

HNRAO Observing Log
40.673181 N – 80.437885 W
EN90sq



Date: December 11, 2019

Object: Jupiter – Io-C

Observer: Unattended

Start - Time UT:	1715	Planetary K-index:	2
Jupiter Altitude (deg):	24.9	Jupiter Azimuth (deg):	166.9
Jupiter CML:	295.3	Jupiter Io Phase:	237.65
Jupiter RA (hr/min):	18:06	Jupiter Dec (hr/min):	-23:19
Hour Angle (hr/min):	-00:52	Polarization	LCP
Sun Altitude (deg):	26.4	Sun Azimuth (deg):	26.4
Sun RA (hr/min):	17:05	Sun Dec (hr/min):	-22:51

End – Time UT:	1852		
Jupiter Altitude (deg):	25.2	Jupiter Azimuth (deg):	190.9
Jupiter CML:	352.31	Jupiter Io Phase	250.96
Hour Angle (hr/min):	00:43	Duration (min):	48
Sun Altitude (deg):	22.1	Sun Azimuth (deg):	205.7
Max Frequency MHz	24	Min Frequency MHz	16.5
J/S Degree Separation	014.6	De:	-2.1

Observatory Configuration

Spectrograph Receiver	Antenna	Polarization	System Loss	Multicoupler	Multicoupler port	Calibrated
FSX-8S	TFD	RCP LCP	-8.35 dB -7.59 dB	#2 RCP #1 LCP	Port 1 +10dB Port 1 +10dB	Twice daily Twice daily
FSX-2	LWA	RCP/LCP manual select		N/A	N/A	N/A
SDRPlay RSP2 #1	TFD	RCP	-8.35 dB	#2 RCP	Port 2 +3dB	Twice daily
SDRPlay RSP2 #2	TFD	LCP	-7.59 dB	#1 LCP	Port 2 +3dB	Twice daily
JOVE II HNRAO #2	Jove dipoles	Linear	-3.66 dB	#3 Linear	Port 4 +3 dB	9/21/2019

Radio JOVE dipoles phased @ 32 degrees for 2018-2019 season

Typinski AN-TFD-24-4 array phased @ 35 degrees for 2018-2019 season

Four LWA antenna array phased @ 35 degrees and orientation for observation: 45 degrees

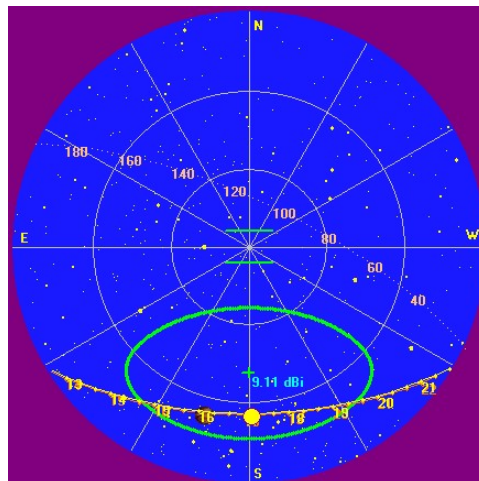
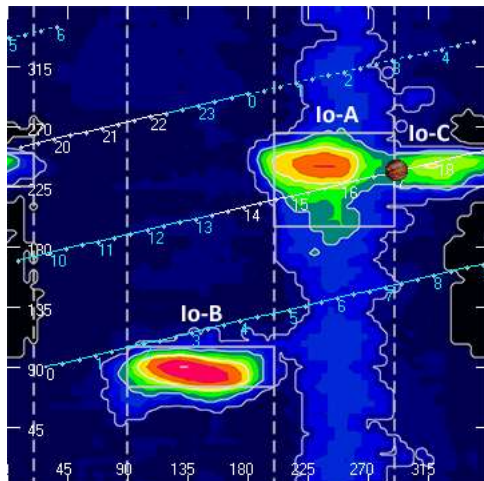
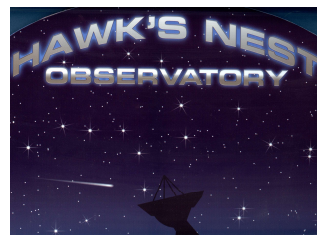
Radio Sky Spectrograph software version 2.9.30

Radio-SkyPipe software version 2.7.33 Radio-Jupiter Pro software version 3.8.2

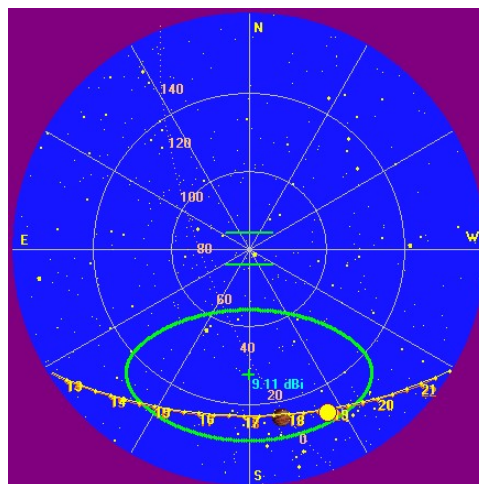
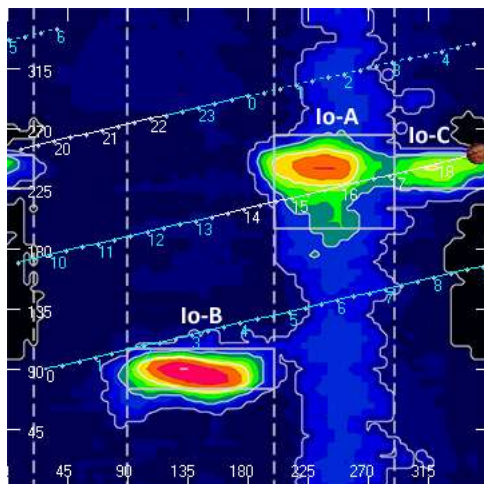
Network Time Server GpsNtp-Pi, Reeve Engineering

All times are synced with a local GPS locked NTP server.

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Beginning of Pass

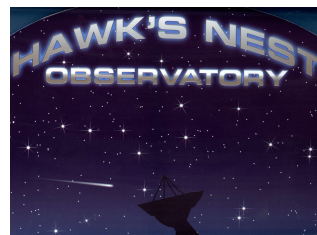


End of Pass



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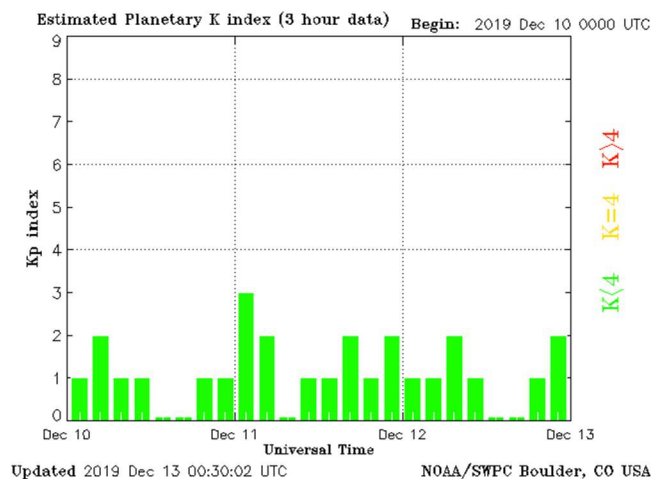


