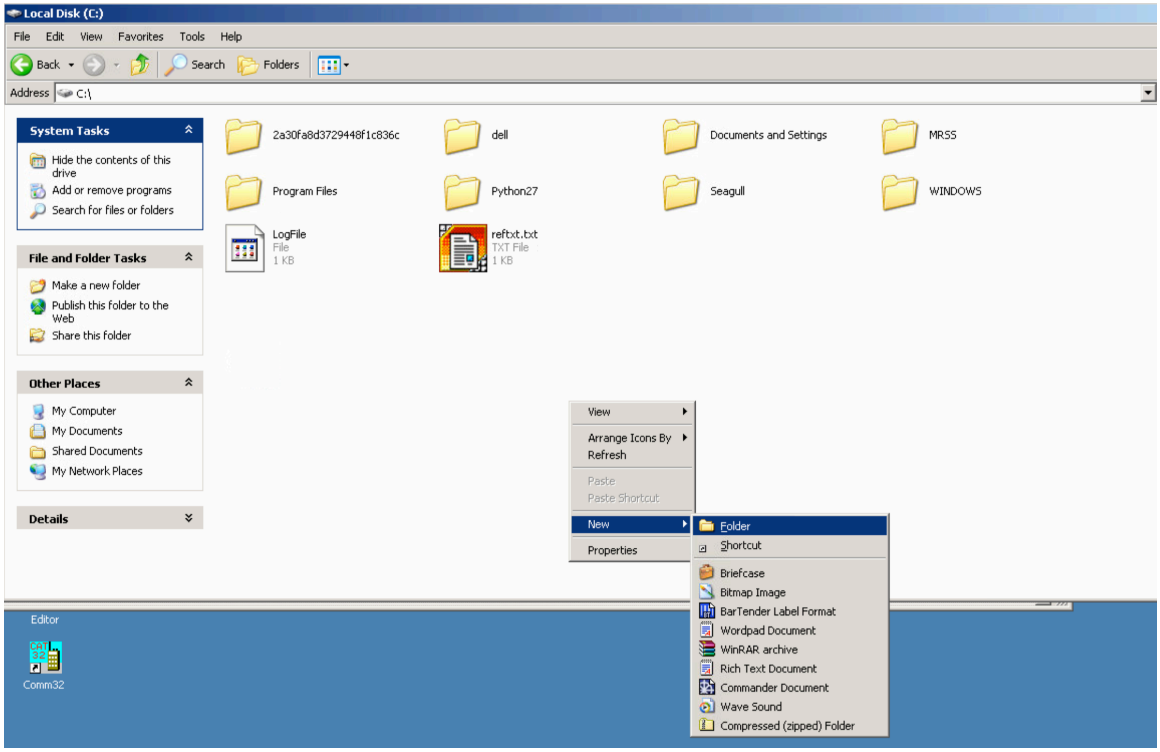
Radio Mobile modeling

Installing and setup on windows

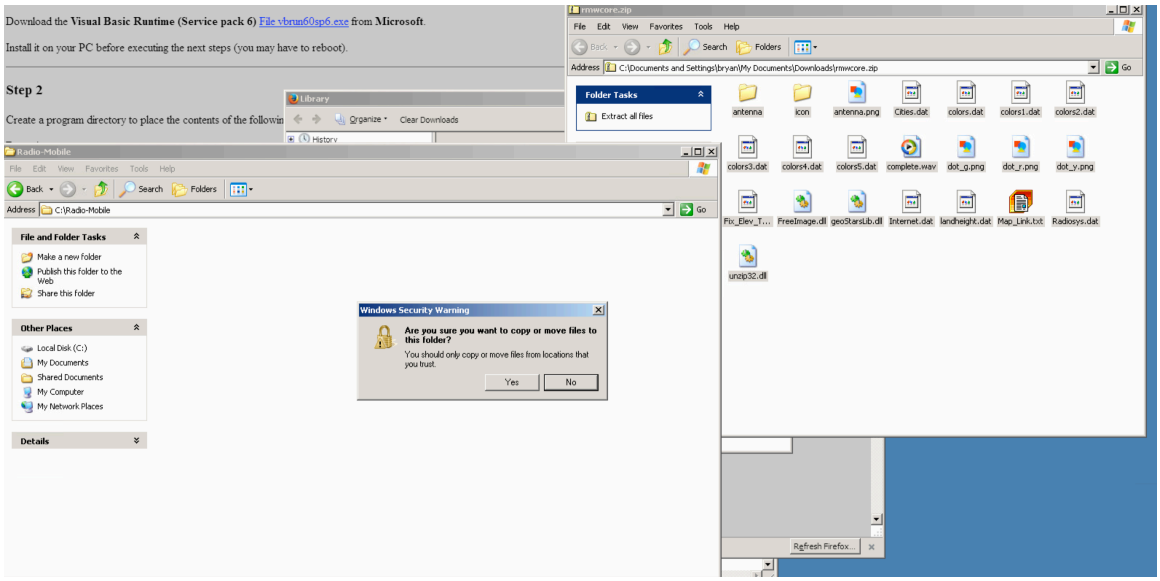
Setup the program

http://www.ve2dbe.com/download/download.html

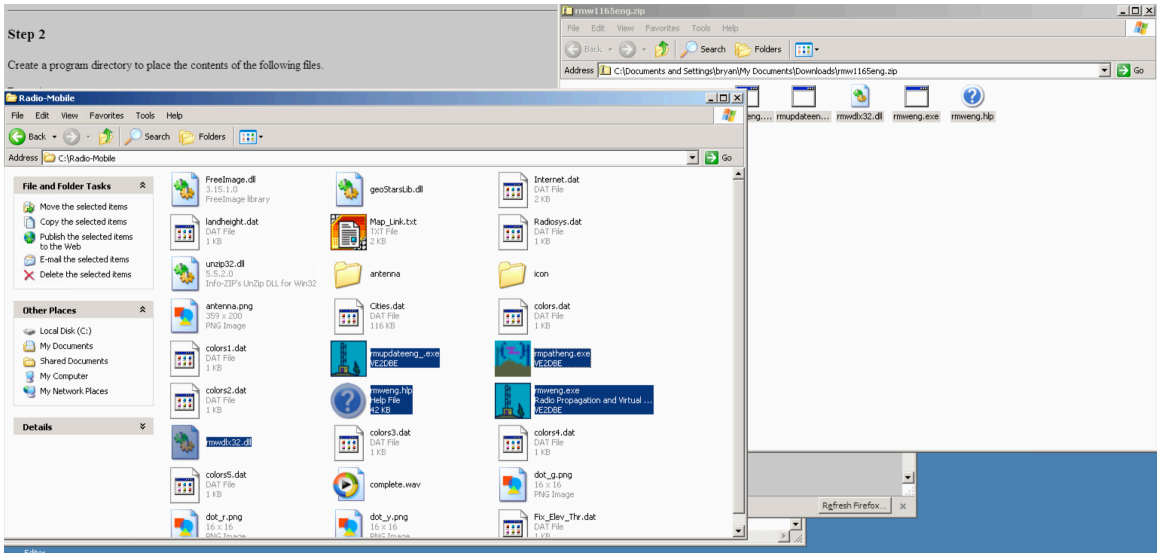
Make a directory for it on the C:\ root called “Radio-Mobile”



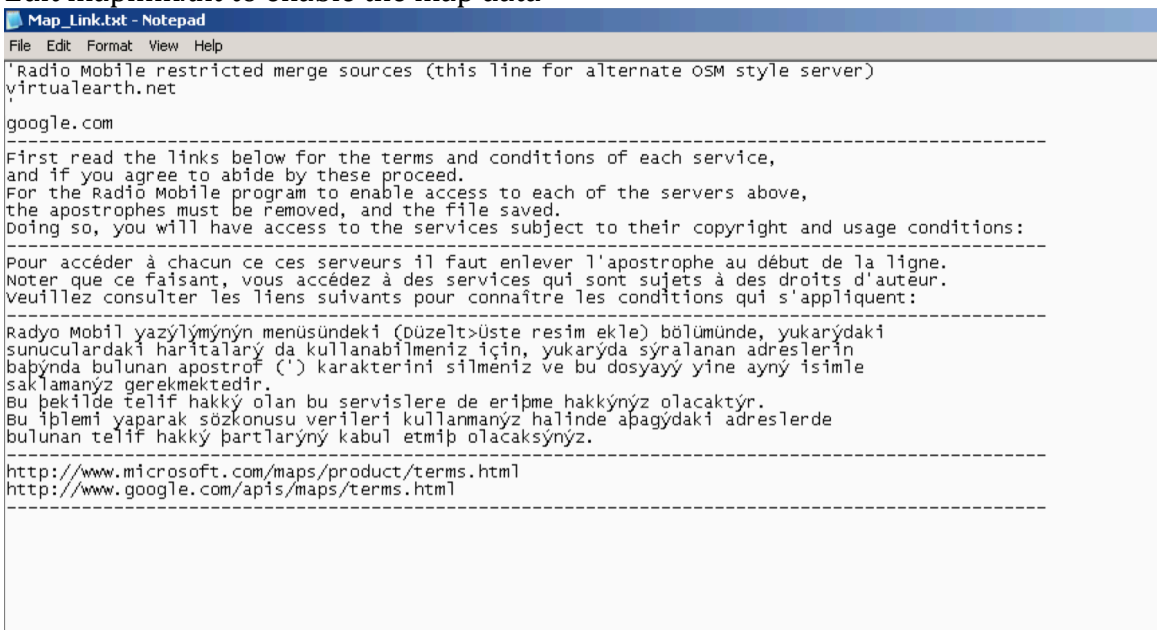
Install the core files



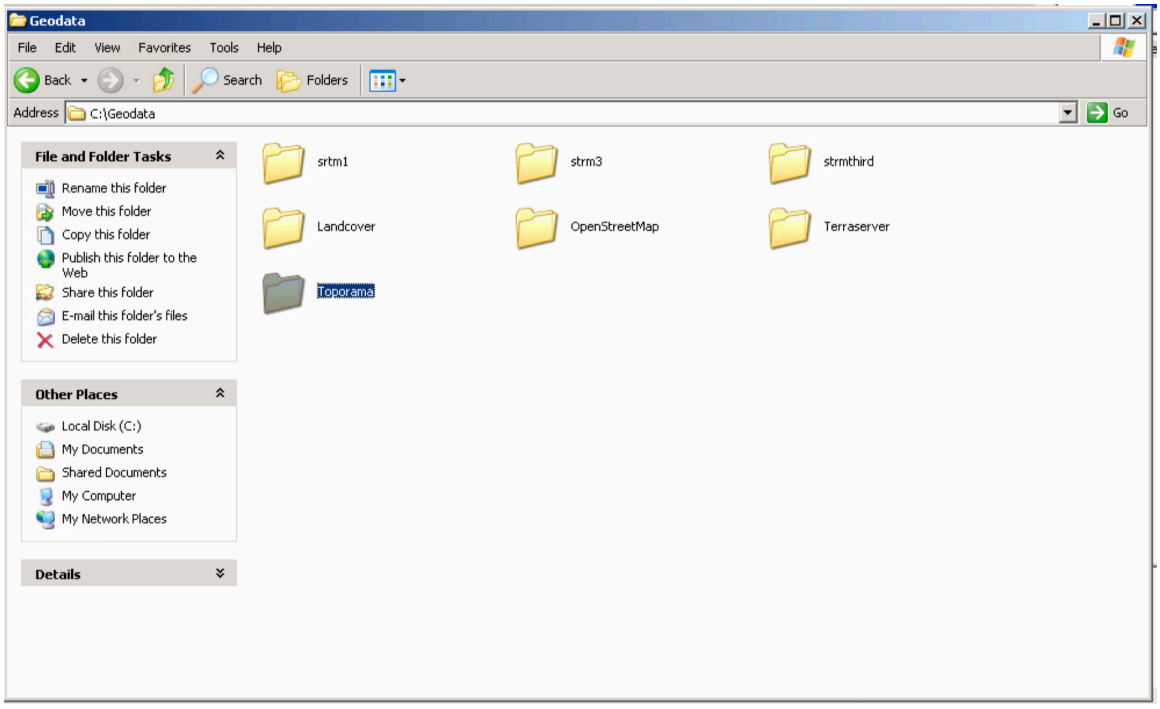
Install the English (or whatever language pack)



