GSG 5-6 Series

The GSG-5/6 Series are end-of-life products of Safran's Trusted 4D GNSS simulator product line. GNSS Constellation Simulators are mainly used for in-line production and development testing, including navigational fix and position testing.

GSG-5 Series simulators reproduce the GNSS signal of a GPS receiver input. Depending on the configuration, these units simulate up to sixteen GNSS satellites, up to 3 SBAS satellites, together with optional multipath and interference signals. The GSG-5 Series applies models to simulate satellite motions, atmospheric effects, and different antenna types. The movement of the GPS receiver under test is defined using NMEA data or pre-defined trajectory models.

GSG-6 Series simulators add advanced features and can simulate up to 64 independent satellite channels on different frequency bands.

In addition, the GSG5/6 series are designed with a front panel display along with an intuitive software user interface - GSG StudioView.

GSG-7/8 Series

GSG-7 & 8 deliver the highest standard of GNSS signal testing in a cost-effective, easy-to-use, turnkey form factor supporting the growing need for location-aware applications and systems that require navigation or timing.

GSG-Converter

This tool made in Python allows the user to automatically convert GSG-5/6 scenarios in Skydel for GSG-7 or 8 simulators. The list of functionalities that can be converted is defined in Appendix A - Table 1.

1. Installation:

1.1. Executable

Download the toolkit containing the converter.

1.2. Python:

1. Install python:

   Make sure python is install (from version 3.8) or download the latest python version from *https://www.python.org/downloads/*.

2. Open a terminal and check the installation:

   $ python –version (or python3 –version for Linux platform)

3. Install the python packages:

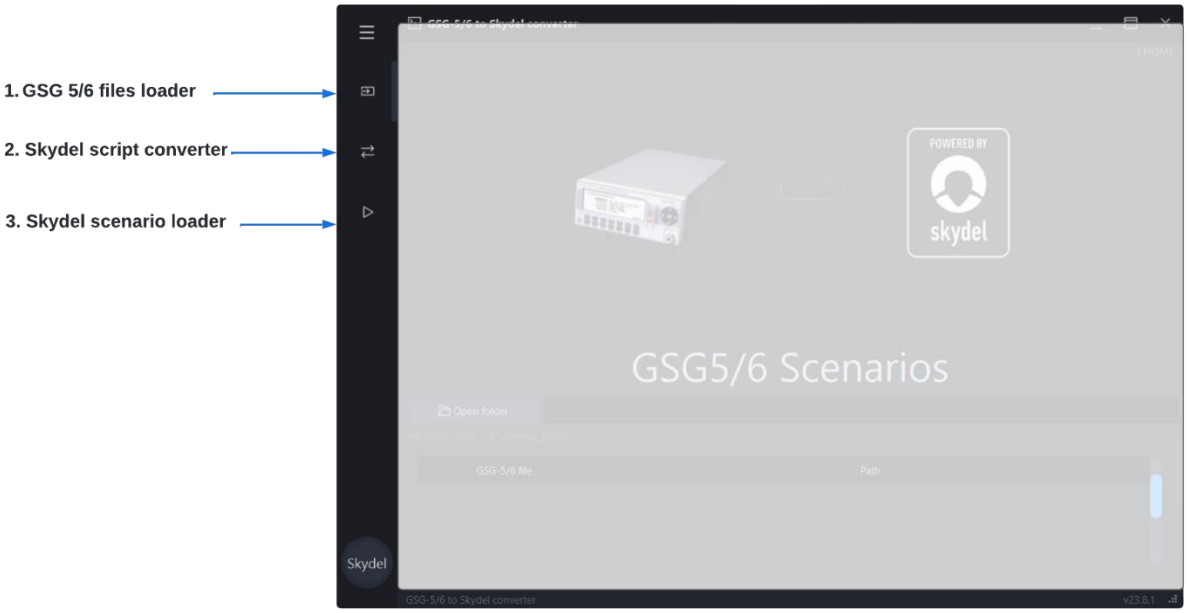
   $ pip install -r requirements.txt.

4. Run the GSG-Converter script:

   $ python main.py

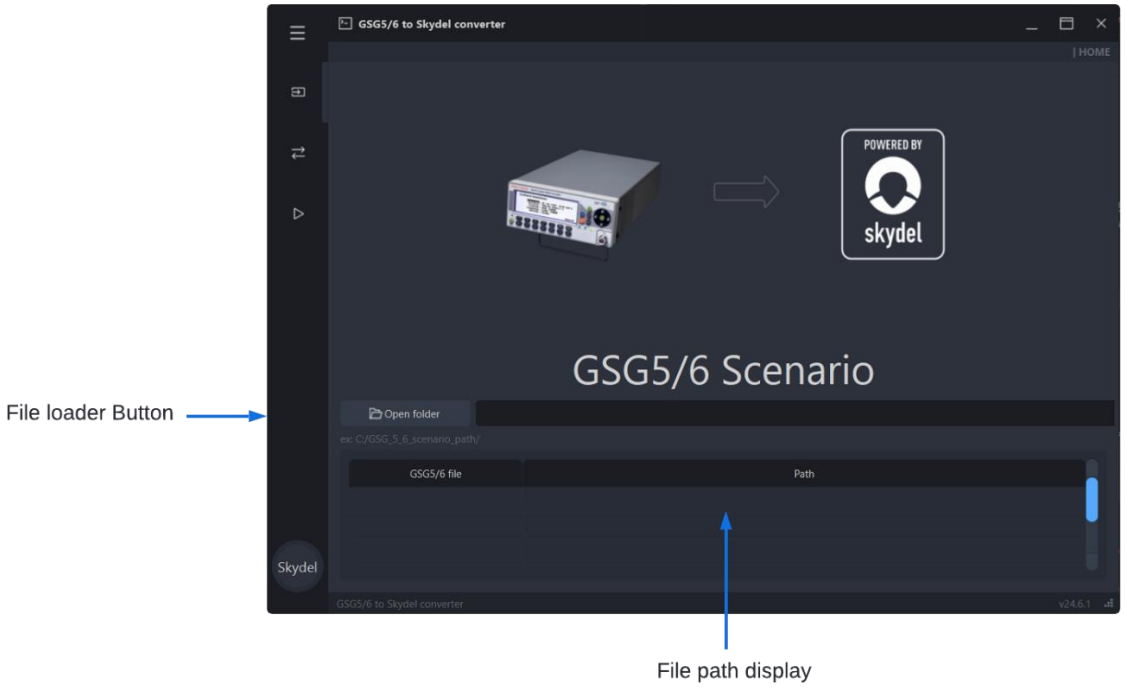
2. GSG Converter

The GSG converter has 3 main menus:



2.1. GSG-5/6 file loader menu

This menu appears by default when starting the application.

