Change Log of CARPET 3

August 3, 2022

Nr.	V	Date	Description
1	3	1-5-2017	Vertical coverage diagram of firm track probability added.
2	3	2-5-2017	Extrapolation of imported antenna patterns changed. For elevation angles less than the first (lowest) elevation angle that is specified, the firstly specified gain is applied.
3	3	3-5-2017	Character string 'Carrier Frequency' removed from antenna pattern diagrams.
4	3	3-5-2017	Character string 'Number of Bursts' added to Doppler Filters diagram.
5	3	9-5-2017	Meyer plot style added, extra item in the Layout - Appearance dialogbox (Funny Probability Axis). The scaling is according to the error function.
6	3	10-5-2017	Two way path loss and pattern propagation factor appeared to go wrong when altitude is along the vertical axis. Fixed.
7	3	10-5-2017	Unit 'kft' appeared to be neglected in certain diagrams. Fixed.
8	3	11-5-2017	Meyer plot format made available to the P_d diagram, see Figure 1.
9	3	30-5-2017	The value of certain detection probabilities in the binary integration worksheet appeared to be clipped at 10%, *i.e.*, a value less than 10% was not possible. This has been repaired.
10	3	31-5-2017	Radial velocity averaging added to the Model dialogbox, see Figure 2.
11	3	31-5-2017	'Max-rule' post detection binary integration has been added.
12	3	2-6-2017	Radial velocity averaging should (obviously) not be applied when radial velocity is varied. Fixed.
13	3	2-6-2017	Legend above firm track diagram improved, see Figure 3.
14	3	13-6-2017	Several propagation plots appeared to be dysfunctional. Mended.
15	3	13-6-2017	Fixed drawing error in vertical cut diagrams. Note: the flaw is only apparent when few points are taken.
16	3	22-6-2017	Flaw in import refractivity M-profile functionality, fixed.
17	3	23-6-2017	Free space can be combined with attenuation in the atmosphere, extra propagation dialogbox added, see Figure 4.
18	3	29-6-2017	The Doppler filtering worksheet caused CARPET to crash. Fixed.
19	3	4-7-2017	Pulse compression gain added to certain diagram legends.
20	3	4-7-2017	Symbols added to refractivity profiles, see Figure 5.
21	3	5-7-2017	Rain cloud dimensions and rain rate added to the legend of pattern propagation factor and path loss diagrams.
22	3	16-7-2017	Sea state and wind speed conversions appeared to be nonreciprocal. For the time being, only the wind speed can be modified, sea state is 'non-editable'.
23	3	17-7-2017	The atmospheric absorption switch appeared to be dysfunctional (EREPS-like propagation model only). This has been repaired. Also, a PPI-view diagram of atmospheric absorption has been added, see Figure 6.
24	3	25-7-2017	Legend error: target range in nautical miles, fixed.
25	3	25-7-2017	In case of multiple waveforms per dwell: pulse compression gain removed from the legend.
26	3	27-7-2017	Atmospheric absorption and also absorption in rain droplets appeared to be inactive for the surface clutter and the volume clutter signal components and for the EREPS-like propagation model. Fixed.
26	3	27-7-2017	Re-design of the Model and the Propagation dialogboxes. TERPEM-users get an additional dialogbox Refractivity Profile as shown in Figure 7. Water/Land distinction must now be made in the propagation dialogbox, see Figure 8 in the case of EREPS-like.
27	3	25-8-2017	Worksheet Geometry also calculates the elevation angle of the reflected ray and the path length difference between the reflected and the direct ray.
29	3	28-8-2017	PPI-view diagrams of received powers added, see Figure 9.
28	3	29-8-2017	Multi-scatterer SCNR over range diagram appeared to be erroneous, *i.e.*, only a single curve is in the plot. Fixed, see Figure 10.
29	3	19-4-2018	Contours added to the diagram layout dialogbox, see Figure 11.
30	3	15-5-2018	Rain attenuation appeared to be independent on the height of the rain cloud, which has been repaired. Also see Figure 12.
31	3	15-5-2018	Rain cloud height has been added to certain legends.
32	3	20-6-2018	CARPET 3 did not remember the directory where Python scripts are stored. Fixed.
33	3	22-6-2018	A suggested filename for plot-data has been inserted, see Figure 13.
34	3	20-8-2018	Blanking sector settings appeared not to be saved correctly. Patched.
35	3	3-9-2018	Four and Five pulse canceler added, see Figure 14.
36	3	3-9-2018	Cascaded architecture of a pulse canceler and a Doppler filter bank has been re-introduced, see Figure 15.
37	3	4-9-2018	Maximum water temperature changed to 35 °C (rather than 30 °C).
38	3	12-9-2018	Target altitude manipulation when leaving the siting dialogbox has been removed.
39	3	12-9-2018	Contours have been added to the KML (Keyhole Markup Language) file (PPI-view detection probability), see Figure 16.
40	3	13-9-2018	The firm track probability diagram in PPI-view appeared to be dysfunctional. Patched, see Figure 17.
41	3	14-9-2018	When selecting a settings file (extension 'par'), CARPET doesn't load the refractivity M-file from file. Repaired.
42	3	14-9-2018	Sanity check on the number of active scatterers inserted.

