QTFGUI Help

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1. Introduction

QTFGUI is a computer program to assist the operator in finding optimal antenna beaming in aurora, FAI, and meteor scatter conditions. All these propagation modes are based on the same scatter law that is similar to the wave scatter by a straight long wire. The geometry is shown in figure 1 for aurora (or FAI). The ray transmitted by A hits a magnetic field line. This defines a scatter cone around the field line. Only receivers situated on the cone can hear the signal from A. They therefore must be on the intersection of the cone and the earth surface. Since the earth surface is not flat as shown here for simplicity the intersection line is more complex than the simple hyperbola. Figure 2 shows the intersection as a bold red line for a typical case. For the meteor scatter case the magnetic field line in figure 1 must be replaced by a meteor path.

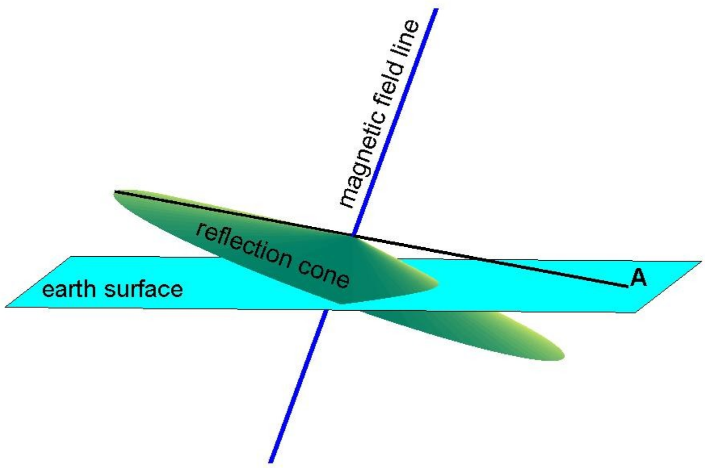


Figure 1. The scatter geometry: The ray transmitted by A hits a magnetic field line. This defines a scatter cone around the field line. Only receivers situated on the cone (and on earth) can hear the signal from A. They therefore must be on the intersection of the cone and the earth surface.

