NFA GPS- Mapping

User's Experience

User's Experience by
Jostein Ravndal

Preface

I'm not a part of the Gigahertz Solutions' organization or development team. The information in this "User's Experience" is based on my personal experience. The advices given might be too restrictive on some points. However, by following these advices I have experienced trouble-free operation of the Google Earth beta functions in NFAsoft.
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Stavanger 03.10.2011, Jostein Ravndal.

Contents

1 Basic Principles

NFAsoft can combine the data recorded on the NFA series instruments with position data recorded on a GPS logger or a GPS navigation unit, and present the information graphically in **Google Earth**.

NFAsoft uses the time information from the GPS log and the NFA log to place the NFA data on the map. This requires that the **NFA time is synchronized with the GPS time** in order to display the NFA data on the correct map position.

To read the position data, NFAsoft requires a track log of the GPS data in the so-called GPX format. Most commercial GPS loggers can export the track information in the GPX format, thus enabling a variety of GPS equipment to be used for track logging, including GPS applications on mobile phones.

2 Steps for creating a Google Earth file

In the following example we have used a small GPS logger to explain the basic functions. See also http://www.nfa-meters.com/en/nfa, E-Learning/GPS mapping.

Before you start, please

- Install Google Earth on your computer.
- Install the GPS software that comes with your GPS logger
- Make some test records and check that you can read the logs and export the track log in the GPX format.

2.1 Preparation before a GPS logging trip

1. Ensure that the time on your NFA logger is correct. See the relevant section in the NFA Operating Manual on how to update the NFA time (section 7.4 in Operating Manual version 6.0)

2.2 Creating GPS and NFA logs

1. Switch on the GPS data logger and thereafter activate the NFA logging function. (The GPS logger should not be connected to the NFA). Please make sure that the GPS has a stable position fix before you activate the NFA logging (a GPS position fix is normally indicated by a flashing LED).

2. Optional step, valid for NFAsoft version 120 or above:
   If your GPS logger has a “Mark Waypoint” function, then you mark a waypoint and at the same time press the “Voice REC” button on your NFA. NFASoft will use these two markers to correct a possible time difference between the GPS time and NFA time. (See section 3.2.2 for further information)

3. Now you can travel the distance to be measured whilst the NFA is logging data and the GPS is logging position.

4. At the end of a logging run, turn off the NFA before you turn off the GPS logger.

2.3 Creating a Google Earth file

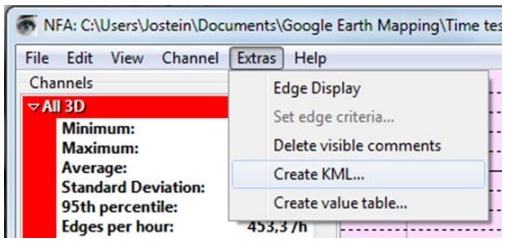
1. Connect the GPS logger to the computer and use the GPS software to load the actual track data to your computer.

2. Choose the actual trip record data and export it in the GPX format.
   Consult the User’s Guide for your GPS software to find how to export data. On some loggers you will find it under "File / Export route", choose GPX format. Other loggers have the export command by right-clicking the trip record.

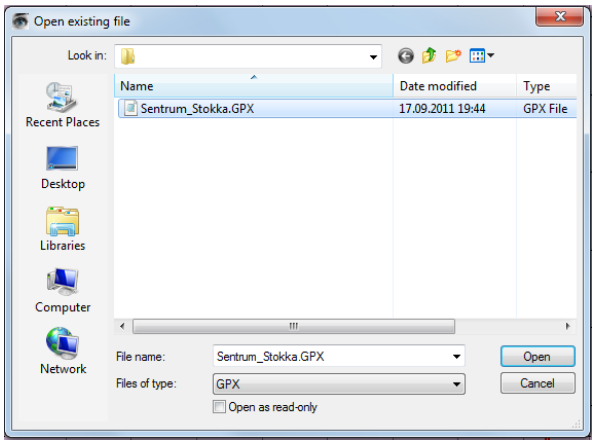
3. Copy the corresponding NFA data log from the SDHC card to the folder where you exported the GPX file.

