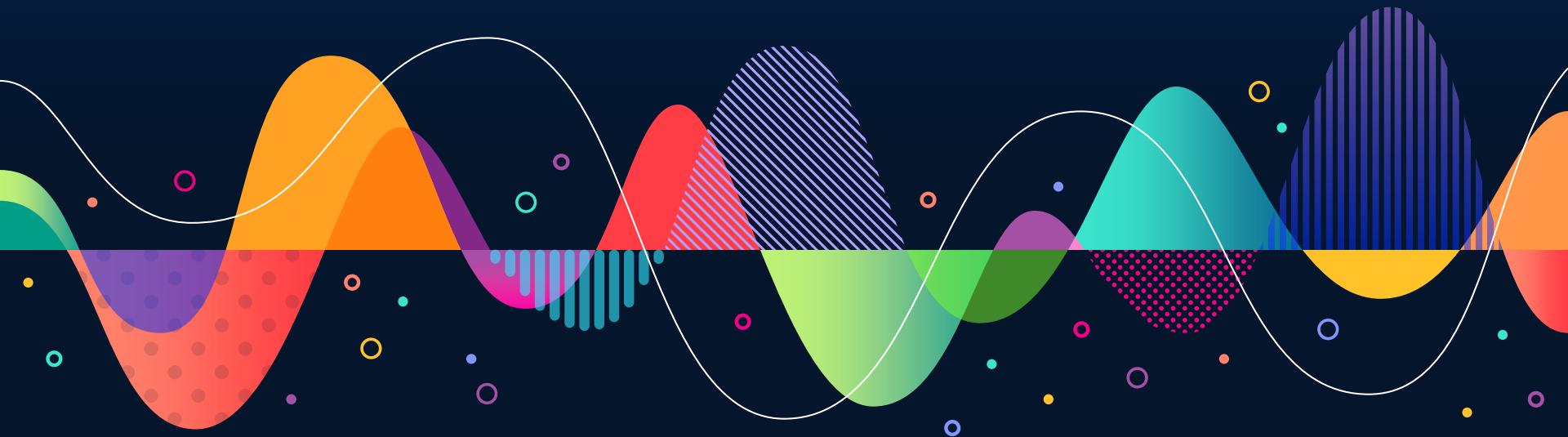


RECEPTION OF NOAA WEATHER SATELLITE IMAGES



Overview

Introduction



Softwares Used



Outputs



Requirements and Setup



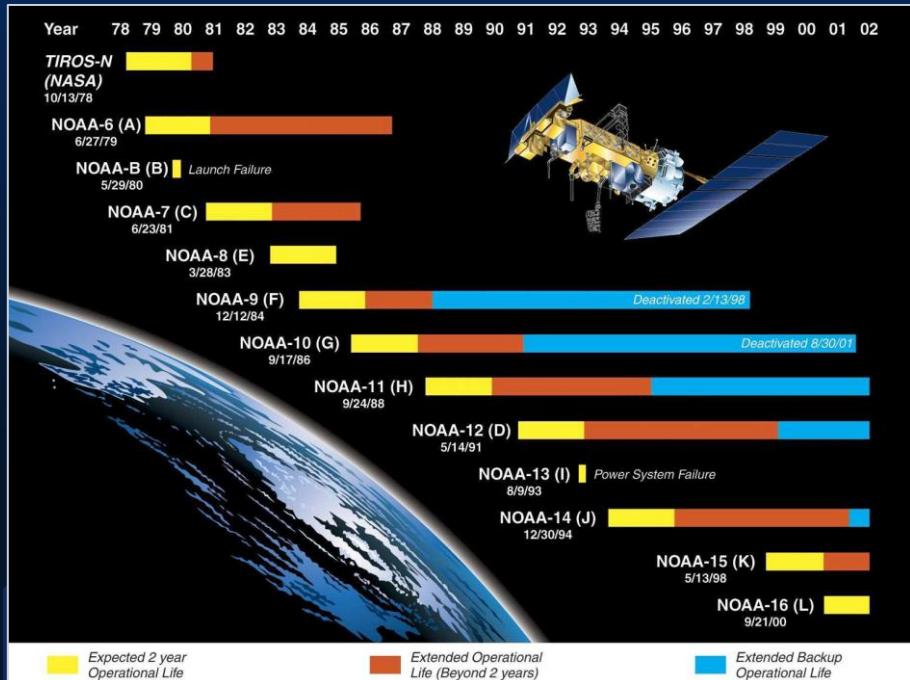
ATP FRAME FORMAT



Conclusion



INTRODUCTION



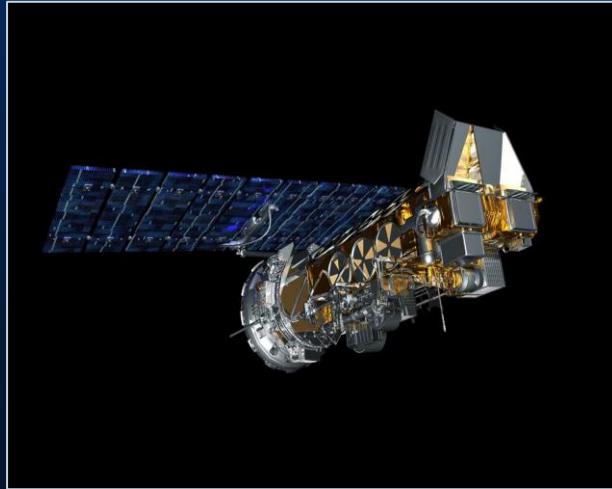
NOAA Satellite that we decode

- Belong to TIROS series
(Television Infra-Red Observation Satellite)

NOAA SATELLITES



NOAA 15

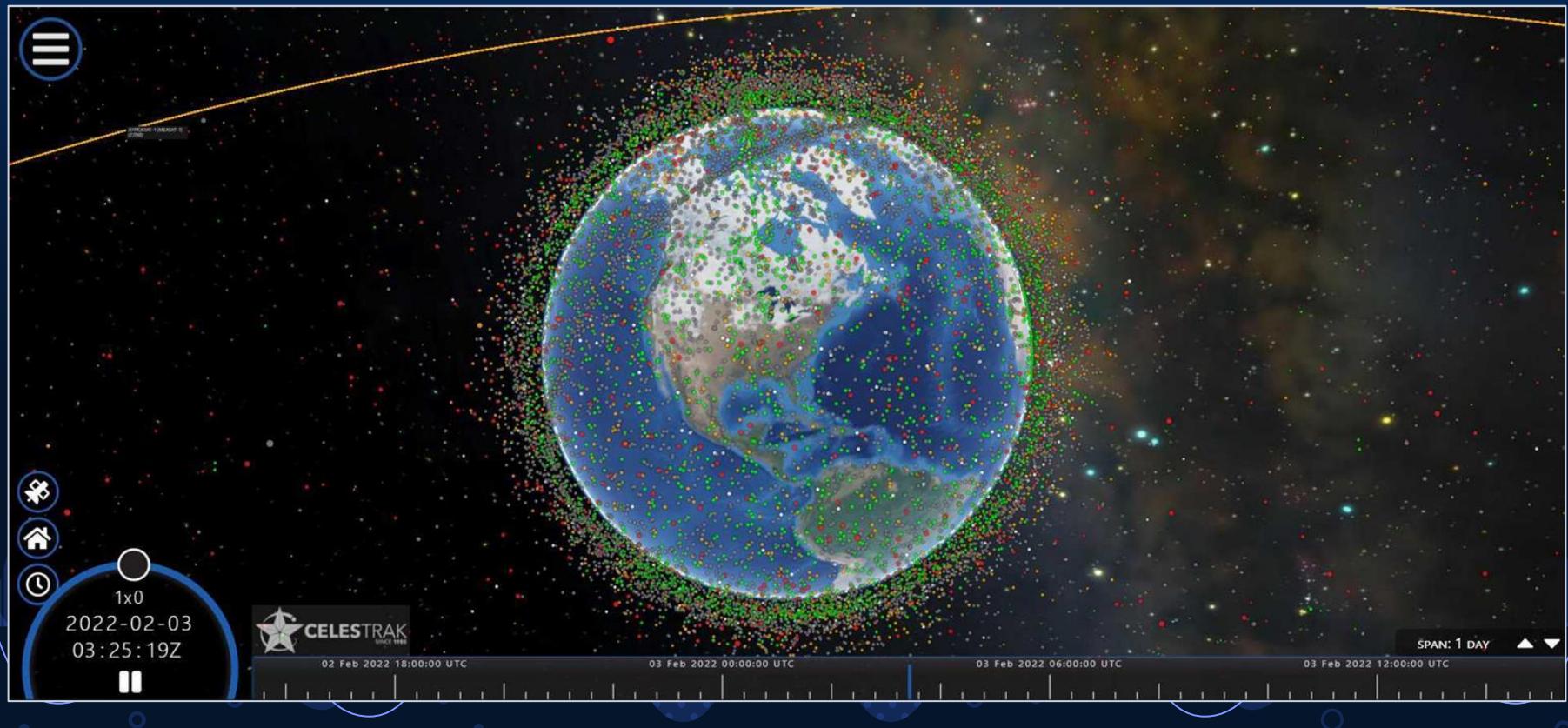


NOAA 18



NOAA 19

SATELLITES - DETECTION



REQUIREMENT AND SETUP

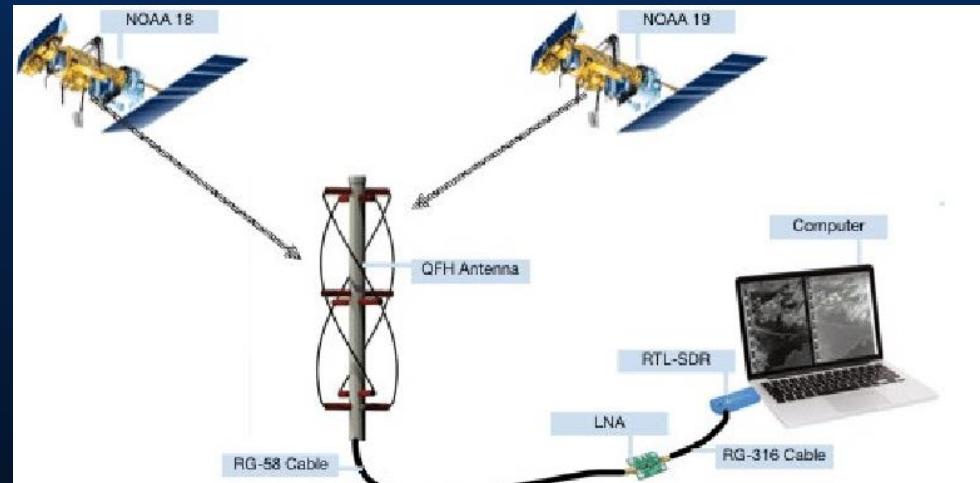
★ SOFTWARES USED:

- SDR SHARP or CUBIC SDR
- WxtoImg or NOAA-apt
- VB AUDIO CABLE Driver

★ HARDWARE

- RTL SDR
- ANTENNA
- LNA

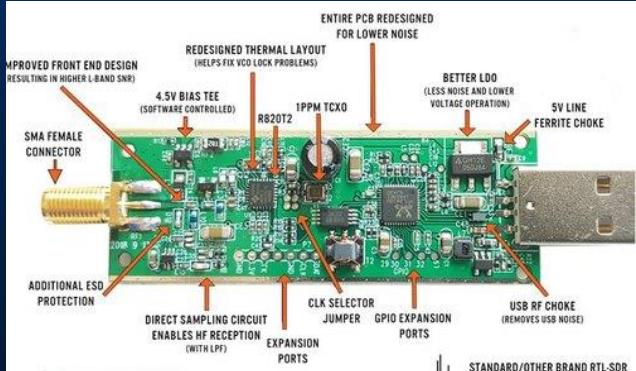
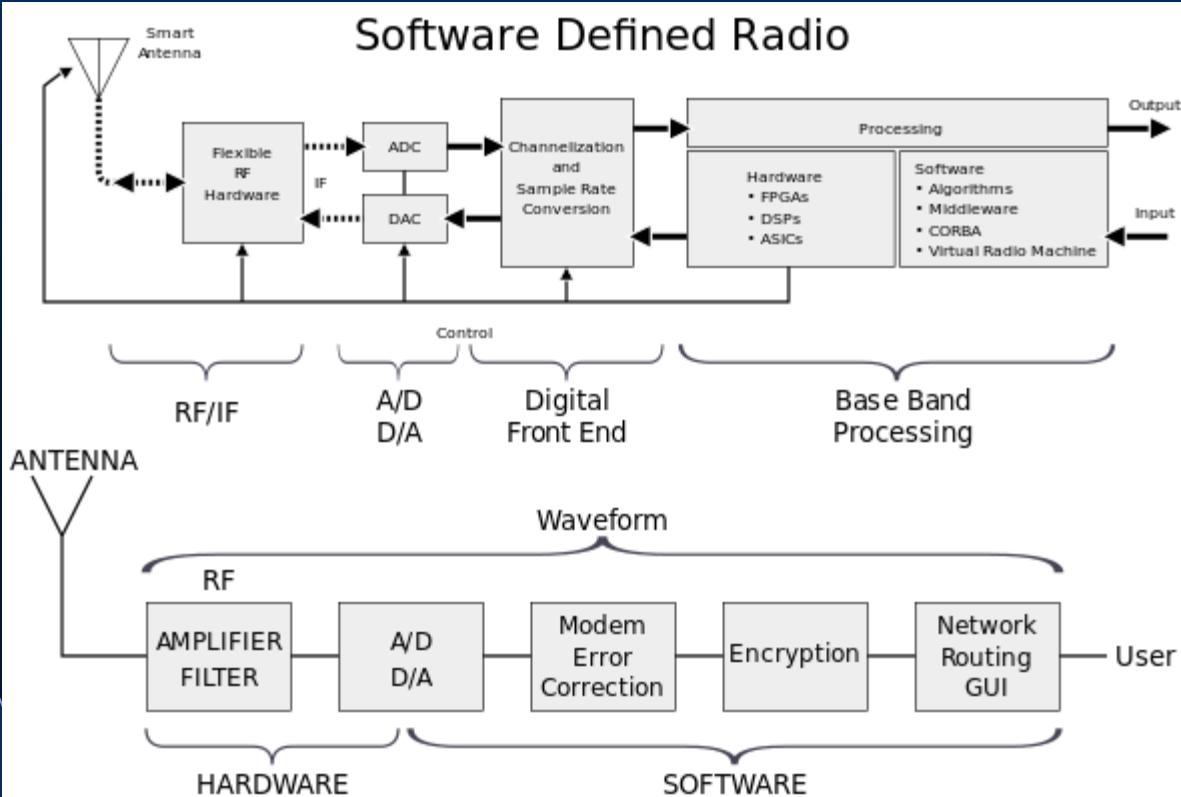
CONNECTING WIRE(CO-AXIAL CABLES AND SMA CONNECTORS)
(RG-58 CABLE(50 ohm) , RG-316 CABLE, SMA



CONNECTORS)

Software-defined radio

RTL SDR:



Types of Antennas can be Used for RECEPTION OF NOAA SATELLITE IMAGES



Turnstile Antenna



Quadrifilar Helix (QFH)
Antenna

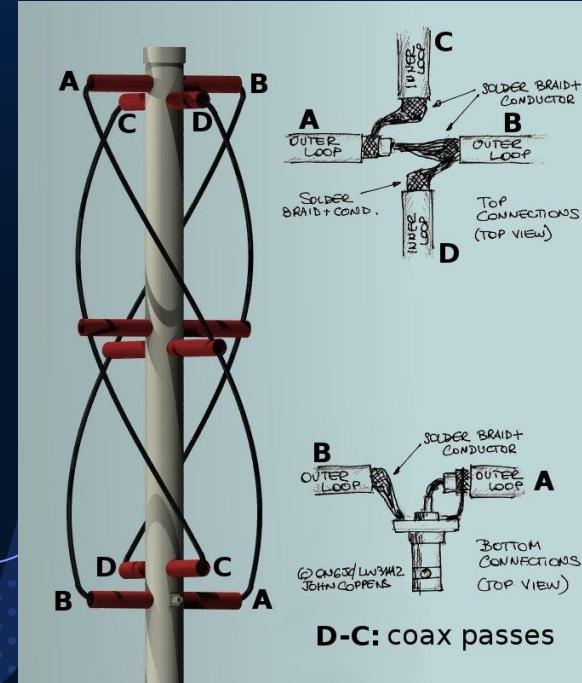


Double Cross
Antenna (DCA)

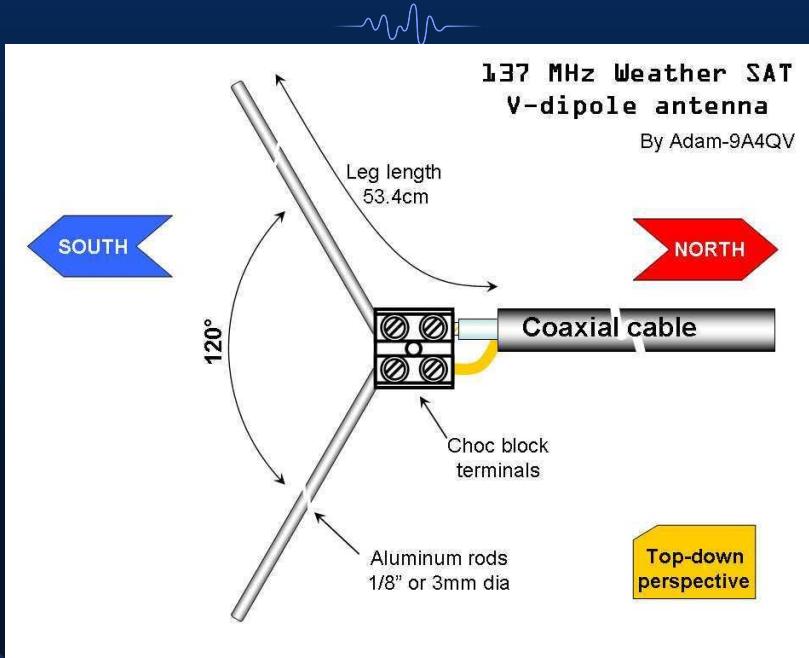


V-Dipole

IMPLEMENTATION IN V DIPOLE and QFH ANTENNA



BY Using V Dipole Antenna:



QFH Antenna



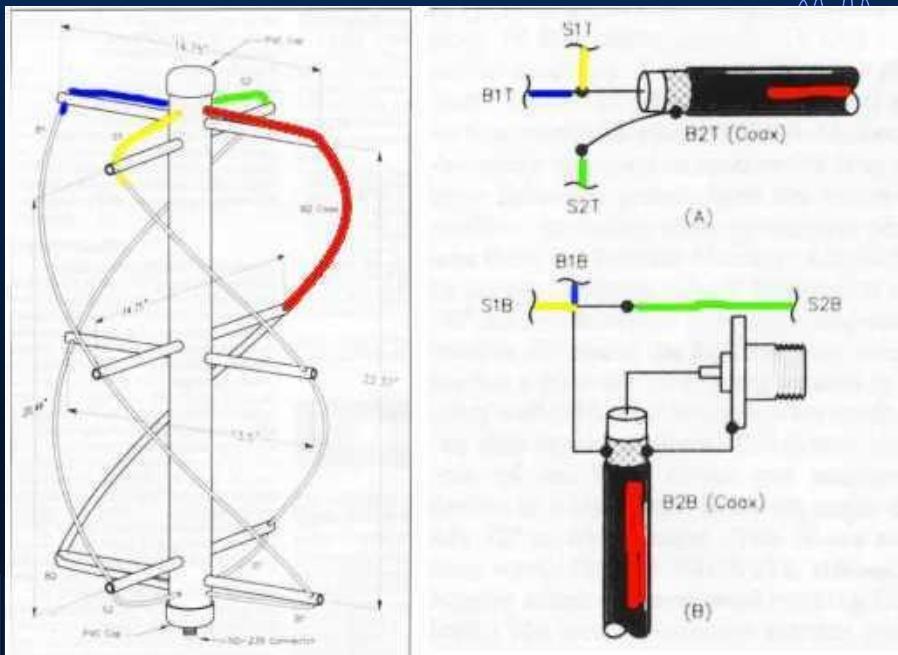
- Used for 137 MHz and 380-430 MHz frequency band.
- Work Based on right-hand circularly polarised (RHCP)
- Mainly for UHF satellite band.
- Best for GPS navigation communication system.
- Helps in detecting a very small strength signal present

near its.

