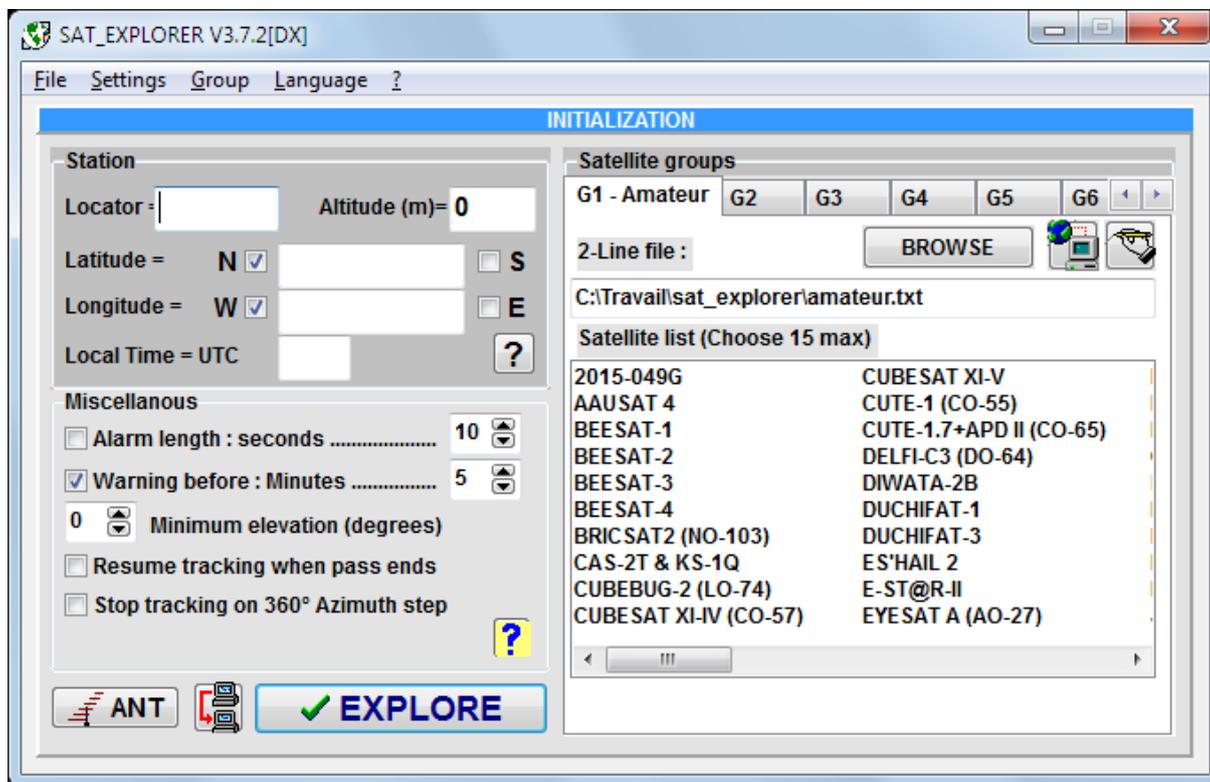


# HOW to get started with SAT\_EXPLORER

By Gabriel F6DQM

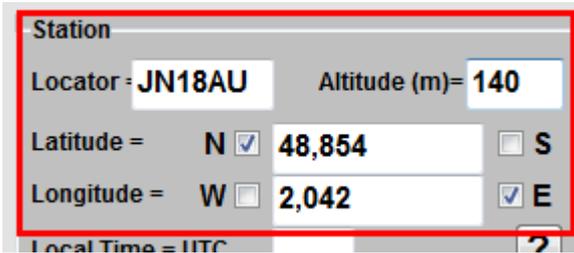
After having installed SAT\_EXPLORER either by using the install package or by unzipping the zip package, when running SAT\_EXPLORER for the first time, the Initialization panel is displayed.



On the left side of this panel, you will have to fill your location and your local time. On the right side of this panel, SAT\_EXPLORER is already set to track a group of satellites named G1-Amateur, the data of which are issued from a Two-Line-Elements file given by the CELESTRAK site. Note that this file is not up-to-date. You will have to update it. This will be explained in a few lines.

## 1 - Entering location and time

In the upper left field named "Locator", enter your locator. It is made of 6 characters: 2 letters, 2 figures and two letters. For example JN18AU (this is my locator). SAT\_EXPLORER will then automatically fill your corresponding latitude and longitude.



Station

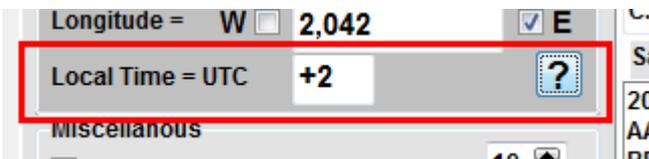
Locator = **JN18AU**      Altitude (m) = **140**

Latitude =    N  **48,854**       S

Longitude =    W  **2,042**       E

Local Time = UTC      ?

If you know neither your locator nor your coordinates, use Google Earth to get your coordinates by clicking your location on the map. Google Earth will display your latitude (positive=North, negative=South) and your longitude (positive=East, negative=West) in decimal degrees. Enter these numbers (decimal degrees are mandatory in SAT\_EXPLORER), without the sign, and check the N/S/E or W boxes according to the signs given by Google Earth.

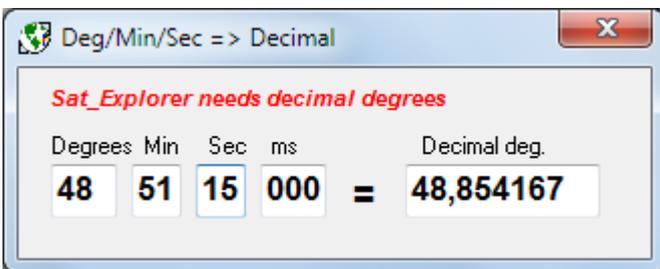


Longitude =    W  **2,042**       E

Local Time = UTC    **+2**      ?

