RELEC Mission: First Results TLE study in ultraviolet and infrared ranges of light spectrum with help of DUV instrument.

DUV is a part of scientific payload RELEC operating on board of MKA-FK2 microsatellite

Main goal of RELEC mission is to study relativistic electron fluxes arising in thunderstorms or in the Earth's radiation belts and there relation to the short time atmospheric luminescence in optical, radiofrequency and gamma ray ranges in global and near Earth space scale.

On behave of RELEC science team

G.K. Garipov
Skobeltsyn Institute of Nuclear Physics,
Moscow State University, Russia

Content.

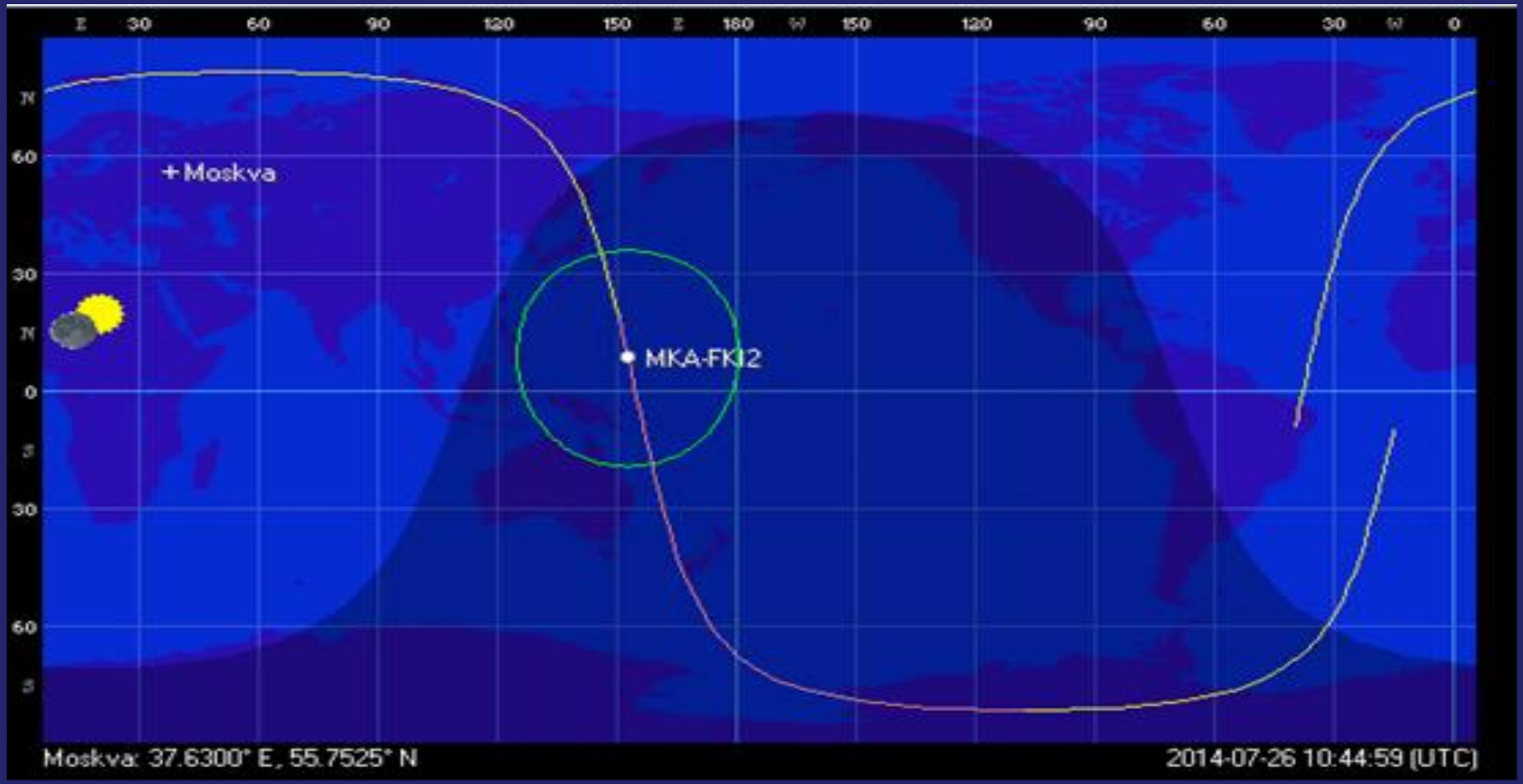
1. DUF Instrument
2. First results ultraviolet and infrared radiation observation with help of RELEC set up on board of the MKA -FK2 microsatellite

Scientific instrument principal investigator SINP MSU
Satellite construction with serves blocs was made by SPA "S.A.Lavochkin"

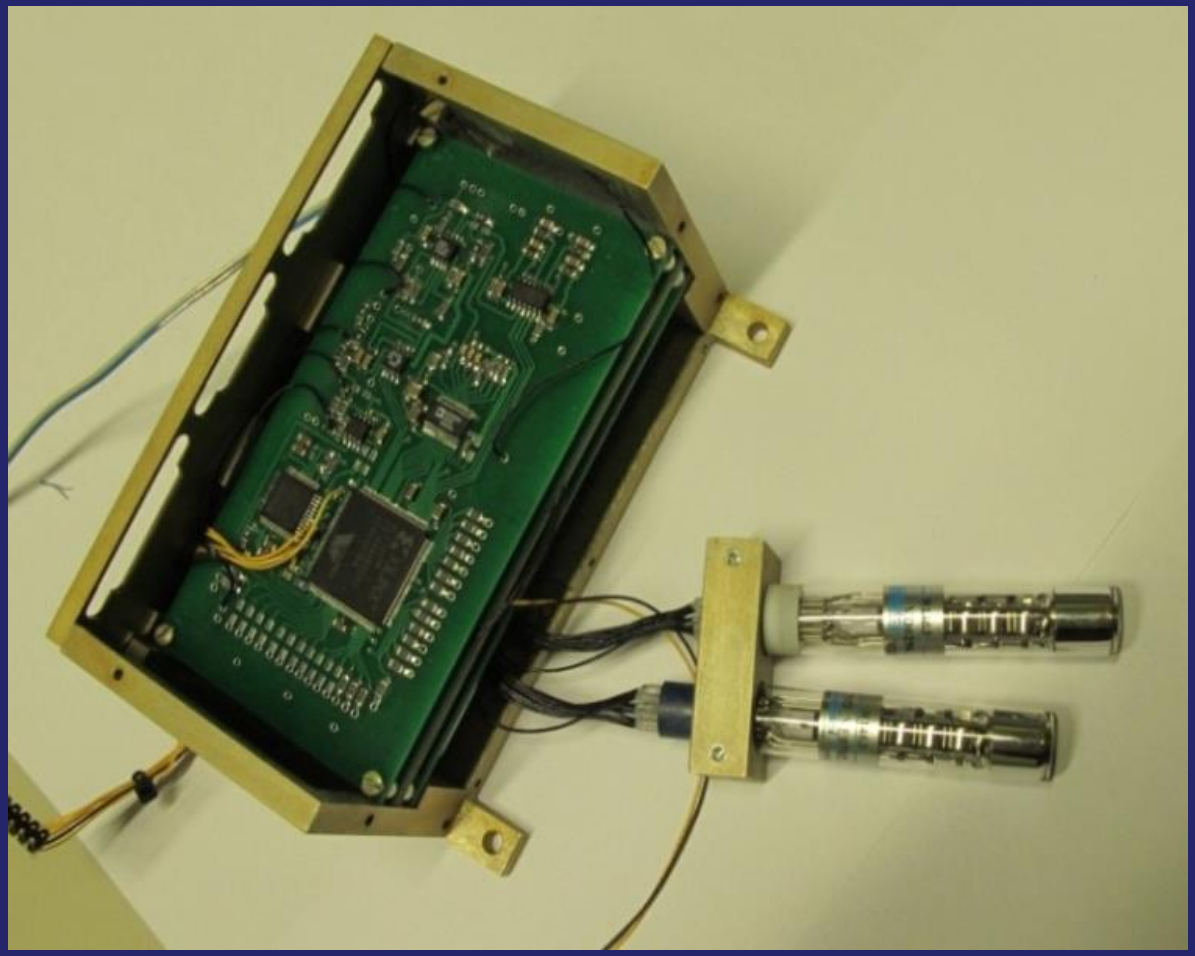
Science team leader - Mikhail Panasyuk.
Together with Sergey Svertilov – SINP MSU & Stanislav Klimov SRI RAS