Edit maplink.txt to enable the map data



Make a directory C:\Geodata and the following directories under it

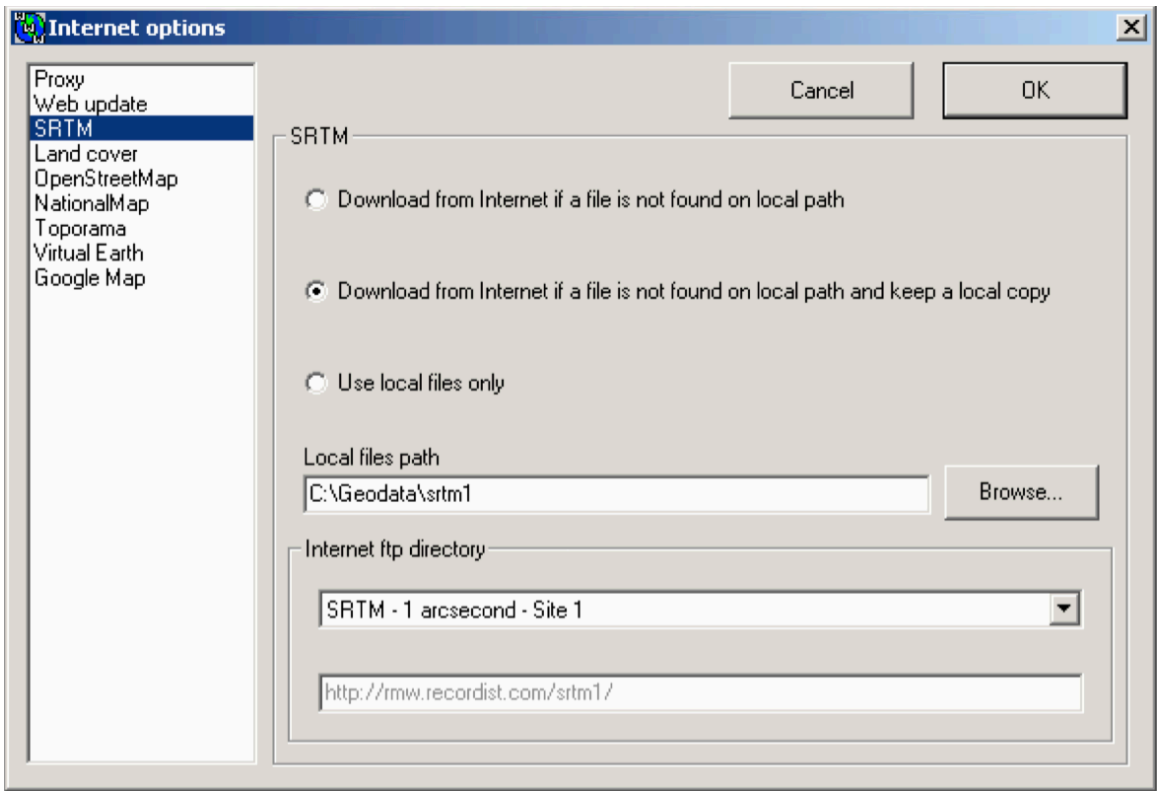


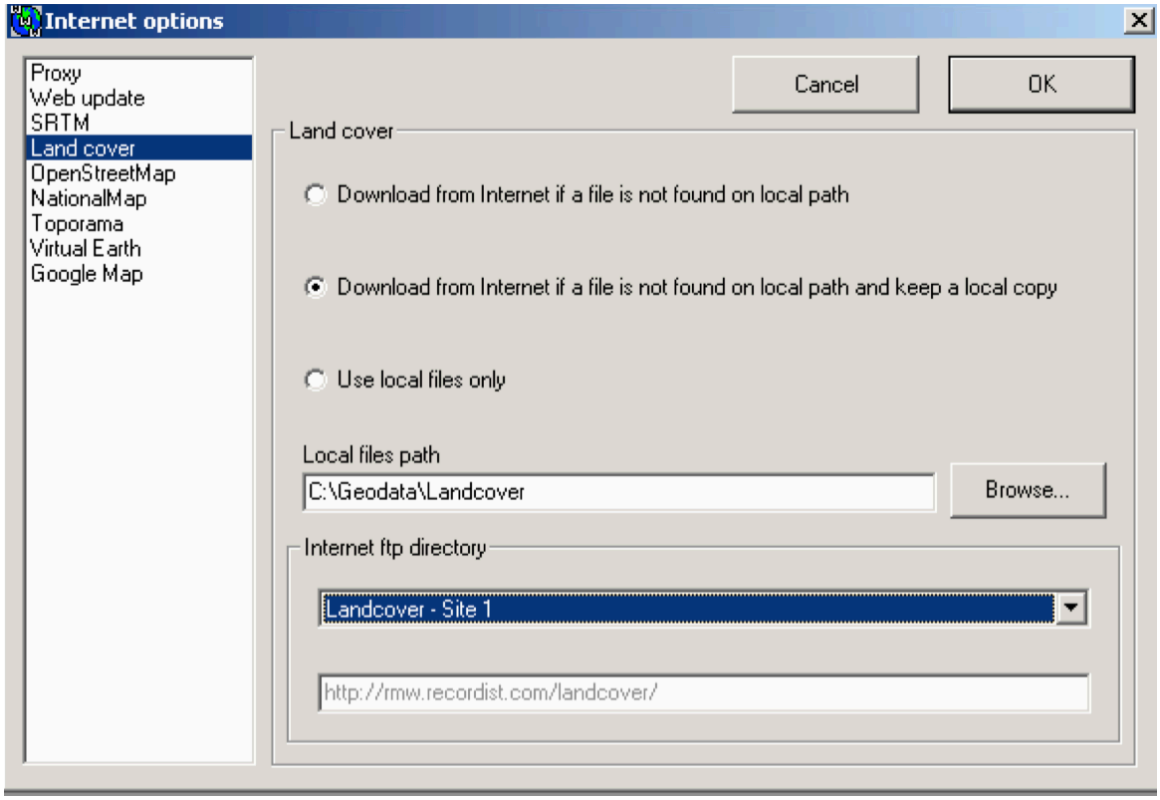
Copy the wmap.zip world map definition files to the program directory

Start the program and make a shortcut to it on the desktop. It is rmweng.exe in the program directory.

Configure the base program settings

Select “options” then “internet” and configure the strm1 data, the 1/3 data is more accurate, but not needed for this purpose.


Internet options
Proxy
Web update
SRTM
Land cover
OpenStreetMap
NationalMap
Toporama
Virtual Earth
Google Map
Cancel
OK
SRTM
Download from Internet if a file is not found on local path
Download from Internet if a file is not found on local path and keep a local copy
Use local files only
Local files path
C:\Geodata\srtm1
Browse...
Internet ftp directory
SRTM - 1 arcsecond - Site 1
http://rmw.recordist.com/srtm1/

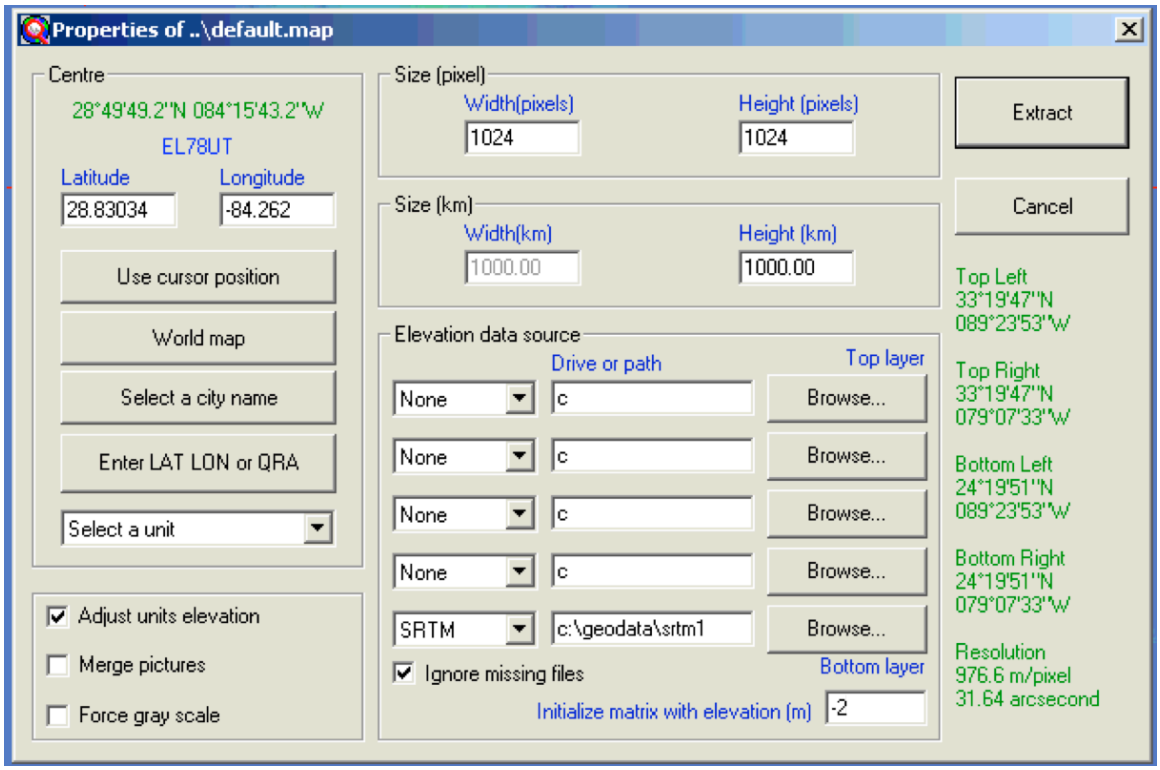

Internet options
Proxy
Web update
SRTM
Land cover
OpenStreetMap
NationalMap
Toporama
Virtual Earth
Google Map
Cancel
OK
Land cover
Download from Internet if a file is not found on local path
Download from Internet if a file is not found on local path and keep a local copy
Use local files only
Local files path
C:\Geodata\Landcover
Browse...
Internet ftp directory
Landcover - Site 1
http://rmw.recordist.com/landcover/

Load Elevation data for the State of Florida

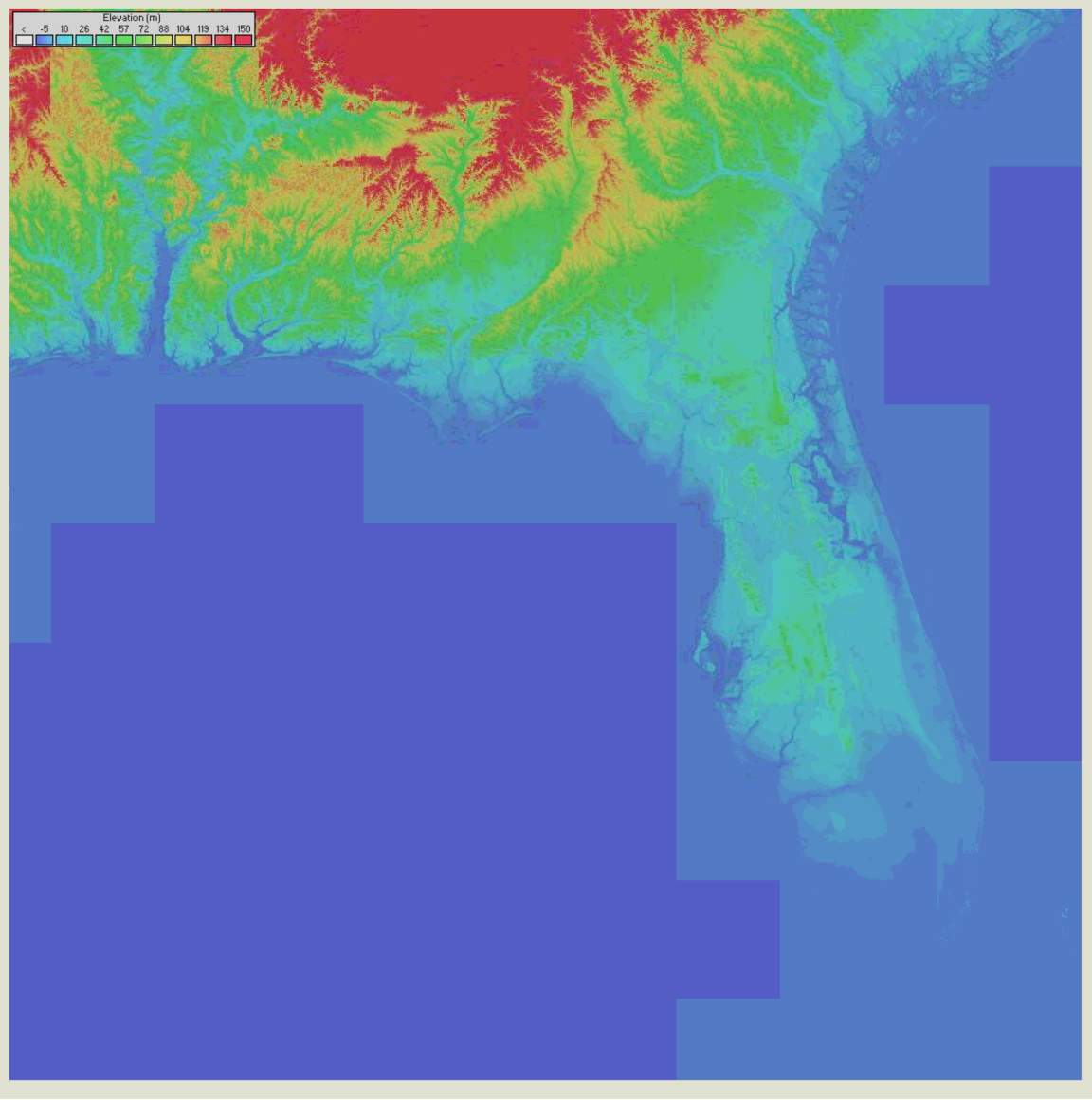
This will make a map of the state and force the downloading of the rather large SRTM elevation data, so you don't have to do this again

File and > Map Properties (f8)

Put in 27.6648° N, -81.5158° W as the center and make it as follows



This should download the entire state of Florida, about 5000mb of files.


