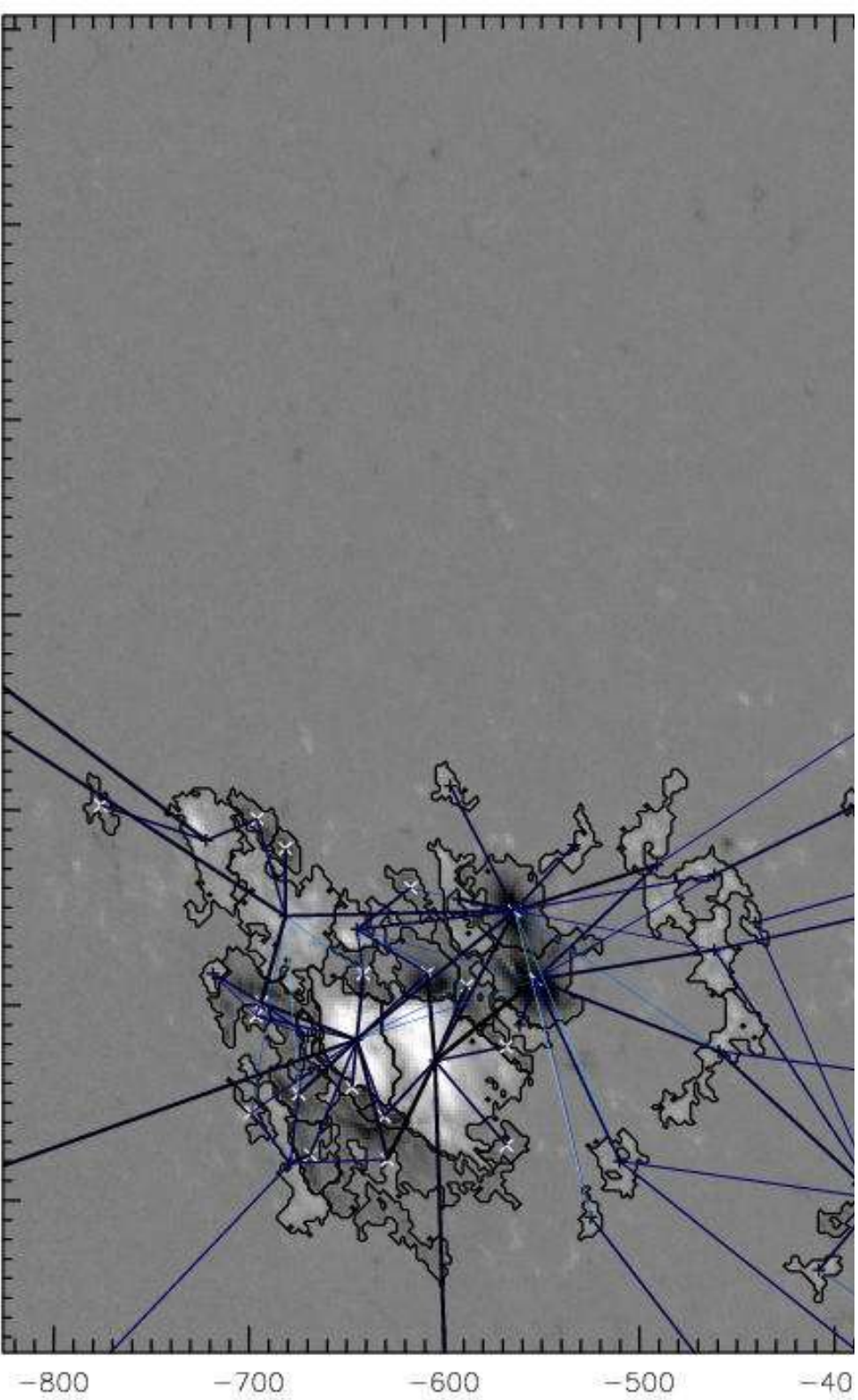


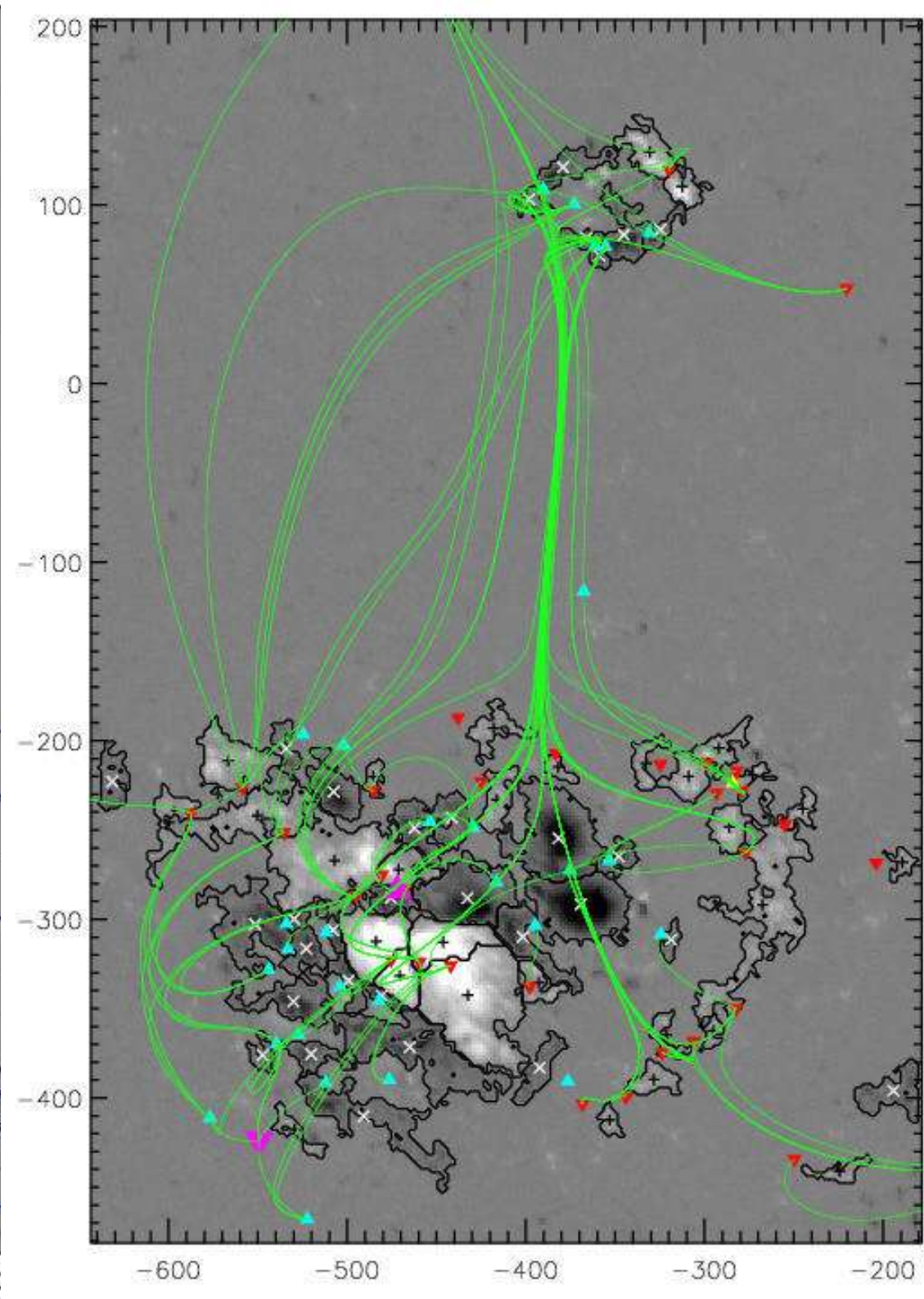
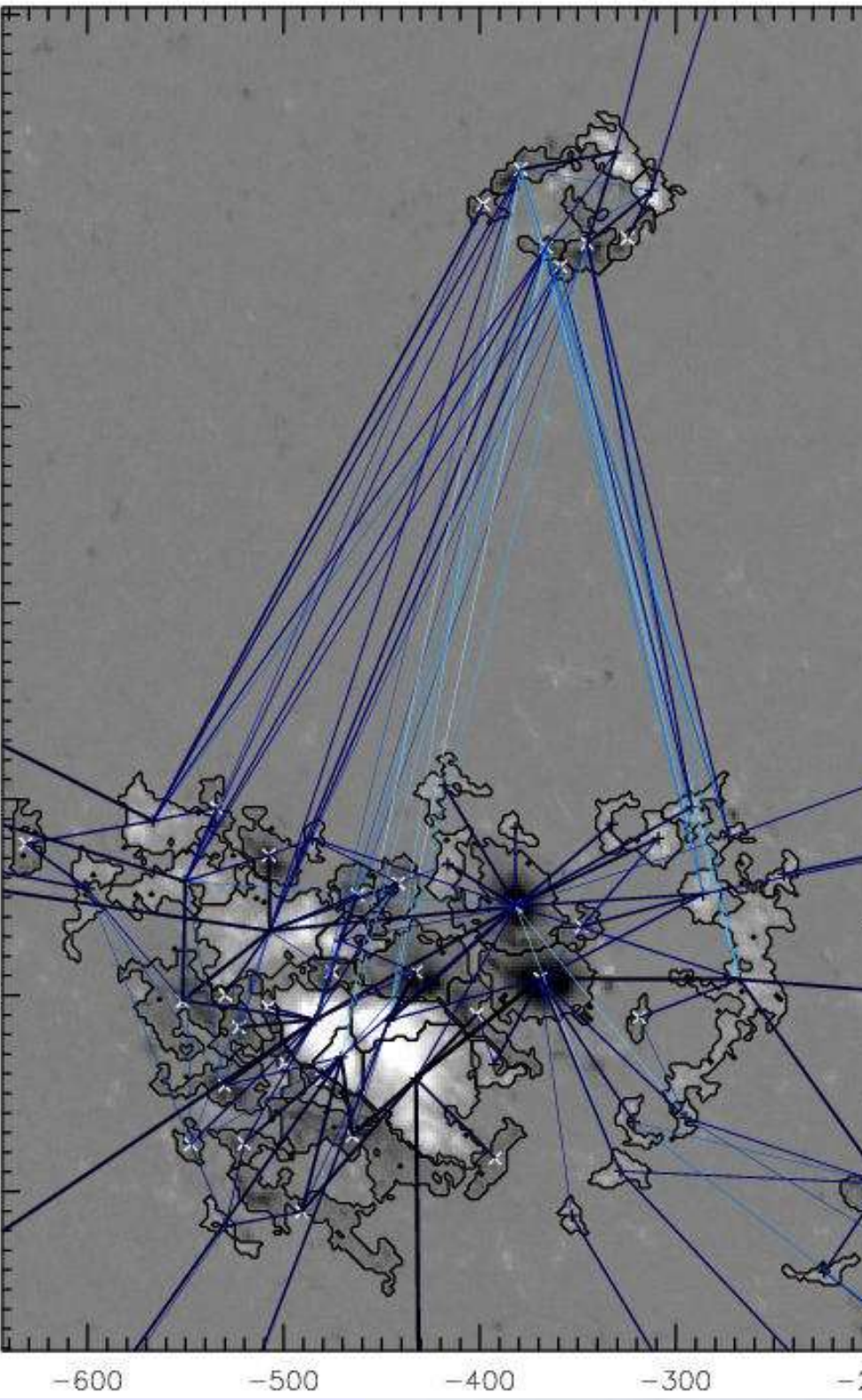