Co-executers
Space Research Institute, Russia
"S.A.Lavochkin" Scientific and Production Association., Russia
NILAKT, Russia
Etvosh University, Hungary
Sungkyunkwan University (SKKU)., Seoul, Korea
Space Research Centrum, Poland Academy of Sciences, Poland
Lvov Center of Space Research Institute, Ukraine

Speaker contribution to this work are design and manufacturing of DUV detector, development of research methods, on-line data processing and analysis



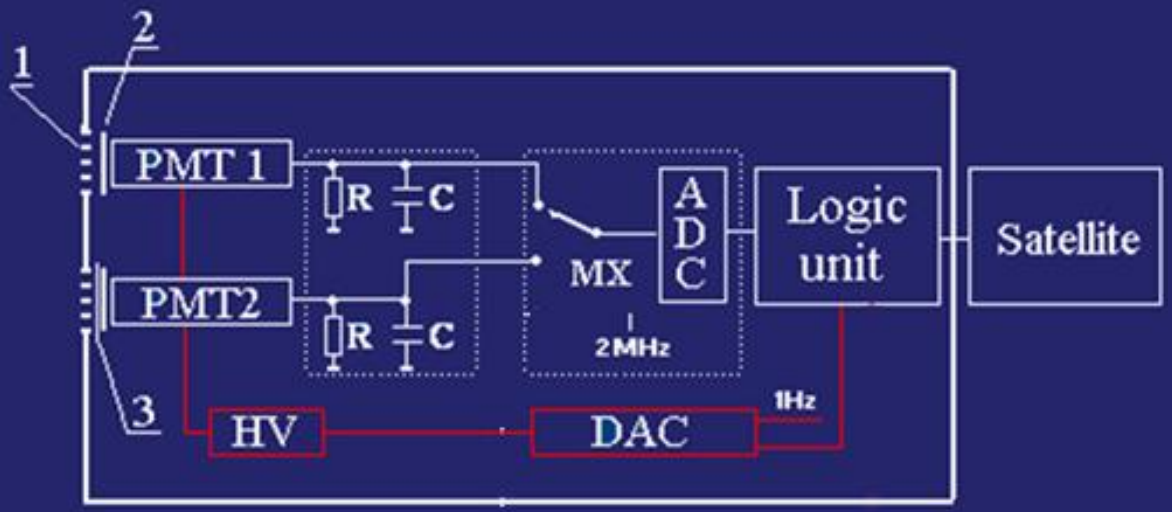
Norad: 40070U Inter. ID: 14037B
Launch.: 2014 .07.09
Period: 99.2 min.
Revs/day: 14.5
Incl.: 98.4 degrees
Apogee: 819 km
Perigee: 621 km



UV – 300-400nm
IR – 610-800nm
Sensitive area 0.4cm²
Field of view ~ 20⁰

UV and IR detector

Block-diagram of the UV & IR detector

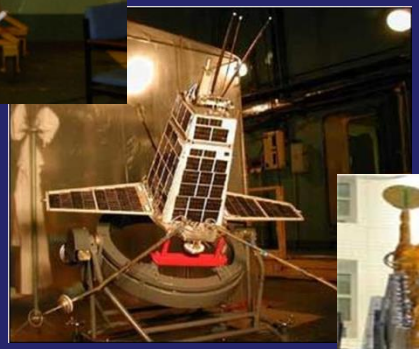


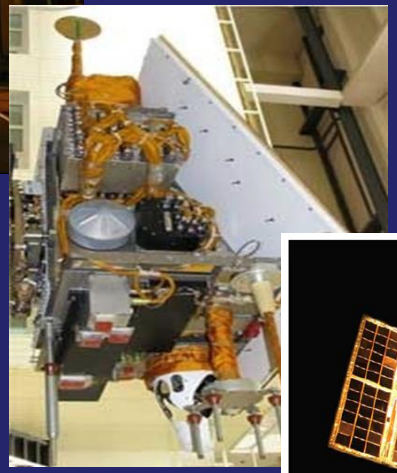
1.Signal finding algorithm of the brightest flashes in every 5sec. time interval.
2. Gain control algorithm to fix PMT anode current at a given level in the whole expected airglow range.
3.Interface algorithm for communication with the satellite board.

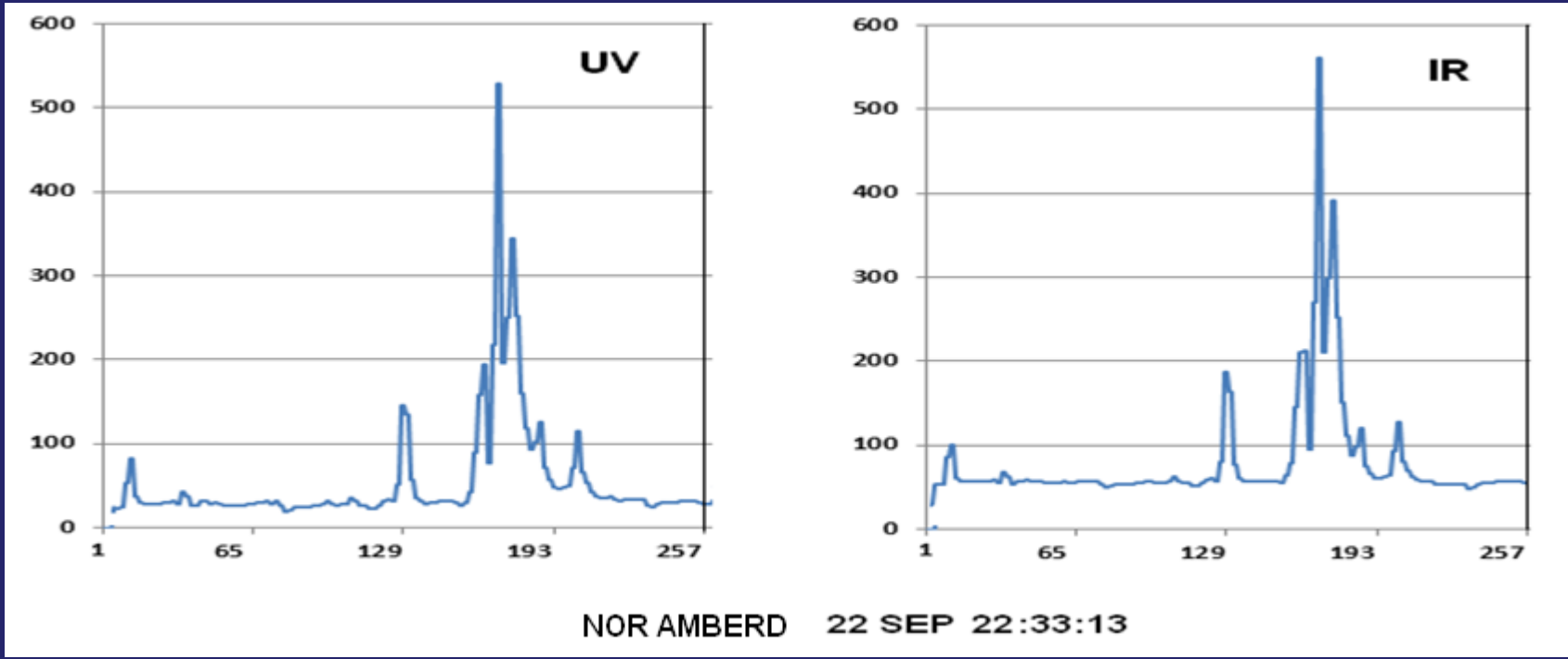
UV&IR detector comprises 2 PMT tubes and electronics block.
(first two tubes measure an optical radiation, third measures the charge particle background)

Two code are recorded and used in measurements:
M- PMT gain DAC code and N- the PMT anode current ADC code