Elevation (m)
< -5 10 26 42 57 72 88 104 119 134 150

Modeling a repeater in RM

Use the following data for the Part 90 Land Mobile signal contours:

Band	Frequencies	Service Contour	Interference Contour	Adjacent Channel Deratings, if applicable
VHF Low Band	29 MHz 50-54 MHz	31 dBμ F(50,50)	13 dBμ F(50,10)	There is no adjacent channel protection on 20 KHz users. There are no narrowband channels on these bands.
VHF High Band	144-148 and 219-225 MHz	37 dBμ F(50,50)	19 dBμ F(50,10)	42 dBμ F(50,10) 15 kHz adjacent channel wide band to wide band 44 dBμ F(50,10) 7.5 kHz adjacent channel narrow band to narrow/wide band. 20 KHz channels need no adjacent channel protection wide to wide 10 KHz channels shall not need adjacent channel unless the intended mode is >8 KHz. If so a 25 dBμ F(50,10) value is to be used for this.
UHF	440-450 MHz	39 dBμ F(50,50)	21 dBμ F(50,10)	There is no adjacent channel protection on 25 or 12.5 KHz users. It's still advisable to be cognizant of this.
	900 MHz	40 dBμ F(50,50)	22 dBμ F(50,10)	There is no adjacent channel protection on 25 or 12.5 KHz users. It's still advisable to be cognizant of this.

The basic concept here is to model the repeater at its coordinates and then define another "mobile" unit with the receiver. This mobile unit doesn't need to be in the coverage area, just defined.

1.83m (6ft)is what the FCC uses, as a standard receive height for this station. The gain of the antenna doesn't matter as we will model for dBμV (dBu) which is the absolute field strength in microvolts per meter where 0dbu is 1 microvolt/m. It's this absolute reading which makes field strength useful for comparing difference repeaters coverage area.

This field strength can be converted to dBm if you know the gain of the receive antenna using the formula below:
P=E-20log(f)+G-77.2
where

P is power in dBm
E is field strength in dBu
f is frequency in MHz
G is antenna gain in dBi (2.15 more than dBd)

In RM there are several different settings used to model networks.

Units – Define the locations of radio transmitters/receivers
Networks – Define the modeling parameters and group units as members
Systems – Define the radio parameters of a unit in a system (ERP, height, etc.)

All three combine to produce a prediction of a given unit's coverage.

Network Properties

We will setup the network properties to match the different frequencies we will be using. Two will be configured for each band, as we have both a primary and interference contour with different modeling parameters. The adjacent channel parameters uses the same as the interference (50% of locations/situations, 10% of the time).

Now setup the network properties, the examples below show a band and then the interference defined for that band.

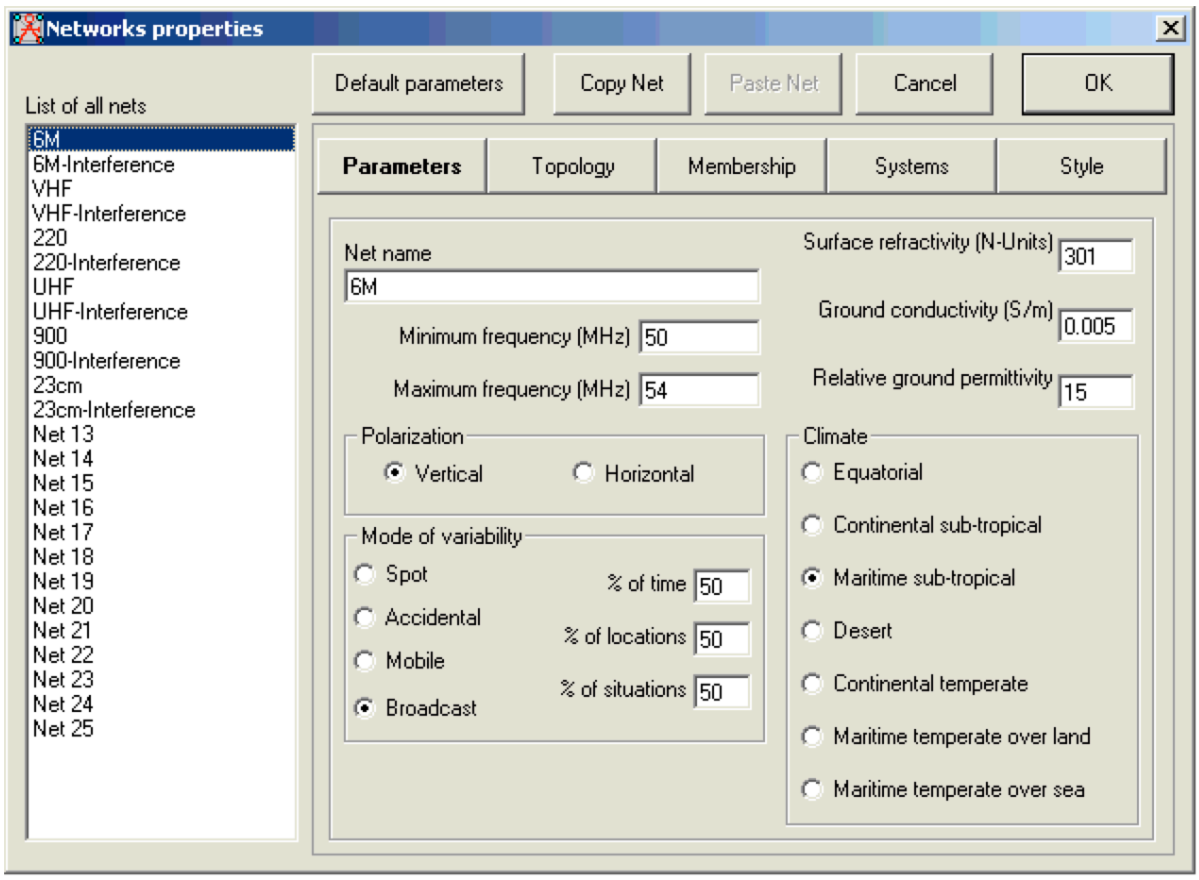


Figure 1 - 6 meter band network properties

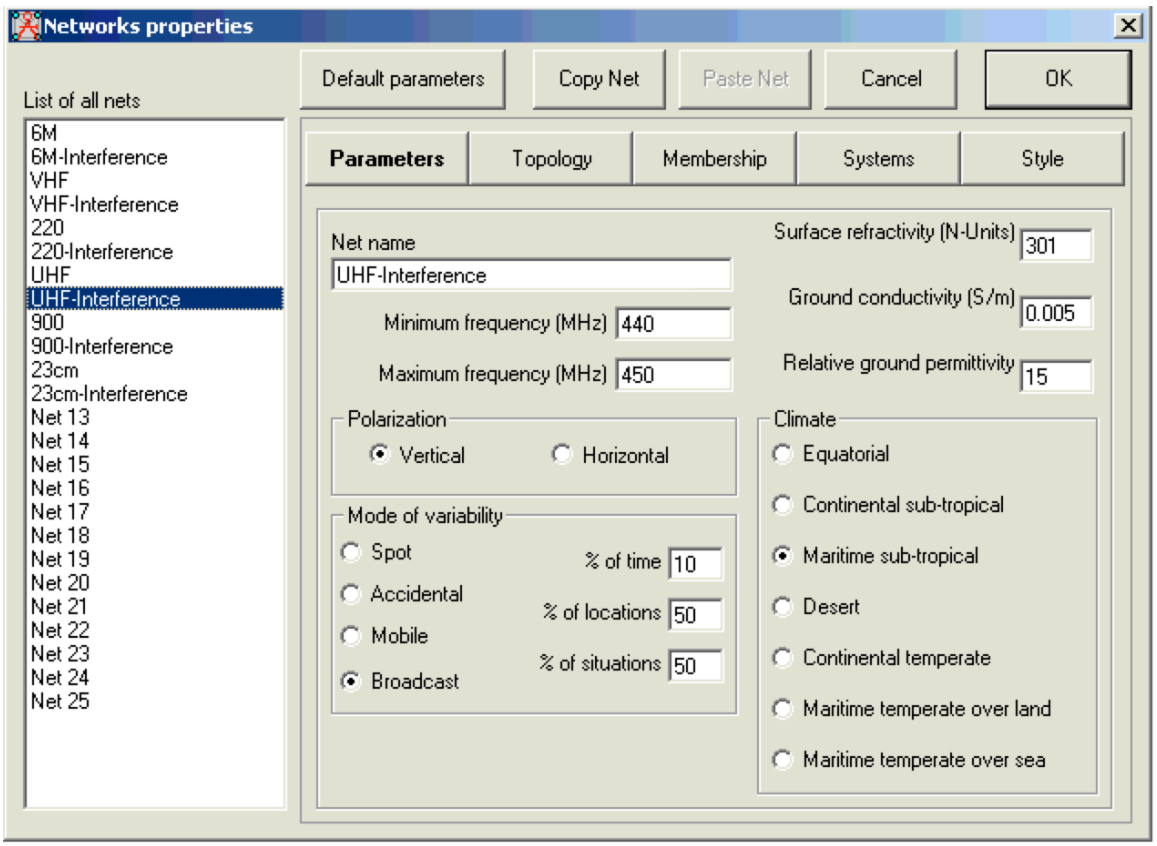
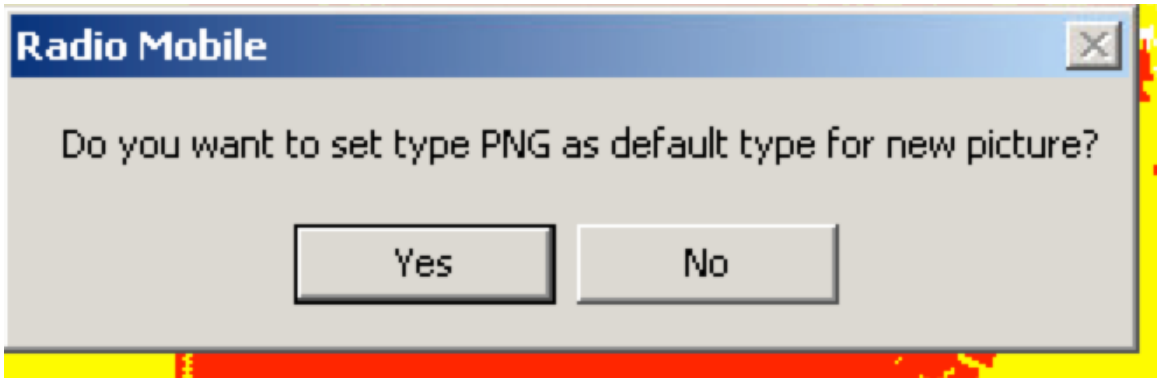


