Type III radio bursts and storms in Metric and DH wavelengths

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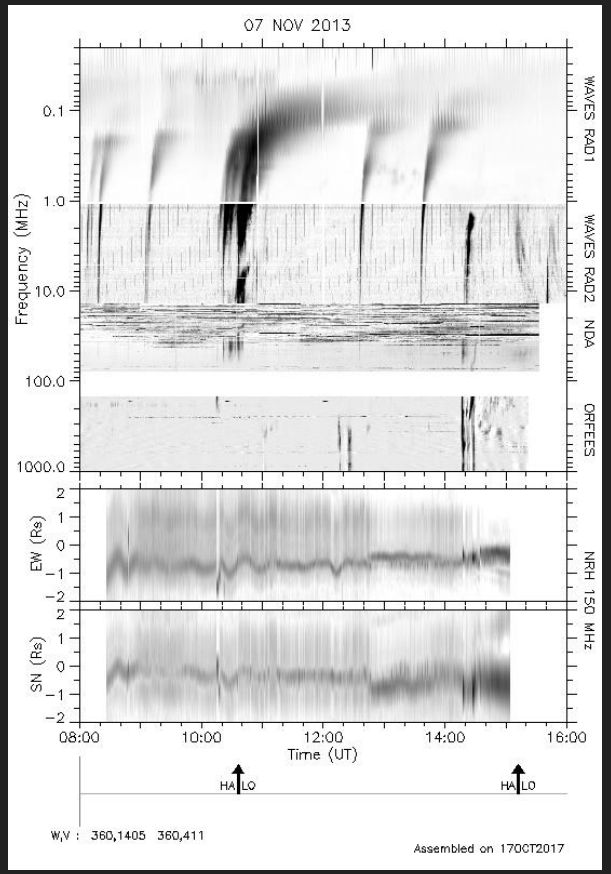
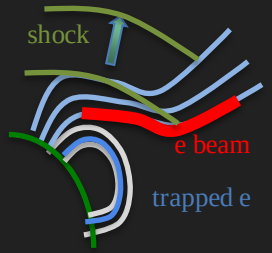
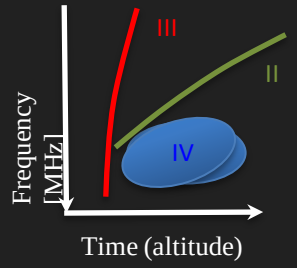
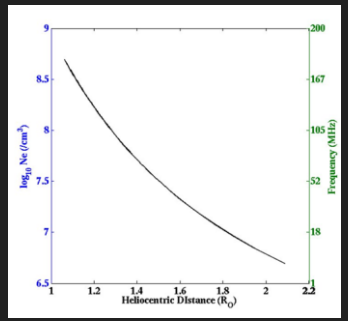
Solar Radio Bursts