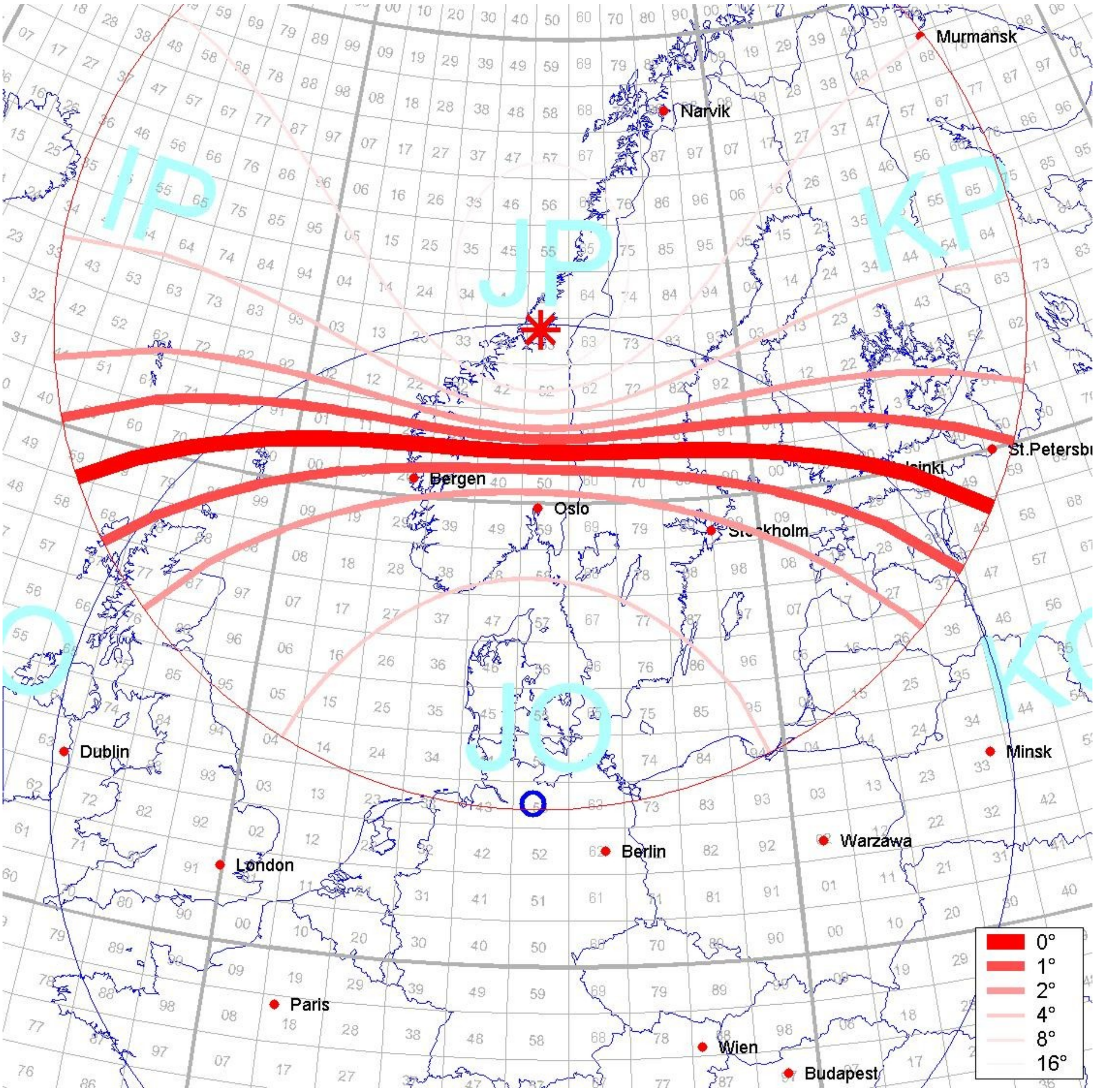


Figure 2. Intersection of the scatter cone with the earth surface for the transmitter **A** in Hamburg and the scatter point near Trondheim in Norway. All stations on the intersection of the scatter cone with the earth ball (the bold red line) can hear the signal. Deviations from the scatter law lead to a loss of about 10 dB/degree. The circle around the transmitting station marks the region where the E-layer can be illuminated from A. The circle around the scatter point marks the region on earth where the scatter point is above the horizon.

Usually we do not know where the scatter points are. Therefore the inverse problem is of interest: Given the locations of both ends of a communication path, where are the possible scatter points? This especially in meteor scatter is very important. If you ignore the scatter geometry you probably can use bursts only which do not follow the scatter law described here.

It is the task of QTFGUI to compute the scatter area if the locations of both ends of a propagation path are given.

2. The Graphical User Interface of the Main Window

The Graphical User Interface (GUI) of the program is shown in figure 3.

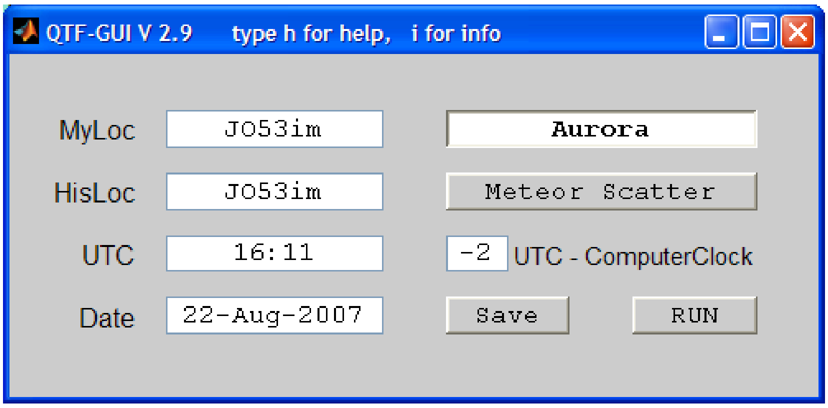


Figure 3. The graphical user interface of QTFGUI.

The fields **MyLoc**, **HisLoc**, **UTC**, **Date**, and **UTC- ComputerClock** are edit fields. Click with the left mouse button into these fields to set the cursor. Then edit your choice by the keyboard. Enter with the ENTER key or click into another field.

MyLoc: The Maidenhead locator at one end of the radio path. Allowed are full locators as JO53im or JO53IM or grids like JO53 or fields JO. Also JO5 and JO53i are accepted.

HisLoc: The Maidenhead locator at the other end of the radio path with the same syntax as with Myloc. If HisLoc is unknown take the same as MyLoc as in figure 3. It can be changed later by mouse click in a map.

