Easy installation Russian Meteor-M2 weather satellite
(MeteorGIS v2.25, September, 2022)

Russian Meteor M-N2-2 †satellite

Roskosmos

Author: C.R.v.d.Laan, PA3CVI

Content   page.

1. Introduction.

Following the first article, NOAA Live Weather Reception, here is a description of Russia's Meteor satellite reception. In about 6 minutes, for example, it flies into orbit from Tunisia to Greenland. Below an example of the (ex) Meteor M2-2† live recording.
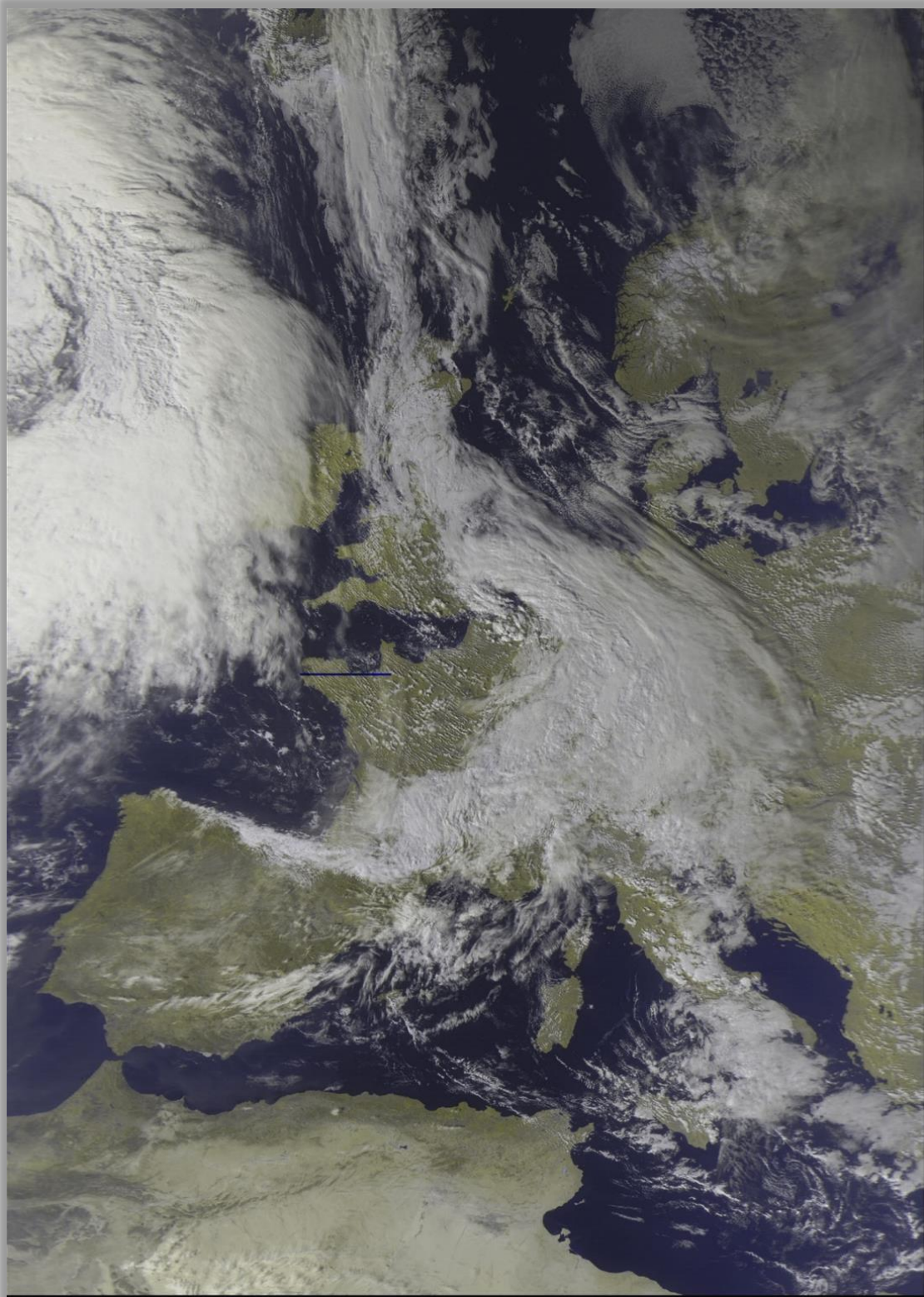

Figure 1, Live Recording of the Meteor M2-2 †

You should have sufficient skills to perform basic PC operations such as downloading and extracting files, installing software, moving and copying files. Also have the motivation to learn to deal with new software. This manual aims to provide support where possible.

In this article I have chosen the simplest way to set up a configuration to receive live satellite recordings. You can then get started relatively quickly. If you want to delve deeper into this matter later, you can create a completely different setup yourself, based on the basic program URLs and the many plug-ins that are available.

The Russian weather satellite takes wide-angle images of the Earth to observe the clouds and the ice sheets. The high image resolution makes it interesting to also receive live weather images from this satellite.

The digital signals are, in contrast to those of the NOAA analog signals, very sensitive to surrounding obstacles and therefore hardly or impossible to receive with an indoor antenna.

Recent developments have caused many problems to arise when setting up a working Meteor LRPT receiving station. The name LRPT (Low Resolution Picture Transmission) is misleading in that the images are still much sharper than the analog NOAA images. The image resolution is 1km/pixel.

Below a beautiful Meteor N2 detail enlargement of the volcano Etna, which shows a large plume of smoke during the eruption, fig.2.
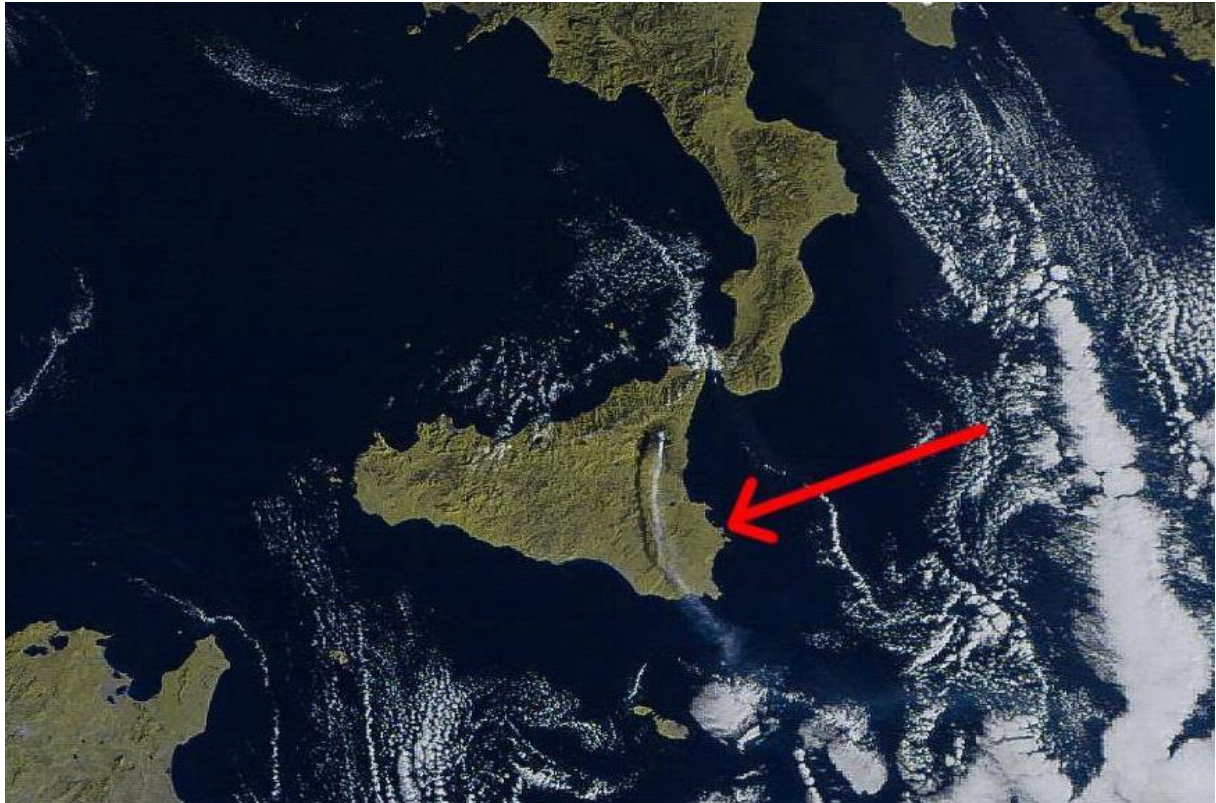

Figure 2, Detail live recording M2 received by Vitor Jacinto, Liège

Figure 3, remnants of snow in the Pyrenees.

Many of the software download URLs have changed. As SDRSharp and its plug-ins evolve rapidly, incompatibilities arise that can lead to system failure resulting in the end of support for Windows XP. Current versions of SDRSharp and its plug-ins require Windows Vista, -7, -8, 10, or -11 to function. They cannot run in Windows XP. Over the years, a lot has changed with the new versions of the SDRSharp program and modified plug-ins.

Let's go back in time:

The launch of the Meteor **M2** took place July 8, 2014. Unfortunately the LRPT adapter is not functioning correctly, which is why a so-called glitch occurs every 6 minutes in the form of a white bar. This is known and cannot be fixed. The cause is, as claimed, cosmic particles of an occurring Solar storm. Some published images don't show these stripes and are then photoshopped away.

July 5, 2019 the launch of a second meteor satellite, the zo mentioned **MN2-2**, but January 2020, there will be only short-term power-ups in the radio visibility zone and battery life wil be reduced tenfold. Of particular concern are the batteris they are very quickly overheated and switching from regular to backup. Onfortunately the power supply features do not allow the 137MHz transmitter to bu used in abnormal power, mode (from solar panels) which is use now although technicalli it is working fine.

There will be no LRPT transmission's anymore. (info Happysat)
The Meteor MN2-2 can still be received in the X-band 61.44MS/s QPSK on 8128MHz (MSU-MR instrument).

Vasili, an SDR RTL plug-in programmer, and Oleg (with whom I've had some contacts about the encoder of 'Lrptdecoder'), combined ideas to create a new QPSK demodulator plug-in for SDR-RTL that would control the real-time reception and allows decoding of the two Meteors.
The demodulator also offers the advantage of faster and longer signal lockout, and also works much better with weak signals compared to the old method.
At the same time, Vasili has also released another plug-in called "DDE Tracker" that allows a satellite tracking program, such as "Orbitron", to control "SDRSharp".
The Russian weather satellite is active on:

Frequency 137.100000 MHz.

2. Necessary hardware.

On to practice.
Which components do you need at least for a reasonable reception:

- o RTLSDR USB stick..
- o QHF, or equivalent, antenna.
- o Een 137 LN- amplifier.
- o Possibly a bandpass filter, 137 MHz.
- o Computer (Windows 11/10/8/7)

Antenna.

For weather satellite reception you should think of a QHF or Turnstile antenna, fig. 4
and 5, in the range of 137Mhz. Googling the internet provides sufficient information
about this. Make sure to place it as high as possible against a metal surface for best
results. Try it first with a high placed antenna, if the signal is still too weak, then you
will have to buy an expensive LNA (Low Nois Amplifier) fig.6 and place it close to the
antenna.

Figure 5, Turnstile antenna.
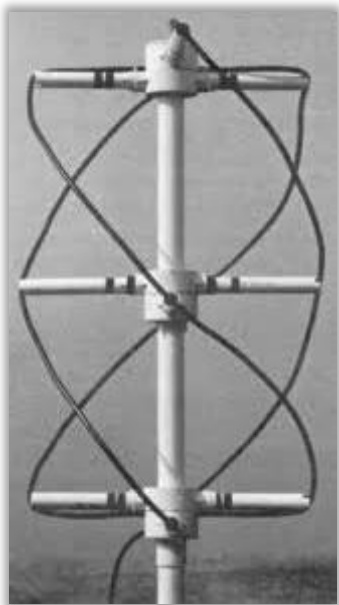
Figure 6, Amplifier.

Figure 4, QHF antenna.