4. Open the NFA log file with NFAsoft.

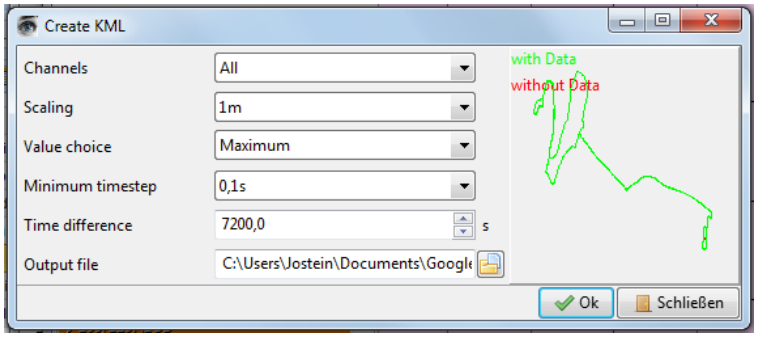
5. Select “Extras / Create KML”. (KML is the Google Earth format):



6. Then you select and open the GPX file:



7. In the Create KML dialogue box you can select parameters:

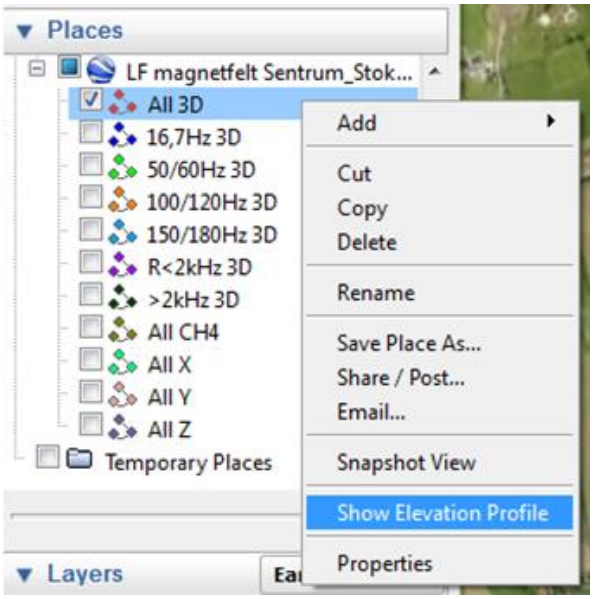


Channels - selects which cannels to be presented in Google Earth
Scaling - defines the height of the curves displayed in Google Earth. A scaling factor of 1m means that 1 unit on the NFA channels will be converted to 1m in the Google Earth elevation profile.
Value choice - max values recorded or average values.
Minimum timestep - defines the resolution along the track.
Time difference - is the time difference between the time in the GPX export file and local time. The default time difference is calculated by NFAsoft. See section 3.2 for more information.

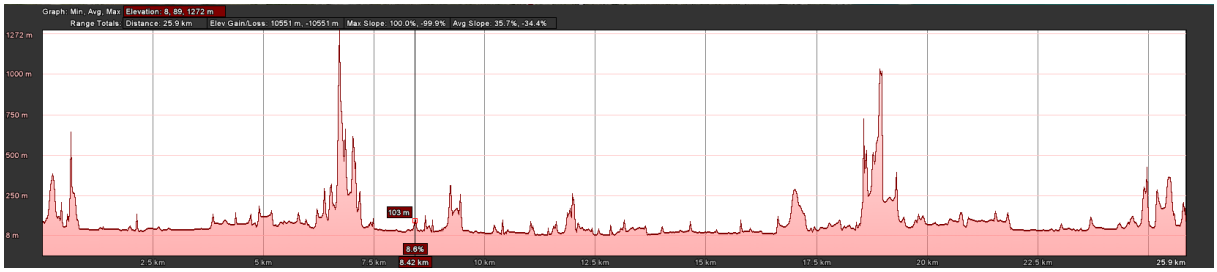
8. Enter a name for the new KML file and confirm the file creation with “Ok”.

9. Now you have created a KML file, ready to be displayed in Google Earth. Simply double click the file and it opens automatically in Google Earth (must be pre-installed).
   If necessary, start Google Earth and "Open File" and select the KLM file.

10. In the Google Earth dialogue box you can choose which channels to be displayed, change the perspective views, and more!



You can display the elevation profile by right-clicking one of the channels (see illustration above) and select “Show Elevation Profile”. If you move the mouse pointer along the elevation profile, the corresponding location is displayed in Google Earth.



The elevation profile is a height curve with reference to sea level (terrain height + “NFA data height”). By deducting the terrain elevation from the height of the elevation profile, you can calculate the NFA channel value apply the scaling factor. You can find the terrain elevation by moving the mouse cursor to the map and place it just outside the height profile (look in the information ribbon at the bottom of the map window).
Or you can always go back to your NFA log and look up the recorded values.