Nr.	V	Date	Description
43	3	14-9-2018	Python method to import a refractivity M-profile added.
44	3	17-9-2018	Messagebox in case SRTM files could not be found added.
45	3	1-10-2018	Water height of the Caspian sea (which is some 30 m below the ECM96 geoid) was not displayed correctly. CARPET apparently 'clipped' the minimum height at -6 m (minimum polder-level in The Netherlands), which has been removed, see Figure 18.
46	3	2-10-2018	Colour map added (Layout dialogbox), to end the colour discussions, see Figure 19.
47	3	9-10-2018	Progress bar added to certain diagrams, see Figure 20.
48	3	9-10-2018	Option 'Write Date/Time in the Legend' added.
49	3	24-12-2018	The radiosonde launch height was not properly considered, which has been repaired. Furthermore, the alertbox that appears when importing a radiosonde file has been improved, see Figure 21.
50	3	14-1-2019	Number of combinations added to binary integration worksheet, *e.g.*, 2-out-of-3: four combination (011, 101, 110, 111).
51	3	15-1-2019	Range-height diagrams of path loss and pattern propagation appeared to be erroneous in case height is given in ft or kft, which has been repaired.
52	3	15-1-2019	The refractivity profile diagrams did not consider the maximum altitude specified in the Layout dialogbox. Fixed.
53	3	6-2-2019	The pathloss according to TERPEM appeared to be wrongly dependent on the antenna's tilt angle which has been repaired, see Figure 22. Note: the erroneous result only occurred when the tilt angle, specified in the Antenna dialogbox, is not zero degrees.
54	3	6-2-2019	The 'infobox' that appears after an elevation antenna pattern has been imported has been improved, see Figure 23.
55	3	1-3-2019	Time Gating added, *i.e.*, minimum and maximum instrumented range per waveform, see Figure 24. This quite significant expansion of CARPET is documented in the CARPET manual. Note that certain Python variables have gone, while additional variables have been added under 'Processing'.
56	3	3-5-2019	The sea state and wind force editboxes allow specification of a decimal, to solve quasi-erratic behaviour of the value of the wind speed.
57	3	3-5-2019	GeoTIFF output of PPI-view diagrams has been added, see Figure 25.
58	3	3-5-2019	Graying added to the Loss Factors dialogbox; Rx radome loss will be grayed out in the case of identical Tx and Rx antennas.
59	3	14-5-2019	Maximum number of range / height points increased to 1000, in order to get satisfactory GeoTIFF output.
60	3	23-5-2019	Improvement of the number of CPU-cores that CARPET will use when making PPI-view diagrams (when this number is more than eight), see Figure 26.
61	3	23-5-2019	Latitude and longitude are written with six decimals in the legend (rather than four).
62	3	23-5-2019	Python functions getTerrainProfile and getTerrainHeight are not mentioned in the description of the API, which has been repaired.
63	3	3-6-2019	The Python function loadConfig caused CARPET to crash in certain cases. The cause appeared to be a non-existing antenna file, referred to in the CARPET settings file. Mended; in case the antenna file is not found, CARPET gracefully aborts the Python program and an error message is issued.
64	3	5-6-2019	The Python function saveData caused CARPET to crash in case the directory where the data is to be written does not exist. Fixed: CARPET will attempt to create the directory. If this fails, the Python program is gracefully aborted.
65	3	26-6-2019	Variables multipath and gaseous attenuation appeared to be not saved in a CARPET 3 settings file. Fixed.
66	3	29-7-2019	The 64-bits version of CARPET 3 is now available, which is substantially (approximately a factor 1.4) faster than the 32-bits version. The 32-bits version has been removed from the download site.
67	3	10-8-2019	Variables phase noise appeared to be not saved in a CARPET 3 settings file. Fixed.
68	3	7-11-2019	The maximum number of azimuth angles has been increased to 36000.
69	3	17-12-2019	The ADC quantisation loss was not saved in the settings file, which has been repaired.
70	3	20-12-2019	The infobox that appears when an antenna elevation pattern has been imported has been extended even furthermore, as shown in Figure 27.
71	3	8-1-2020	The maximum number of pulses per burst has been increased to 512.
72	3	10-1-2020	Extra Python functionality has been added: GetFirmTrackProbabilities, GetTrackLossProbabilities and GetTrackAcquisitionProbabilities.
73	3	3-2-2020	Extra Python functionality: GetReceivedPowersVersusRange.
74	3	3-2-2020	The user can specify the number of Doppler filters of the Doppler filter bank, see Figure 28. This functionality has been added since certain radars have a higher number of Doppler filters than the number of pulses that is coherently integrated, in order to reduce the Doppler straddling loss. The user should be aware that prior to this addition, the number of filters equaled the number of pulses coherently integrated. Thus, if a pulse canceler is applied in combination with a Doppler filter bank, the number of filters reduced.
75	3	1-3-2020	Waveform parameters are now in a separate dialog box, as shown in Figure 29.
76	3	1-3-2020	A new quantity 'Number of Channels' has been introduced in the Transmitter Dialogbox. Also, an M-out-of-N channel combining criterion can be specified in the Processing - Detection dialogbox, see Figure 30. This new feature, which is relevant for radar systems that receive simultaneously at different frequencies, is discussed in the CARPET manual.
77	3	4-5-2020	When the RCS is less than 1 m^2, the value in dBm^2 was wrongly displayed, when the Target dialogbox was firstly put-up. Fixed.
78	3	5-5-2020	Scaling of the diagram Doppler filter gain versus target radial speed improved. Also the Doppler filter gain of volume cutter was not painted correctly.
79	3	27-5-2020	Minimum allowed cloud height set to 1000 m (rather than 100 m).

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80	3	3-6-2020	If surface clutter is absent and a PPI-view plot of surface clutter is requested, CARPET appeared to crash. This has been repaired, the diagram cannot be requested if surface clutter is absent. Likewise, the volume clutter power PPI-view diagram cannot be requested if volume clutter is absent.
81	3	4-6-2020	The one-way path loss diagram versus range and altitude appeared to be erroneous in case of dissimilar transmit and receive antennas. Fixed!
82	3	27-10-2020	An additional function has been added to the Python plug-in: `GetPdSwerling`. This function returns the detection probability from the Swerling case, the number of pulses non-coherently integrated. the false alarm probability and the signal-to-noise-ratio, as shown in Figure 31.
83	3	27-10-2020	The terrain profile can be displayed while taking into account the earth's curvature, as illustrated in Figure 32. Terrain that is not visible from the antenna's position is depicted in red, otherwise green is used. The k-factor is used in the criterion to determine visibility.
84	3	12-11-2020	The terrain following target altitude profile is supported, next to the fixed altitude profile. There is an extra checkbox in the Target dialogbox. Obviously, the TERPEM plug-in is required for this functionality. Examples of diagrams that reveal this options are shown in Figure 33.
85	3	26-2-2021	The velocity span is written in the legend in case velocity averaging is applied, as shown in Figure 34.
86	3	18-5-2021	The azimuth and range stepsizes are written in the legend of the PPI-view Target - Line-of-Sight diagram.
87	3	23-8-2021	The sidelobe level that the Dolph-Chebyshev taper provides is not saved in the settings file, as it should. Fixed.
88	3	24-8-2021	Refractivity N-profile data were not properly imported. Fixed.
89	3	25-8-2021	The dialogbox that provides feedback of the imported antenna pattern has been improved somewhat, see Figure 35.
90	3	24-9-2021	1 arc second SRTM data is supported. These can be downloaded from https://dwtkns.com/srtm30m/ Please do not store 1 and 3 arc second tiles in the same directory.
91	3	24-9-2021	The M-out-of-N post-detection integration missed sequences when a maximum allowed gap is specified. Fixed, we thank the CARPET-user that observed this 'bug'.
92	3	27-9-2021	Increased maximum antenna gain in the Antenna worksheet.
93	3	30-9-2021	Track Probabilities worksheet has been added to the GUI, see Figure 36.
94	3	30-9-2021	The Tracking Parameters dialogbox has been modified; checkbox Consecutive Plots during Track Initiation has been added, see Figure 37.
95	3	1-10-2021	Multi CPU-core support of the P_d versus range and altitude diagram, in case of EREPS-like and free space propagation.
96	3	24-5-2022	STC (Sensitivity Time Control) modeling has been added. An ASCII file containing triplets of time-instance, receiver gain and noise figure must be imported.
97	3	3-8-2022	The contour-representation of the PPI-view diagrams of the detection probability and the firm track probability appeared to be only working when the specified detection probability (in the Layout-Limits dialogbox) is lower than the specified contour-probability (in the Layout-Appearance dialogbox). Fixed!
98	3	3-8-2022	Specifying an eclipsing loss resulted in the disappearance of *all* dead zones. However, the first (initial) dead zone will obviously never go away, which has been fixed.

