LMA vs LIS data comparison

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This presentation has been adapted from the original by:

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Stage at Lightning Research Group (June-September 2018)

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Index

- Current status at LRG
- Objective and working hypothesis
- Methodology
  - Data collection
  - Data analysis
- Results

- *Processing Software*
- Conclusions

Current status at LRG

- Oscar's LMA software: maps sources, events and LINET
  - Required Inputs: txt files with LIS info.
  - Drawback: LIS data → HDF files

Processing code is required for download and adaptation of HDF files

  - Drawback: It can not be easily used to make statistical analysis

Analysis code that produces statistical values

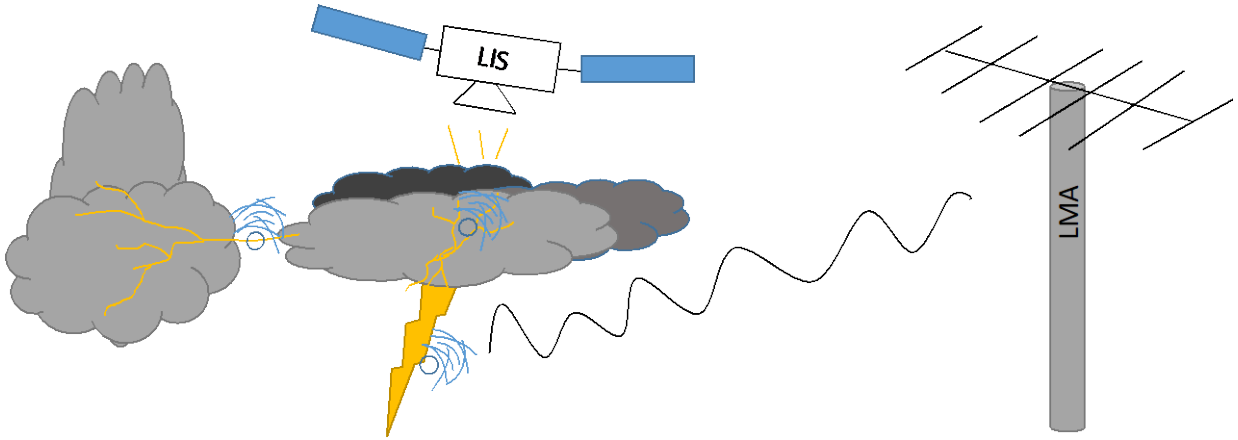
Objectives

- Codes for processing the data files from the sensors into a nicer format
- Comparison of the data collected by LIS and LMA
- Explore the influence of sources properties as detected by LMA on its LIS detection

Hypothesis

VHF SOURCES - LMA ⟷ HIGH LUMINOSITY (RADIANCE) EVENTS - LIS

"The luminosity detected by LIS is part of the same physical process that generates the VHF emissions recorded by LMA, i.e. leader propagating through the air."



Methodology: data collection

LIS

- High Luminosity Events
  - 777.4nm
  - 2ms
  - 4 km IFOV
  - CCD 128x128 pixel
  - ISS

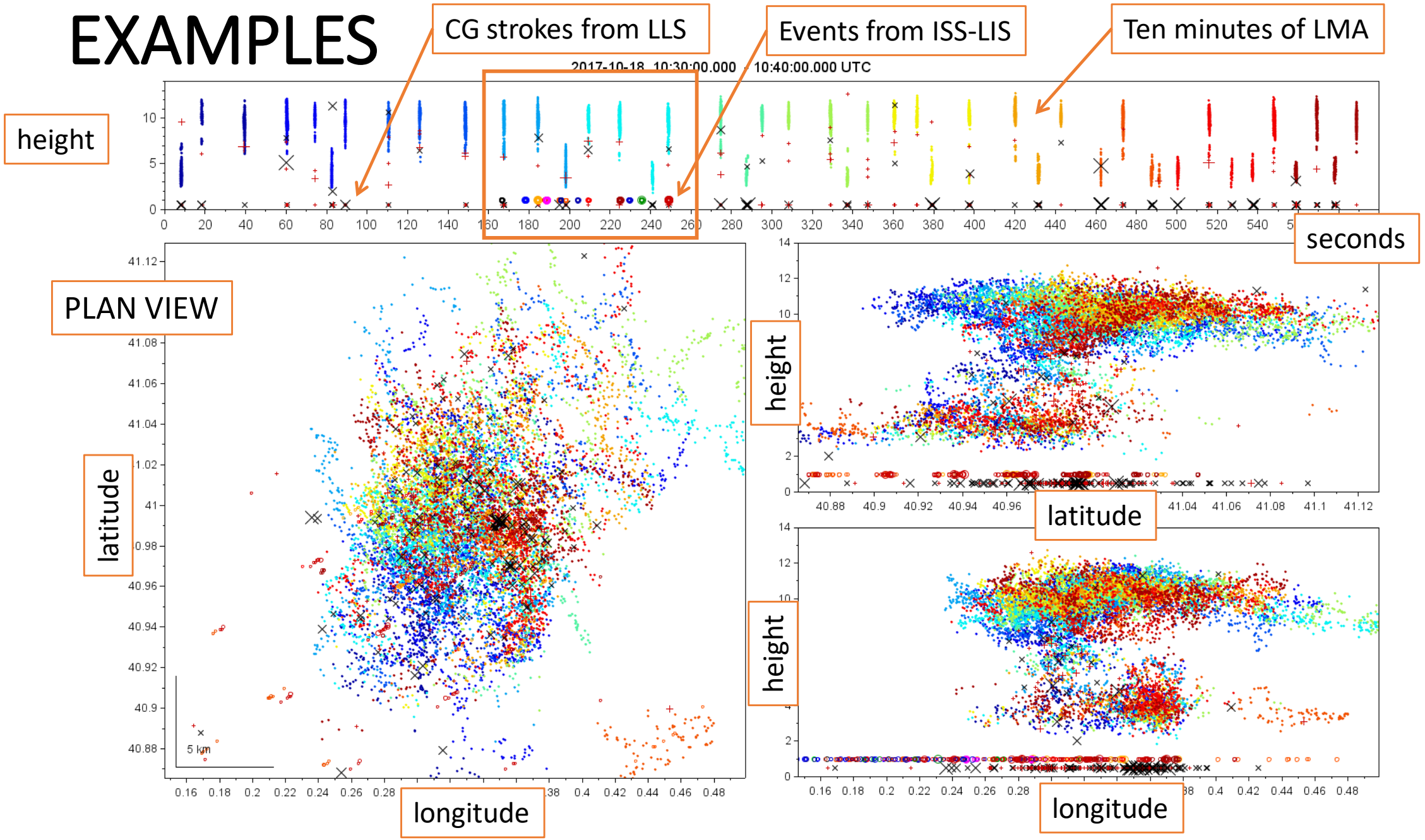
LMA

- Radio freq. antennae
  - 60-66 MHz

- Mapping sources using up to 7 antennae
- 60 km radius around **Ebre delta** @ sea level

Simultaneous measurements available from March 2017 (LIS start)
5 time periods (10 min) with simultaneous detections have been identified until July 2018

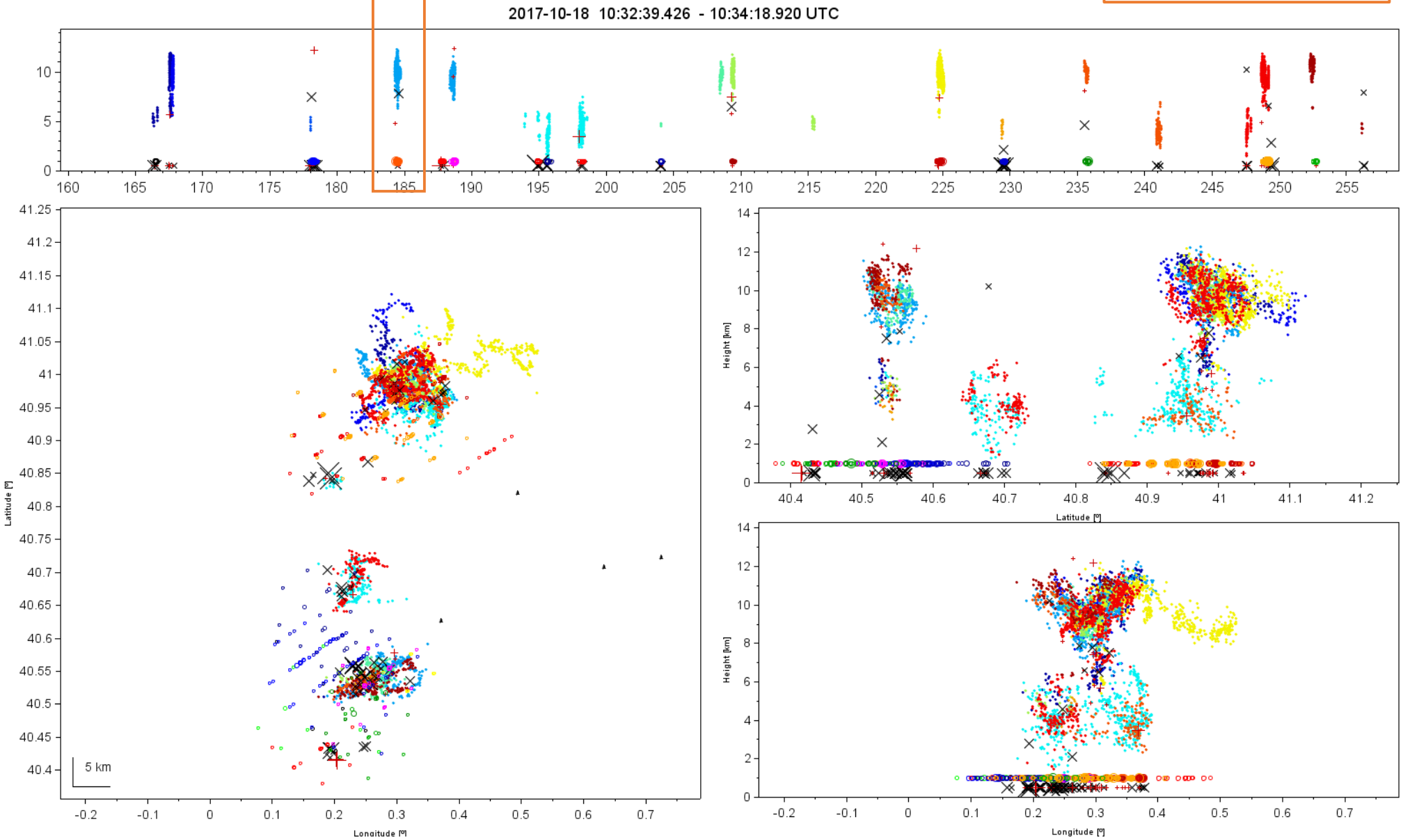
EXAMPLES


CG strokes from LLS
Events from ISS-LIS
Ten minutes of LMA
2017-10-18 10:30:00.000 - 10:40:00.000 UTC
height
seconds
PLAN VIEW
latitude
longitude
height
latitude
height
longitude
5 km