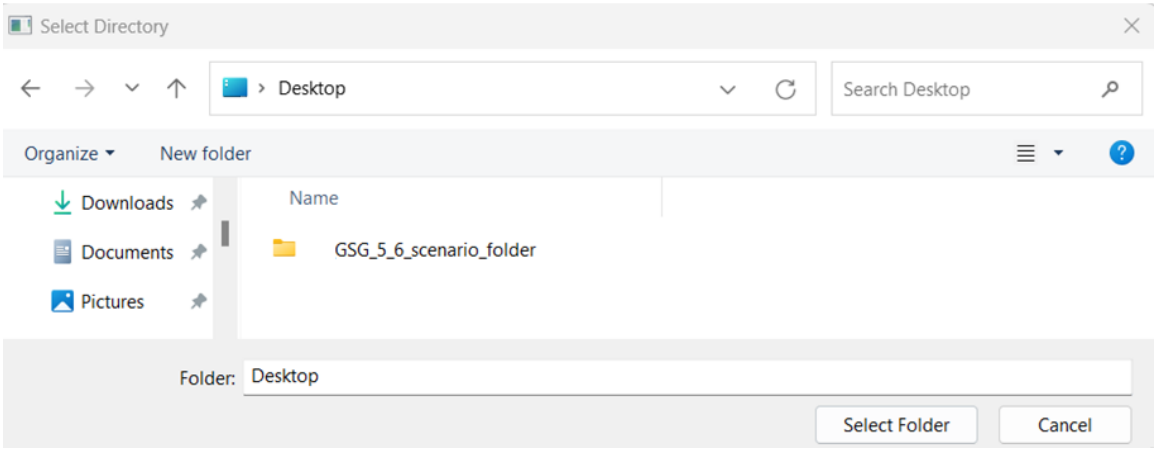


2.1.1. Files loader buton

The *Open folder* button allows you to import the GSG 5/6 scenario files.

NB: It's possible to load and convert files from a single GSG-5/6 scenario at a time. Also, the current release of the GSG converter only considers the scenario file (.scen) and the NMEA trajectory file (.nmea).

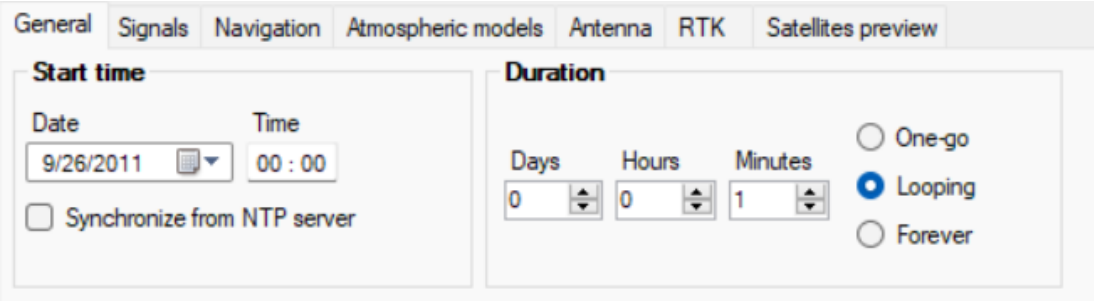
Make sure that all scenario files are in the same folder, then click *Open folder*:



Once the folder is selected, the list of GSG 5/6 files will appear as shown below:

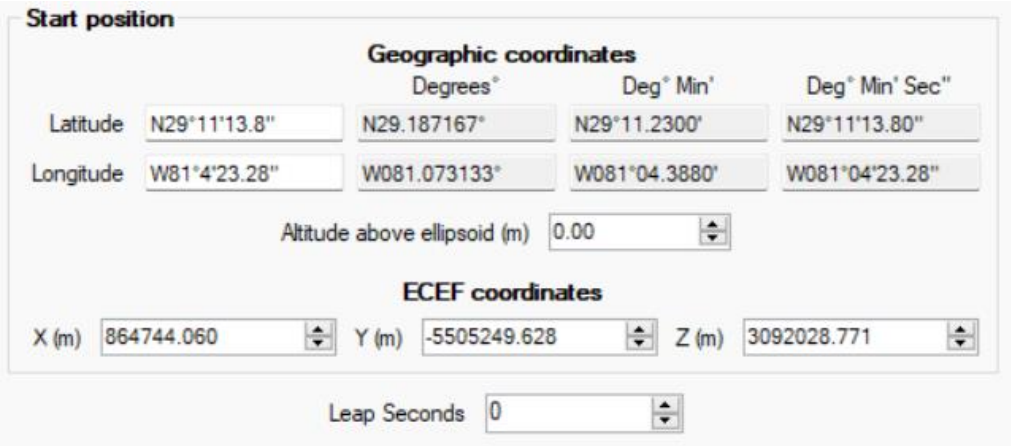
Let's check the characteristics of the *Daytona500.scen* scenario used as an example with GSG-Studio View:

a. In the General tab, we can get the start time and duration of the simulation:
   - ***Start time***: 9/26/2011 at 00:00
   - ***Duration***: 1 minute

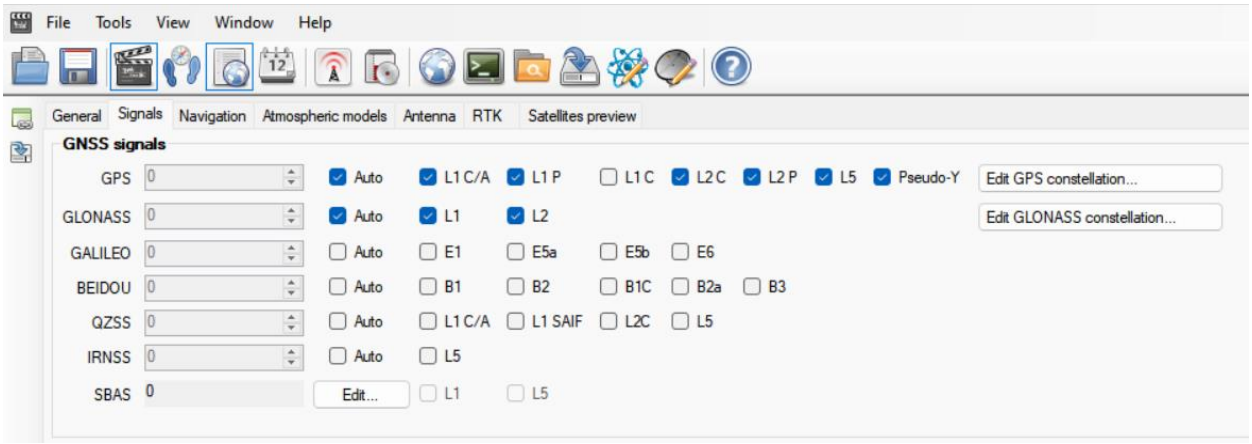


The scenario is in Looping mode (it will restart again right after).