Miscellaneous

If you know your coordinates in degrees, minutes, seconds, you must convert them into decimal degrees before entering them. A small tool does this in SAT\_EXPLORER. Click the button [?] next to the time setting to open this converter.



Deg/Min/Sec => Decimal

*Sat\_Explorer needs decimal degrees*

Degrees	Min	Sec	ms		Decimal deg.
48	51	15	000	=	48,854167

After entering your coordinates, SAT\_EXPLORER will automatically compute your locator.

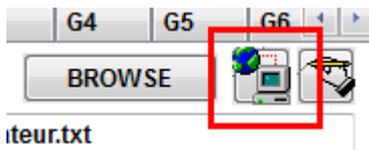
If you know the altitude of your location, you may enter it in meters. Unless you are somewhere in Himalaya, the impact on the satellite visibility will be insignificant if you set to zero.

Now, you have to enter your local time difference with regards to the UTC time. This value must be positive if your local time is greater than the UTC time; for example, summertime in Paris is UTC+2, than I have to enter +2. This is usually the case in Eastern Europe and Asia. This value is negative if your local time is smaller than the UTC time. For example, In New-York City, summertime is UTC-4, and then you have to enter -4. When changing from summertime to wintertime, SAT\_EXPLORER will advise you that time has changed and you will have to update the setting of the time. It is not done automatically as far as users may set their computer time in UTC time and so the value to enter is zero whatever summertime or wintertime.

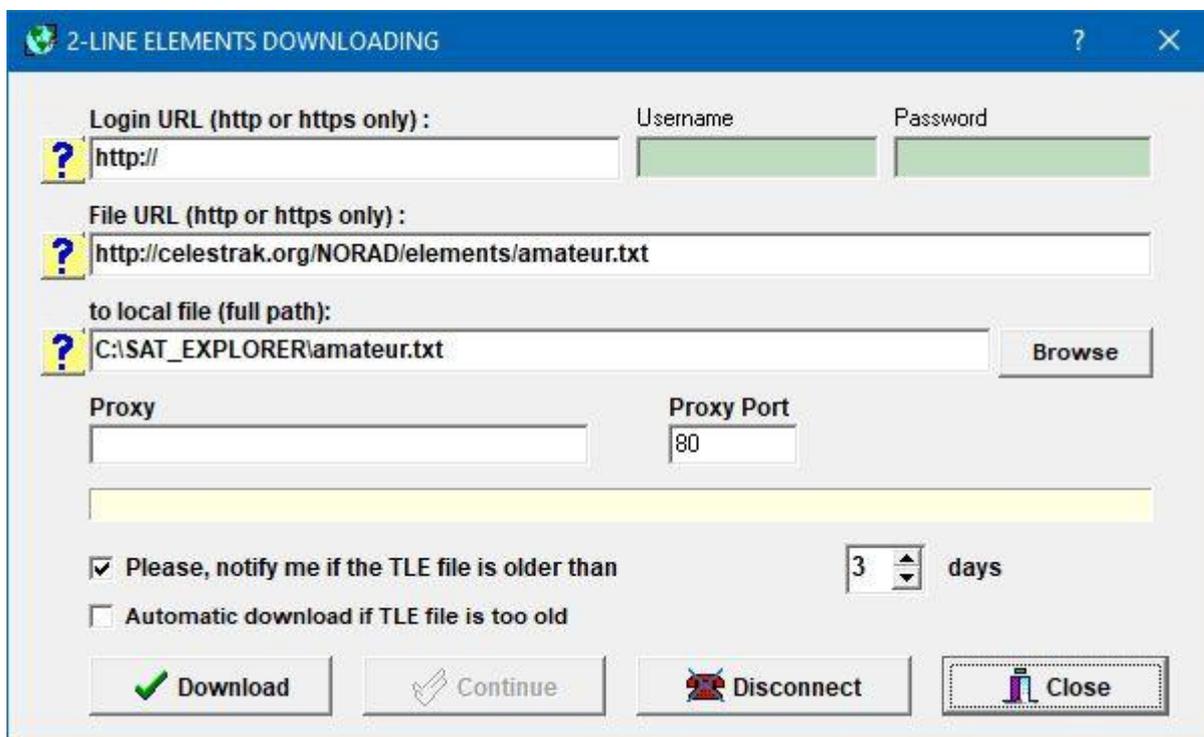
## 2 - Updating and downloading TLE files

“TLE file” stands for Two-Line-Elements file. These files are mandatory so that SAT\_EXPLORER can compute the orbit of satellites and their visibility periods above your location. For low-orbiting satellites, these TLE files must be updated every 3 or 4 days because of the drift of the orbits or maneuvers on these satellites. When running SAT\_EXPLORER for the first time, the program comes out with a predefined G1-Amateur group of satellites which are those included in the “amateur.txt” TLE file of Celestrak.

To update this file, click the button showing the earth and a computer in the upper right side of the Settings panel (next to the button BROWSE).



Now the 2-Line elements downloading panel opens.

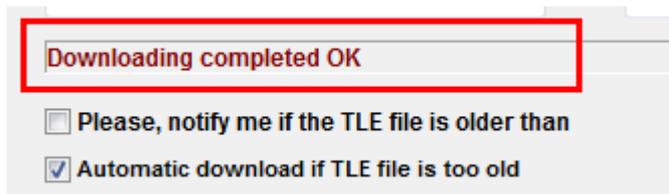
A screenshot of the '2-LINE ELEMENTS DOWNLOADING' dialog box. The dialog has a blue title bar with a question mark and a close button. It contains several input fields and buttons. The 'Login URL (http or https only):' field has a question mark icon and contains 'http://'. The 'File URL (http or https only):' field has a question mark icon and contains 'http://celestrak.org/NORAD/elements/amateur.txt'. The 'to local file (full path):' field has a question mark icon and contains 'C:\SAT\_EXPLORER\amateur.txt', with a 'Browse' button to its right. There are 'Proxy' and 'Proxy Port' fields, with the port set to '80'. A checkbox is checked with the text 'Please, notify me if the TLE file is older than' followed by a spinner set to '3' and the word 'days'. Below it is an unchecked checkbox 'Automatic download if TLE file is too old'. At the bottom are four buttons: 'Download' (with a green checkmark), 'Continue' (with a checkmark), 'Disconnect' (with a red X), and 'Close' (with a window icon).