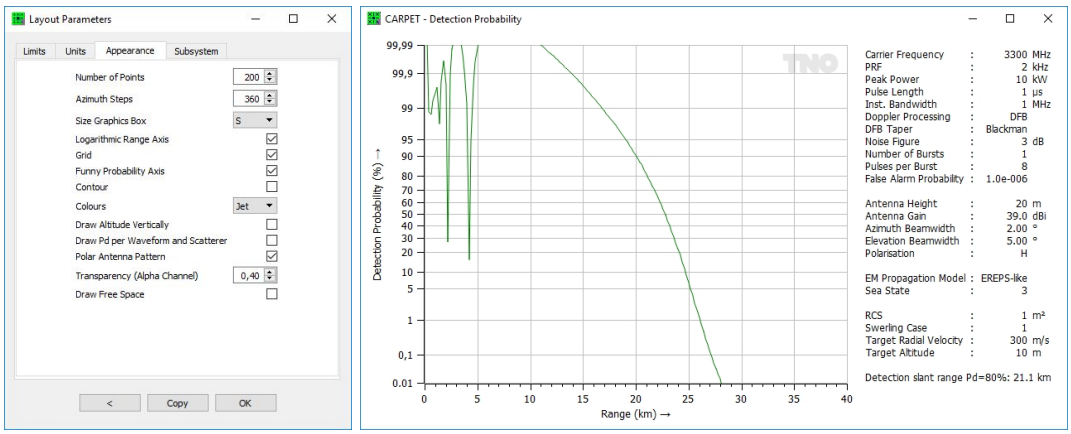

Figure 1: 'Funny' scaling of the vertical axis.

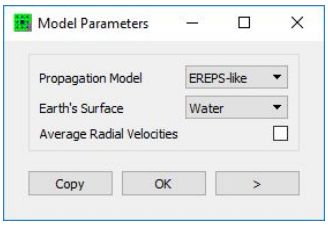

Figure 2: Model dialogbox, which enables averaging of radial velocities.

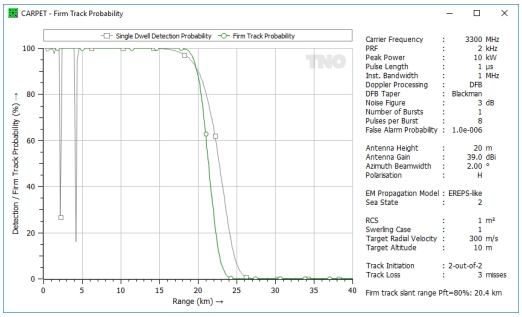

Figure 3: Improved legend above the diagram.

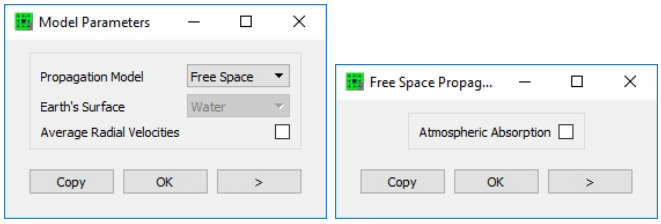

Figure 4: Model and Propagation dialogbox in case Free Space is selected.

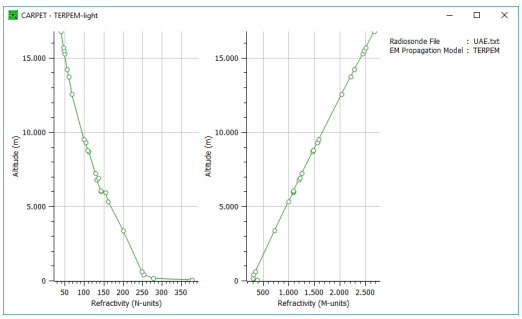

Figure 5: Refractivity profile curves with symbols.

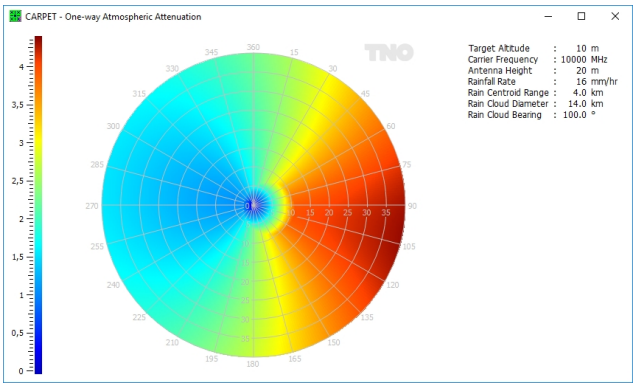

Figure 6: PPI-view diagram showing one-way atmospheric losses in dB.

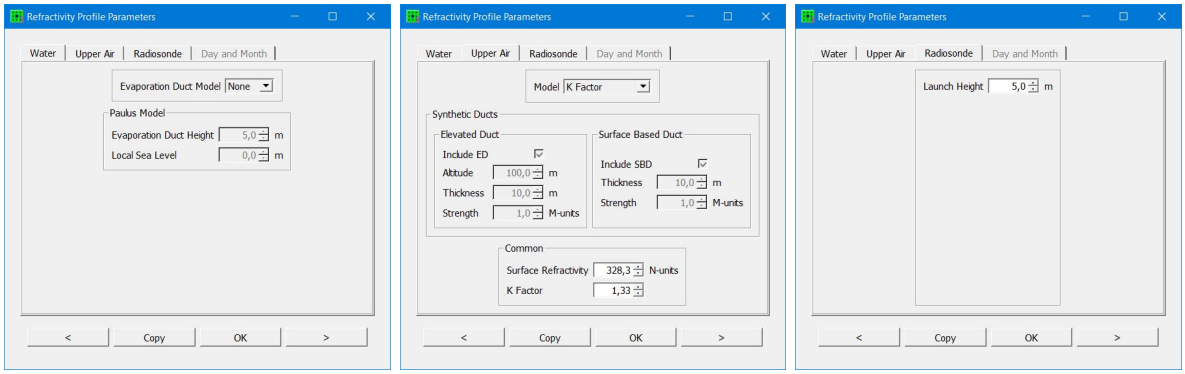

Figure 7: Refractivity Profile dialogboxes.

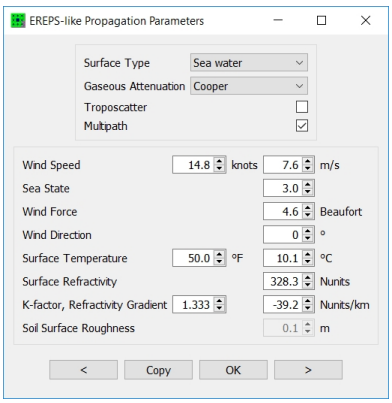

Figure 8: Propagation dialogbox for the EREPS-like model.