UTC: UTC by default is taken actually at the time of program start. It is not updated. You can freely change this value. The syntax is hh:mm where hh mean the two digits of the hour and mm mean the two digits of the minute. The scatter points in aurora conditions do not depend on time, but they do in meteor scatter.

Date: As UTC, date is actually taken at the program start. It can freely be changed within the allowed syntax: dd-mmm-yyyy with dd being the day number (other than minutes and hours starting at 1), mmm being the month coded by the first three letters of the English month name:

Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec

The scatter points of aurora only weakly depend on the year because the earth magnetic field does change slowly in decades. Magnetic field data are only available for the period 1900 until now. In meteor scatter the actual showers are selected by the date.

UTC-ComputerClock: The difference between UTC and your local time is important for the computation of meteor scatter pathes. It mut be given in full hours (east from 0 is negative).

Aurora and **Meteorscatter**: These are toggle buttons. Pushing one selects that mode and deselects the other.

Save: Pushing this button saves the actual settings of MyLoc, HisLoc, UTC-ComputerClock, and Aurora/MeteorScatter as the default settings for the next program start.

RUN: Pushing this button starts the search of scatter points for the actual settings. A map will be displayed with MyLoc and Hisloc and all possible scatter points. Pushing the button again starts a new computation leading to another map. The earlier maps are not deleted.

3. The Map

Figure 4 shows the generated map with the scatter points colored red. In a small section the antenna beaming is drawn additionally. This is enlarged in figure 5. The map also has a graphical user interface which is outlined here:

Shifting the QTF section and the legend: The QTF section or the legend possibly hide an important part of the map. Then type the letter p on the keyboard (the map must be the window in focus).

Changing the other end of the path (HisLoc): The mouse pointer is a small cross if it is over the map. Choose the other end of the path by moving the cross to your destination then click left. It takes a while to find the scatter points.

Changing MyLoc: When the map window is active then (1) type the letter m and (2) choose the location by moving the pointer cross and left click.

In the meteor scatter case a very similar map is shown with the same user interface plus some additional options:

Show scatter points one hour later:	Push the arrow right key on the keyboard
Show scatter points one hour earlier:	Push the arrow left key on the keyboard
Show scatter points one day later:	Push the arrow down key on the keyboard
Show scatter points one day earlier:	Push the arrow up key on the keyboard
Toggle between both plots of QTF:	Hit the key t (for toggle) on the keyboard

Because of the complex QTF situation there are two plots of the QTF, one for MyLoc, and one for HisLoc.

The earth rotates within the meteor stream. Therefore the point from where the meteors seem to come from behaves like a star passing from east to west or turning around the pole. As a consequence, the geometric situation permanently changes. Figure 7 shows the scatter points for the path Hamburg – Barcelona in the Quadrantides at 07:00 UTC and at 09:00 UTC as an example.