- These antennas are mounted in Vertical(180°).



CONSTRUCTION:



The Antennas helice diameter and pitch distance are dependent and the number of turns must be more than 1.25.

Dimensions can be calculated in jcoppens.com

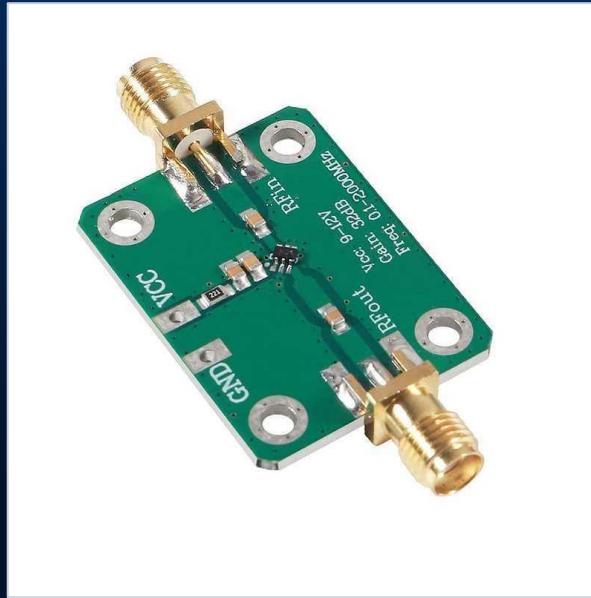
QFH ANTENNAS Done



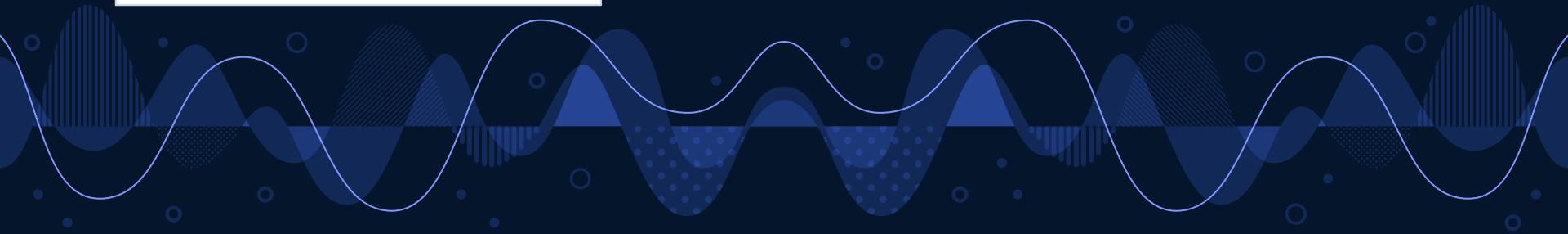




LOW NOISE AMPLIFIER - LNA



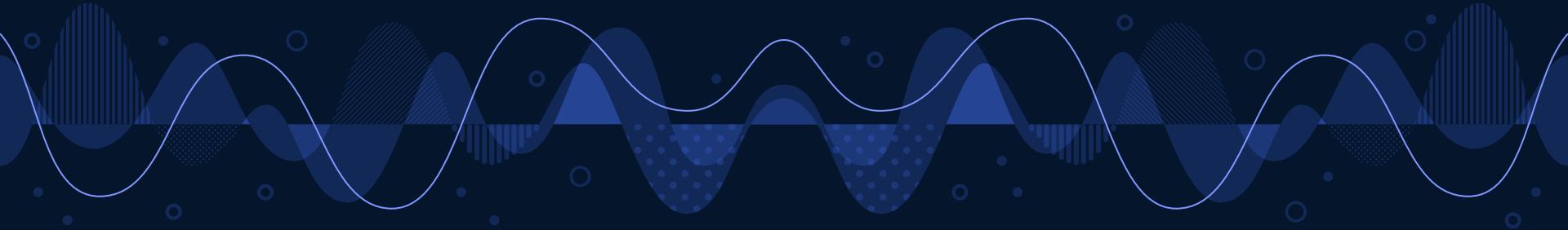
- **Wide frequency range**
- **High Gain**
- **Low Noise Figure**



CABLES AND CONNECTORS USED



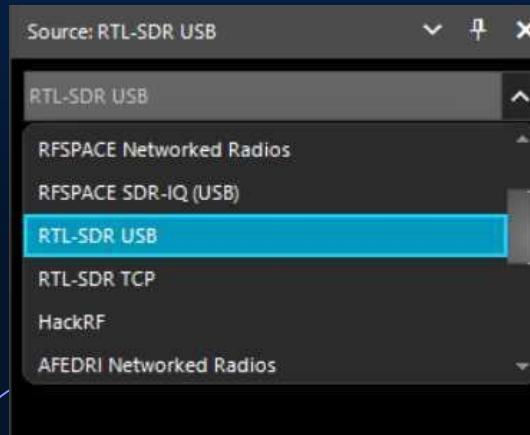
- RG-58 CABLE** for construction of antenna, it has impedance of 50 ohm
- RG-316 CABLES** for connecting between RTL SDR and antenna
- SMA MALE TO MALE WIRE** (To connect with LNA having female pins on both side)
- SMA FEMALE TO MALE WIRE**
- RP-SMA FEMALE TO SMA MALE**
- RG-58 CO AXIAL CABLE IS CONNECTED WITH RP-SMA MALE**



SD - SHARP CONFIGURATIONS

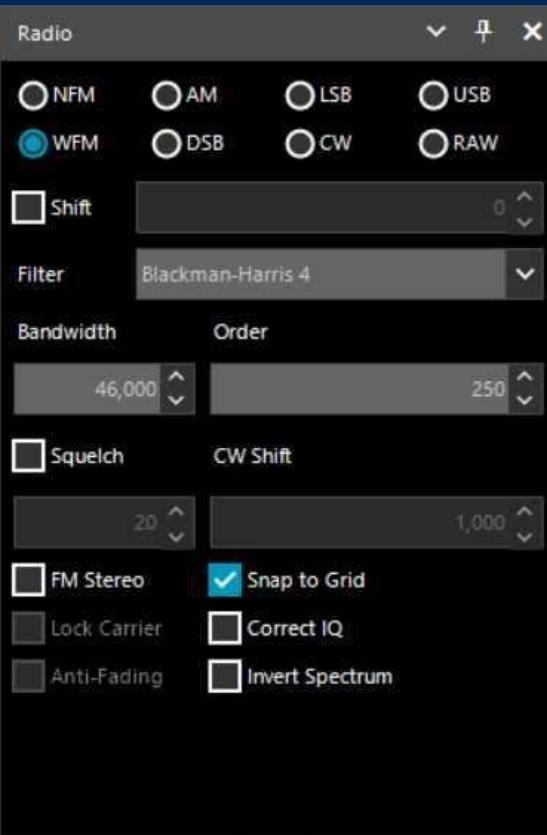


- ▶ After Connecting the RTL-SDR
 - ▶ Selecting the Source as RTL-SDR



SD - SHARP CONFIGURATIONS

- ▶ Selecting the WFM(Wideband FM signal)
- ▶ Setting the Bandwidth - 46000



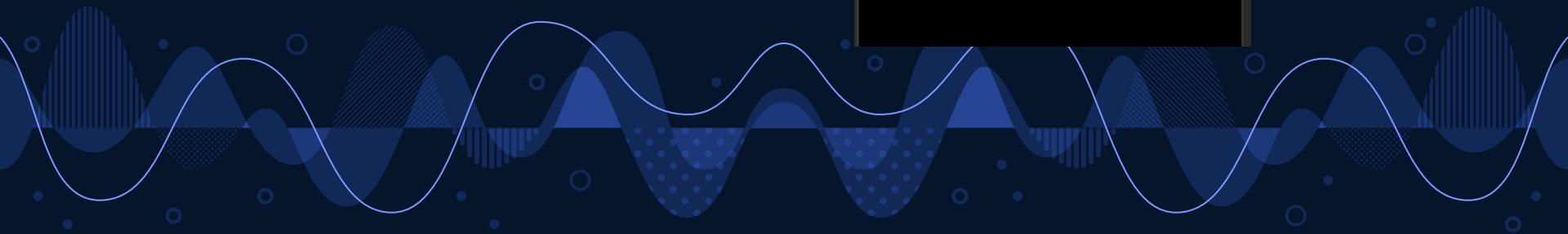
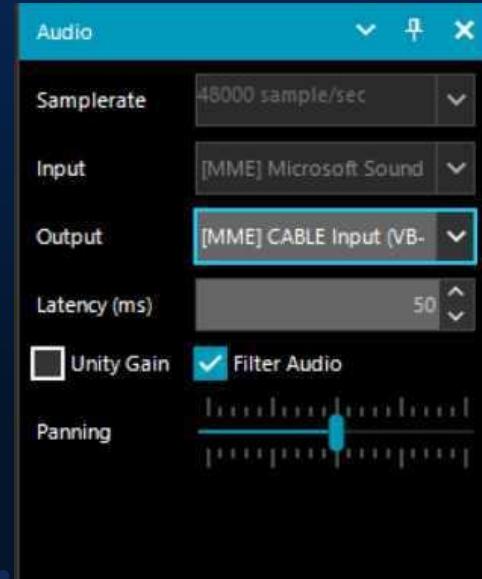
SD - SHARP CONFIGURATIONS



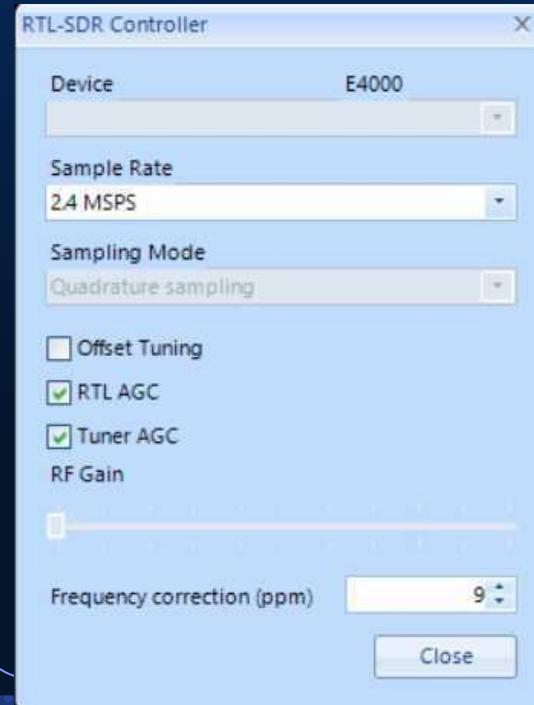
- ▶ Setting the Frequency Obtained with the Satellite details chart

2022-02-02 UTC										
Satellite	Dir	MEL	Long	Local Time	UTC Time	Duration	Freq			
NOAA 19	S	59E	81E	02-02 07:35:41	02:05:41	11:32	137.9125			
NOAA 15	S	60W	73E	02-02 08:06:40	02:36:40	11:13	137.6200			
NOAA 18	S	24E	89E	02-02 09:38:57	04:08:57	9:48	137.1000			
NOAA 18	S	25W	65E	02-02 11:19:20	05:49:20	9:51	137.1000			
NOAA 19	N	24E	89E	02-02 18:46:35	13:16:35	9:38	137.9125			
NOAA 15	N	42E	84E	02-02 19:10:34	13:40:34	10:38	137.6200			
NOAA 19	N	26W	65E	02-02 20:26:48	14:56:48	9:58	137.9125			
NOAA 18	N	63W	74E	02-02 22:28:23	16:58:23	11:32	137.1000			

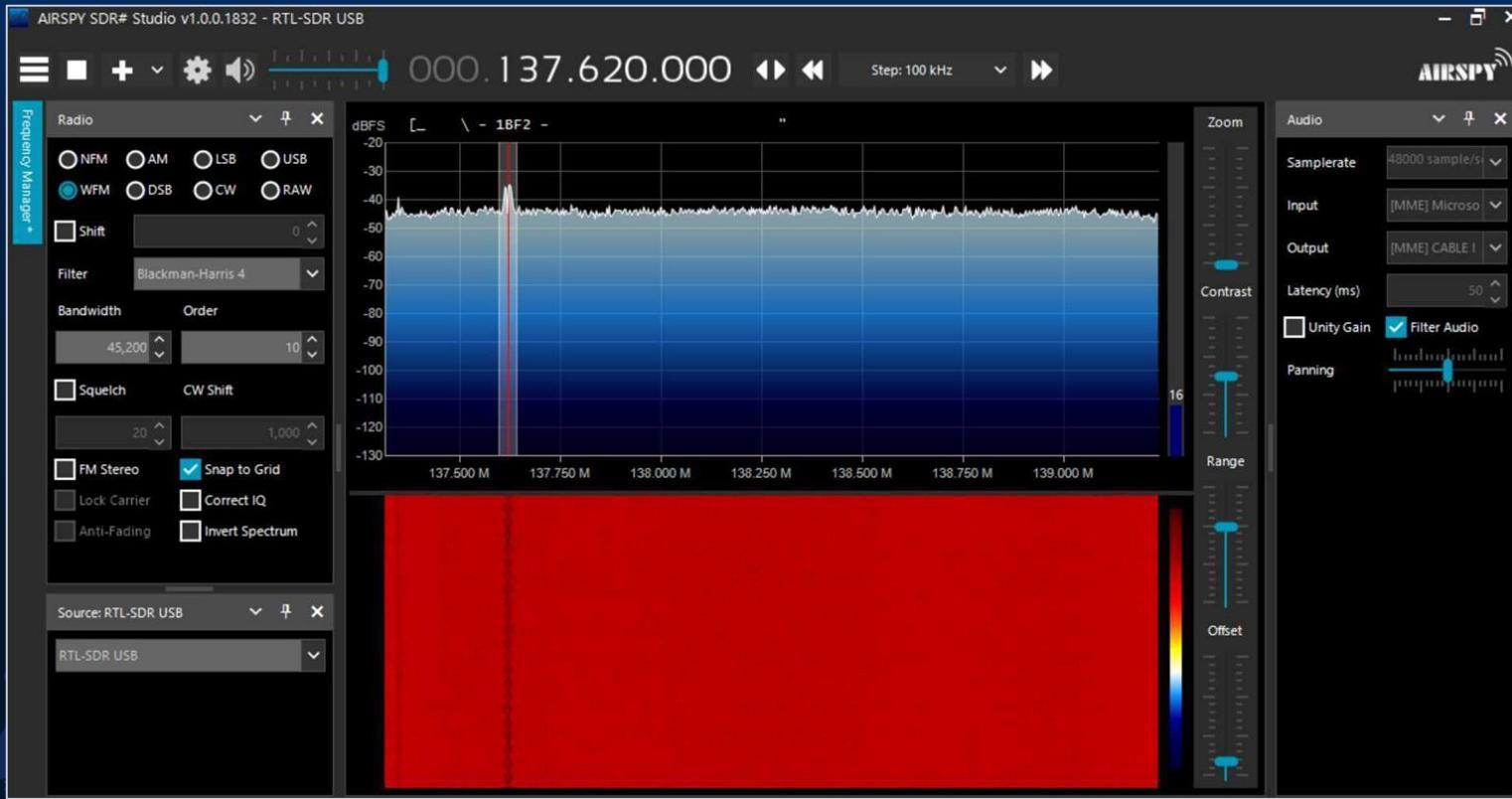
- ▶ Setting the Input and Output audio
 - ▶ Input - MME Microsoft Sound Mapper
 - ▶ Output - MME VB Cable



- ▶ In RTL-SDR Controller,
 - ▶ RTL AGC and Tuner AGC is selected.