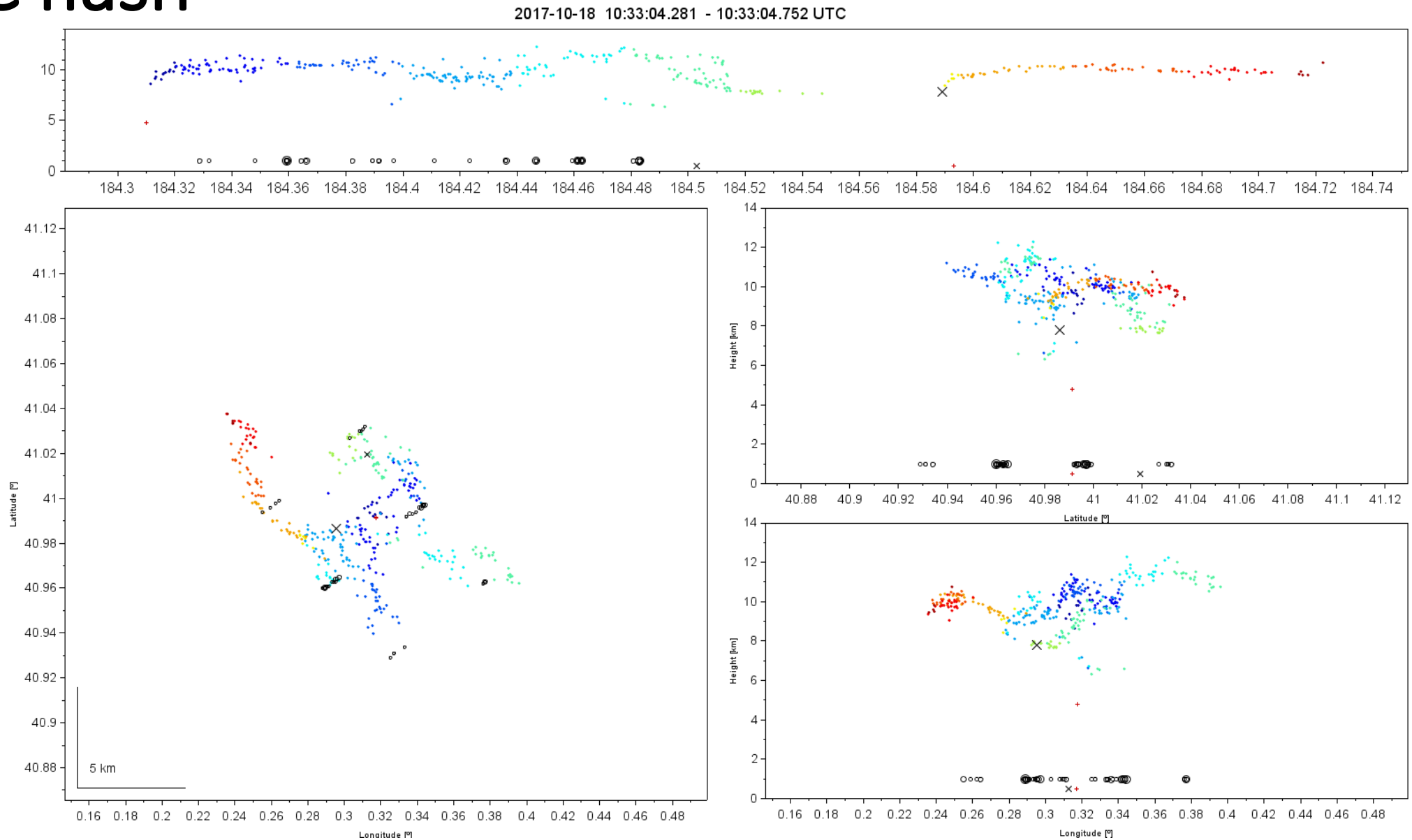
EXAMPLES

Select One flash

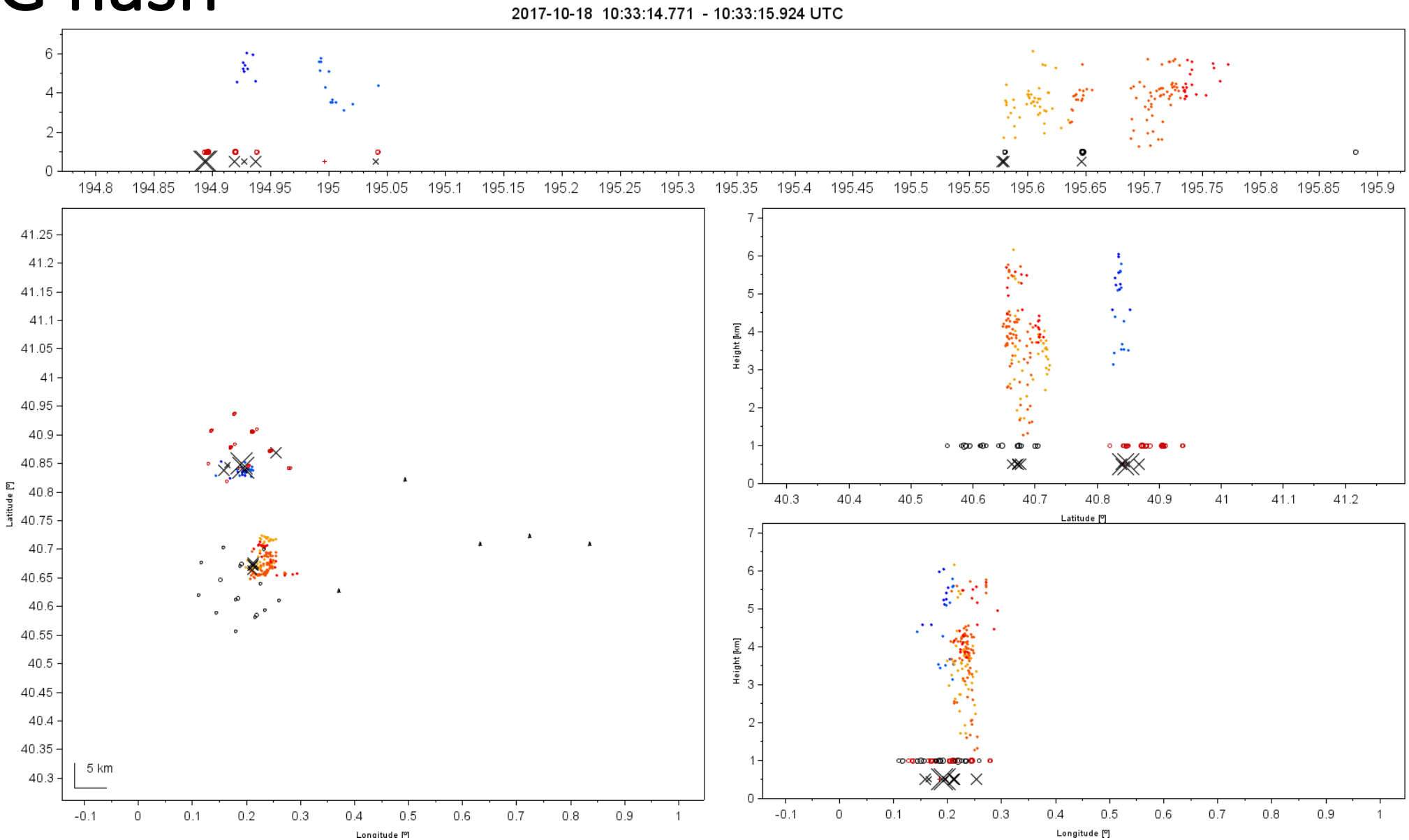
Two minutes zoom



IC flash

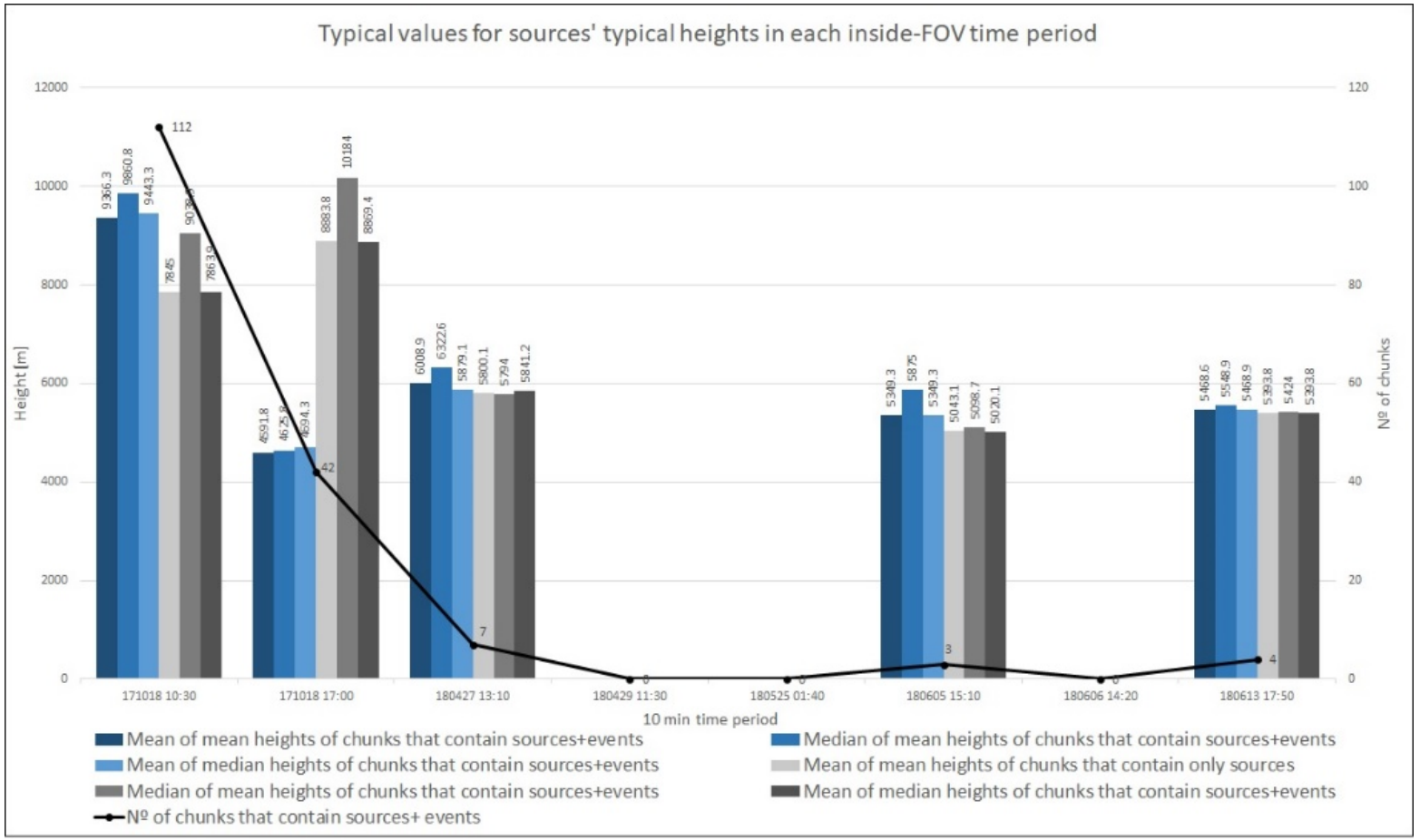

2017-10-18 10:33:04.281 - 10:33:04.752 UTC
Latitude [°]
Longitude [°]
Height [km]
5 km

CG flash

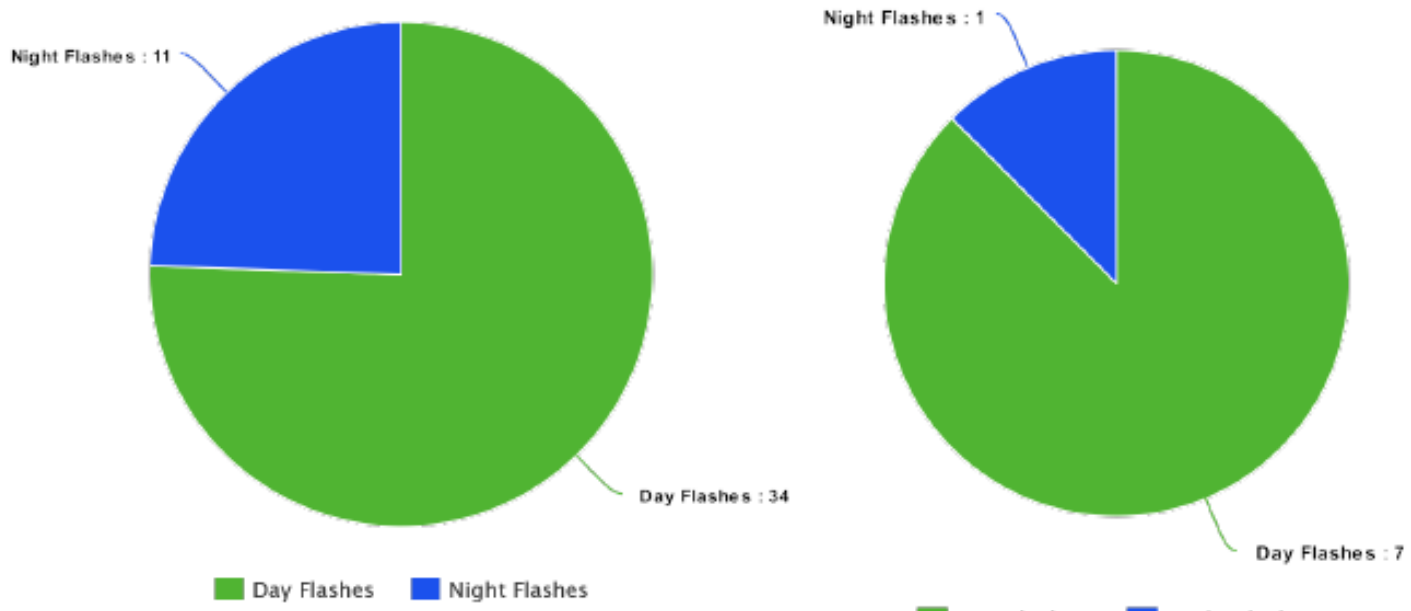

2017-10-18 10:33:14.771 - 10:33:15.924 UTC
Latitude [°]
Longitude [°]
Height [km]
5 km

DATA SET

Simultaneous measurements available from March 2017 (LIS start)
5 time periods (10 min) with simultaneous detections have been identified until July 2018



DATA SET



(a) 2017

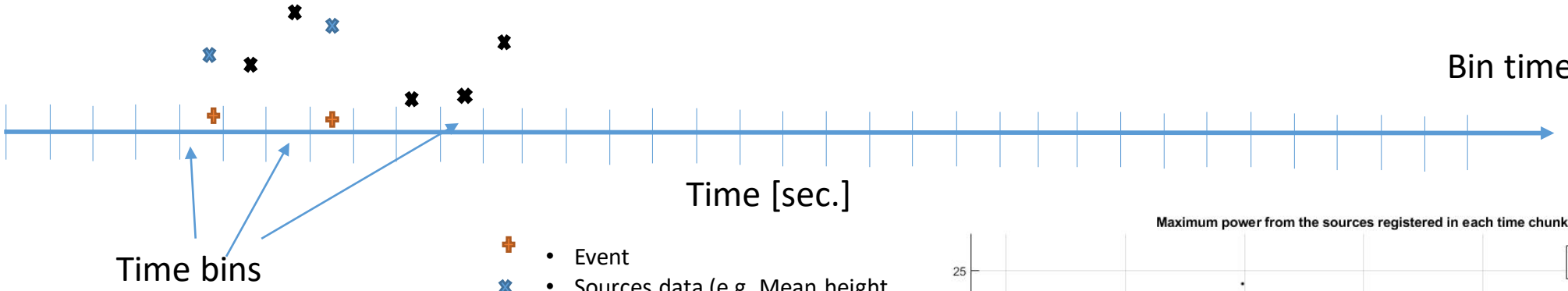
(b) 2018

Figure 3.1: Night-Day presence of lightning detected by LIS around Deltebre area.

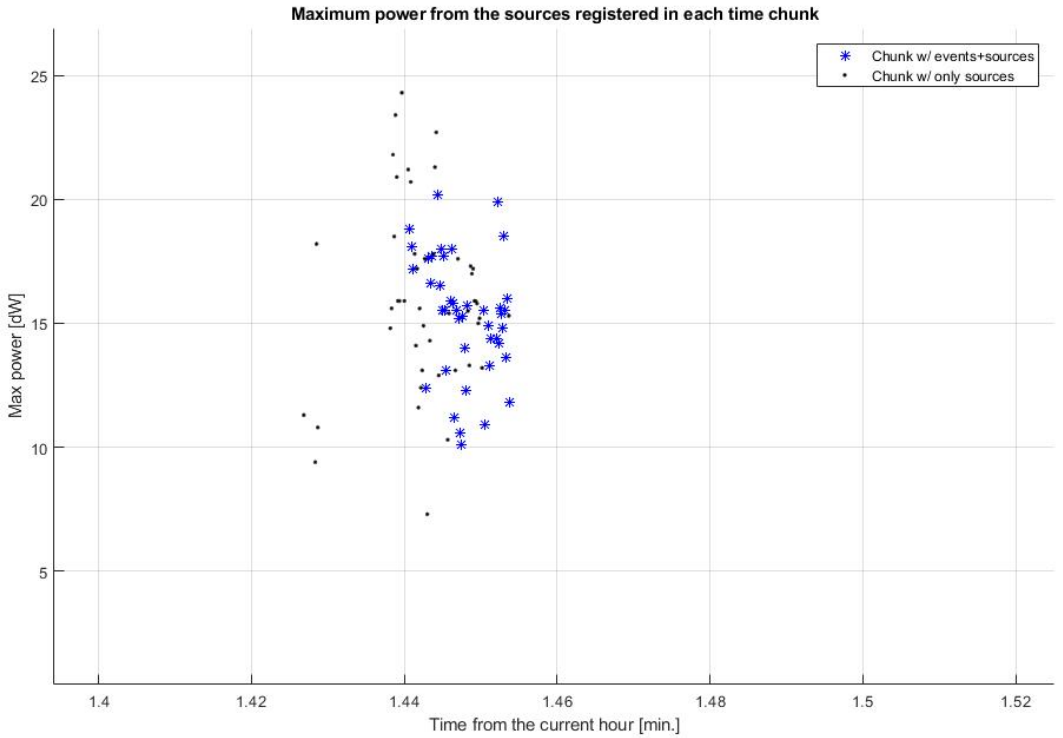
Period March 2017 to before July 2018

Methodology: data analysis

TIME DISCRETIZATION APPROACH



- Event
- Sources data (e.g. Mean height, source with max. Power…)



Results

1. Influence of bins' *mean height* on LIS detection
2. Influence of bins' *maximum power*
3. Influence of bins' *power centroid*
4. Influence of bins' *numerical density*