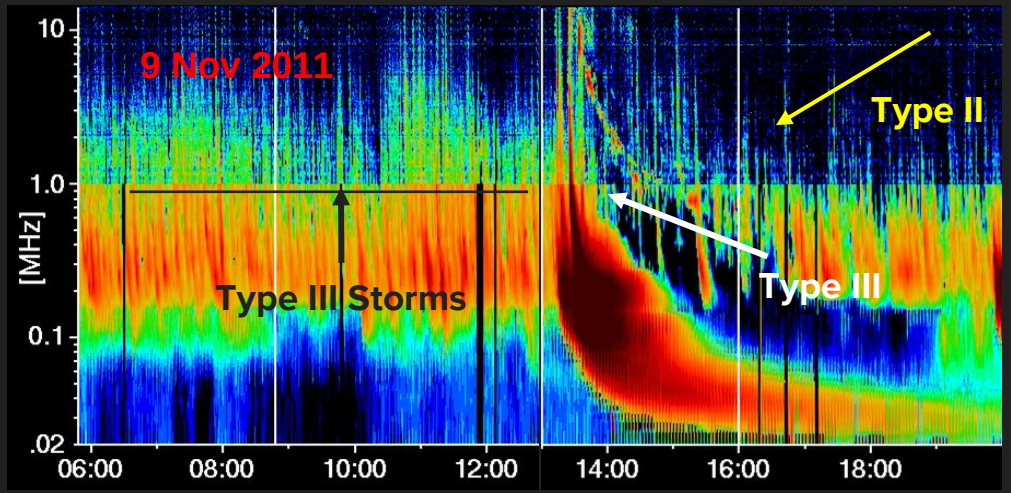


Credit: LESIA Observatoire de Paris



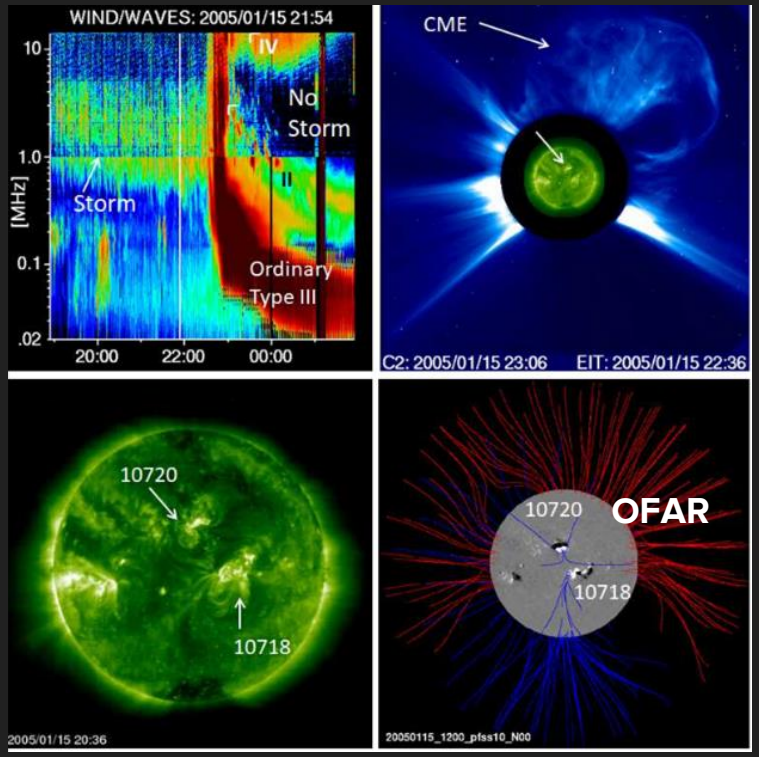




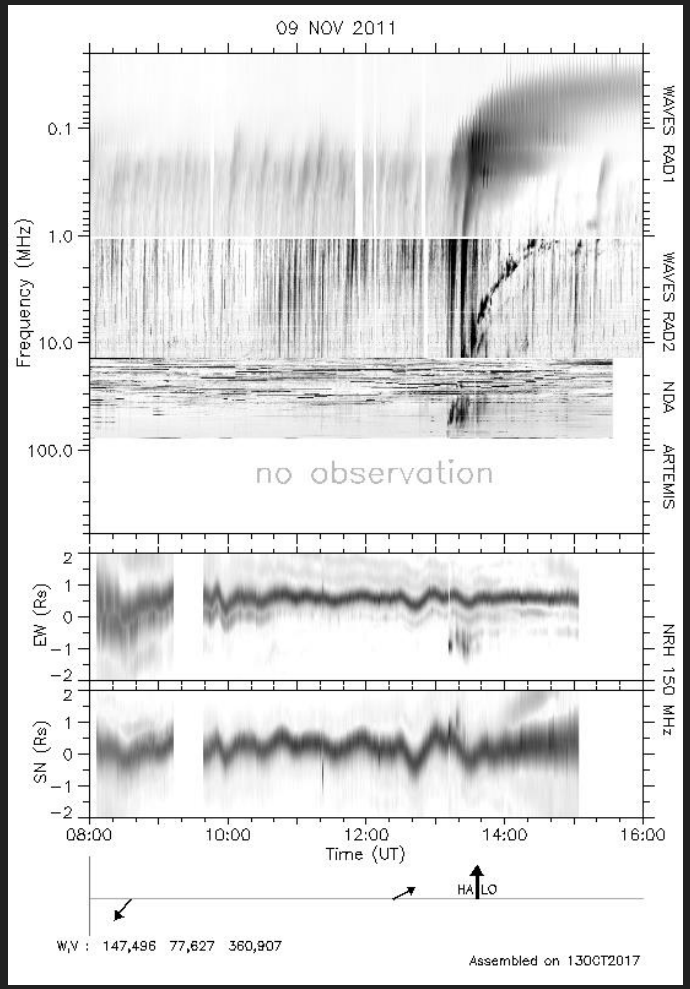


Credit: CDAW

Type III Burst and Storms



Gopalswamy et. al. 2022



Credit: LESIA Observatoire de Paris

Scientific Motivations

- **Can type III storm source accelerate ions?**
- **How does Noise storms/Type III behave as it passes through the solar disc?**
- **To understand the type III bursts and storms origin and propagation in the middle corona.**

Event Selection:

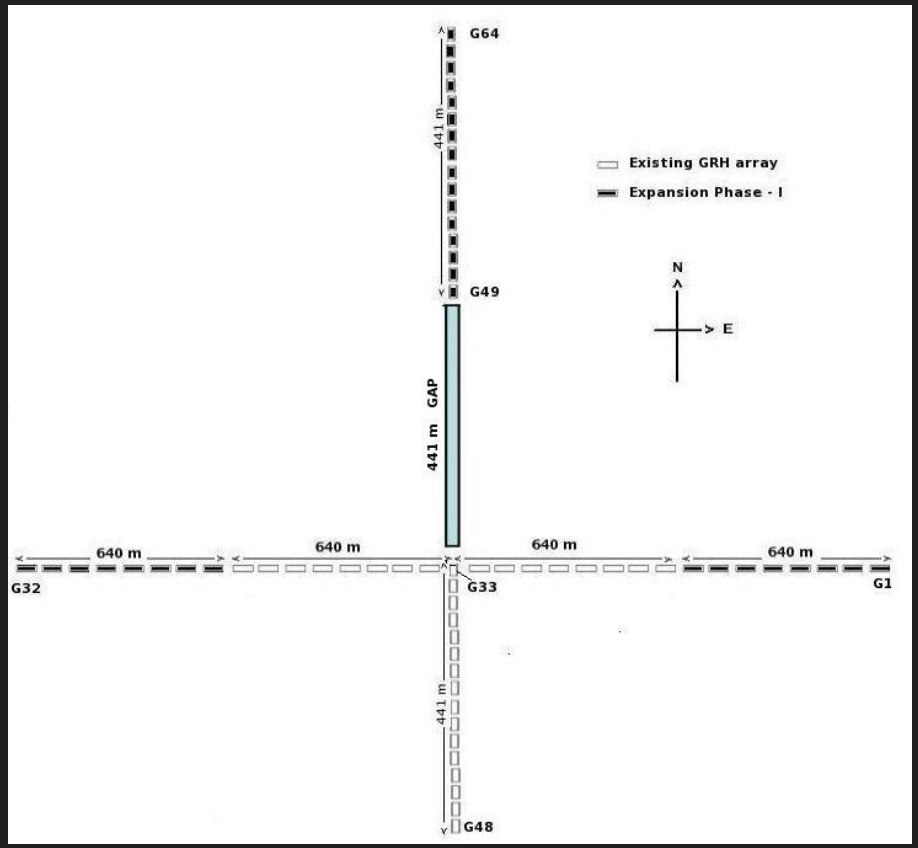
(a) Type IIIs and storms : 20170829 to 20170909 with GRAPH

(b) Type III and storms : 20111109 with NRH

(c) Only type IIIs, no storms : 20180330 with LOFAR (Limb event)