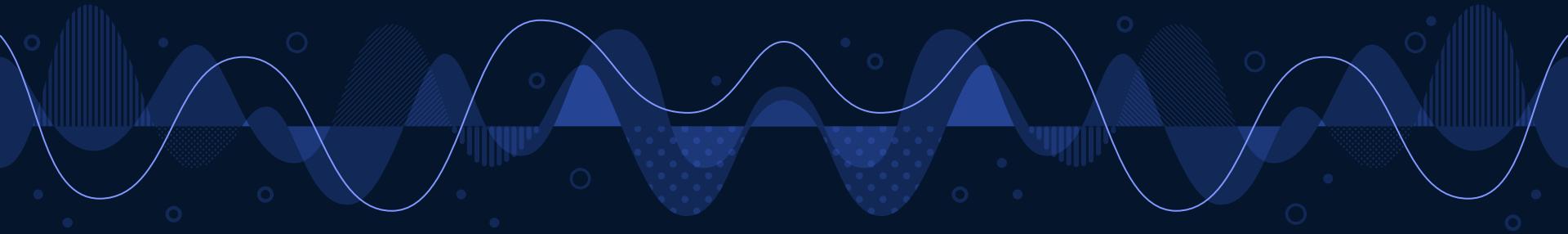
OUTPUT SIGNAL



NOAA-APT Software

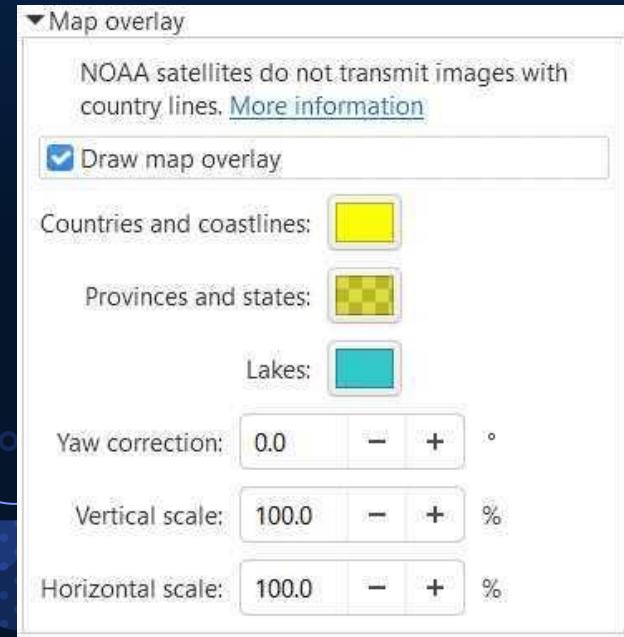
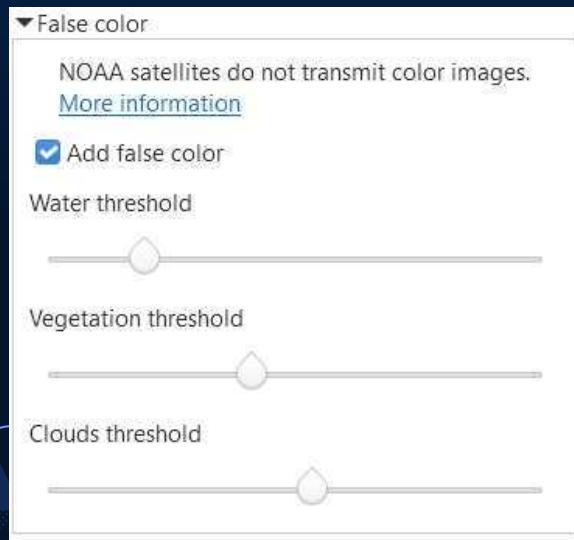


This software does not collect the signal received, rather it just converts the audio signal feeded as an input from the file to an image.

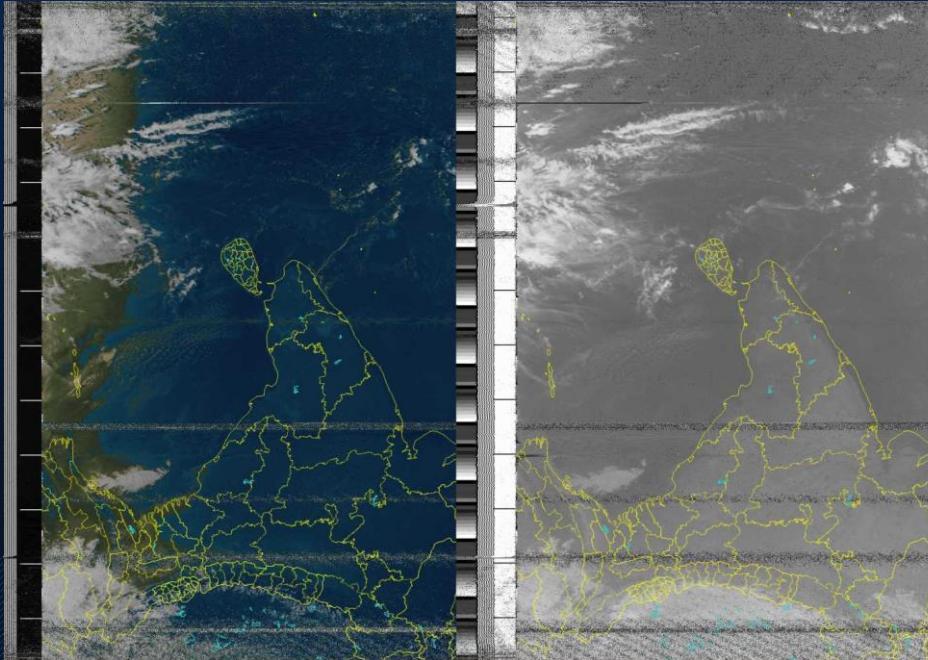


Adding false colour since the
NOAA satellites does not
transmit colour image.

Setting up Map overlay



Then the image is feed and processed.



Processed Image

WXtolmg

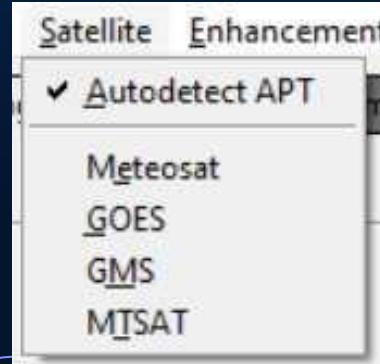


This Application is used to collect the Audio signal received and to process it as Image.

Setting up the Necessary Configuration

Satellite Configurations

- ▶ Set to Auto Detect APT



Selecting MSA multispectral analysis to add colour to the images



Enhancements	Options	Projection	Image	Help
Normal				
Pristine				
Contrast enhance				
Contrast enhance (NOAA ch A only)				
Contrast enhance (NOAA ch B only)				
MCIR map colour IR (NOAA)				
MCIR with precipitation (NOAA)				
MCIR anaglyph false 3-D (NOAA)				
✓ MSA multispectral analysis (NOAA-# 2-4/1-4)				
MSA with precipitation (NOAA-# 2-4/1-4)				
MSA anaglyph false 3-D (NOAA-# 2-4/1-4)				
HVCT false-colour (NOAA)				
HVCT with precipitation (NOAA)				
HVC false-colour (NOAA)				
HVC with precipitation (NOAA)				
Sea surface temp (NOAA)				
Thermal (NOAA)				
Vegetation (NOAA 1-2)				
Anaglyph false 3-D (GOES/NOAA)				
Colour anaglyph false 3-D (NOAA)				
Class enhancement (NOAA)				
NO colour IR enhancement (GOES/NOAA)				
ZA general IR enhancement (GOES/NOAA)				
MB thunderstorm (GOES/NOAA)				
MD warm season MB (GOES/NOAA)				
BD hurricane (GOES/NOAA)				

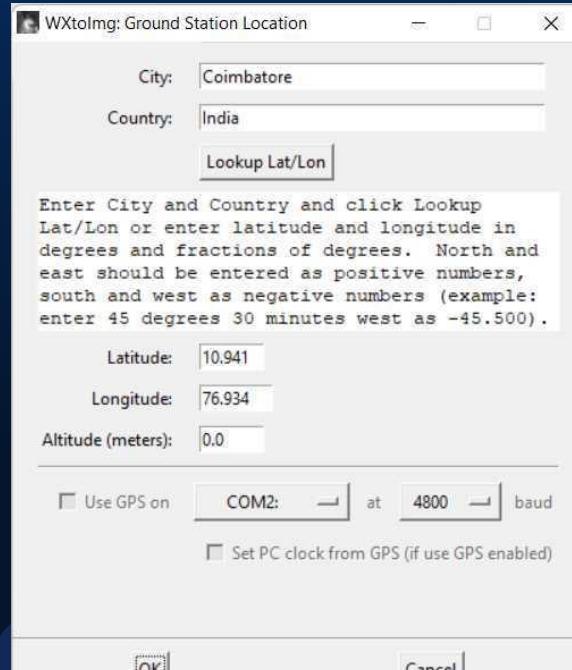
The Active APT Satellites

- ▶ Satellite 15 ,Satellite 18, Satellite 19 are selected.
- ▶ This table is update whenever Kepler is updated.

Satellite	Active	Freq (MHz)	Priority (1=high)
NOAA 15	<input checked="" type="checkbox"/>	137.6200	<input type="button" value="1"/>
NOAA 17	<input type="checkbox"/>	137.5000	<input type="button" value="1"/>
NOAA 18	<input checked="" type="checkbox"/>	137.1000	<input type="button" value="1"/>
NOAA 19	<input checked="" type="checkbox"/>	137.9125	<input type="button" value="1"/>

Update this table when updating Keplers.

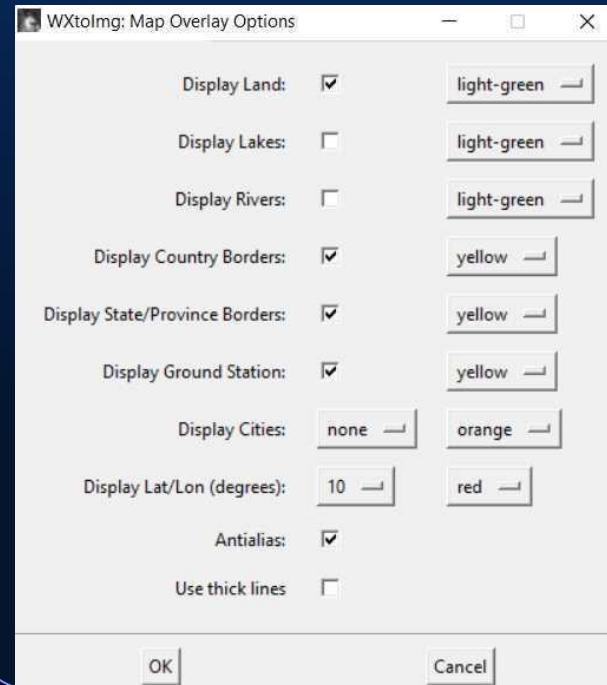
Setting the Ground Station Location with its exact Latitude and Longitude.



Here we can set the display of the map according to our choice.

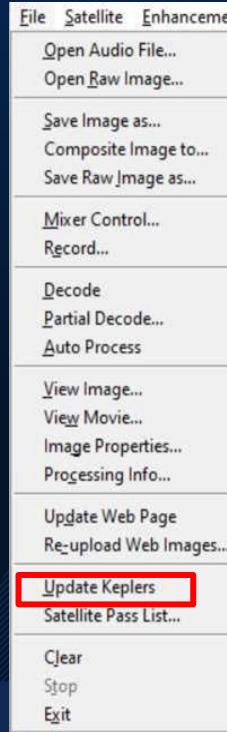
For this Project we mainly want ,

- ▶ Land, Country Borders,
Ground Station to be
displayed.



WXtolmg Configurations

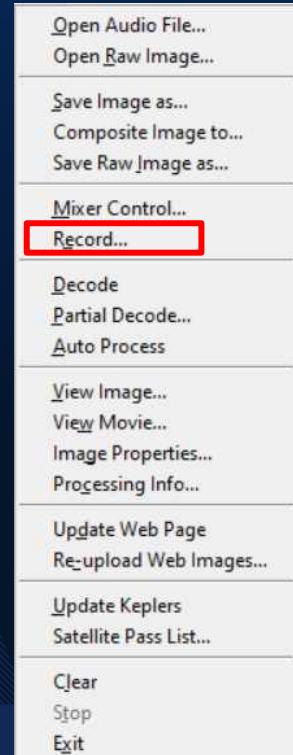
Updating Kepler.



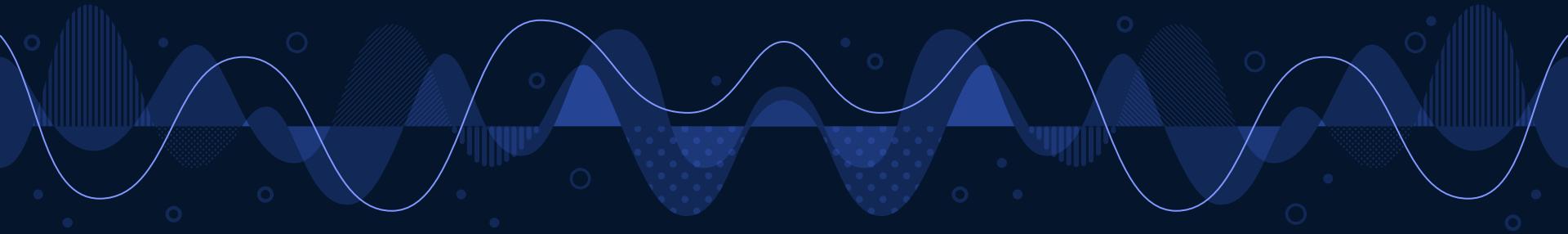
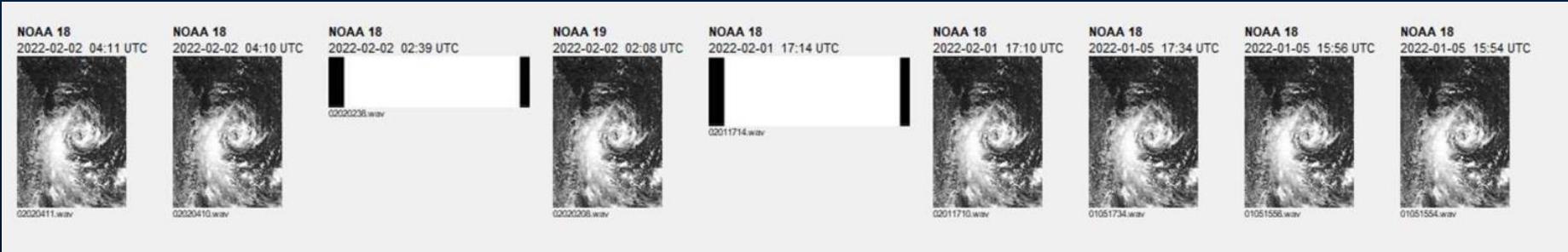
RECORDING THE AUDIO

We can Use the Record option available to record the audio files

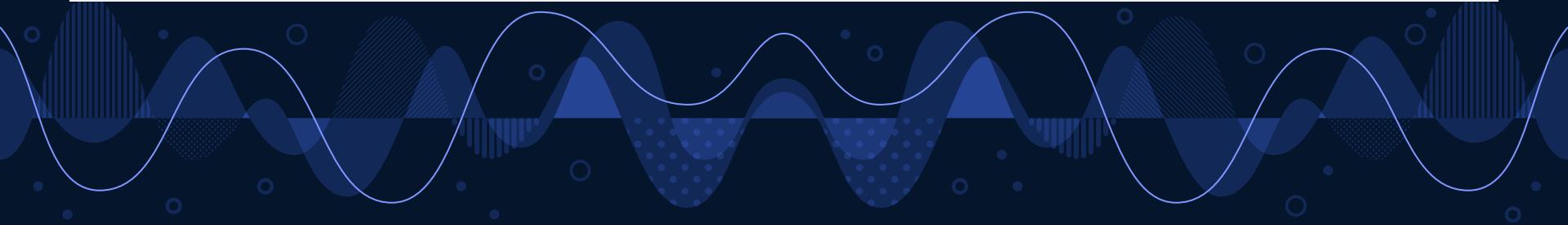
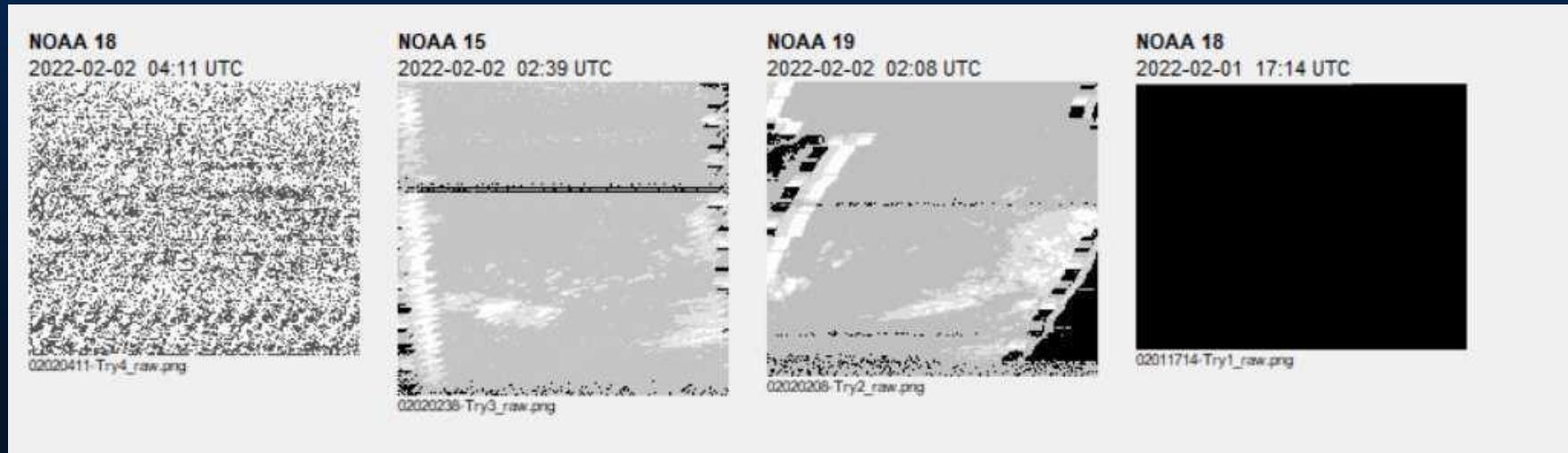
Which then processes to the image displayed.



Audio files obtained



Raw Images are obtained after processing.