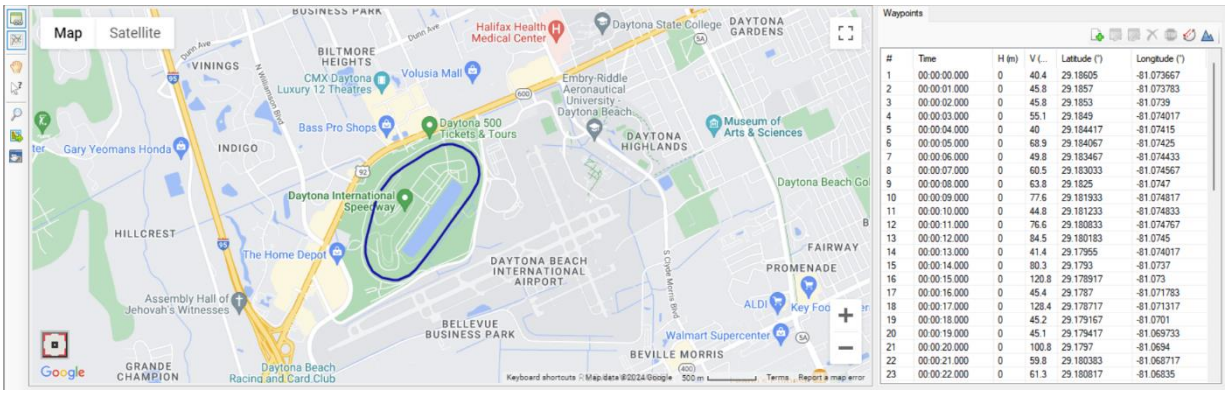
The initial position of the vehicle is defined as follows:



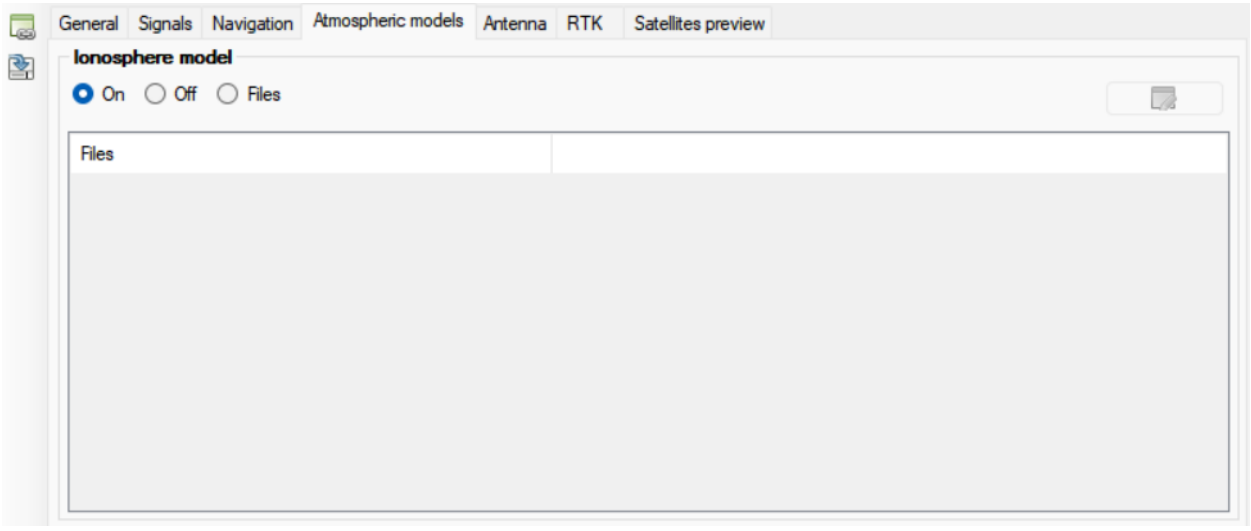
b. The constellations selected in the GSG scenario can be viewed in the *Signals* tab:
   - ***Upper L-Band***: GPS L1 C/A, L1 P-code, GLONASS G1
   - ***Lower L-Band***: GPS L2C, GPS L2 P-code, GPS L5, GLONASS G2



c. This GSG5/6 scenario is provided with an NMEA file (Daytona500.nmea) which contains the trajectory of the simulated vehicle:

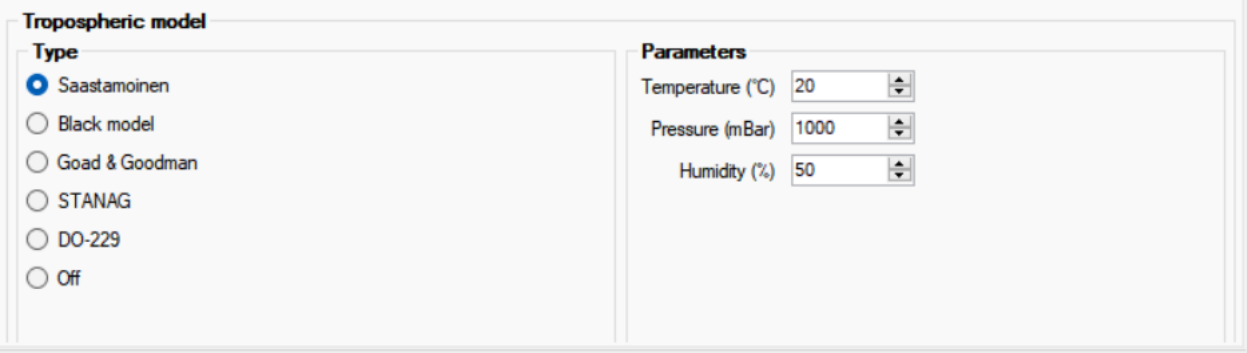


d. The ionospheric model is set to ***On***:



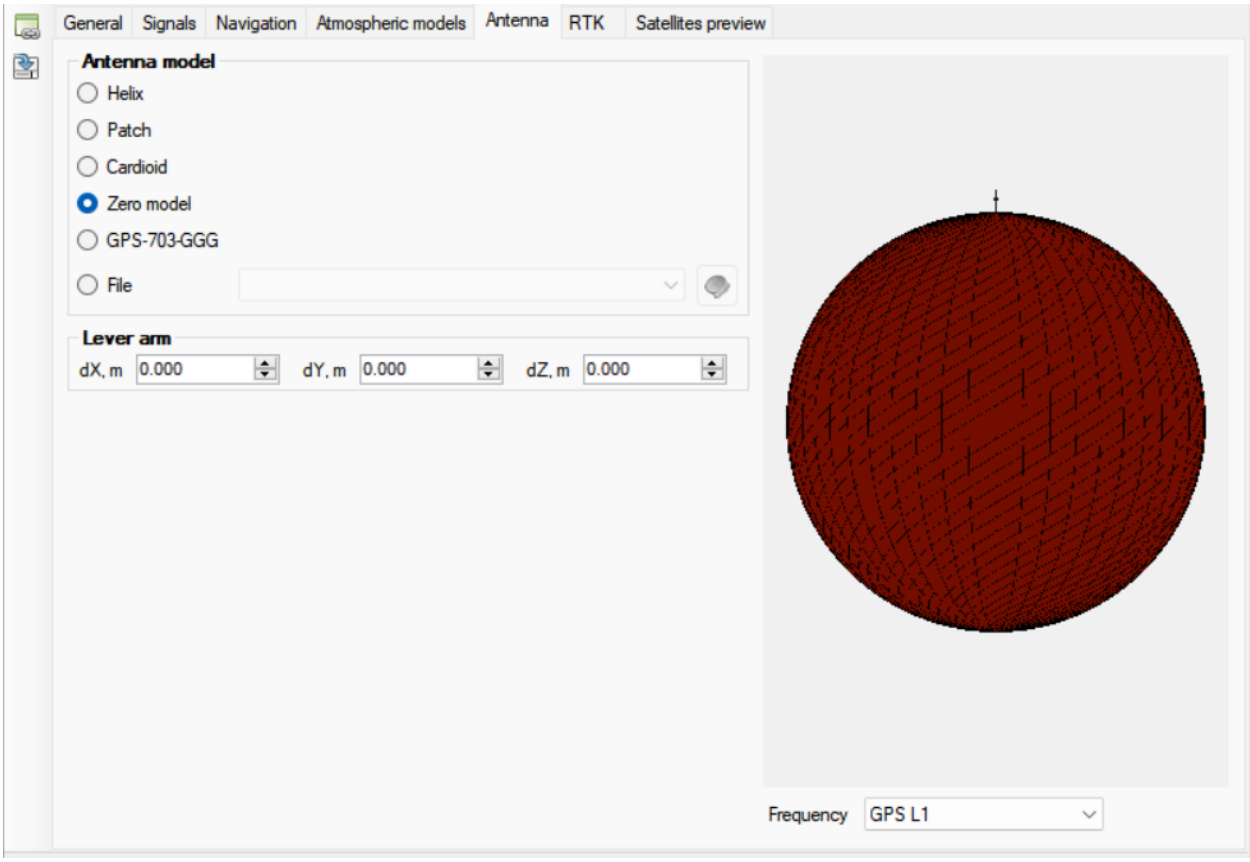
On mode used a reverse model of the model described in IS-GPS-200D, section 20.3.3.5.2.5. When set on ***Off***, no effect caused by the ionosphere will be used in the simulation. The ***Files*** option allows users to simulate ionospheric delays using IONEX files.

The Saastamonian tropospheric model is enabled:



Atmospheric parameters (temperature, pressure, and humidity) are not applicable to Skydel currently.

e. The selected antenna model is Zero model:



The lever arm location is set to zero in all axes.

2.2. Skydel script converter

This page allows users to convert data files from GSG-StudioView, GSG-5/6 into Skydel script files.

Two types of files will be generated:

- a Skydel SDX script file
- a python script file

2.2.1. Skydel output selection

Use the Skydel Output selection drop-down list to select the radio type.

Note :

- ***None***: RF is not generated, and IQ is not saved, raw logging data is saved.
- ***NoneRT***: Like None but runs in Real Time. Useful when developing automation scripts.
- ***DTA-2115B***: Software-defined radio from DekTec.
- ***DTA-2116***: Software-defined radio from DekTec.

2.2.2. Radio gain

Enter the selected SDR gain in the *radio gain input* field. By default, the gain is 50 dB for DTA-2115B and DTA-2116.

2.2.3. Gaussian noise selection

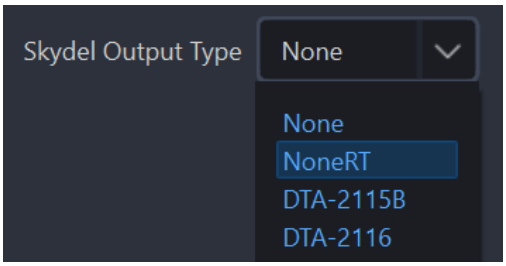
Add Gaussian Noise in Skydel scripts to reproduce realistic C/No.