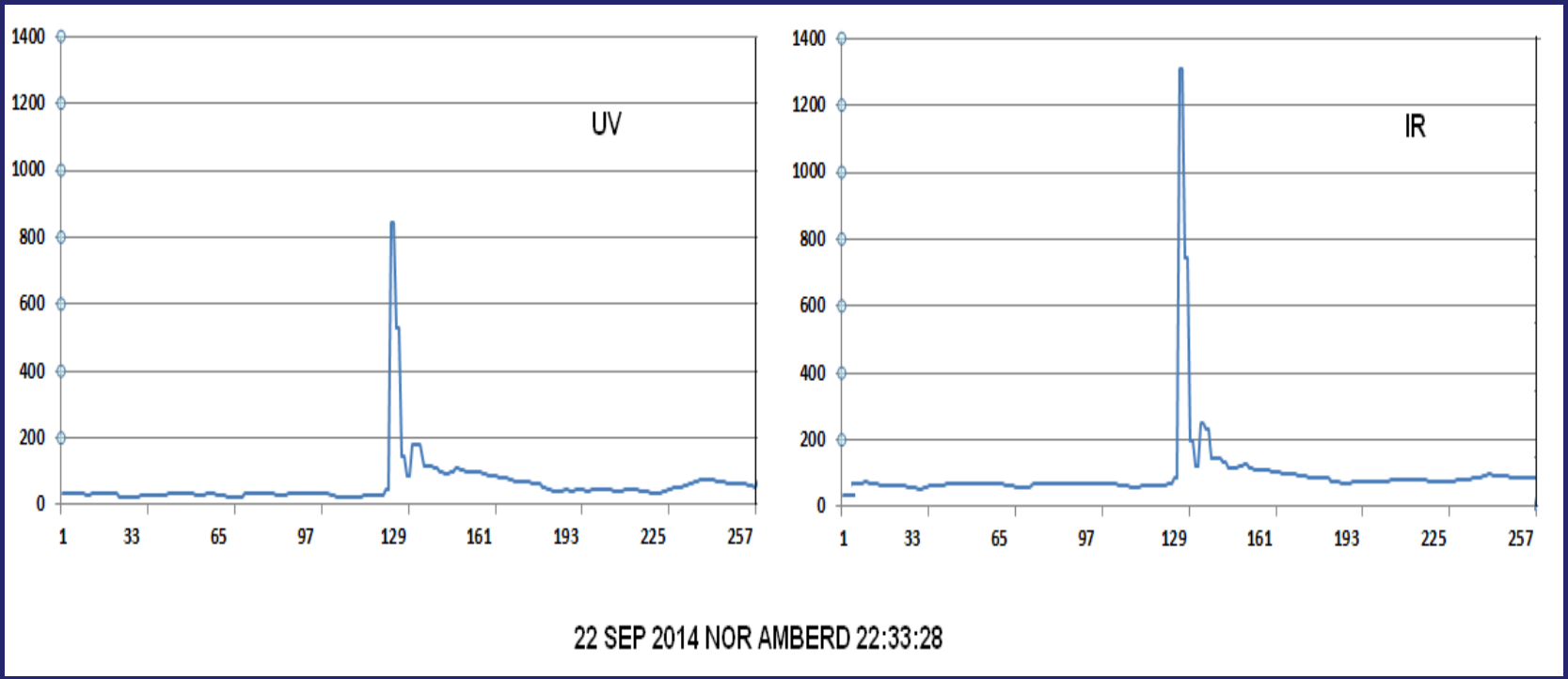
(1) collimator, (2) UV-1 filter, (3) IR filter, MX—multiplexor, HV—voltage supply for PM tubes, ADC and DAC—analog-digital and digital-analog convertors, Logic Unit-FPGA.



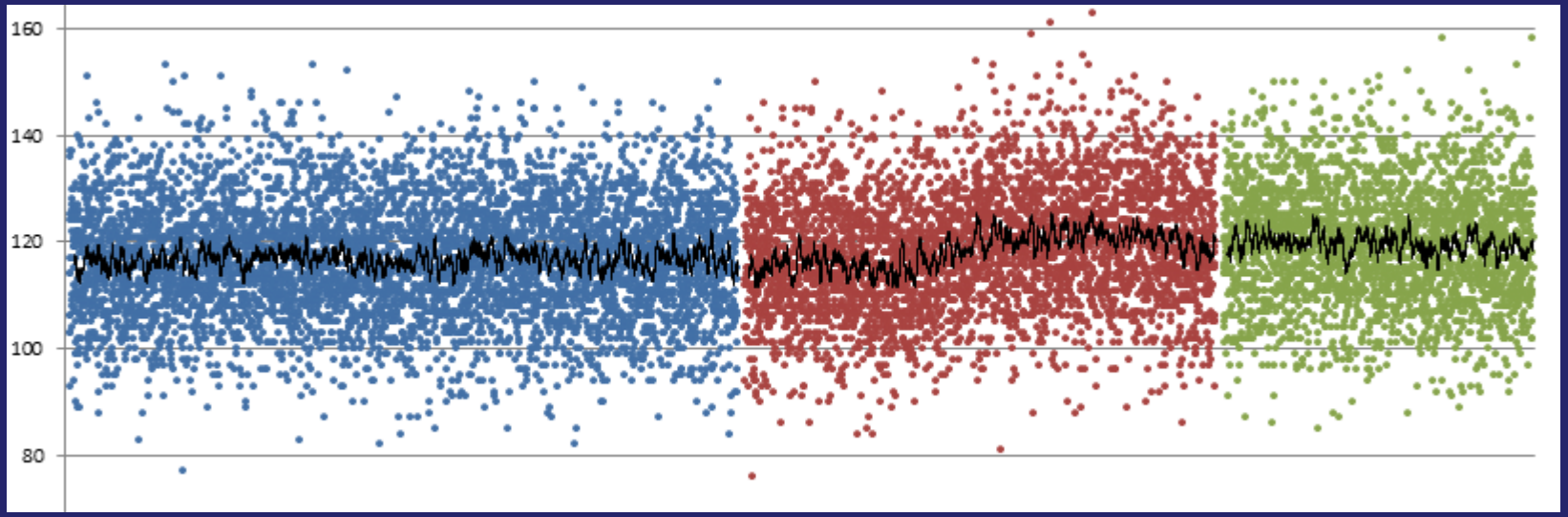




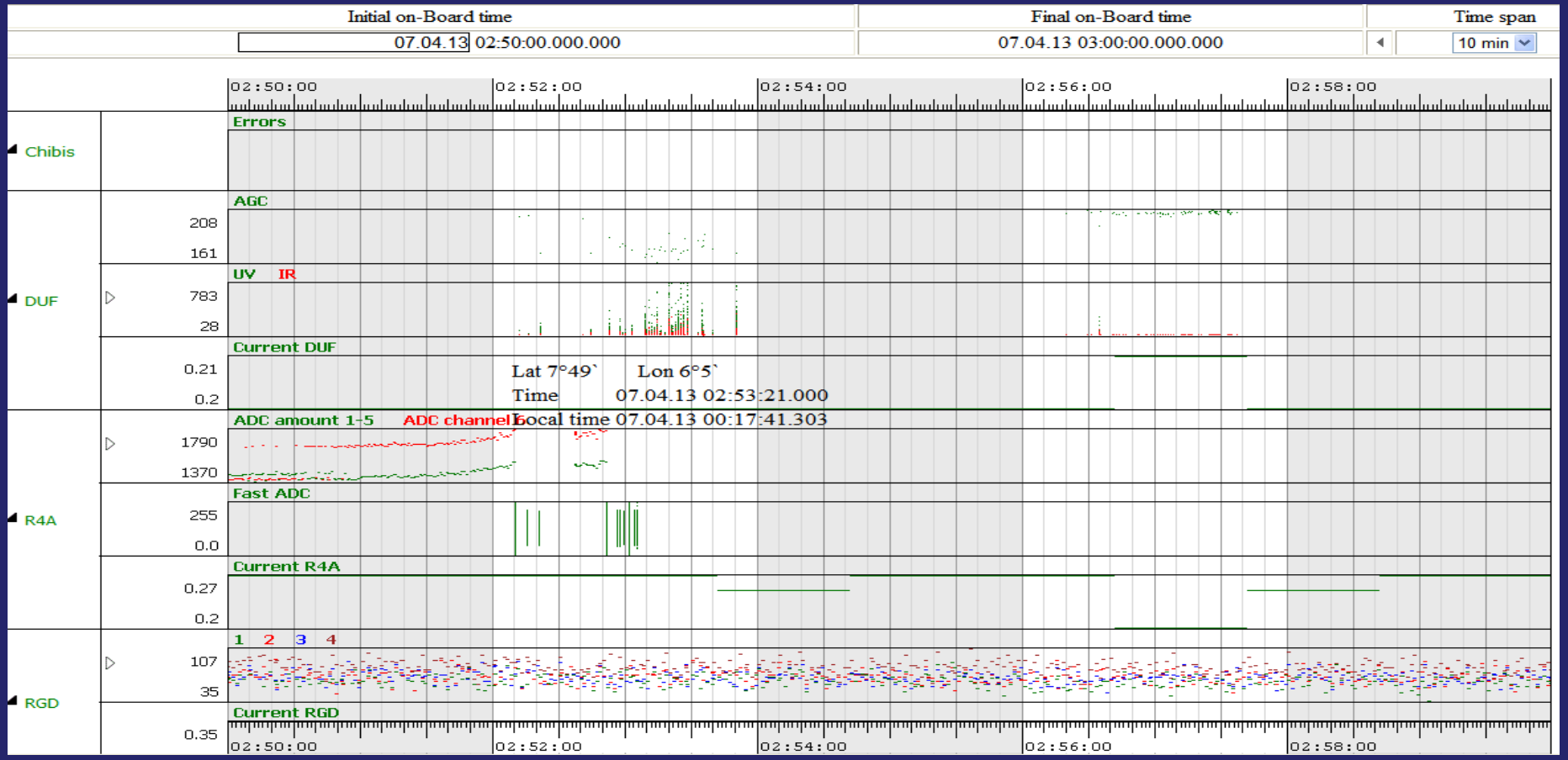
TEPA 2014 Armenia, NOR AMBERD 22-26 SEP 2014