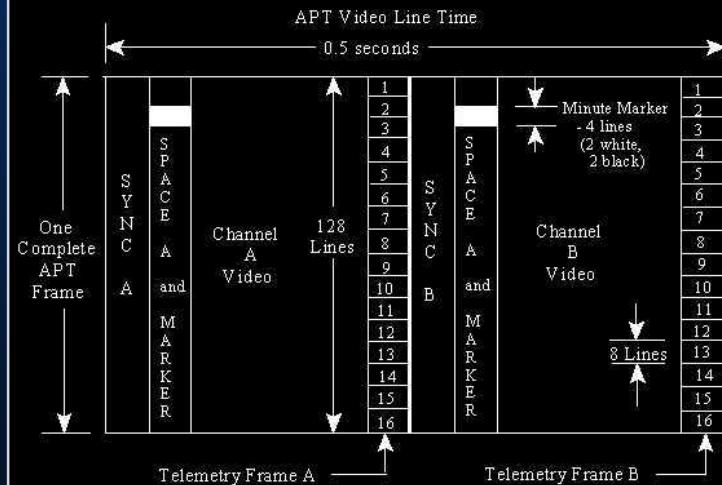
APT

Automatic Picture Transmission



APT FRAME FORMAT

Figure 4.2.2-1. APT Frame Format.

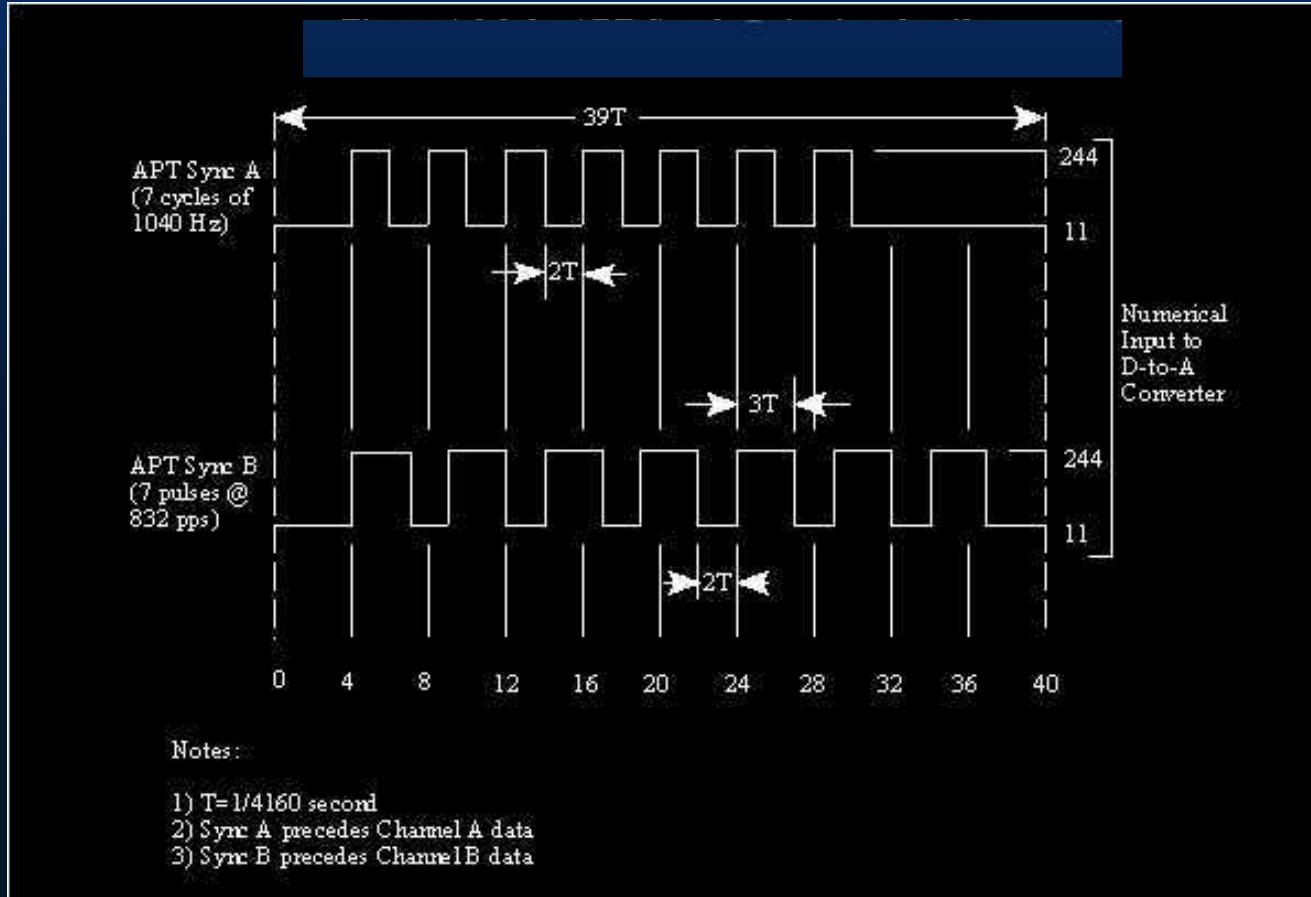


WEDGE #1	WEDGE #2	WEDGE #3	WEDGE #4	WEDGE #5	WEDGE #6	WEDGE #7	WEDGE #8
1	2	3	4	5	6	7	8
Zero Modulation Reference	Thermistor Temp. #1	Thermistor Temp. #2	Thermistor Temp. #3	Thermistor Temp. #4	Patch Temp	Back Scan	Channel I.D. Wedge

Notes:

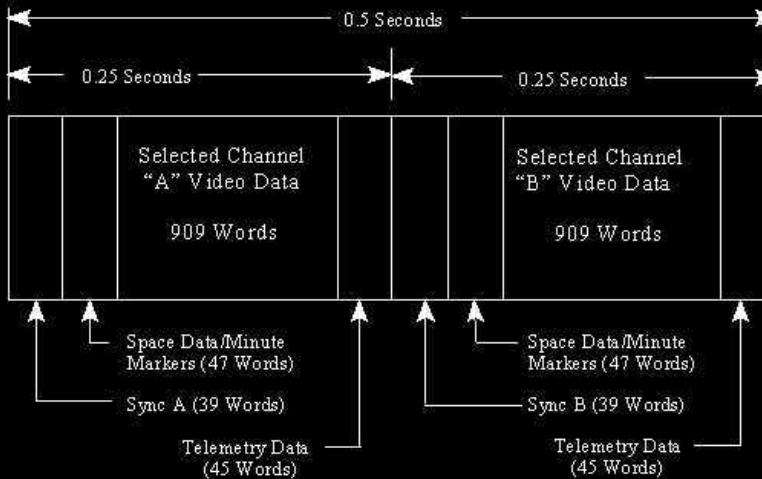
- 1) Each telemetry frames consists of 16 points
- 2) Telemetry frame rate is 1 frame per 84 seconds
- 3) Each telemetry point is repeated on 8 successive APT video lines

APT SYNCHRONIZATION



APT VIDEO LINE FORMAT

Figure 4.2.3-2. APT Video Line Format.

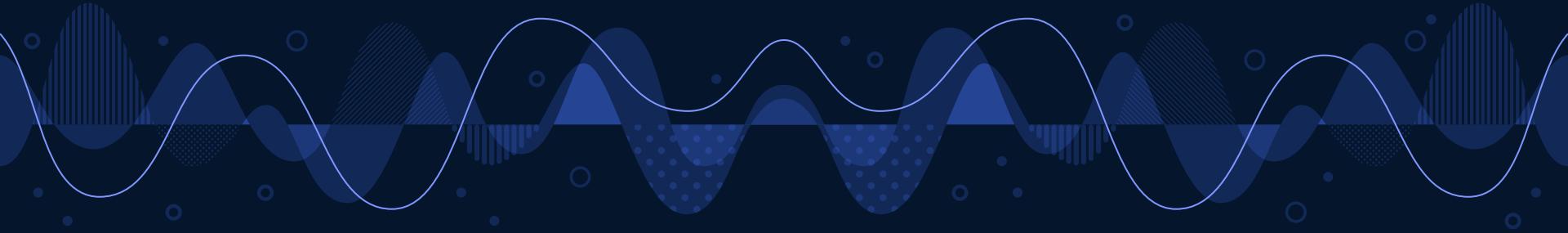


Notes:

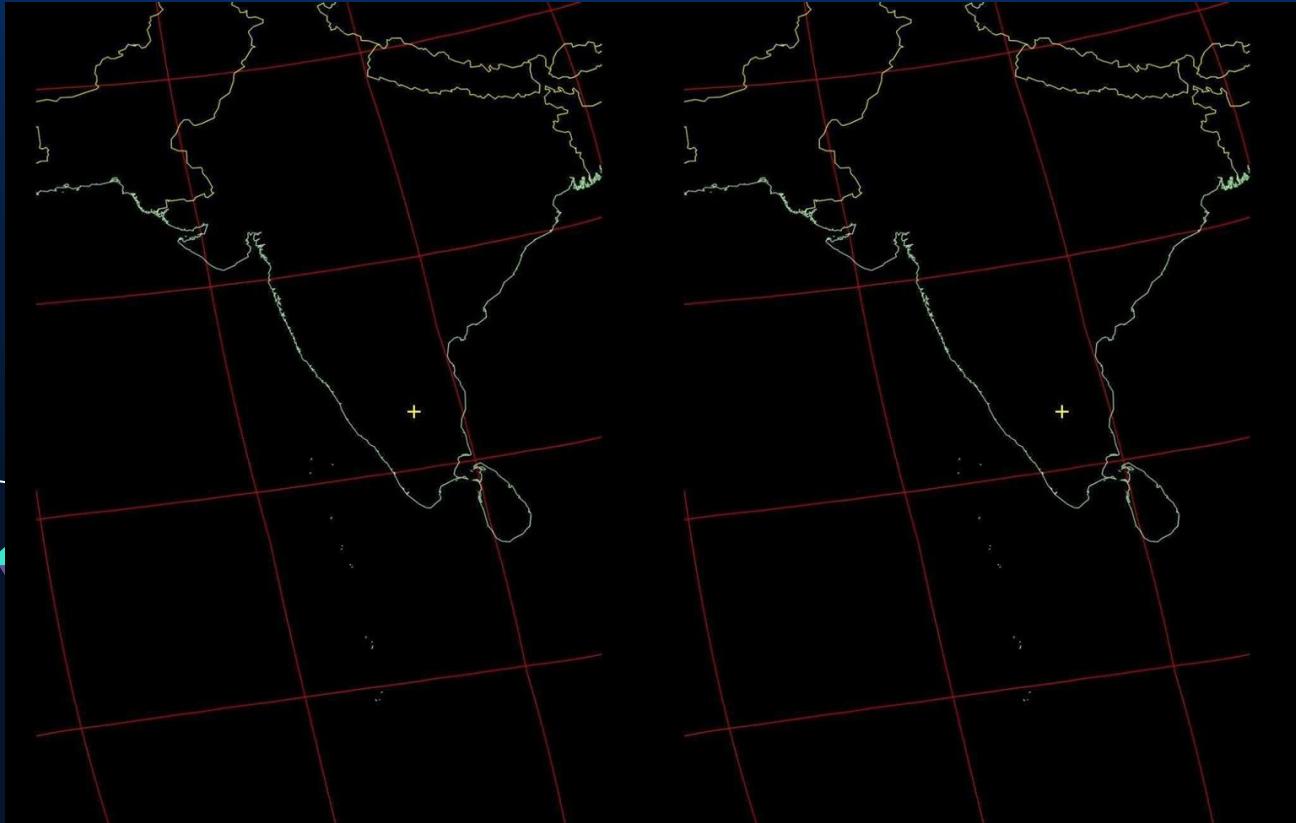
- 1) Equivalent output digital data rate is 4160 words/second
- 2) Video line rate - 2 lines/second
- 3) APT frame size - 128 lines
- 4) Any two of the five (six for group 505) AVHRR channels may be selected for use
- 5) Sync A is a 1040-Hz square wave - 7 cycles
- 6) Sync B is an 832-pps pulse train - 7 pulses
- 7) Each of the 16 telemetry points is repeated on 8 successive lines
- 8) Minute markers are repeated on 4 successive lines, with 2 lines black and 2 lines white