The second field is preset first with the link to the “amateur.txt” TLE of Celestrak and the third one with the location where this file will be saved in your computer. By default, this file will be saved in the same directory as SAT\_EXPLORER and the name of the file will be the same as the one in Celestrak, but you can change this as you like. The field Login applies to SPACETRACK which needs identification and password to login. Celestrak and AMSAT do not need such login procedure. For more information, please read the Help.

SAT\_EXPLORER may download automatically TLE files if the actual one in your computer is too old (more than 3 days old by default). For such an automatic download, please uncheck the box “Notify me ...” and check the box “Automatic download ...”. This automatic download will be performed when starting the program or when changing group.

A close-up screenshot of the checkbox options in the dialog box. A red rectangular box highlights the two checkboxes. The first checkbox is unchecked and labeled 'Please, notify me if the TLE file is older than'. The second checkbox is checked and labeled 'Automatic download if TLE file is too old'. To the right of these checkboxes is a spinner set to '3' and the word 'days'. Below the checkboxes are the 'Download', 'Continue', and 'Disconnect' buttons.

Now click the button "DOWNLOAD" to update the TLE file. The report "Downloading completed OK" should appear if your Internet connection is effective. If an error is reported, please check the hyperlink to Internet or your connection to Internet. If you have no connection to Internet in your computer, you need to import the TLE file from another computer and copy it in the directory of SAT\_EXPLORER.

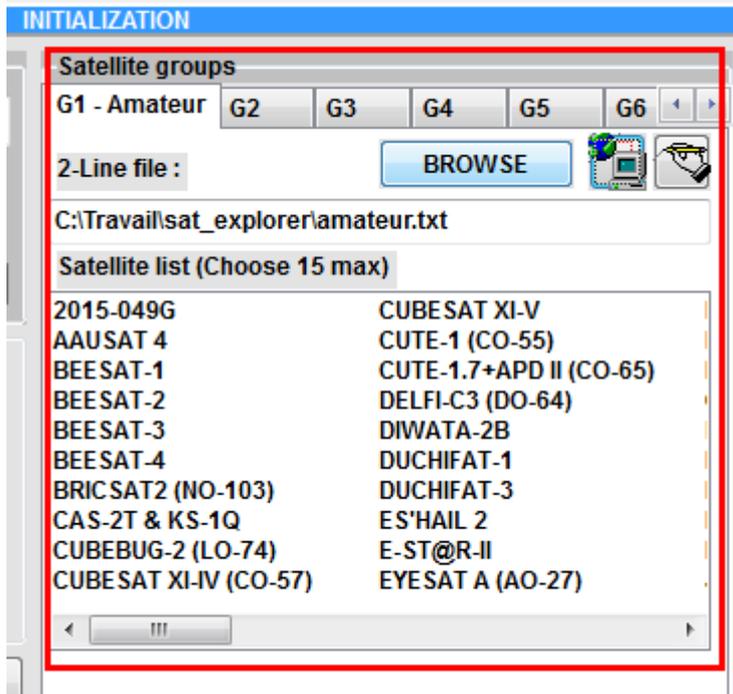


Finally, close the TLE-Downloading panel.

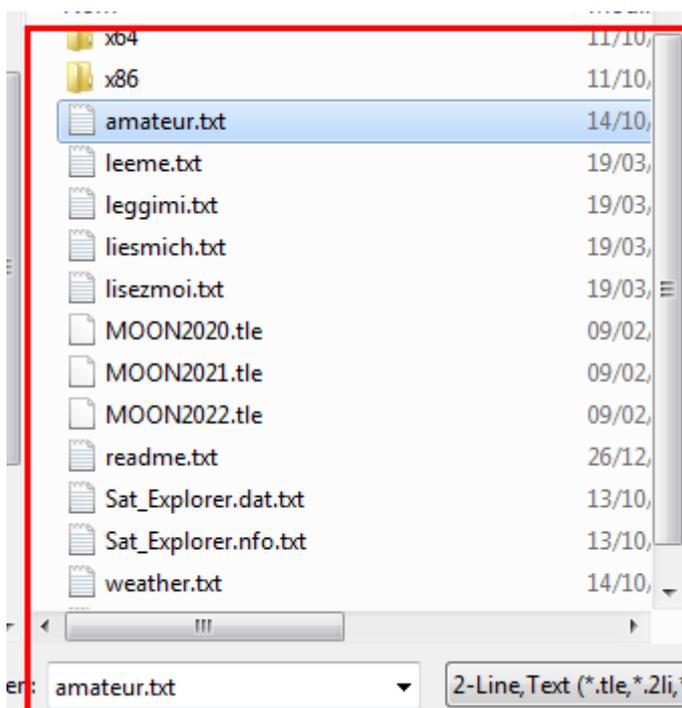


### 3 - Associating a TLE file to a group of satellites

Next step is to associate a TLE file to our working group of satellites (G1-Amateur). We will see later how to create and set a new group. If you have just updated the default TLE file named "amateur.txt", you will notice that a number of satellites are already listed in the "Satellite list". This is because SAT\_EXPLORER associates by default the "amateur.txt" TLE to the group G1. This appears in the field above the satellite list where you can notice that the path and name of the TLE file associated to group G1 are exactly the same as those used in the Download panel to save the Celestrak TLE file.