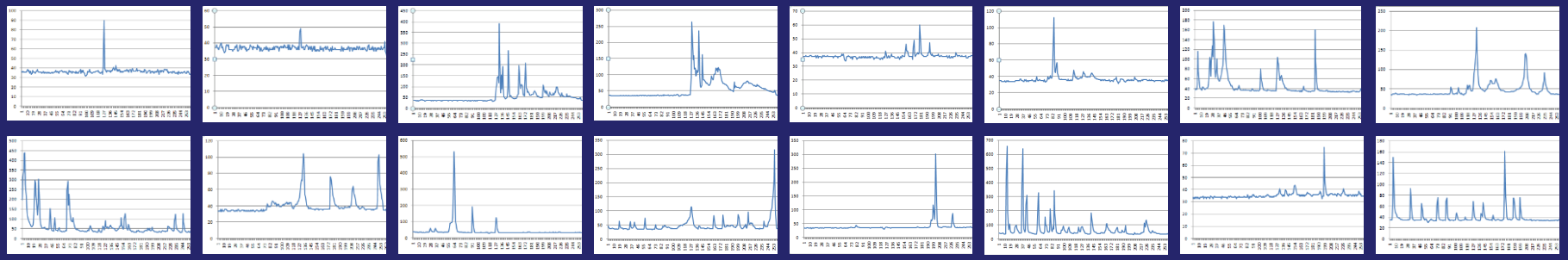

1400
1200
1000
800
600
400
200
0
UV
1
33
65
97
129
161
193
225
257
1400
1200
1000
800
600
400
200
0
IR
1
33
65
97
129
161
193
225
257
22 SEP 2014 NOR AMBERD 22:33:28

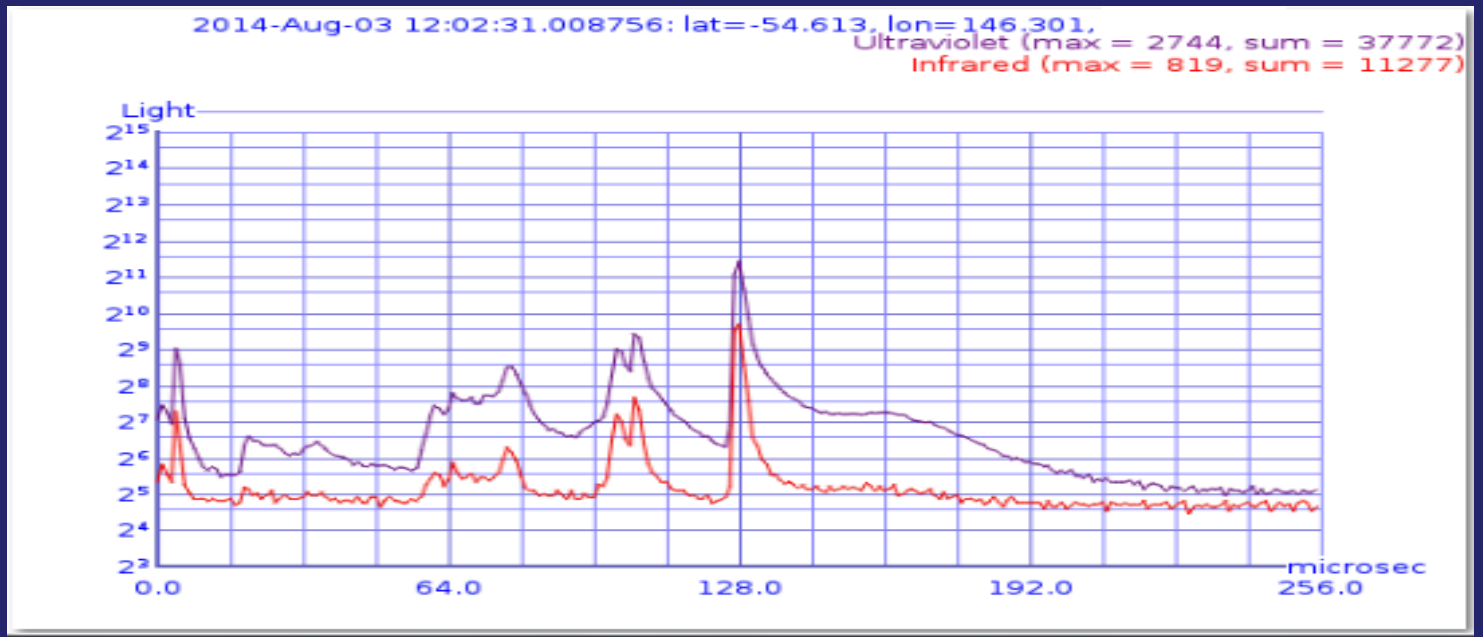
Preliminary
22 SEP 2014 from 20:00 to 22:30 pm