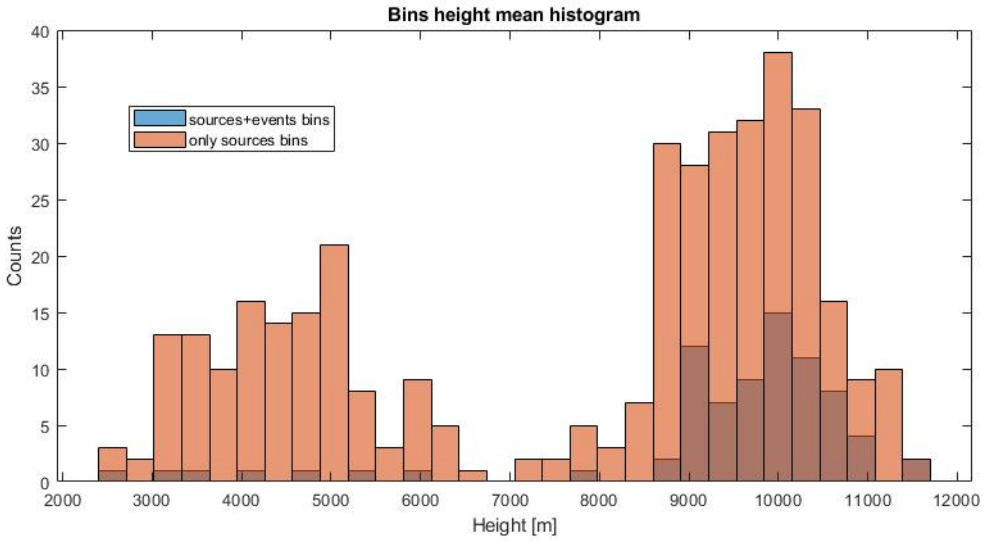
Other

5. Histographic individual values vs bins discretization
6. Flash duration values depending on sensor
7. Influence of CCD pixels' position

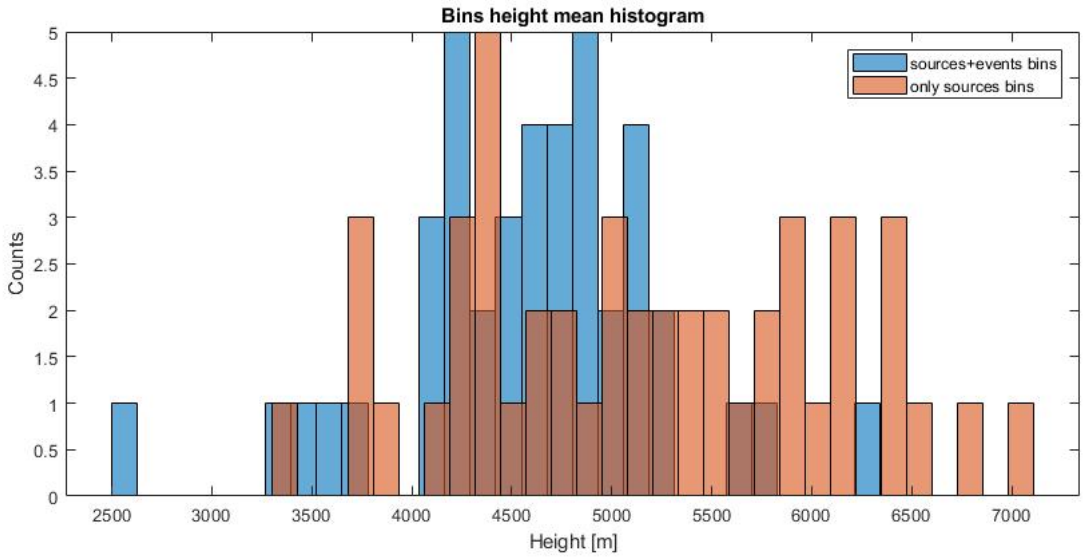
Results 1: LMA Height vs ISS-LIS detections

1: LMA Height vs ISS-LIS detections

2017-10-18 10:30

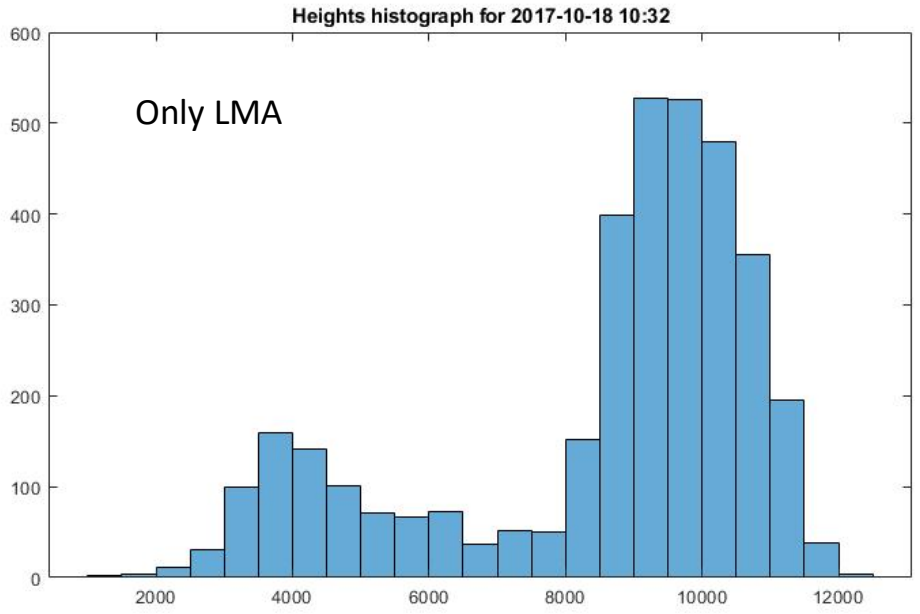


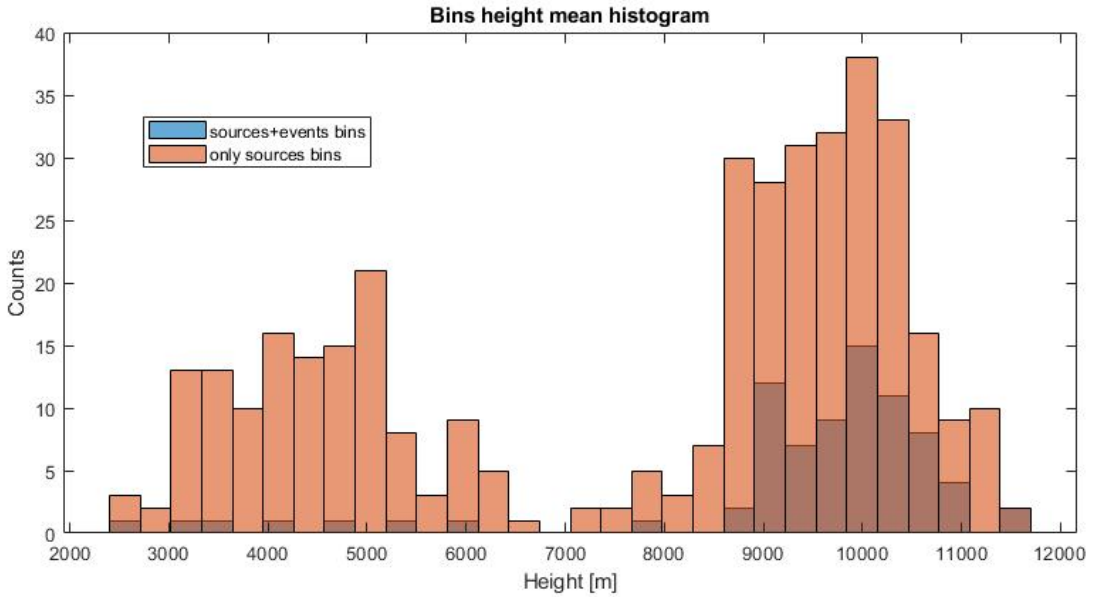
2017-10-18 17:30



1: LMA Height vs ISS-LIS detections

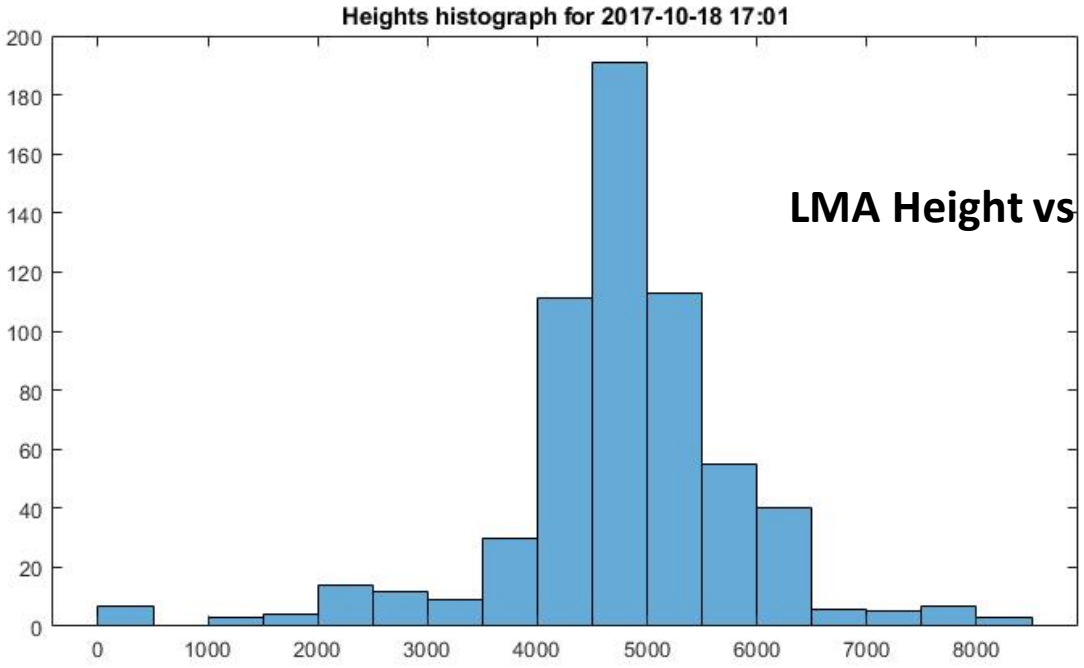
2017-10-18 10:30



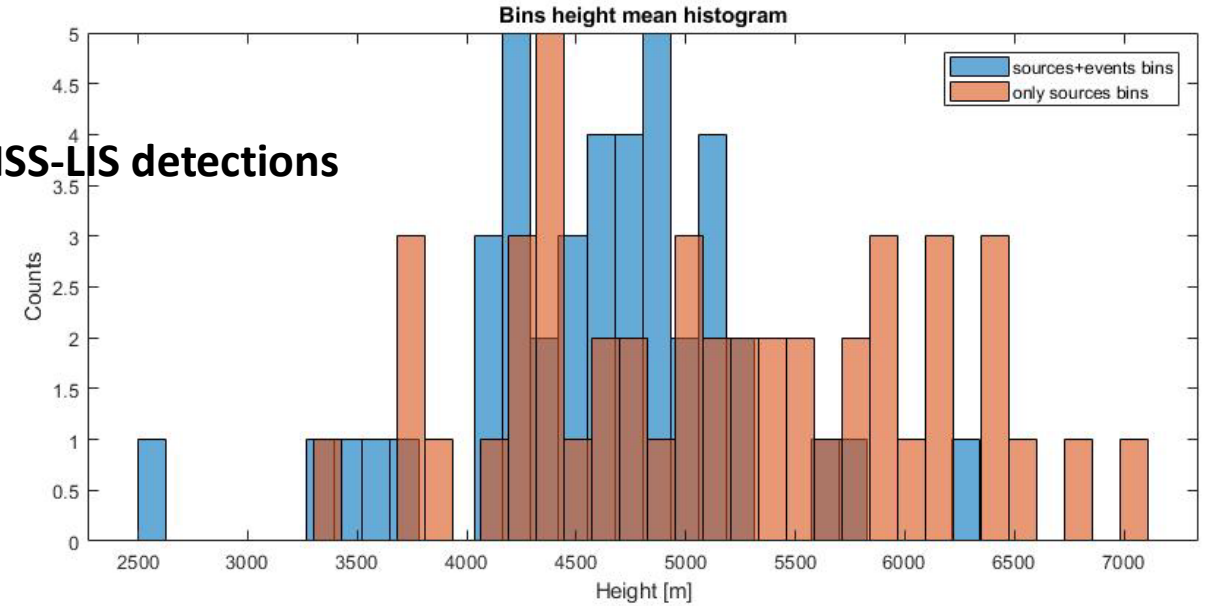


1: LMA Height vs ISS-LIS detections

2017-10-18 17:00



LMA Height vs ISS-LIS detections



Results 2: LMA RF power vs ISS-LIS

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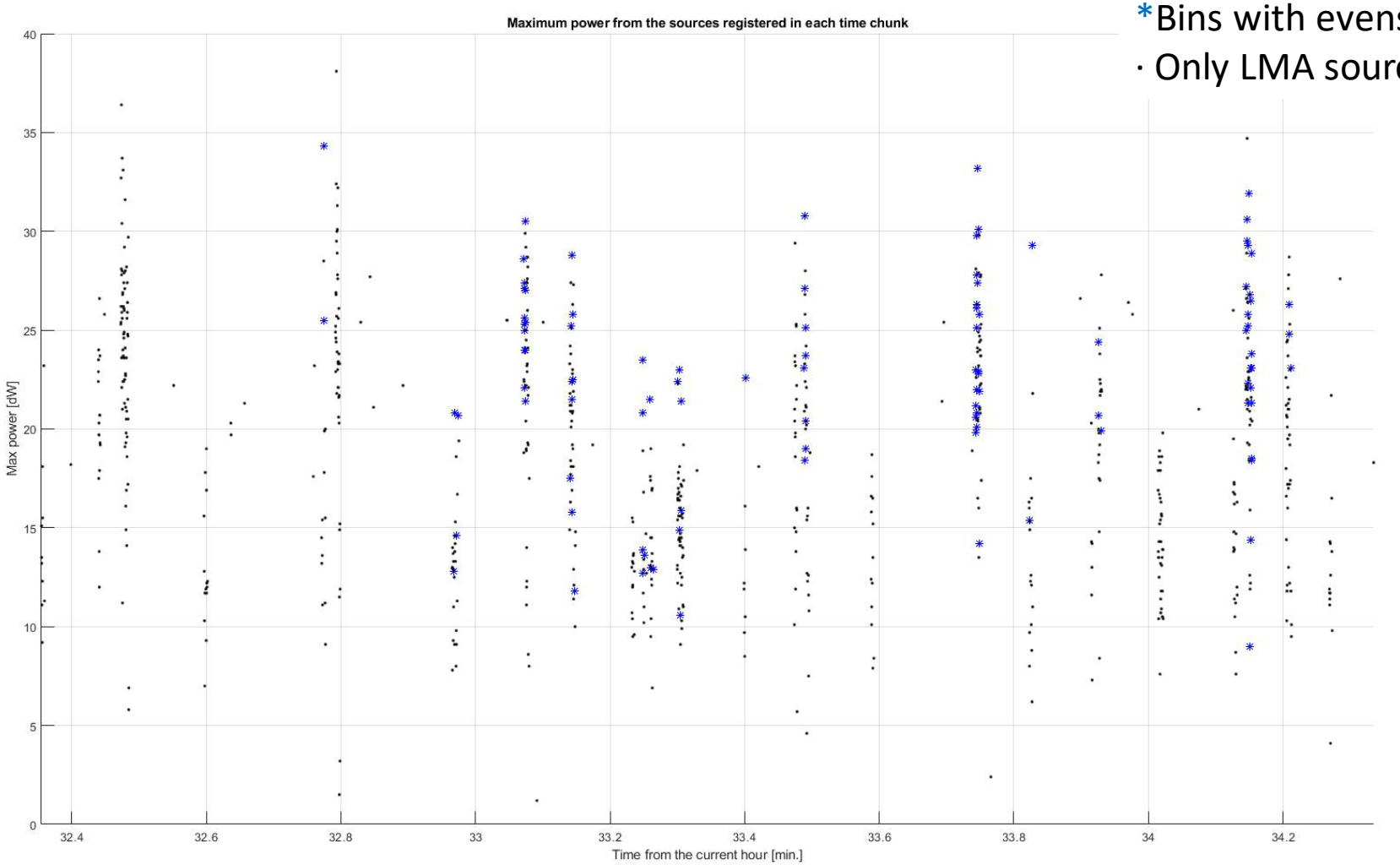