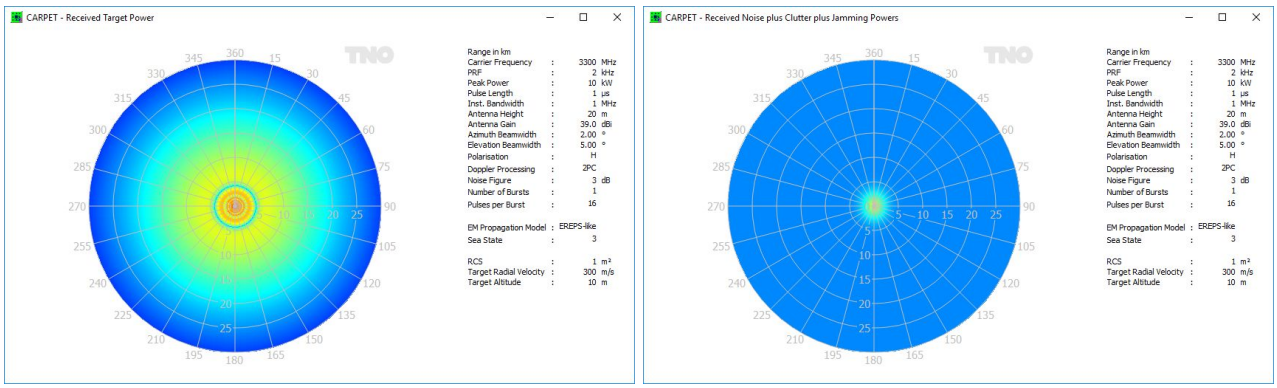

Figure 9: PPI-view diagram of received powers.

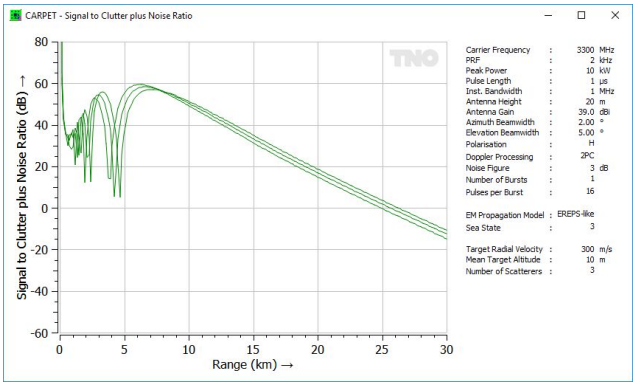

Figure 10: SCNR over range for an extended target, made up of three scatterers.

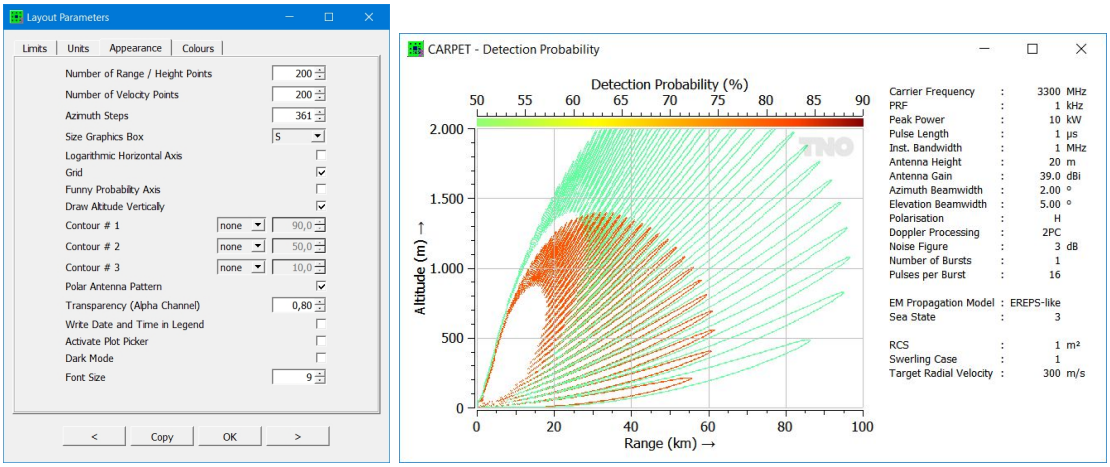

Figure 11: Left: Layout dialogbox which enables the specification of three contours.
Right: example of a diagram with two contours.

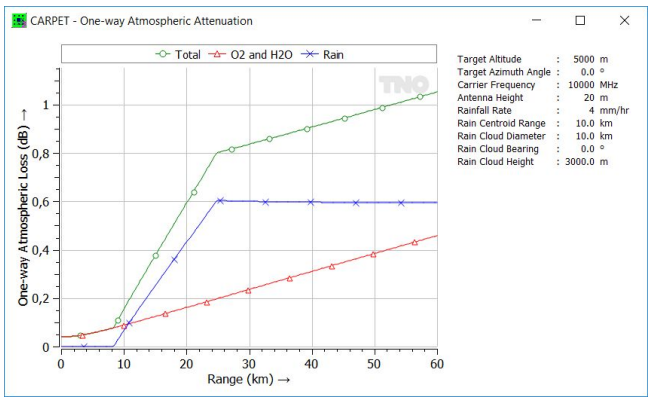

Figure 12: Absorption versus target range.

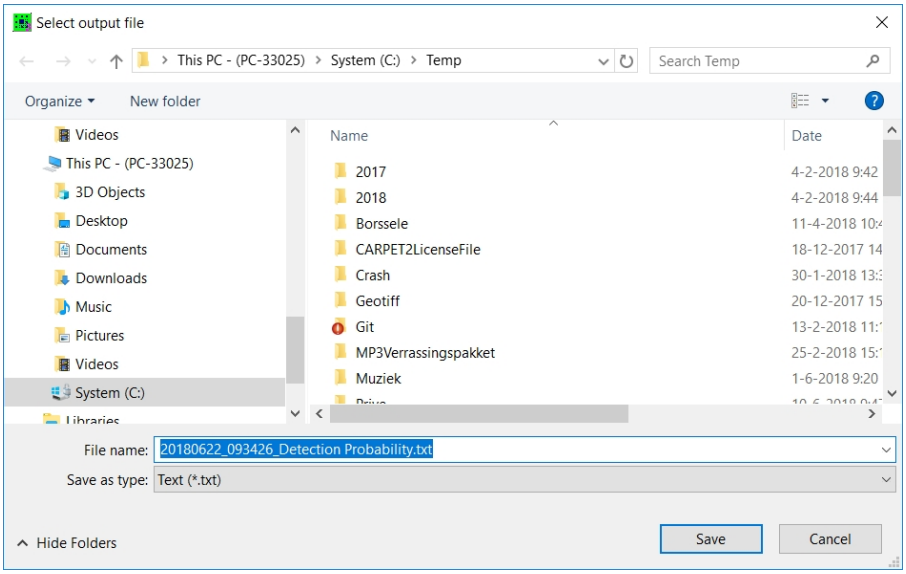

Figure 13: CARPET 3 suggests a filename for the file that contains numerical data of a diagram.