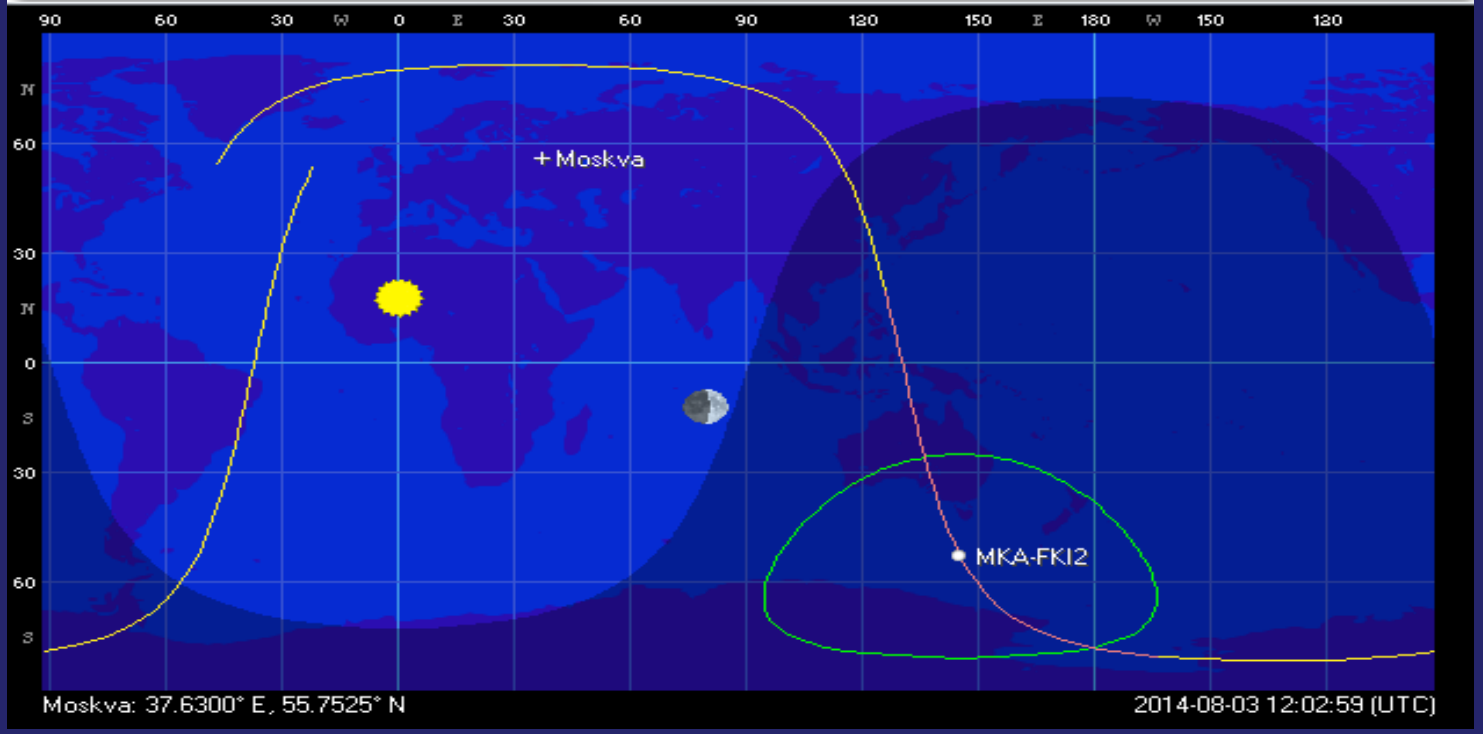


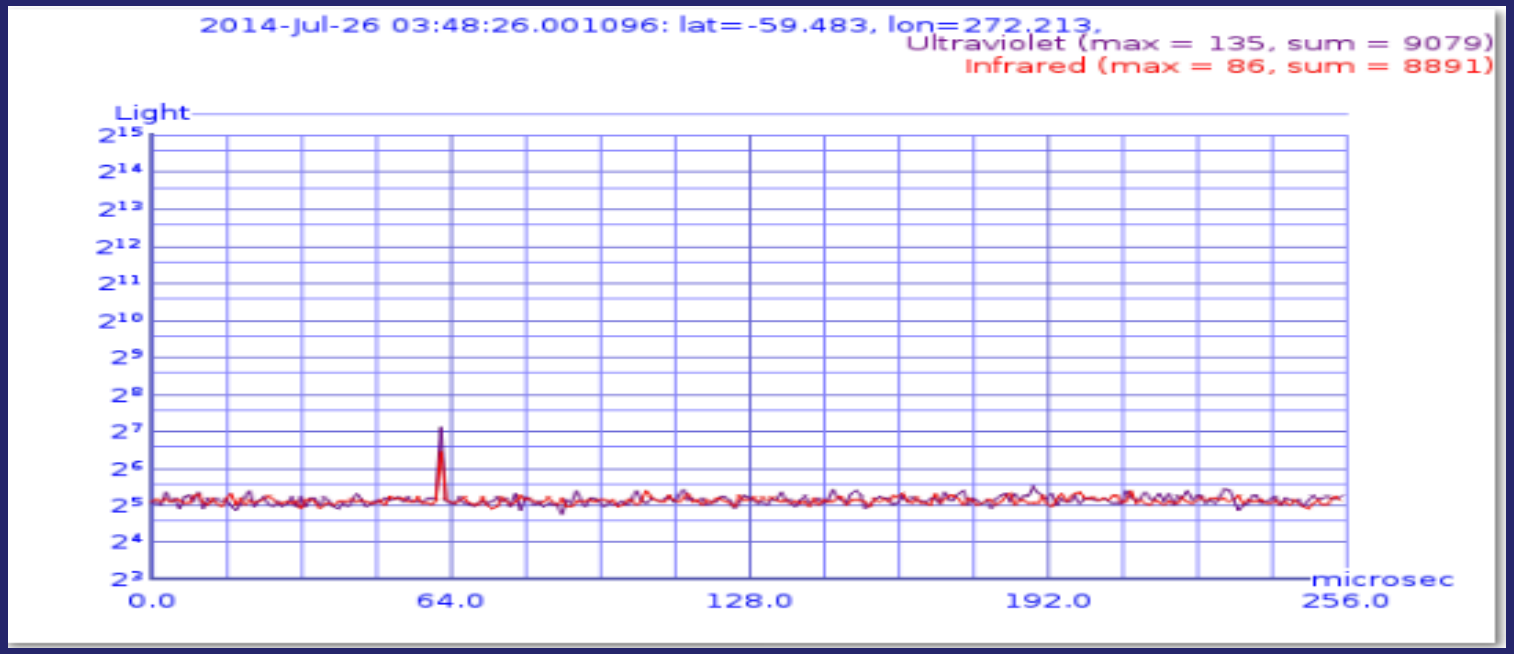
Example of local series of flashes recoded by CHIBIS-M above Africa