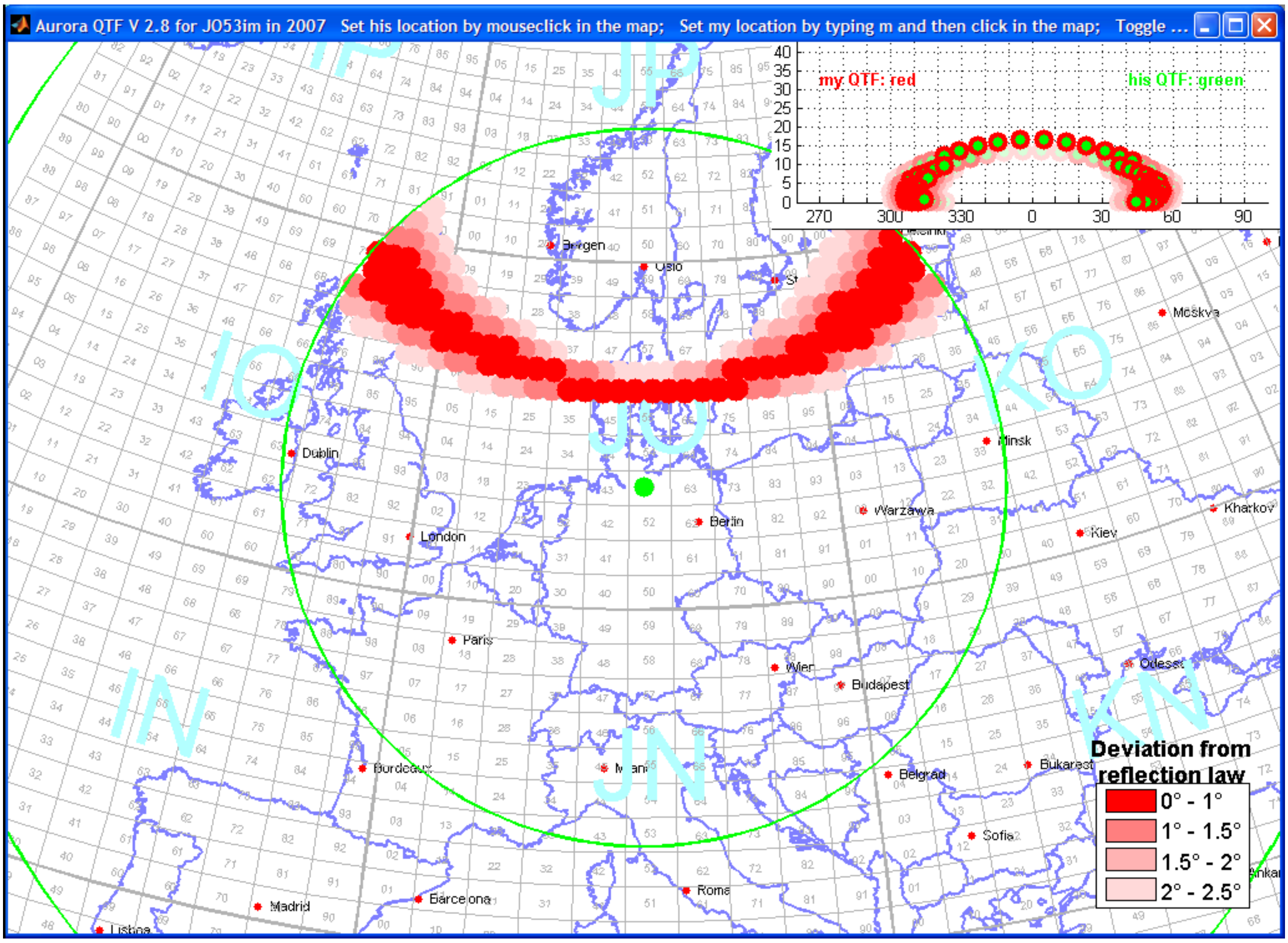


Figure 4. The map generated for the aurora case and for the author's location as both, the transmitting end and the receiving end of the radio path. The red area shows the region where the scatter law is satisfied (in this special case of RADAR it is where the propagation is orthogonal to the magnetic field lines). The smaller figure at the upper right shows the corresponding QTF and elevation. It is enlarged in figure 5. The scattered signal strength strongly depends on the deviation from the reflection law. The author in his nearly 50 years of aurora experience never had a QSO at more than 2.5° deviation.

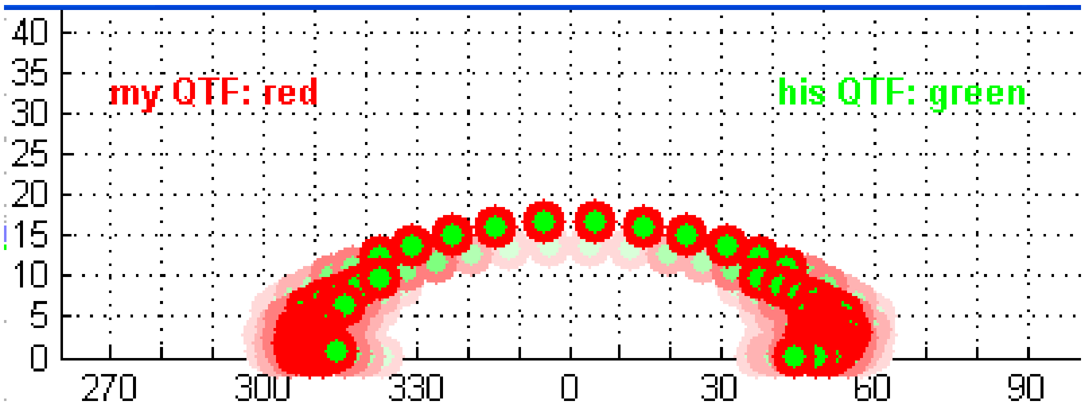


Figure 5. Azimuth and elevation of the scatter points. In this special case of identical ends of the radio path the QTF is identical at both ends, of course.