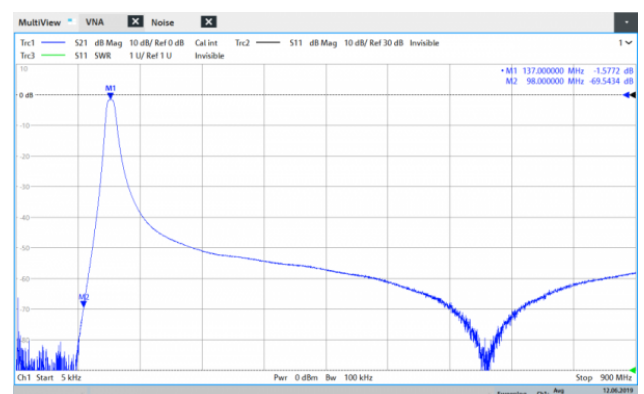*Figure 7, Helical bandpass filter, Meteosat 137 MHz*

Figure 8, bandpass curve, filter

RTLSDR USB stick (tested on Windows 11/10/8/7

32/64 Bit)

Currently the most common RTL-SDR USB sticks are
the R820T/R820T2, usually for sale for about 30 Euro.
fig.9. I have bad experiences with a Chinese-made
RTL sticks. In general, at least a modern fast PC pro-
cessor is needed to run most SDR software
smoothly.

Before we start with the installation, *put the RTL-
SDR USB stick aside* for a while and the usually sup-
plied CD can go in the trash.

Figure 9, RTL-SDR USB sticks.

3. Download all files.

first of all:
*The manual described here, is based on the downloadable MeteorGIS installation file
from Les Hamilton's site. He has already preinstalled almost all settings in the neces-
sary programs, which considerably simplifies the installation.
Despite that, there is still a lot to clarify during the installation, if only to get a clearer
understanding of the whole process. That's what I've tried to do.*

The simplest and quickest way to get the required setup for
receiving the Meteor-M2 signals can be found at Les Hamilton's
URL:

https://leshamilton.co.uk/MeteorGIS.htm
(download the MeteorGIS Suite Installer)

In this page, press [**Click this button**] to download.
the zip file. Place the unzipped **Meteor Gis** folder in a root di-
rectory, *not in a subdirectory*, in my case **C:/**, fig.10.

At this time of writing, MeteorGIS 2.24 will be installed.
On my question to the designer of MeteorGis whether the fonts
of the place names could be displayed a bit larger, version 2.25
has meanwhile been developed. This will become clear later in
the manual.

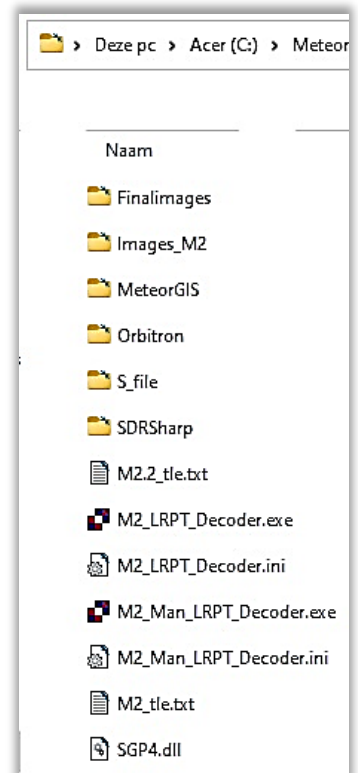Download this version from URL:
http://www.meteorgis.space/beta/

Figure10, MeteorGIS folder

MeteorGIS v2.25 download.

Paste and overwrite the existing files with these files fig.11, in the respective folders: Meteor-GIS and C:\MeteorGIS\Mete-orGIS.

Figure 11, MeteorGIS 2.25.

NB *It is also wise to copy and paste the hole MeteorGIS folders into a USB stick, because you can fall back on it in case of any PC problem*s.

Not in the package: **Smoothmeteor v 1.68** SmoothMeteor is a development from the SmoothMODIS program which stretches Meteor images laterally to compensate for the foreshortened view from satellite.

Folder structure.
The folder configuration then looks like this and it is useful to also include Smooth Meteor, fig.12.
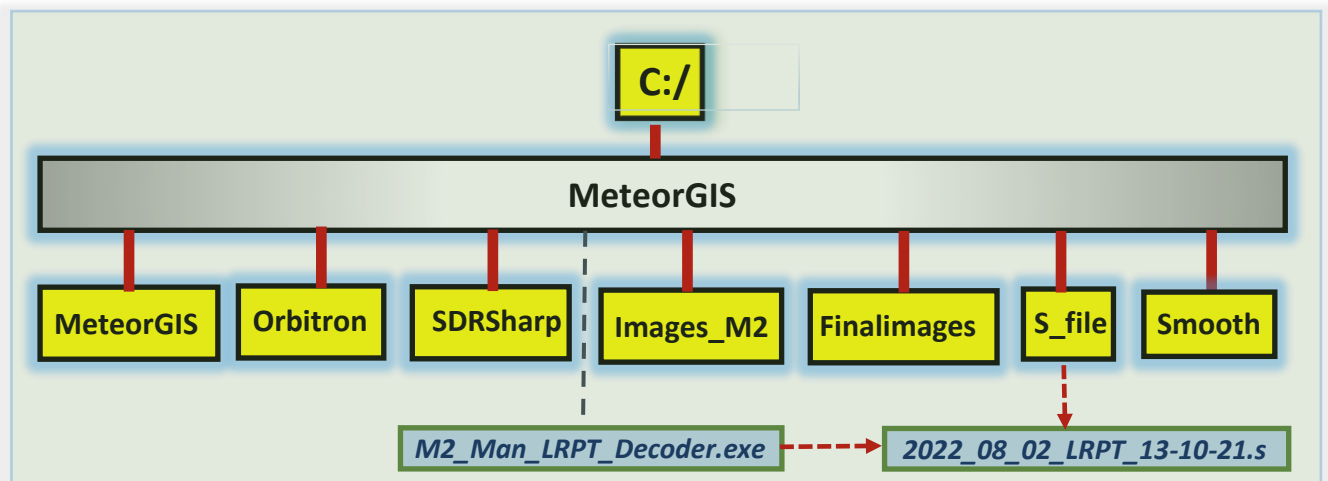
Figure 12, folder structure

Explanation storage folders with images, to get an idea of where which picture is stored, here's a short summary:

- **Images_M2**: decoded LRPT images, fig.13

- **Final Images:** MeteorGIS images, fig.14 and 15

- **S_file**

  2022_08_05_LRPT_18-30-28.s

  With the M2_Man_LRPT_Decoder present in the Meteor folder can later possibly be decoded the S-Files.
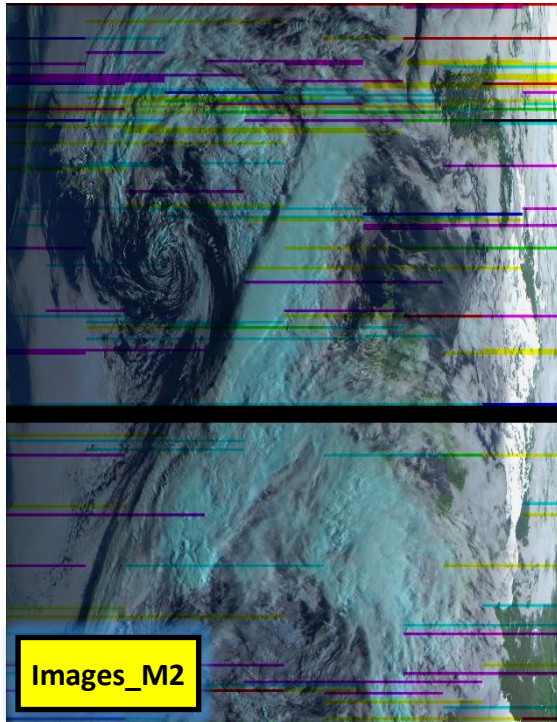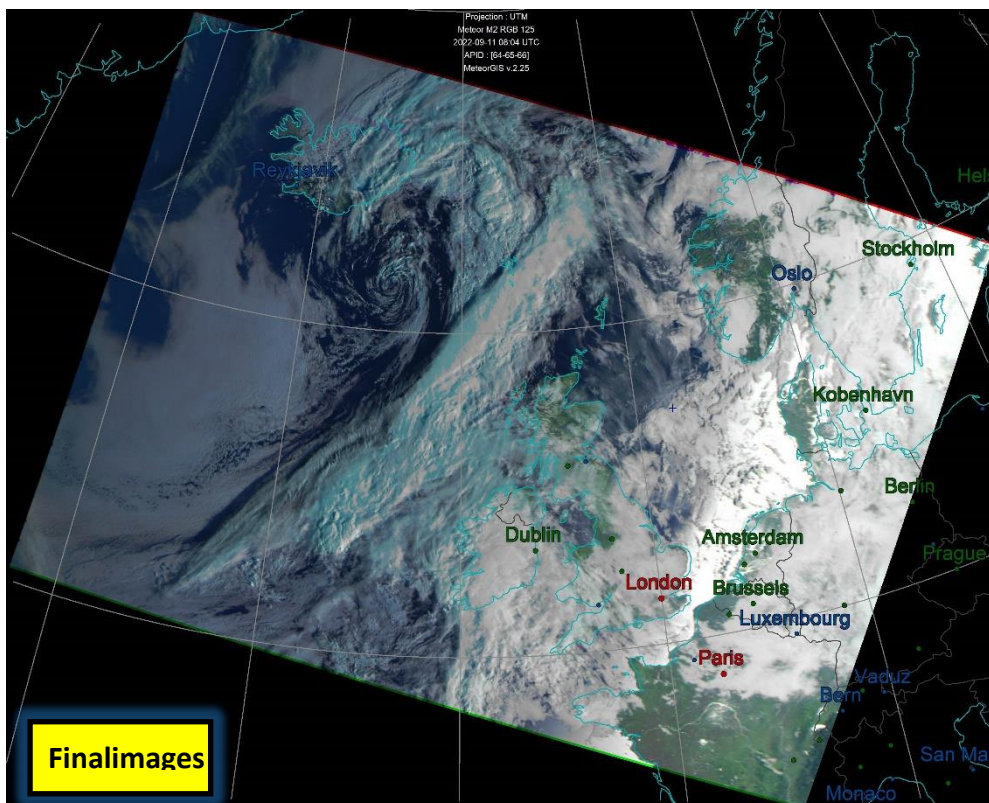
- **Smooth Meteor**, fig.16:

Fig 13, LRPT Images_M2

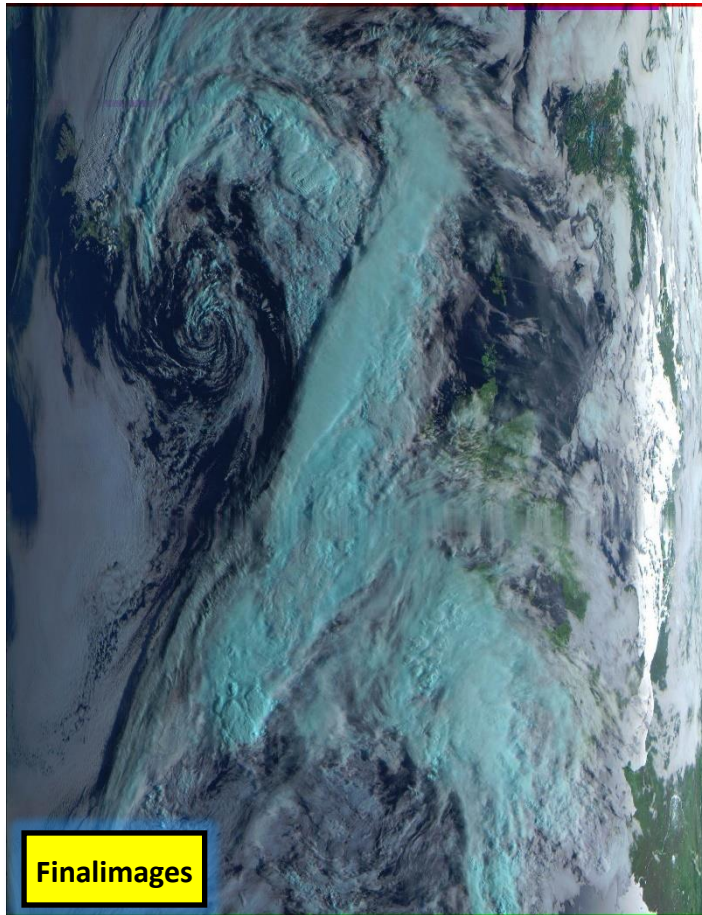*Figure 14, with clearly visible position positions*
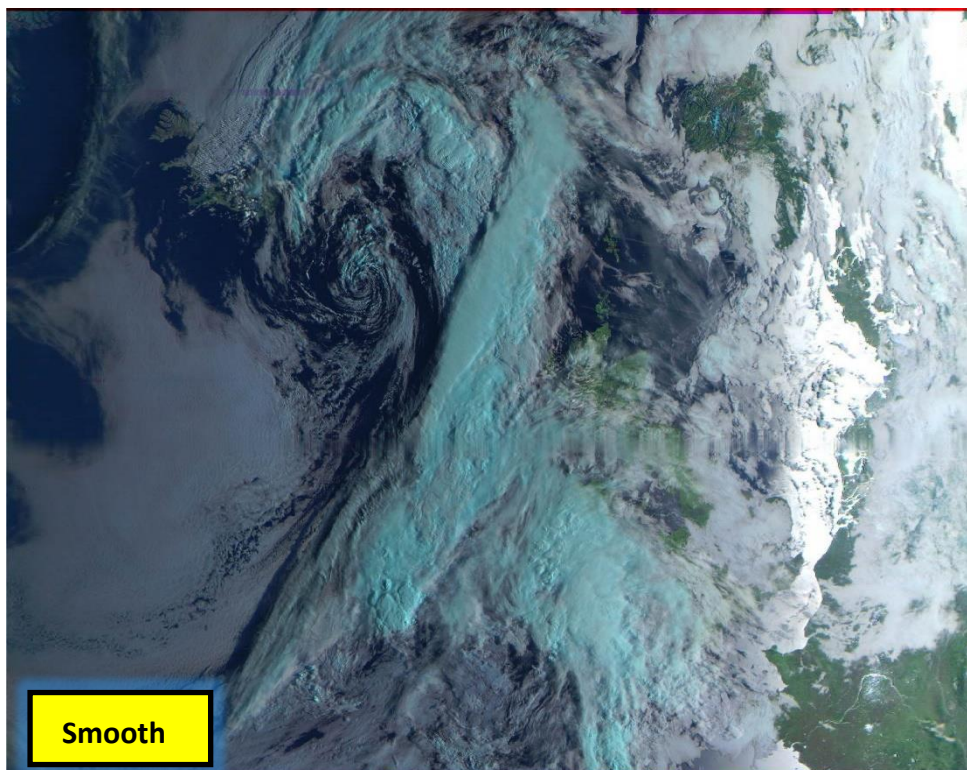
Figure 15, Treated image

Fig. 16, Smooth Meteor Images

4. SDRSharp

First we are going to install SDRSharp.

Run **Zadig** as administrato**r,** zadiq.exe

- **Installing the RTL-SDR USB stick.**

  ✓ Connect your RTL-SDR USB stick.
  ✓ Start 'Zadig', from the SDRSharp folder,
  ✓ (run as administrator!).
  ✓ Click on 'Options'.
  ✓ Click on 'List All Devices'.
  ✓ Select RTL2838UHIDIR.
  ✓ Click on 'Reinstall Driver', fig.17.
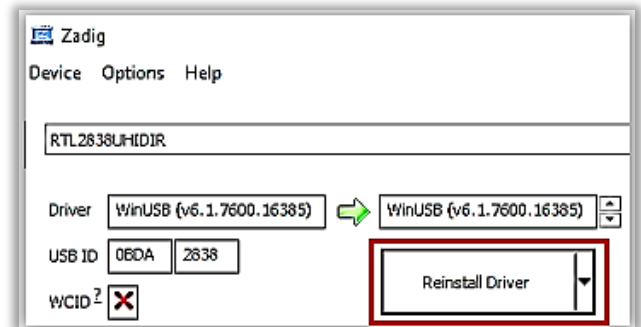

Figure 17, click on Reinstall Driver

When you're done with that, take a look under 'Device Manager' in 'USB devices' to see if the 'RTL2838UHIDIR' driver is included, fig.18.
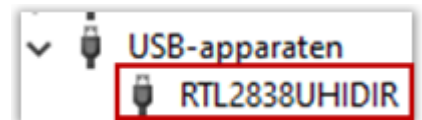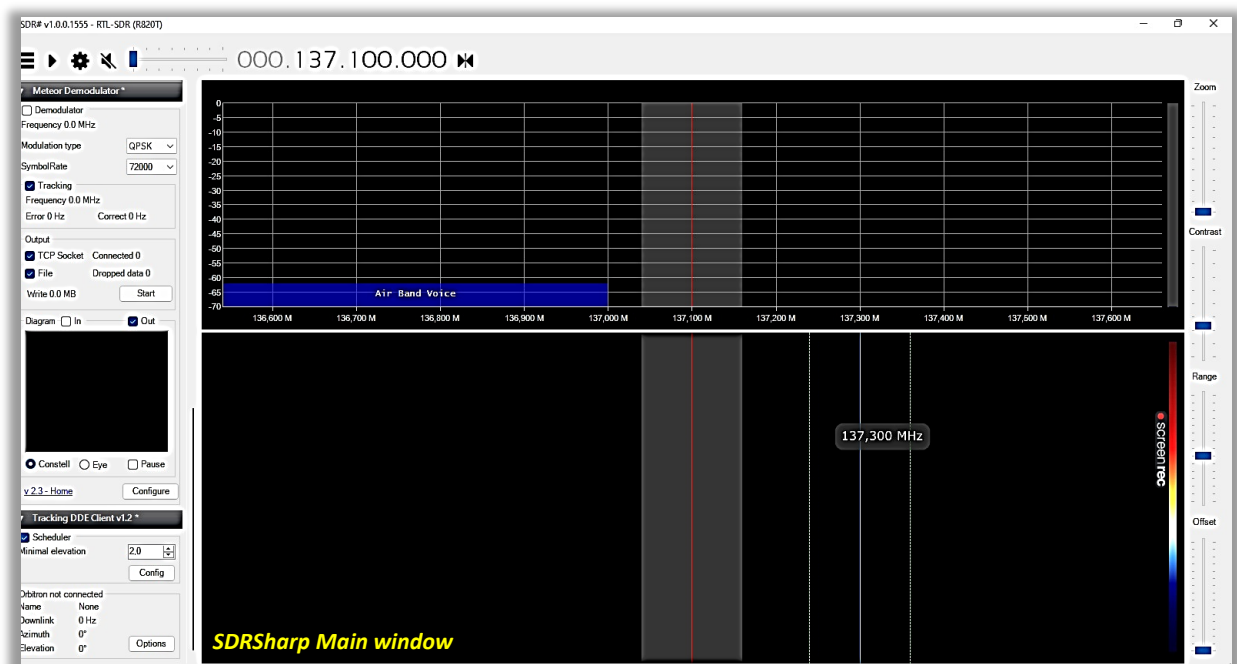

Figurer 18, RTL2838, UHIDIR included.

NB.   *Note that if you take out the USB stick or insert it into another USB port, you may need to run 'Zadig.exe' again and then restart your PC. The installation of the USB stick is now complete.*

Start up SDRSharp: SDRSharp.exe

'C:\Meteor\ \SDRSharp\SDRSharp.exe

When you press this icon   the following window, fig.19, should appear, SDRSharp then communicates with your RTL stick, 20.
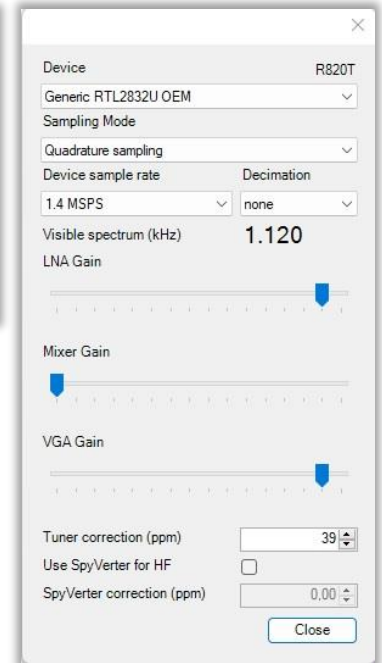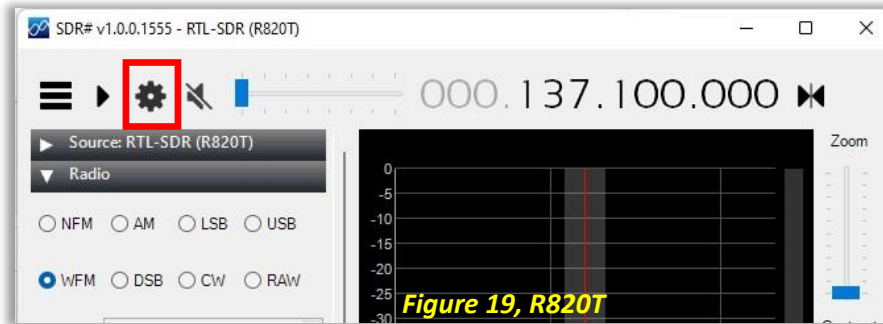

Figure 19, R820T

Figure 20, RTL device

▪ **Frequency Manager setting.**

With this plug-in, you can pre-set reception frequency of M2 satellite to later select the this satellite with a simple click. fig.21.

The ATIS Eindhoven selection is visible above the two Meteors. This is a way to accurately tune your RTL stick.

Figure 21, SDRSharp, Frequency Manager

▪ **ATIS.**

RTLSDR USB sticks are manufactured in large numbers and therefore show small frequency deviations. In my 'Frequency manager' I also selected an ATIS. The ATIS (*Automatic Terminal Information Service*) signal is sent out by the local airport in Eindhoven, 126.025 MHz.

An ATIS frequency is useful for accurately calibrating an RTL-SDR USB stick using the 'Tuner Correction' option of the RTL Controller. In my case I can use the ATIS Eindhoven signal, which I can receive well, but maybe you have a different frequency calibration point. Click on **'Edit'** in 'Frequency Manager', fig.21 and then adjust the data suitable for you, fig. 22.
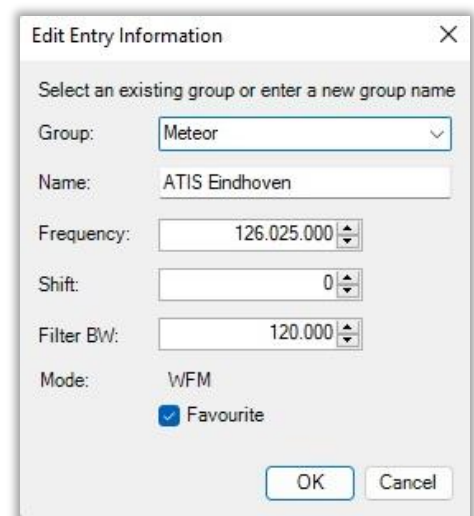

Figure 22, ATS Eindhoven

Start SDRSharp

The signal appears, in SDRSharp, as a sharp peak at a precise frequency, Fig. 23. If you want, you can already connect your USB stick to the antenna and perform the correction by setting SDRSharp to receive, and looking for a known calibration frequency. Zoom in on it and adjust exactly to the signal peak using the RTL-Drivers 'Tuner Correction option', fig.23.
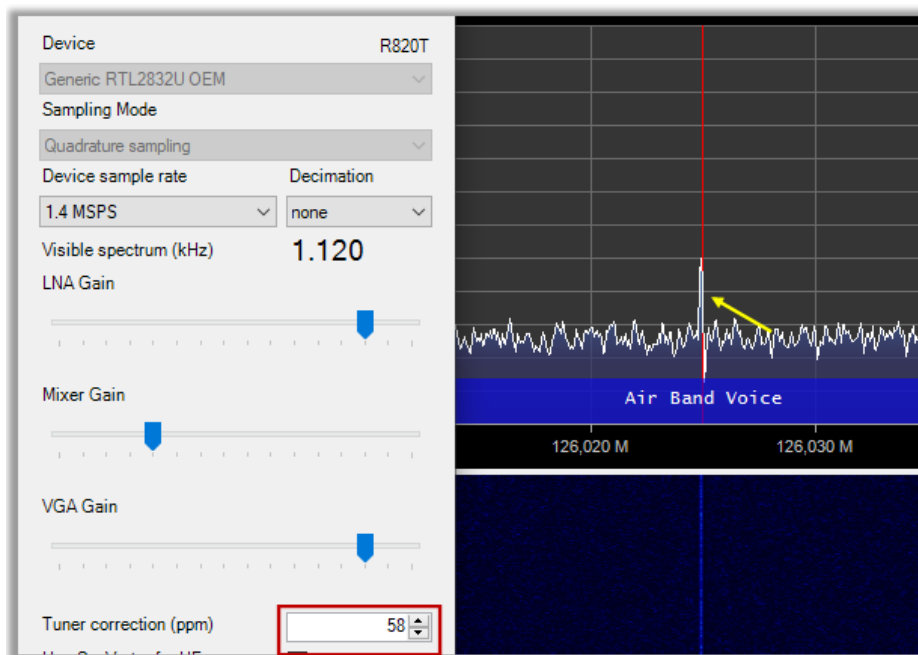

Figure 23, tuner correction and ATS signal.