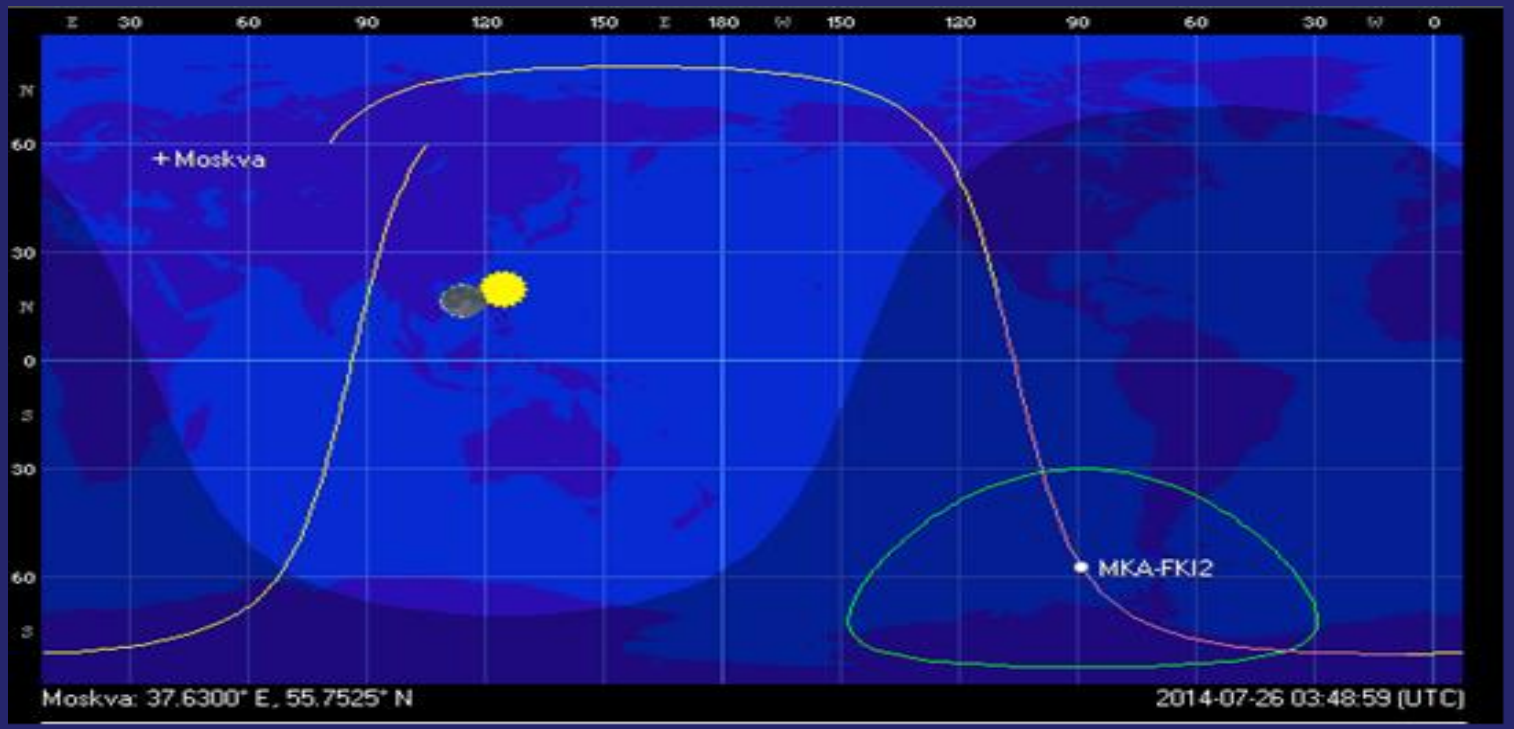


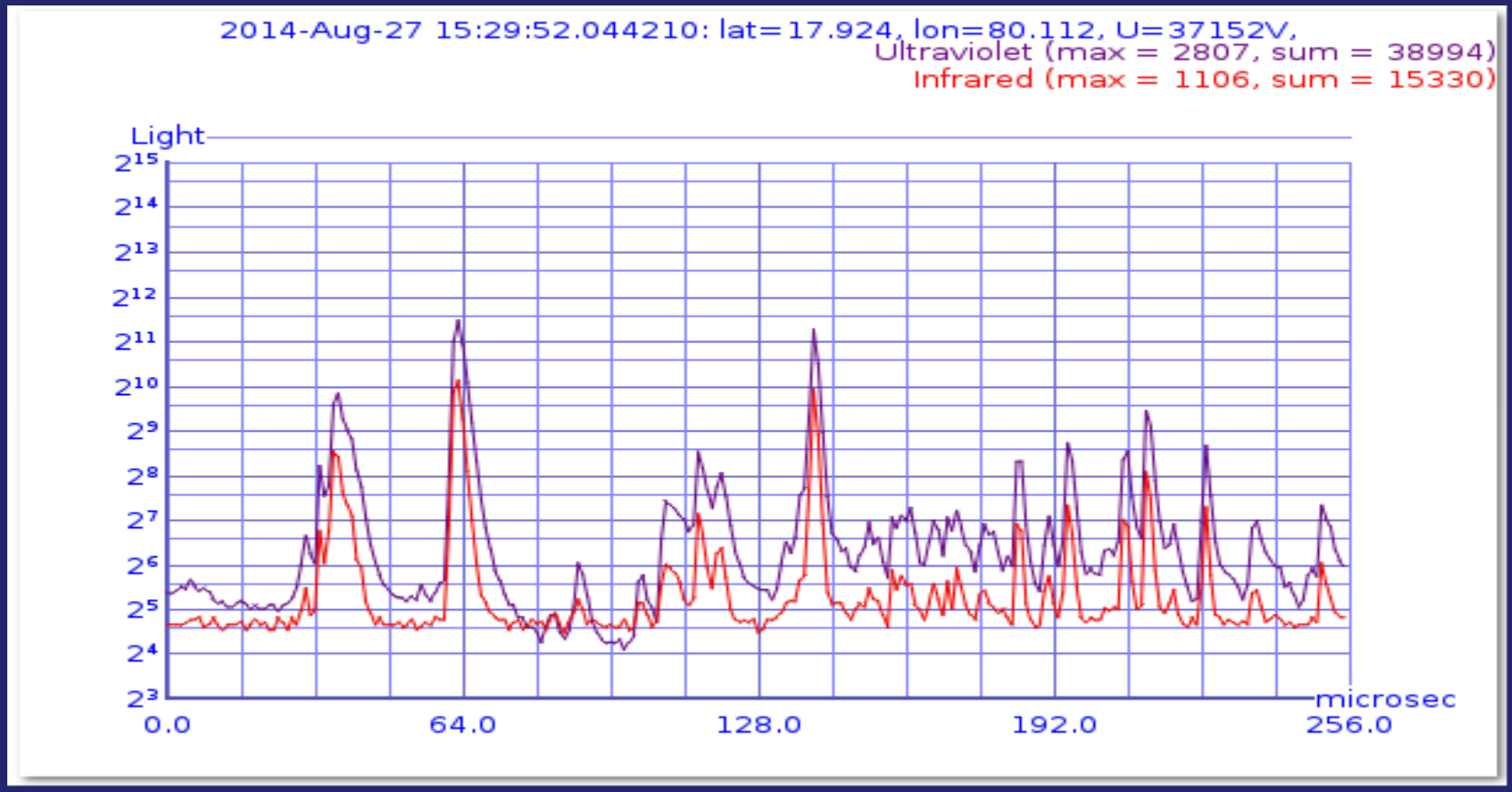


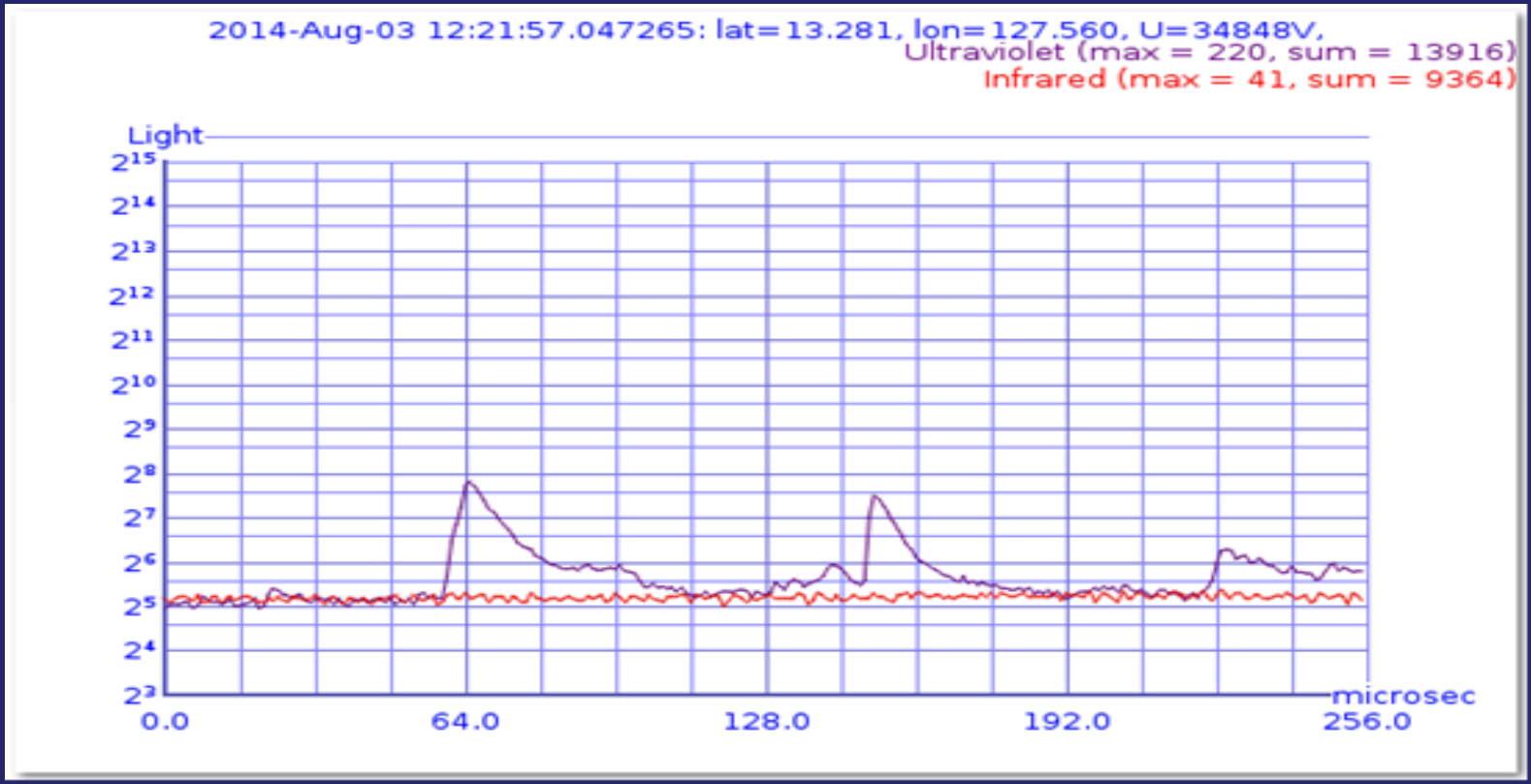

2014-Aug-03 12:02:31.008756: lat=-54.613, lon=146.301,
Ultraviolet (max = 2744, sum = 37772)
Infrared (max = 819, sum = 11277)
Light
microsec
0.0
64.0
128.0
192.0
256.0