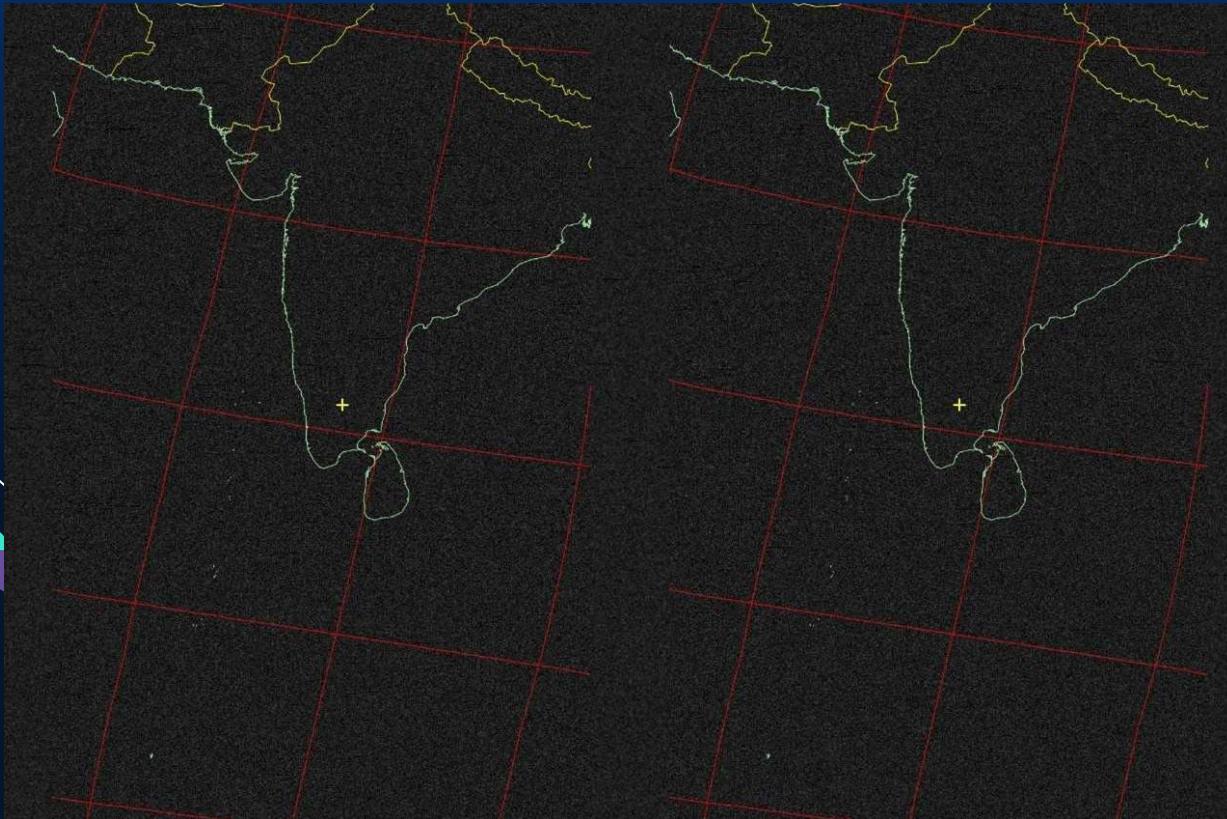
Output Images



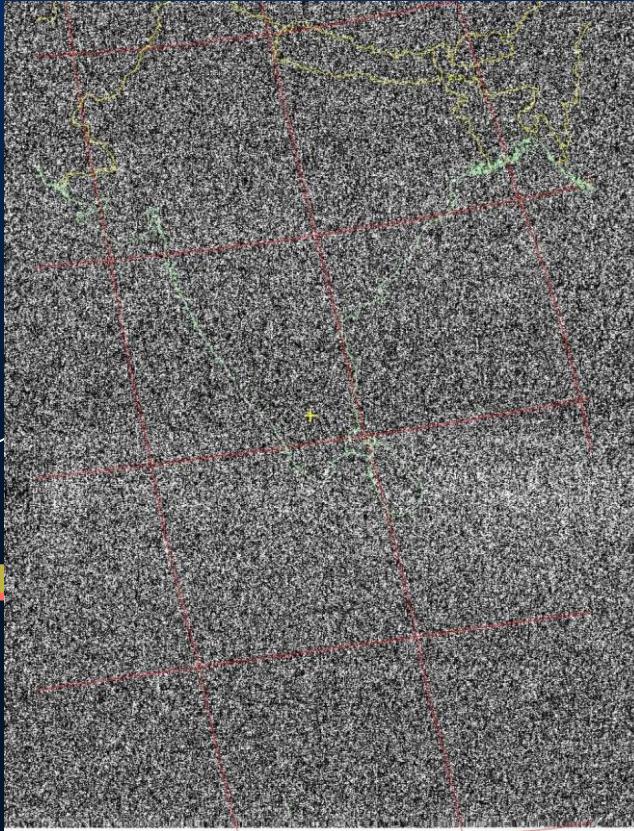
Using WXTOIMG



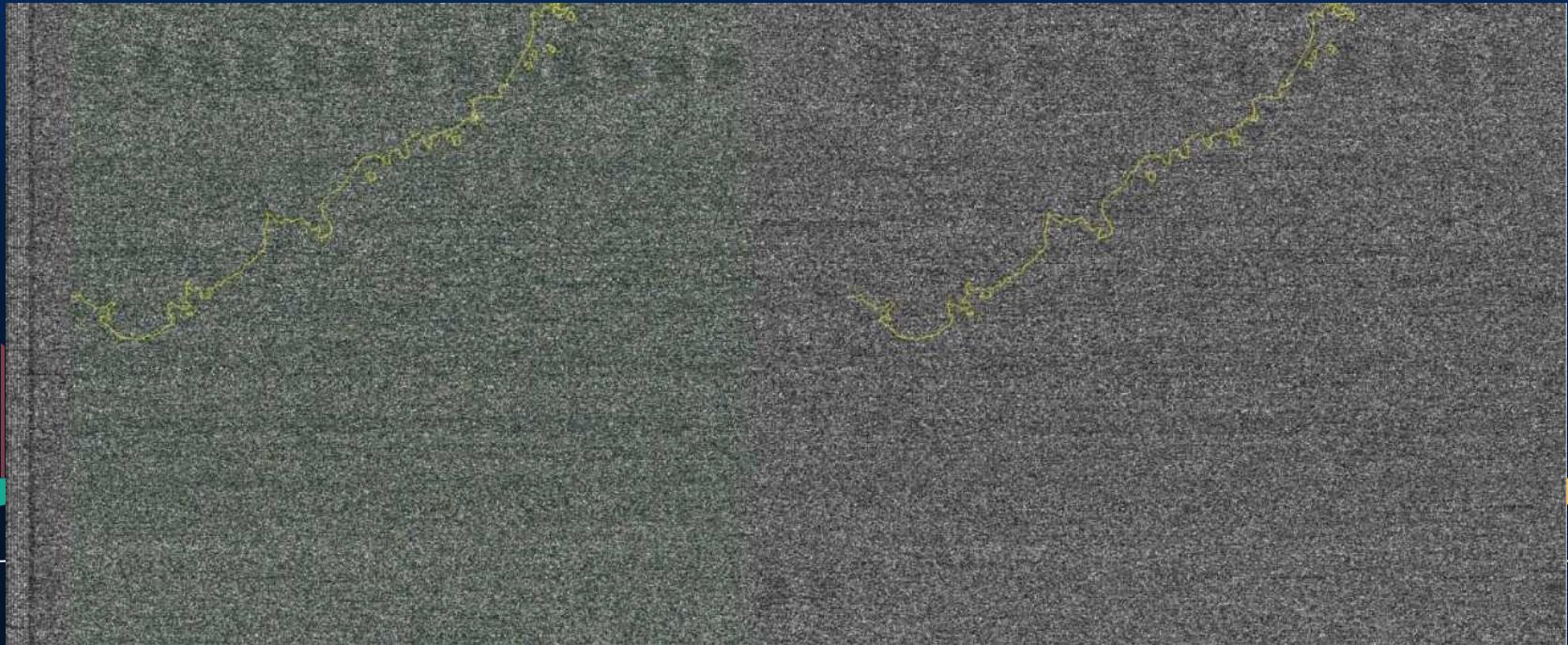
Using WXTOIMG



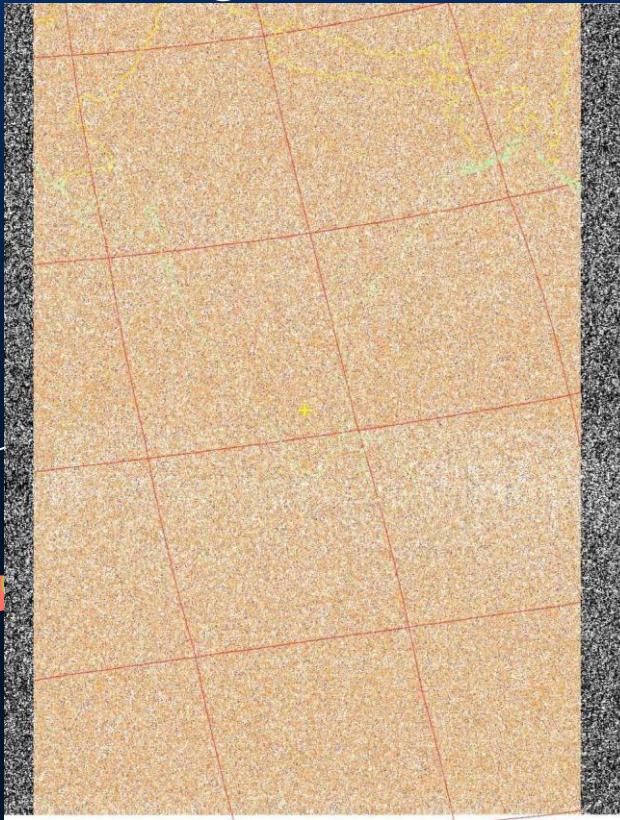
Using WXTOIMG



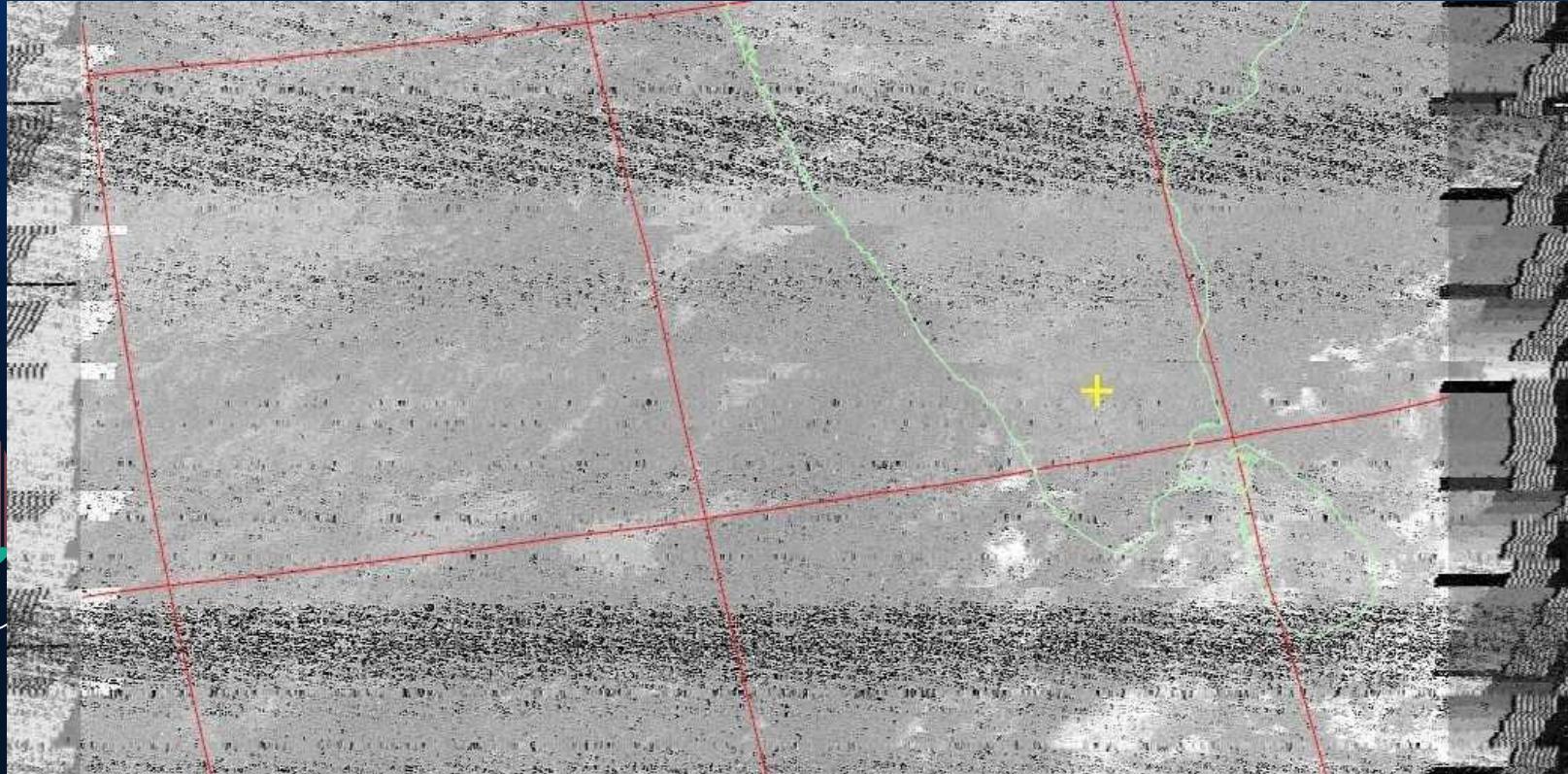
Using WXTOIMG



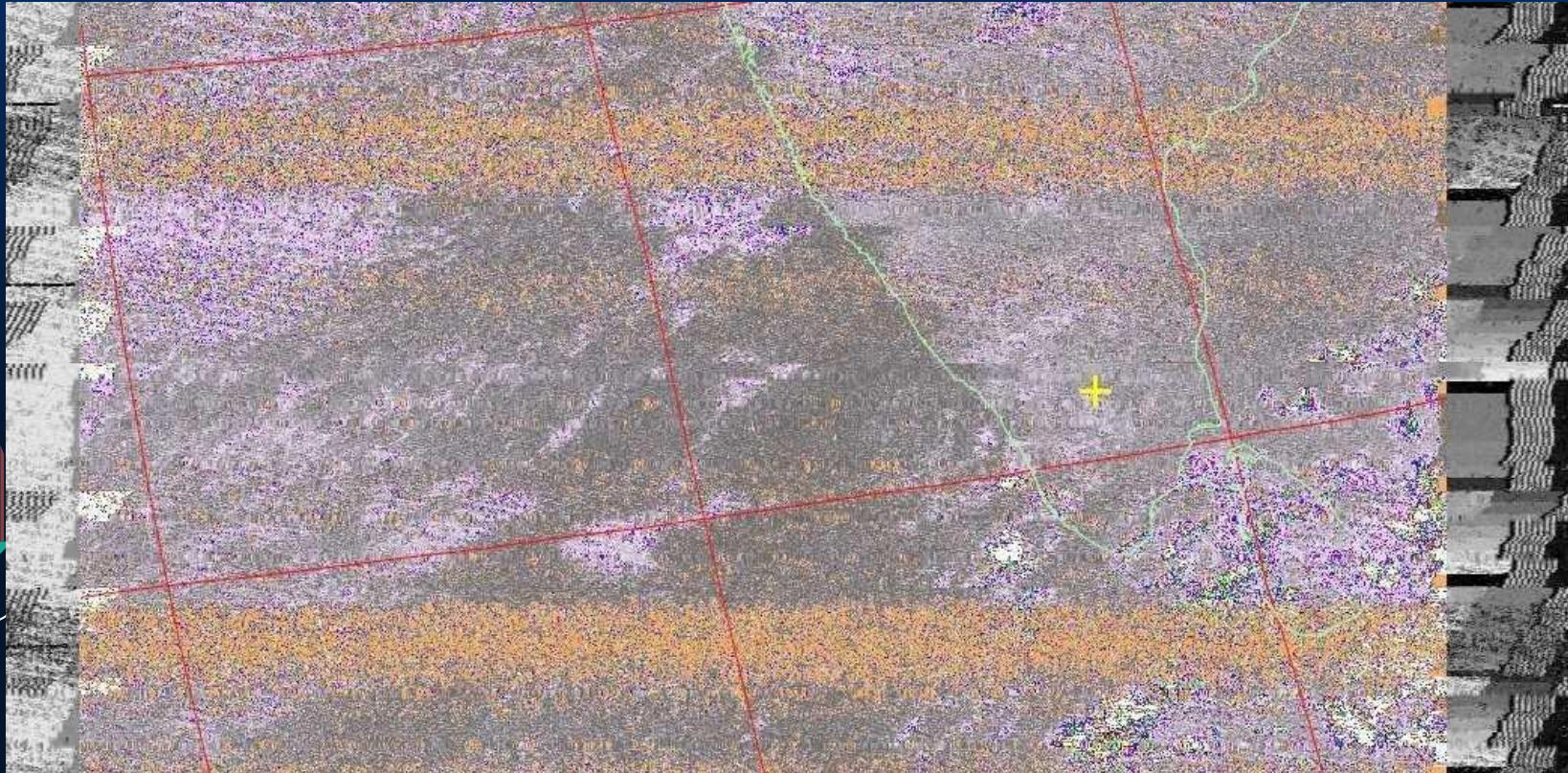
Using WXTOIMG



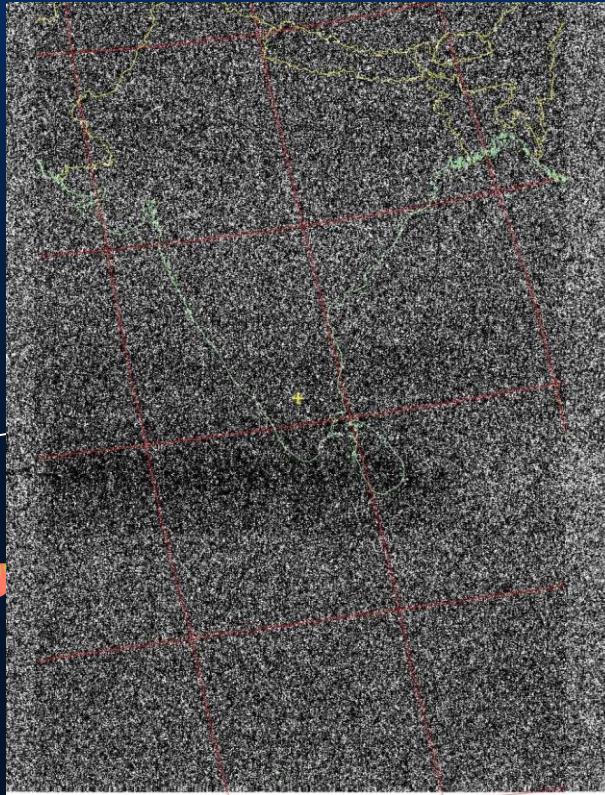
Using WXTOIMG