MODE	CML RANGE	Io RANGE	MAX F	POLAR	ARC	NOTES
Io-D	0-200	95-130	18	LH	Early	Also called "fourth source"
Io-B	(105 - 185)	(80-110)	39.5	RH	Early	Also called "early source"
non Io-B	80-200	0-360	38	RH	Early	Voyager info
Io-A	(200-270)	(205-260)	38	RH	Late	Also called "main source"
non-Io-A	(230-280)	0-360	38	RH	Late	
Io-C	(300-20)	(225-260)	36	RH&LH	Late	Also called "third source"
non-Io-C	300-360	0-360	32	RH&LH	Late	Voyager info

<https://www.radiosky.com/jupmodes.html>

Modulation Lanes Designations*	
L - Burst	S-Burst
L1 – No lanes	S1 – No lanes
L2 - Positive slope	S2 – Positive slope
L3 - Cross hatched	S3 – Cross hatched
L4 – Negative slope	S4 – Negative slope

*Modulation Lanes in the Dynamic Spectra of Jovian L-bursts, J.J. Riihimaa, Astron. & Astrophys. 4, 1970



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Observatory weather was 28 degrees and clear.

All antennas functioning nominally. All spectrographs operating normally. Data collected with FSX-8S and SDRPlay RSP2/LCP. The FSX-2 spectrograph was in RCP mode and there was no data applicable for this storm. The Radio JOVE / SkyPipe telescope was not operational due to local RFI. RFI was present in the spectra, especially at slightly above 19 MHz. Source unknown. Foreign broadcast station visible in spectra obscured some emissions groups between 19 MHz and 20 MHz, but overall didn't affect the data.

Equivalent antenna temperatures measured with NSEC MKII calibrator and Radio Sky Spectrograph version 2.9.30. Galactic background (GB) was sampled at different frequencies at the beginning of the storm. 17.5 MHz, 78 kK, 18.5 MHz, 96 kK, 20.5 MHz, 88 kK, 22.5 MHz, 85 kK and at 23.5 MHz, 75 kK for an average of 84.4 kK.

This was an LCP Io-C storm composed of S-bursts with some negative slope, S4, modulation lanes. The first observed signs of emissions were at 1715 UT as S-bursts at 17.5 MHz. This group lasted about 20 seconds. At 1718:20 UT, another group of S-bursts, this time much more pronounced, were observed and lasted about 30 seconds. This group were broader with a bandwidth of about 500 KHz, again, just below 18 MHz. At 1720:10, an N-event (or S-burst train), formed from a weak group of S-bursts. This feature was very strong, measured at its hottest to be 1.2 MK at 17.5 MHz, and continued until 1721:20 where it faded into a weak group of S-bursts.

Some very faint, near galactic background (GB) were observed at 1812 UT. These were also between 23 MHz and 24 MHz. Right at GB makes positive identification (L-burst vs S-burst) difficult.

At 1817 UT, a group of what appear to be S-bursts, between 22.5 MHz and 23.5 MHz, were observed. These too were slightly above GB. This group lasted about 14 seconds. This was followed by another group of be S-bursts between 1818:09 UT and 1818:24 UT. These were right at GB and makes positive identification (L-burst vs S-burst) difficult.

At 1820 UT, a more energetic group of S-bursts, with modulation lanes. These are most certainly S-bursts and span 2 MHz, from just below 22 MHz to 24 Mhz. This group trailed off into weak S-bursts right at GB, then another slightly stronger group at 23 MHz followed that lasted about 5 seconds. This group faded away at 1820:55 UT.

No more emissions were observed until 1827 UT, with a very weak group of S-bursts at 22 MHz. Again, slightly above GB and lasted about 20 seconds. At 1828:20 UT, a 30-second-long group of S-bursts were observed between 21 MHz to 22 MHz.

Another very weak group, slightly above GB, between 21 MHz and 22 MHz at 1828:20 UT.

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At 1832:30 UT, emissions dropped back down to 18 MHz with another N-event (S-burst train). This event was narrow in bandwidth, of about 30 KHz, but became wider and at the end had a bandwidth of about 750 KHz.

Emissions continued between 21 MHz and 22 MHz at 1834:40 UT. This was also slightly above GB and lasted until about 1835:10 UT.

Yet another N-event (S-burst train) was observed between 1836:10 UT faded away at 1836:40 UT. This event was between 17 MHz and 18 MHz.

Another group was observed starting at 1837:50 UT which was again, slightly above GB. This group was between about 20 MHz and 22 MHz and lasted less than 30 seconds.

Between 1839:20 UT, and 1839:40 UT, a slightly stronger group with visible modulation lanes was observed, again, between 20 MHz and 21 MHz.

A much stronger group, between 19.5 MHz and 21 MHz, was observed at 1846:35 UT with several S-bursts particularly strong. This entire event began at about 1845:40 UT and faded out around 1847:05 UT. A single S-burst here measured 600 kK.

At 1848:45 UT, a line of S-burst emissions was observed at 20 MHz. The Radio JOVE telescope was not operational due to local RFI so no SkyPipe data exists for this event.

Emissions continue to drop in frequency with a strong group between 19 MHz and 21 MHz. Another S-burst group with modulation lanes visible. Within this group were several very energetic S-bursts.

More very weak emissions at 19 MHz, at 1852:20 UT. Foreign broadcast stations beginning to obscure the emissions. This was the last identifiable Jupiter Io-C emission from this observatory.

A weak Io-C storm overall, composed of S-bursts. There were some emission groups that could not be resolved as S-bursts or L-bursts, but the identifiable bursts were S-bursts. Three N-events (S-burst trains) were the more notable events in this storm. Throughout the storm, there were emissions that remained steady around 17 MHz, which were the N-events (S-burst trains), and the other groups that spanned from 24 MHz to 19 MHz.