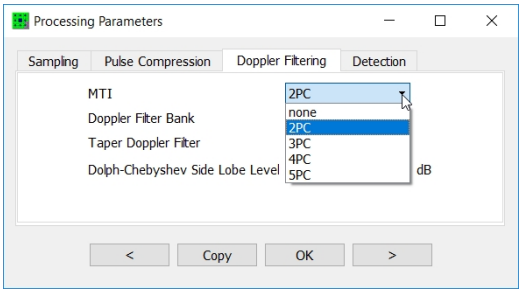

Figure 14: Doppler Filtering sub-panel of the Processing dialogbox revealing support of a four and five pulse canceler.

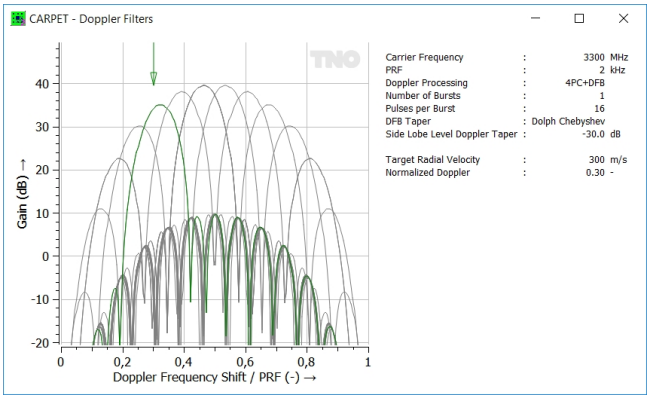

Figure 15: Doppler Filter responses. A four pulse canceler is cascaded with a Doppler filter bank.

Figure 16: Left: PPI-view diagram of the single scan detection probability, projected on Google Earth. Right: Menu that enables switching on/off contours.

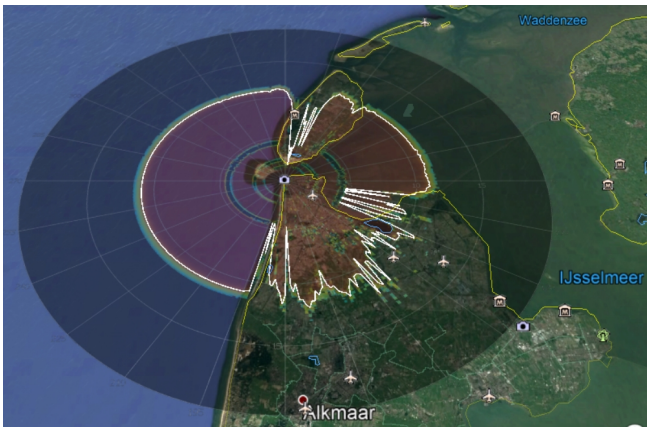

Figure 17: PPI-view diagram of the firm track probability, projected on Google Earth. The contour is at 80 %.

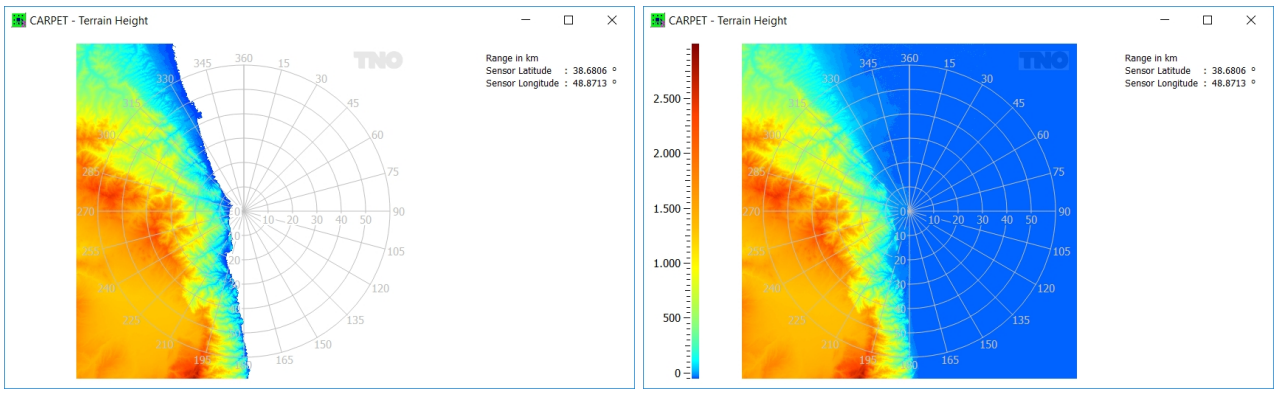

Figure 18: Left: The border of the Caspian Sea, terrain height is incorrectly clipped at -6 m. Right: corrected version.

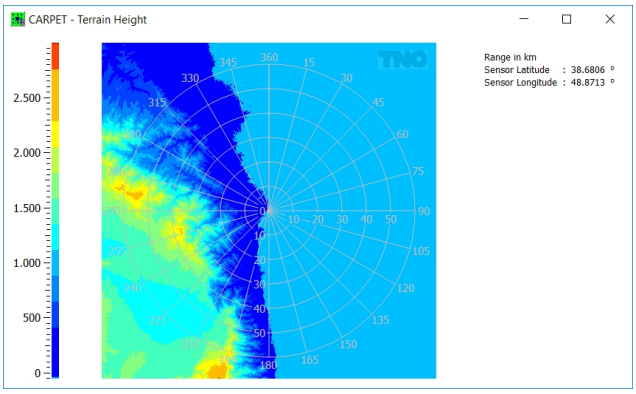

Figure 19: User-defined colourscheme is applied to properly display the shore.

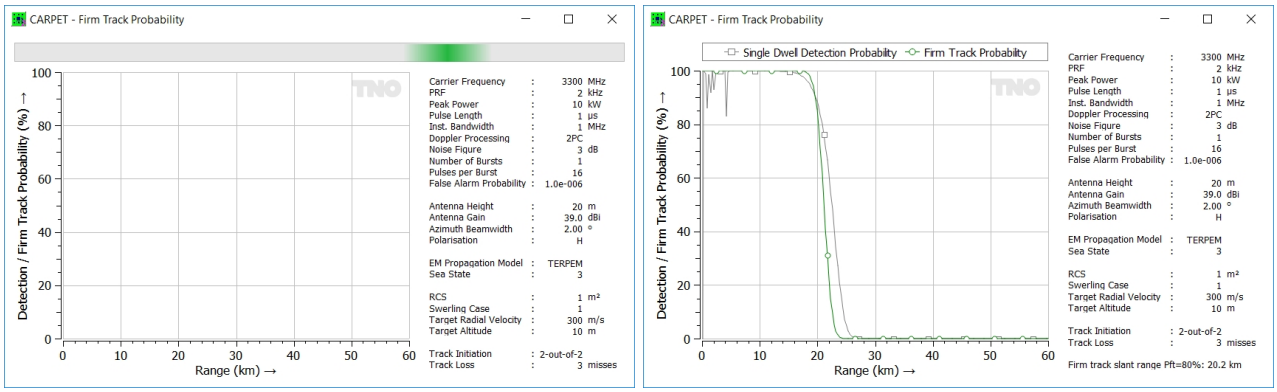

Figure 20: Left: While calculating a progress bar is shown. Right: when the calculations are finished, the progress bar disappears.