In 'Meteor Demodulator 'select Config and then in 'QPSK Config' to folder: 'C:\MeteorGIS\ S_file' folder, fig.24. In it SDRSharp stores the unencrypted data of Meteor M2, the so-called S-files.
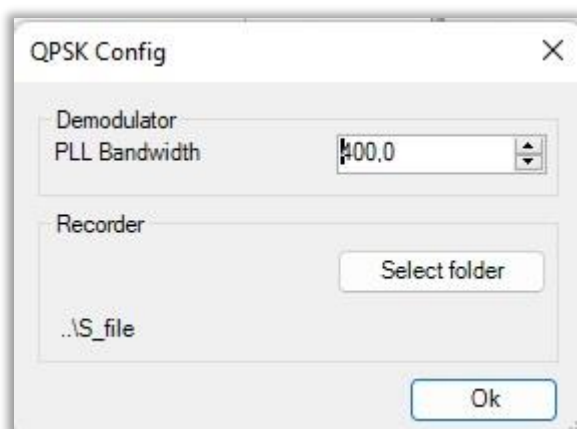

Figure 24, S_files folder.

NB. *The installation is not yet complete, after the MeteorGIS installation a final SDRSharp installation will follow.*

Close SDRSharp.

5. Orbitron.

Orbitron, fig.25, is a satellite tracking system for radio amateurs who want to receive images from the Russian weather satellites and was developed by Sebastian Stoff. (http://www.stoff.pl/)

The application shows the positions of satellites at any time (in real or simulated time). It's FREE and, according to thousands of users around the world, it is probably one of the easiest and most powerful satellite trackers.
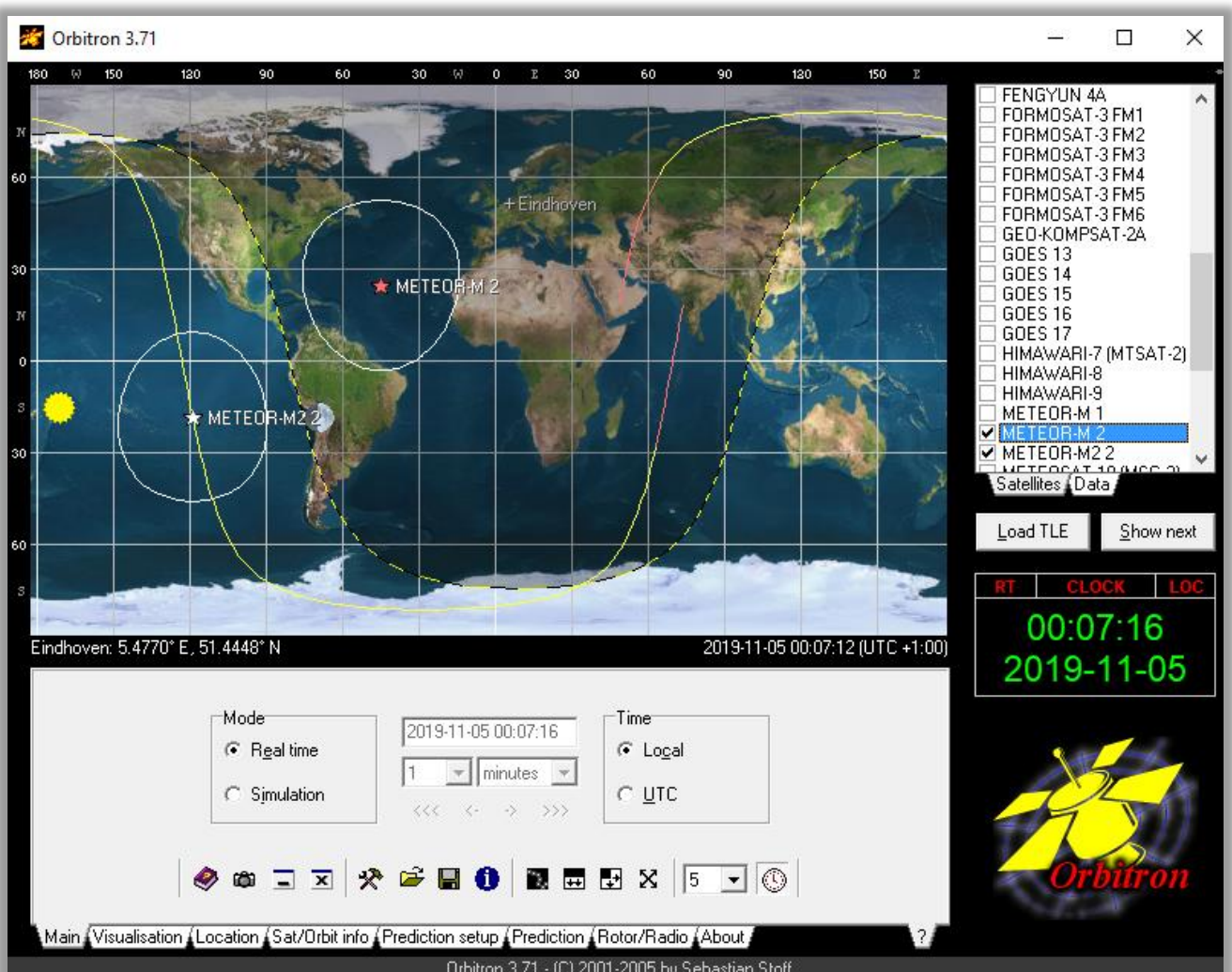

Figure 25, Orbitron, Entry Window

▪ **Installation.**

Beforehand: you will probably come across the abbreviation TLE in the Orbitron windows. What does 'TLE' mean and what is the purpose of 'TLE' anyway?

Very briefly:
TLE is a standard mathematical model for describing the orbit of a satellite and is the abbreviation of: Two Line Elements. These are processed in a computer program, which produces predictions for the viewing time and position of the satellite. The program determines the location of selected satellites above the horizon from a chosen (in your case your antenna position) observation location.

Much is pre-installed, but a number of settings you have to adjust yourself and are described below:

Start Orbitron: Orbitron.exe

With the keys [Alt] [Enter] the window can be enlarged or reduced.

▪ **Preduction setup**

Note!: *After the first installation, 'Lighting required' and 'Elevation sun' may be checked. If that's the case, remove both checks, otherwise things won't work*, fg.26.
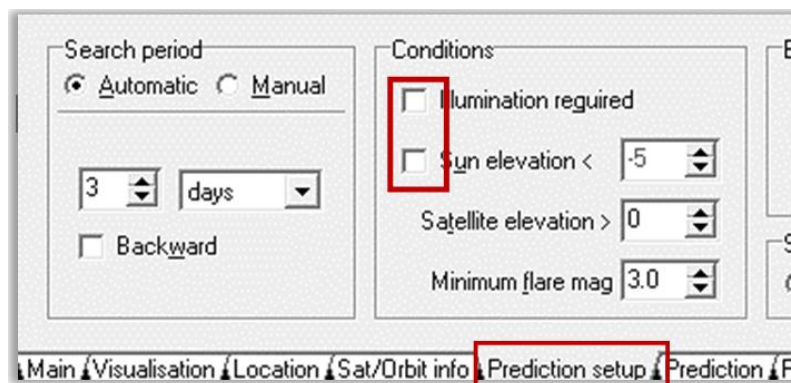

Figure 26, Prediction setup: uncheck both windows if necessary

▪ **Set-up Orbitron.**
NB. *Most settings are already pre-selected, but it doesn't hurt to check a few things anyway.*

From 'Main' > 'Settings', settings can be made with the various tabs, fig.27.
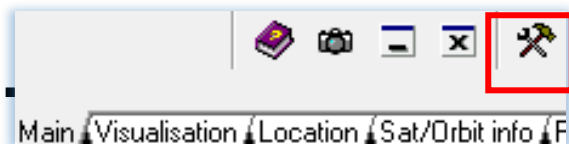

Figure 27, Settings.

If desired, set the your language with the tab 'Miscellaneous' and then copy the values stated in fig.28. If "Play Sound" is checked in this, an alarm will sound as soon as the satellite rises above your horizon and will sound again when the satellite is out of sight.
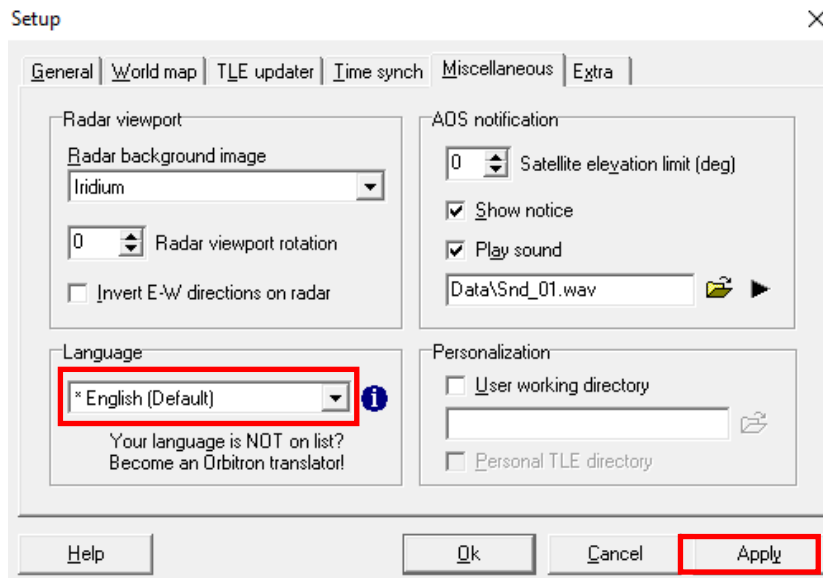
Then click on, 'Apply'.

Figure28, Tab Miscellaneous.

- **General, Time.**

Set your time zone, fig.29.

First, make sure your computer clock is right. Absolute accuracy is not necessary, but should indicate the correct time within seconds. It's a good idea to check that regularly or use a sync program to maintain accuracy.