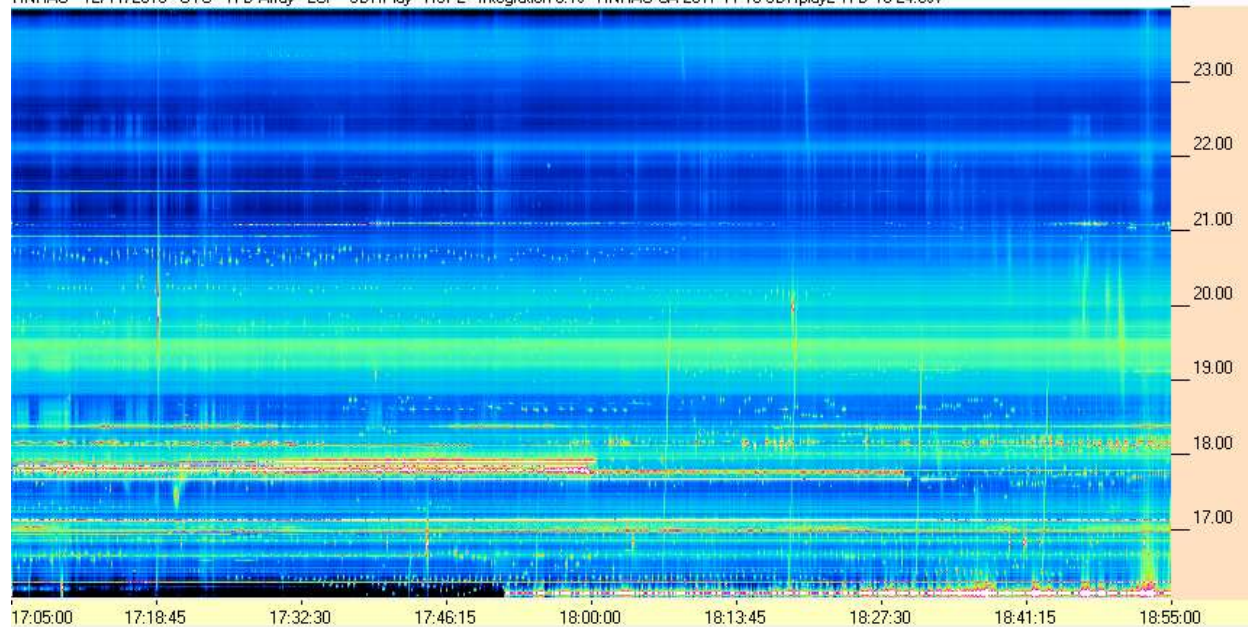
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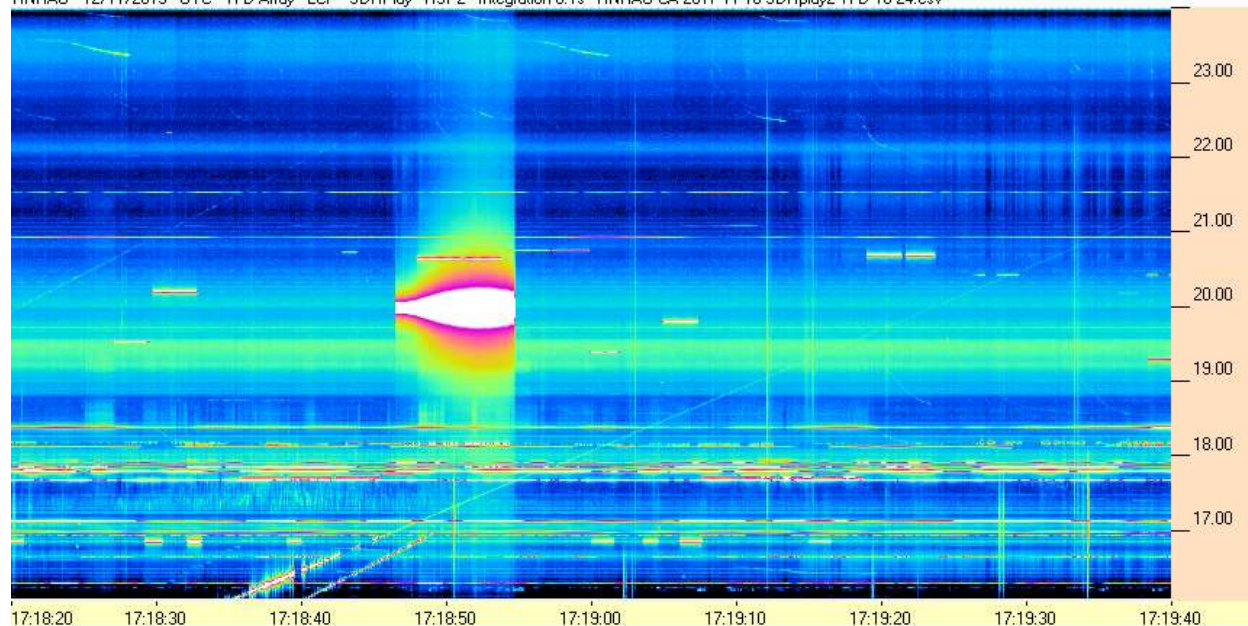


SDRPlay RSP2 / LCP / TFD Array

HNRAO - 12/11/2019 - UTC - TFD Array - LCP - SDRPlay - RSP2 - Integration 0.1s - HNRAO CA 2017 11 10 SDRplay2 TFD 16-24.csv