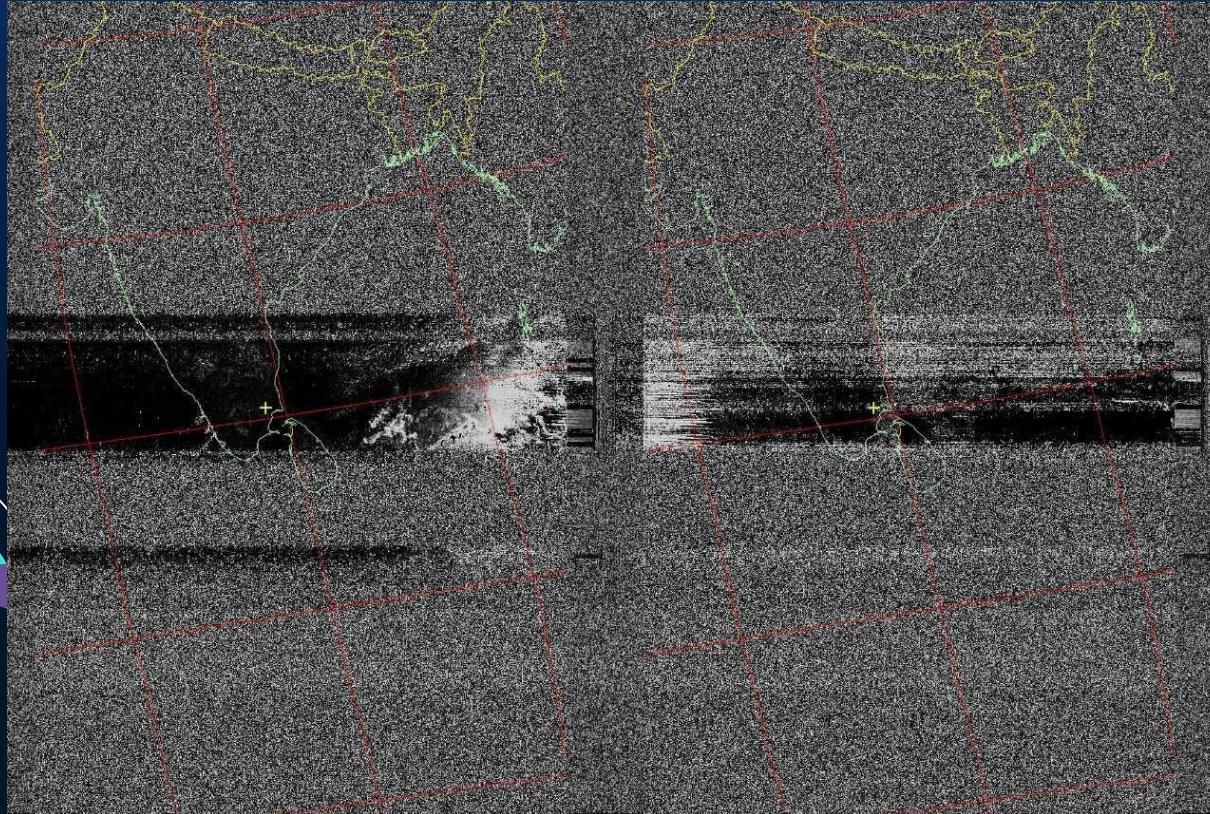
Using WXTOIMG



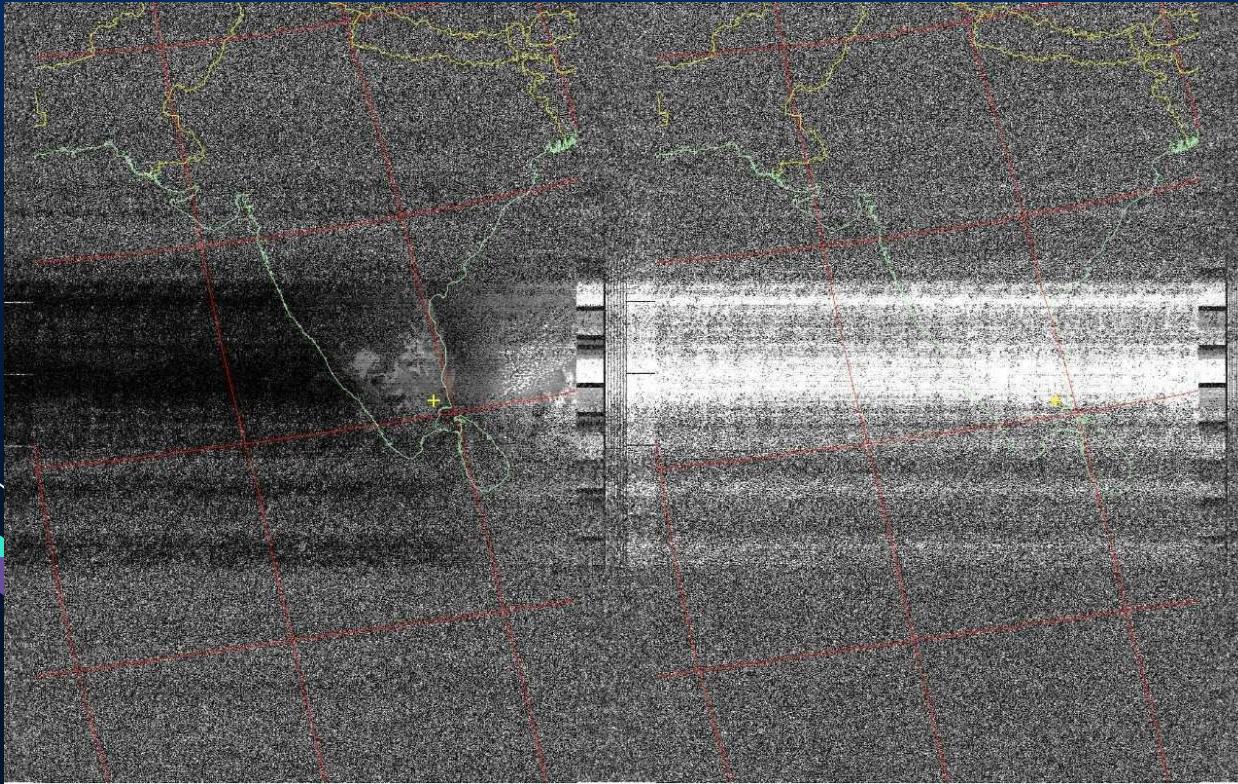
Using WXTOIMG



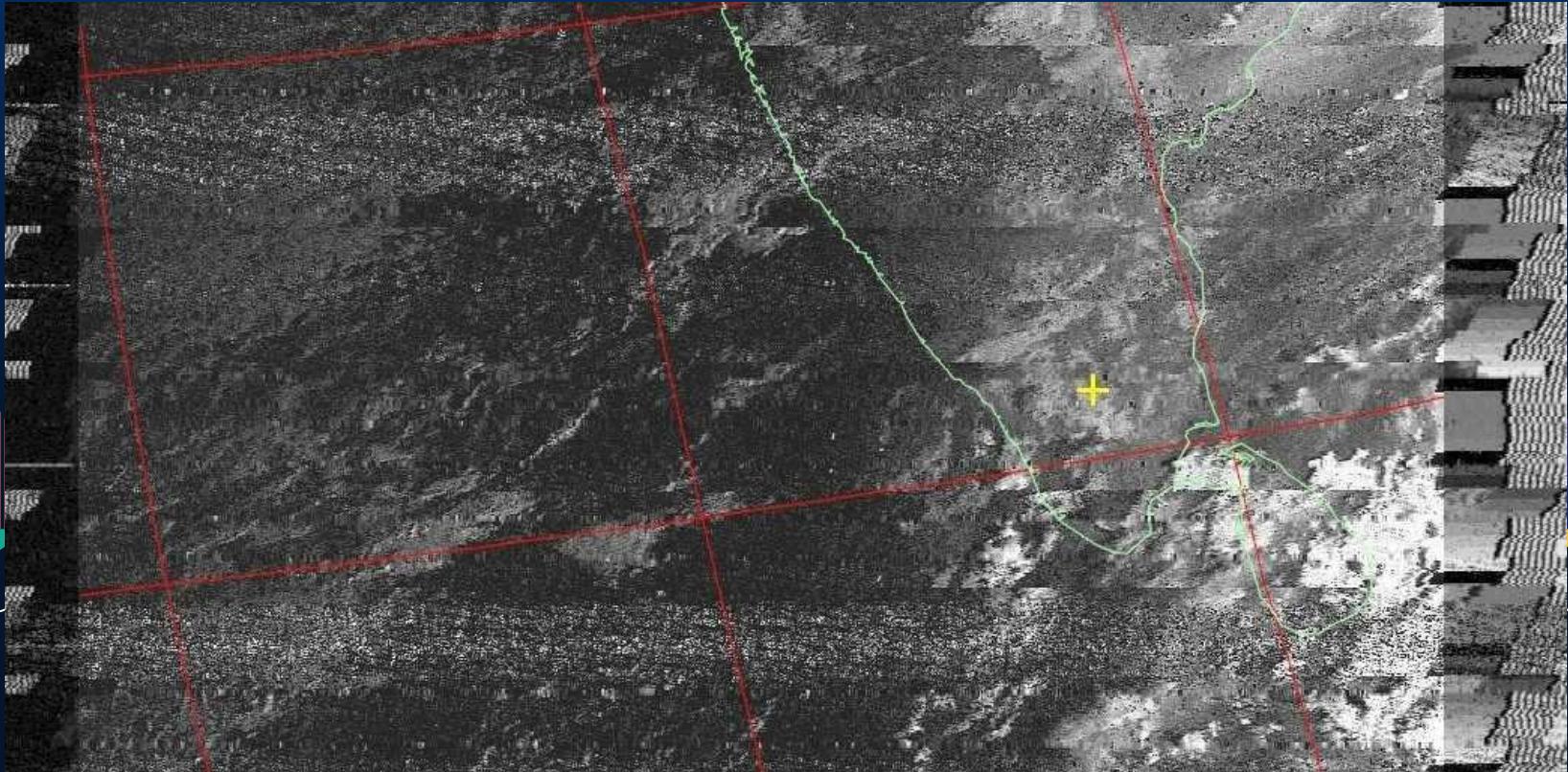
Using WXTOIMG



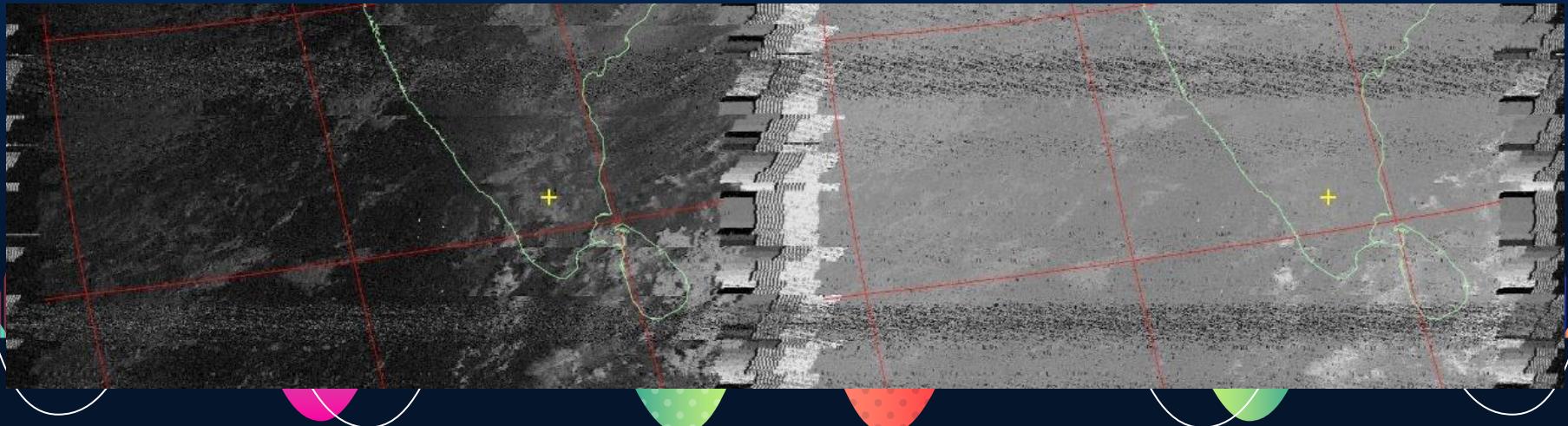
Using WXTOIMG



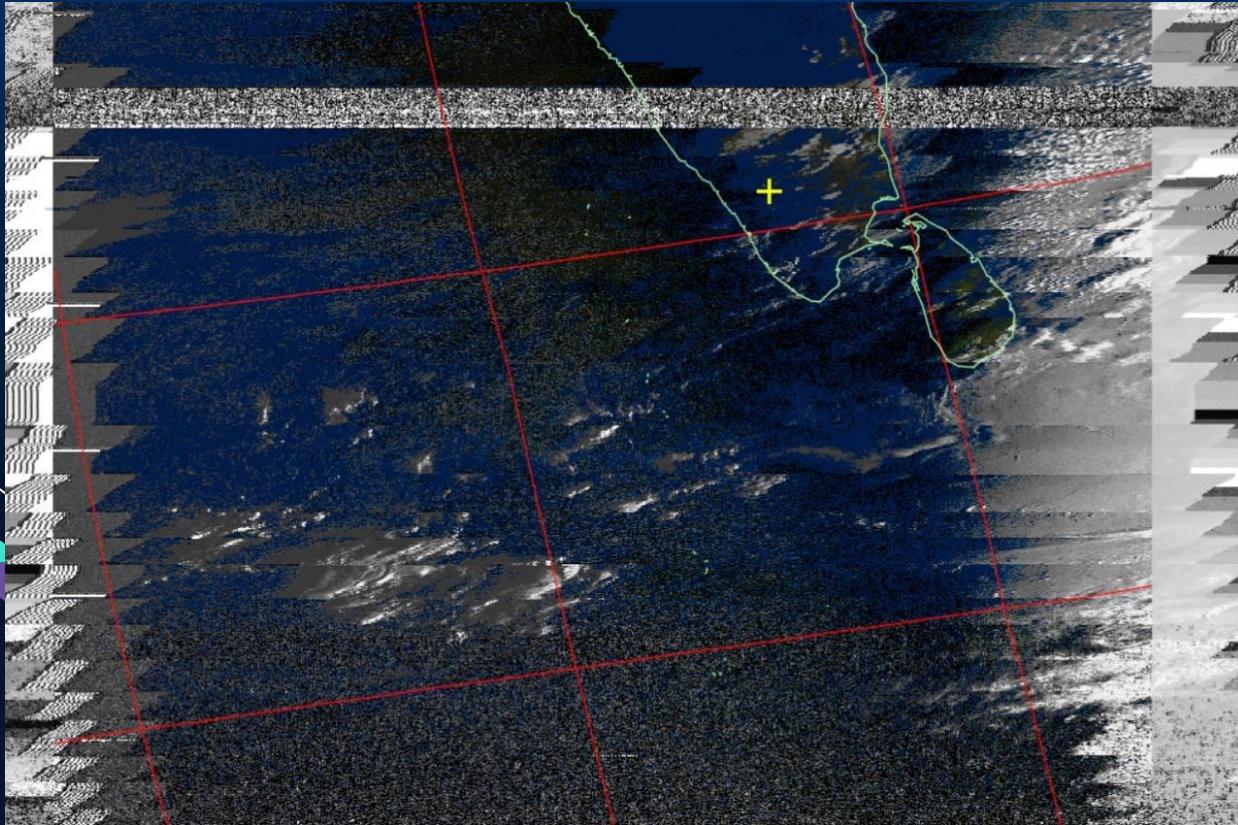
Using WXTOIMG



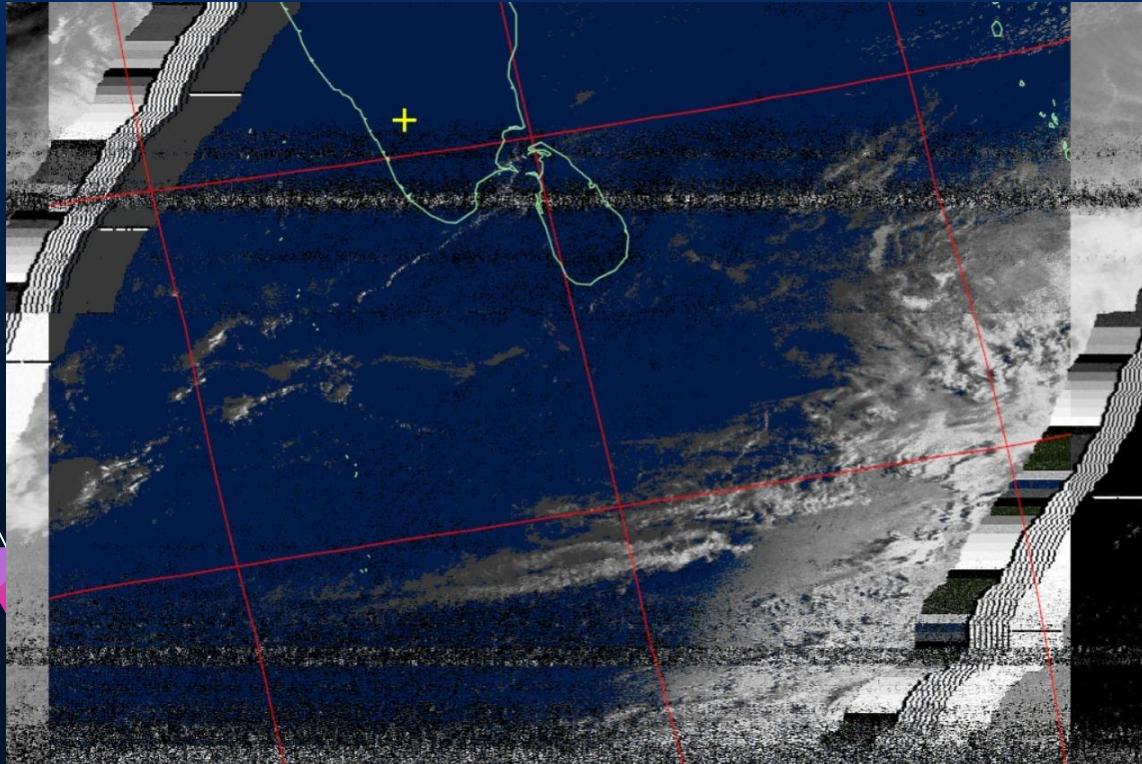
Using WXTOIMG



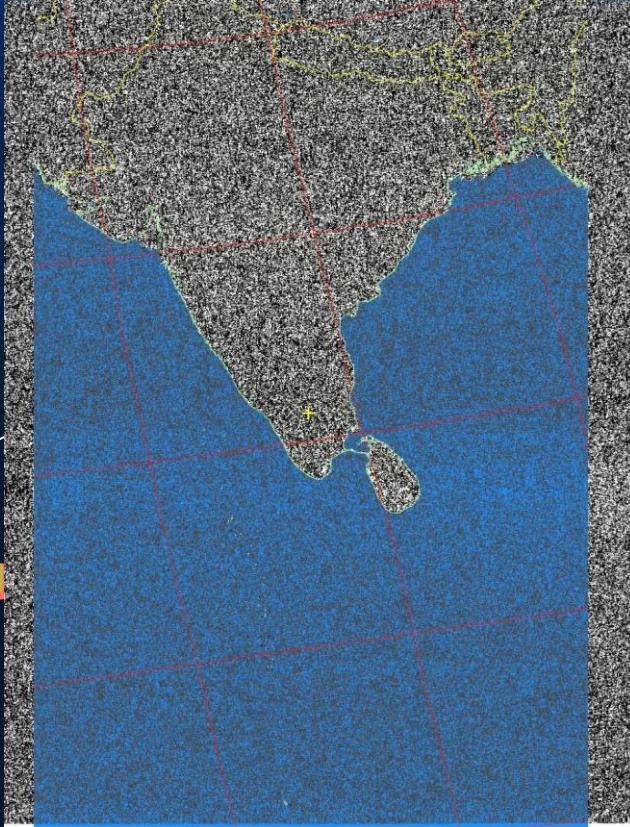
Using WXTOIMG