If your PC clock is not set to the local time, open the General tab and insert a correction for the local time.
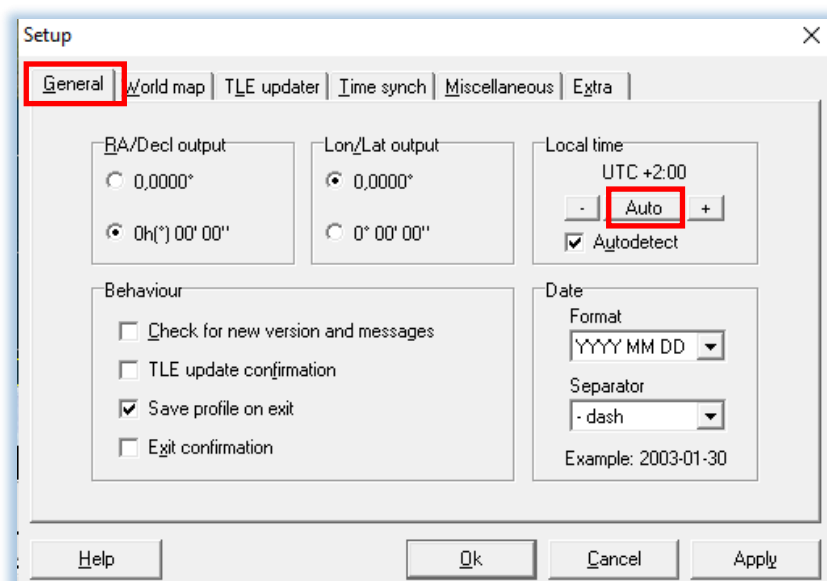

Figure 29, Local Time
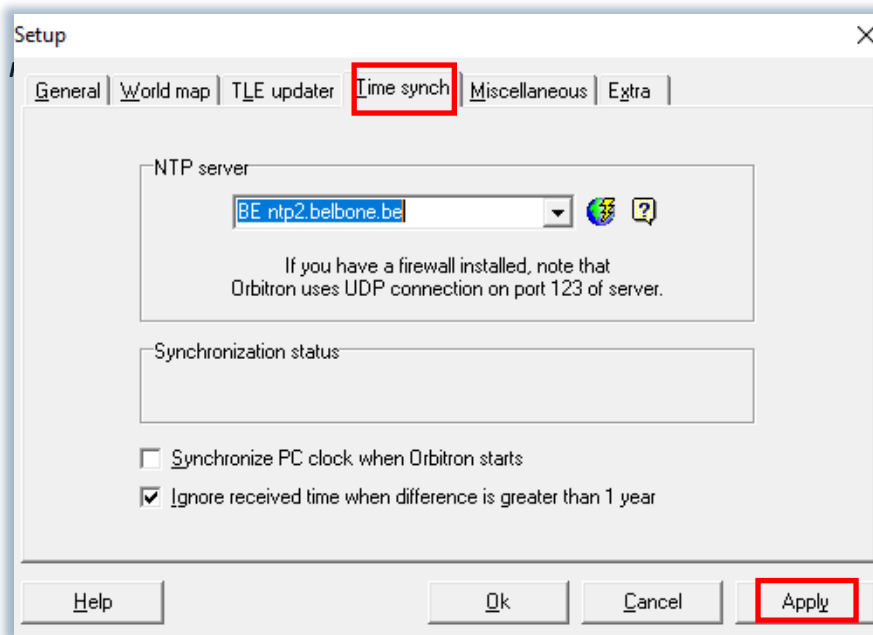
▪ **General, Time synch**, fig.30.

Figure 30, select NTP server for time synchronization.
(N etwork Time Protocol)

▪ **Location.**
In the main screen, open 'Location' and under 'World' enter your city.
If it is not listed in the menu, you must enter these latitude and longitude coordi-
nates manually, fig.31. Enter the height of your antenna and click on 'Choose'**.**

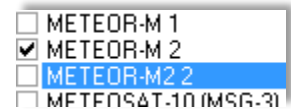
Figure 31, Location determination.

Figure 32, M2, double click.

In the Satellites window, on the right, is the Meteor M2 that can be checked as de-
sired,
for example M2, fig.32.

After 'Prediction'/'Prediction', fig.33 and 33a, the position of the Meteor M2 and the times of the transition is calculated, fig.34, will appear as seen from your antenna position.
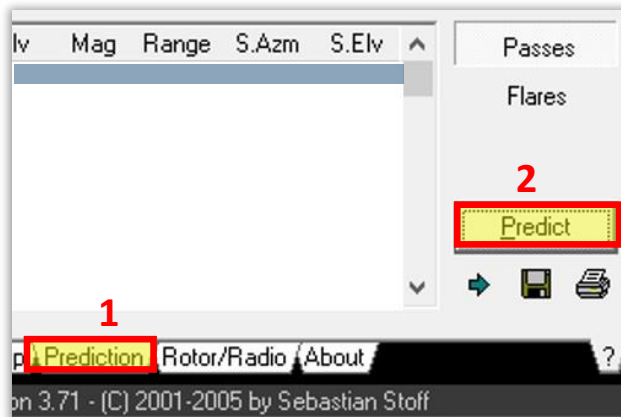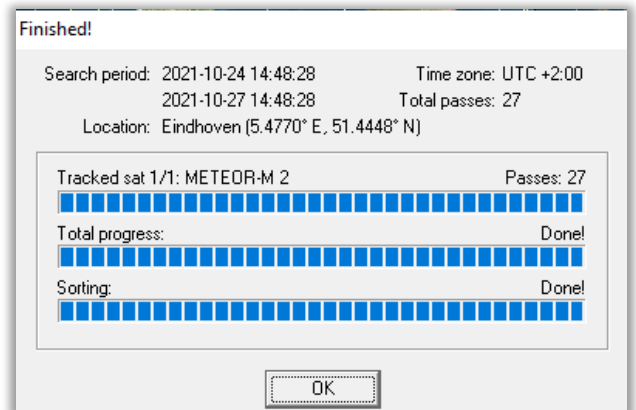

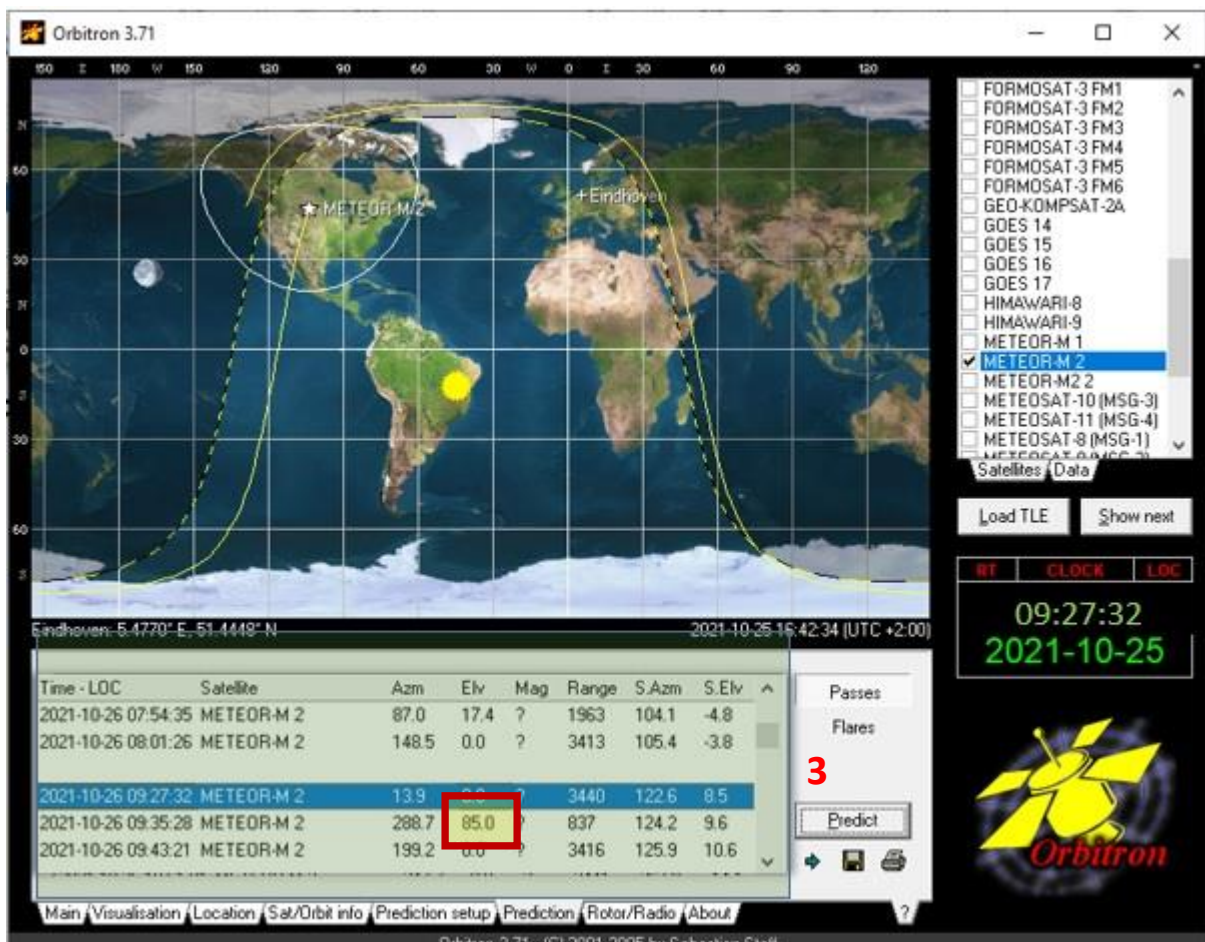*Figure 33, Predict(ion)*

Figure, 33a

Figure 34, Satellite position and transition times.

Interpreting this data needs some explanation. At the moment this action is made, the local time is 09:27:32 hours, fig.34. The satellite is still a long way from my hometown Eindhoven and its orbit does not bode well for a long recording time. How do you find the orbit for the most optimal recordings?

The Elevation value plays a determining role in this. The greater the Elv value, the longer the time interval that the Decoder can decode the signals.

In the list you can scroll all orbits of that day and in the list above I've looked up the most suitable time to turn on my computer and start the recording procedure, fig.36.

Figure 35, optimal orbit

If you would start the computer about 5 minutes before 9:27:32 with an Elv of 85, gives the longest decoding time, the satellite then passes above my hometown, fig.35, but it's not there yet because there are still a few things to set up!

NB. *The whole start-up procedure is explained point by point at the end of this manual*

For example Meteor-M2, and enter the frequency 137.100000 once in the Dnlink/MHz window, for M2 that is 137.100000 MHz.

The 'Dnlink/MHz' window shows the nominal frequency, while the 'Receive/doppler window' shows a value slightly adjusted depending on the Doppler effect, fig.36.
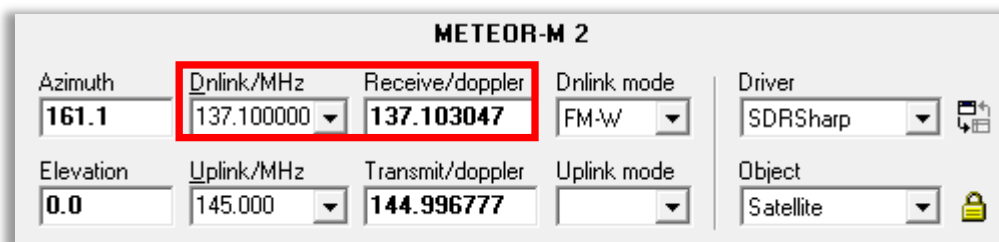
- **Rotor/Radio**

Figure 36, M2-2 frequency en Dnlink frequency.

Select the 'Rotor/Radio' tab.
SDRSharp must first be selected in the driver.Then click on the icon: 'Start selected driver', fig.37, SDRSharp will now start.
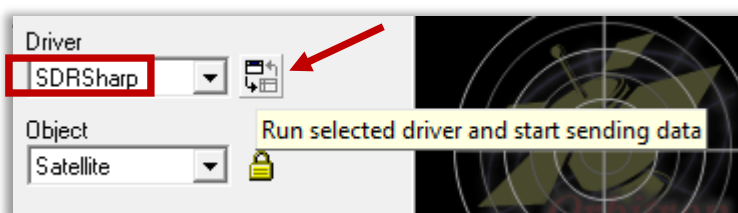

Figure 37, icoon select SDSharp driver

Doesn't that work? : Check whether RTL-SDR (R820T) is in the Source.

NB. If you get an error message, check whether the following lines are in your 'Orbitron\Config\Setup' of Orbitron, fig. 38:

```
[Drivers]
SDRSharp =..\SDRSharp\SDRSharp.exe
```

Figure 38, SDRSharp script

Close Orbitron, SDRSharp will also be closed automatically, all settings of both programs are ready and in principle you should now be able to receive live recordings from the Meteor satellites.

The next and last program is MeteorGIS, this program processes the live images in its own way and is even capable of connecting multiple satellite orbits seamlessly, as it were.

6.   MeteorGIS, designer, Christophe Marchand.

MeteorGIS is a free program for georeferencing images send by the Russian weather satellite Meteor MN-2. What the program actually does is best described by the images below.

We are now ready to install the third and final program.

Once everything works, you can start the recording process in two or three clicks. In that time you can do other other things, the program does the rest. Later in the day you can retrieve and edit the recording.

Installation MeteorGIS.