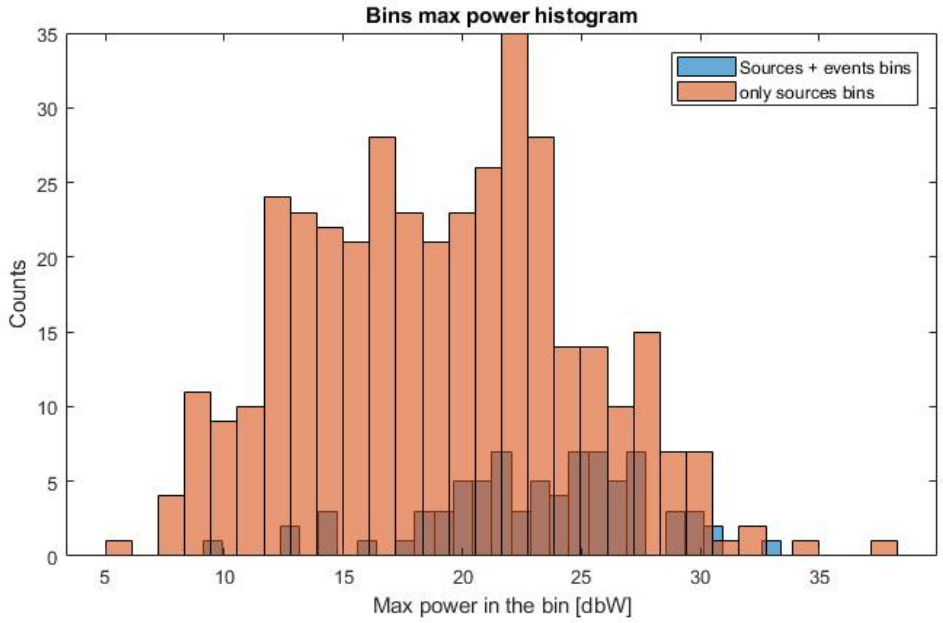
*Bins with evens + source

· Only LMA sources

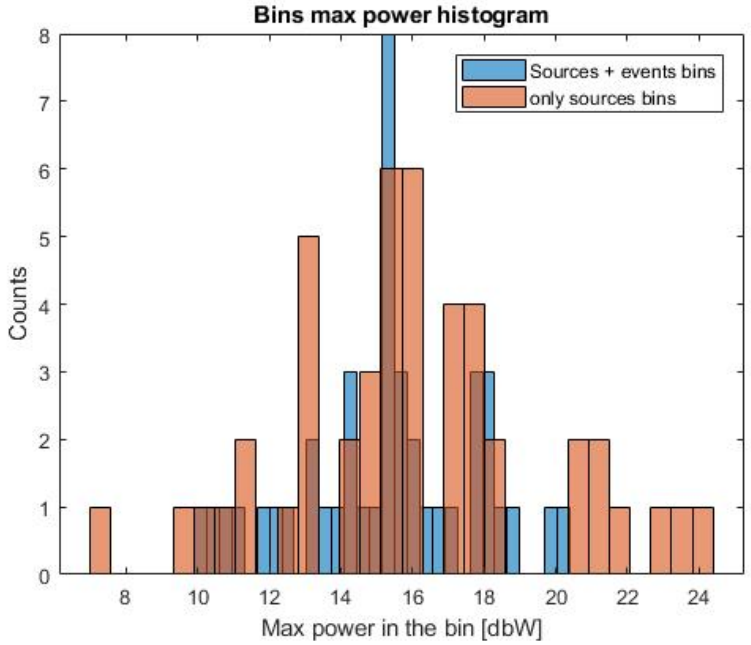
2: LMA RF power vs ISS-LIS

Histographical distributions

2017-10-18 10:30

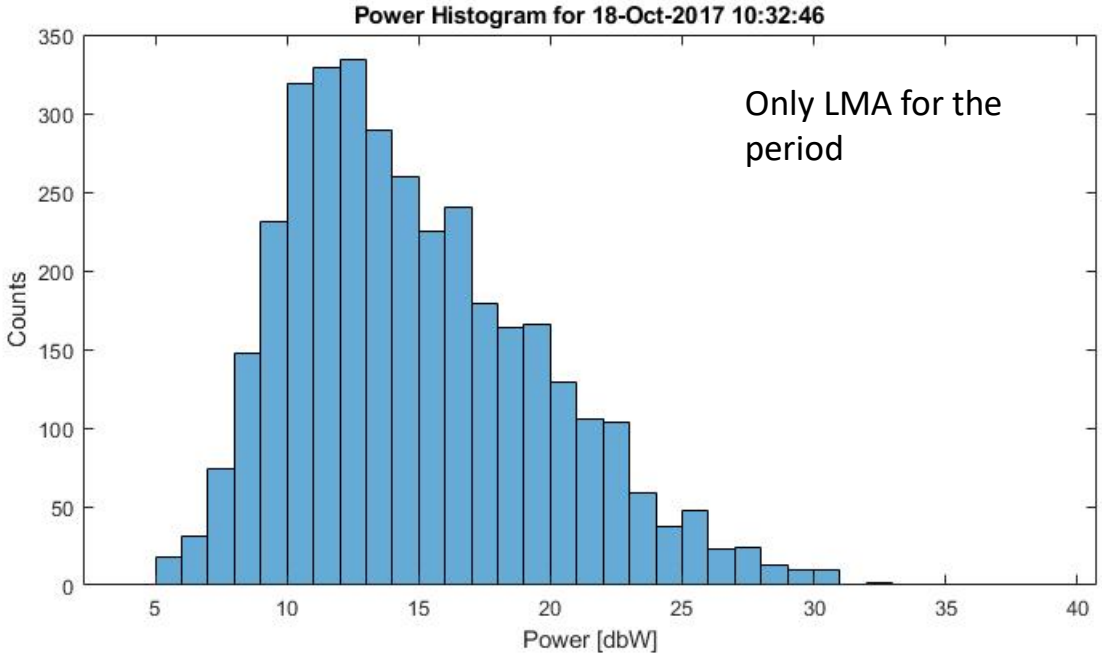


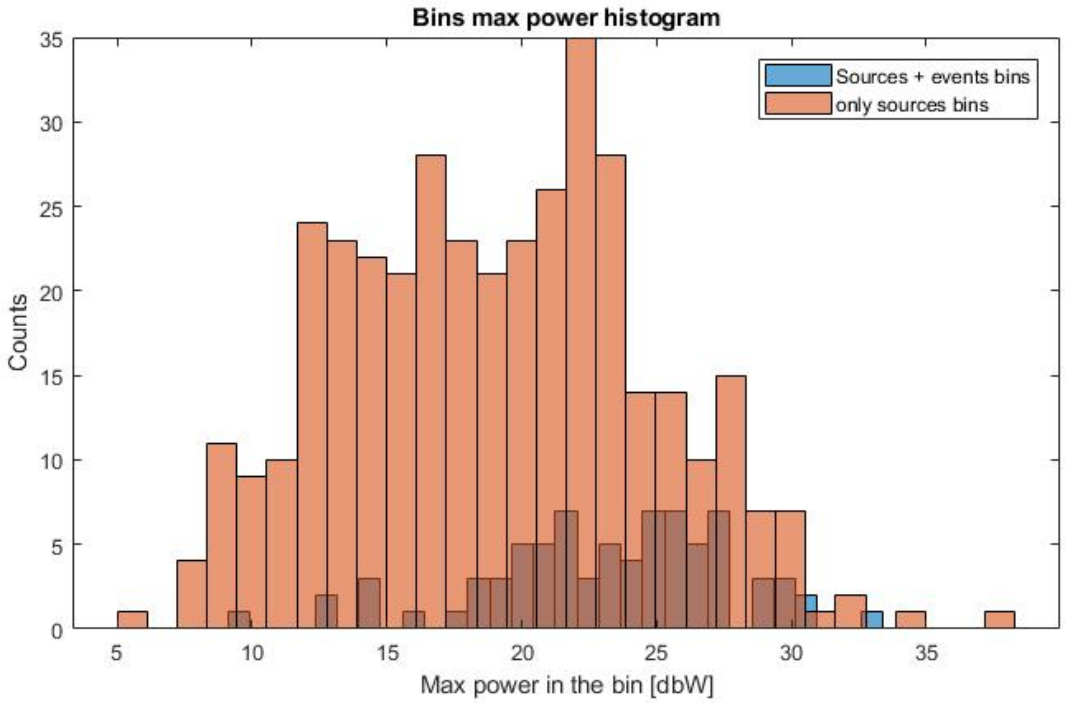
2017-10-18 17:30



2: LMA RF power vs ISS-LIS

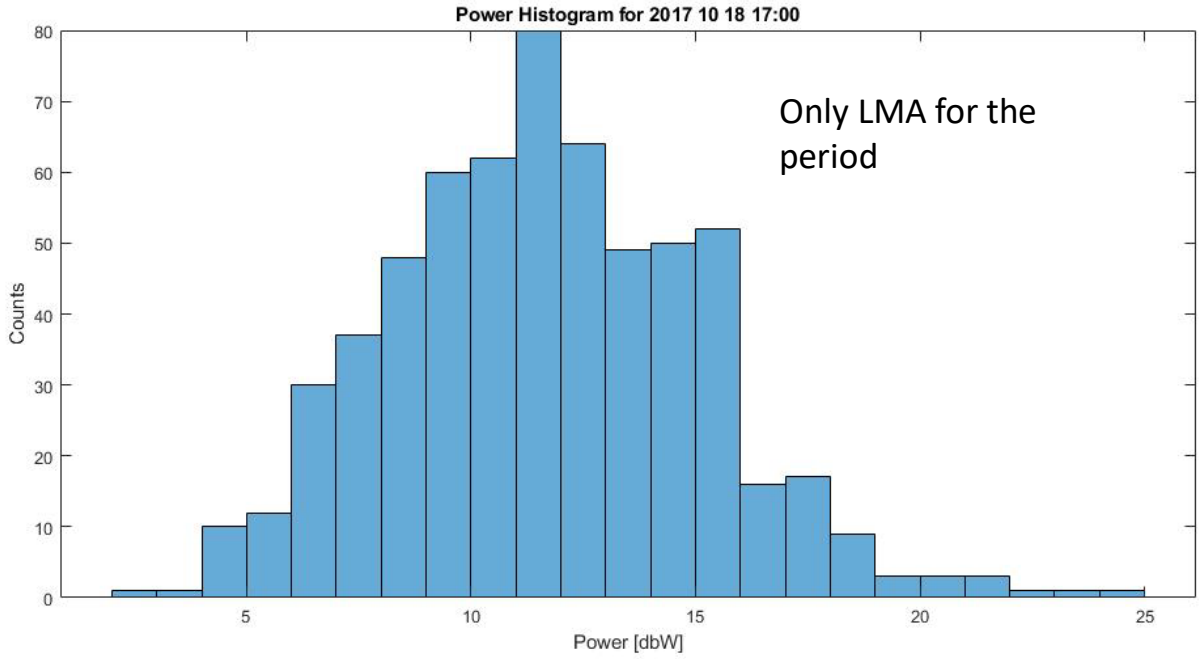
2017-10-18 10:30



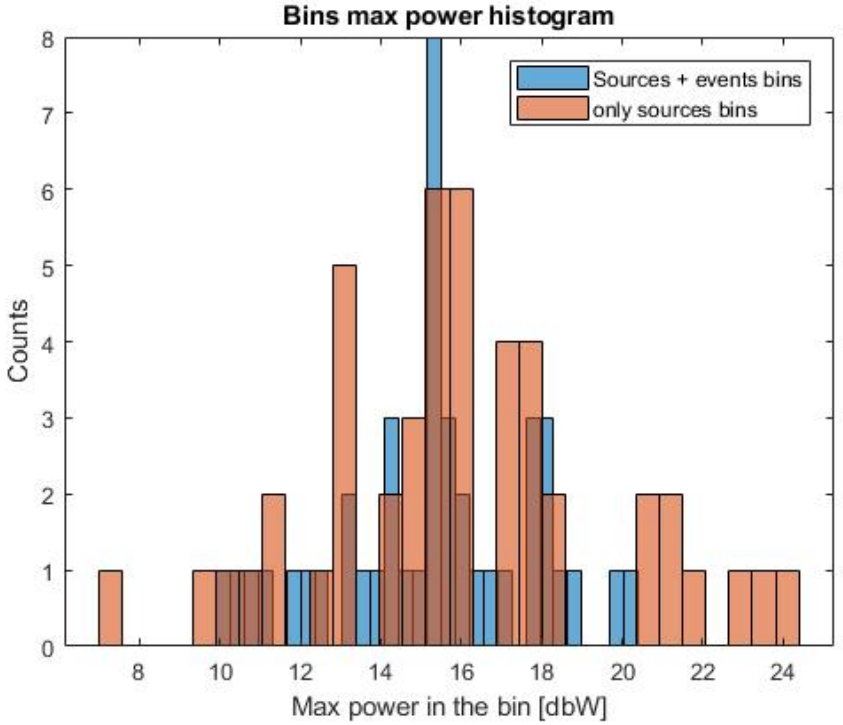


2: LMA RF power vs ISS-LIS

2017-10-18 17:00

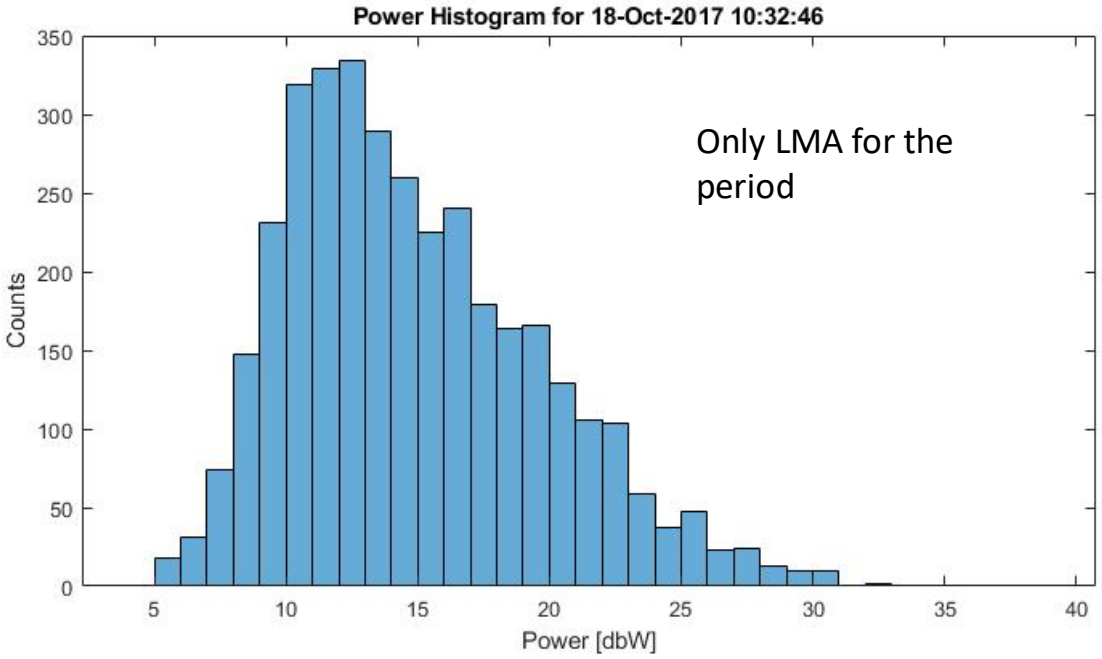


Only LMA for the period

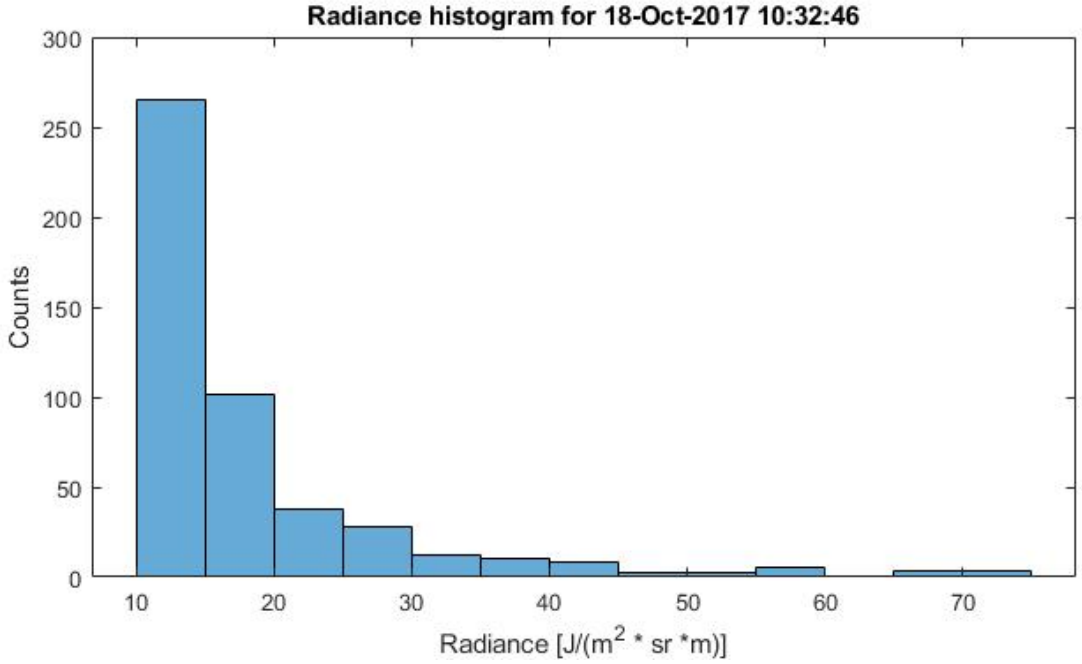