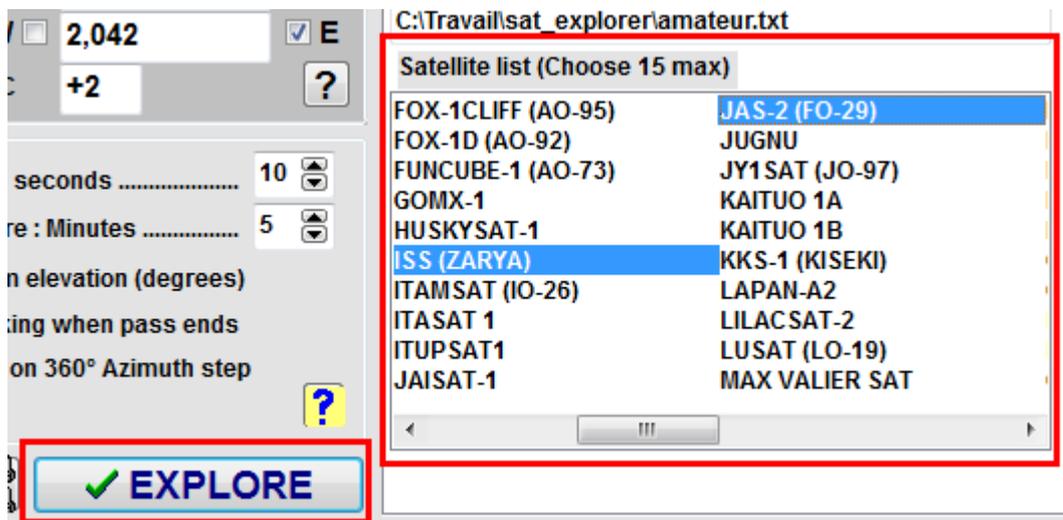


But maybe you want to associate another TLE file available in your computer to the group G1. If it is the case, click the BROWSE button and choose in your computer the TLE file to associate to group G1. If this file has the right format, the satellite list will be filled with the satellites which are defined in this TLE file. Be sure that this file is recent (less than 3 days).



## 4 - Choosing satellites to track

Now you can choose up to 15 satellites in the list. They will be tracked simultaneously by SAT\_EXPLORER. In the example below, we have chosen the ISS and JAS-2. We are ready to track these satellites: Just click the button EXPLORE in the bottom left side of the settings panel.

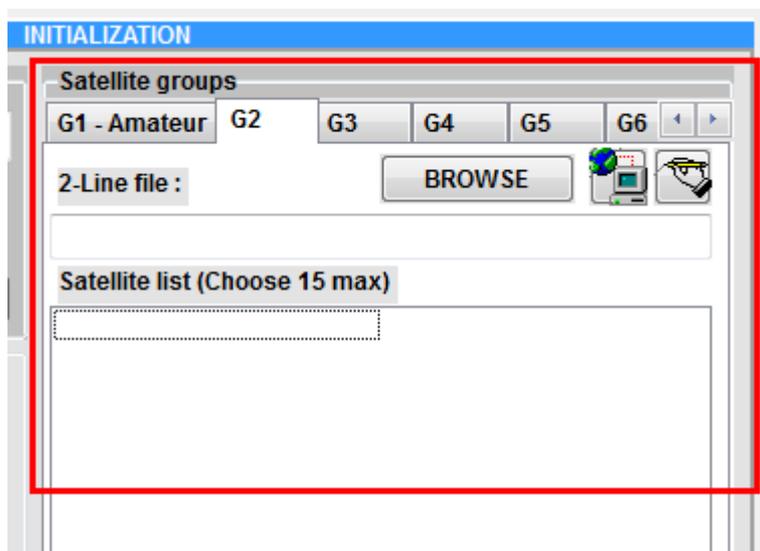


The settings panel closes and you are entering the Tracking process. But before looking at this new small panel, let us go back to the settings panel and see how to create and set a new group of satellites.

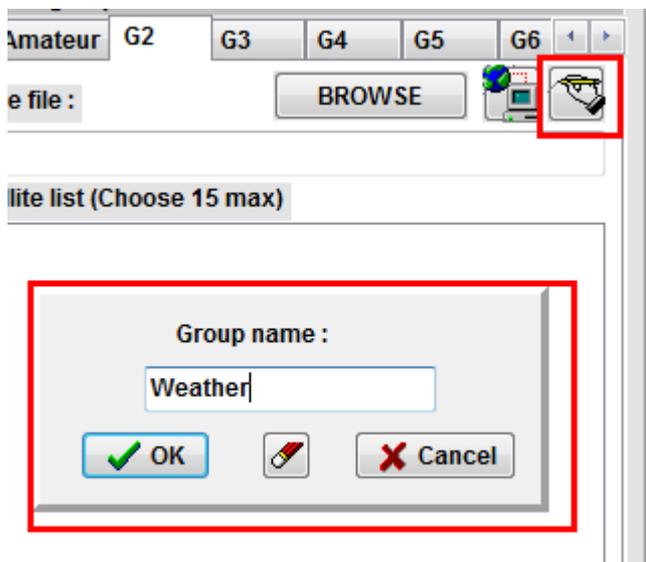
## 5- Creating a new group of satellites

Click the menu Settings in the menu bar to re-open the settings panel if it is not already displayed.

To create and set a new group, click the relevant thumbnail in the table of groups G1 to G10. For example, we have clicked the group G2. As you can note, the data of this group are empty: nothing in the path of the associated TLE file and nothing in the satellites list.



First we may change the name of this group by clicking the button showing a hand writing. In the pop-up window, enter the new name. In the example, we will assign this group to weather satellites, so we enter "WEATHER".