3 Tips and possible error sources

3.1 Starting and ending a logging run

Most loggers take some time to get a stable position fix. During start-up you may experience fluctuations in the position calculated by the GPS. To avoid this and other start-up irregularities, do as follows:

- At start-up of a measurement run:
  Switch on the GPS logger and let it run a short period to get a stable position fix, ***before*** you activate the logging function on the NFA
- At completion of a measurement run:
  Switch off the NFA logger ***before*** you switch off the GPS logger

3.2 Getting the time right

It is of utmost importance that the correct time is set on the NFA. Unless this is done, you will experience problems to display the NFA data correctly in Google Earth.

3.2.1 Synchronize NFA to local time

The GPS software exports the GPS log in the GPX file format which contains time and location information. NFAsoft uses the time information from the GPX file and the NFA log to relate the NFA data to a location on the map. To display the NFA data on the correct map position, the **NFA time has to be synchronized with the local time**.

The best way get the times right and thereby the NFA data on the correct map position is as follows:

1. Set the correct local time by synchronizing the NFA time to the computer time as explained in the NFA Operating Manual (section 7.4 in version 6.0).
2. NFAsoft calculates the time difference between the start of the GPX and the NFA recordings. This value is then rounded up/down to the nearest hour and displayed in the “Create KLM” dialogue box (see step 11 on page 5).

If your NFA did not have the correct time, or the time deviation from the start of the GPS log and NFA log is more than 30 minutes, then you can:

1. Manually set the time difference in the “Create KLM” dialog box (see step 7 on page 5).
2. Set time markers as explained below to have NFAsoft to calculate the exact time difference.

In central European countries (Time zone: UTC+1) the time difference between the GPX export file and local time will be 7200 sec in the summer and 3600 sec during the winter.

3.2.2 Set time markers

If your GPS logger has a “Mark Waypoint” function, you can use this function together with the “Voice REC” function on your NFA to set “time markers” in both the GPS and the NFA logs.

Simply press the “Mark Waypoint” and the “Voice REC” buttons simultaneously at the start of your logging trip. NFAsoft will use the first “Voice REC” and the first “Waypoint” to calculate the exact time difference between the two logs.

As the clock in NFA is drifting somewhat it is always a good practise to set “time markers” at the beginning of your GPS logging job.

3.2.3 Verifying the Google Earth profile

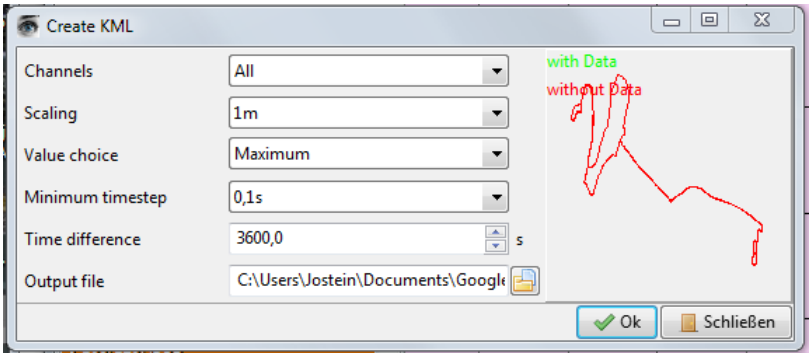
It is always a good practice to verify that the NFA data profile has a correct placement in Google Earth. This can easily be done if you know the location of installations known to give outstanding signals on the NFA log, such as the crossing of power lines on the “50/60 Hz channel” or railways on the “16.7 Hz channel”. If needed, adjust the time difference till you are satisfied with the location of the profile.

In areas without visible installations, such as underground power lines, you can drive the track in both directions. Then you can check the location of such signals – they should be on the same position in Google Earth.

3.2.4 Data not displayed or misplaced

If the track is wholly or partly displayed in red as shown below, please:

- Check that the NFA time is correct. See NFA Operating Manual on how to set the time.
- Check that the time offset used by NFA corresponds to the time offset between UTC (GMT) and your local time.



In the figure above, the Time difference is set to 3600 sec to demonstrate the effect of an incorrect time difference – the whole track becomes red (without data).

3.3 GPS logger setup

3.3.1 Connecting the GPS logger to your computer

If it is the first time you connect the GPS logger to your computer, please read the installation manual carefully and check that it functions correctly together with the GPS software.