3: LMA RF power and ISS-LIS radiance histograms

2017-10-18 10:30

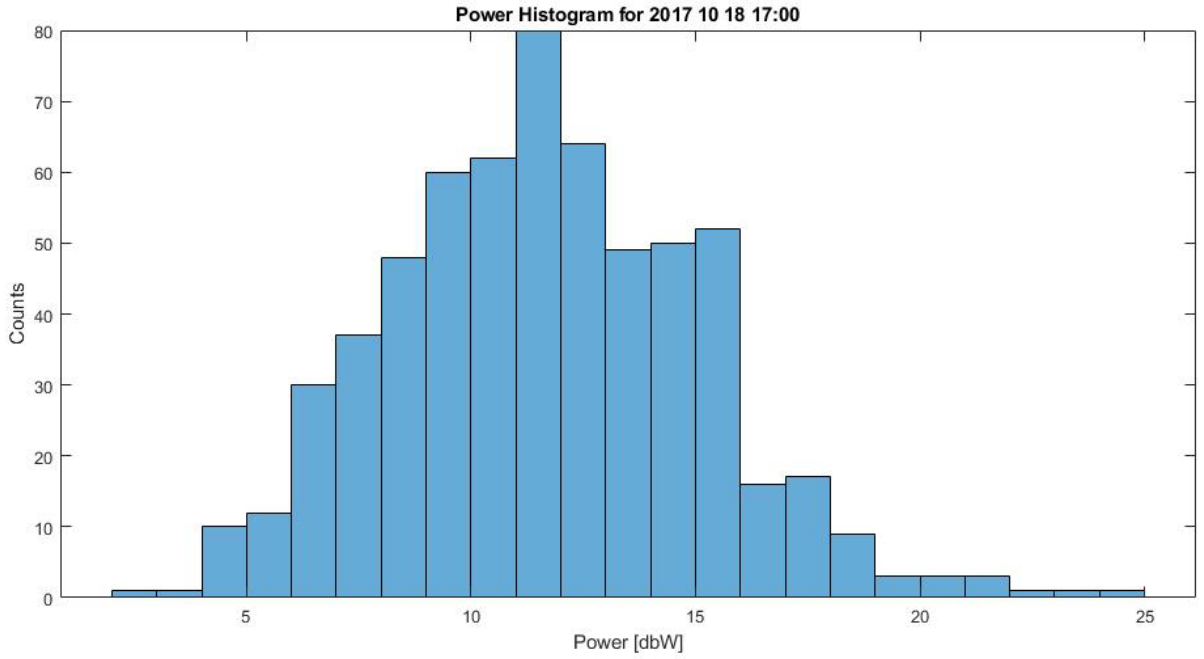


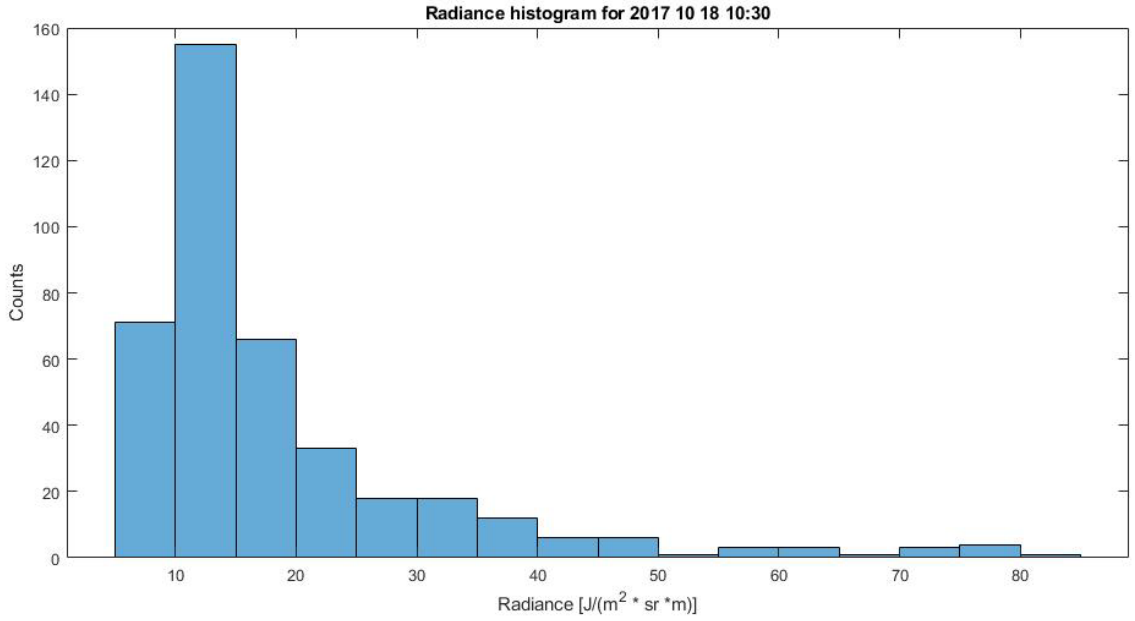
Only LMA for the period



3: LMA RF power and ISS-LIS radiance histograms

2017-10-18 17:00

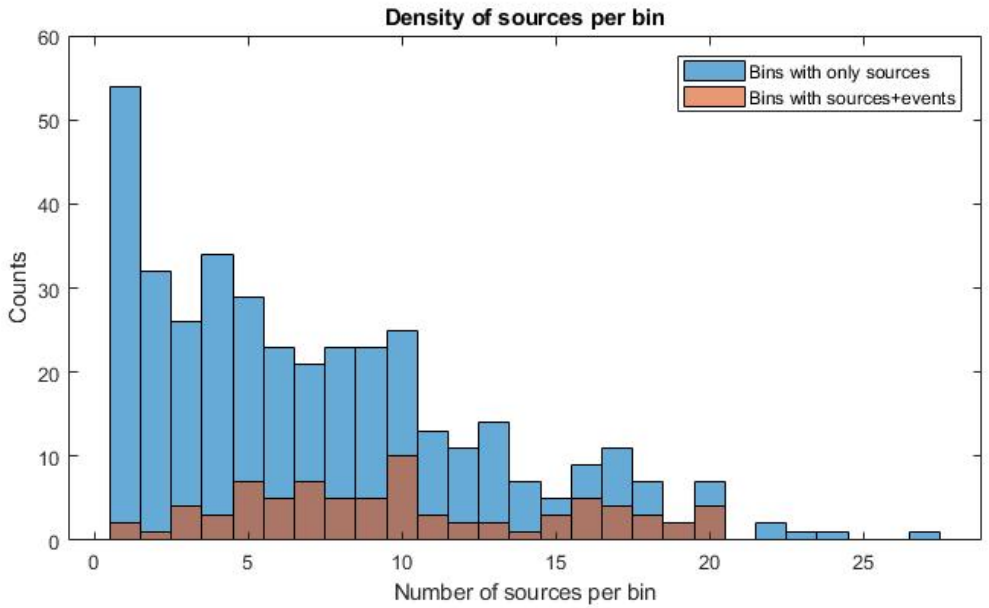




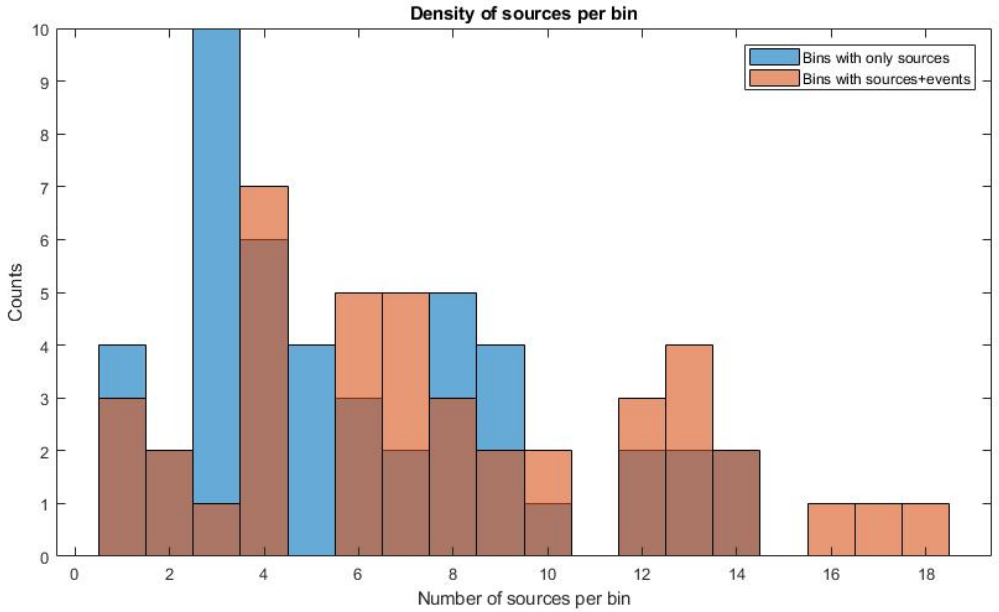
Results 4: Bin densities

4: Bin densities

2017-10-18 10:30



2017-10-18 17:30

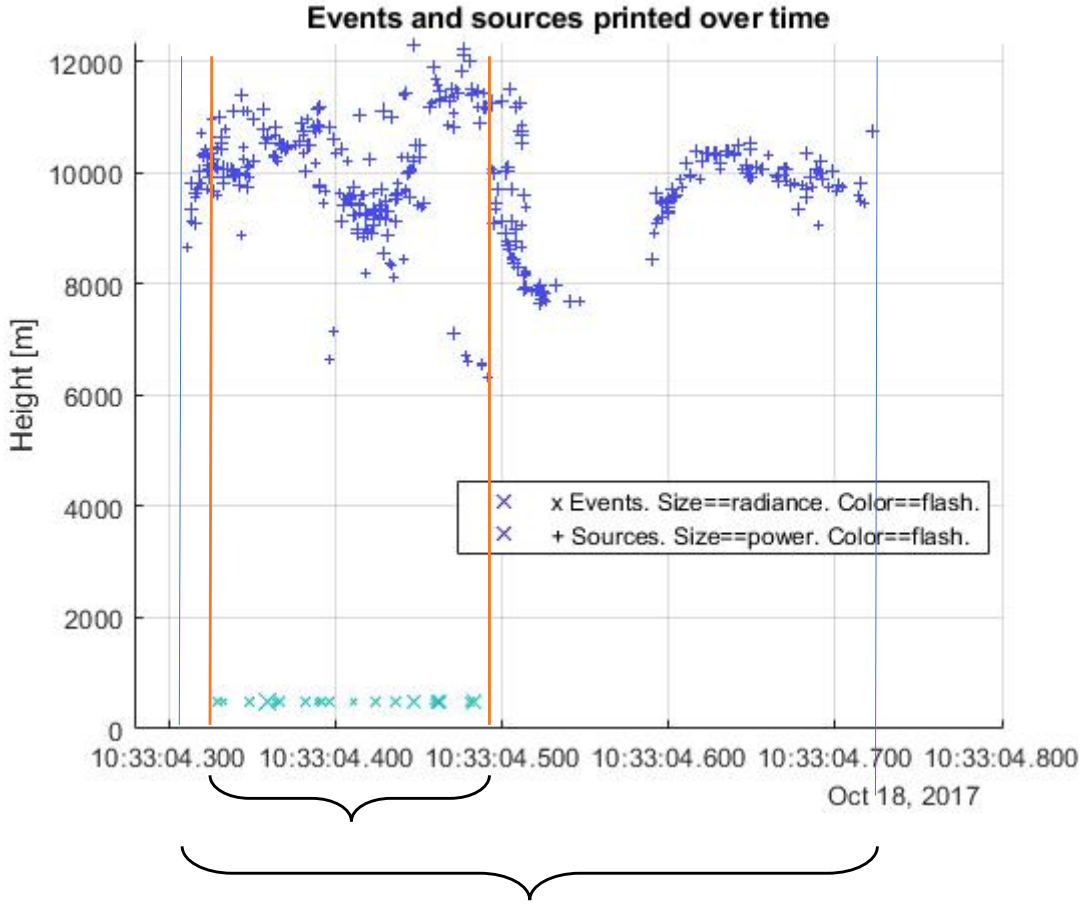


Results 5: Flash durations: LMA and ISS-LIS

5: Flash durations: LMA and ISS-LIS

2017-10-18 10:30 time period

Flash duration

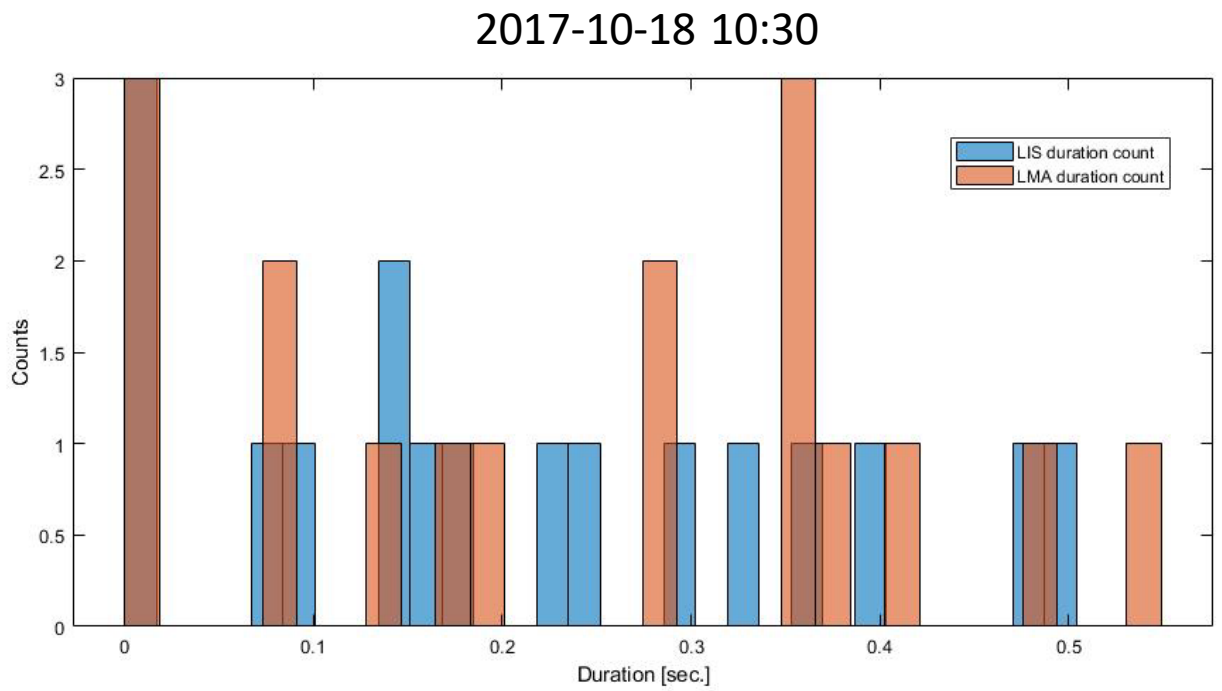