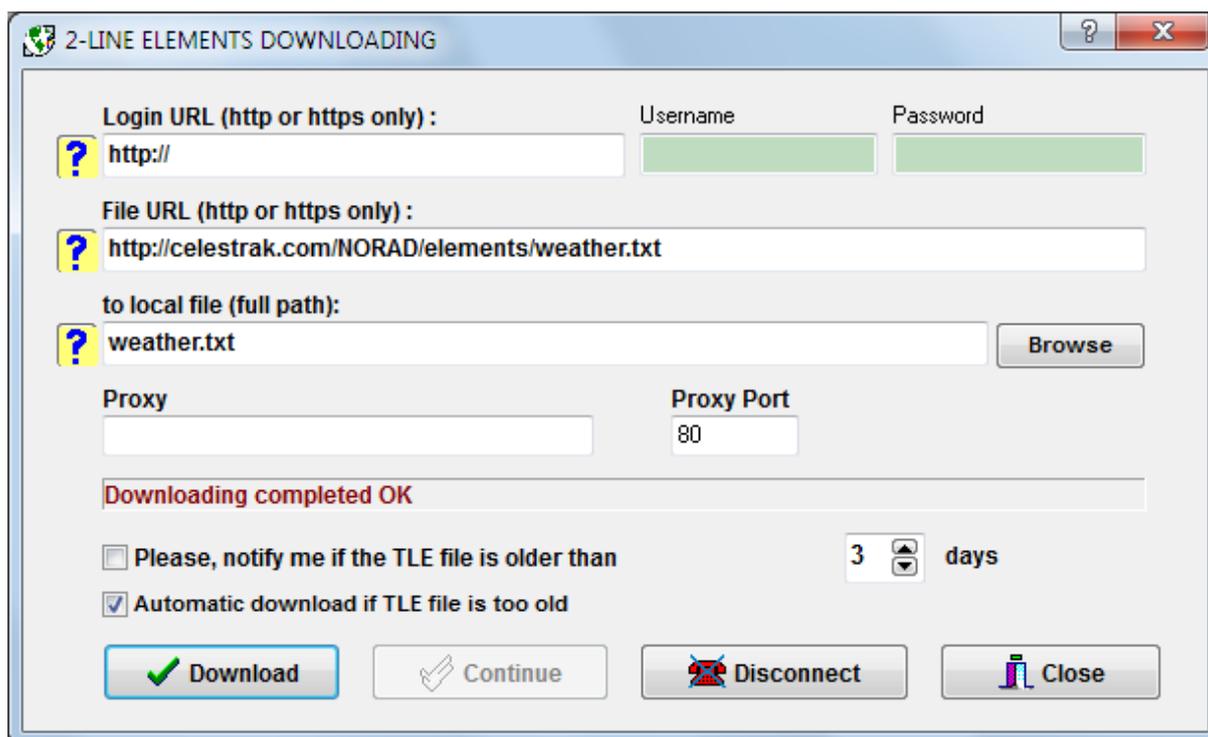
Now we must associate a TLE file of weather satellites to this group. If you already have one in your computer, just BROWSE to this file and attach it, but probably you don't have this file, so we will get one from the Celestrak site on Internet. For that, click the button next to BROWSE with the Earth and the computer to open the TLE-File Download panel. You already know this panel because we have earlier updated the amateur TLE file by using this panel.

To retrieve the weather file, in the File URL field, type this link (or copy/paste):

<http://celestrak.org/NORAD/elements/weather.txt>

Note that we have just replaced the word "amateur" by the word "weather".

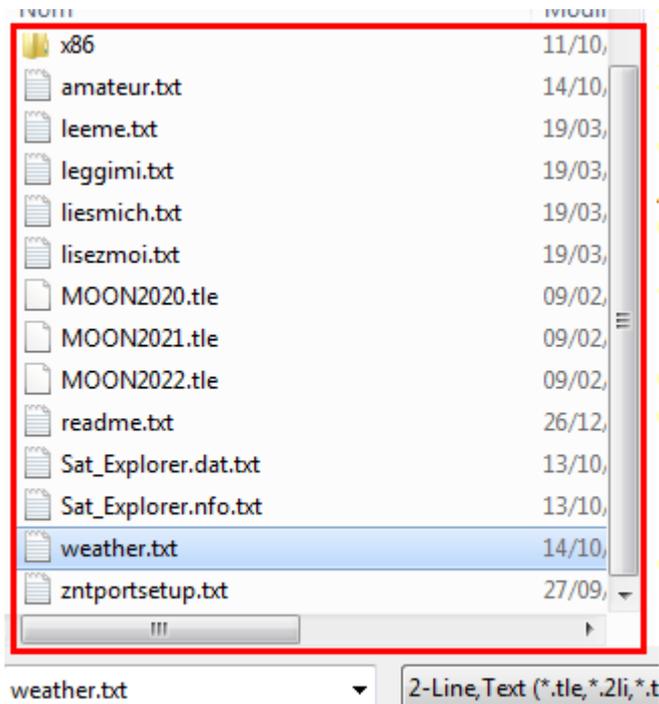
Now in the local file path, enter "weather.txt". You don't need to enter the full path. If SAT\_EXPLORER does not detect a full path, it will automatically save the file in the same directory as SAT\_EXPLORER. And finally click the button DOWNLOAD. If the link is correct and if your internet connection is correct, you must have the result "Download completed OK". Close the Download panel. Now our weather TLE file is available in our computer and we can associate it to our Weather group.



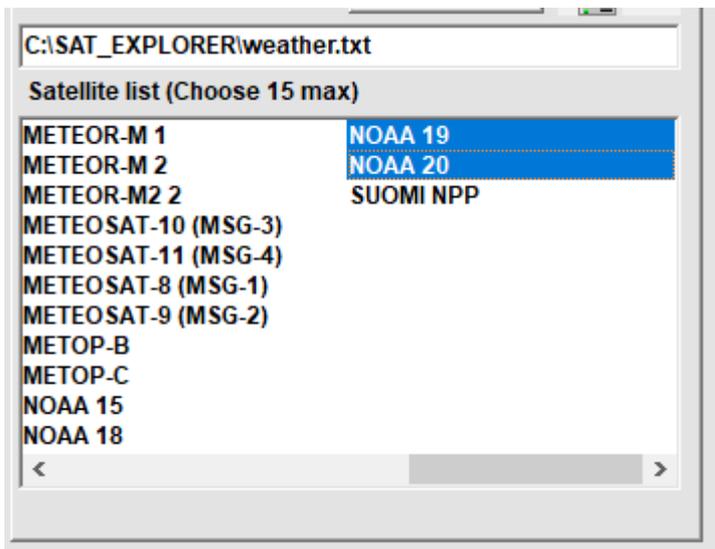
In the right side of the settings panel, click the button BROWSE



Choose the file named “weather.txt” in the SAT\_EXPLORER directory and open it.



The content of this directory is displayed by default. After clicking Open, the Satellite List must immediately be filled with all the weather satellites that are defined in the “weather.txt” TLE file. Choose the satellites that you want to track, for example NOAA-19 and NOAA-20, and finally click the button EXPLORE. You are ready to track these 2 weather satellites.