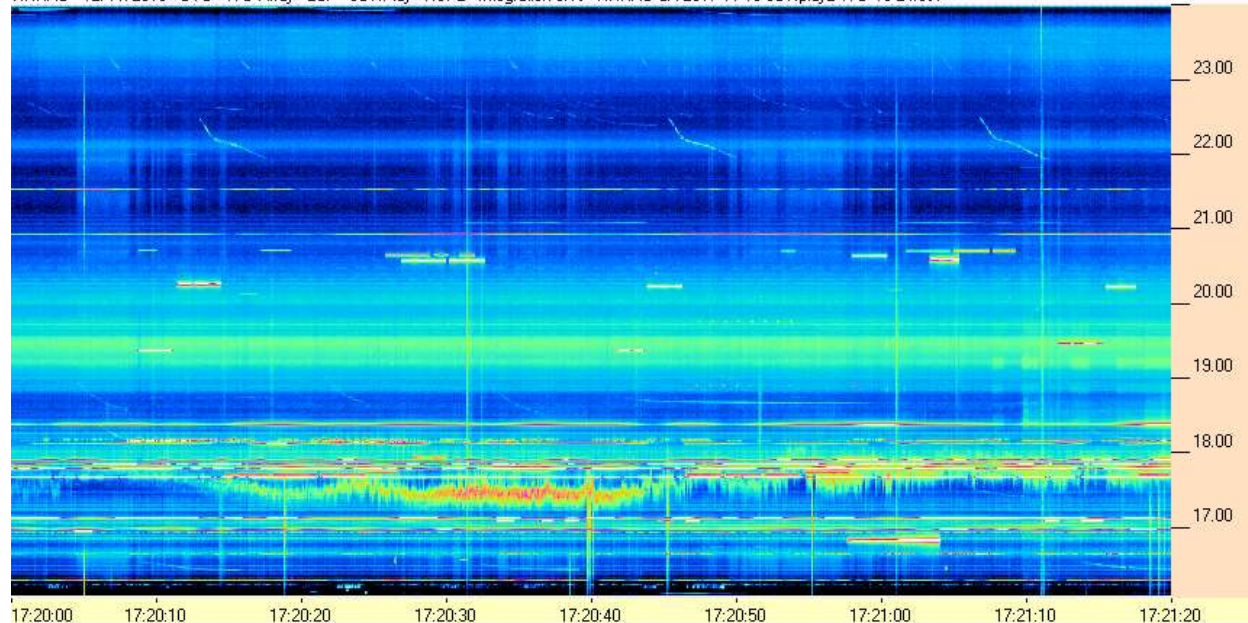
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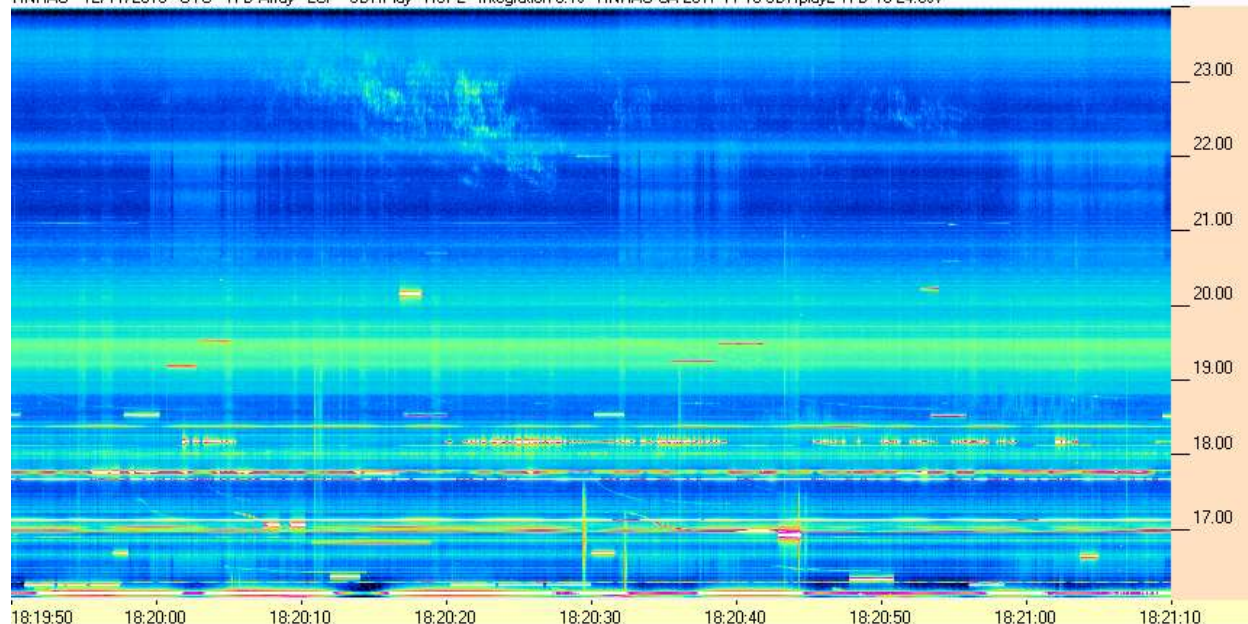
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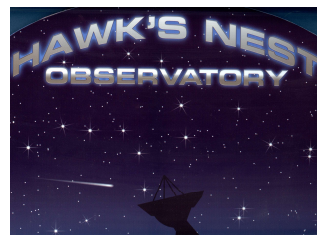
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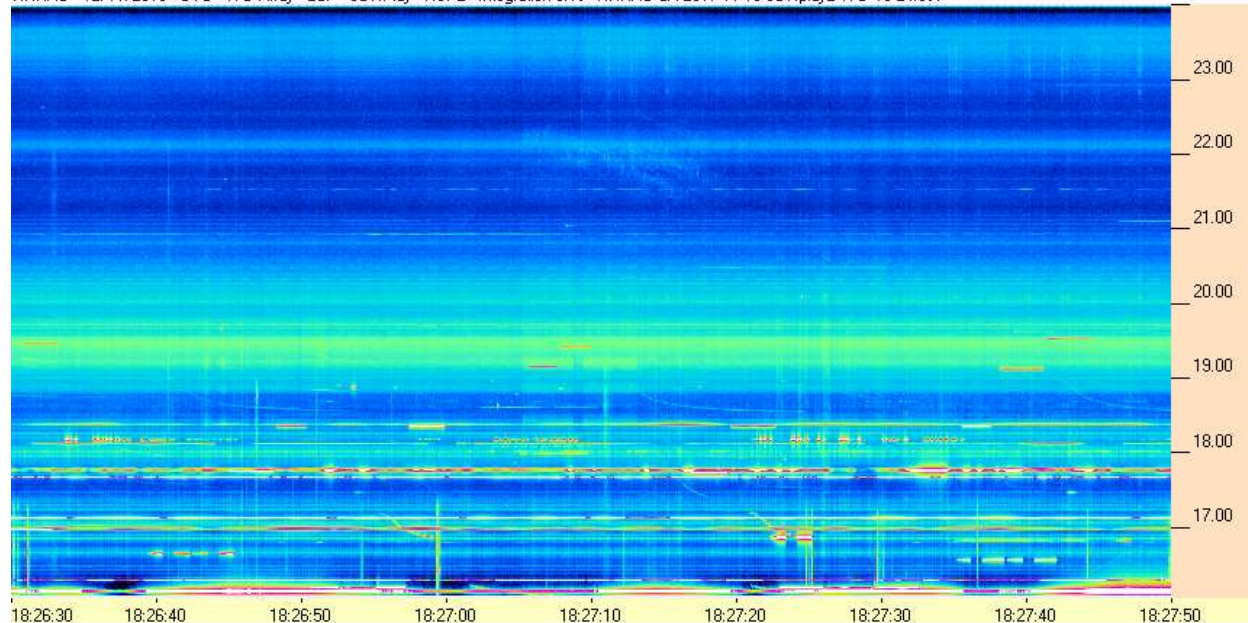
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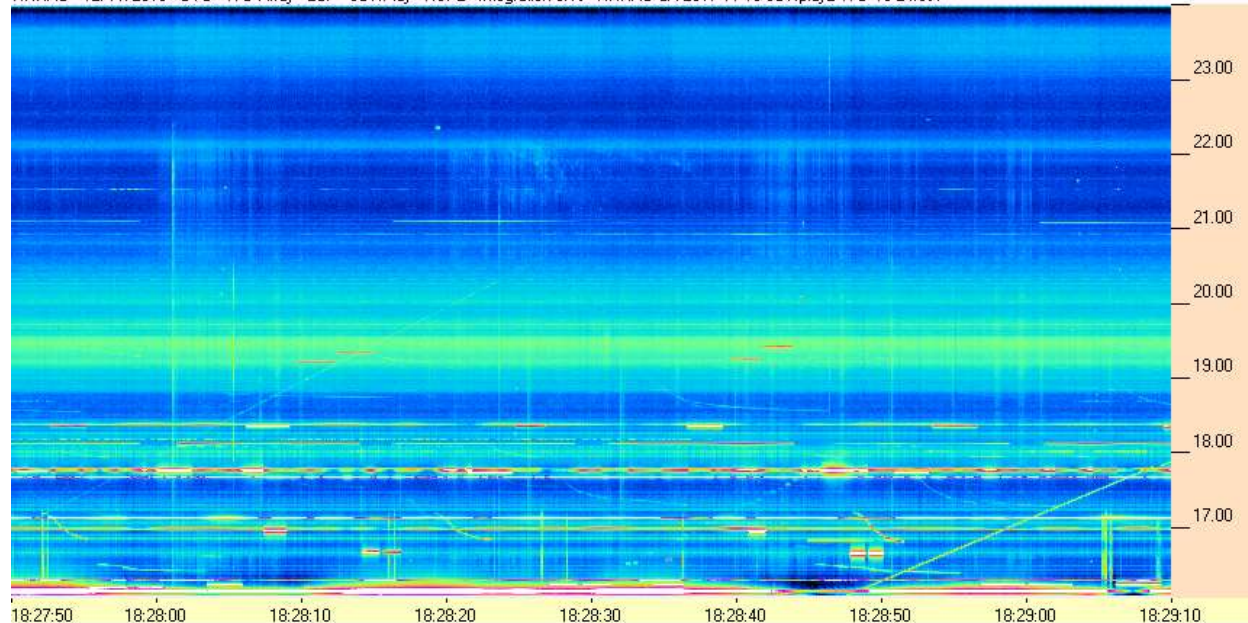
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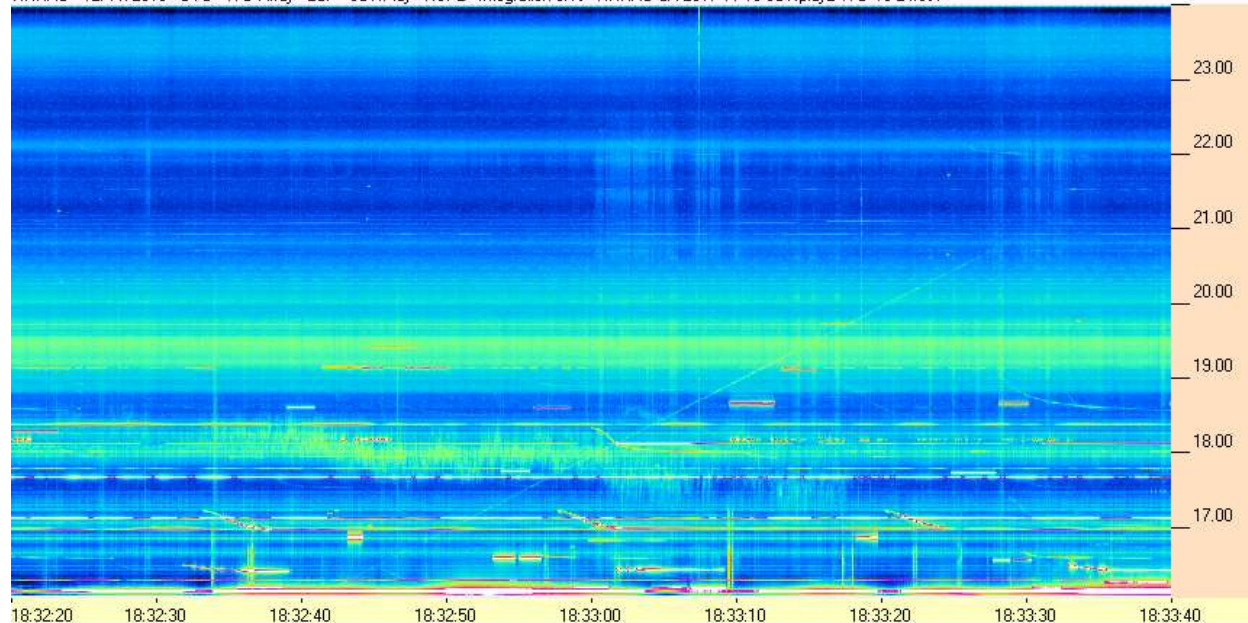