5: Flash durations: LMA and ISS-LIS

TYPICAL FLASH DURATION

- ISS-LIS: mean=0.2144 median=0.1809
- LMA: mean=0.2405 median=0.2754

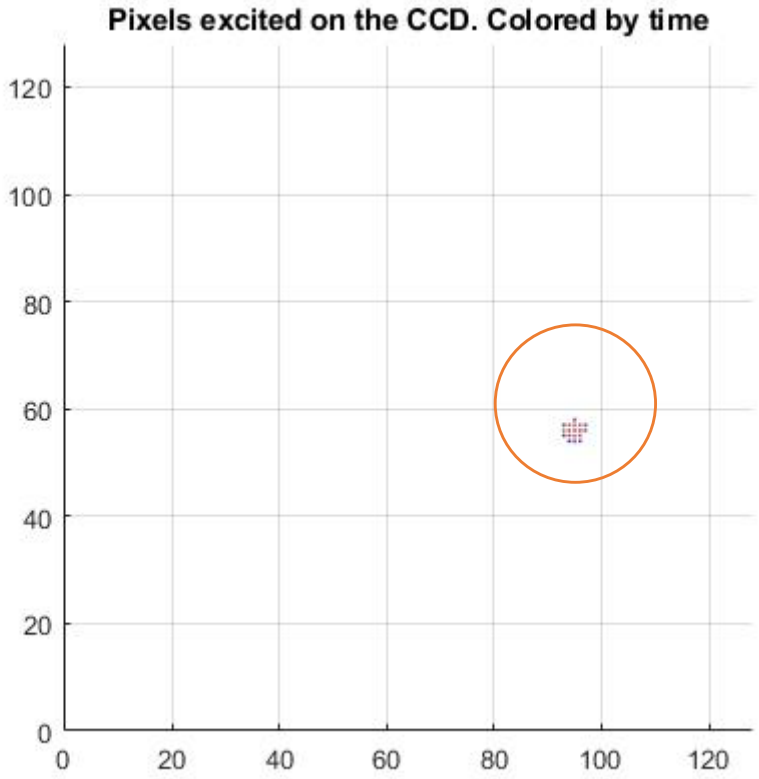
2017-10-18 10:30 time period



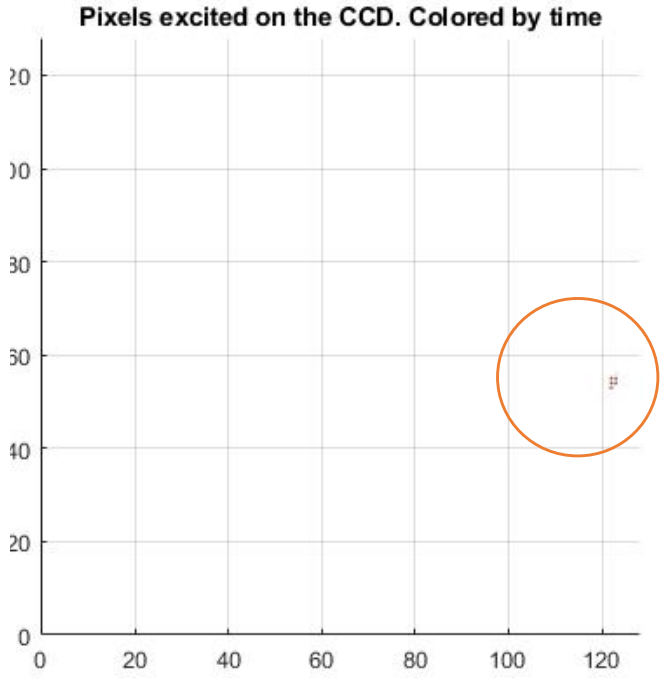
Results 6: Influence of the CCD pixels position

6: Influence of the CCD pixels position

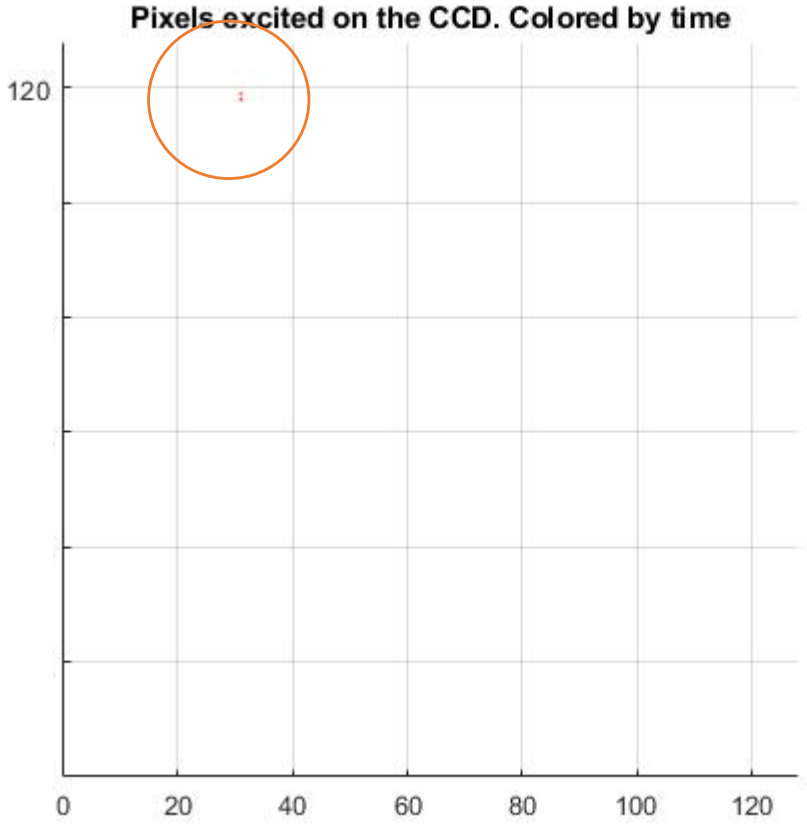
Days with few LMA - ISS-LIS coincidences



18-04-29



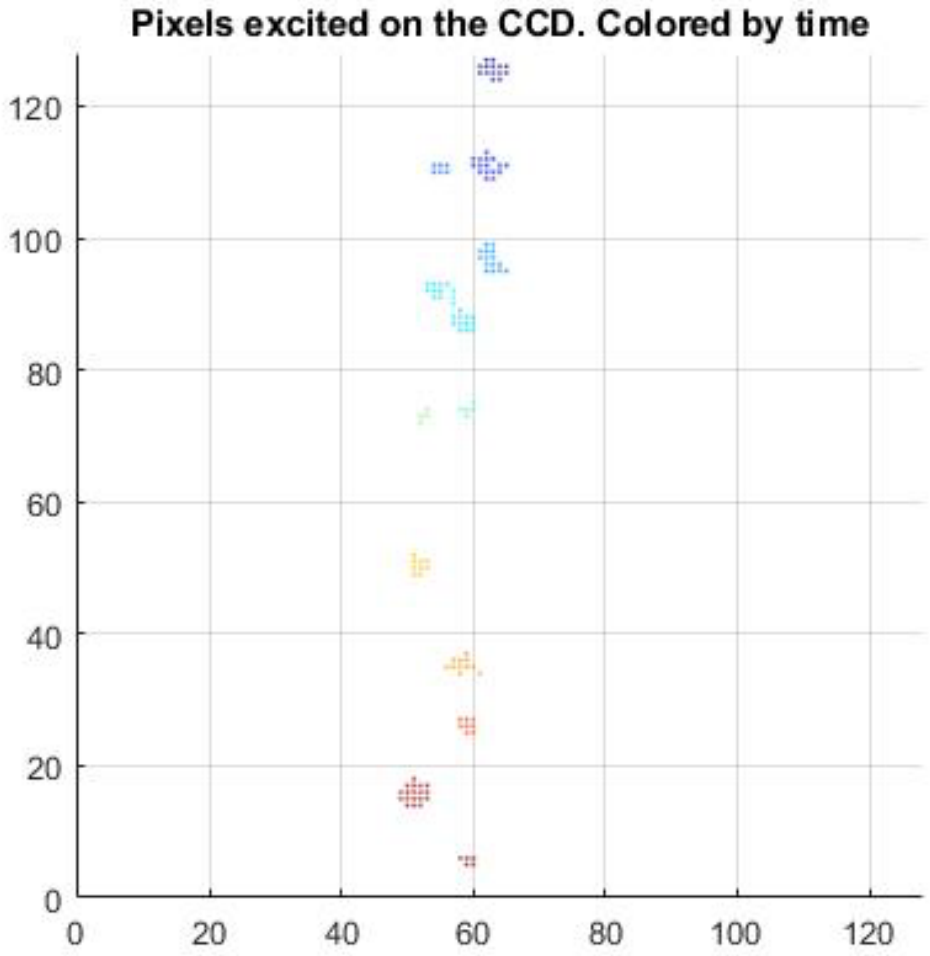
18-05-25



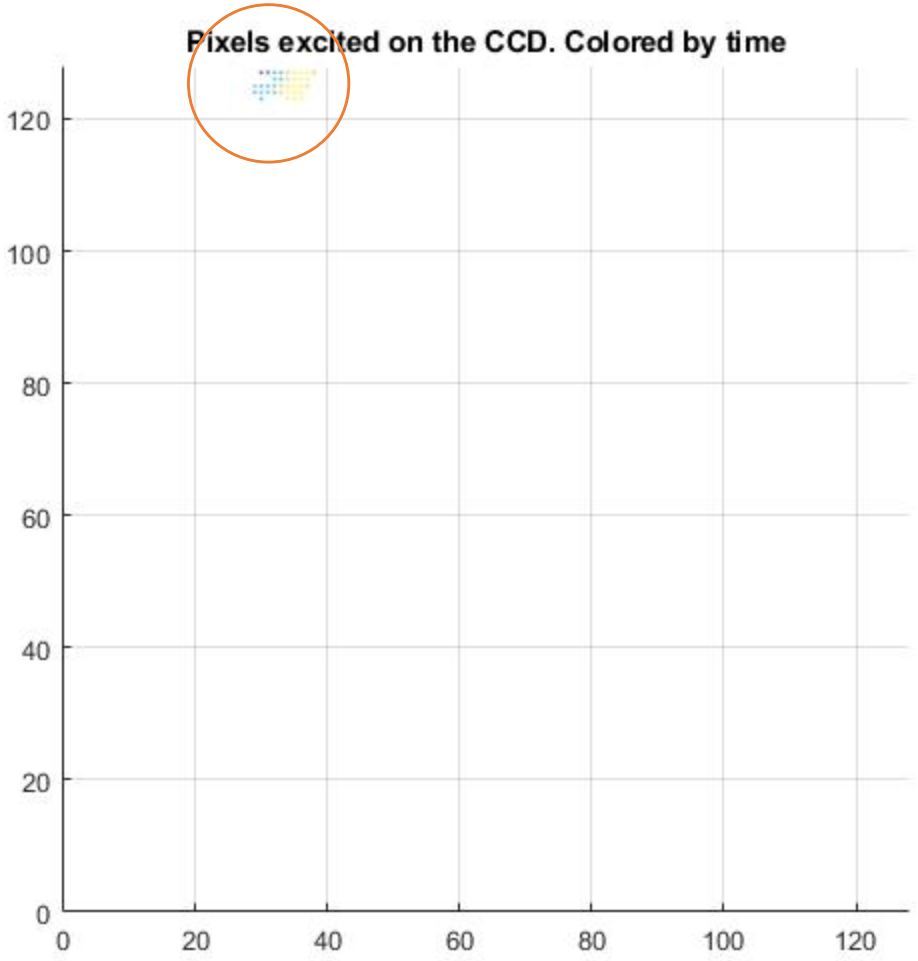
18-06-14

6: Influence of the CCD pixels position

Good data



17-10-18 (period 10:30 h)