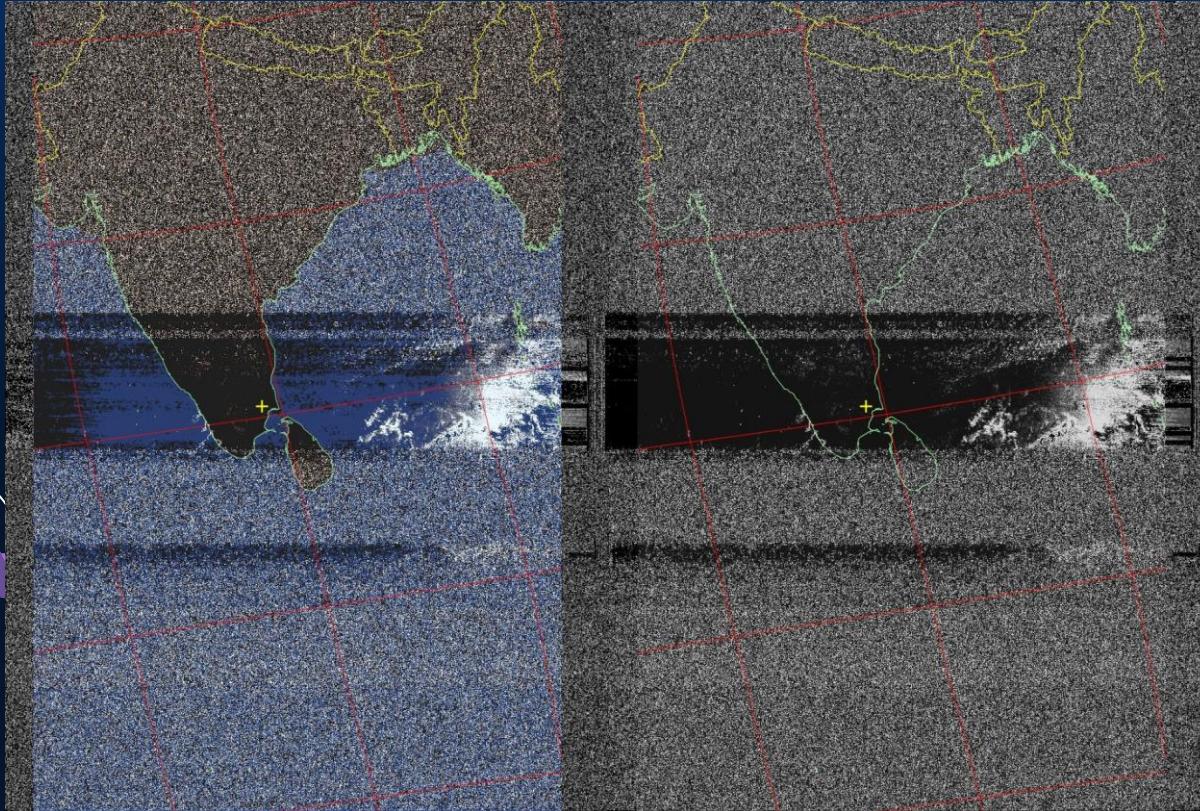
Using WXTOIMG



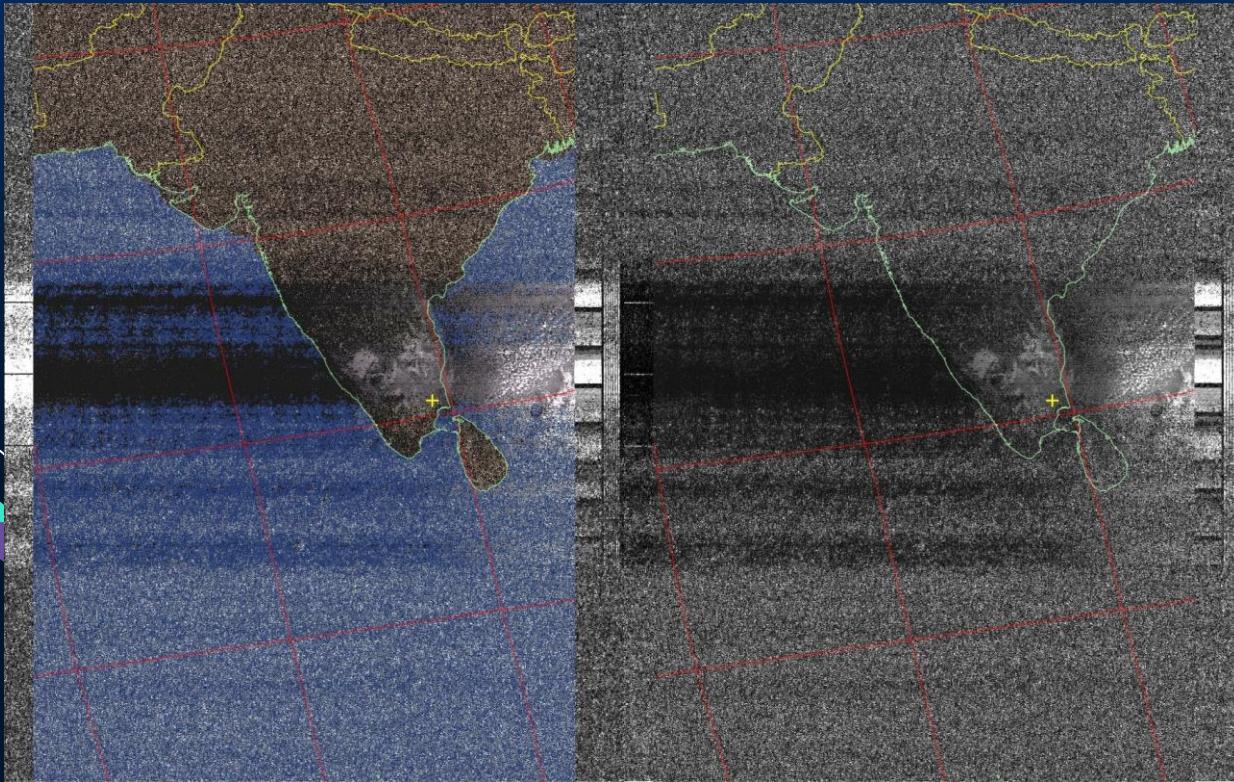
Using WXTOIMG



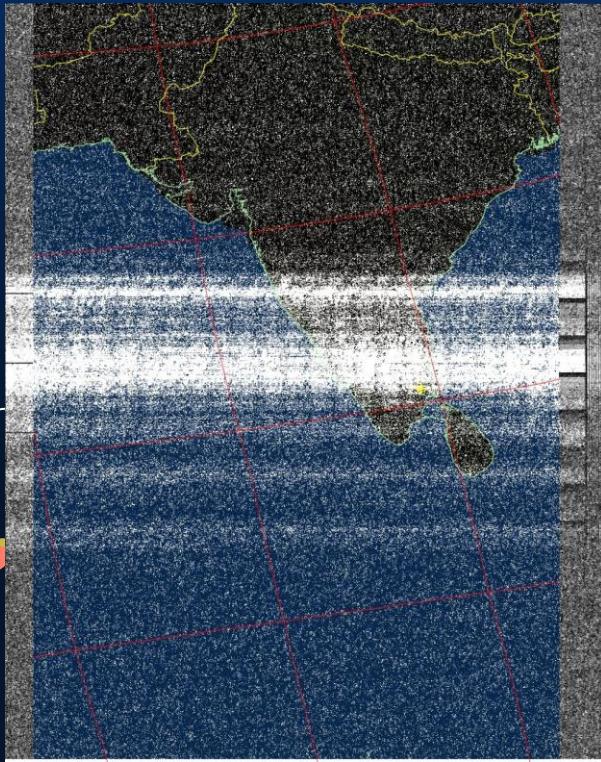
Using WXTOIMG



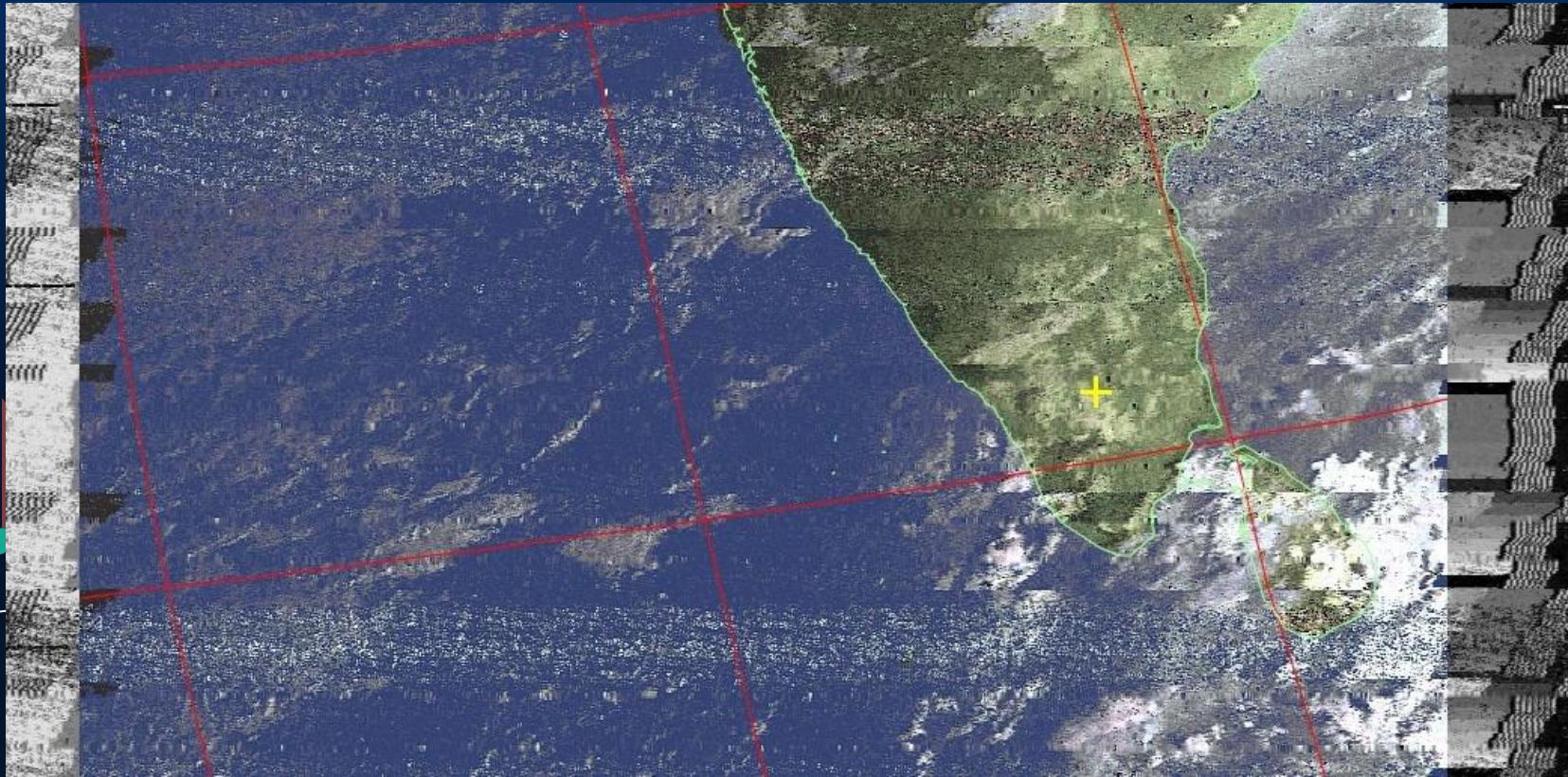
Using WXTOIMG



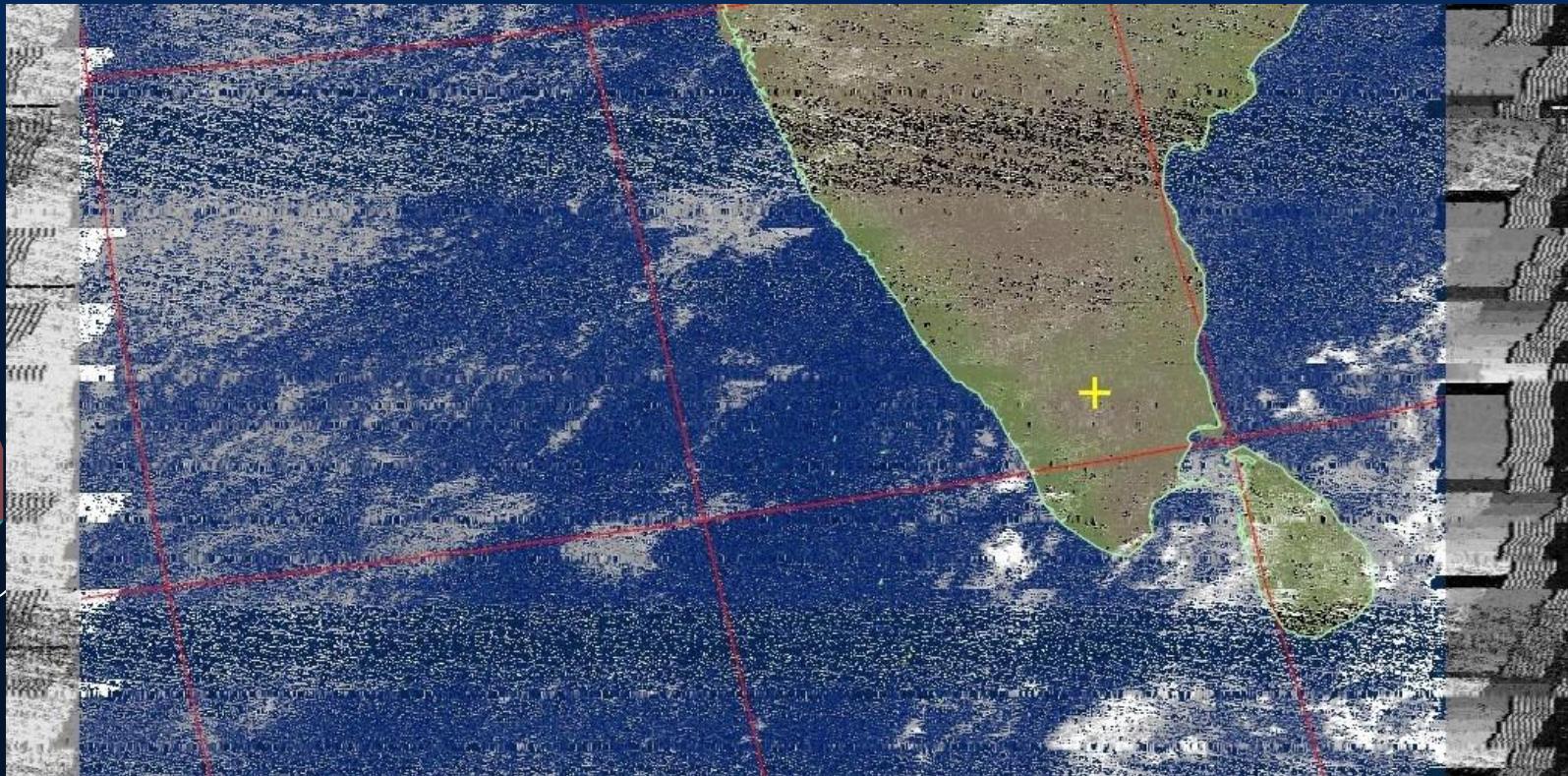
Using WXTOIMG



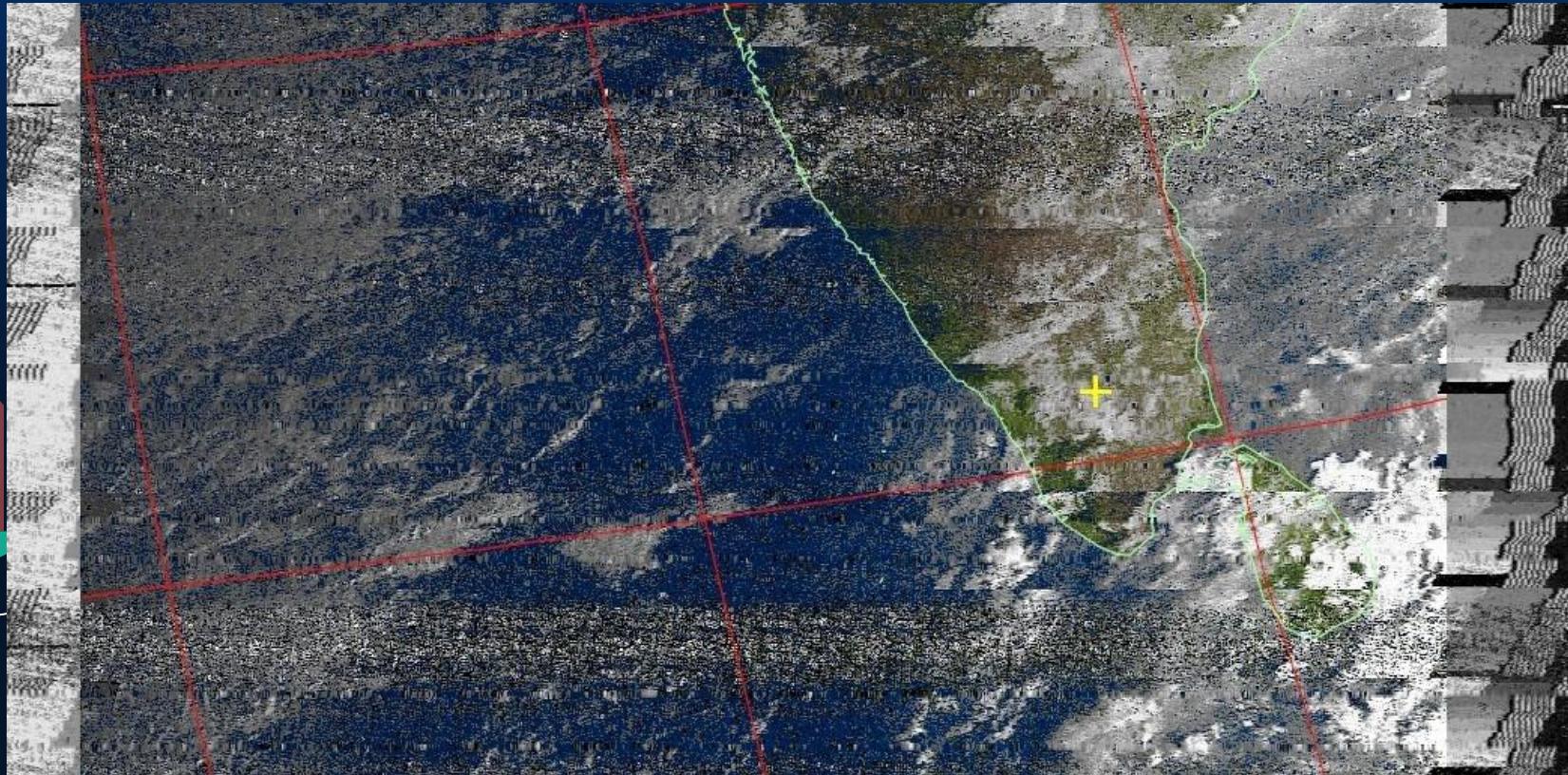
Using WXTOIMG



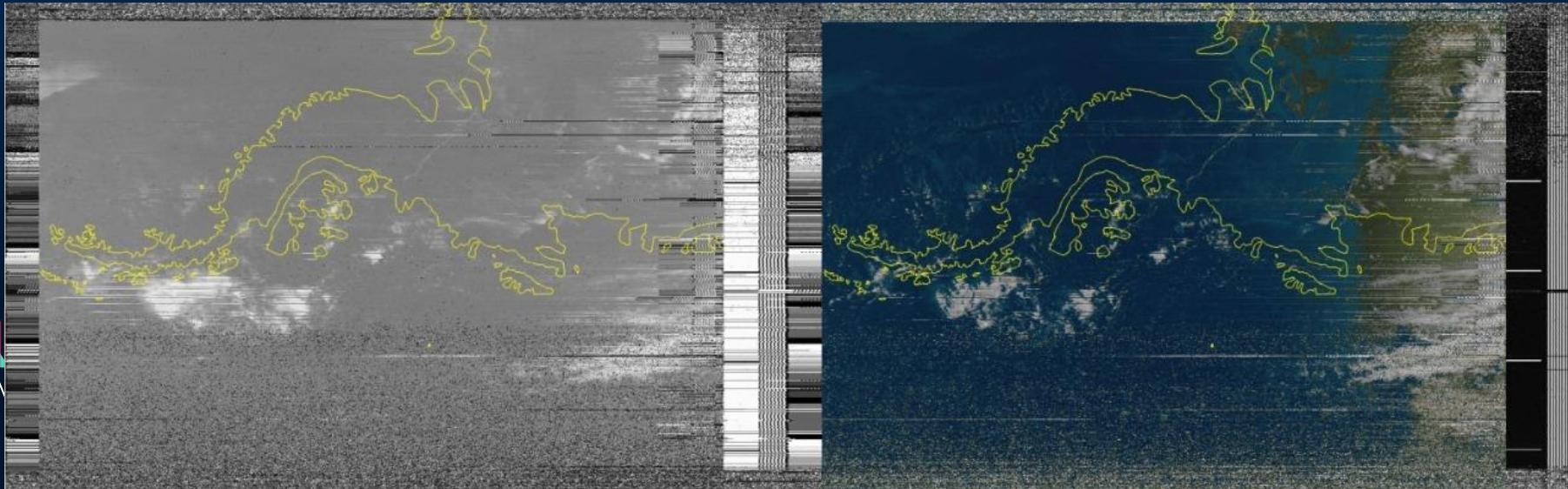
Using WXTOIMG