Figure 2 - UHF Interference properties

Setting up the Systems

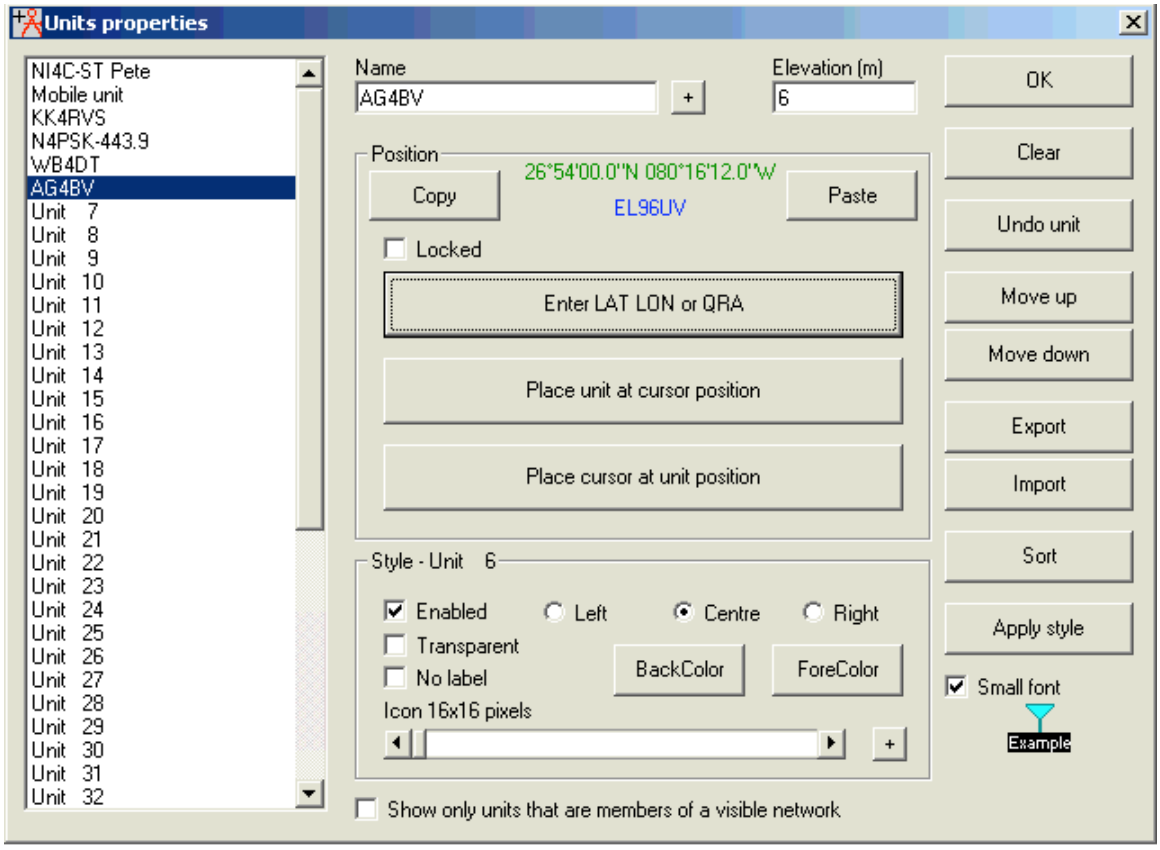
Systems define the radio settings for each transmitter and at least one will need to be changed for each model produced. The first system will define the "mobile" receiver, and the second the currently modeled repeater. The next few can be filled with example repeaters (50w at 50', etc).



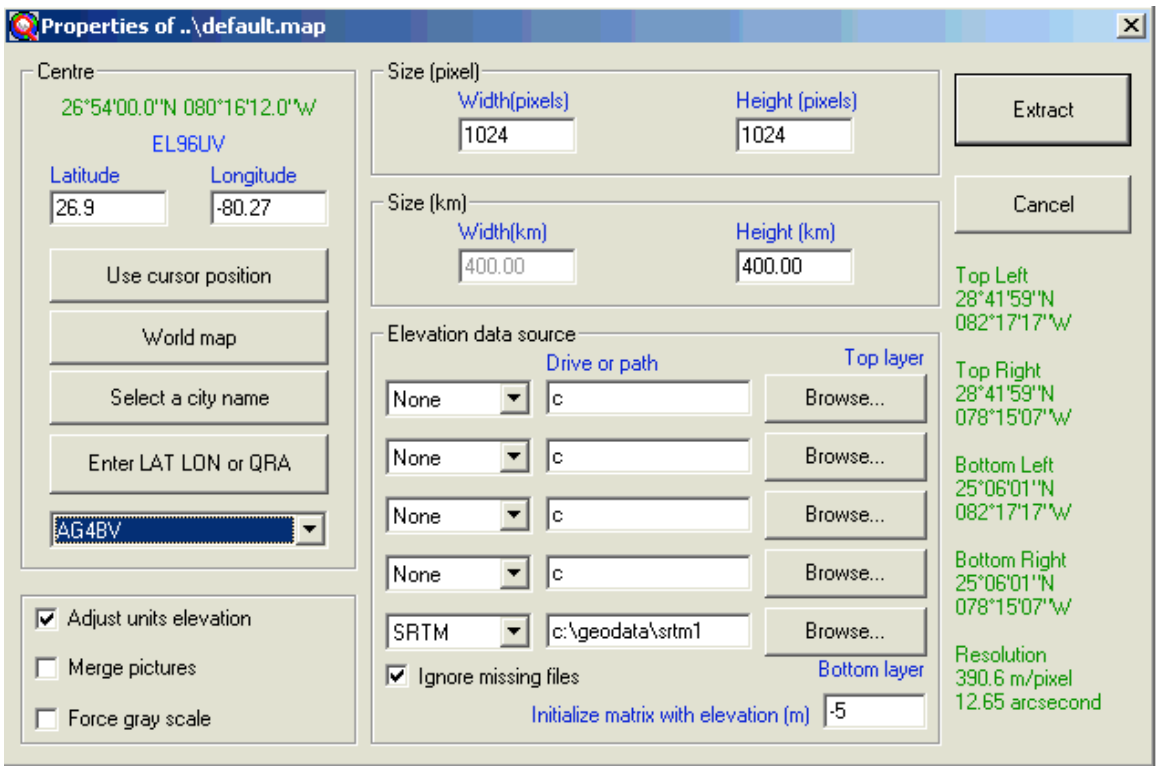
Modeling a repeater

First determine your band and interference criteria
In this example we'll be modeling a UHF, with a 39 dBu service contour and a 21 dBu interference contour.

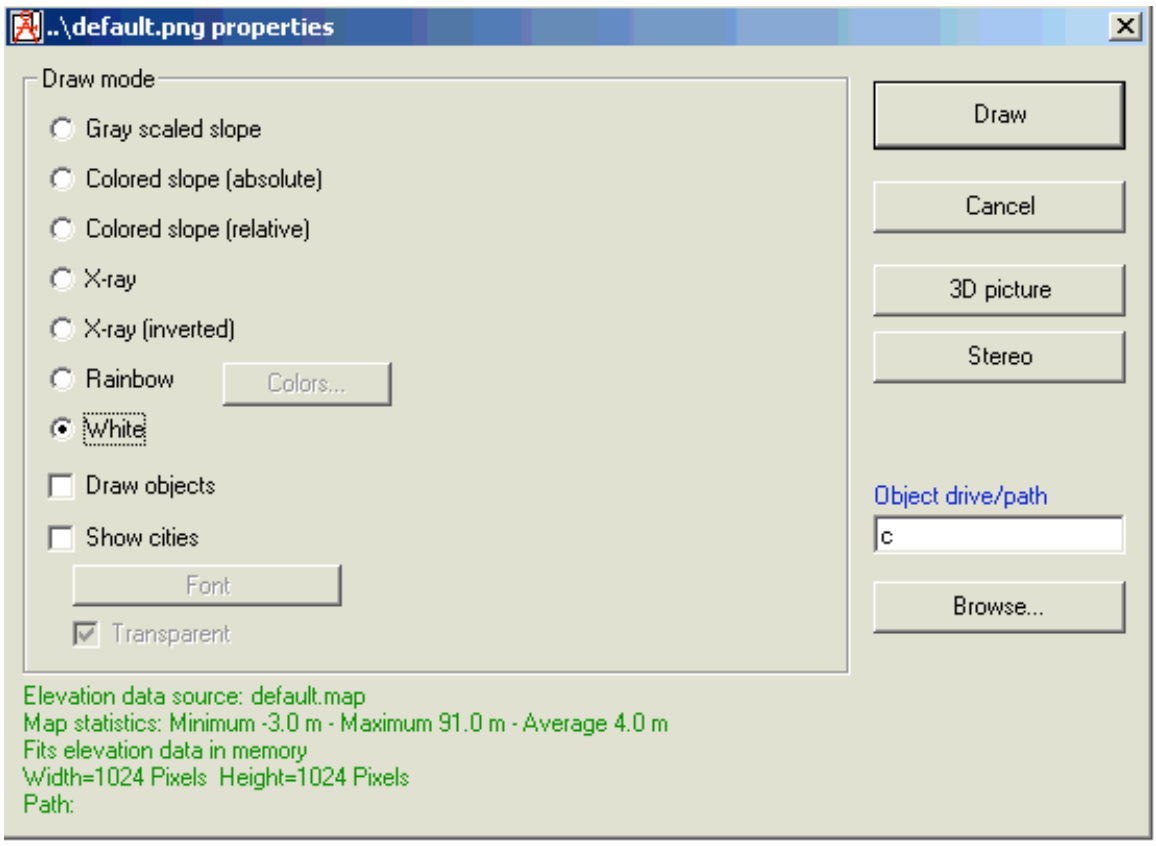
First Setup a new unit with the lat/lon of the subject unit.



Now draw a new map, with this unit at the center. Note the extents 400x400km, some VHF and Low band may require a larger map to plot the interference area. The "adjust Units elevation" should be checked, as it will use the SRTM data to adjust the base elevation at the unit (ASL height)

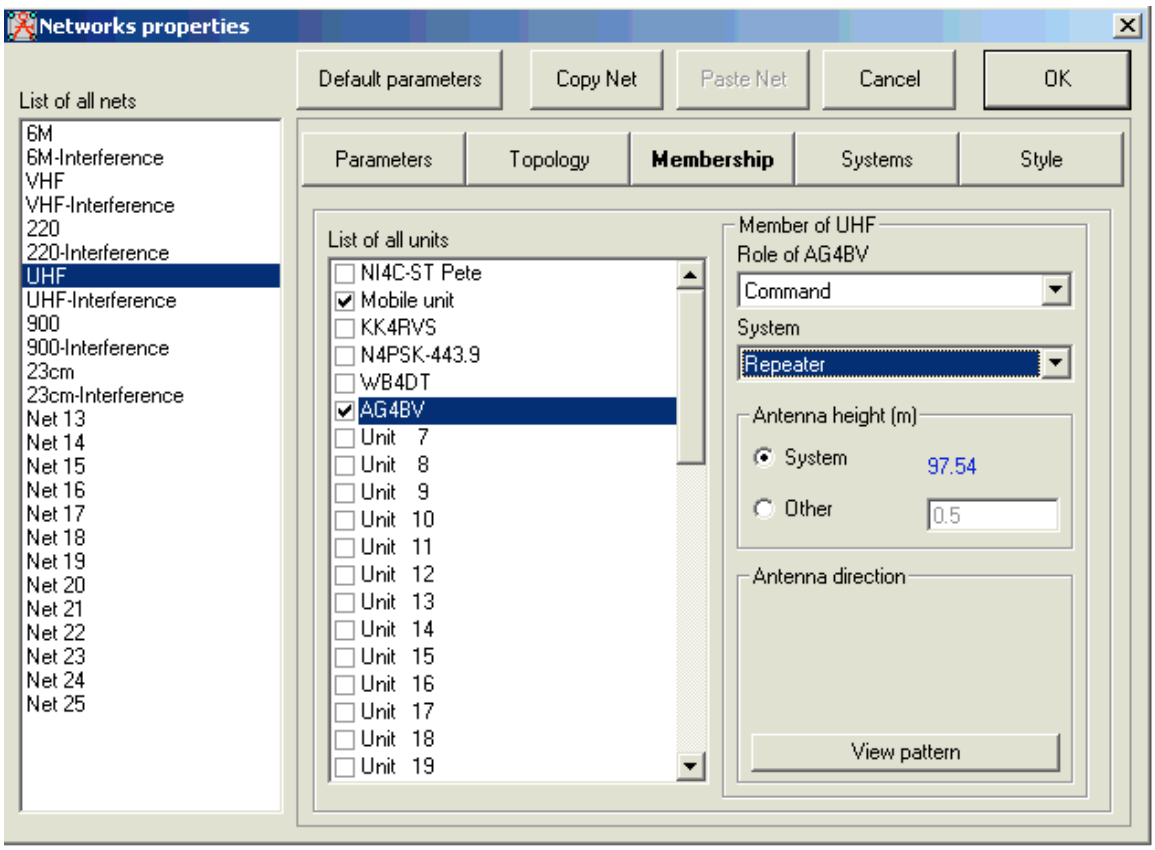


Now click and extract the map and go to picture properties.
Select White as we want a totally white background which will be transparent in the final rendering.