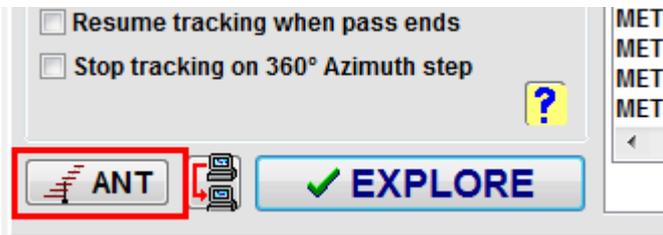
In the above example, we have explained how to create a new group in using the Celestrak data. Maybe you would prefer to use the AMSAT data. In this case, download the TLE file from this link:

<http://amsat.org/amsat/ftp/keps/current/nasa.all>

and save it as a local file named “nasa\_all.txt” in your computer. Then you may attach this TLE file to a group named “AMSAT”. This is just an example.

## 6 -Choosing an antenna system

Now, we could look at our satellites orbiting around the earth but perhaps have you got an antenna system and would you like to point your antenna toward one of these satellites and follow it when it passes over your location. For this, you need to tell SAT\_EXPLORER what is the model of your antenna control system. So, we have to go back to the settings panel. Click the menu Settings again. Click the button ANT in the bottom left of the panel.

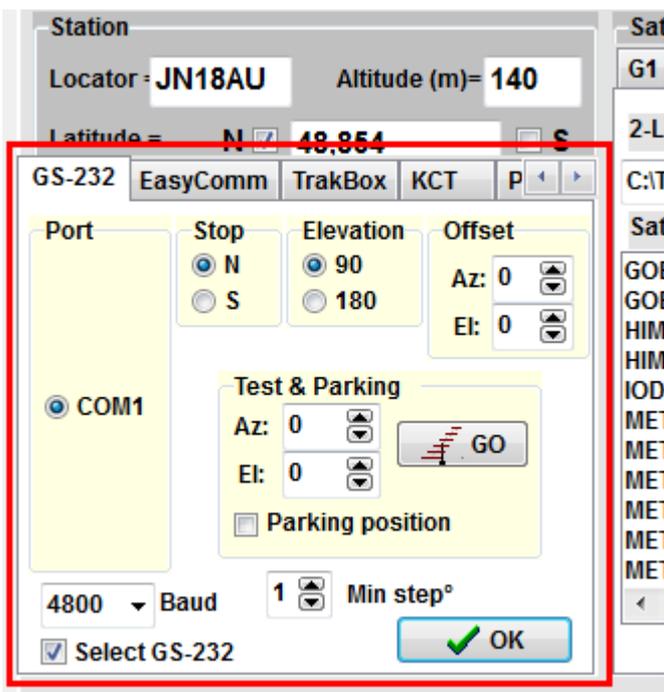


The list of the available antenna interfaces in SAT\_EXPLORER is displayed.

Click the thumbnail corresponding to your own antenna interface, for example GS-232, which is one of the most commonly used. SAT\_EXPLORER treats 10 antenna interfaces. Maybe your antenna interface is not listed but you have a good chance that it is compatible with one the 10 managed in SAT\_EXPLOER. Just try. If you got no way to control your antenna system, drop me a line and I will try to help you.

You must now fill the data required by SAT\_EXPLORER to control your antenna system. These data depend on the antenna system. Be careful to fill correctly each data. For example, for the GS-232 system, you need to choose a free COM port, the relevant Baud rate, the STOP position (North or South), the Elevation range (90° or 180°) and the offsets if necessary. Whatever your antenna system, you have the possibility to test “off-line” the good control of your antenna system by SAT\_EXPLORER. For that, set elevation & azimuth angles in the “Test & Parking” zone and click the button [GO]. Your antenna should move to the right positions. If not, check your data or your antenna system.

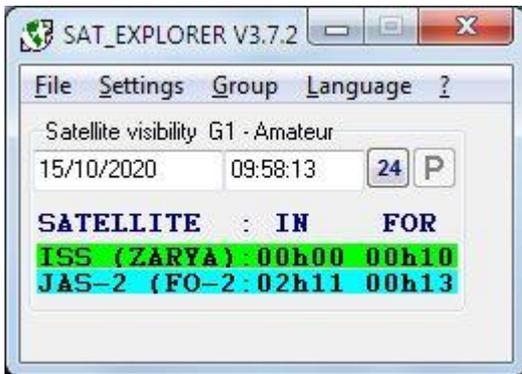
If everything is OK, check the box “Select GS-232” (or other antenna system). Checking this box is mandatory other else SAT\_EXPLORER will not use this antenna system!



Finally click OK in the antenna panel. We are ready now to track satellites with our antenna. Click EXPLORE in the settings panel to switch to the Tracking process.

## 7 - The STAND-BY window

This reduced and simplified window is displayed every time you start SAT\_EXPLORER, assuming you have correctly set the program. It displays the last chosen satellites (up to 15) in the last working group. It displays for each satellite the time to wait before it is visible (column IN) and the duration of the visibility when it becomes visible (column FOR). These times are in hours & minutes referring to your local time. If the satellite is visible, it is displayed in **green color** and the FOR data displays the remaining minutes until the satellite disappears. In the following example, we have chosen to display our satellites of group G1. You can see that the ISS is now visible (green line) for 10 minutes more. The JAS-2 will be visible in 2h11 for 13 minutes.

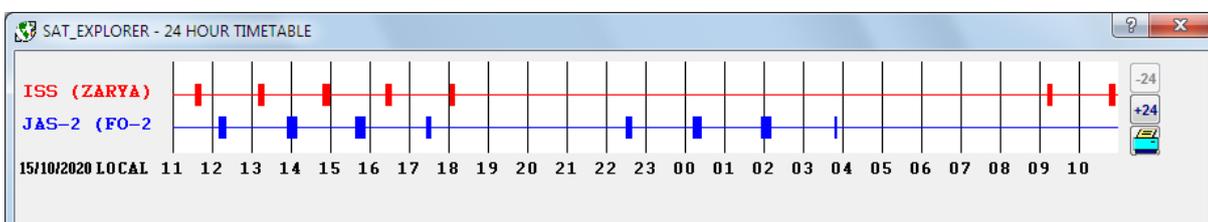


If the satellite is in yellow, this means that it is approaching and will be visible in a few minutes (by default less than 5 minutes). A satellite in **blue** means that it is the next one to be visible, whatever the time to wait. If you want to look at others satellites of another group, click the menu Group and choose the wanted group.