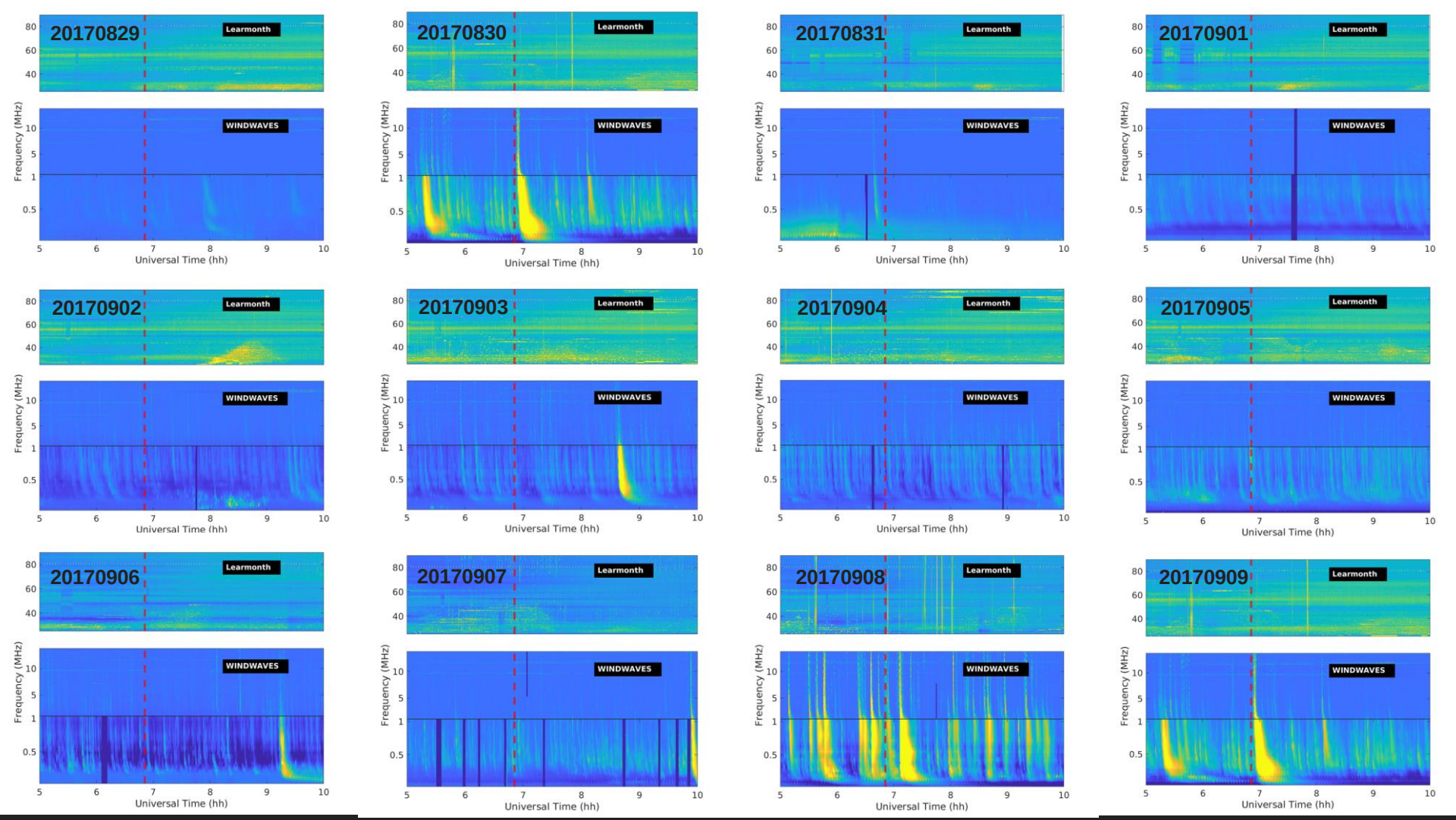
(A)29 Aug - 09 Sep, 2017

Gauribidanur RAdioheliograPH (GRAPH)

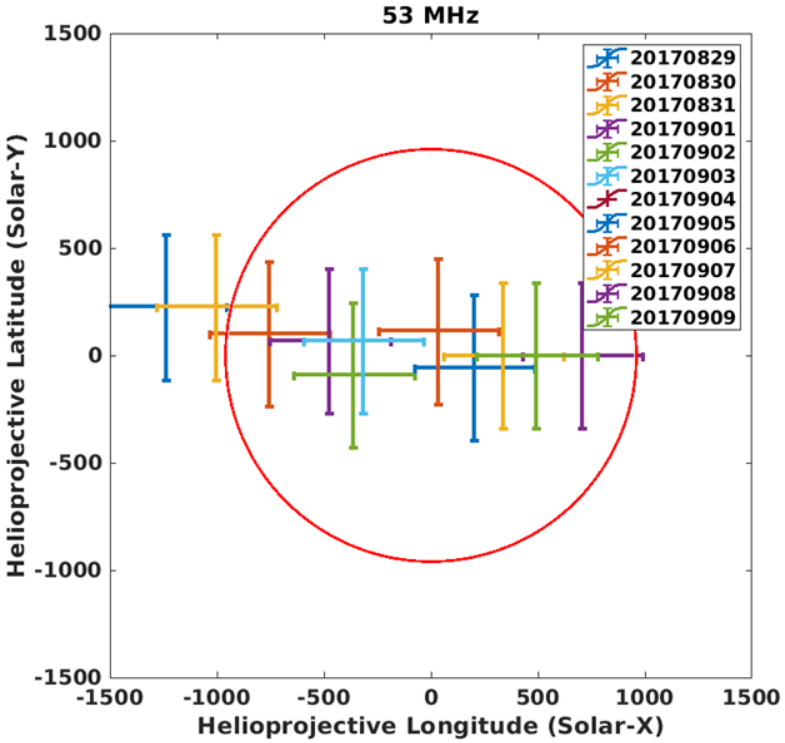


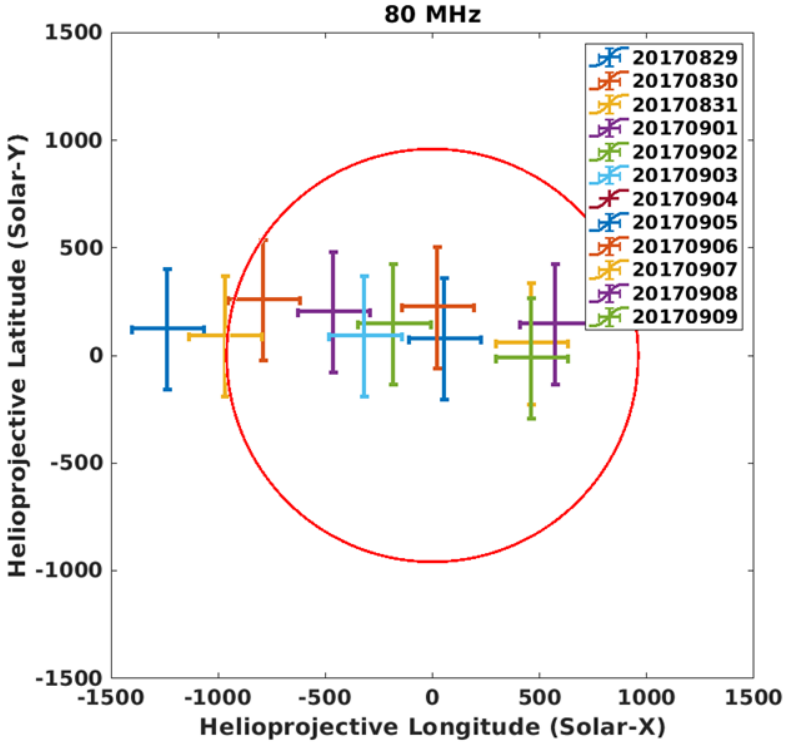
- Total number of LPDs: 384 [192, 16 groups of 8 LPDs in the East- West & 16 groups of 4 LPDs in the South]
- Frequency range: 40 – 150 MHz
- Observing time: 4 – 9 UT
- Number of baselines: 2016 [496] (496 E-W + 496 N-S + 1024 E-W x N-S)
- Short / long baseline: 10.5 / 2490 m

Ramesh et. al. 1997

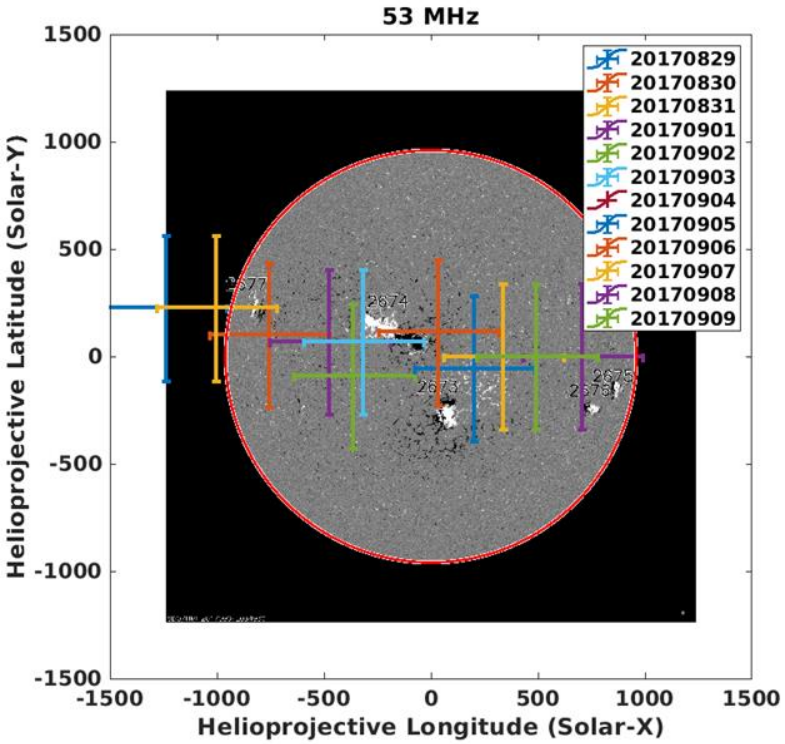

20170829
20170830
20170831
20170901
20170902
20170903
20170904
20170905
20170906
20170907
20170908
20170909
Learmonth
WINDWAVES
Frequency (MHz)
Universal Time (hh)