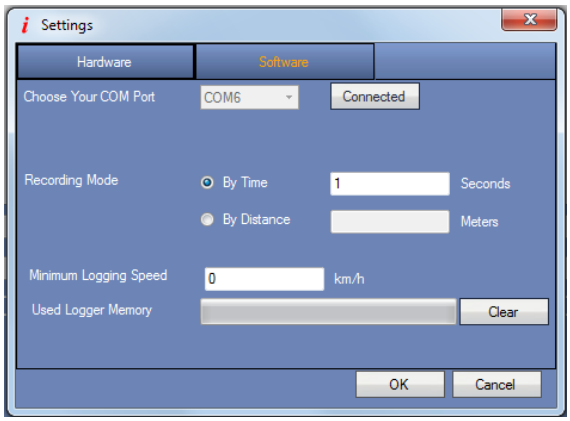
3.3.2 Daylight saving time

On some GPS loggers you can enable «Daylight saving time". If DST is enabled, the time difference between NFA local time and the GPS recorded time will be 1 hr. (3600 sec in time zone UTC+1). Without the DST enabled, the time difference during summer time will be 2 hrs. (7200 sec in time zone UTC+1).

3.3.3 GPS logger recording mode

The setup for the GPS loggers may vary. If your GPS logger has several recording modes, please note:

- On some loggers you can select if the GPS position should be logged by time or by distance. If your logger has such options, **use recording by time.**
- Some loggers have a built in movement sensor. When activated, the logger stops logging after a certain time of inactivity. If your logger has such functions, **deactivate the sleep function**.



3.4 Connecting HF59B and NFA

3.4.1 Set the DC output to 1 V

The NFA input has a cut off limit of 1.5 VDC. If you set the output voltage on the HF59B to 2 VDC, then the max value recorded on NFA will be clipped off at 1.5 VDC. Even if the display on the HF59B is showing 20 (19.99), the max recorded value will correspond to a display reading of 15. **Therefore, set the DC output to 1 V if you want to record values up to the max reading of the HF59B display**.

3.4.2 Extended measuring range

The internal circuits of HF59B have a measuring range that is higher than the max value shown on the display. As a matter of fact the internal circuits can measure values which are 1.5 times higher. These values are directly reflected in the DC output, meaning that the DC output can be up to 1.5 VDC with the switch set to 1 V, and 3 VDC if the switch is set to 2 V.

You can benefit from this extend output range by setting the DC output to 1 V when using a NFA unit to record your measurement. By this setting you actually can record values that are 1.5 times higher than the max display range of the HF59B. So even if the display is “in peak” the HF59B will deliver a correct DC output (up to 1.5 times the max display range).

3.4.3 Example

If you set the Range selector to “Coarse”, then the max displayed value will be 20 mW/m2 and the DC output will be 1 V. However, the internal circuits can measure values up to 1.5 x 20 mV/m2 = **30 mW/m2.** The corresponding DC output will be up to 1.5 V, which is within the input range of the NFA.

In you set the DC output to 2 V, the NFA input clips off the signal at 1.5V and thereby limiting the max value that will be recorded to **15 mW/m2**.

3.5 Using a car for logging

3.5.1 HF signals

Place the HF instrument in the front window to allow best possible reception. Also drive the route in both direction to minimize possible “signal shadows” from the car itself.

Be aware that newer types of GPS car navigation units (such as TomTom Live) are transmitting traffic data over the mobile phone network at regular intervals. To avoid that signals from such units disturbs your measurement, turn them off while logging HF signals. Do the same with your mobile phone.

3.5.2 LF magnetic fields

When placing the NFA in the car, try to find a position that is approx. 1 meter above the street surface. The reason for using 1 m is that this distance is often used as a reference when measuring LF magnetic fields in town streets. If you are going to use the data for your personal use, you may place the instrument at your choice.

Logging LF magnetic fields by using a car introduces several possible error sources. The electrical system in the vehicle can generate substantial LF magnetic fields. The steel band in the tires can also create considerable LF fields. Movement in the Earth's magnetic field also creates LF magnetic fields.

Try to place the NFA in a position that is as little as possible influenced by LF magnetic fields generated by the car itself:

- The best position for placing the NFA is as far away as possible from the engine or electrical wiring in the car. The rear window or the luggage compartment is often good places.
- Check the magnetic fields in your car before you choose a location for the NFA. You can determine the vehicle-specific fields by measuring with the engine on and off.
- The steel belts in the tires are magnetic and can produce quite high alternating magnetic fields. Field strength from 3 000 nT and up to 10 000 nT has been measures inside cars, close to the tires.
- You have a few options to minimize the influence of magnetic fields generated from car tires:
    1. Place the NFA away from the car tires,
    2. Set the NFA filters at minimum 50 Hz and **drive at speeds below 50 km/h**. The basic frequency and major harmonics generated by the car tires will then be so low that they will not disturb your measurements. If you are going to register 16.7 Hz, you should preferably drive at speeds below 15 km/h.
    3. Demagnetize your car tires.

So, if you are going to log LF magnetic fields in streets, consider if you should walk or use a bicycle - it gives you less measurement errors - and is healthier☺.