▪ **Configuration MeteorGIS.**
In the MeteorGIS folder you will find the overwritten file 'MeteorGIS_Configurator', fig.39, with which you can easily create and save the configuration.
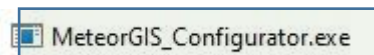
▪ **MeteorGIS Configurator.**
Start 'MeteorGIS_Configuration.exe', from the folder MeteorGIS.

▪ **Open the 'default.ini' file**.
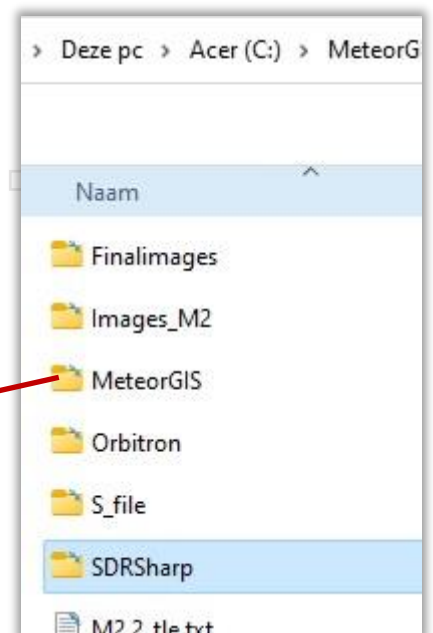After which the configuration window appears, fig.40.
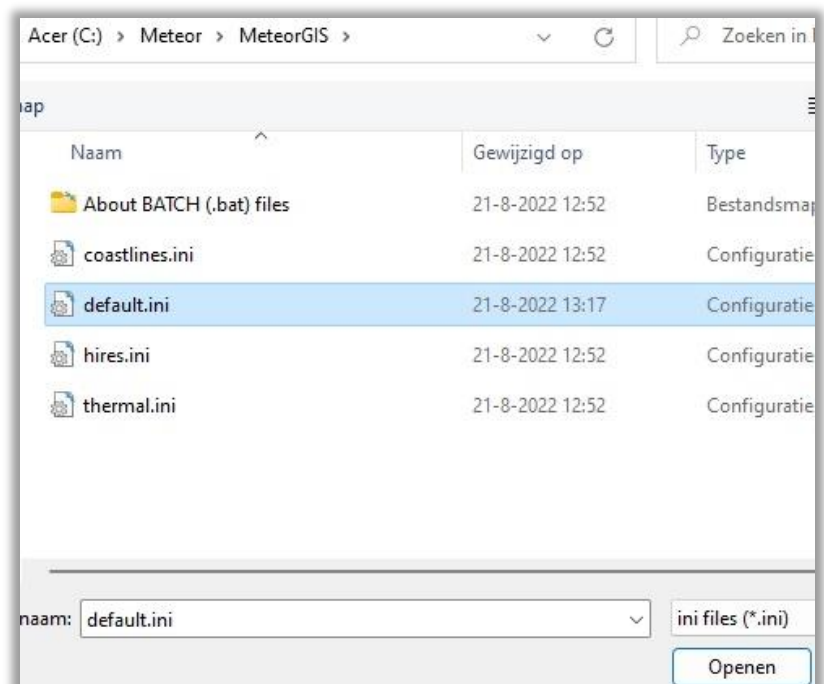
Figure 39, root folder contents

Figure 40, open de default.ini file

In the following MeteorGIS configuration screen, fig. 41, all data can be entered in **Program** and **M2_LRPT_**Decoder.
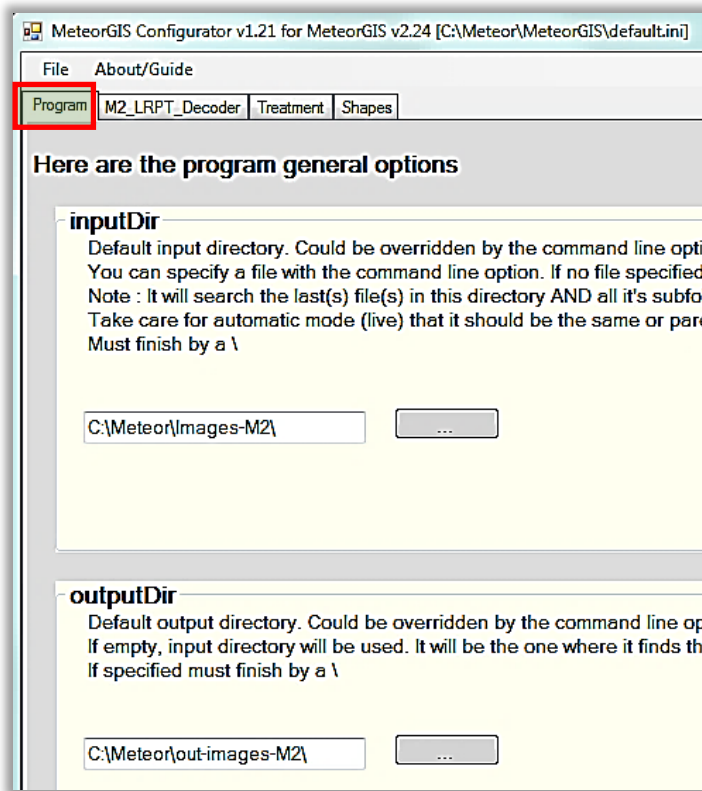

Figure 41, MeteorGIS configurator.

All you need to enter in the configuration is your <u>location</u> and possibly a '<u>cross</u>' of your location in the image.

Start filling in the options according to the example shown below:

[Program]

- Location_atitude: *(take the coordinates from Orbitron)*
- Location_Longitude: *(take the coordinates from Orbitron)*

7. Overlays.

Overlays are actually transparent images that are, as it were, pasted over the base image.

You have 2 similar image overlays available:

1. **Watermarks**
2. **Shapes**

1. Watermarks

Shows the information of the meteor pass. This overlay showing information about the Meteor pass, fig.42. You can set the size, color and location yourself, zie fig.43.
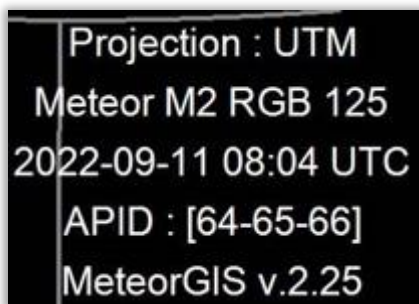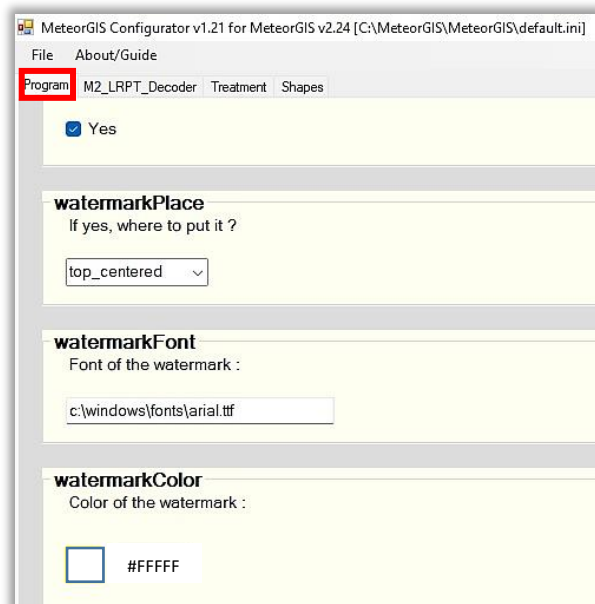

Figure 42, Watermark

Figure 43, example watermark settings

2. Shapes.

The designer has created an excellent opportunity to position towns in the image, among other things. This is very easy to achieve in the Shape setting.

A handy tool is the Manual_M2_GIS.bat file with which you can check whether your settings are satisfactory. More on this later.

Select Shapes and set the slider to the desired Shape, fig.44.
This Shape overlay offers 5 options that can be set with the slider and is automatically transferred to the default.ini list.

Shape 0:   no overlays
Shape 1:   coastlines
Shape 2:   boundarylines
Shape 3:   latitude en longitude grid
Shape 4:   position places,towns
Shape 5:   indicate major mountains and high elevations

Note *that all previous shapes, except shape zero, are included. For example, you cannot set a single shape.*
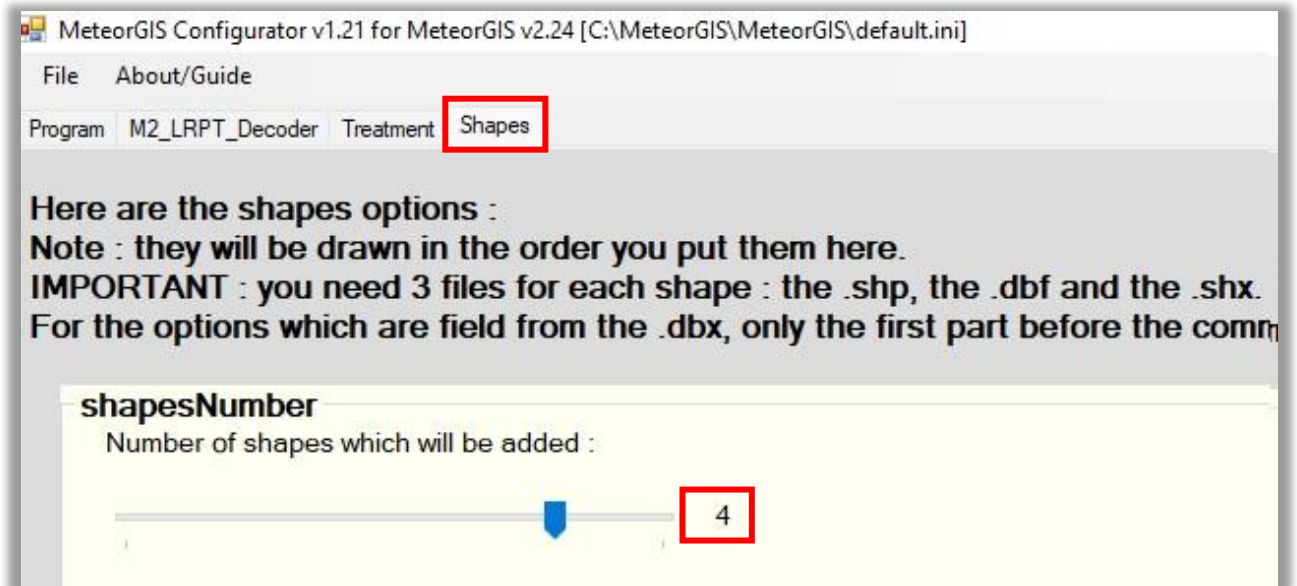

Figure 44, Shapes button

- Adopt all other settings unchanged.

This file will be **Saved** as: 'default.ini', (overwrites the old one, which is renamed to 'default.bak').