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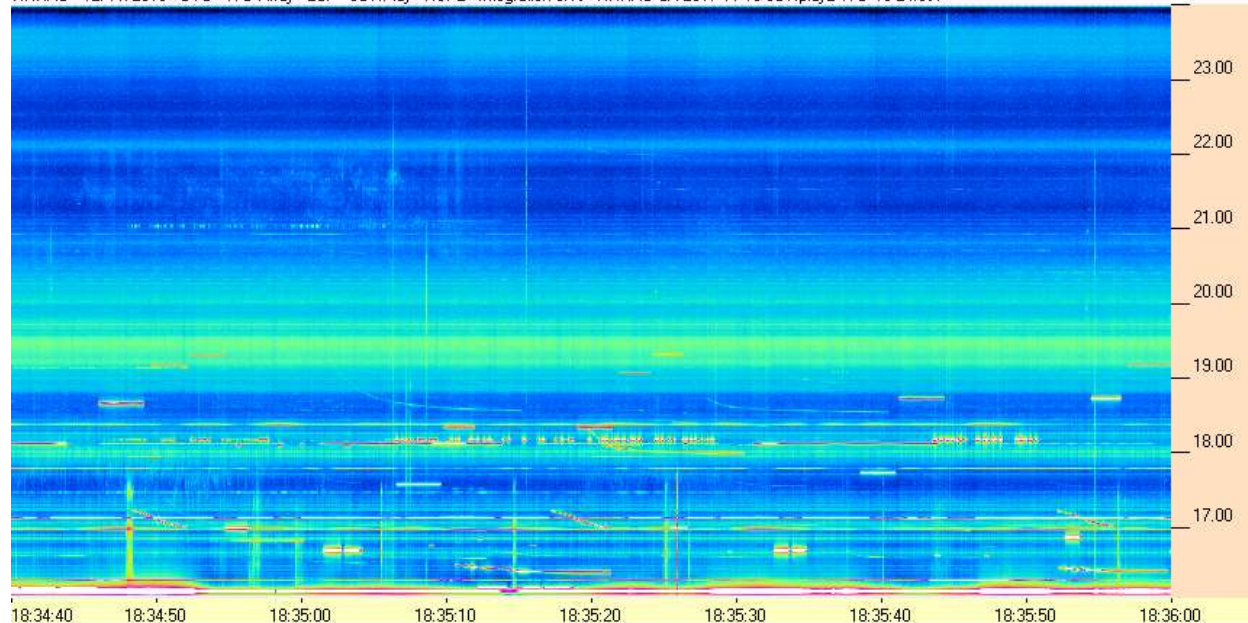
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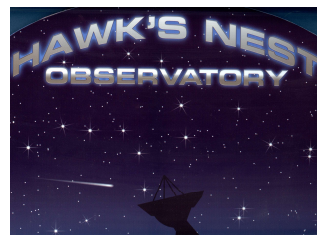
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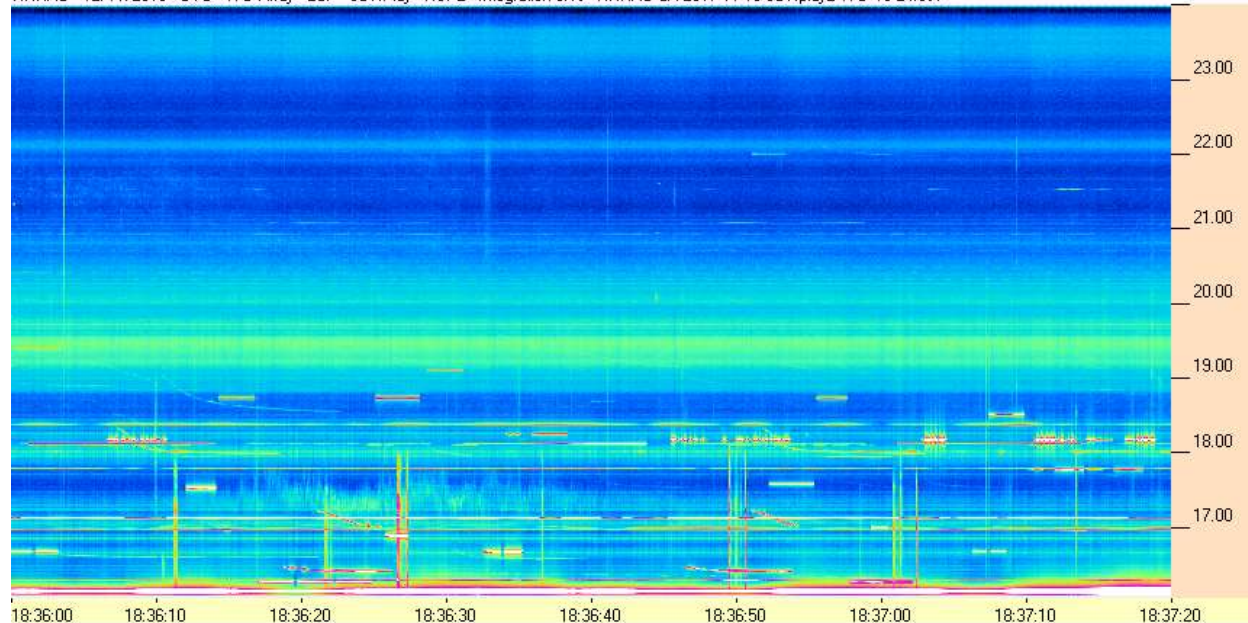
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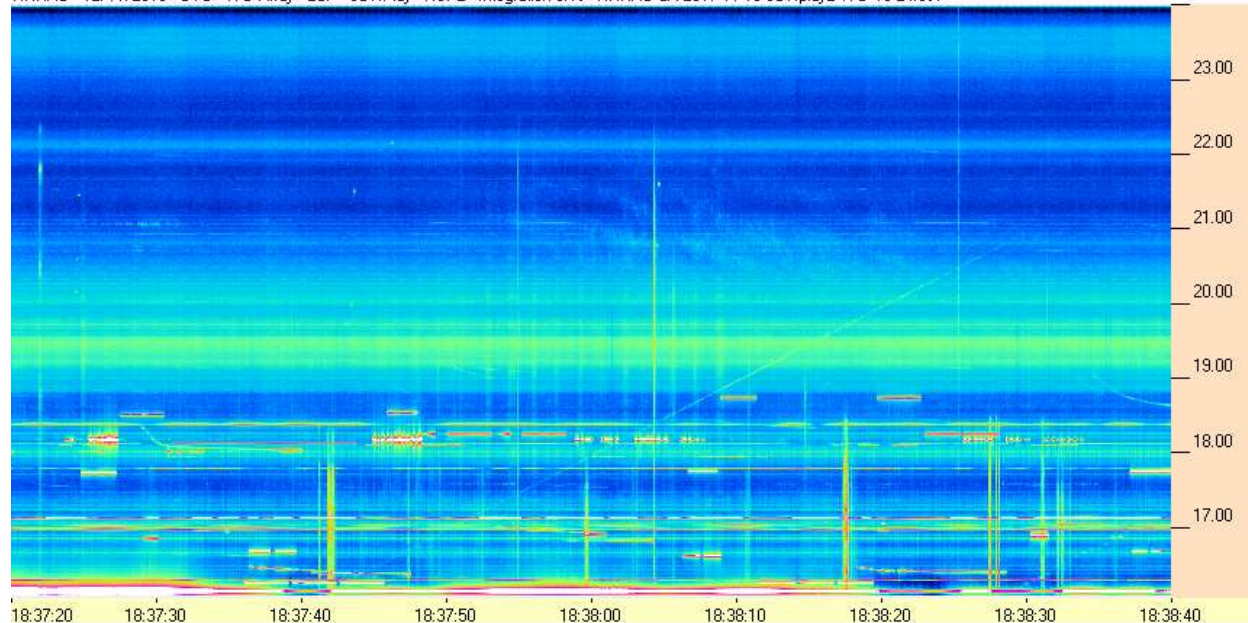
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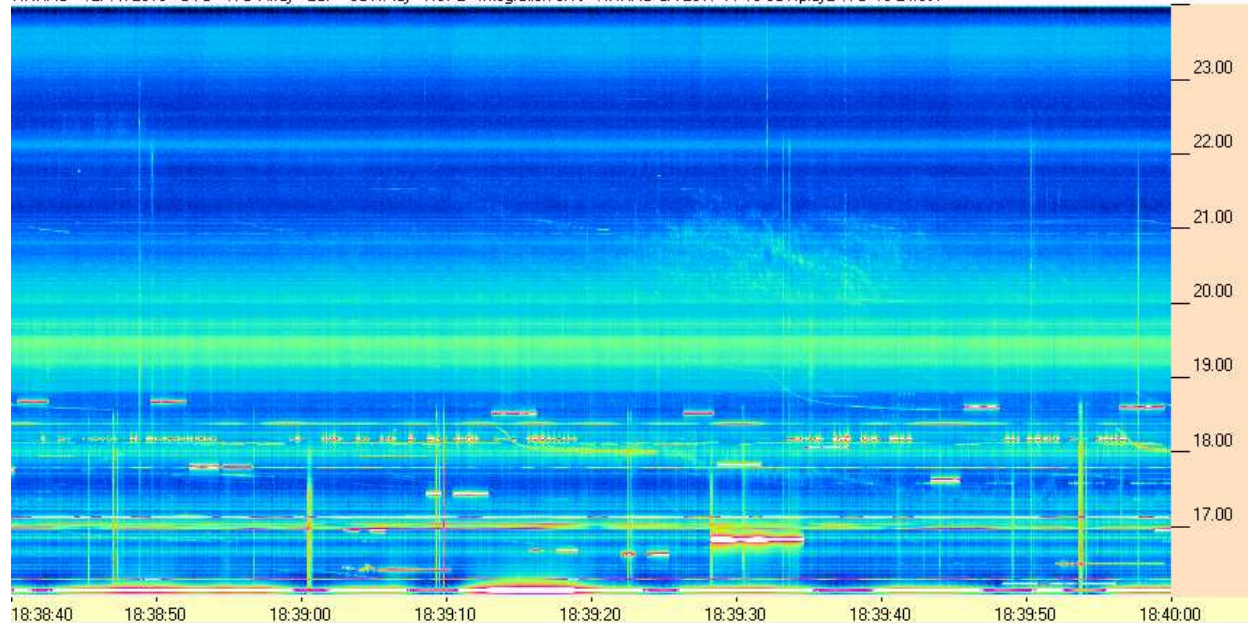
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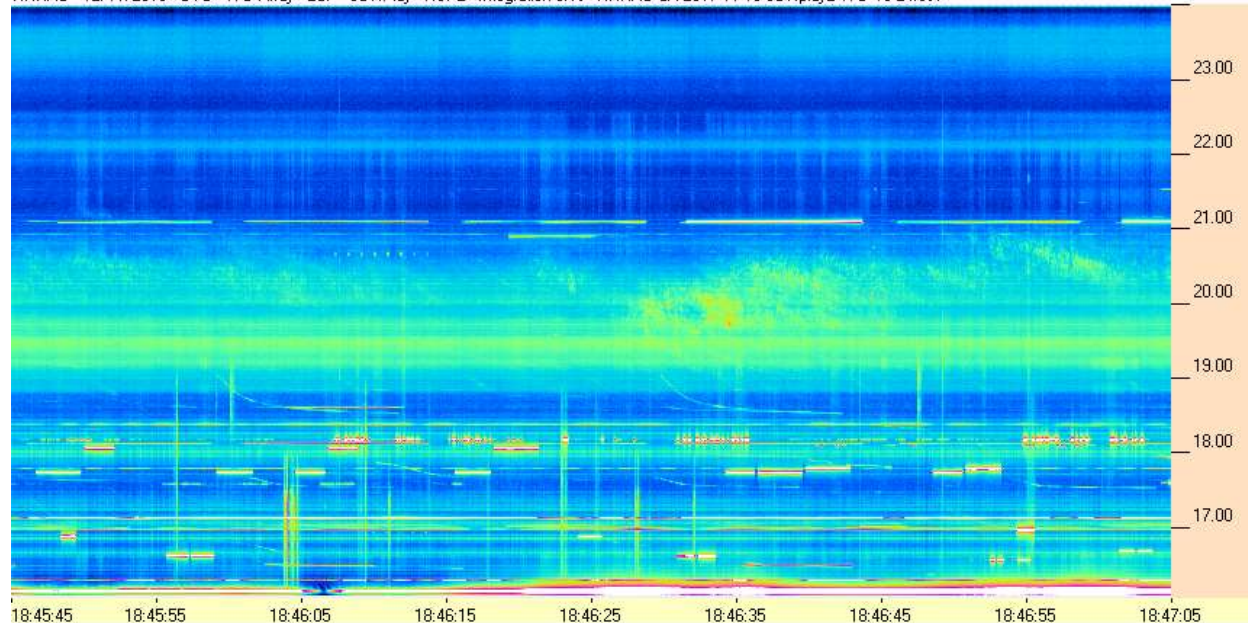