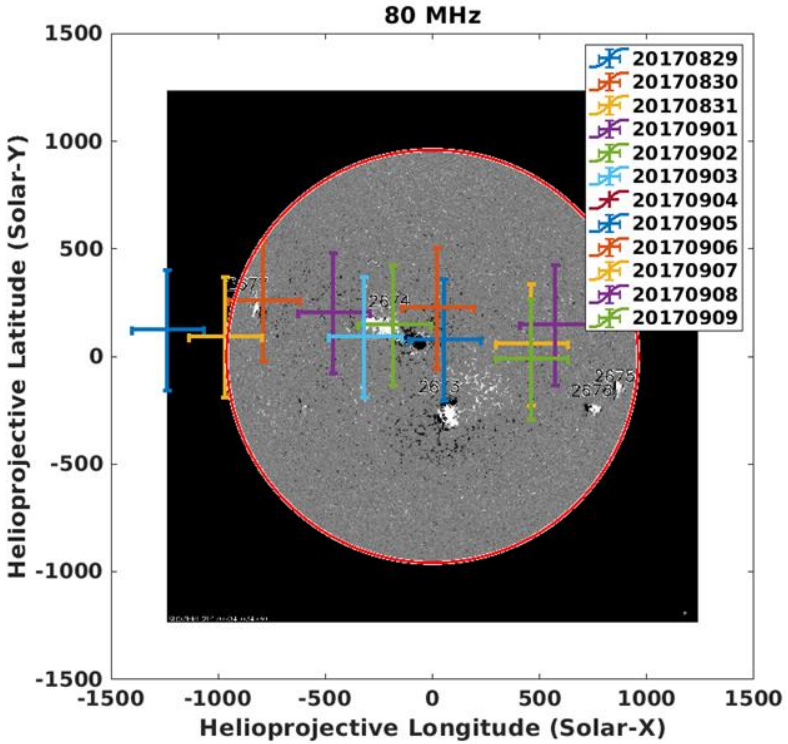
Radio source movement across the disc



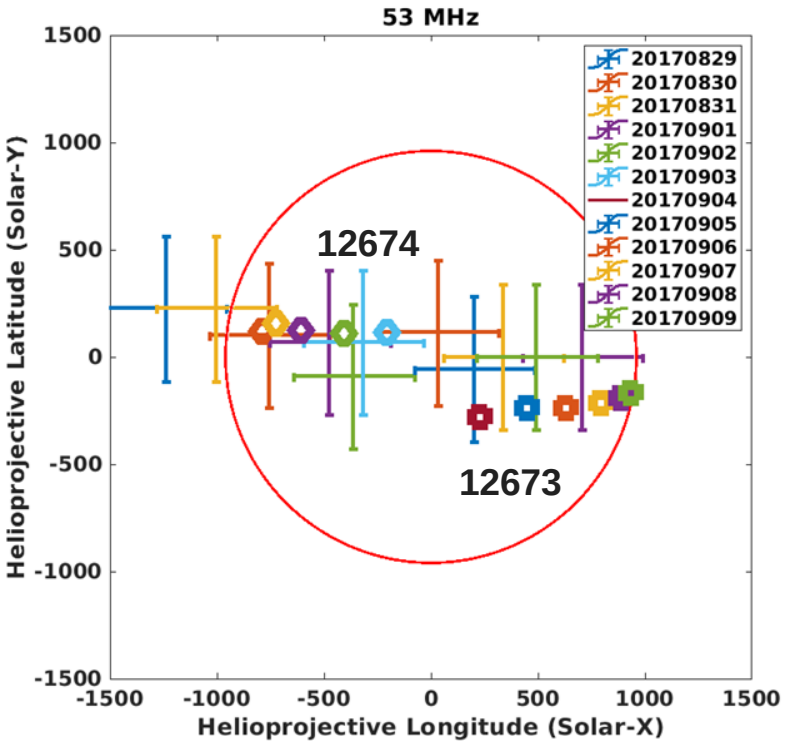


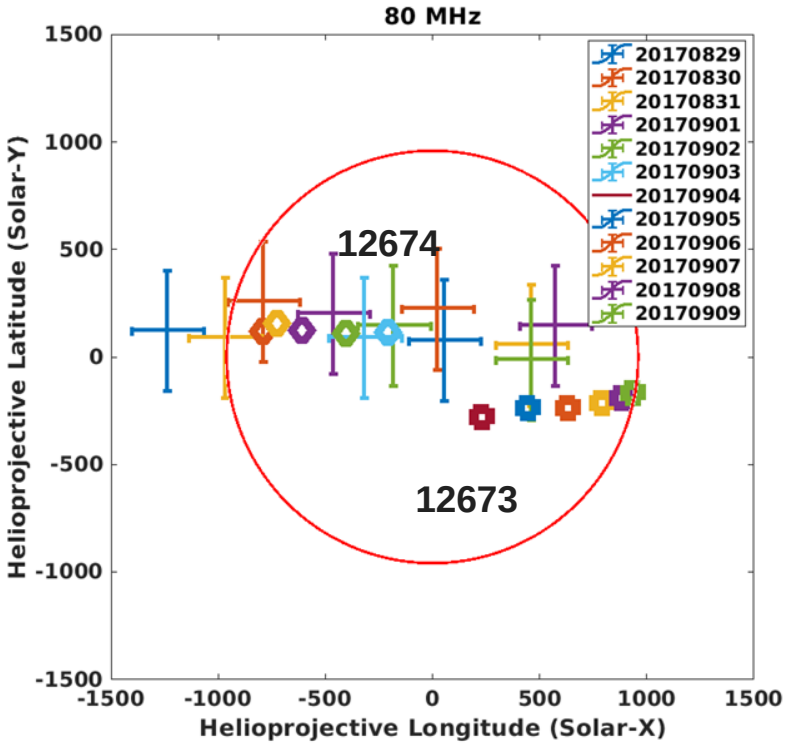
Radio source movement across the disc

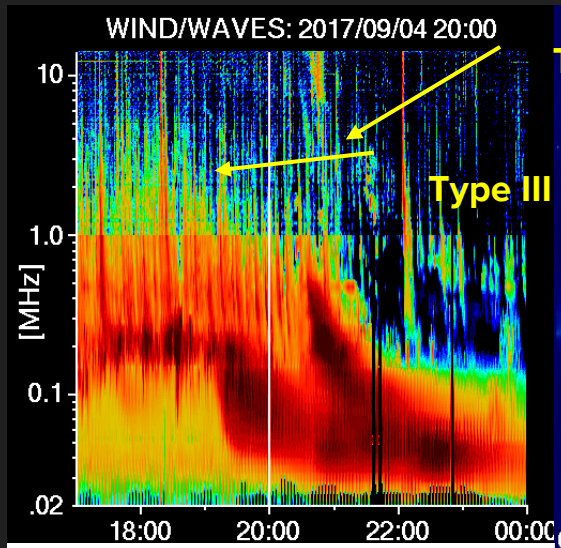


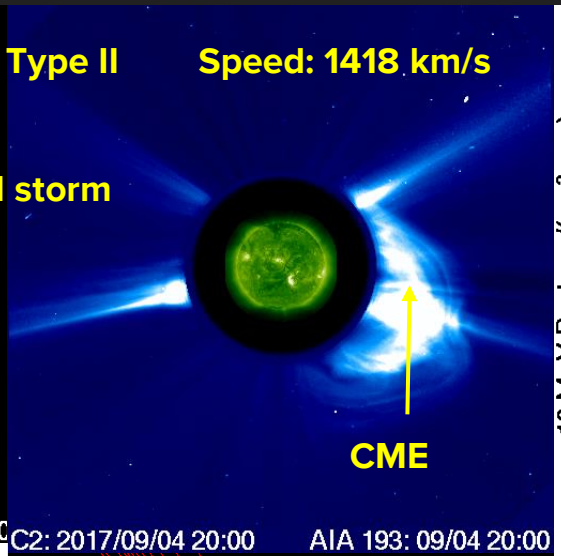


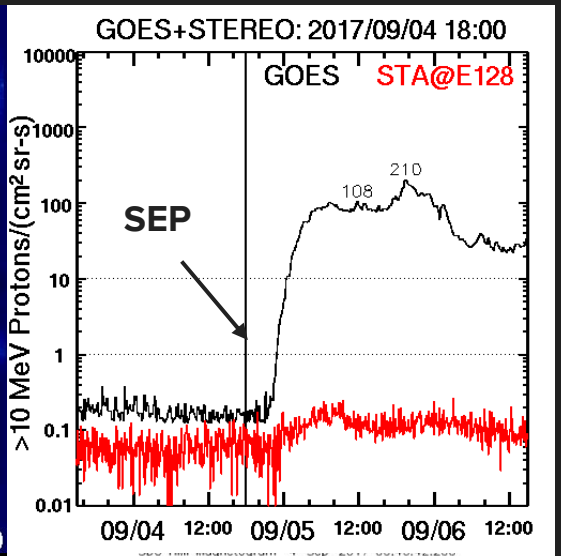
Radio source movement across the disc

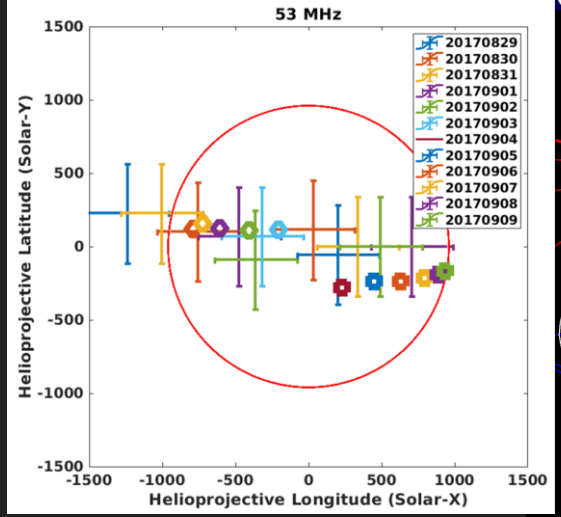


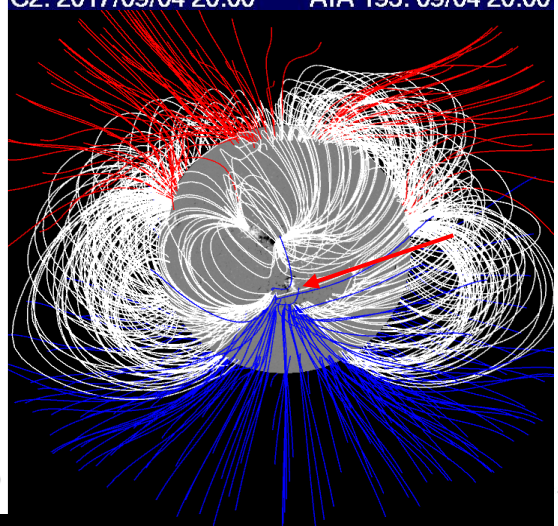


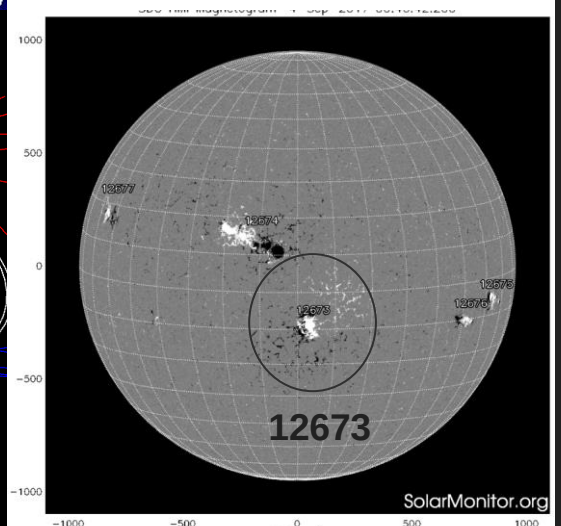

WIND/WAVES: 2017/09/04 20:00
Type II
Type III storm
10
1.0
0.1
.02
[MHz]
18:00
20:00
22:00
00:00


Type II
Speed: 1418 km/s
CME
C2: 2017/09/04 20:00
AIA 193: 09/04 20:00


GOES+STEREO: 2017/09/04 18:00
GOES
STA@E128
SEP
210
108
>10 MeV Protons/(cm² sr-s)
10000
1000
100
10
1
0.1
0.01
09/04
12:00
09/05
12:00
09/06
12:00


53 MHz
Heliprojective Latitude (Solar-Y)
Heliprojective Longitude (Solar-X)
1500
1000
500
0
-500
-1000
-1500
20170829
20170830
20170831
20170901
20170902
20170903
20170904
20170905
20170906
20170907
20170908
20170909