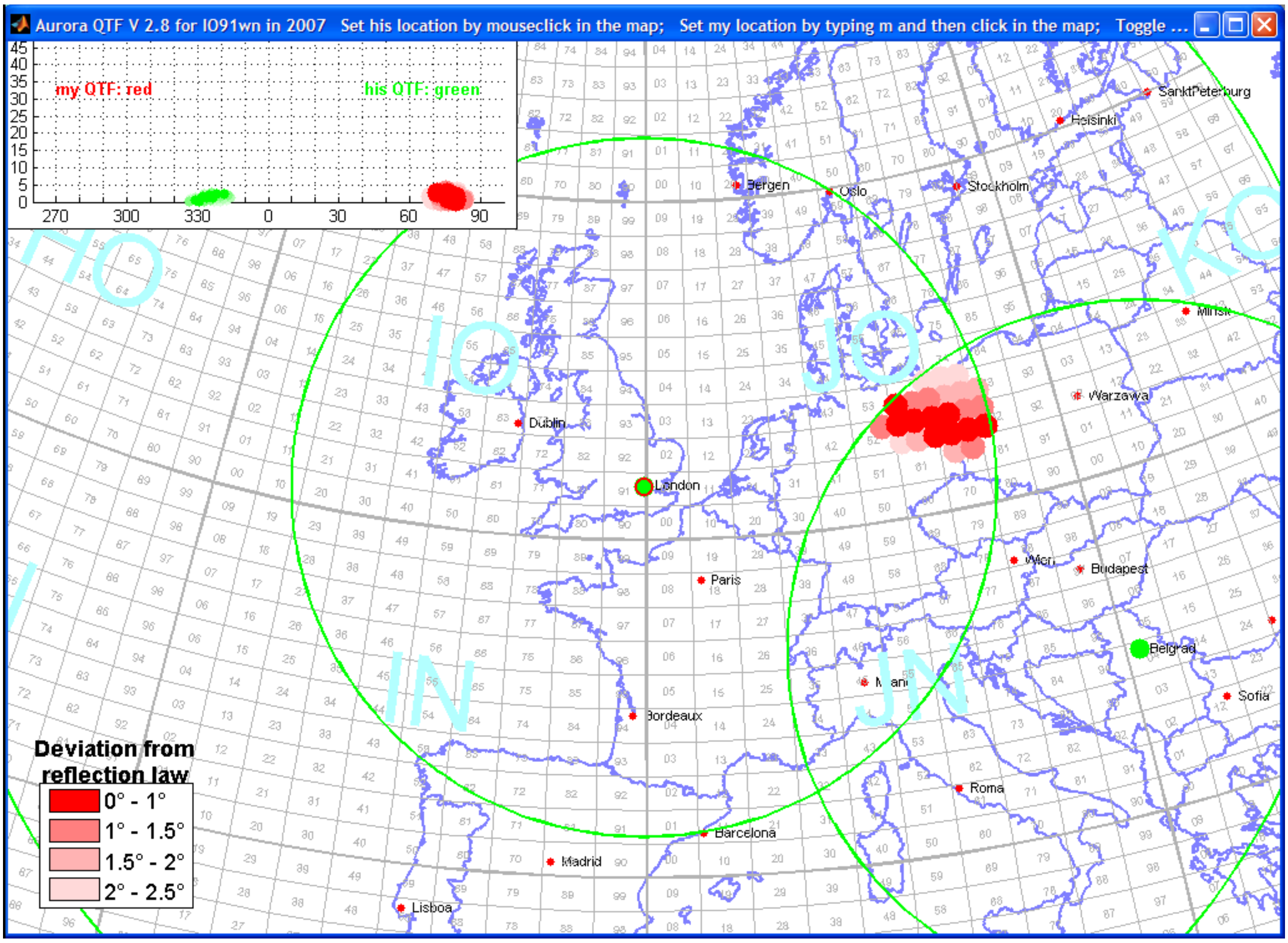
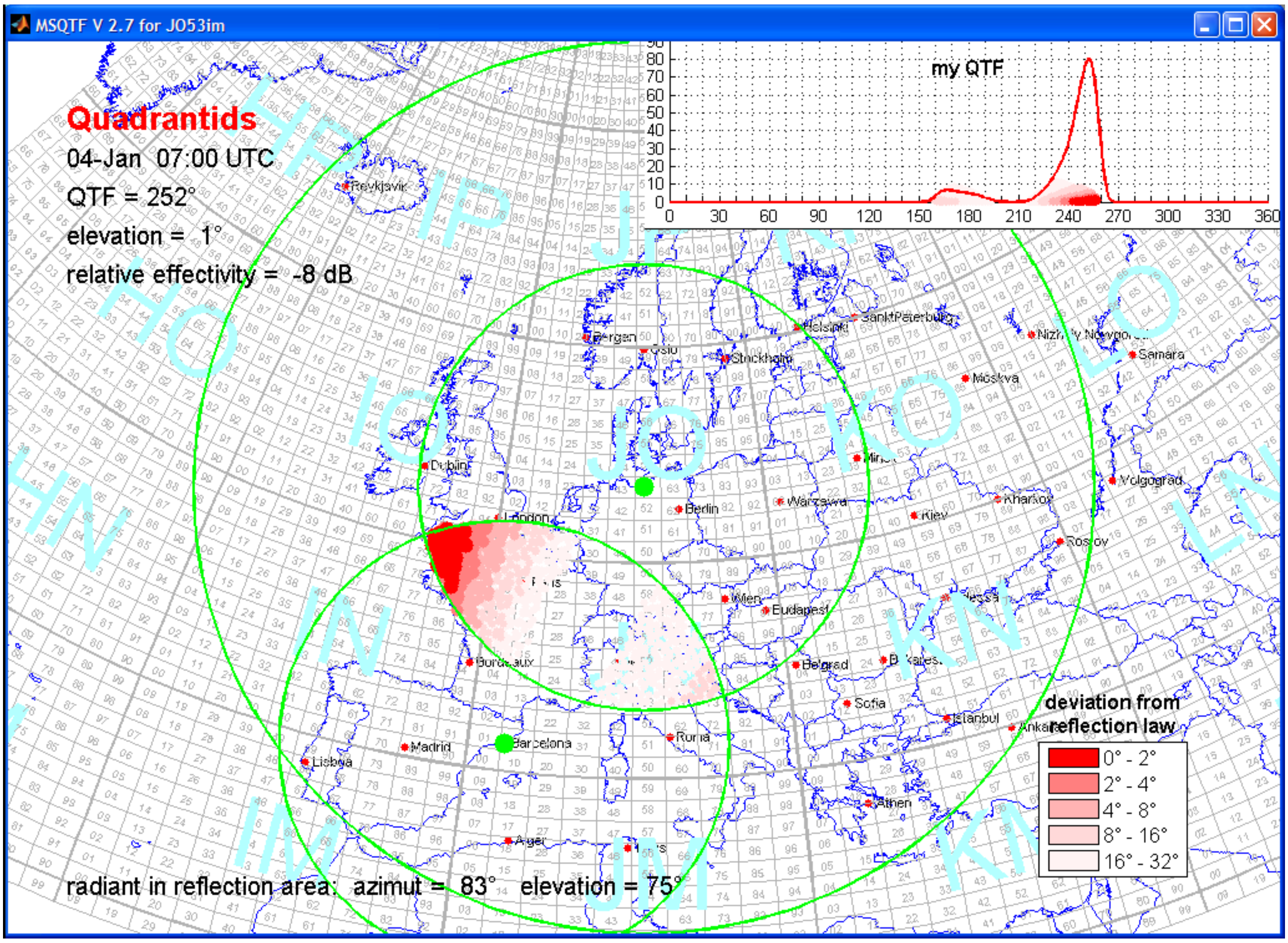
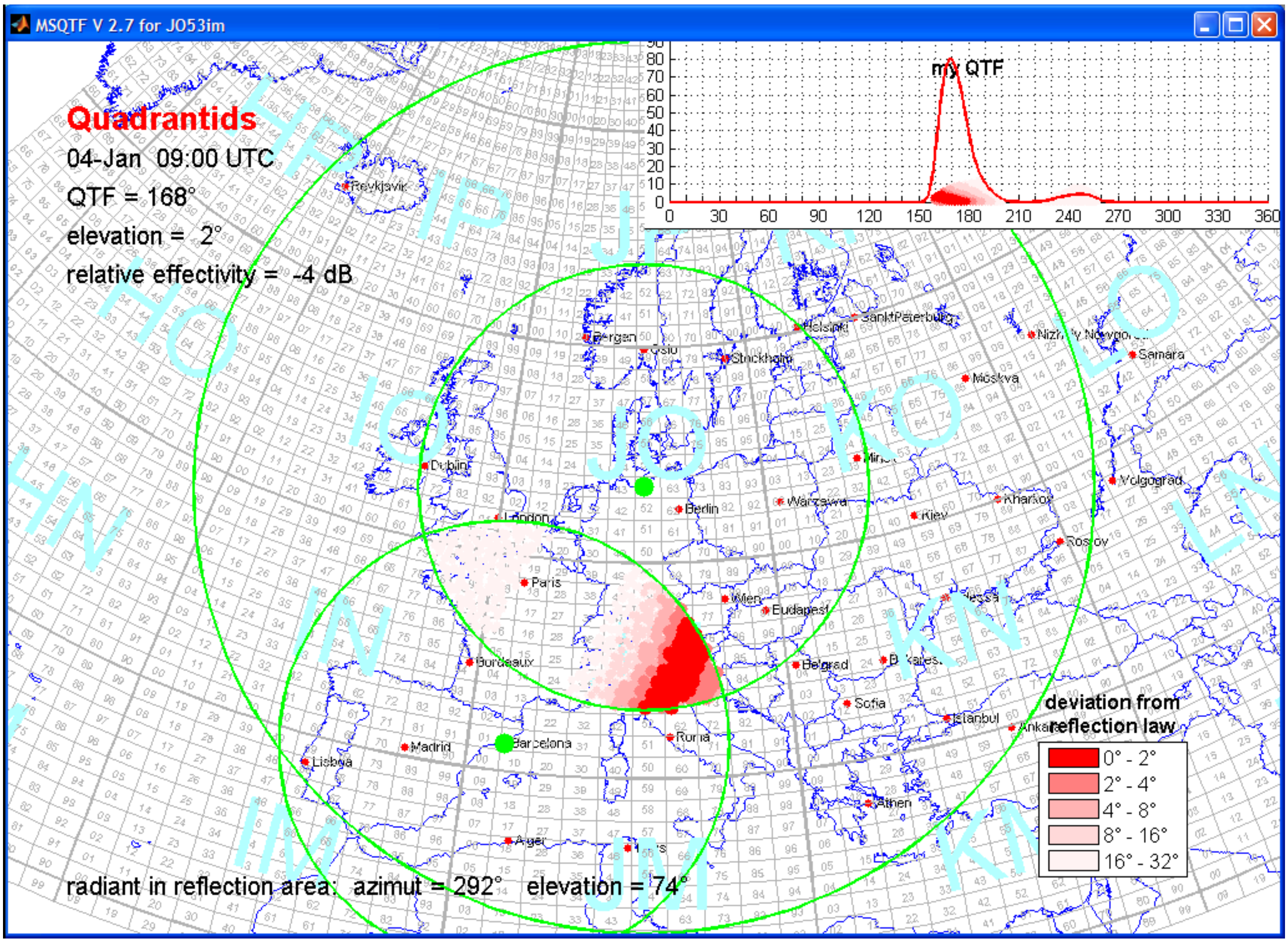


Figure 6. Here London was chosen as MyLoc and Beograd as HisLoc. The QTF shown in red is valid for MyLoc, so London will beam to 75°. The QTF colored green is for HisLoc, so Beograd should beam to 330° ... 340°.

Figure 7 (next page). Rapidly changing scatter area for the path Barcelona-Hamburg. Both maps differ in time by only two hours. At 08:00 UTC there even is no scatter area at all.


MSQTF V 2.7 for JO53im
Quadrantids
04-Jan 07:00 UTC
QTF = 252°
elevation = 1°
relative effectivity = -8 dB
my QTF
deviation from reflection law
0° - 2°
2° - 4°
4° - 8°
8° - 16°
16° - 32°
radiant in reflection area: azimut = 83° elevation = 75°


MSQTF V 2.7 for JO53im
Quadrantids
04-Jan 09:00 UTC
QTF = 168°
elevation = 2°
relative effectivity = -4 dB
my QTF
deviation from reflection law
0° - 2°
2° - 4°
4° - 8°
8° - 16°
16° - 32°
radiant in reflection area: azimut = 292° elevation = 74°