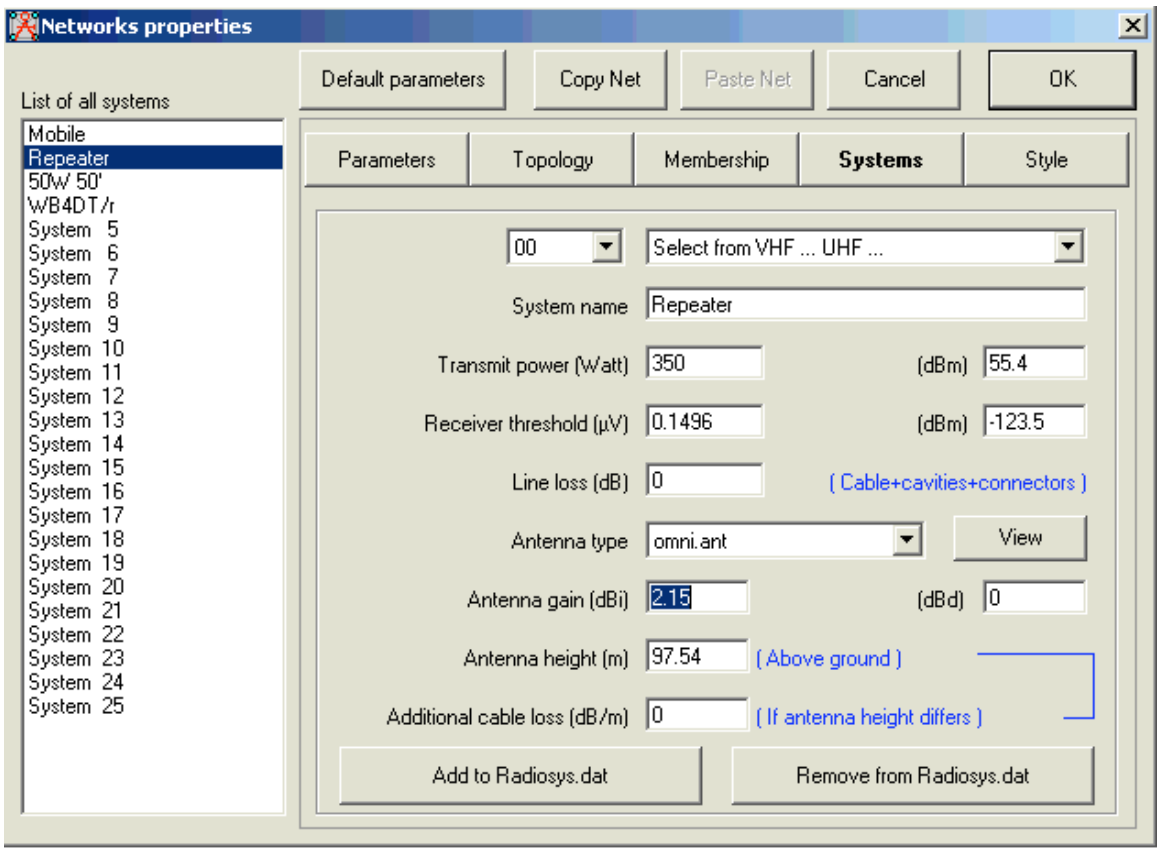
You will only have to do this once if you're doing more than one model.

Now setup the network to have the mobile user and the unit in the same network, with the mobile unit have the mobile system, and the subject unit have the "repeater" system.



Now configure the Repeater system to have the proper ERP and antenna height.
The program can calculate this based on the antenna gain (In dBd for our needs!), or preferably you can insert the calculated ERP as the transmitter power output as the ERP in dBm.
Note the Line Loss is 0 dB, and the antenna gain is 0 dBd (2.15 dBi). The forces the output power to be whatever there in watts dBd.

If the system uses a different antenna you can select the antenna from the antenna type selection. This can be important with the offset dipole antennas, which have a “D” or offset gain pattern.

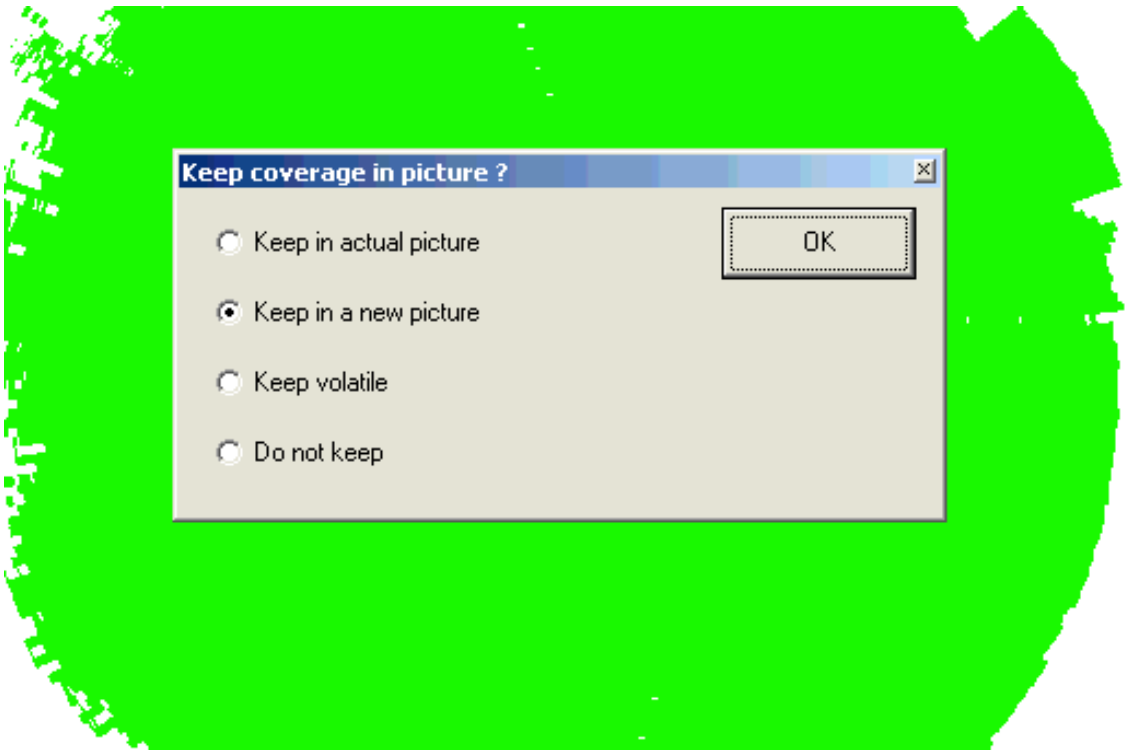


The first model will be the interference model.
Do a single polar model, with the Center Tx – Mobile Rx, which is modeling the received field strength at the mobile unit.

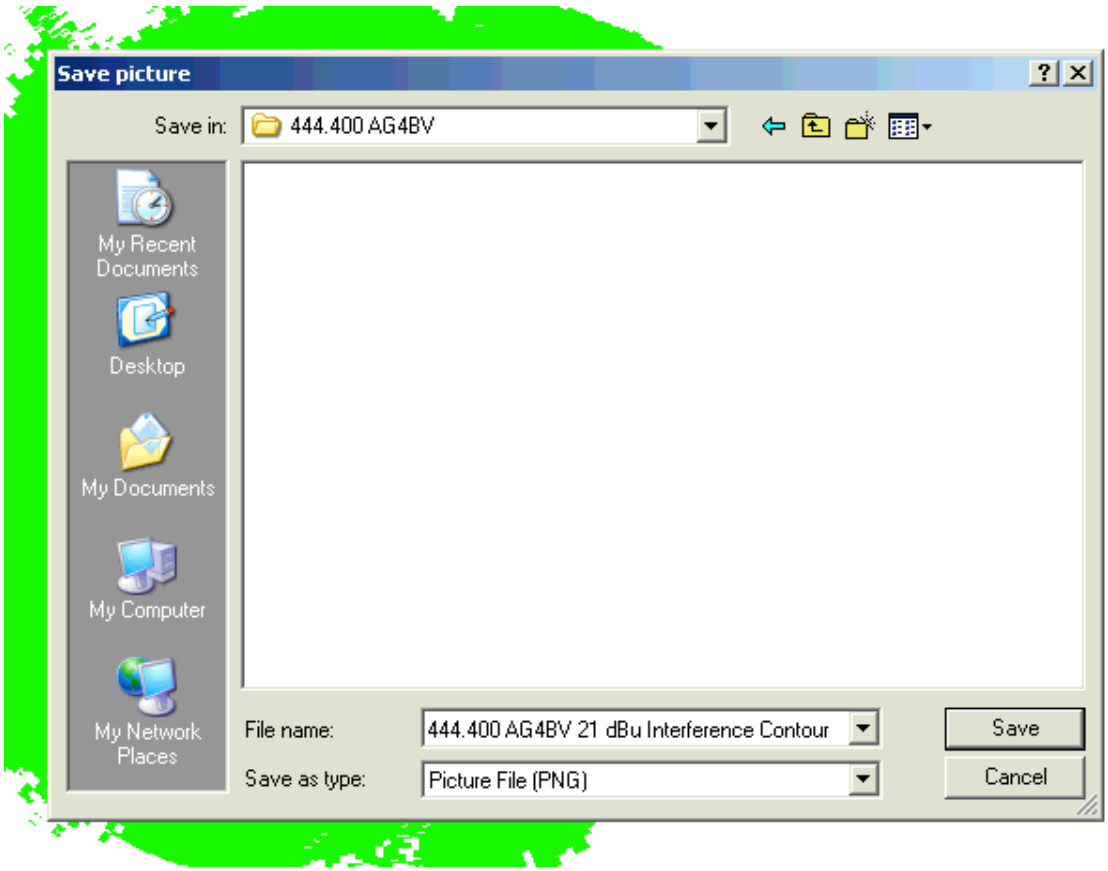
The radial range is typically 200km, but may need to be longer on high elevation systems and/or low band.

Select a color for the interference, and that it should be a solid color, with a fill area.
Enter in the value for interference criteria on the threshold and select dBuV/m, which is another way to say dBu.

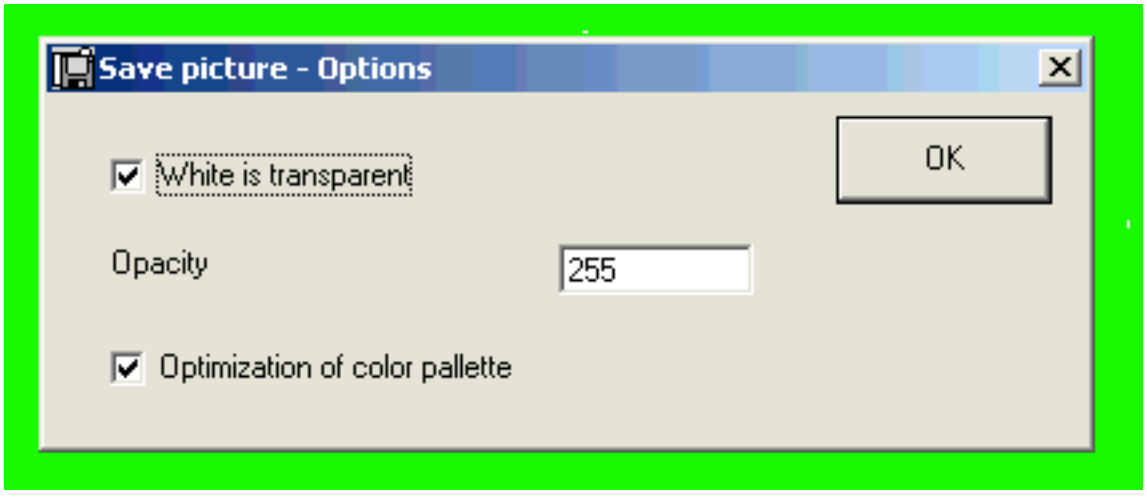
After this completes it will ask if you want to keep it in a new picture, select this.



Now Save this picture in the C:\PLOTS directory, and create a directory in the format “FREQ CALLSIGN” to save them in.



Save the file, and the next dialog will pop up. Ensure white is transparent and Optimization of color palette is checked. This will make a PNG with only the green area solid.