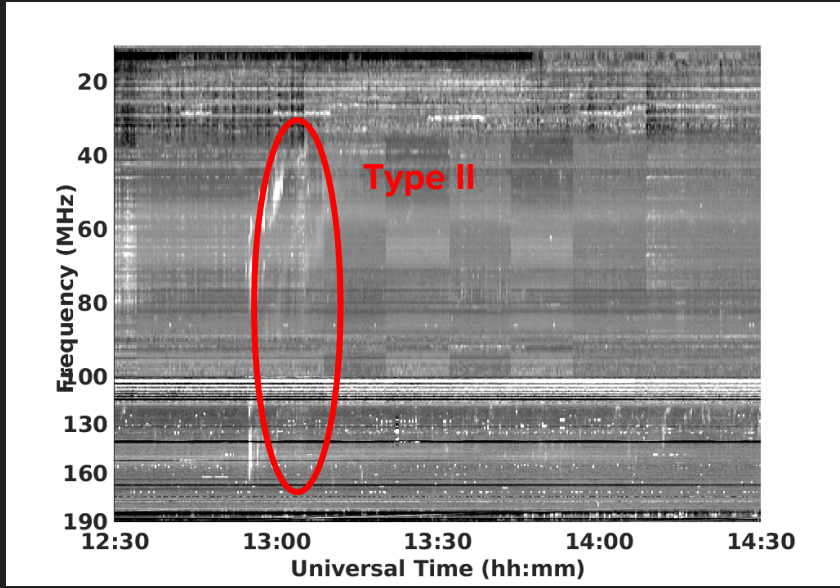


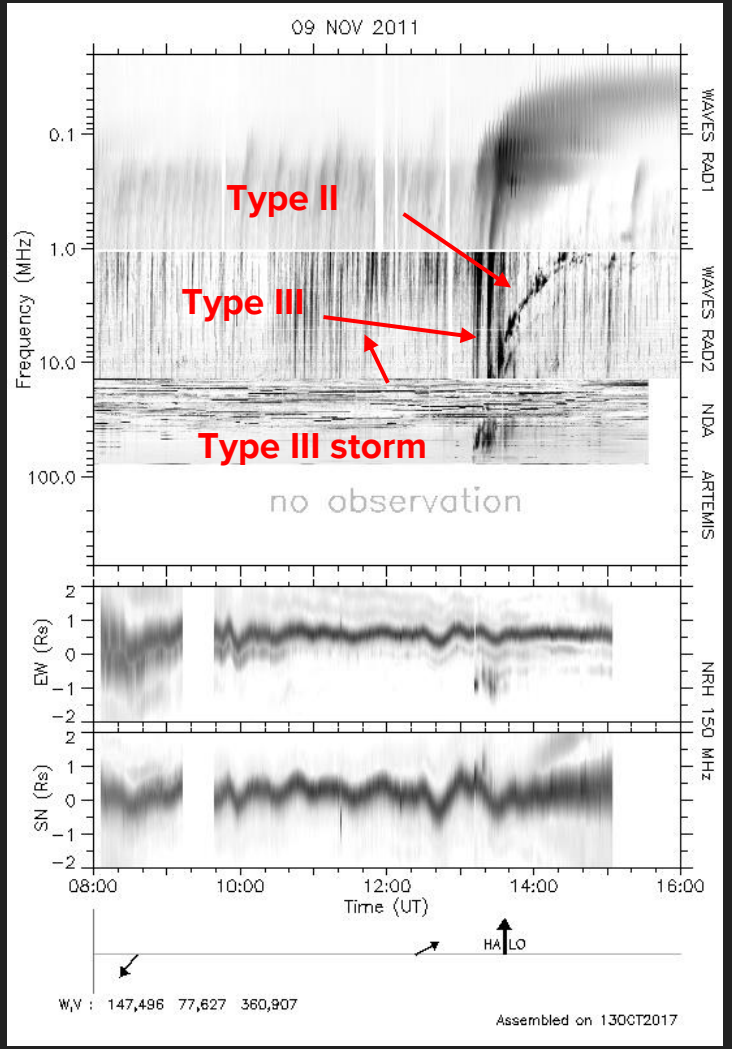

12673
SolarMonitor.org

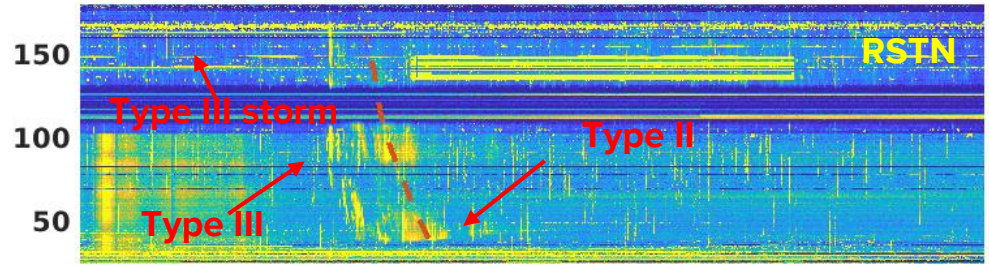
(B) 09 Nov 2011

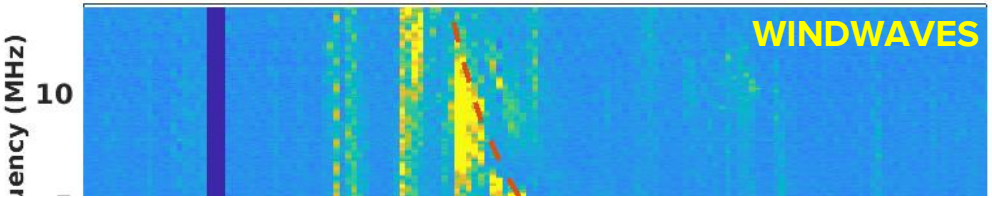
AR 11344, M4.1 flare at 13:04 UT

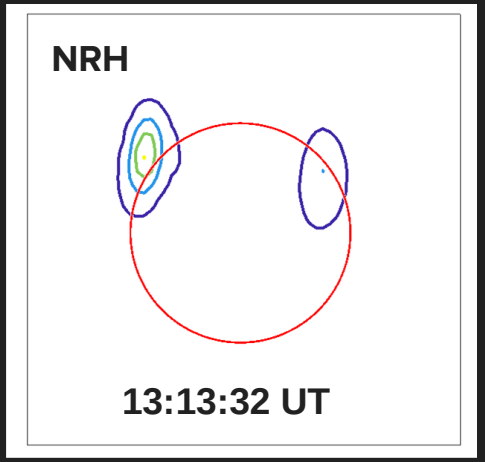
CME at 13:36 UT

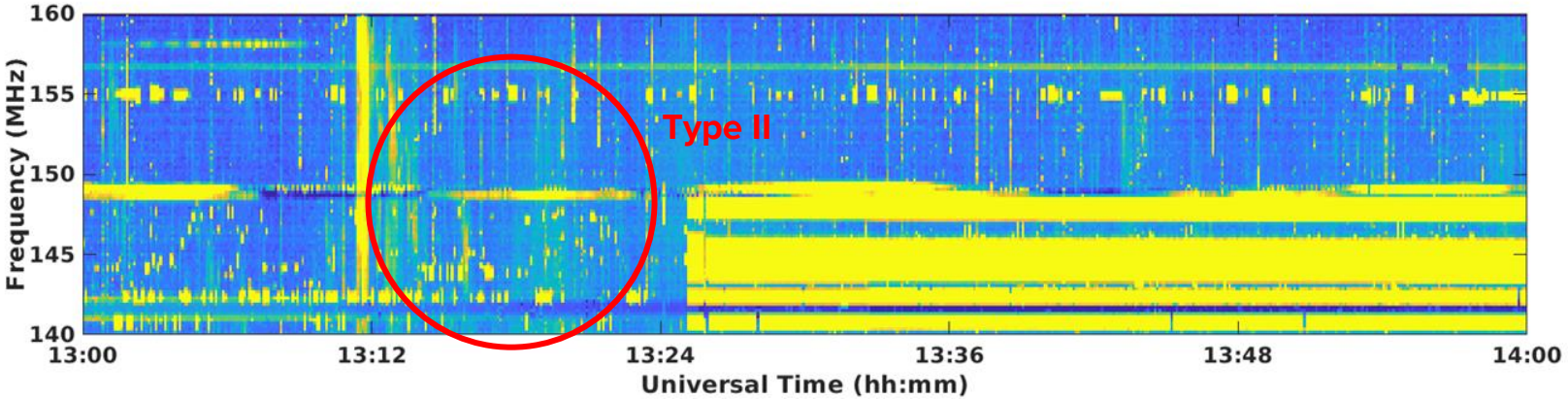