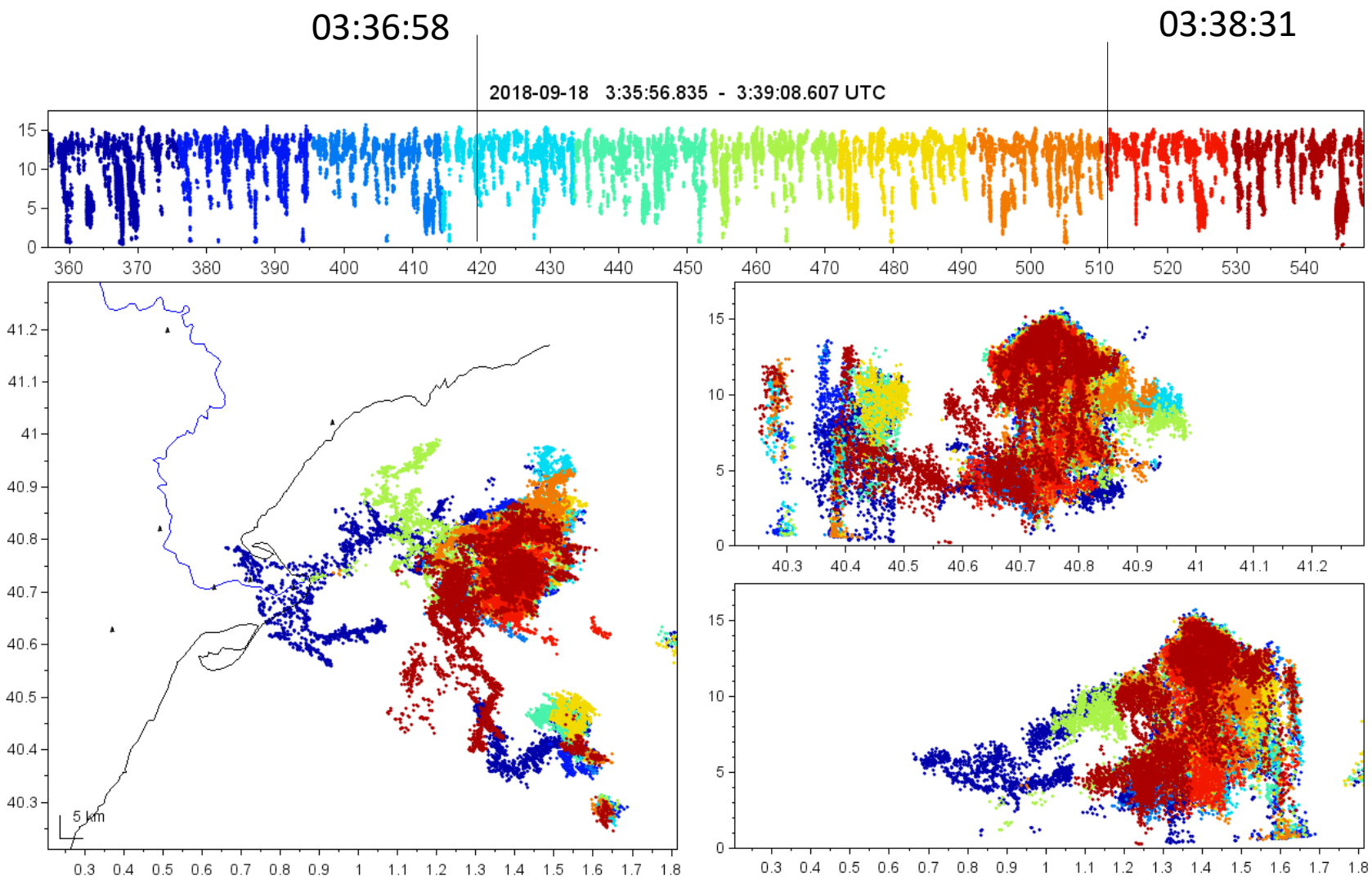


17-10-18 (period 17:30 h)

New summer 2018 data (to check)

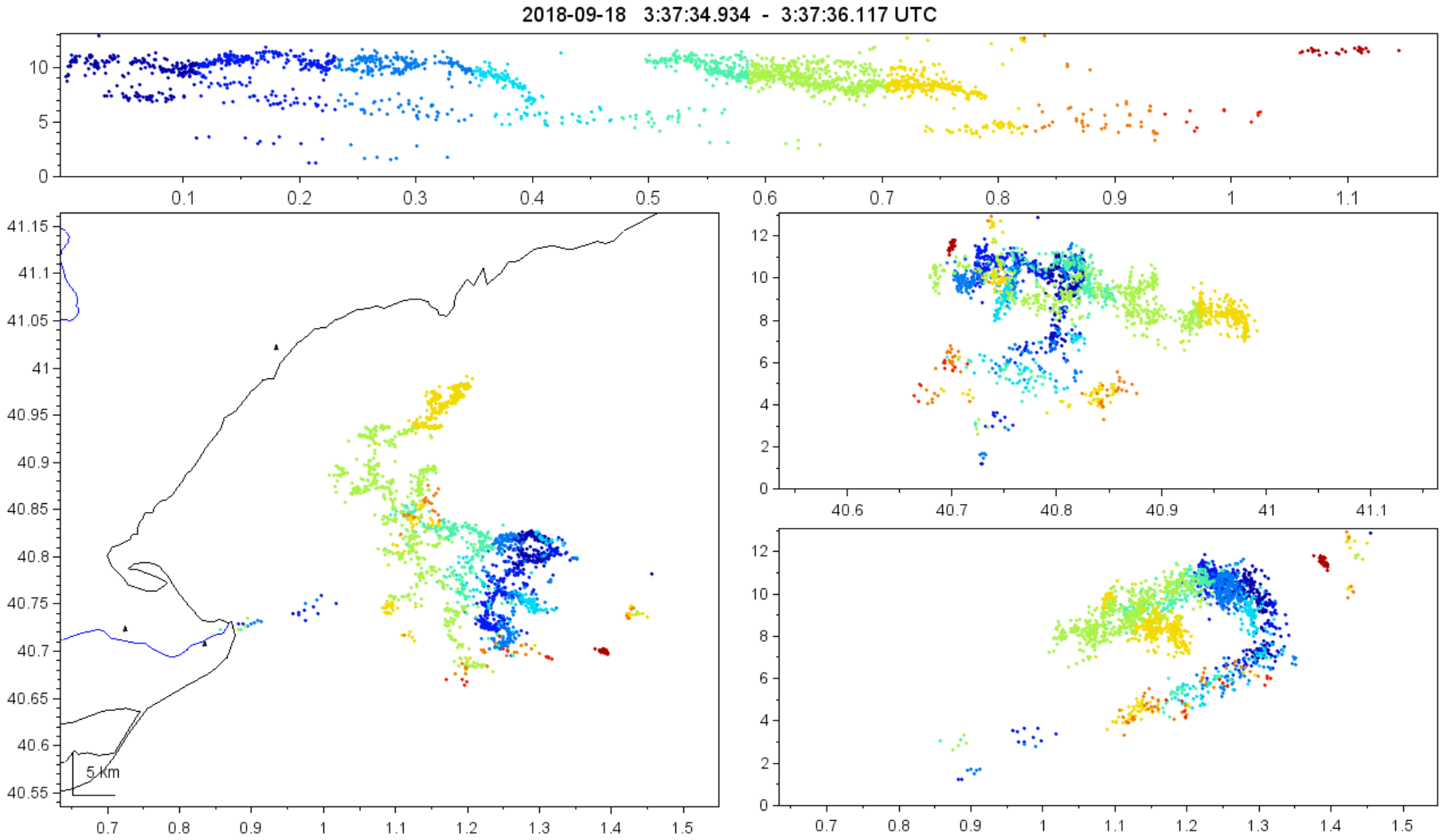
File name		Start time (UTC)	End time (UTC)	Flashes
ISS_LIS_SC_P0.2_20180623_NQC_08371.hdf	[Jun 23]	2018-174T13:11:18Z	2018-174T14:43:54Z	1
ISS_LIS_SC_P0.2_20180712_NQC_08658.hdf	[Jul 12]	2018-193T00:08:21Z	2018-193T01:41:00Z	5
ISS_LIS_SC_P0.2_20180716_NQC_08723.hdf	[Jul 16]	2018-197T04:27:41Z	2018-197T06:00:17Z	1
ISS_LIS_SC_P0.2_20180807_NQC_09071.hdf	[Aug 07]	2018-219T13:35:46Z	2018-219T15:08:23Z	7
ISS_LIS_SC_P0.2_20180808_NQC_09090.hdf	[Aug 08]	2018-220T18:55:26Z	2018-220T20:28:03Z	6
ISS_LIS_SC_P0.2_20180809_NQC_09105.hdf	[Aug 09]	2018-221T18:04:38Z	2018-221T19:37:15Z	2
ISS_LIS_SC_P0.2_20180811_NQC_09132.hdf	[Aug 11]	2018-223T11:45:12Z	2018-223T13:17:49Z	4
ISS_LIS_SC_P0.2_20180812_NQC_09151.hdf	[Aug 12]	2018-224T17:04:51Z	2018-224T18:37:28Z	4
ISS_LIS_SC_P0.2_20180816_NQC_09212.hdf	[Aug 16]	2018-228T15:14:13Z	2018-228T16:46:49Z	1
ISS_LIS_SC_P0.2_20180822_NQC_09304.hdf	[Aug 22]	2018-234T13:14:28Z	2018-234T14:47:05Z	2
ISS_LIS_SC_P0.2_20180823_NQC_09319.hdf	[Aug 23]	2018-235T12:23:38Z	2018-235T13:56:15Z	1
ISS_LIS_SC_P0.2_20180831_NQC_09441.hdf	[Aug 31]	2018-243T10:14:37Z	2018-243T11:47:14Z	2
ISS_LIS_SC_P0.2_20180904_NQC_09498.hdf	[Sep 04]	2018-247T02:13:16Z	2018-247T03:45:52Z	1
ISS_LIS_SC_P0.2_20180917_NQC_09712.hdf	[Sep 17]	2018-260T20:32:09Z	2018-260T22:04:46Z	14
ISS_LIS_SC_P0.2_20180918_NQC_09716.hdf	[Sep 18]	2018-261T02:42:36Z	2018-261T04:15:13Z	121
ISS_LIS_SC_P0.2_20181010_NQC_10064.hdf	[Oct 10]	2018-283T11:53:11Z	2018-283T13:25:48Z	2
ISS_LIS_SC_P0.2_20181014_NQC_10129.hdf	[Oct 14]	2018-287T16:13:05Z	2018-287T17:45:42Z	35
ISS_LIS_SC_P0.2_20181018_NQC_10190.hdf	[Oct 18]	2018-291T14:22:28Z	2018-291T15:55:05Z	13

New data: 20180918 seems a very good case!



New data: 20180918 case of 3:37:34.9 – 3:37:36.1

2018-261T03:37:34.9398Z [Sep 18] (40.758, 1.237) 1789 645 38 **107** 9716
2018-261T03:37:34.9509Z [Sep 18] (40.682, 1.465) 152 182 6 **10** 9716
2018-261T03:37:35.4778Z [Sep 18] (40.811, 1.217) 4362 107 27 **170** 9716



Processing Software

A. HDF files processer
B. LMA vs LIS comparator
C. NC files processer (similar to HDF files)

Annex

HDF files processer (MATLAB)

MAIN APPLICATIONS

1. Download interesting HDF files
2. Search for interesting HDF files in a PC database and extract its relevant information and print txt files containing such information

1. Download HDF files

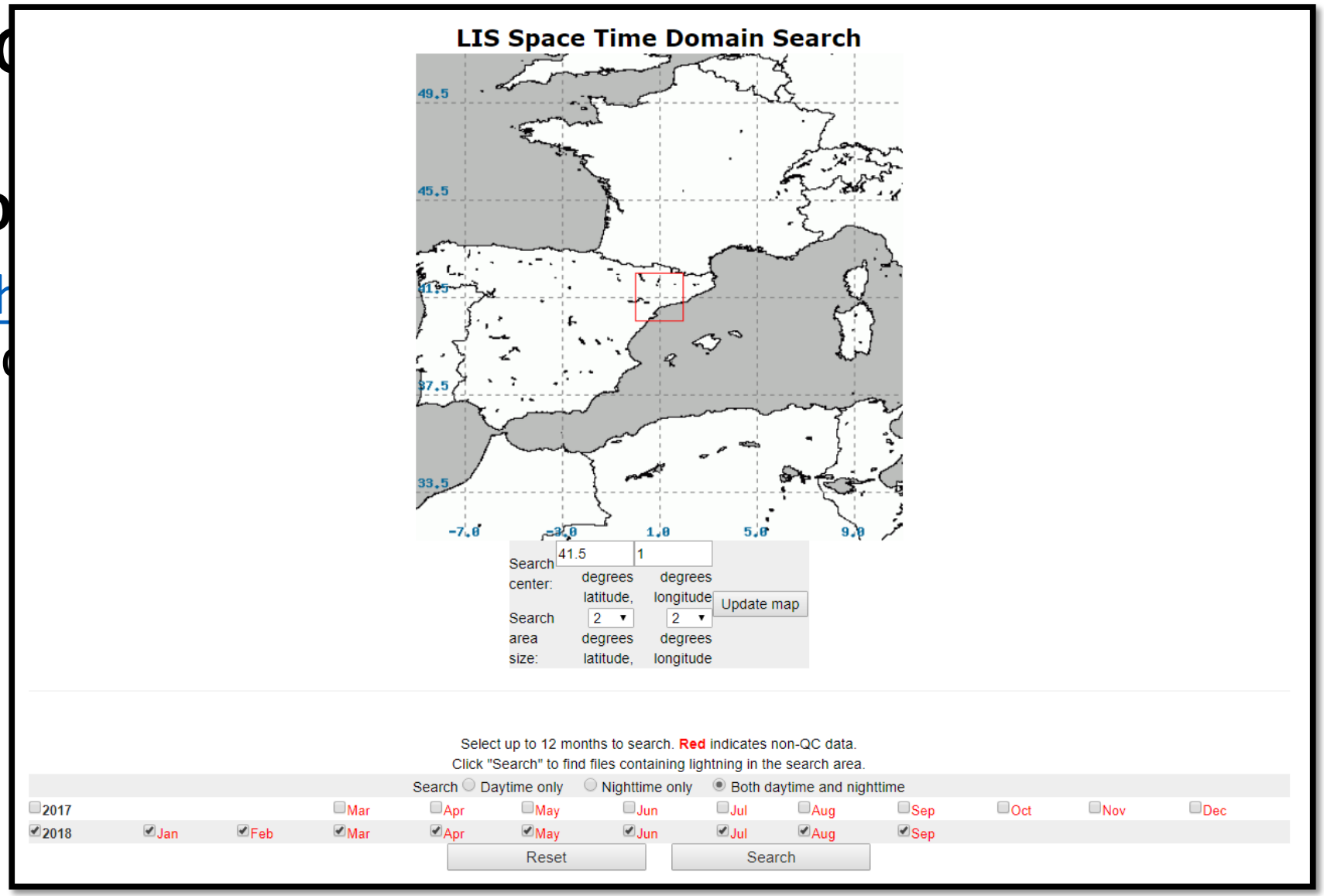
WAY OF USE (I/V)

Go to https://lightning.nsstc.nasa.gov/isslisib/isslissearch.html and select desired space-time domain, and click “Search”

1. Do

WAY O

Go to h and select



2. Download HDF files

WAY OF USE (II/V)

Manually select all the files info that is displayed

2. Dow

WAY OF U

Manually

) a txt file

The table below lists the files containing flashes in the area of interest (**red rectangle**) in the image.
Click a file name for detailed information about that orbit.
Click a flash count to show the flashes for just that orbit on this map.