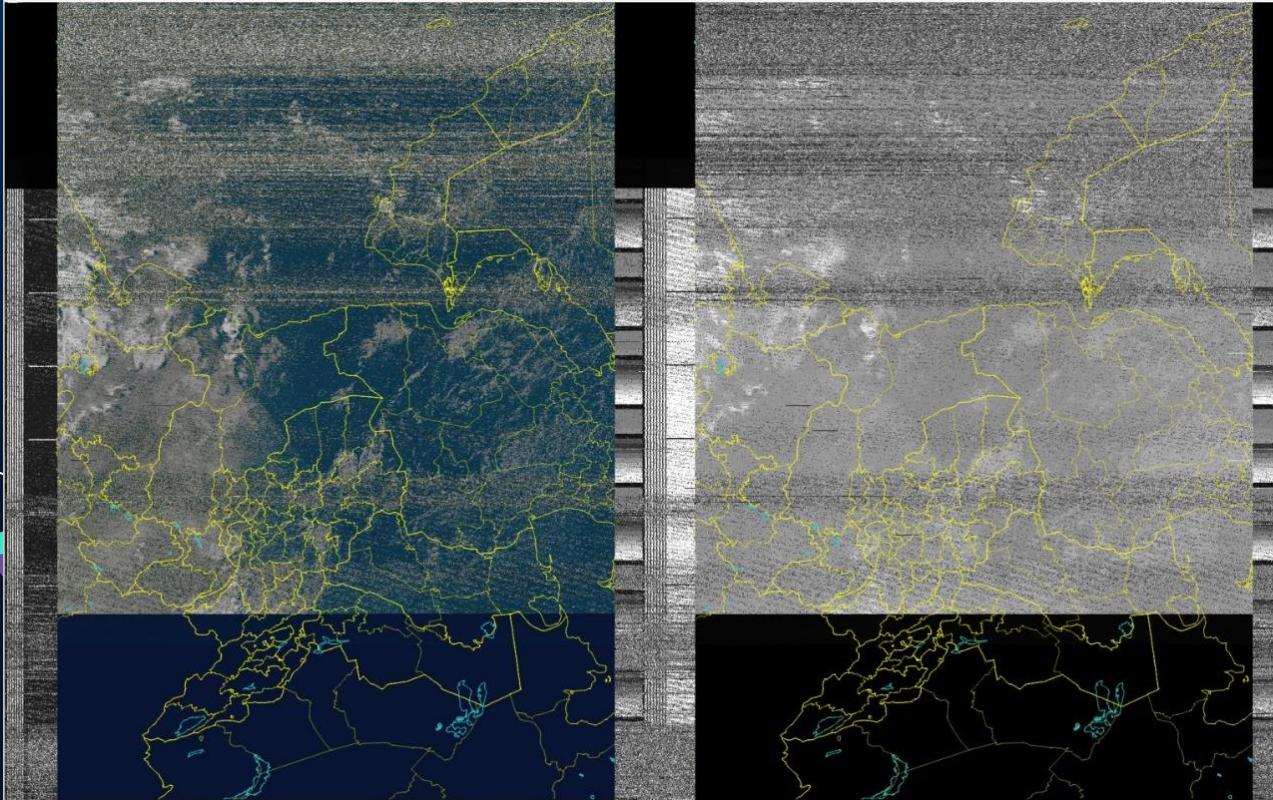
Using WXTOIMG



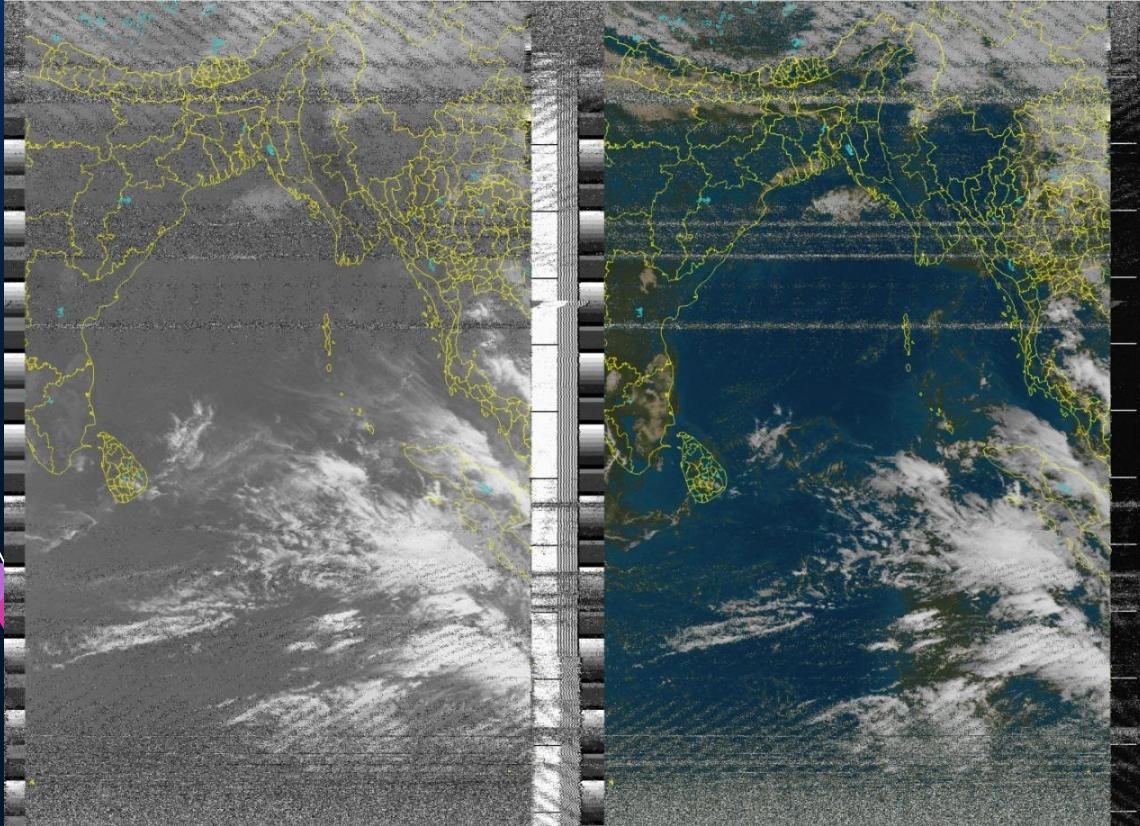
Using NOAA-APT



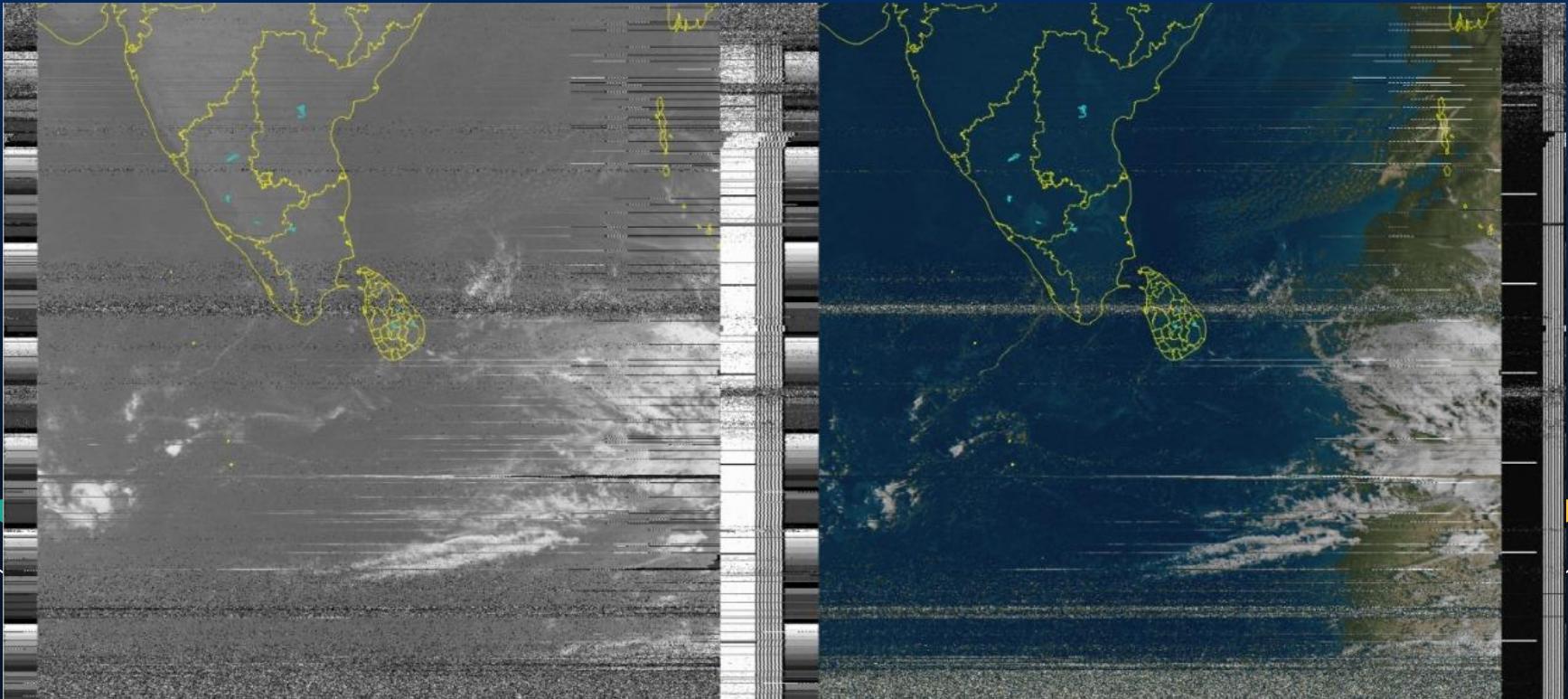
Using NOAA-APT



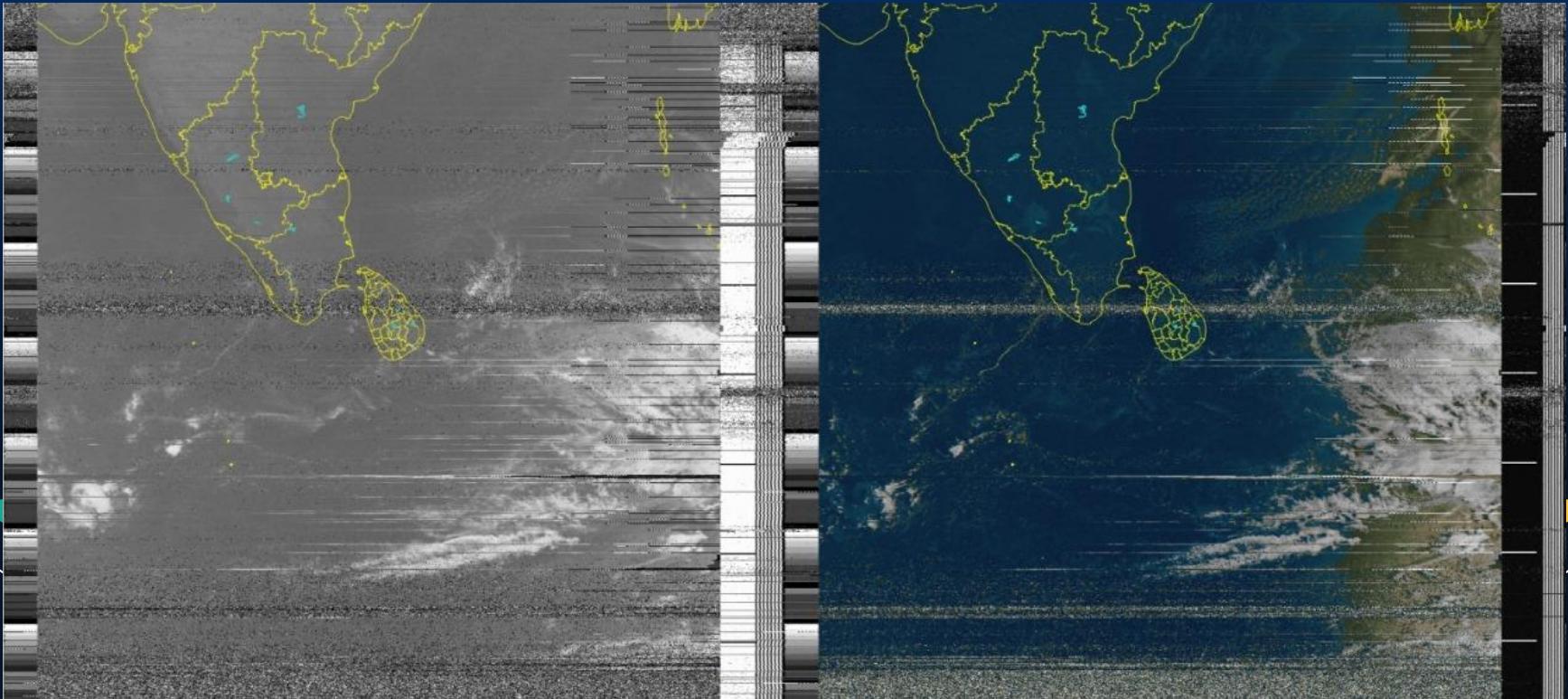
Using NOAA-APT



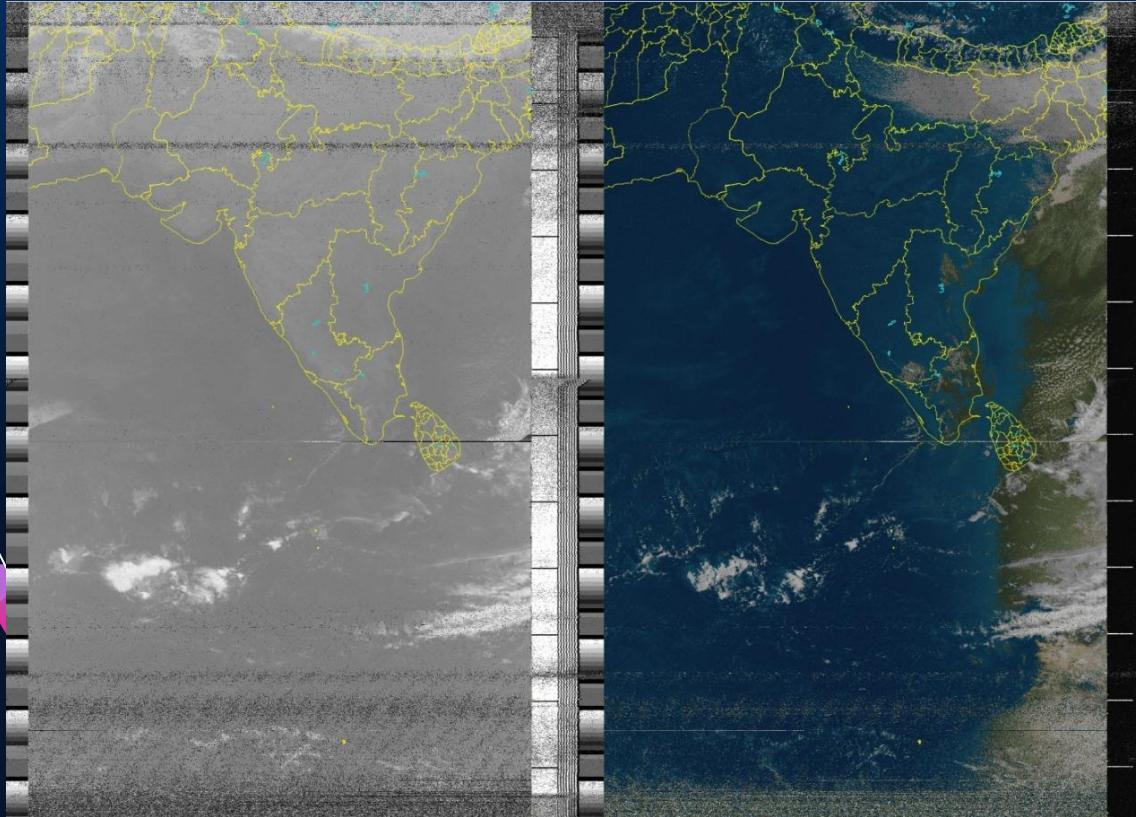
Using NOAA-APT



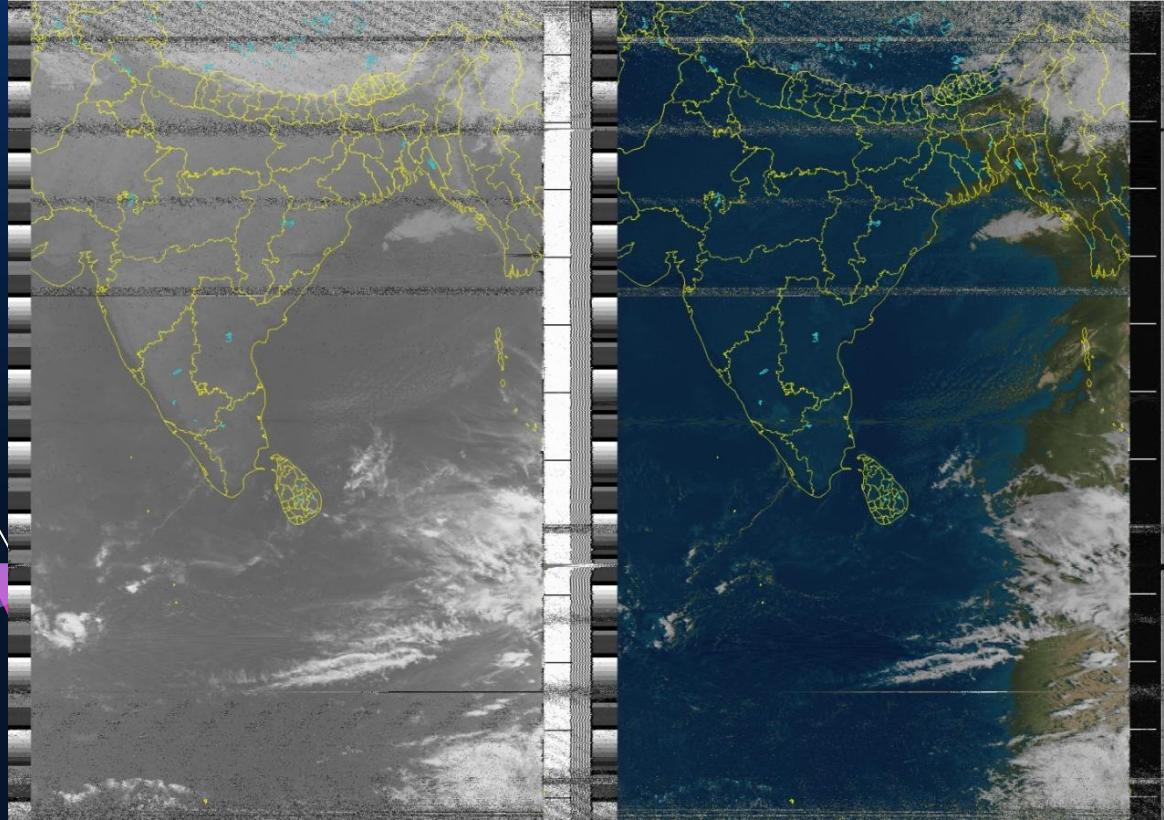
Using NOAA-APT



Using NOAA-APT



Using NOAA-APT



THANK YOU