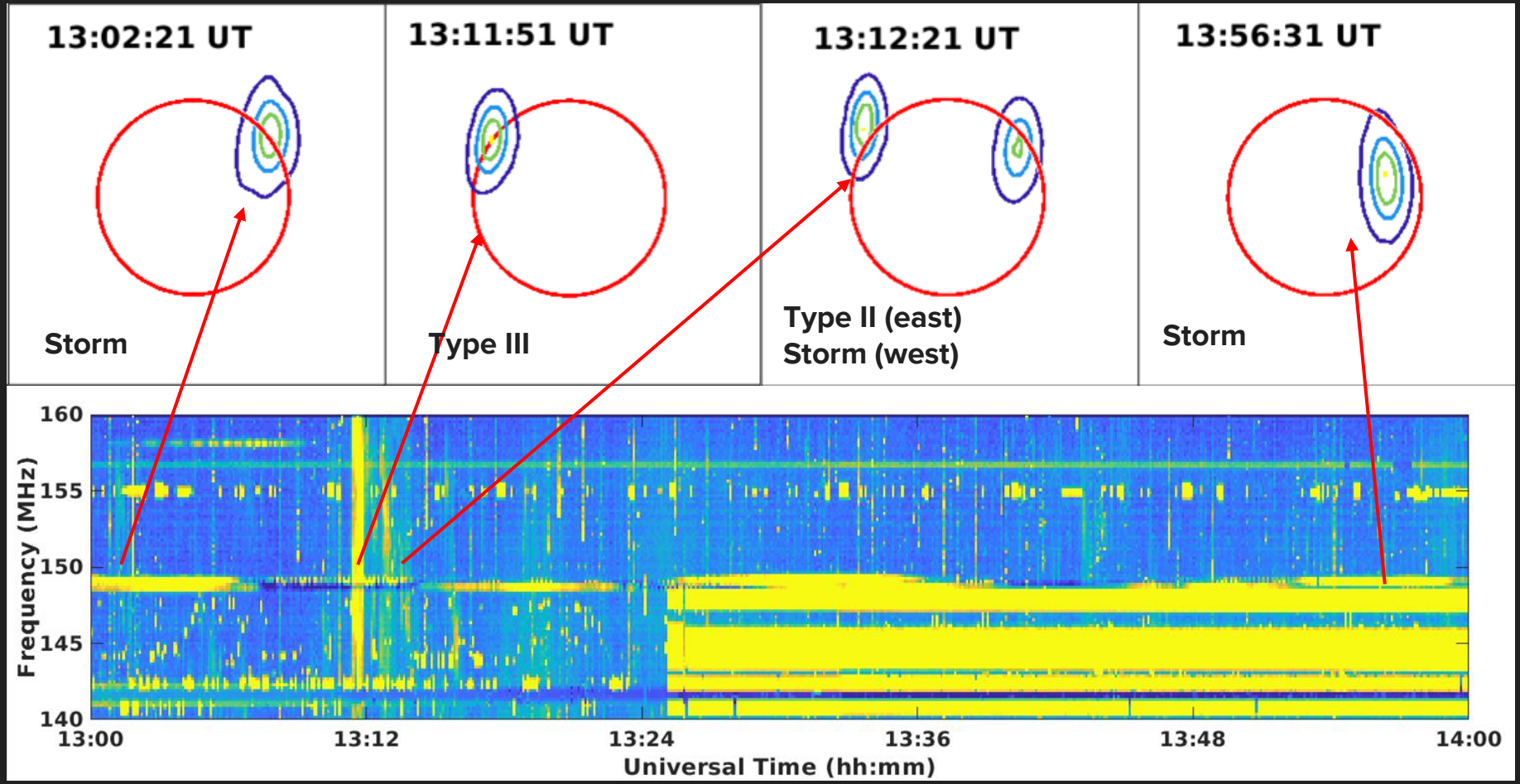

150
100
50
RSTN
Type III storm
Type II
Type III

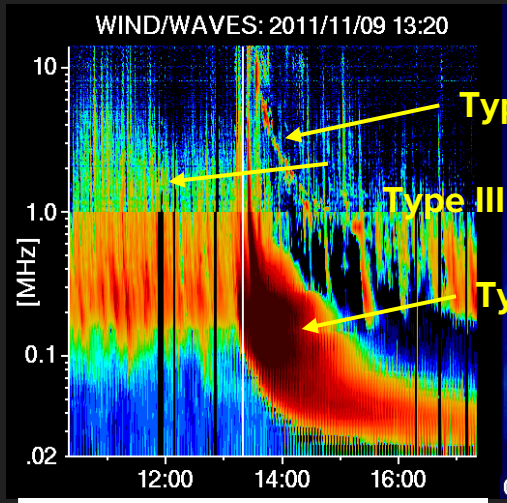

ency (MHz)
10
WINDWAVES

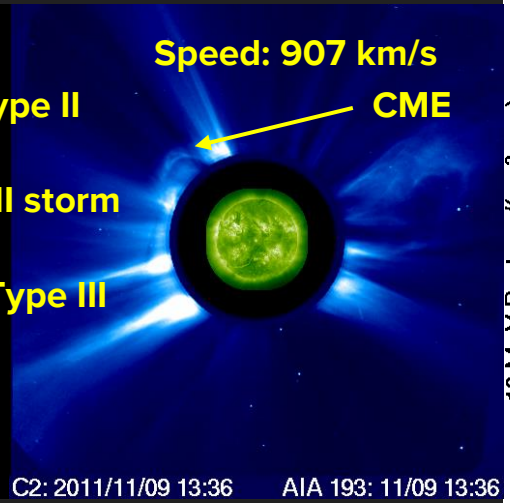

NRH
13:13:32 UT

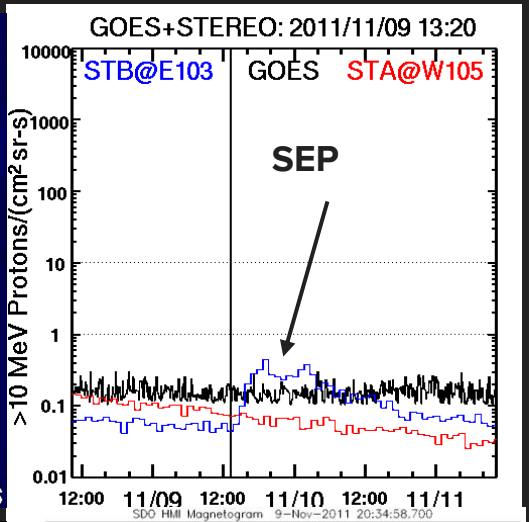

160
155
150
145
140
Frequency (MHz)
Type II
13:00
13:12
13:24
13:36
13:48
14:00
Universal Time (hh:mm)