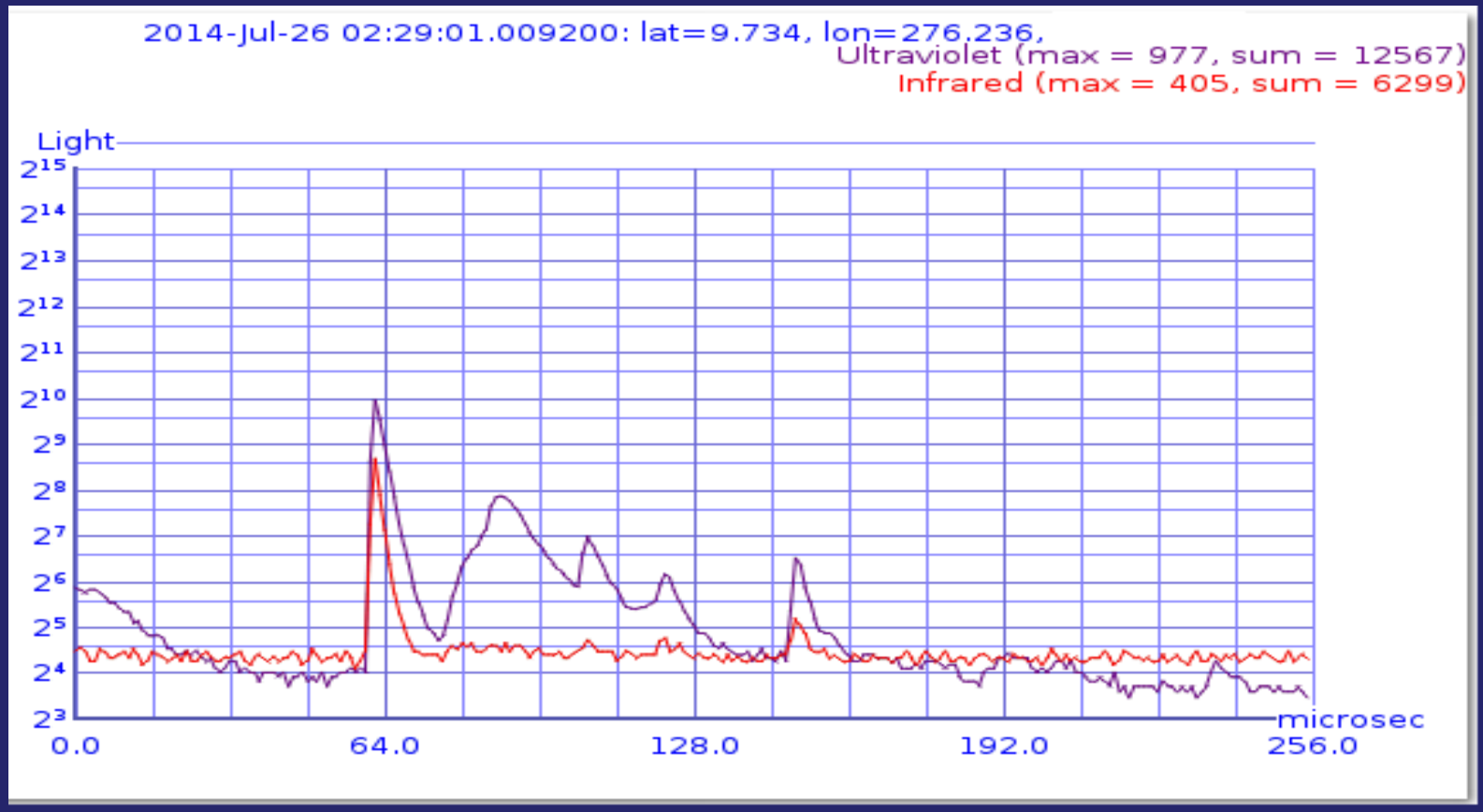

Moskva
MKA-FKI2
Moskva: 37.6300° E, 55.7525° N
2014-08-03 12:02:59 (UTC)

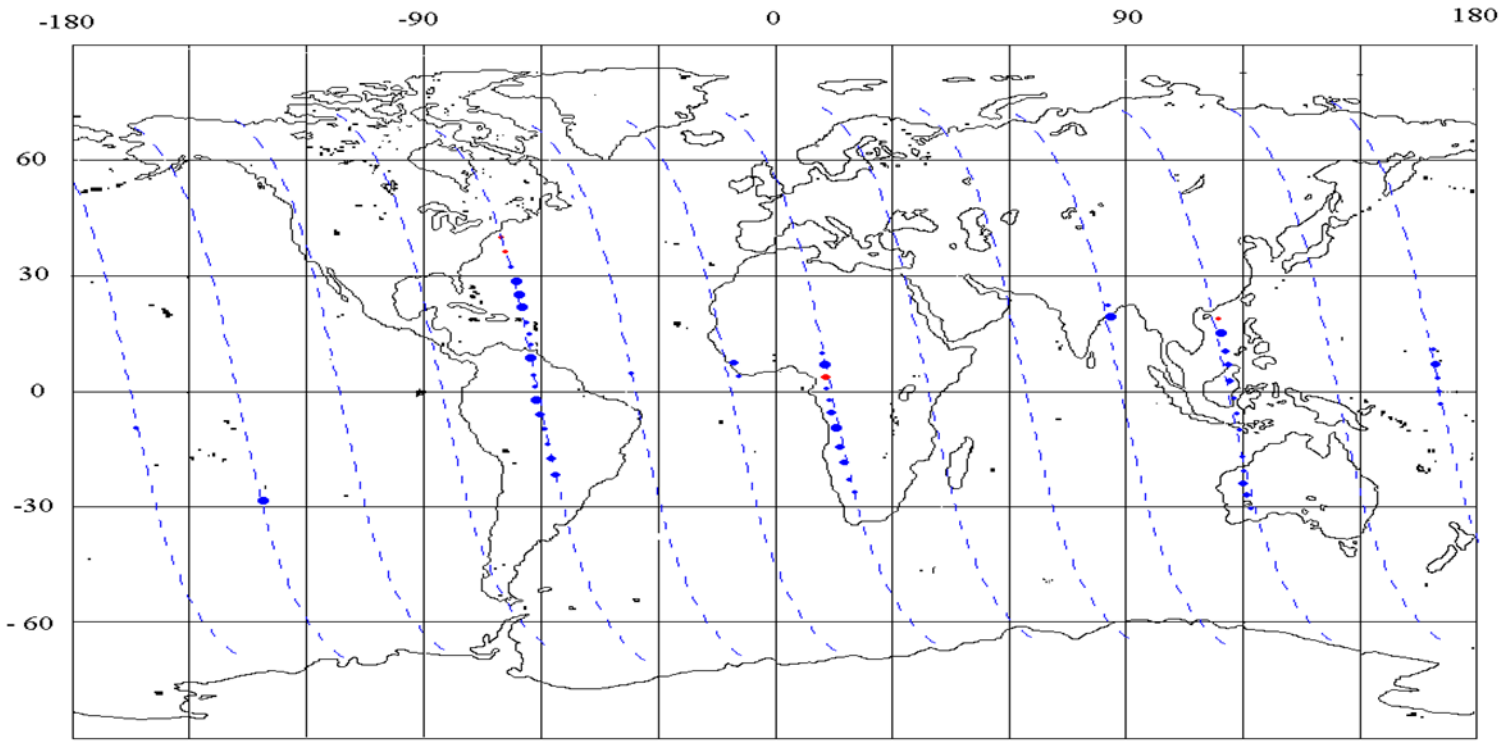

2014-Jul-26 03:48:26.001096: lat=-59.483, lon=272.213,
Ultraviolet (max = 135, sum = 9079)
Infrared (max = 86, sum = 8891)
Light
2^{15}
2^{14}
2^{13}
2^{12}
2^{11}
2^{10}
2^{9}
2^{8}
2^{7}
2^{6}
2^{5}
2^{4}
2^{3}
0.0
64.0
128.0
192.0
256.0
microsec


Moskva
MKA-FKI2
Moskva: 37.6300° E, 55.7525° N
2014-07-26 03:48:59 (UTC)