Of course, you want to check whether your setting gives the desired result. **Manual_M2_GIS.bat** in de MeteorGIS folder allows the MeteorGIS unwinding process to be repeated over and over again. *Don't forget to empty the Finalimage folder first.*

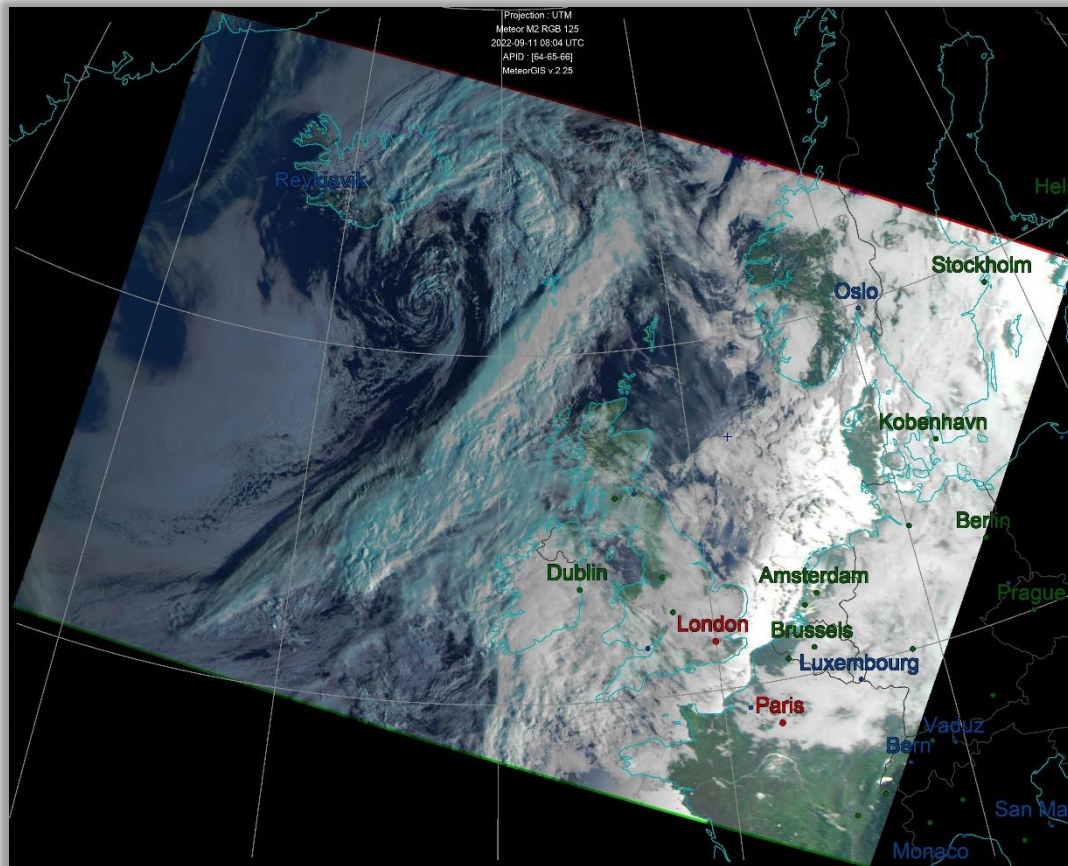*With de MeteorGIS v2.25 it is possible to change the font size of the places in the default.ini list.*

Figure 45, Places

The previously pasted 2 files are not enough to increase the FintSize of the places. That requires another line addition in the **default.ini**. Open default.ini and add the following line here, see list below: [Shape3]

```
filename=ne_50m_populated_places.shp
form=circle
latitudeField=LATITUDE,N,19,11
longitudeField=LONGITUDE,N,19,11
rupturesField=POP_MAX,N,9,0
ruptures=500000,1000000,5000000
colors=004590,006000,BF0000
sizes=41,44,47
fontSize=60
nameField=NAMEASCII,C,100
drawName=fromfield
fromField=FEATURECLA,C,50
contain=Admin-0 capital
containType=strict
```

Don't forget to save the file.

8. SDRSharp, continued.

Let's go back to **SDRSharp** for a moment and **start** this program again.

- **Scheduler,** *already preset*.

SDRSharp contains a so-called 'Scheduler'.
The Scheduler is a kind of scheduler that automatically executes commands. In this case, among other things, the automatic handling of the start and stop time of the recording.
For those who are interested, the commands in the Scheduler can be made visible as follows:
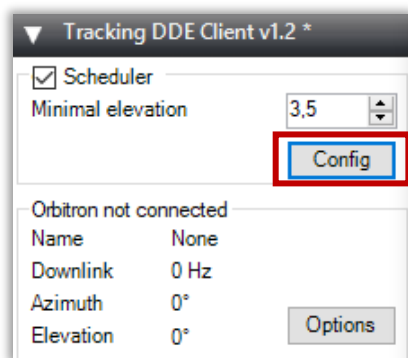
The Scheduler can be called up by clicking on 'Config' in 'Tracking DDE Client v1.2', fig.46, but this Scheduler is already properly preprogrammed.

Figure 46, config scheduler

In the window then displayed, fig.47, the 'DDE Tracker' must be programmed to perform the tasks correctly when a Meteor signal is first detected, (AOS: Acquisition of Signal) and at the end of the passage (LOS: loss of Signal). AOS contains, among other things, the transmission frequency, type of modulation and bandwidth.

Only the "underscore" may be used in the command lines. All available commands can be selected with the mouse and copied to the center panel using the arrow keys.
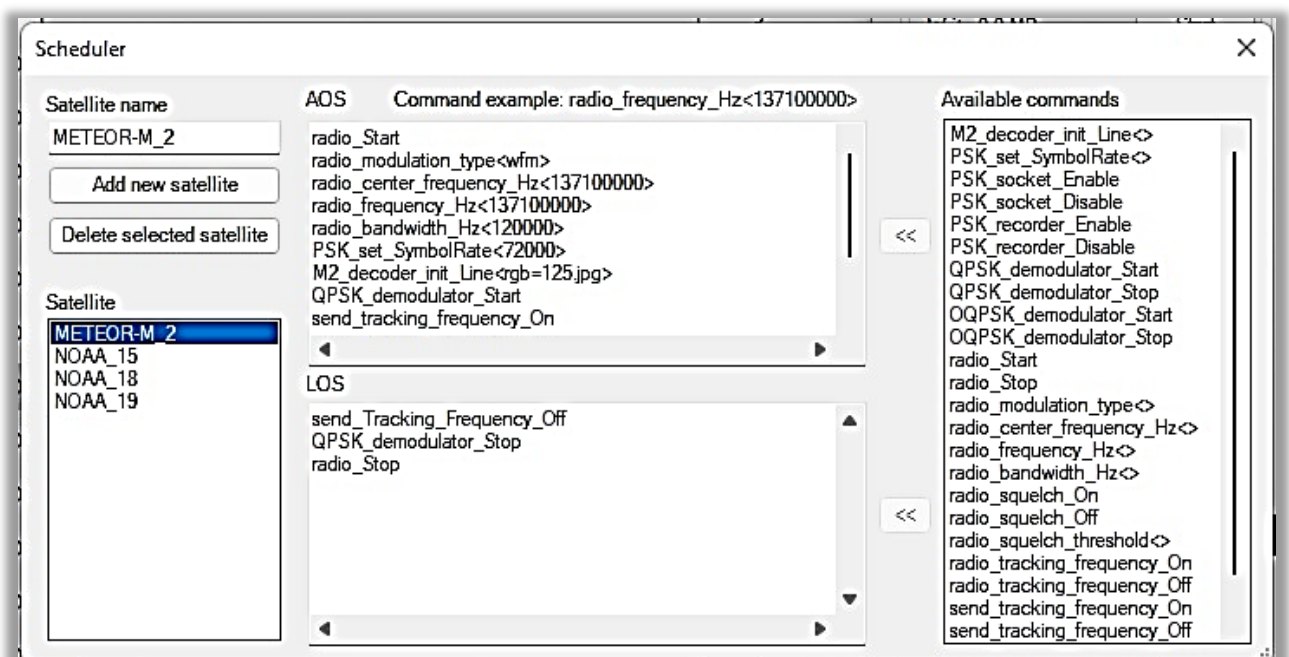
Meteor-M_2

Figure 47, Scheduler

You do not need to save the Scheduler commands. All quotes and changes are automatically saved to a file called 'DDESchedule.xml', which can be found in the SDRSharp folder.

Exit SDRSharp.

8. RGB settings.

The Russian Meteor satellites have three types of optical-mechanical TV sensors on board that operate in both the visible part of the spectrum and infrared. They can provide a global picture of cloud cover and the Earth's surface both during the day and at night.
The infrared camera is sometimes switched on and off by the Russian satellite tracking station. For this, regularly check the URL, fig.48 and 49.

http://happysat.nl/Meteor/html/Meteor_Status.html

The 1.2.5 RGB setting below is active at the time of writing and you will therefore receive Infrared recordings.

Figure 48, Happysat info

(R)ood) :   channel 1, visible light
(G)roen):   channel 2, visible light.
(B)lauw) : channel 5, middel infrared.

(R)ood) :   channel 1, visible light
(G)roen):   channel 2, visible light
(B)lauw) :   channel 3, visible light

NB. Depending on the satellite setting (1,2,3 or 1,2,5) you need to adjust the next two **.ini** files

For the LRPT images: the .INI file in the folder:
• C:\MeteorGIS**M2_LRPT_Decoder.ini**

For the S_files: the .INI file M2 in the folder:
• C:\MeteorGIS\ **Man_LRPT_ Decoder-M2.ini**

```
[FAST]
FORMAT=jpg
R=1
G=2
B=5
```

Figure 49, A crop of the ini files list, (.ini B=5 or 3).

9.   Start recording.

How do you start receiving satellite images now? Well that has become a piece of cake. A recording will only succeed if all previous operations have been performed flawlessly!

- Start het Obitron programma.
- Selecteer de Meteor satelliet,M2.
    - Prediction, 2x
    - OK
    - Rotor/Radio
    - Select as Driver: SDRSharp, fig.50.
    - SDRSharp is is not yet in recording (Start) mode and waiting for the start command from the Scheduler
    - You don't have to stay with it, recording process starts and stops automatically.
    - Then, Orbitron will ring to indicate that the programmed start time has been reached and SDRSharp Starts.

    - The Meteor demodulator plugin start and wating for a lock, fig.51
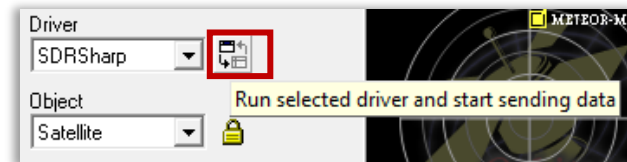

Figure 50, run driver/SDRSharp


Figure 51, MeteorGIS waiting for lock

Note: Don't forget to set the sleep time, under 'System' / 'Power Options and Sleep mode' (Windows10) you can set this.

Note: The following figures are shots of the M2-2 while it was still alive

- In the SDRSharp window, during recording, an increasingly strong "bump-shaped" signal is displayed with a bandwidth of 110000Hz, fig.52 and the decoder will write the data and display the current number of MBs.

Figure 52,, typical Meteo signal bump
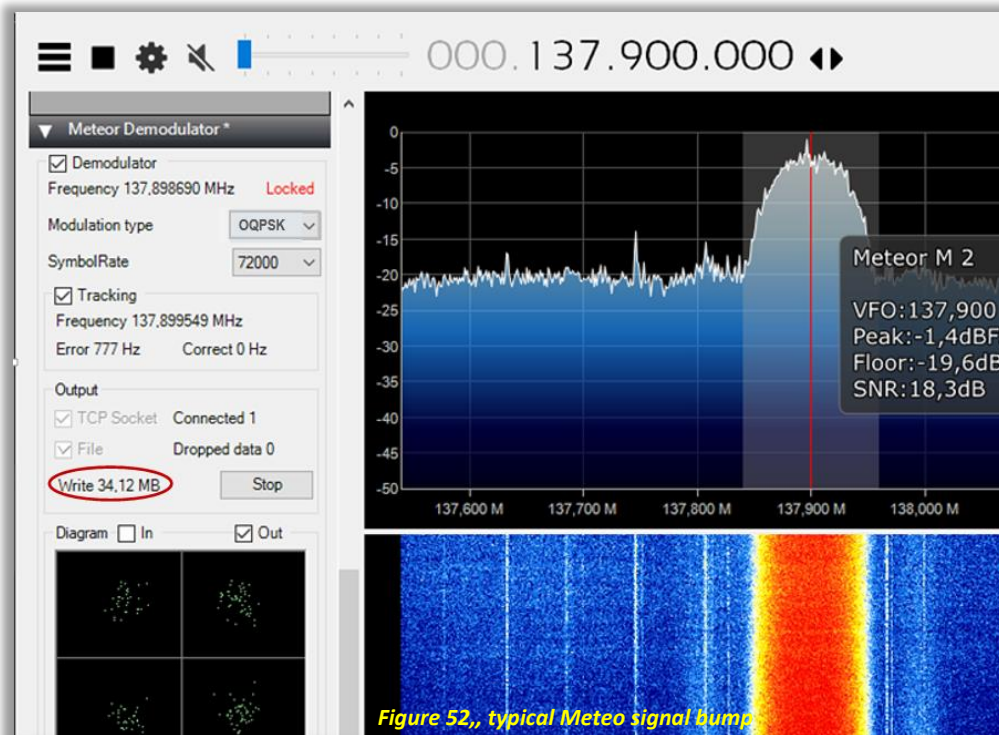
- The decoder has started up and the picture is built up line by line, fig.53.
- The compactness of the four round figures is a measure of the signal strength, the more compact the stronger the signal.