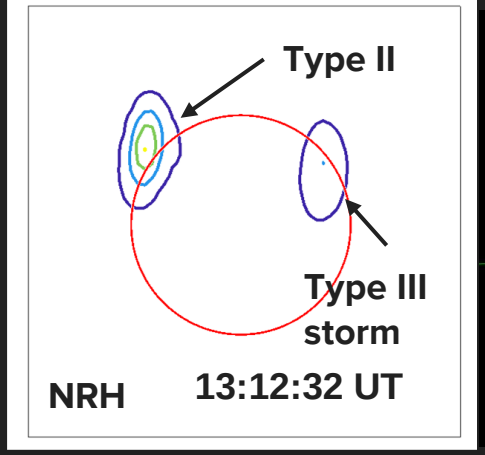
150.9 MHz

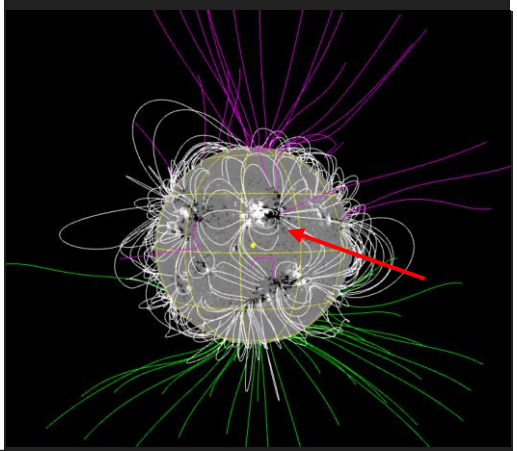

13:02:21 UT
13:11:51 UT
13:12:21 UT
13:56:31 UT
Storm
Type III
Type II (east)
Storm (west)
Storm
Frequency (MHz)
160
155
150
145
140
13:00
13:12
13:24
13:36
13:48
14:00
Universal Time (hh:mm)

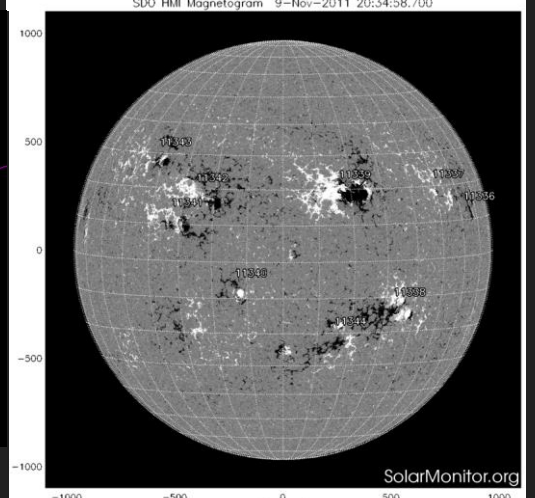

WIND/WAVES: 2011/11/09 13:20
10
1.0
0.1
.02
[MHz]
12:00
14:00
16:00
Type II
Type III storm
Type III


Speed: 907 km/s
CME
C2: 2011/11/09 13:36
AIA 193: 11/09 13:36


GOES+STEREO: 2011/11/09 13:20
STB@E103
GOES
STA@W105
SEP
>10 MeV Protons/(cm² sr-s)
10000
1000
100
10
1
0.1
0.01
12:00
11/09
12:00
11/10
12:00
11/11


Type II
Type III storm
NRH
13:12:32 UT



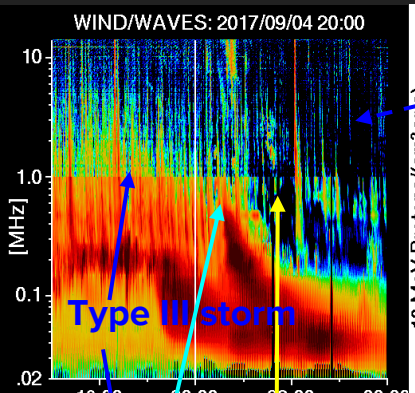

SDO HMI Magnetogram 9-Nov-2011 20:34:58.700
1000
500
0
-500
-1000
SolarMonitor.org

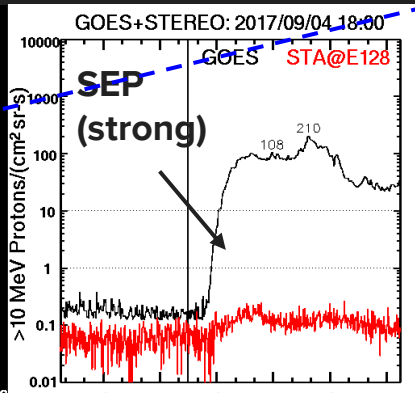
Summary and Future work

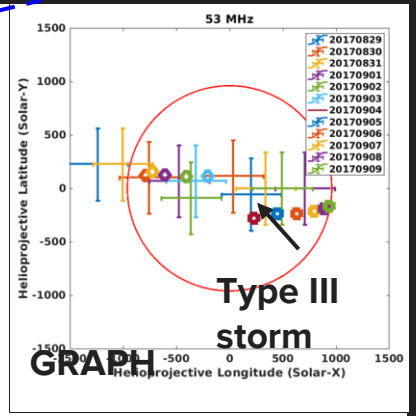
- We studied three set of type III- type III storms events with GRAPH, NRH and LOFAR.
- OFAR magnetic configuration, which gives rise to type III storms can be responsible for accelerating ions as well, that may serve as seed particles to the CME shock.
- We are presently investigating more events to conclude the preliminary results (with NRH and LOFAR).

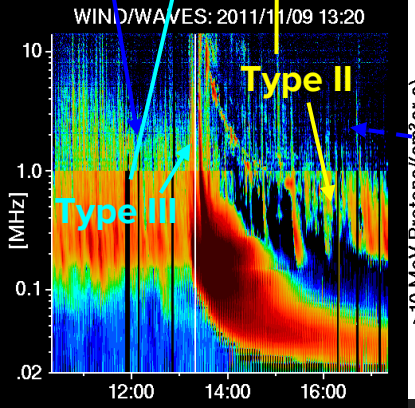
Summary Slide

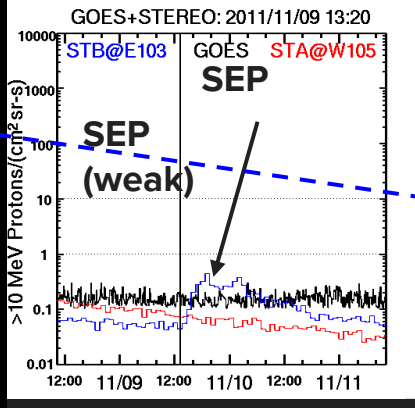
- Can type III storm source accelerate ions?

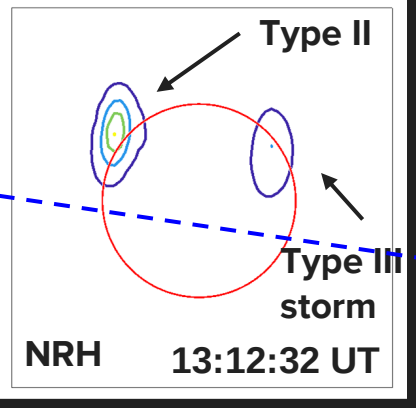












Storm disrupts

Source location of type III storms and type II are the same!

The type III storm source, which accelerates electrons to produce the storm, can also accelerates ions that serve as seed particles to the CME shock.

Storm continues

Source location for type III storms and type II are different!