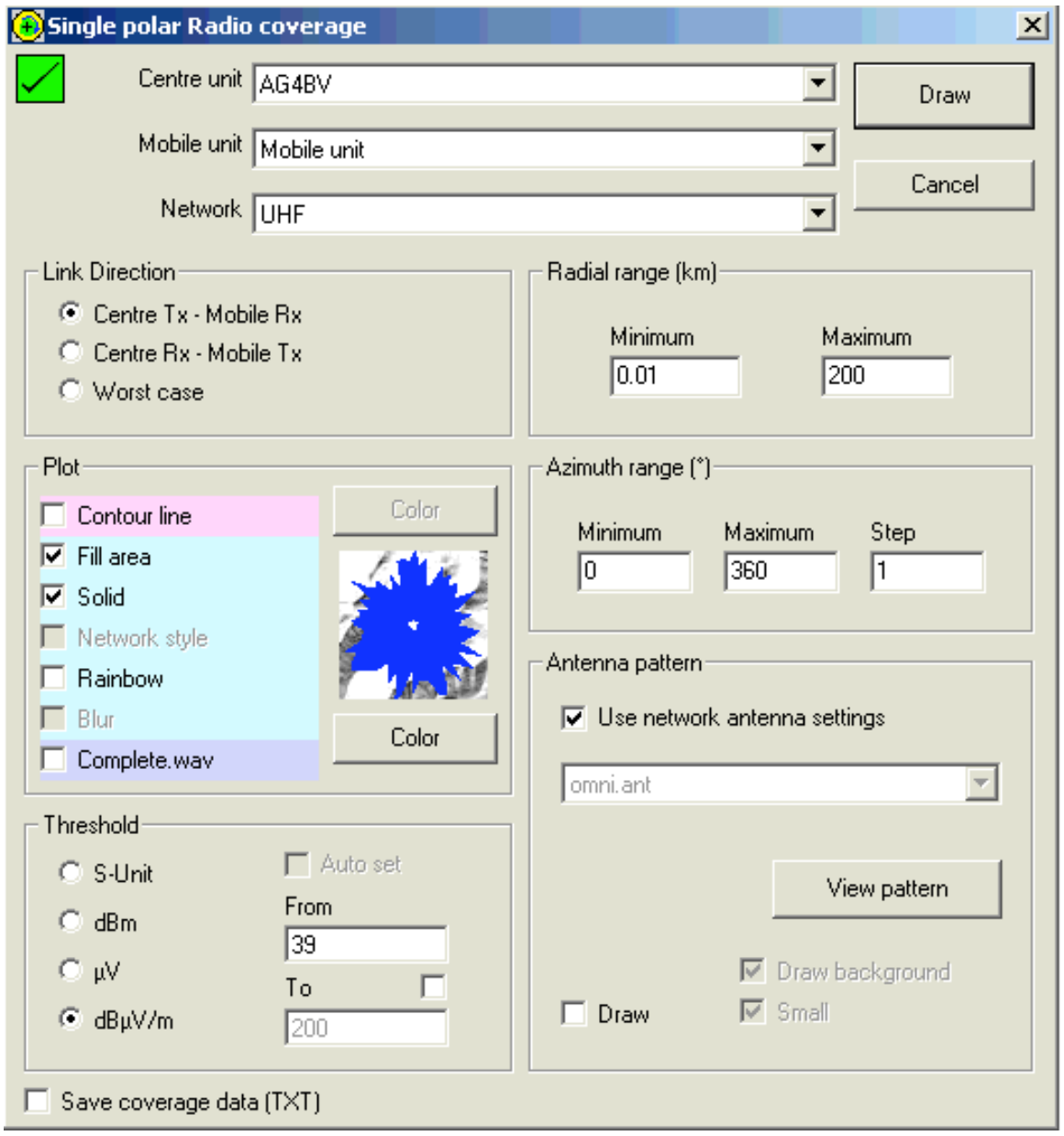


Model the service contour

This next step is modeling the service contour and is similar to the prior steps.

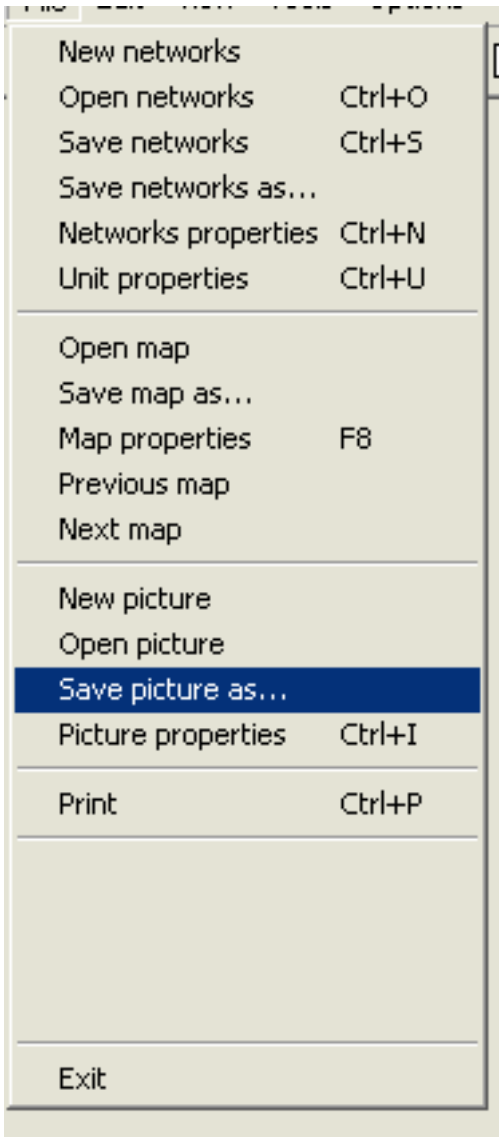
First go back to the white picture from the window menu.

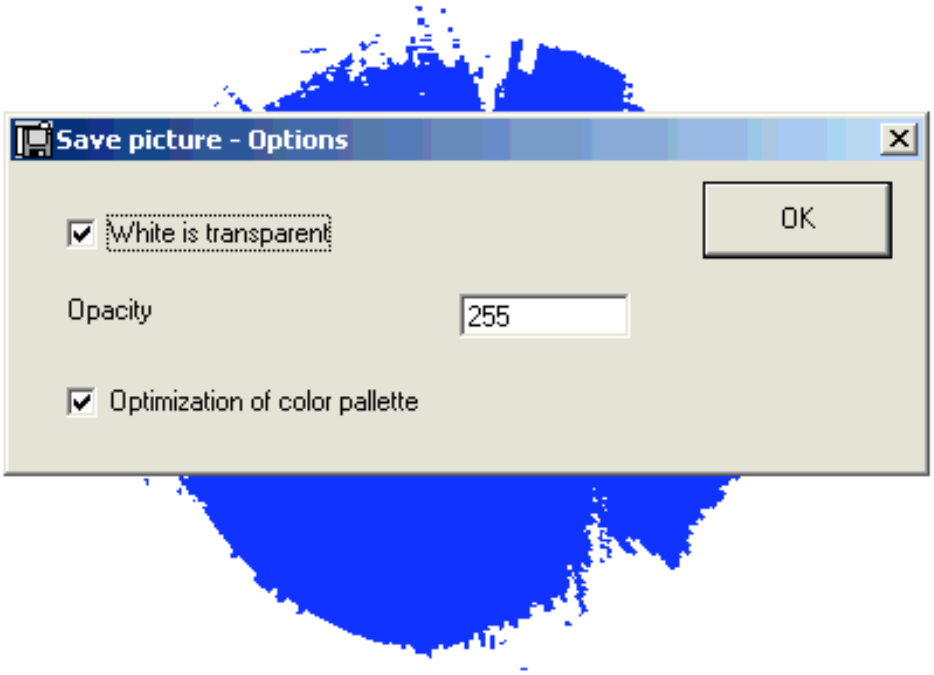
Select the single polar radio coverage with the network being the service contour network this time. Change the color and the Threshold to the appropriate threshold.

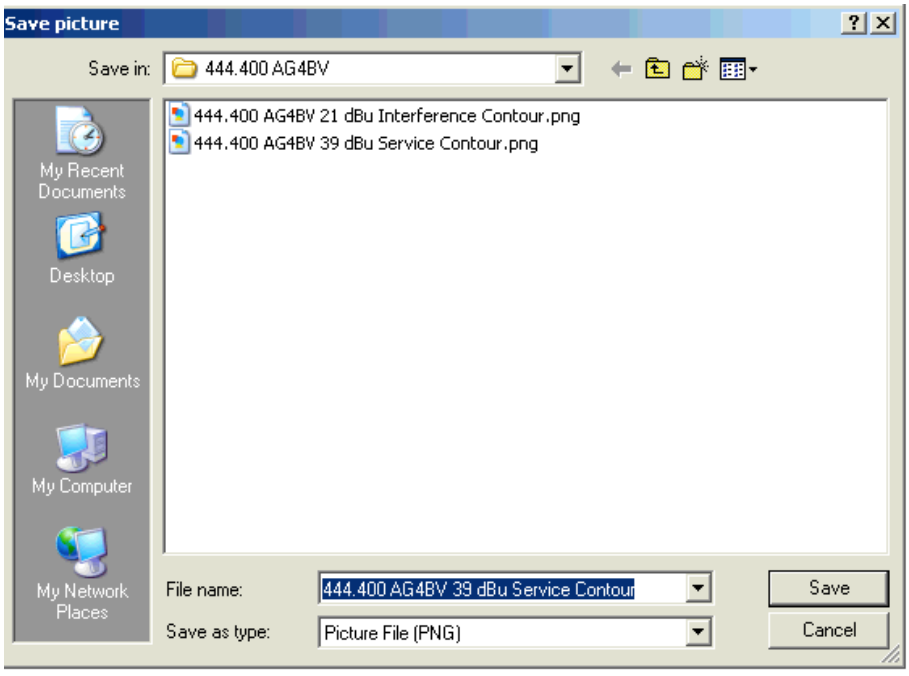


Keep in a new picture

Save picture as

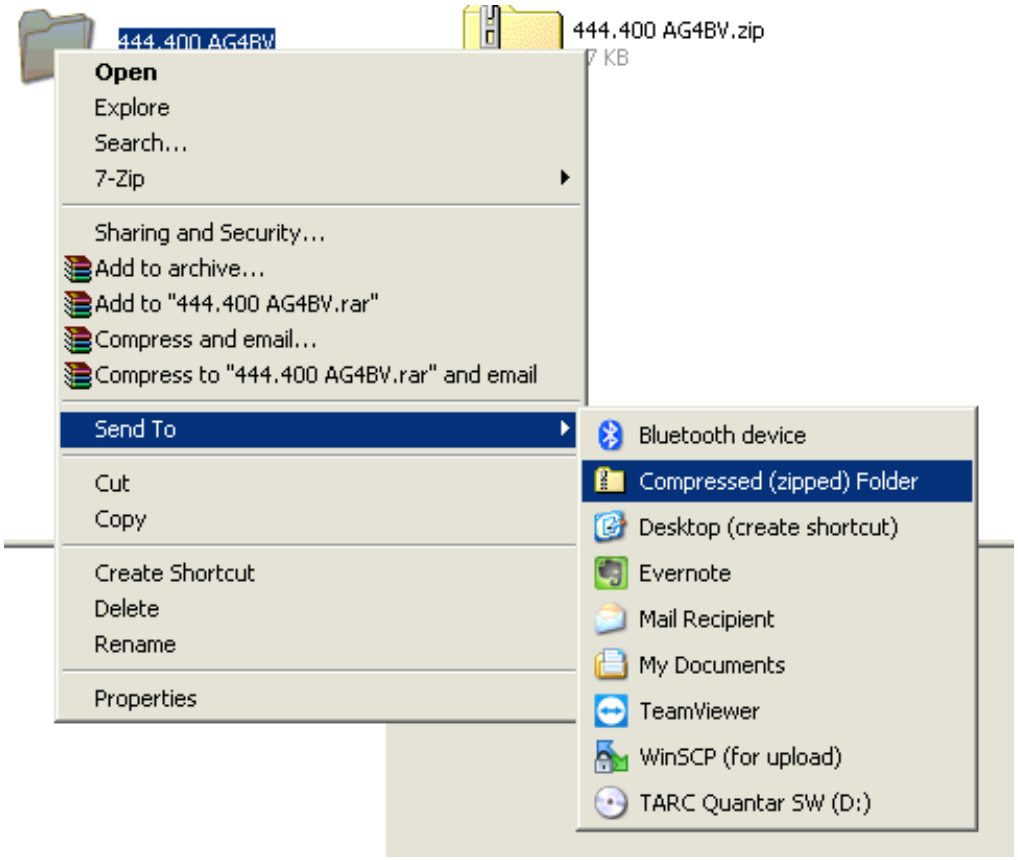

New networks
Open networks Ctrl+O
Save networks Ctrl+S
Save networks as...
Networks properties Ctrl+N
Unit properties Ctrl+U
Open map
Save map as...
Map properties F8
Previous map
Next map
New picture
Open picture
Save picture as...
Picture properties Ctrl+I
Print Ctrl+P
Exit