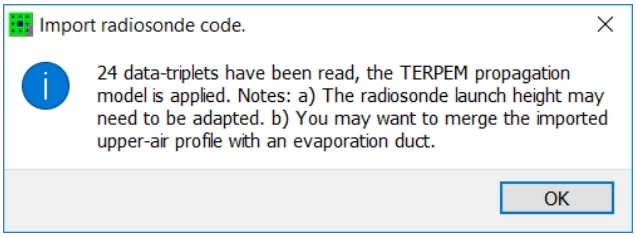

Figure 21: Alertbox that appears when a radiosonde file has been selected.

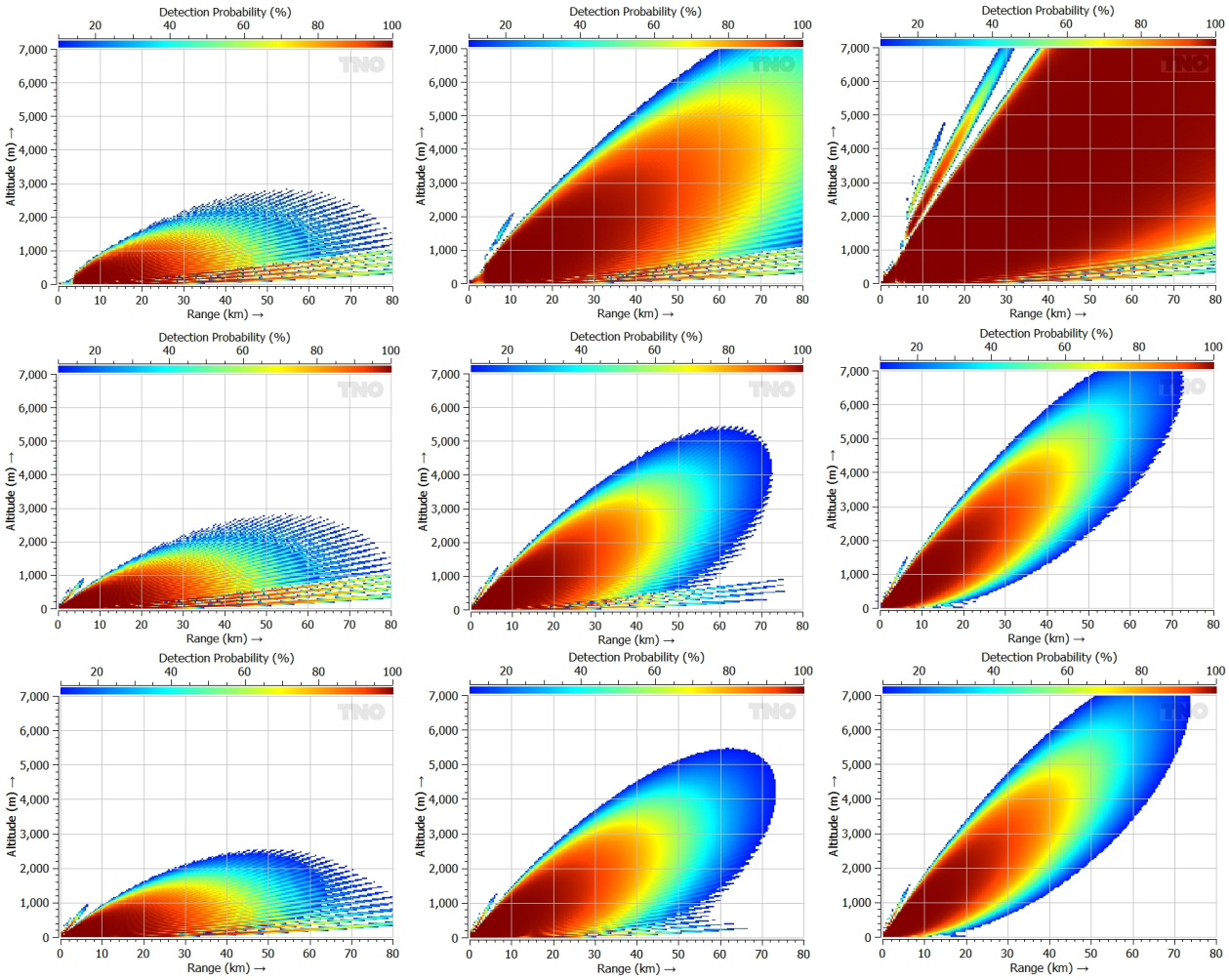

Figure 22: Detection probability diagrams. Left column: 0° tilt angle, middle column: 3° tilt angle, right column: 5° tilt angle. Top row: TERPEM-light prior to February 6th 2019, middle row: TERPEM-light since February 6th 2019, bottom row: EREPS-like.

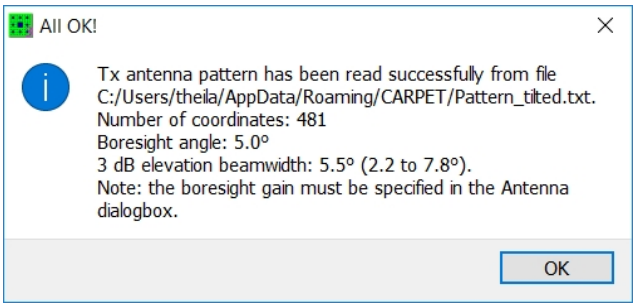

Figure 23: Infobox that appears when an antenna pattern has been imported.

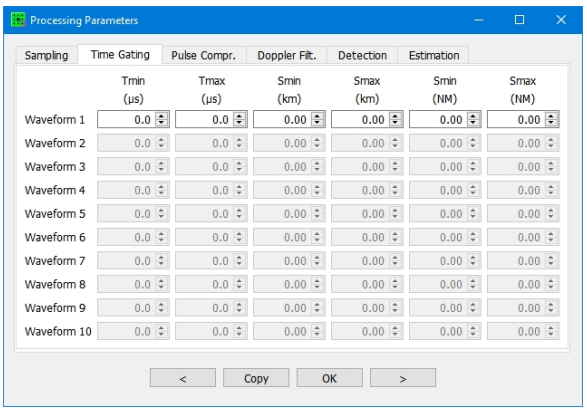

Figure 24: Time gating pane of the Processing dialogbox.