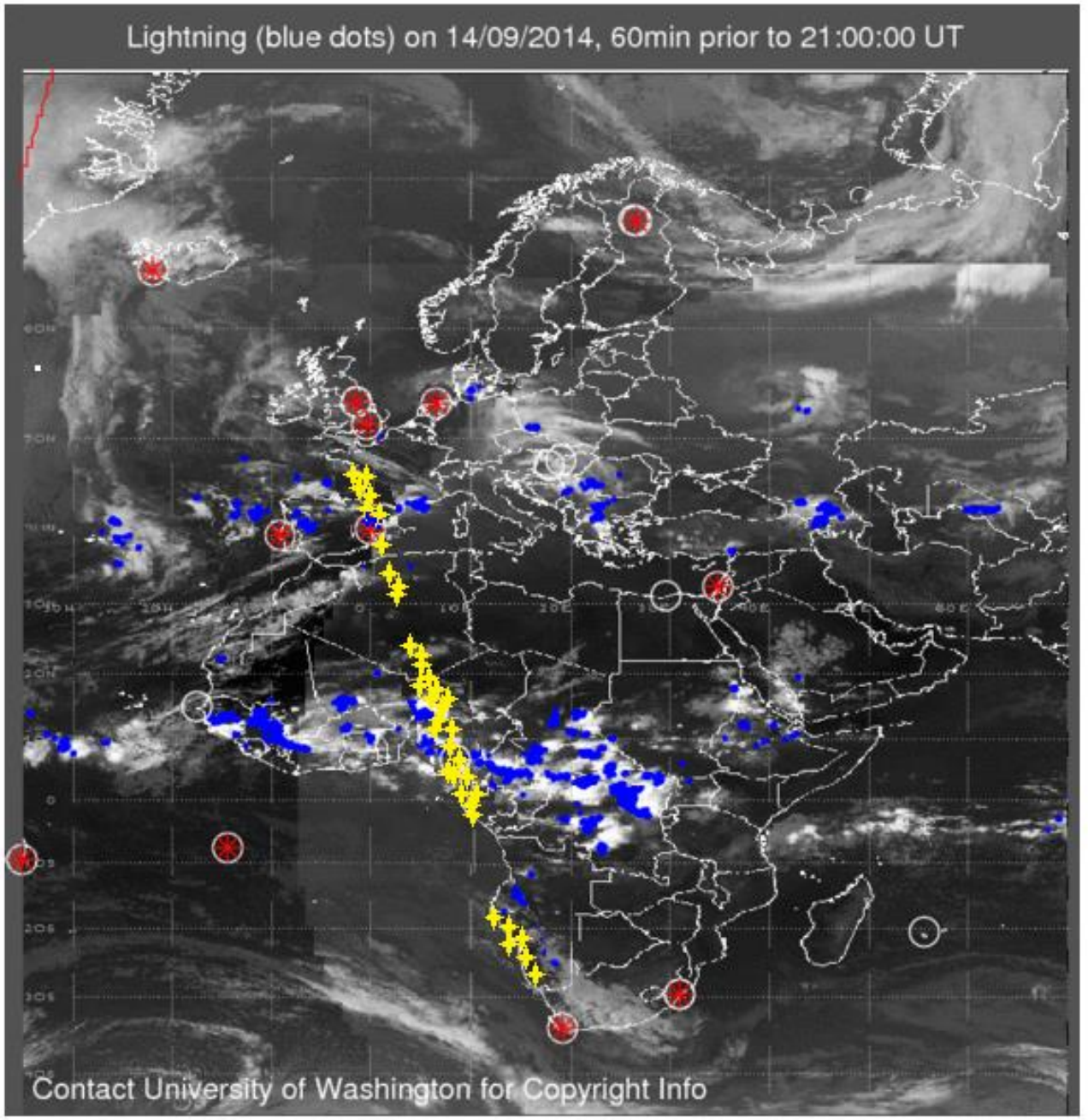

2014-Aug-27 15:29:52.044210: lat=17.924, lon=80.112, U=37152V,
Ultraviolet (max = 2807, sum = 38994)
Infrared (max = 1106, sum = 15330)
Light
2^{15}
2^{14}
2^{13}
2^{12}
2^{11}
2^{10}
2^{9}
2^{8}
2^{7}
2^{6}
2^{5}
2^{4}
2^{3}
0.0
64.0
128.0
192.0
256.0
microsec


2014-Aug-03 12:21:57.047265: lat=13.281, lon=127.560, U=34848V,
Ultraviolet (max = 220, sum = 13916)
Infrared (max = 41, sum = 9364)
Light
2^15
2^14
2^13
2^12
2^11
2^10
2^9
2^8
2^7
2^6
2^5
2^4
2^3
0.0
64.0
128.0
192.0
256.0
microsec

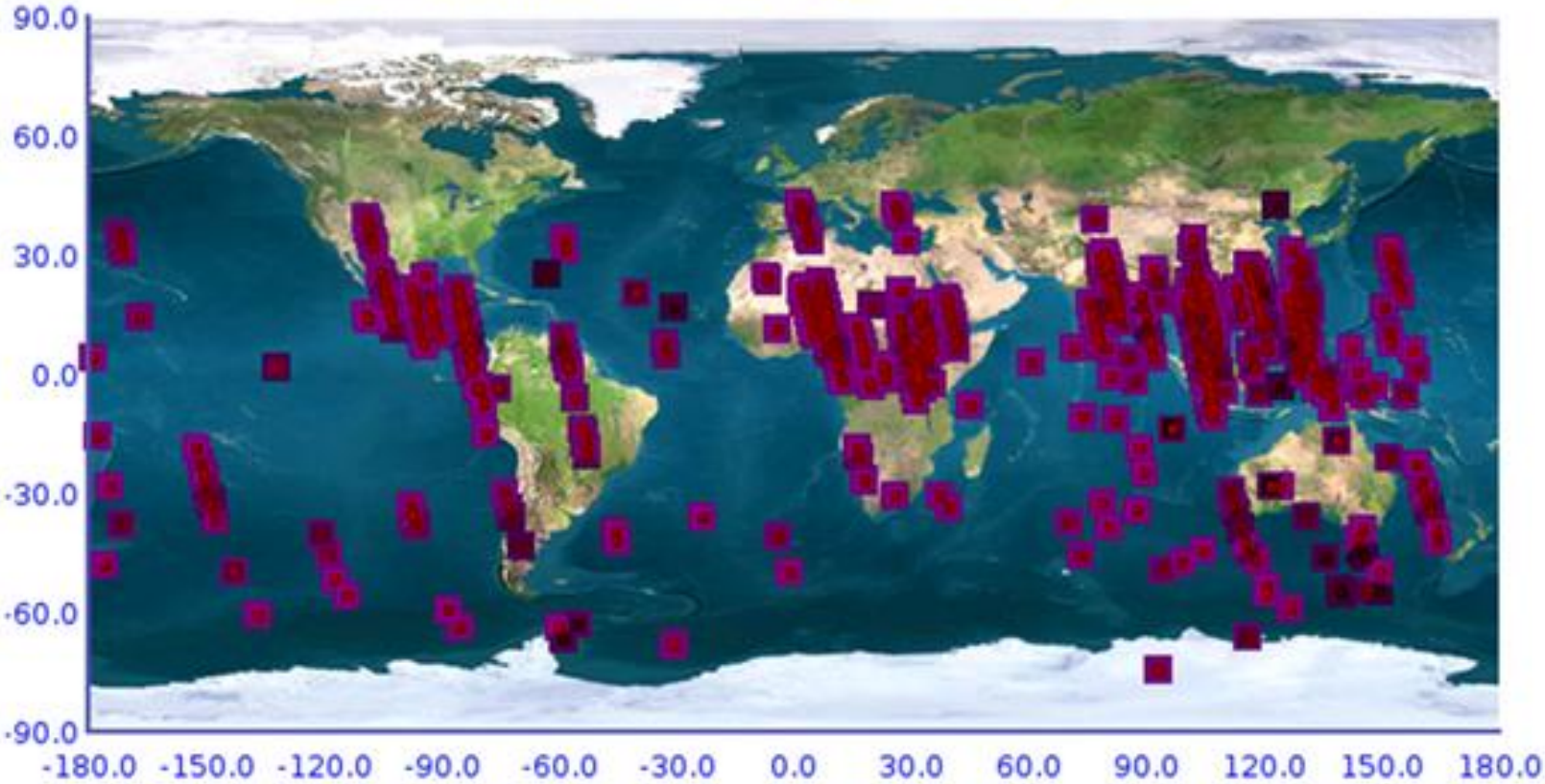

2014-Jul-26 02:29:01.009200: lat=9.734, lon=276.236,
Ultraviolet (max = 977, sum = 12567)
Infrared (max = 405, sum = 6299)
Light
2^15
2^14
2^13
2^12
2^11
2^10
2^9
2^8
2^7
2^6
2^5
2^4
2^3
0.0
64.0
128.0
192.0
256.0
microsec


-180
-90
0
90
180
60
30
0
-30
- 60

Q_a/N_s	1	2	3	4	>4	Total number of flashes
10^{20}–10^{22}	202	59	48	18	49	372
10^{22}–10^{23}	118	146	128	85	222	699
>10^{23}	44	58	56	37	103	298


Lightning (blue dots) on 14/09/2014, 60min prior to 21:00:00 UT
Contact University of Washington for Copyright Info

Карта зарегистрированных вспышек



Thank you !