Save picture - Options
White is transparent
OK
Opacity
255
Optimization of color pallette

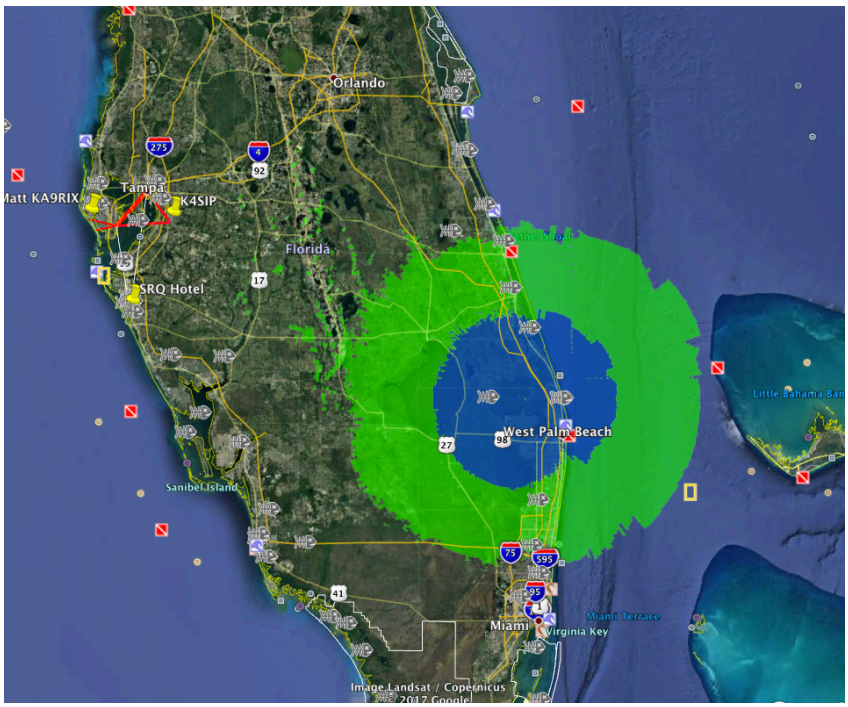

Save picture
Save in:
444.400 AG4BV
444.400 AG4BV 21 dBu Interference Contour.png
444.400 AG4BV 39 dBu Service Contour.png
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name:
444.400 AG4BV 39 dBu Service Contour
Save as type:
Picture File (PNG)
Save
Cancel

Evaulating the results in google earth

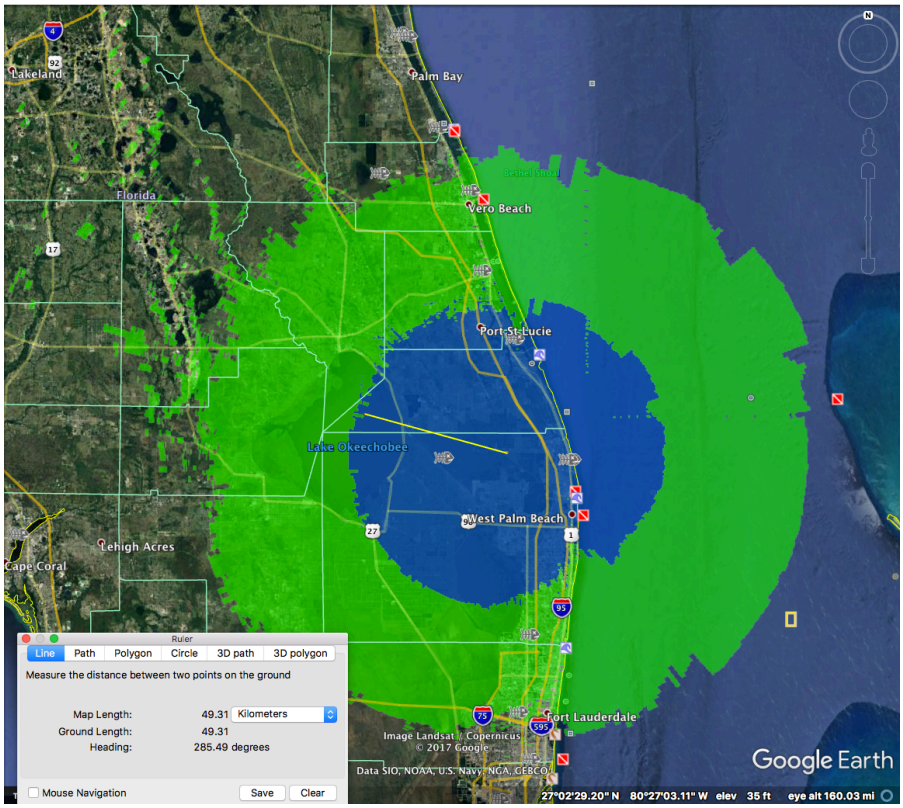
First we need to create a zipfile of the plots and export it to your desktop or if running it in a windows natively, just skip to opening the KML file directly.

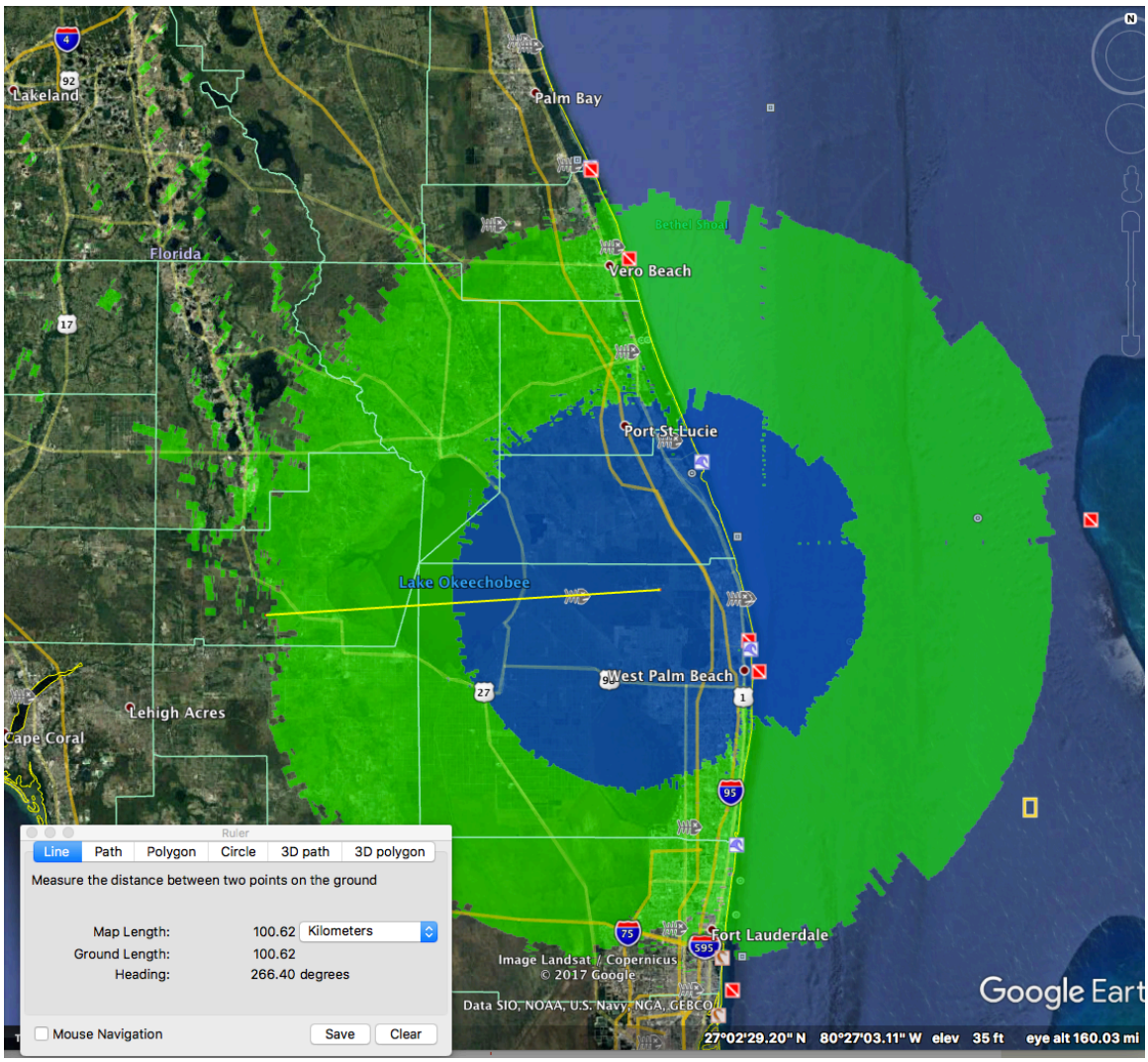


Now transfer that file to your computer and open each kml in google earth.



The average radius of the service contour and the interference contour can be measured and added in the coordination database.



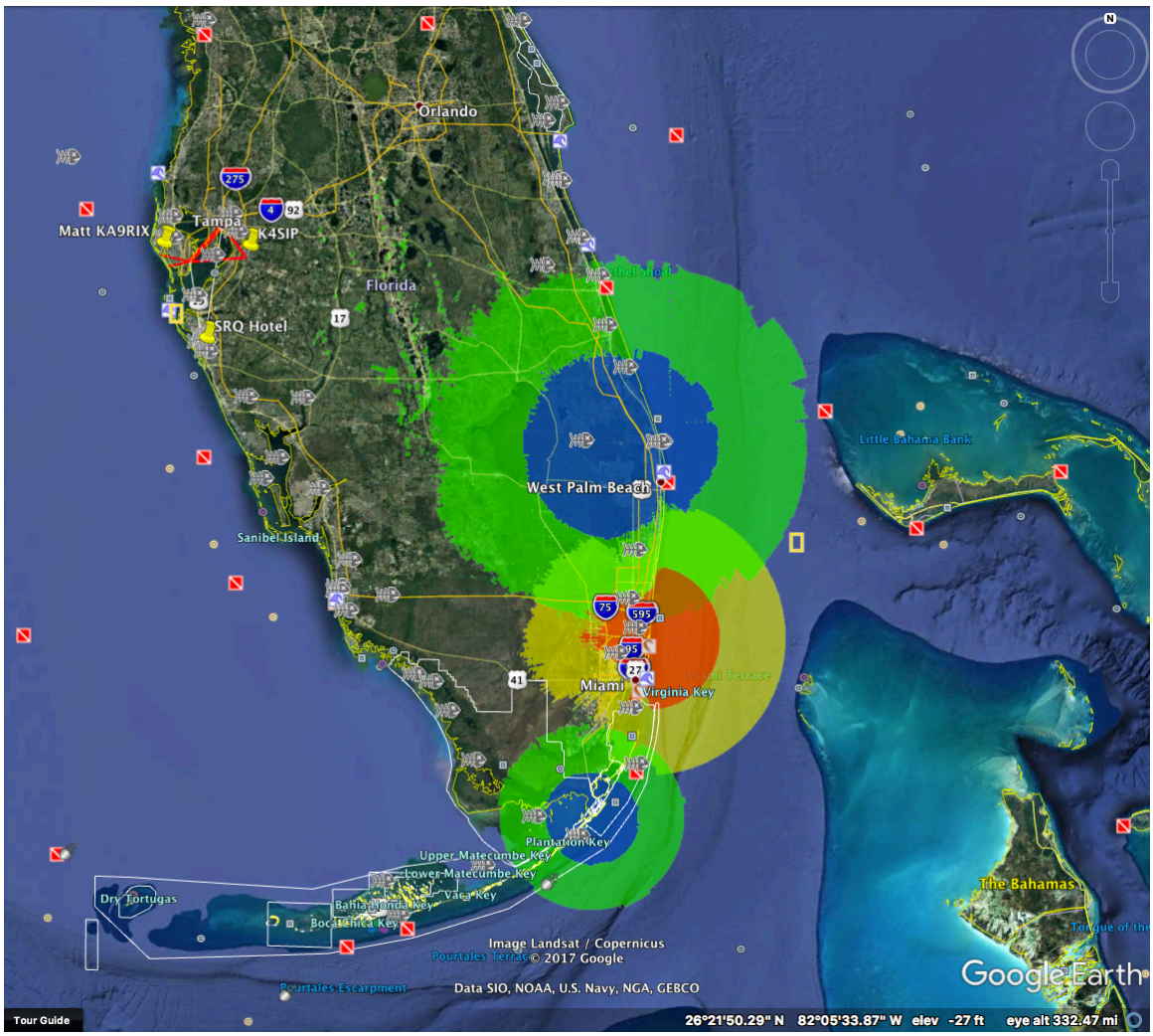


In this case we find the Service radius is about 50km and the interference radius is about 100km. We do not consider the over water part, and are ignoring the parts up on the mid Florida ridge. These contours are only for quick searching in the database for close frequencies. The models will govern the actual use of a frequency by a coordinated system.