If you have chosen geostationary satellites, either they are always visible, or they are never visible. In the first case (satellite always visible), the satellite appears in green and the FOR time of visibility is set to 47h58 (2 days). In the second case (satellite never visible), the IN and FOR times are replaced by the strings #####.

Clicking the button marked 24 will show the time table of the visibilities for the next 24 hours.



## 8 -The TRACKING window

To track a satellite, click the relevant line in the Stand-by window. The tracking window for this satellite is displayed. Several informations are available in this window. We will not describe all of them here. The help file of SAT\_EXPLORER does this. We will in this paper just show you how to track the satellite with your antenna when this satellite is visible.

If the satellite is orbiting over your location, it is **GREEN** in the Stand-by window and the ephemeris table in the tracking window will display a **BLUE** line which gives the actual position of the satellite referring from your station. This BLUE line moves down every minute until the satellite disappears. When the satellite is not visible, the Ephemeris table displays the data of the next visibility (or further visibilities when clicking the buttons >, < or <<).

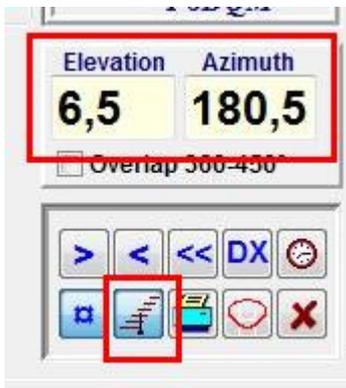
The screenshot shows the SAT\_EXPLORER V3.7.2[DX] [ISS (ZARYA)] window. The interface includes a menu bar (File, Settings, Group, Language, Options, Window, ?), a status bar (Satellite visibility G1 - Amateur, 15/10/2020 09:59:33), and a main display area. The main display area is divided into several sections:

- SATellite visibility:** Shows the satellite name (ISS (ZARYA)) and its visibility status (IN FOR). The current visibility is highlighted in green.
- SAT\_EXPLORER G. RIVAT F6DQM:** A central panel with a globe icon and the operator's name.
- Elevation and Azimuth:** Displays the current elevation (6,5) and azimuth (180,5) angles. A checkbox for "Overlap 360-450°" is also present.
- Control Buttons:** A set of buttons for navigation and tracking, including >, <, <<, DX, and a refresh button.
- Orbit Parameters:** A list of orbital parameters for ISS (ZARYA), including Epoch (DD/MM/YY), Epoch (NASA), Inclination, R.A.A.N., Eccentricity, Argument of perigee, Mean anomaly, and Mean motion.
- Doppler (Hz):** A section for Doppler shift, with a dropdown menu for Mode and input fields for RX (0) and TX (0) frequencies.
- Ephemeris Table:** A table showing the satellite's position over time. The current row is highlighted in blue, indicating the satellite is visible.

DATE & LOCAL TIME	EL	AZ	RANGE	ALTIT	LAT	LONG	PHAx	SQU	RX-DOPP
15 OCT 2020 09:58	1	193	2264	418	30N	3W	6	0	0
15 OCT 2020 09:59	4	186	1934	418	32N	0E	9	0	0
15 OCT 2020 10:00	8	176	1646	418	35N	3E	12	0	0
15 OCT 2020 10:01	11	161	1427	418	37N	7E	14	0	0
15 OCT 2020 10:02	14	143	1315	418	40N	11E	17	0	0
15 OCT 2020 10:03	13	123	1336	418	42N	14E	20	0	0
15 OCT 2020 10:04	11	106	1485	418	44N	19E	23	0	0
15 OCT 2020 10:05	7	93	1729	418	46N	23E	25	0	0
15 OCT 2020 10:06	3	84	2032	418	48N	28E	28	0	0
15 OCT 2020 10:07	0	78	2372	418	49N	33E	31	0	0

At the bottom of the window, a status bar indicates "Satellite is visible".

When a satellite is visible, the Elevation and Azimuth angles give every second the pointing data for your antenna system. If you have selected an antenna system in the settings panel, just depress the button showing an antenna to track the satellite. If you cannot depress this button, this means that no antenna system has been selected. Please verify the antenna settings. The Elevation and Azimuth angles are normally sent every second to the antenna interface but this time may be longer if the minimum step that you have chosen does not require sending these angle values every second.



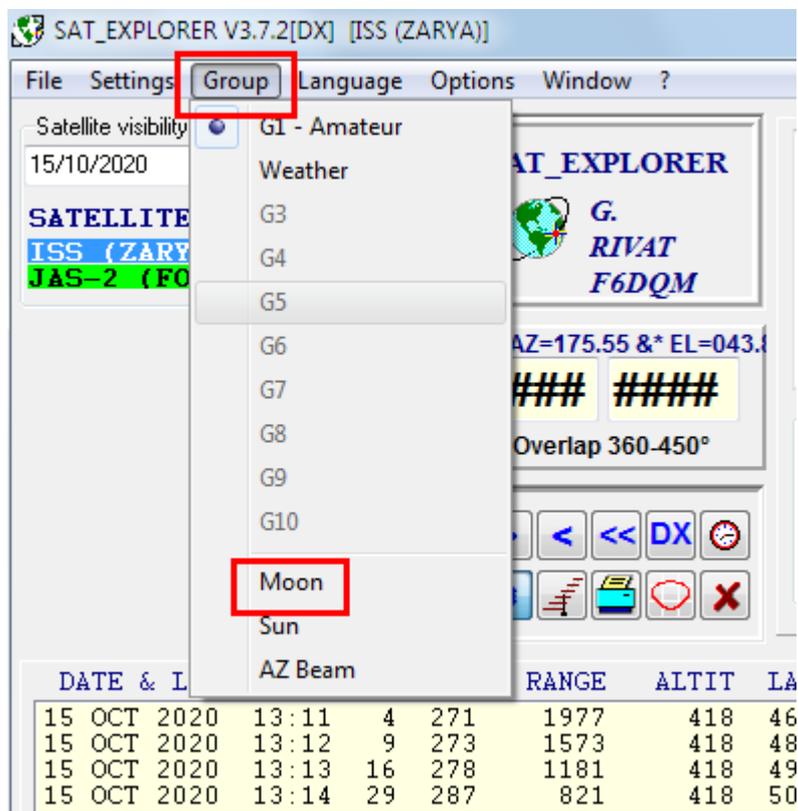
If the satellite is not visible and you depress the tracking button, the antenna will move to the azimuth where the satellite will appear over horizon. The elevation angle should be zero unless you have chosen to track the satellite from a higher elevation angle. These values are the one displayed in the very first line of the Ephemeris table. Note that the actual elevation and azimuth angles are replaced by the string #####.