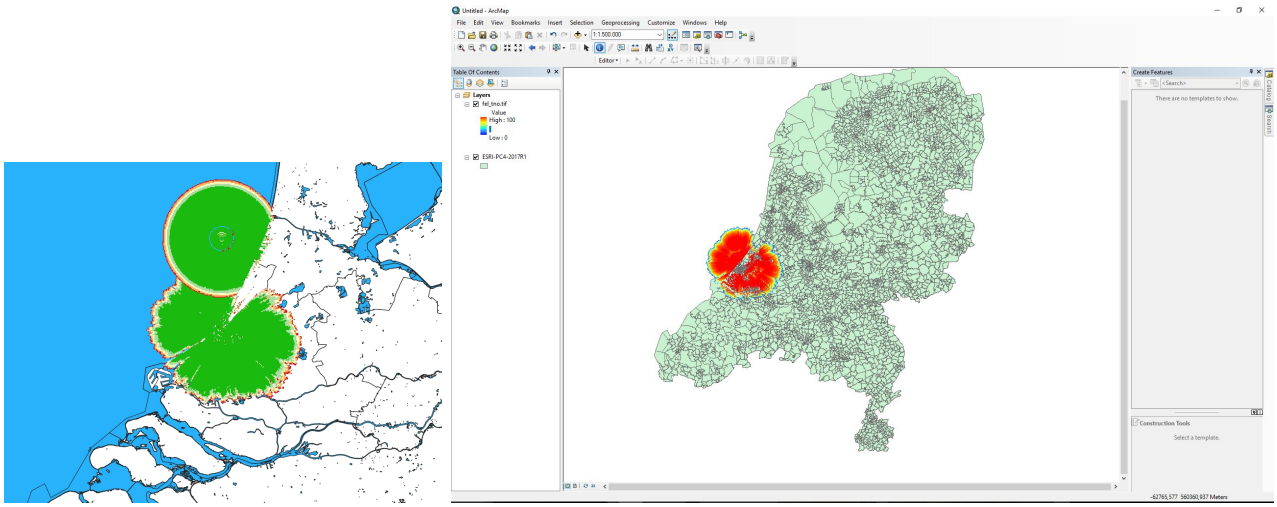

Figure 25: CARPET output imported in Quantum GIS (left) and in ArcGIS (right).

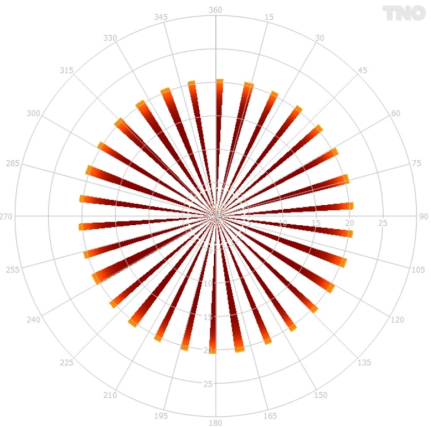

Figure 26: PPI-view diagram 'in the make' on a PC with 2 processors, 20 cores and 40 logical processors. CARPET is able to distribute the processing load over 30 cores.

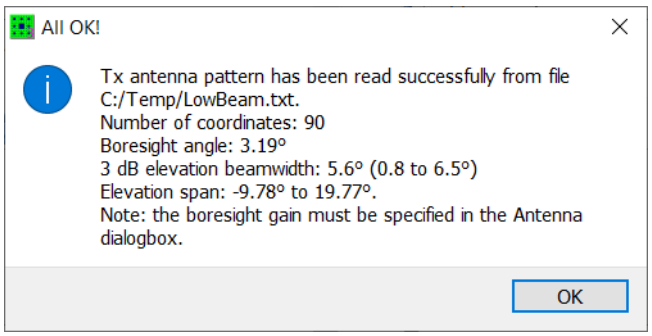

Figure 27: Infobox that appears when an antenna pattern has been imported.

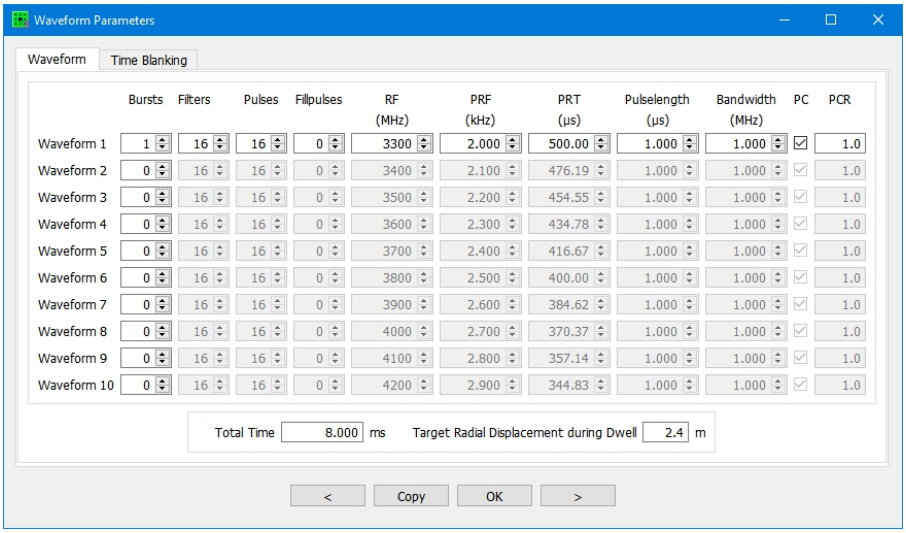

Figure 28: Transmitter dialogbox showing Number of Filters editboxes.

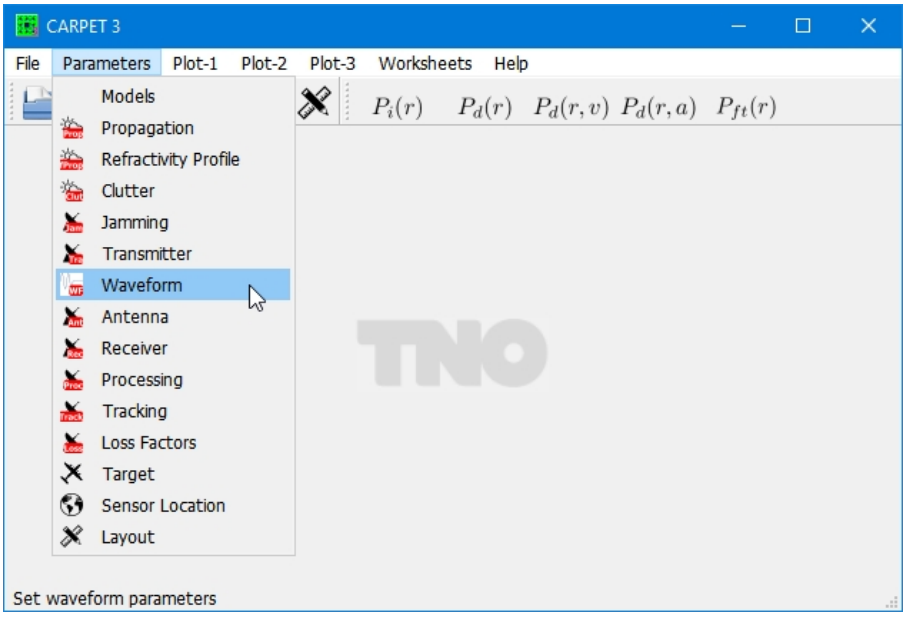

Figure 29: The pulldown menu that leads to the waveform dialogbox.