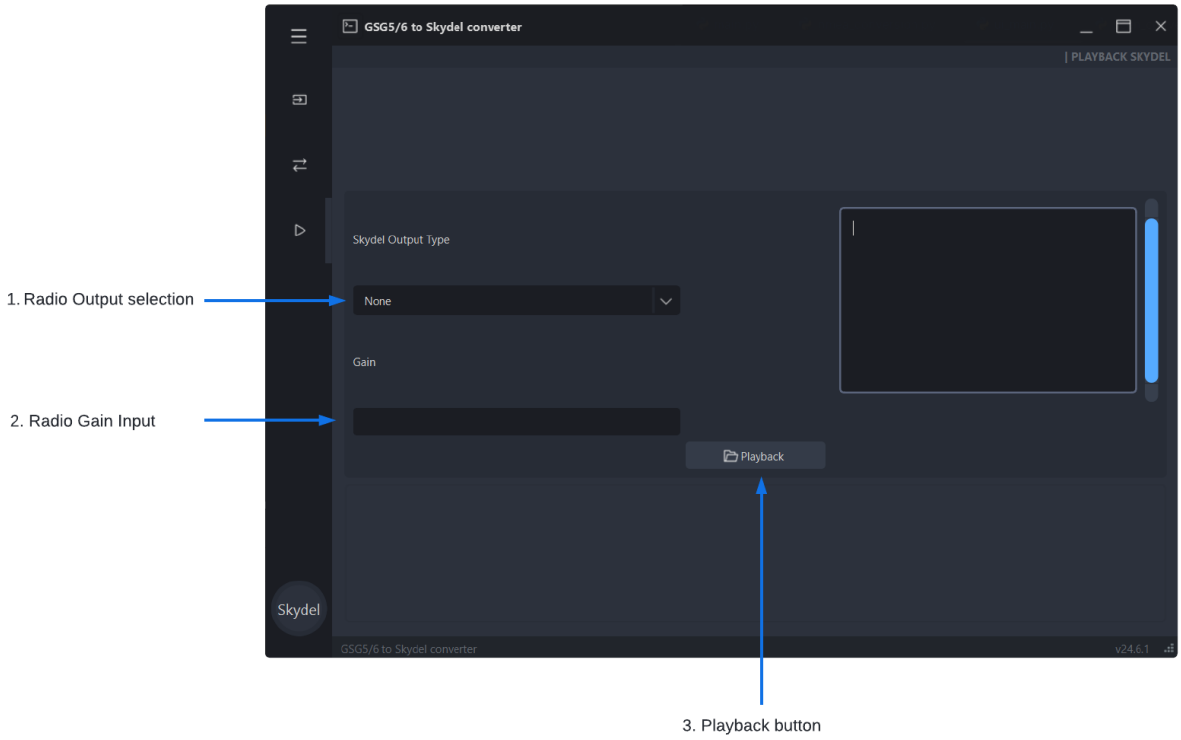
2.2.4. Conversion button

Convert the loaded GSG5/6 scripts into python and skydel script.

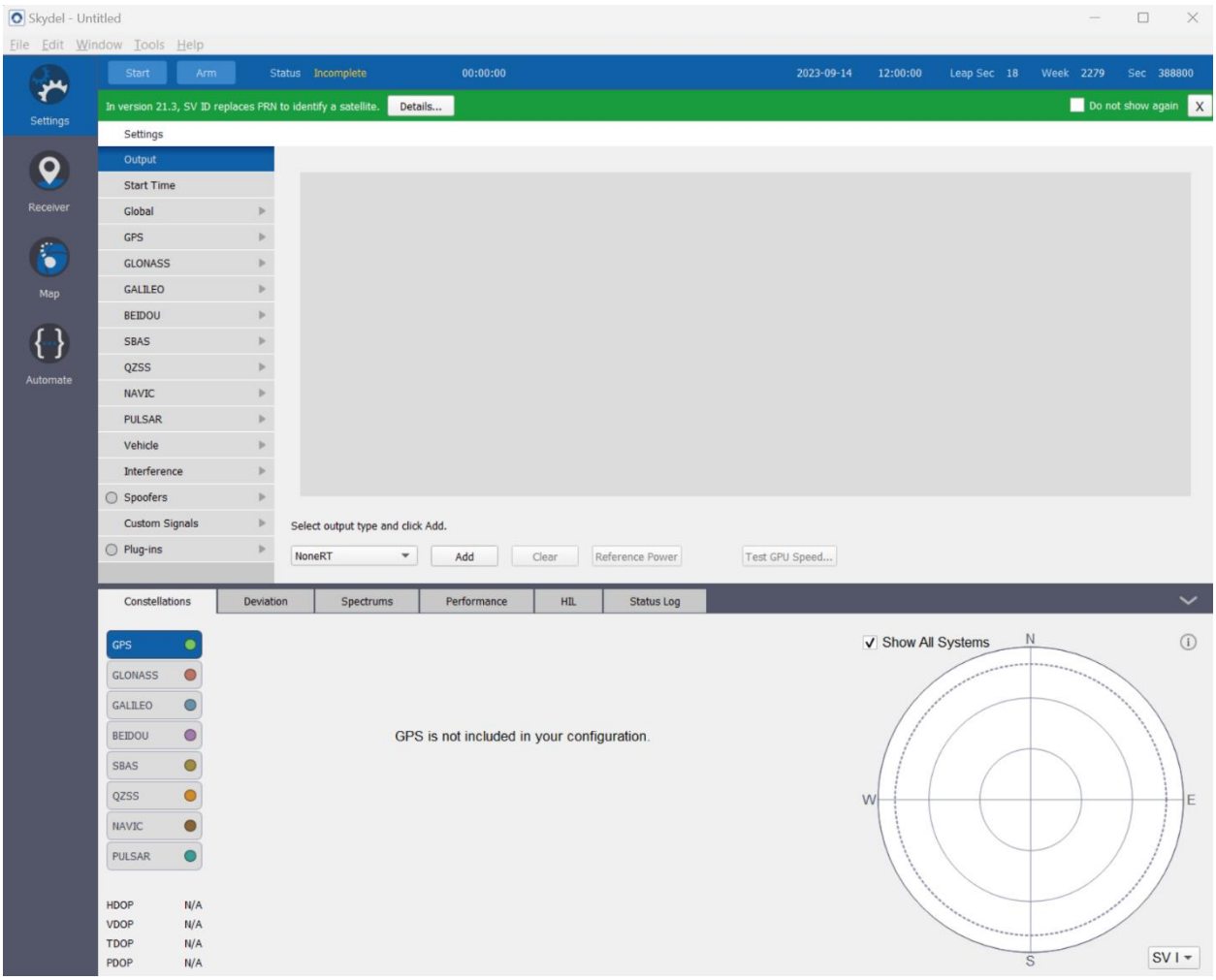
2.3. Playback in Skydel

This page will allow you to directly replay GSG5/6 scenarios in the Skydel interface.



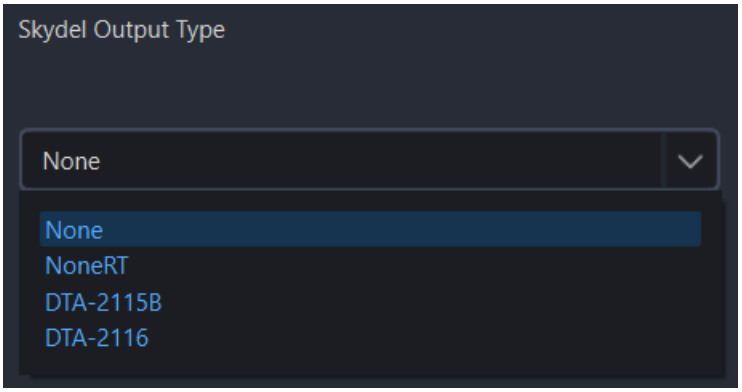


To get started, make sure an instance of Skydel is open by default:



2.3.1. Skydel output selection

The Skydel Output selection drop-down list allows you to select the type of radio that will be used in Skydel scripts.



Note :

- ***None***: RF is not generated, and IQ is not saved, raw logging data is saved.
- ***NoneRT***: Like None but runs in Real Time. Useful when developing automation scripts.
- ***DTA-2115B***: Software-defined radio from DekTec.
- ***DTA-2116***: Software-defined radio from DekTec.