Modeling Co-Channel adjacencies

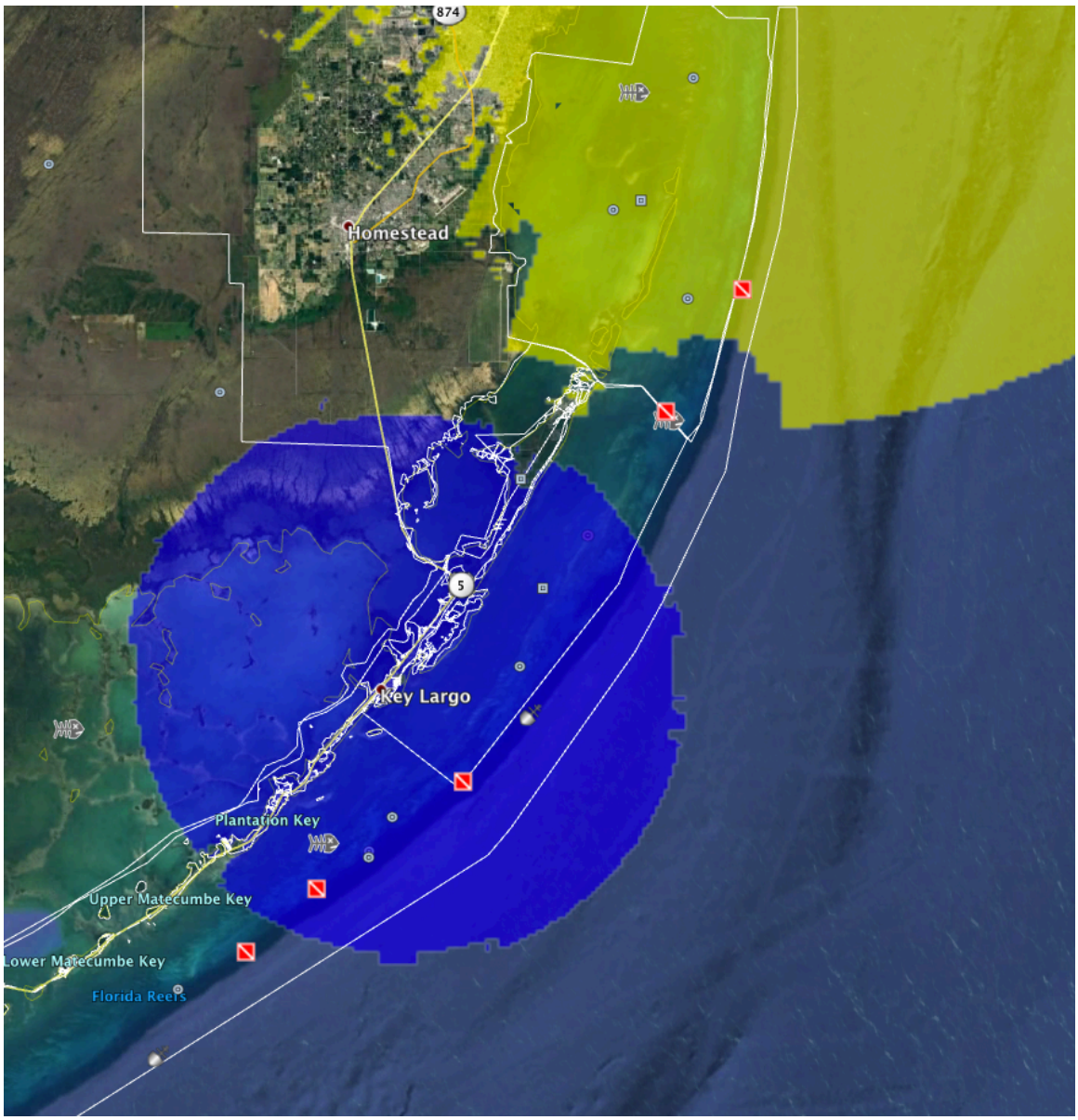
Co channel adjacent systems start as a model of all individual systems, which are then overlaid in Google earth.

Open the appropriate CO-Channel systems in Google earth to evaluate. In this example we are evaluating the middle system in red and yellow against the two existing systems in green and blue.



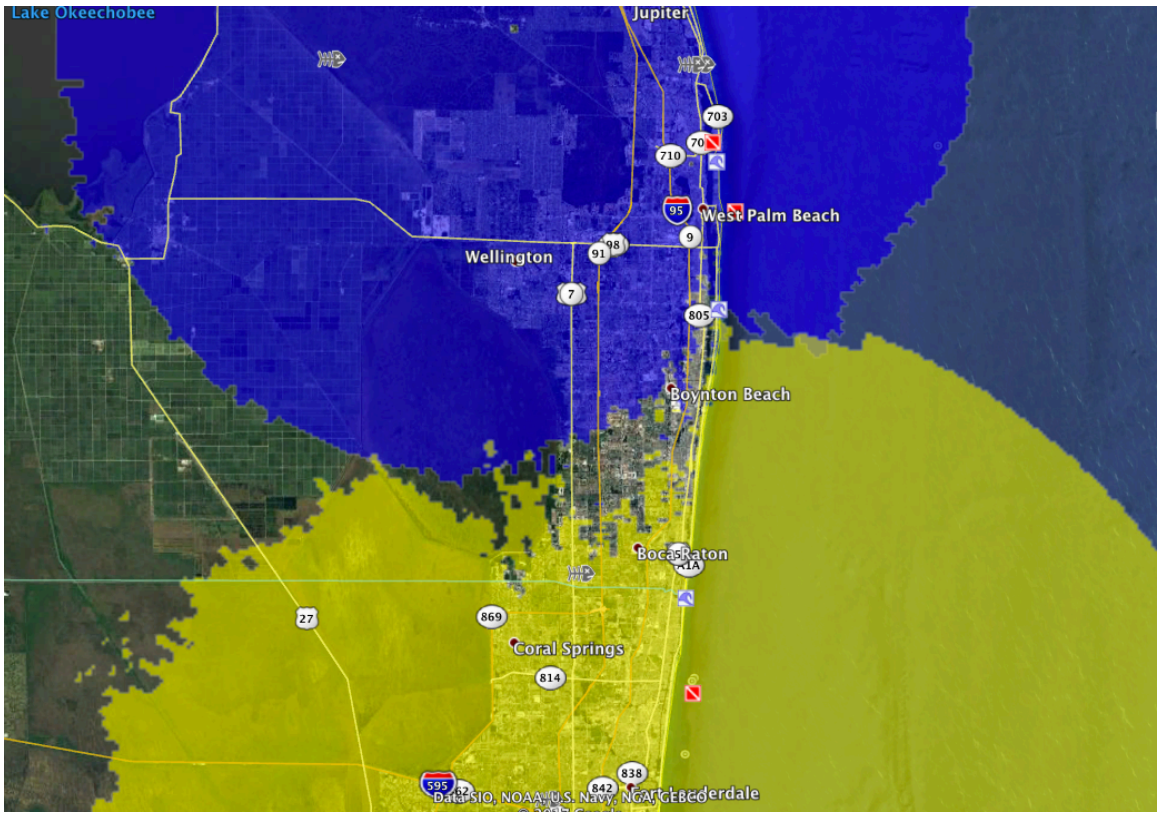
Using the Places dialog, uncheck and check the appropriate images and examine for overlap of the service contour of one and the interference contour of another.

In this case the system in Key Largo is not going to have the proposed interference contour of the Golden Beach system overlap it.



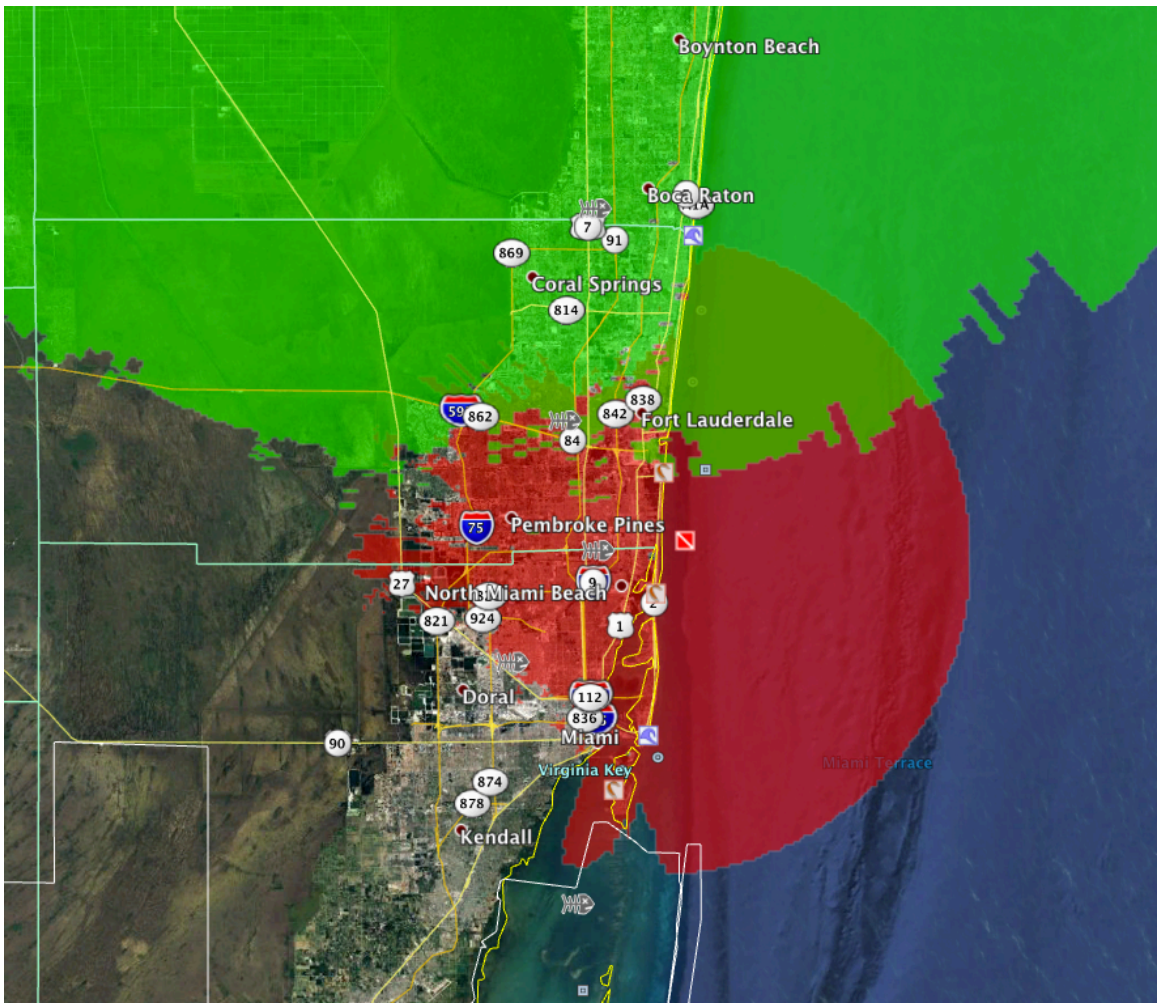
The same is true for the interference contour from Key Largo on the service contour of the proposed system.

Now looking at the incumbent system in Jupiter Farms, it service contour is only slightly overlapped by the interference contour of the proposed system.



This minor overlap is completely acceptable in most amateur radio systems.

Note the overlap of the northern systems interference contour on the proposed system's service contour.



This is typically not acceptable, however most the overlap is over water so this new proposed system should not interfere with the established systems, but the north system may interfere with it.

Modeling Adjacent channels on VHF systems

TBD, basically modeling the adjacent channel with a signal strength of (50,10) 42/44dBu, so that an adjacent channel contour doesn't overlap the service contour of any adjacent channel users. The idea here is the