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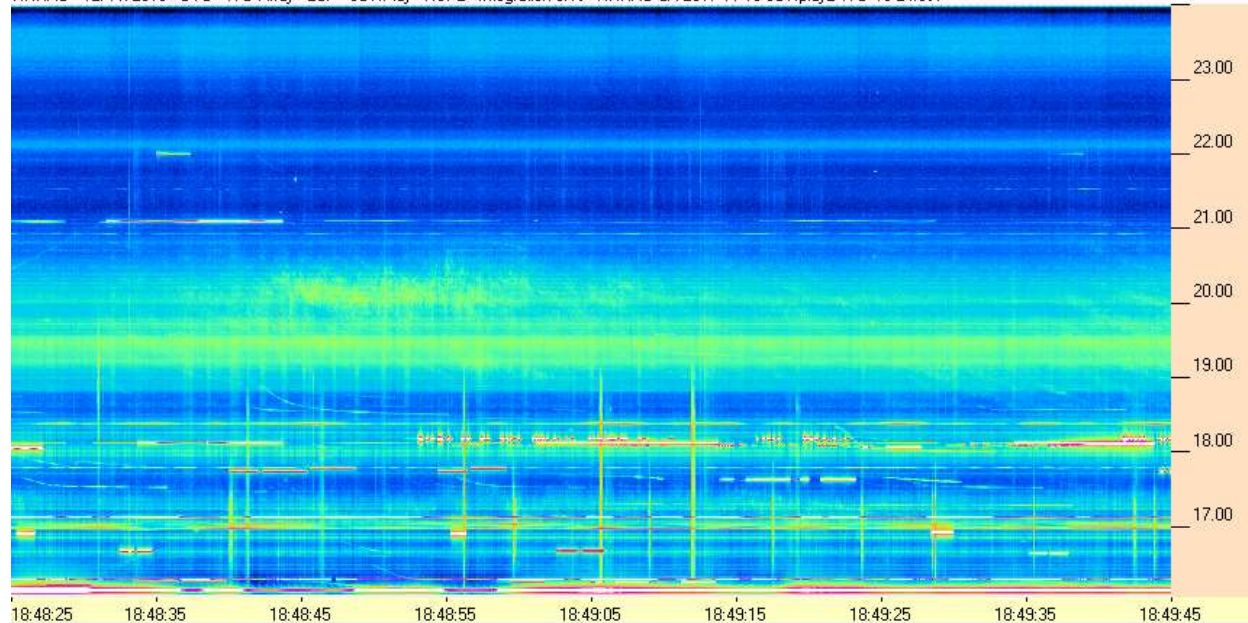
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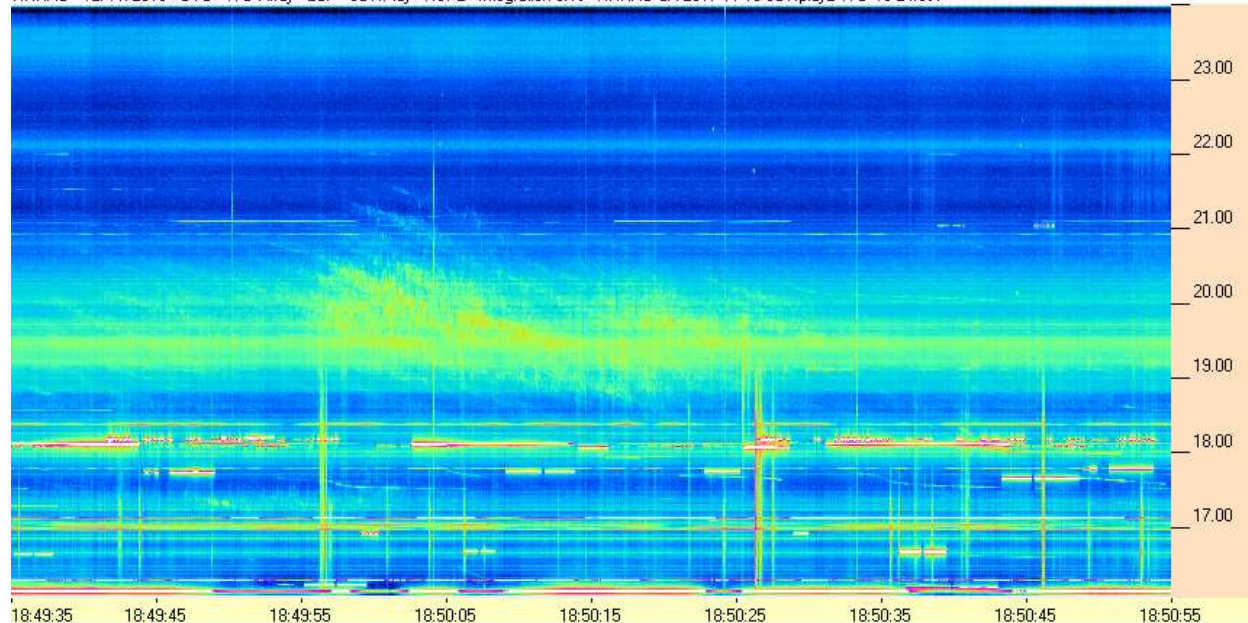
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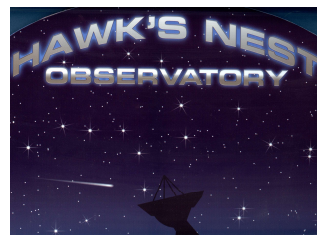
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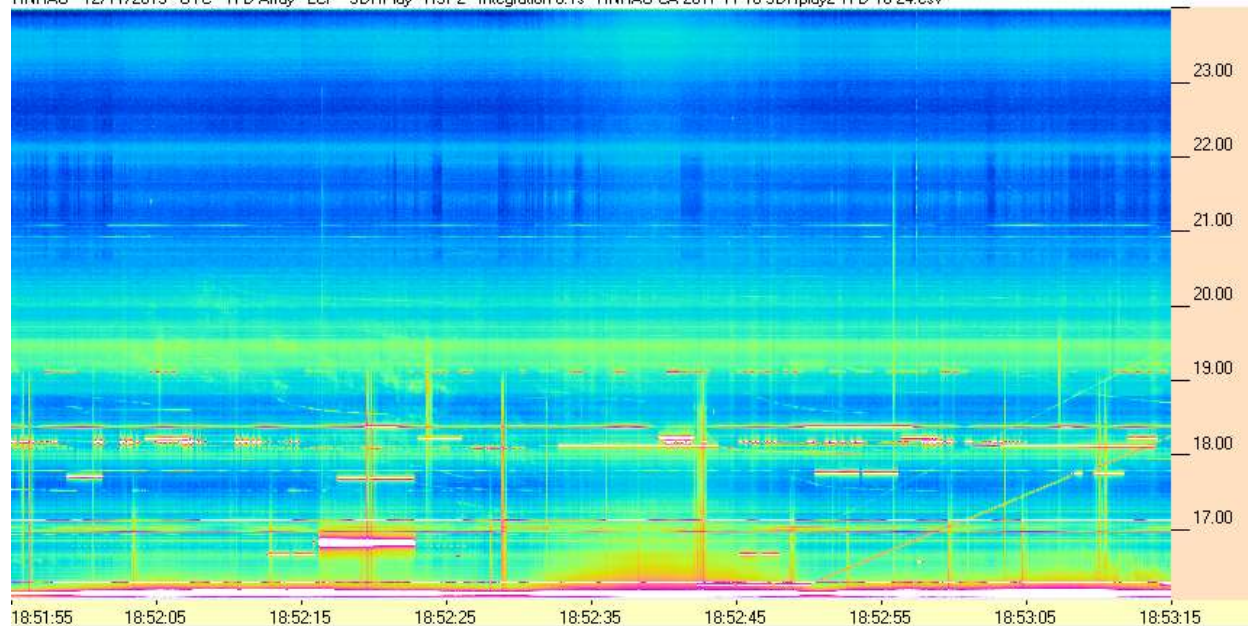
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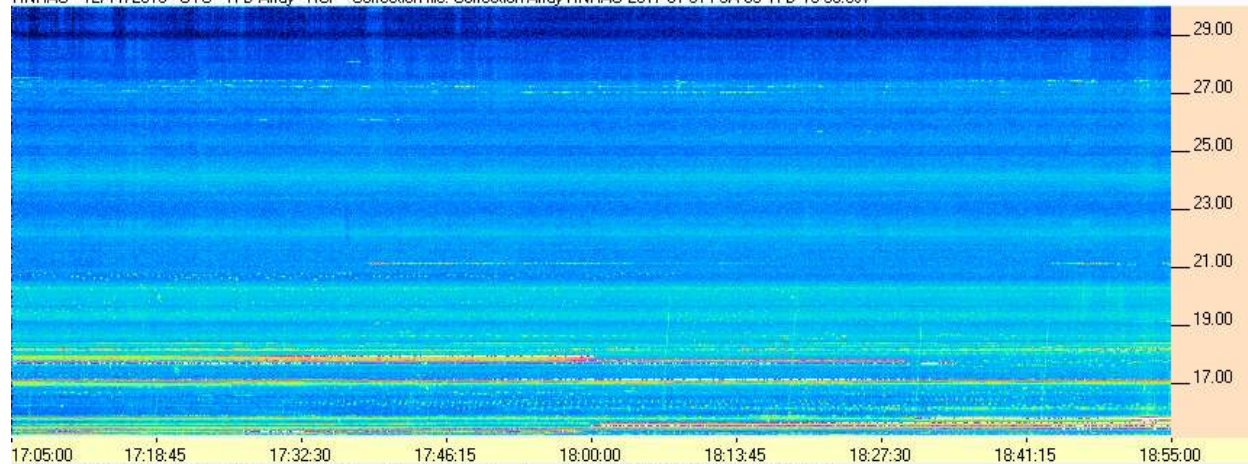