File name		Start time (UTC)	End time (UTC)	Flashes
ISS_LIS_SC_P0.2_20180425_NQC_07453.hdf◆	[Apr 25]	2018-115T12:30:11Z	2018-115T14:02:46Z	6
ISS_LIS_SC_P0.2_20180427_NQC_07484.hdf◆	[Apr 27]	2018-117T12:20:33Z	2018-117T13:53:09Z	1
ISS_LIS_SC_P0.2_20180429_NQC_07514.hdf◆	[Apr 29]	2018-119T10:38:20Z	2018-119T12:10:55Z	1
ISS_LIS_SC_P0.2_20180501_NQC_07545.hdf◆	[May 01]	2018-121T10:28:41Z	2018-121T12:01:16Z	1
ISS_LIS_SC_P0.2_20180509_NQC_07667.hdf◆	[May 09]	2018-129T06:44:42Z	2018-129T08:17:17Z	1
ISS_LIS_SC_P0.2_20180523_NQC_07893.hdf◆	[May 23]	2018-143T19:31:23Z	2018-143T21:03:59Z	2
ISS_LIS_SC_P0.2_20180527_NQC_07954.hdf◆	[May 27]	2018-147T17:39:49Z	2018-147T19:12:24Z	26
ISS_LIS_SC_P0.2_20180529_NQC_07985.hdf◆	[May 29]	2018-149T17:30:18Z	2018-149T19:02:54Z	3
ISS_LIS_SC_P0.2_20180530_NQC_08000.hdf◆	[May 30]	2018-150T16:39:15Z	2018-150T18:11:51Z	2
ISS_LIS_SC_P0.2_20180601_NQC_08031.hdf◆	[Jun 01]	2018-152T16:29:43Z	2018-152T18:02:19Z	2
ISS_LIS_SC_P0.2_20180602_NQC_08046.hdf◆	[Jun 02]	2018-153T15:38:39Z	2018-153T17:11:15Z	10
ISS_LIS_SC_P0.2_20180604_NQC_08080.hdf◆	[Jun 04]	2018-155T20:06:53Z	2018-155T21:39:29Z	4
ISS_LIS_SC_P0.2_20180605_NQC_08092.hdf◆	[Jun 05]	2018-156T14:38:01Z	2018-156T16:10:37Z	7
ISS_LIS_SC_P0.2_20180606_NQC_08107.hdf◆	[Jun 06]	2018-157T13:46:56Z	2018-157T15:19:32Z	1
ISS_LIS_SC_P0.2_20180613_NQC_08218.hdf◆	[Jun 13]	2018-164T17:04:48Z	2018-164T18:37:24Z	1
ISS_LIS_SC_P0.2_20180712_NQC_08658.hdf◆	[Jul 12]	2018-193T00:08:21Z	2018-193T01:41:00Z	5
ISS_LIS_SC_P0.2_20180716_NQC_08723.hdf◆	[Jul 16]	2018-197T04:27:41Z	2018-197T06:00:17Z	3
ISS_LIS_SC_P0.2_20180801_NQC_08979.hdf◆	[Aug 01]	2018-213T15:35:13Z	2018-213T17:07:50Z	1
ISS_LIS_SC_P0.2_20180805_NQC_09040.hdf◆	[Aug 05]	2018-217T13:44:44Z	2018-217T15:17:21Z	5
ISS_LIS_SC_P0.2_20180807_NQC_09071.hdf◆	[Aug 07]	2018-219T13:35:46Z	2018-219T15:08:23Z	43
ISS_LIS_SC_P0.2_20180808_NQC_09090.hdf◆	[Aug 08]	2018-220T18:55:26Z	2018-220T20:28:03Z	10
ISS_LIS_SC_P0.2_20180809_NQC_09105.hdf◆	[Aug 09]	2018-221T18:04:38Z	2018-221T19:37:15Z	43
ISS_LIS_SC_P0.2_20180812_NQC_09151.hdf◆	[Aug 12]	2018-224T17:04:51Z	2018-224T18:37:28Z	82
ISS_LIS_SC_P0.2_20180813_NQC_09166.hdf◆	[Aug 13]	2018-225T16:14:02Z	2018-225T17:46:39Z	2
ISS_LIS_SC_P0.2_20180816_NQC_09212.hdf◆	[Aug 16]	2018-228T15:14:13Z	2018-228T16:46:49Z	18
ISS_LIS_SC_P0.2_20180822_NQC_09304.hdf◆	[Aug 22]	2018-234T13:14:28Z	2018-234T14:47:05Z	12
ISS_LIS_SC_P0.2_20180823_NQC_09319.hdf◆	[Aug 23]	2018-235T12:23:38Z	2018-235T13:56:15Z	2
ISS_LIS_SC_P0.2_20180831_NQC_09437.hdf◆	[Aug 31]	2018-243T04:04:11Z	2018-243T05:36:48Z	67

View flash data | Start a new search

2. Download HDF files

WAY OF USE (III/V)

Enter required directories and files

website_filename: file where the names of HDF files are

2. Download HDF files

WAY OF USE (IV/V)
Select Option

0: Exit Program
1: Write general event txt files
2: Write general event txt and plot them
3: Write event txt files for scilab (TO VERIFY)
4: Plot events in interesting time-space from HDF4 files (TO VERIFY)
5: Plot events in interesting time-space from .txt files
6: Correct GHRCs URLs and generate a new URLs txt file
7: Process website filenames to list of interesting URLs 
8: Check only for interesting files and save the workspace.

2. Download HDF files

WAY OF USE (V/V)

Open the Windows CMD

Execute the command

wget --user *earthdata_username* --ask-password --auth-no-challenge --no-check-certificate -i *URLSfile_dir*

This will download the HDF to the current directory

3. Print txt files

WAY OF USE (I/III)

Enter required directories and files

read_dir: where the HDF files are stored

write_dir: where to write the txt files

3. Print txt files

WAY OF USE (II/III)

Select interesting space-time domain

```
%coordinates info
deltebre=[40.7212388 0.7176492];
santamarta=[11.2403547 -74.2110227];
barranca=[7.06878 -73.744418];

%scanning_area specification
centroid=barranca; %LAT/LON (remember, on the plot, this would be y and x)
range=60*sqrt(2); %range in km
%time interval
starttime=datetime(2018,6,1,0,0,0);
endtime=datetime(2018,7,3,8,0,0);
timerange=[starttime endtime];
```

3. Print txt files

WAY OF USE (III/III)
Select Option

0: Exit Program
1: Write general event txt files 
2: Write general event txt and plot them
3: Write event txt files for scilab (TO VERIFY)
4: Plot events in interesting time-space from HDF4 files (TO VERIFY)
5: Plot events in interesting time-space from .txt files
6: Correct GHRCs URLs and generate a new URLs txt file
7: Process website filenames to list of interesting URLs
8: Check only for interesting files and save the workspace.

3. Print txt files

“ISS_LIS_20171018_1701_1701_events”

ISS_LIS_20171018_1701_1701_events - Llibreta

Fitxer Edició Format Visualització Ajuda

TAI93_time	e_lat	e_lon	e_radiance	group	g_lat	g_lon	flash	f_lat	f_lon	area	a_lat	a_lon	a_observe_time	x_pixel	y_pixel	bg_radia
7.8249969643939281E+08	40.598	1.074	9	27	40.567	1.192	3	40.570	1.195	3	40.570	1.195	97	33	124	0
7.8249969643939281E+08	40.609	1.177	11	27	40.567	1.192	3	40.570	1.195	3	40.570	1.195	97	32	125	0
7.8249969643939281E+08	40.573	1.130	23	27	40.567	1.192	3	40.570	1.195	3	40.570	1.195	97	33	125	0
7.8249969643939281E+08	40.536	1.090	12	27	40.567	1.192	3	40.570	1.195	3	40.570	1.195	97	34	125	0
7.8249969643939281E+08	40.547	1.194	19	27	40.567	1.192	3	40.570	1.195	3	40.570	1.195	97	33	126	0
7.8249969643939281E+08	40.584	1.233	14	27	40.567	1.192	3	40.570	1.195	3	40.570	1.195	97	32	126	0
7.8249969643939281E+08	40.595	1.337	9	27	40.567	1.192	3	40.570	1.195	3	40.570	1.195	97	31	127	0
7.8249969643939281E+08	40.558	1.297	13	27	40.567	1.192	3	40.570	1.195	3	40.570	1.195	97	32	127	0
7.8249969643939281E+08	40.520	1.257	10	27	40.567	1.192	3	40.570	1.195	3	40.570	1.195	97	33	127	0
7.8249969644140697E+08	40.609	1.178	9	28	40.570	1.220	3	40.570	1.195	3	40.570	1.195	97	32	125	0
7.8249969644140697E+08	40.573	1.130	21	28	40.570	1.220	3	40.570	1.195	3	40.570	1.195	97	33	125	0
7.8249969644140697E+08	40.535	1.090	10	28	40.570	1.220	3	40.570	1.195	3	40.570	1.195	97	34	125	0
7.8249969644140697E+08	40.546	1.194	18	28	40.570	1.220	3	40.570	1.195	3	40.570	1.195	97	33	126	0
7.8249969644140697E+08	40.584	1.234	14	28	40.570	1.220	3	40.570	1.195	3	40.570	1.195	97	32	126	0
7.8249969644140697E+08	40.595	1.337	9	28	40.570	1.220	3	40.570	1.195	3	40.570	1.195	97	31	127	0
7.8249969644140697E+08	40.633	1.376	9	28	40.570	1.220	3	40.570	1.195	3	40.570	1.195	97	30	127	0
7.8249969644140697E+08	40.558	1.297	13	28	40.570	1.220	3	40.570	1.195	3	40.570	1.195	97	32	127	0
7.8249969644140697E+08	40.520	1.257	10	28	40.570	1.220	3	40.570	1.195	3	40.570	1.195	97	33	127	0
7.8249969644291759E+08	40.572	1.130	15	29	40.565	1.204	3	40.570	1.195	3	40.570	1.195	97	33	125	0
7.8249969644291759E+08	40.584	1.234	10	29	40.565	1.204	3	40.570	1.195	3	40.570	1.195	97	32	126	0
7.8249969644291759E+08	40.546	1.194	12	29	40.565	1.204	3	40.570	1.195	3	40.570	1.195	97	33	126	0
7.8249969644291759E+08	40.557	1.297	10	29	40.565	1.204	3	40.570	1.195	3	40.570	1.195	97	32	127	0
7.8249969658813548E+08	40.567	1.139	10	30	40.542	1.203	3	40.570	1.195	3	40.570	1.195	97	33	125	0
7.8249969658813548E+08	40.578	1.243	10	30	40.542	1.203	3	40.570	1.195	3	40.570	1.195	97	32	126	0
7.8249969658813548E+08	40.541	1.203	20	30	40.542	1.203	3	40.570	1.195	3	40.570	1.195	97	33	126	0
7.8249969658813548E+08	40.503	1.163	9	30	40.542	1.203	3	40.570	1.195	3	40.570	1.195	97	34	126	0
7.8249969658813548E+08	40.514	1.267	9	30	40.542	1.203	3	40.570	1.195	3	40.570	1.195	97	33	127	0
7.8249969667758250E+08	40.537	1.209	9	31	40.537	1.209	3	40.570	1.195	3	40.570	1.195	97	33	126	0
7.8249969667958140E+08	40.537	1.209	11	32	40.537	1.209	3	40.570	1.195	3	40.570	1.195	97	33	126	0
7.8249969672079539E+08	40.573	1.251	11	33	40.573	1.251	3	40.570	1.195	3	40.570	1.195	97	32	126	0
7.8249969676199412E+08	40.723	1.156	11	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	30	123	0
7.8249969676199412E+08	40.735	1.260	16	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	29	124	0
7.8249969676199412E+08	40.697	1.220	22	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	30	124	0
7.8249969676199412E+08	40.660	1.173	12	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	31	124	0
7.8249969676199412E+08	40.623	1.134	13	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	32	124	0
7.8249969676199412E+08	40.585	1.094	15	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	33	124	0
7.8249969676199412E+08	40.597	1.198	40	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	32	125	0
7.8249969676199412E+08	40.634	1.237	12	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	31	125	0
7.8249969676199412E+08	40.671	1.277	16	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	30	125	0
7.8249969676199412E+08	40.709	1.324	11	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	29	125	0
7.8249969676199412E+08	40.571	1.254	26	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	32	126	0
7.8249969676199412E+08	40.560	1.150	70	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	33	125	0
7.8249969676199412E+08	40.523	1.110	20	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	34	125	0
7.8249969676199412E+08	40.534	1.214	55	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	33	126	0
7.8249969676199412E+08	40.497	1.174	20	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	34	126	0
7.8249969676199412E+08	40.507	1.278	11	34	40.592	1.196	3	40.570	1.195	3	40.570	1.195	97	33	127	0
7.8249969676350474E+08	40.597	1.198	14	35	40.555	1.192	3	40.570	1.195	3	40.570	1.195	97	32	125	0
7.8249969676350474E+08	40.560	1.150	20	35	40.555	1.192	3	40.570	1.195	3	40.570	1.195	97	33	125	0
7.8249969676350474E+08	40.571	1.254	9	35	40.555	1.192	3	40.570	1.195	3	40.570	1.195	97	32	126	0
7.8249969676350474E+08	40.534	1.214	15	35	40.555	1.192	3	40.570	1.195	3	40.570	1.195	97	33	126	0

LMA vs LIS comparator

WAY OF USE (I/III)

Introduce the required directories

sources_data_file: the txt file from Oscar program

events_data_file: the txt file with LIS info, from HDF processor

LMA vs LIS comparator

WAY OF USE (II/III)

Specify timestep with “etimestep” variable

10e-3 recommended

LMA vs LIS comparator

WAY OF USE (III/III)

Select modes

correcting 1/0

toinput 1/0

storedinput 1/0 (by “fovtime” variable)

```
fovtime=[datetime(2017,10,18,17,01,25), datetime(2017,10,18,17,01,28)];
```

plotting 1/0

save_workspace 1/0

savingcsvfile 1/0