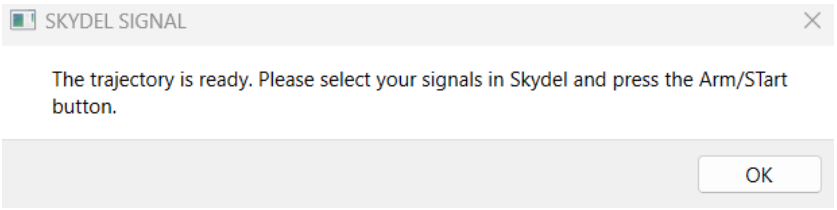
2.3.2. Radio gain

Enter the output gain of the selected SDR using the *radio gain input* field.

2.3.3. Playback button

This button sends the API commands corresponding to the data from GSG5-6 scenarios directly in a Skydel instance.

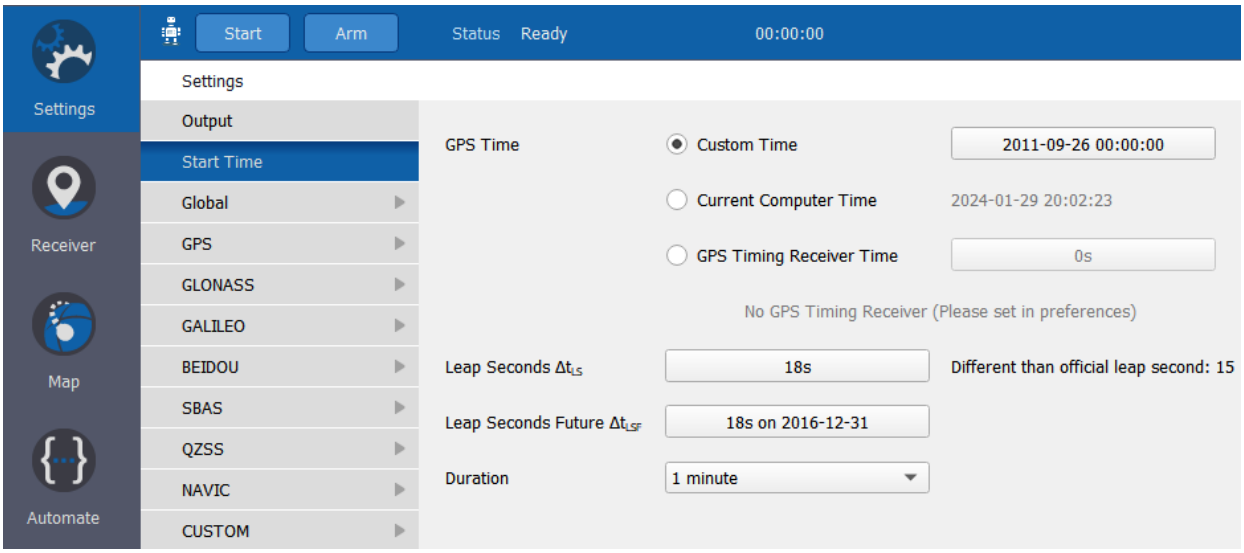
When the scenario is ready to start in Skydel, the following pop-up window will appear:



Click *Ok* to close this window and go to the Skydel instance.

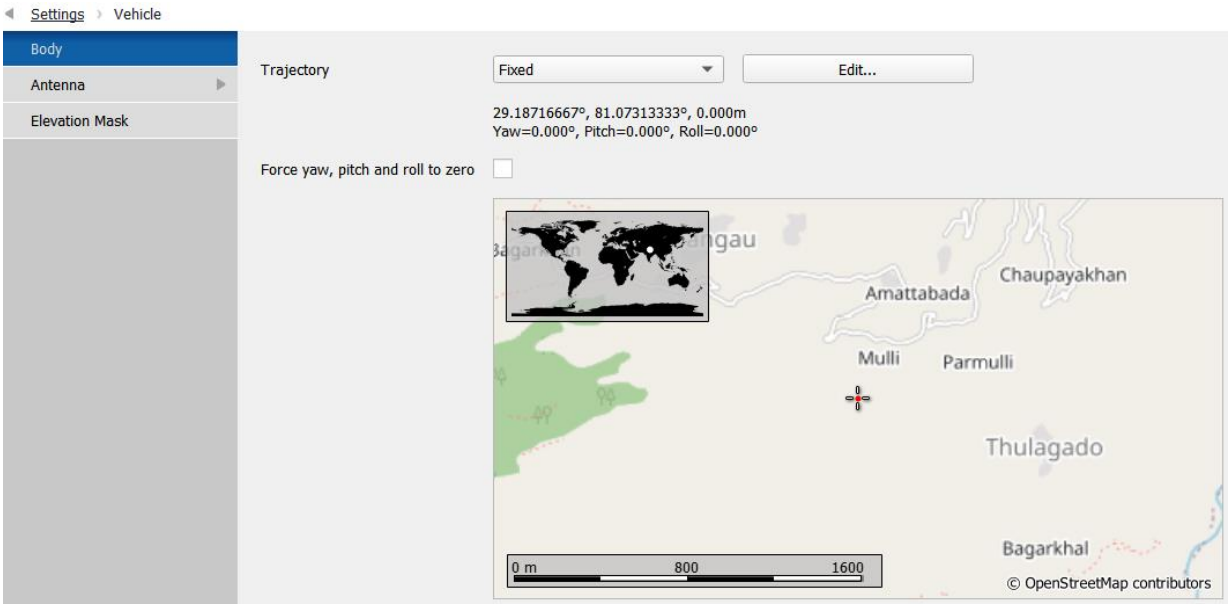
Check that all the elements defined in your GSG-5/6 scenario are present such as the signals:

a. The start date and time correspond to the settings in the GSG-Scenario (see section 2.1.1.a):



The duration was also set to 1 minute, corresponding to the GSG 5/6 scenario duration.