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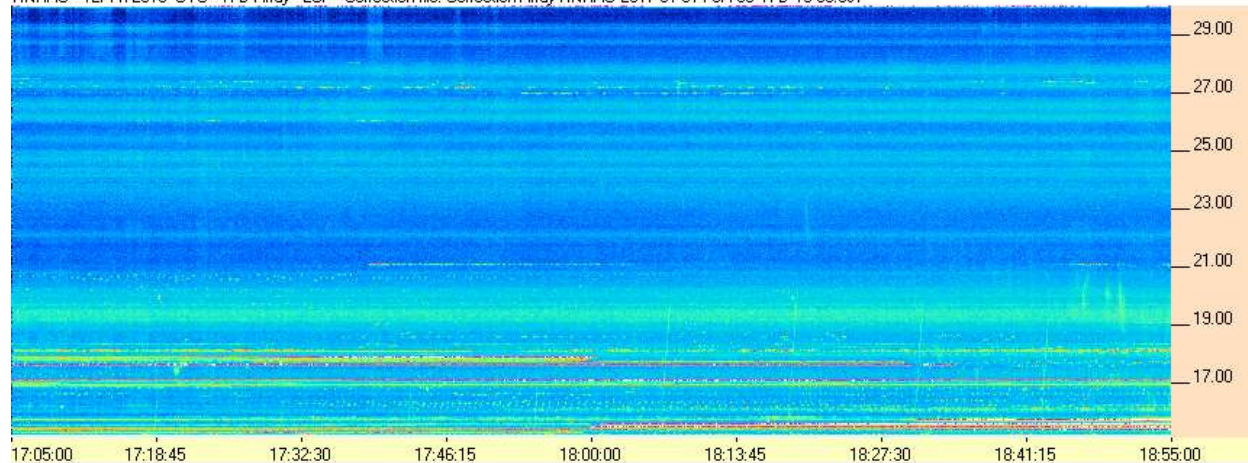