Figure 53, building the image
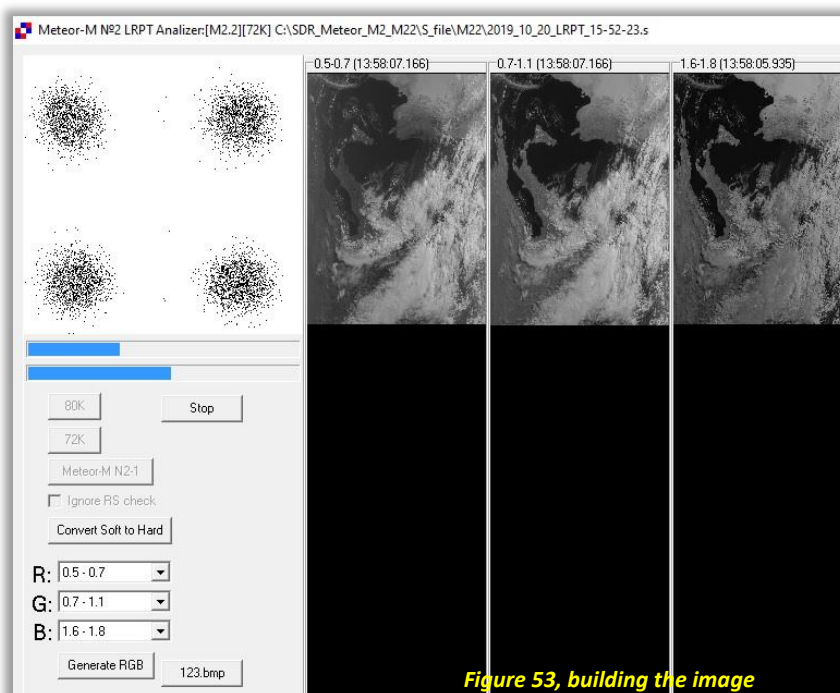
- The decoding will stop automatically when the signal strength has reached a lower limit, approx. 8dB.
- Then you have to wait for the end time set by Orbitron. First, the S files are saved.
- The MeteorGIS processing takes place and, depending on the PC processor and recording time, it may take some time, fig.54. Finally, the Orbitron and SDRSharp windows remain on the screen, waiting for the next pass.
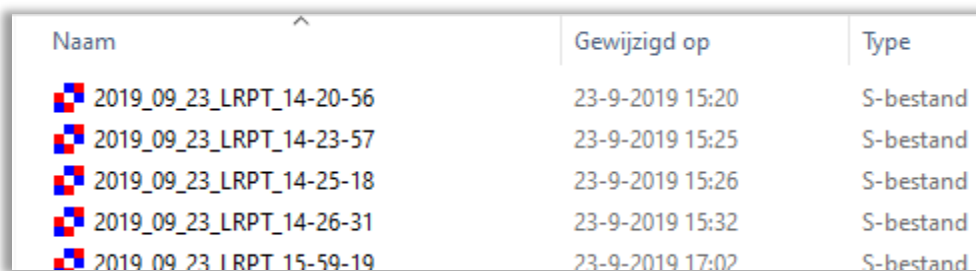

Figure 54, MeteorGIS Processing

The saved images can be found in:
- Images_2 folder   ==> LRPT images
- Final Images map ==> MeteorGIS images

(See also page 9, folder structure)

10. S-Files

You may have noticed that the Map configuration also includes the Map S files. This is where the so-called 'S_files' are stored, fig.55.

Figure 55, S_files

This enables the system to store uncoded data in addition to the decoded images, which is useful for two reasons:

a.   If the decoding of the LRPTimages does not go well, you can always fall back on the S files.
b.   If you have such a file, you can check whether the decoding program works correctly.

In SDRSharp (QPSK) you have already defined where the S files are stored, namely in the folder 'C:\Meteor\S_file'.

To convert the S files to the basic images from the satellite, a so-called '*M2_Man_LRPT_Decoder*' is needed, located in the MeteorGIS folder, fig.56.
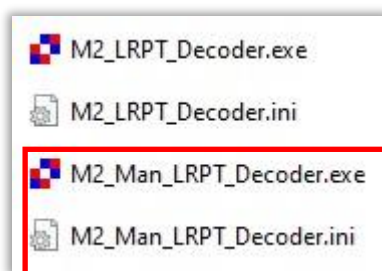

Figure 56, M2_Man_LRPT_Decoder

Convert the S-files from the S_file folder.
These images are also in JPG format and can be opened with any suitable program.
In the 'images' folder you can find the images edited by MeteorGIS from the satellite, in which small lines of interference have been cleverly removed.
The oblique arrangement corresponds to the orbit of the satellite, see previous image.
The beauty of this program is that you can make small adjustments to the script from the MeteorGIS folder yourself. Although the program is written in C#, it is still reasonably understandable with the help of the explanations.

The use of existing S-files, fig.57.
Converting an S-file to a Meteor image is very simple:

- Go to: 'C:\MeteorGIS\ **M2_Man_LRPT_Decoder**'
- The M2_Man_LRPT_Decoder has been started.
- Click on 72K in the Decoder window
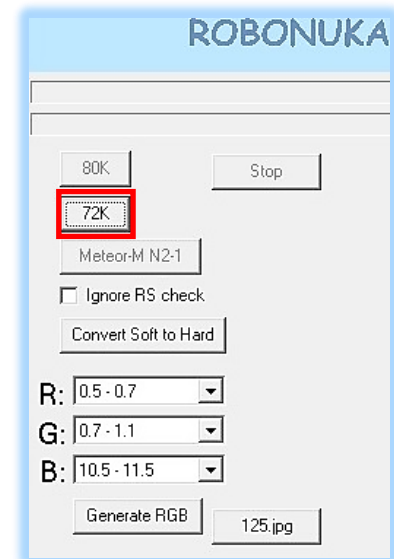- Select the S file, the image build-up will start and the image will be saved.

Figure 57

11. SmoothMeteor.

The files are in JPG format and can be opened with any suitable program. With the program 'SmoothMeteor' you can stretch the images sideways so that the image gets a more "natural" appearance, fig.58.
Download and install 'Smooth.exe' in de map 'Smooth':
https://leshamilton.co.uk/meteor3m.htm
Smooth Meteor v 1.75(zip)

- Start SmoothMeteor
- 'Load an RGB Meteor Image'
- 'Processing' - 'Rectify'.
- Save as: **.**JPG of **.**BMP file.
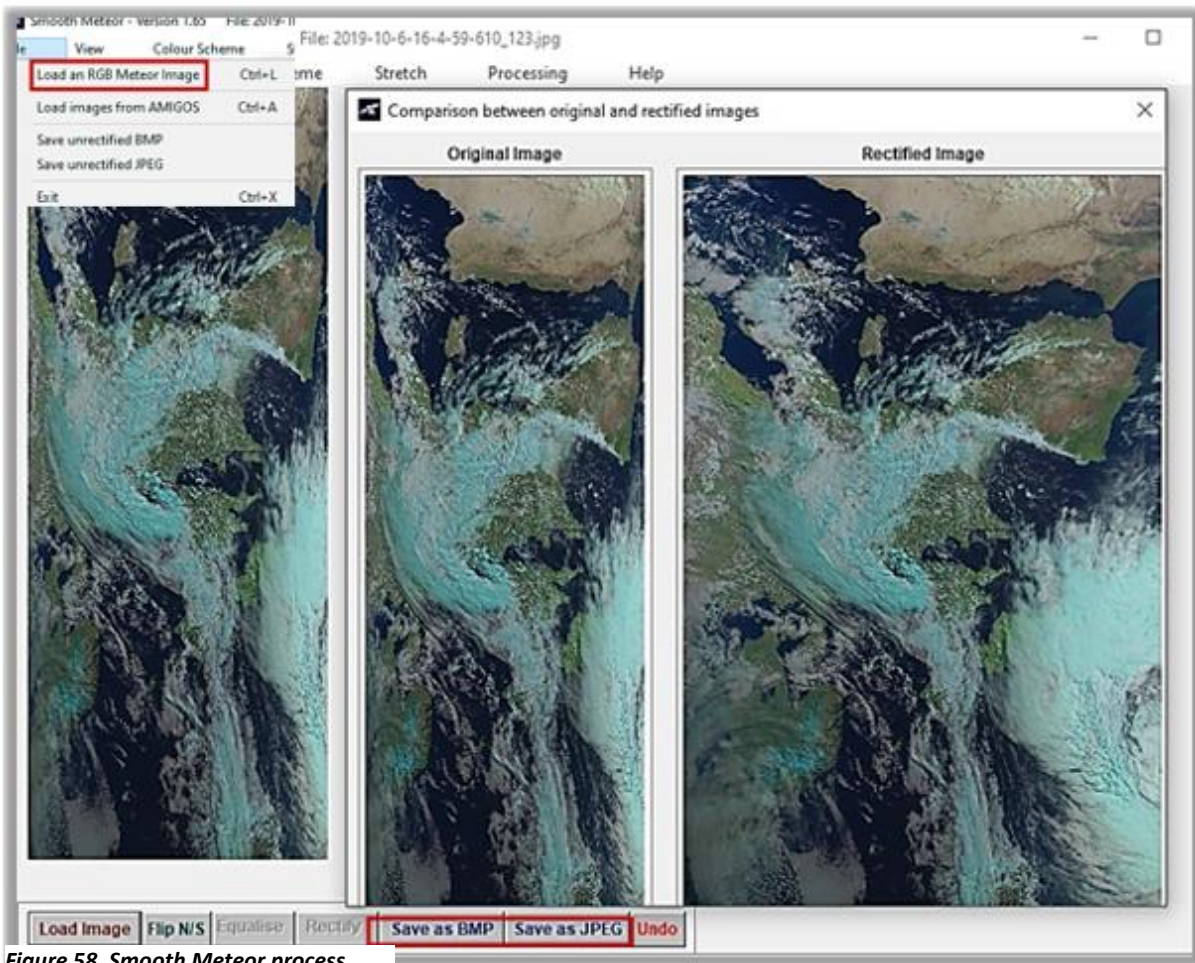- Open the files from the LRPT_Images folders.

Figure 58, Smooth Meteor process

12. Desktop arrangement.

Note: An example of a desktop arrangement, fig.59. Orbitron is the starting program with the other icons, the saved images and S files are easily and quickly accessible.

Figure 59 , example desktop layout

Finally:

- The installation procedure in this article has been followed twice from the beginning to check for possible errors, with the end result being an error-free system.

- A group APT is present on Facebook, in which many enthusiastic members worldwide put their Meteor satellite images on the site. You can also ask your questions there.

It would be nice if your Meteor images also appear on the APT group soon.

- Much more information can be found at:

Happysat: http://happysat.nl/Setup_Meteor/Setup.html

Meteor M-N2 and N2-2 Satellite Operational Status:
http://happysat.nl/Meteor/html/Meteor_Status.html?fbclid=IwAR19YlbUWdGcfFuENVDRM-wtQN054MBVX8Y1oWu-cRrO3cskJ9xLTNgSmGZY

APT Group: https://www.facebook.com/groups/Satellite.apt.group/

RTS-SDR.RU: http://www.rtl-sdr.ru/

RTL-SDR.com: https://www.rtl-sdr.com/weather-satellite-meteor-m2-2-now-transmitting-images/

Radio Scanner RU: http://www.radioscanner.ru/forum/topic47659-119.html
https://www.facebook.com/groups/Satellite.apt.group/permalink/700059506844154/

Thibaut 'Fouine' beheerder APT group: https://www.facebook.com/groups/Satellite.apt.group/permalink/700059506844154/

RTL-SDR.Com met plug-in Night mode: https://www.rtl-sdr.com/forum/viewtopic.php?f=5&t=2123

Les Hamilton Web page: https://leshamilton.co.uk/MeteorLRPTSuite.htm

Group for Earth Observation: http://www.geo-web.org.uk/GEO-nl.php

Last but not least, for those who want to delve deeper into the subject matter of Kunstmanen, there is the Kunstmanen working group, which focuses specifically on receiving weather satellites, with everything related to it (receivers, antennas, rotors, software, etc.).   http://www.kunstmanen.net