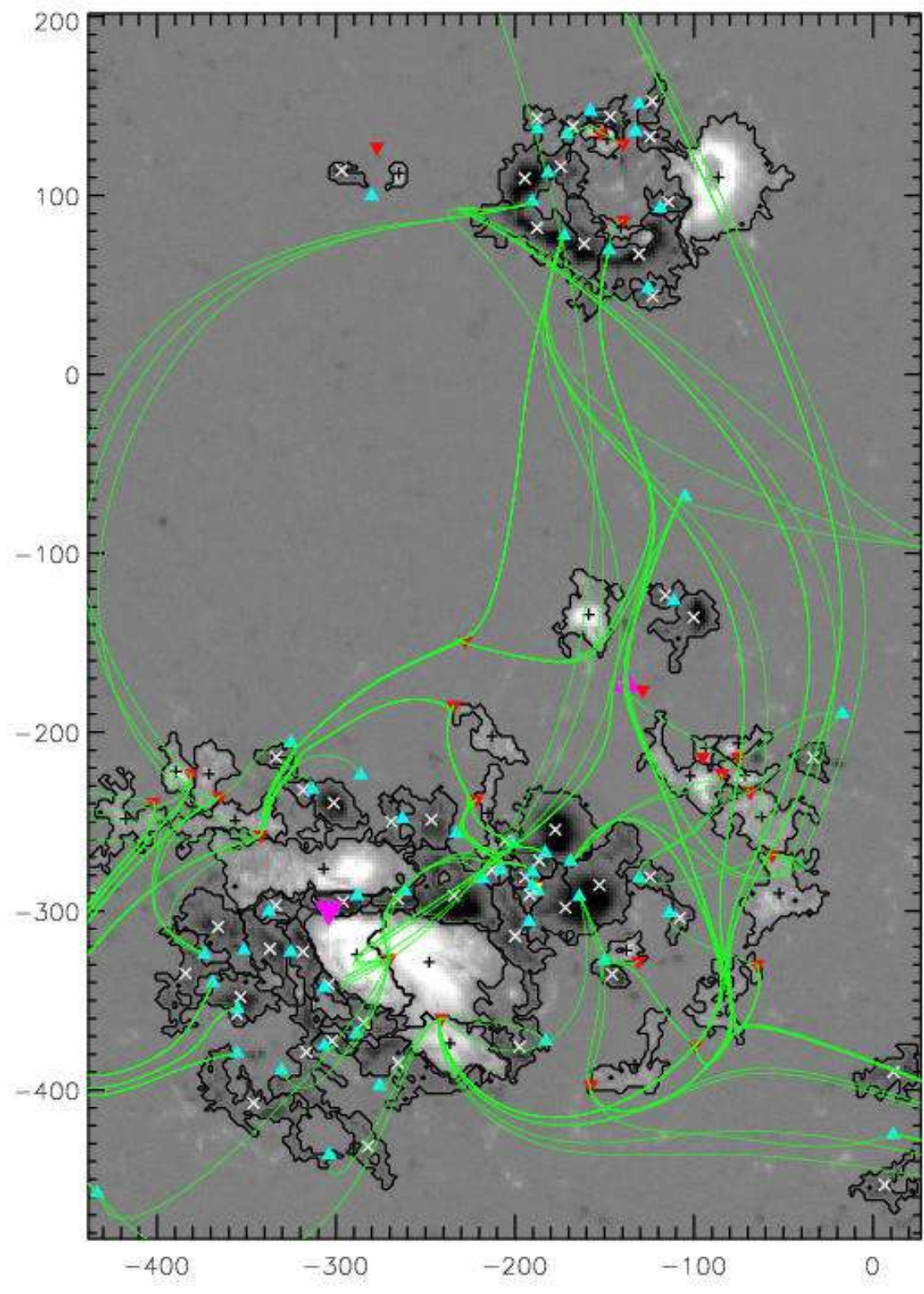
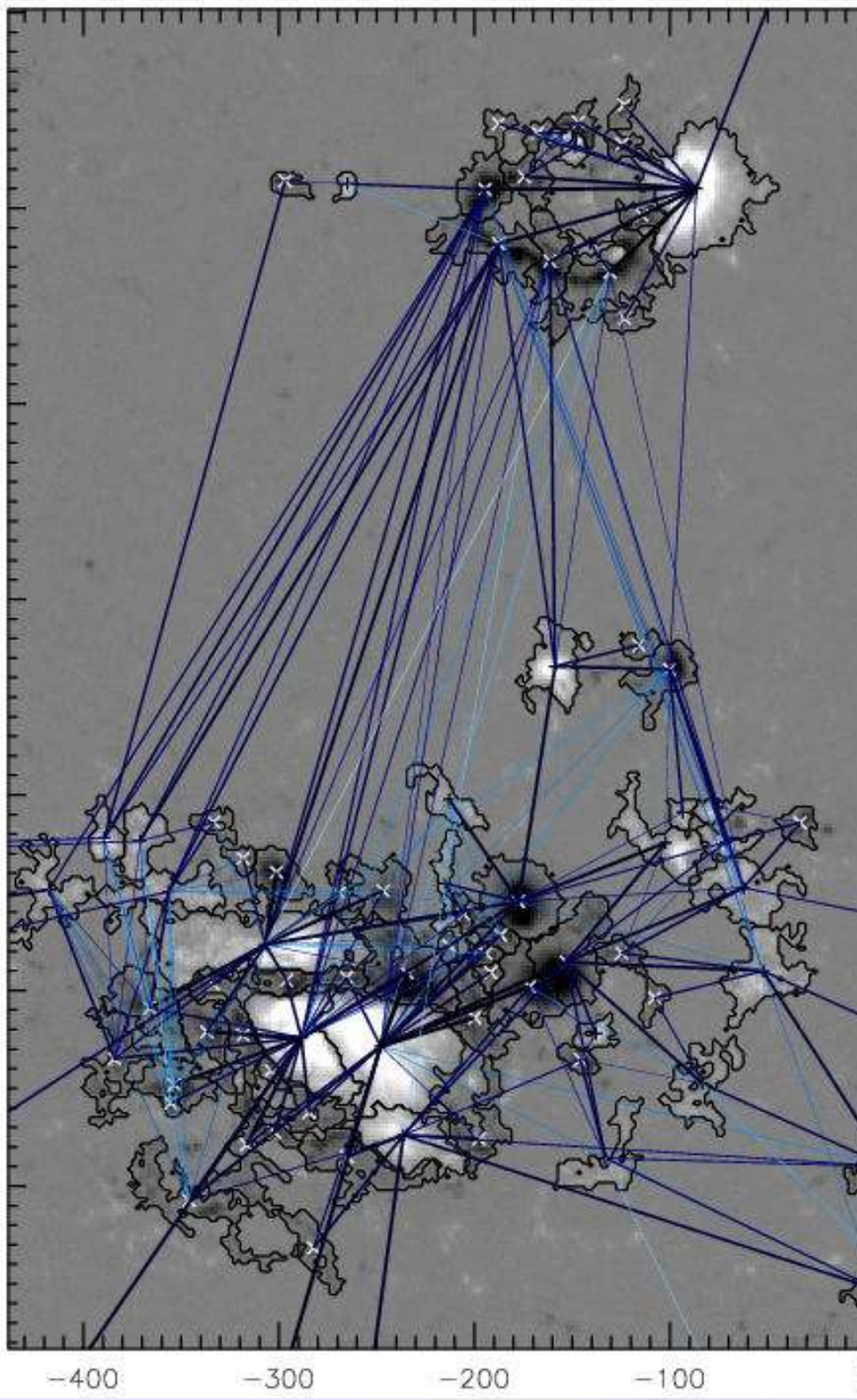












Large active regions:

- Exhibit current and energy storage
 - The extremely large potential active region is *rare*.
- Are flare-productive
 - Any flare-forecasting method has to out-perform the total flux as a forecasting parameter!

Emergence of active regions:

- Can be very rapid
- Influence the corona with heating, energy injection, and additional sites for reconnection as soon as they appear

Put the two together for a volatile situation.