FSX-8S / TFD Array

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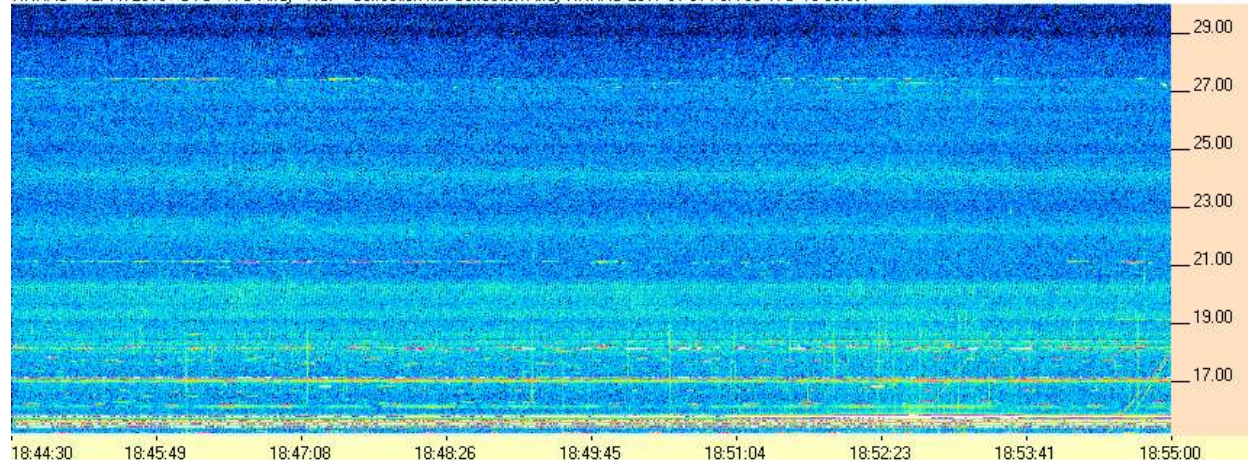
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