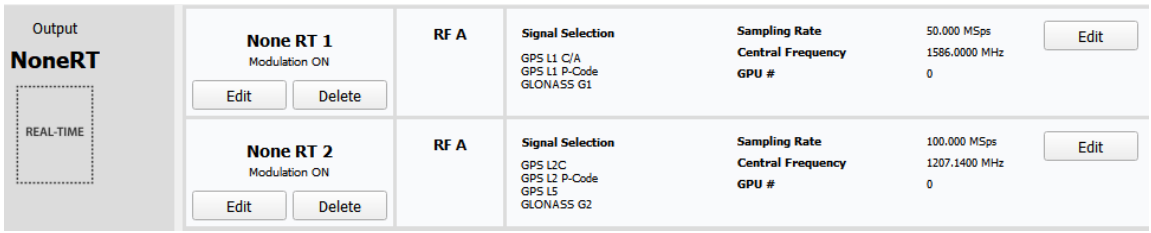
b. The initial position converted from the GSG scenario has been defined in the vehicle settings:



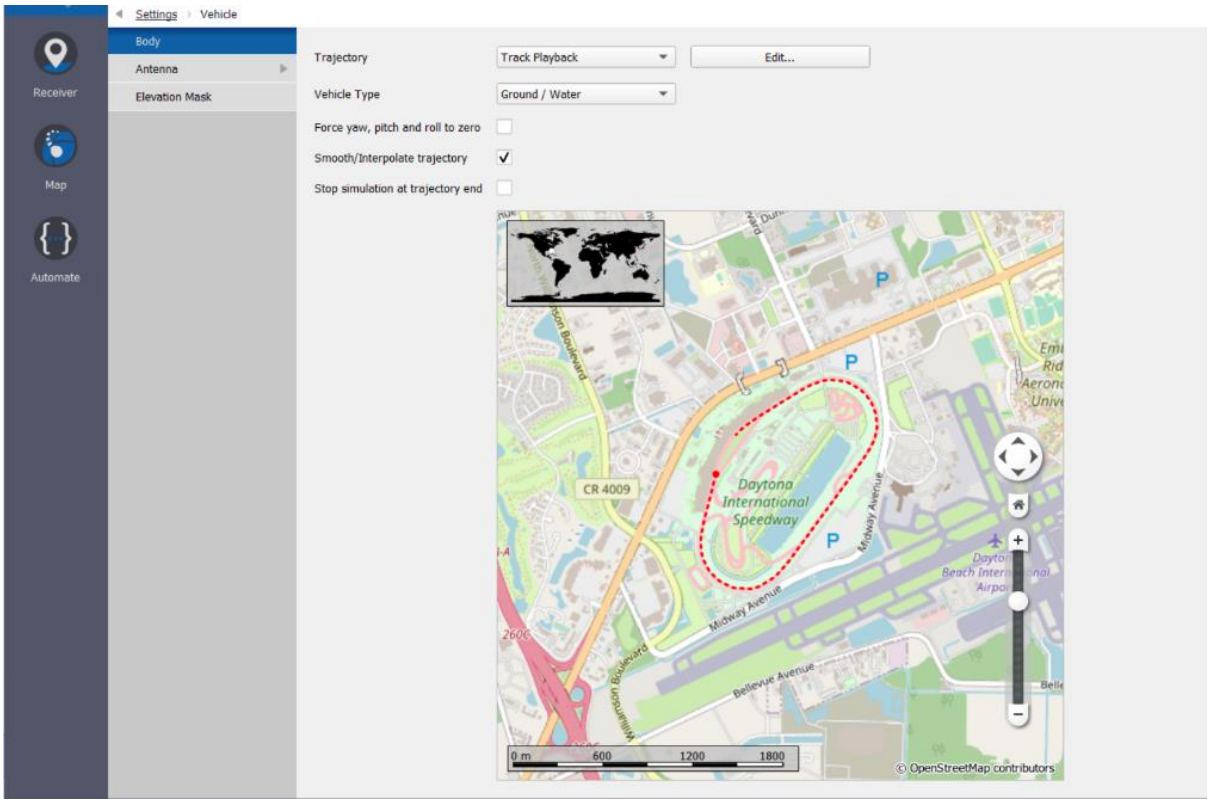
Given that the GSG scenario contains an NMEA file, the initial trajectory will change from ***Fixed*** to ***Track Playback***.

c. The constellations defined in the GSG scenario have been applied in the Skydel scenario accordingly:

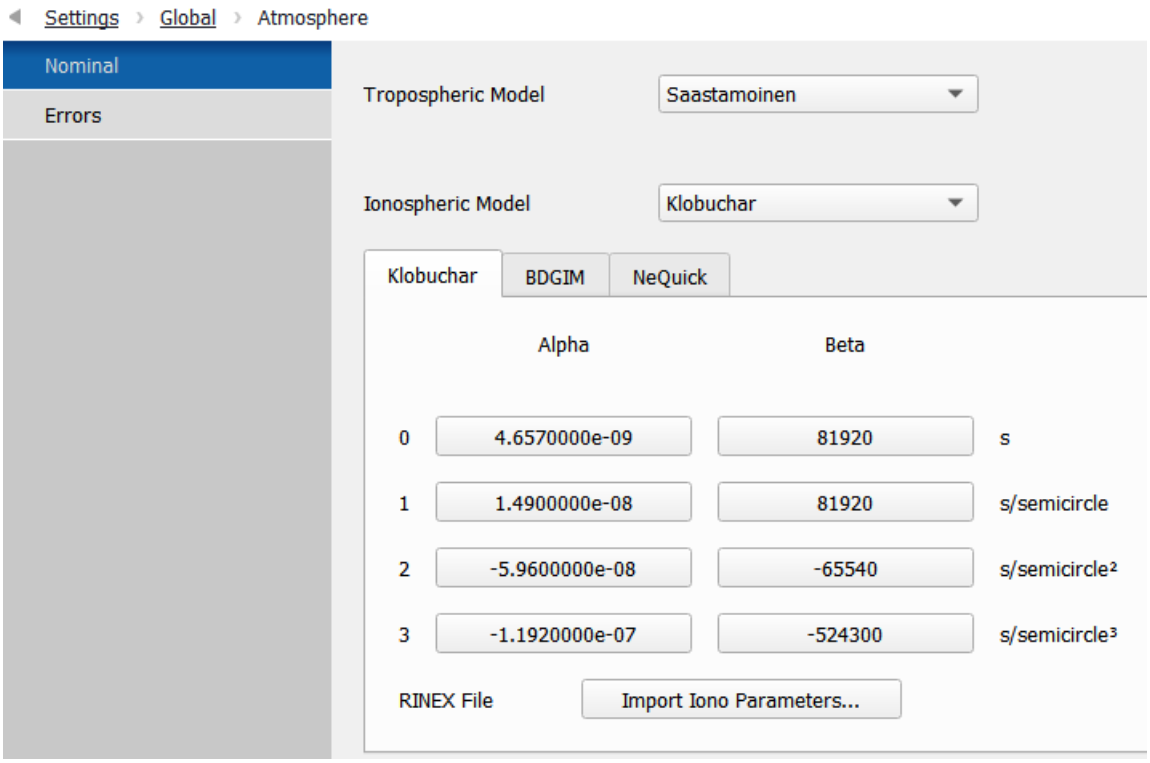
- ***Upper L-Band***: GPS L1 C/A, L1 P-code, GLONASS G1
- ***Lower L-Band***: GPS L2C, GPS L2 P-code, GPS L5, GLONASS G2