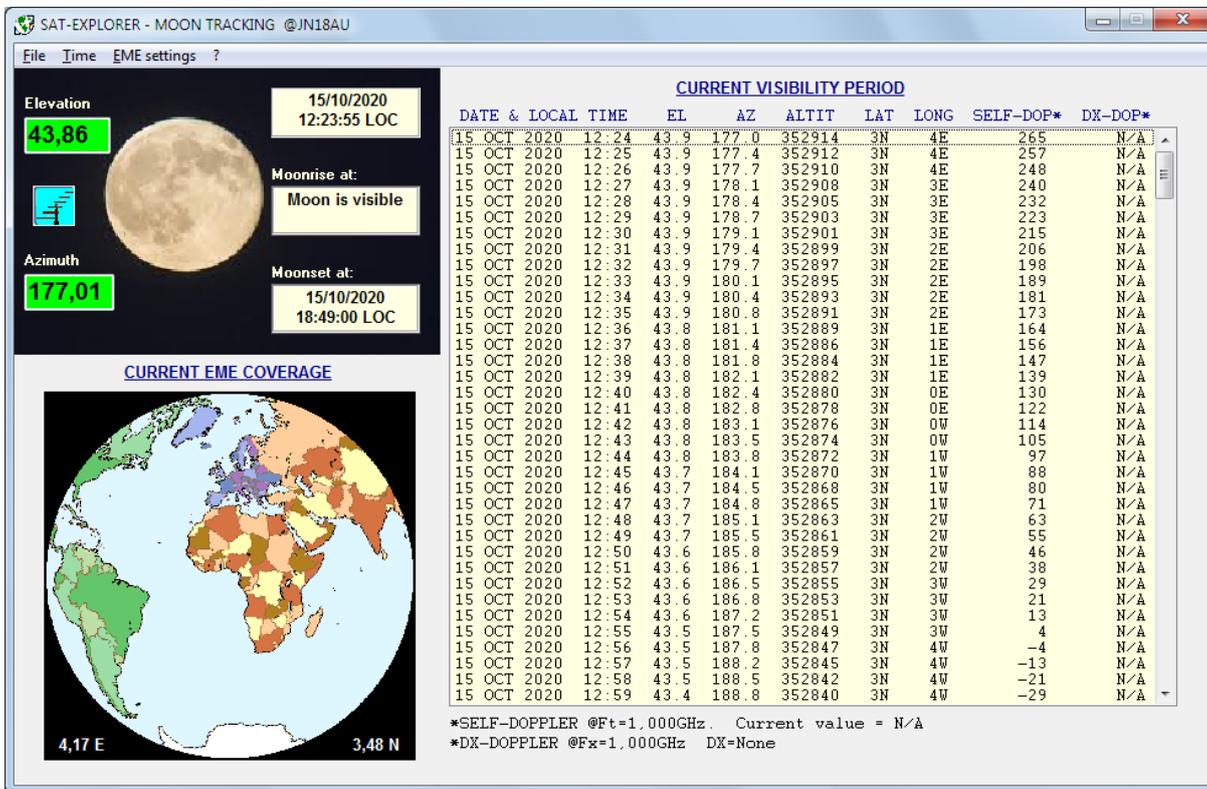
To switch to another satellite, just click the relevant line in the Standby window or panel. To switch to another group of satellites, click the menu "Group" and choose the wanted group.

## 9 -MOON tracking

SAT\_EXPLORER includes algorithms to compute the orbit of the Moon and its current visibility from the Earth. The precision of elevation and azimuth angles is better than one tenth of a degree which good for EME communication. If using the EGIS antenna interface, the control angles are sent with a precision of one hundredth of a degree. To track the Moon, click Moon in the menu "Group".



The Moon tracking window is displayed. In the image below, you can see on the map the current coverage of the Moon. It is visible from my location near Paris, so the Elevation and Azimuth angles are displayed in green color. The Moon is located vertically right over the geometric center of the circle. The tracking button is depressed (blue color) and antenna tracking is running. Angles are computed every second. The Moon will set behind the horizon at 18h49. The Ephemeris table always shows the actual minute on its top line. The table moves up every minute. Self-Doppler and DX-Doppler are computed from the data entered in the menu "EME Settings".



Please note that the Moon tracking uses the same antenna system as the tracking of the artificial satellites. If you are equipped with two different antenna systems, one for artificial satellites and the other one for EME, you must install SAT\_EXPLORER twice in your computer, in using two different directories.

You may then run two separate sessions of SAT\_EXPLORER, the first one dedicated to artificial satellites and set with the relevant antenna system, the second one dedicated to the Moon and set with the EME antenna system. If these two antenna systems use COM ports to be controlled, they must be different.

## 10 -Other features in SAT\_EXPLORER

This paper intends to get you ready to track a satellite or the Moon with SAT\_EXPLORER. This is the minimum to go on the air. SAT\_EXPLORER has got also some features such map, DX visibilities, Doppler computing, data transfer with other applications. The Help file describes all the menus. We will let you explore by yourself these different menus.

And if you have any question, don't hesitate to send me a mail. You will find my mail address on the Contact page of my Web site or in the readme.txt.

Gabriel F6DQM