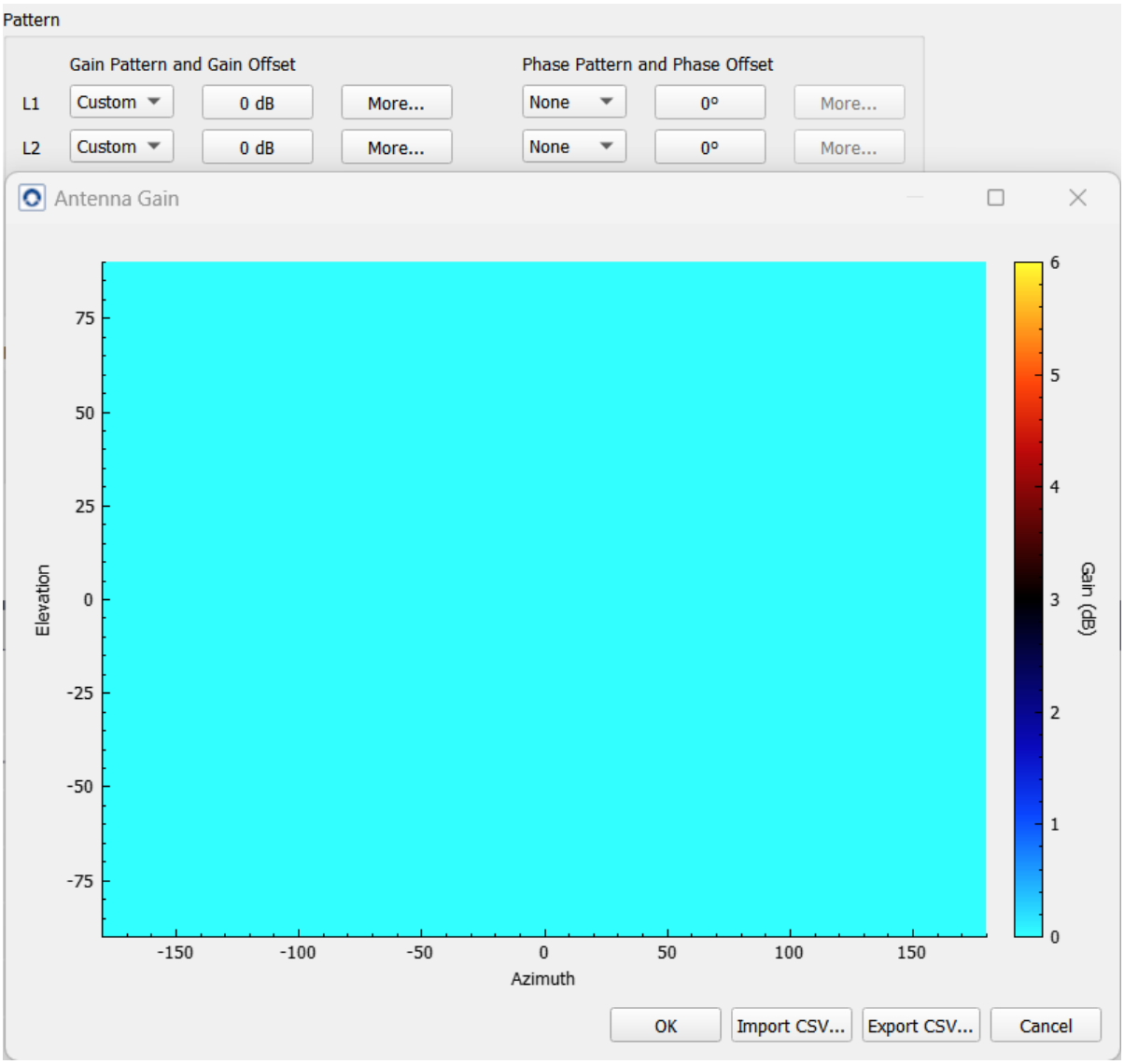
d. And the trajectory of the GSG5/6 scenario in the Skydel Settings -> Vehicle window:



e. The atmospheric model was also applied as defined in the GSG scenario:



f. The Zero antenna model has been selected in the ***settings->Vehicle->Antenna*** menu.


Pattern
Gain Pattern and Gain Offset
Phase Pattern and Phase Offset
L1
Custom
0 dB
More...
None
0°
More...
L2
Custom
0 dB
More...
None
0°
More...
Antenna Gain
75
50
25
0
-25
-50
-75
Elevation
-150
-100
-50
0
50
100
150
Azimuth
6
5
4
3
2
1
0
Gain (dB)
OK
Import CSV...
Export CSV...
Cancel

Annexe A :

Table 1: List of the GSG options that can be converted to Skydel features.

GSG Studio View Functionalities		Implemented in Skydel	Comments
General			
Start Time		Yes	
Duration			
	Total time	Yes	
	Looping	No	This functionality is not yet directly implemented in Skydel, but it is possible to do it using a python script.
	Forever	Yes	
	One-go	Yes	
Start position		Yes	
Signals			
GNSS Signals		Yes	In GSG scenarios, it is possible to define the maximum number of satellites to simulate. This functionality has not yet been implemented in the converter. All visible satellites will therefore be simulated by default in Skydel.
Interference Signals		No	
Multipath Signals		No	
Elevation mask		yes	
Navigation			
Trajectory			
	File (NMEA)	Yes	
	Circle	Yes	
	Static	Yes	
	3 GPP	No	
Events			
	None	Yes	
	File	No	
Environment			
	None	Yes	
	File	No	
Vehicle model			
	None	Yes	
	File	No	
Navigation Data			
	Default	No	
	Download	No	
	Files	No	
Atmospheric models			

Ionosphere model			
	On	Yes	When the ionosphere model option is **ON** in the GSG scenario, the Klobuchar model will be applied by default in the Skydel scenario.
	Off	Yes	
	Files	No	
Tropospheric model			
	Saastamoinen	Yes	
	Black model	No	
	Goad & Goodman	No	
	STANAG	Yes	
	DO-229	Yes	
	Off	Yes	
Parameters			
	Temperature(C)	No	
	Pressure (mBar)	No	
	Humidity (%)	No	
Antenna			
Antenna model			
	Helix	Yes	
	Patch	Yes	
	Cardioid	Yes	
	Zero model	Yes	
	GPS-703-GGG	Yes	
	File	No	
Lever arm			
RTK			
Base Station		No	