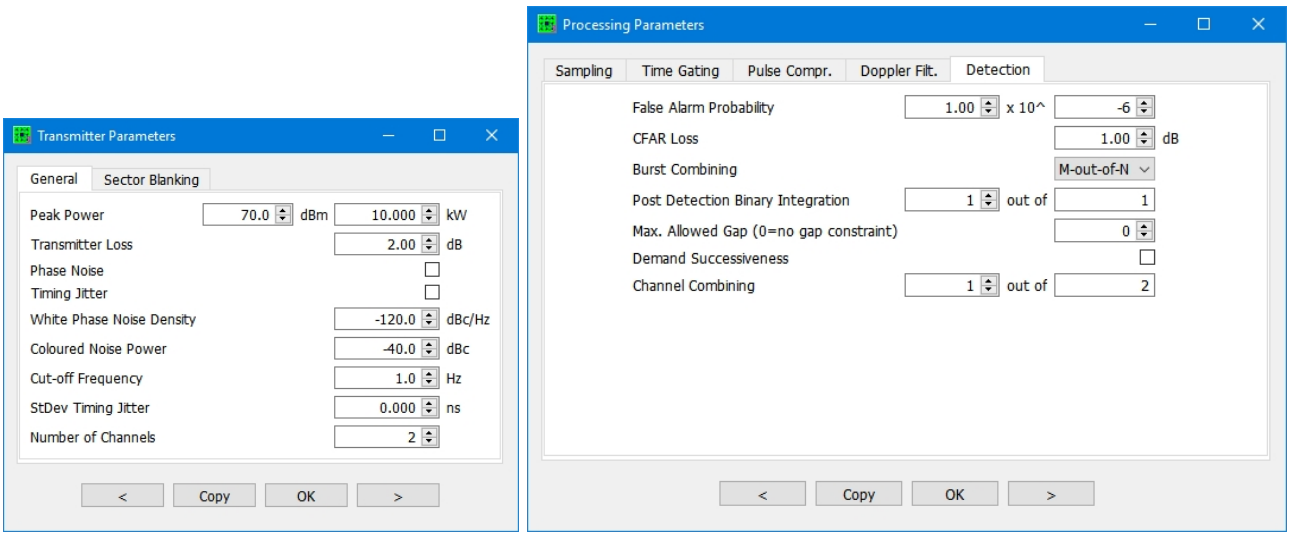

Figure 30: Left: The Transmitter dialogbox revealing the new parameter 'Number of Channels'. Right: The Processing - Detection dialogbox revealing the new Channel Combining parameter.

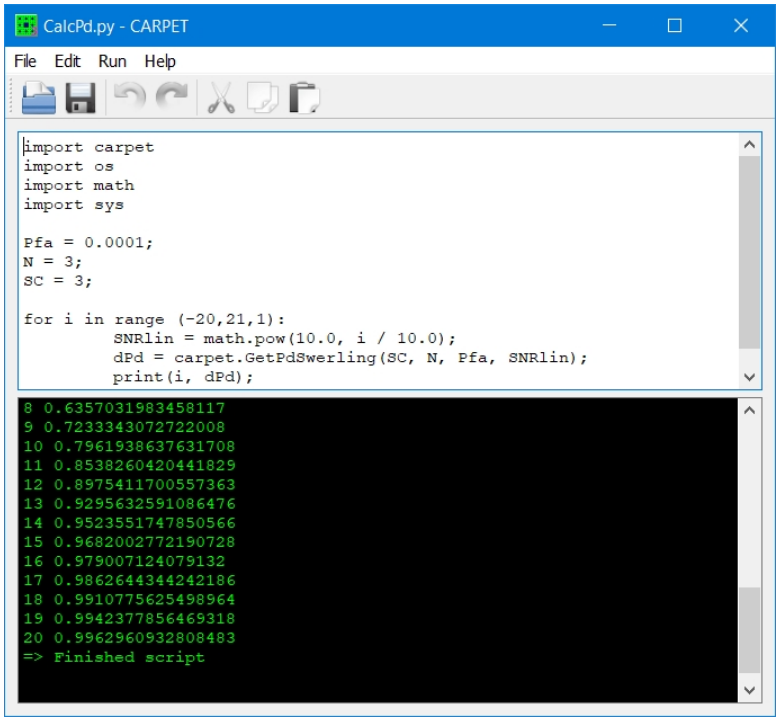

Figure 31: Python program that reveals the usage of function `GetPdSwerling`.

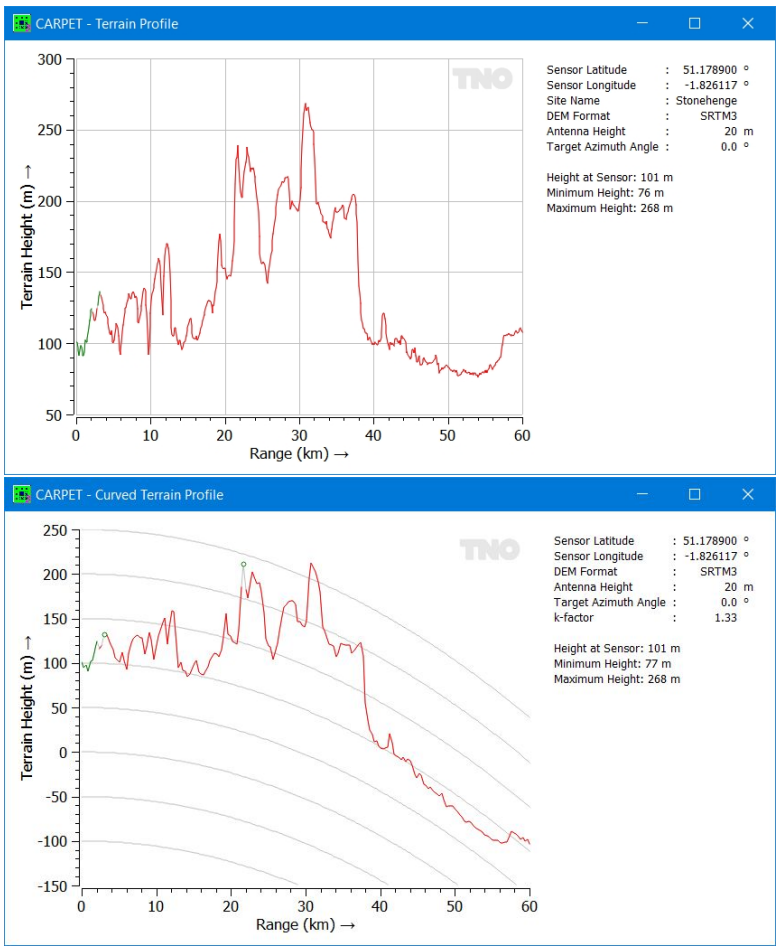

Figure 32: Straight (top) and curved (bottom) terrain profile.

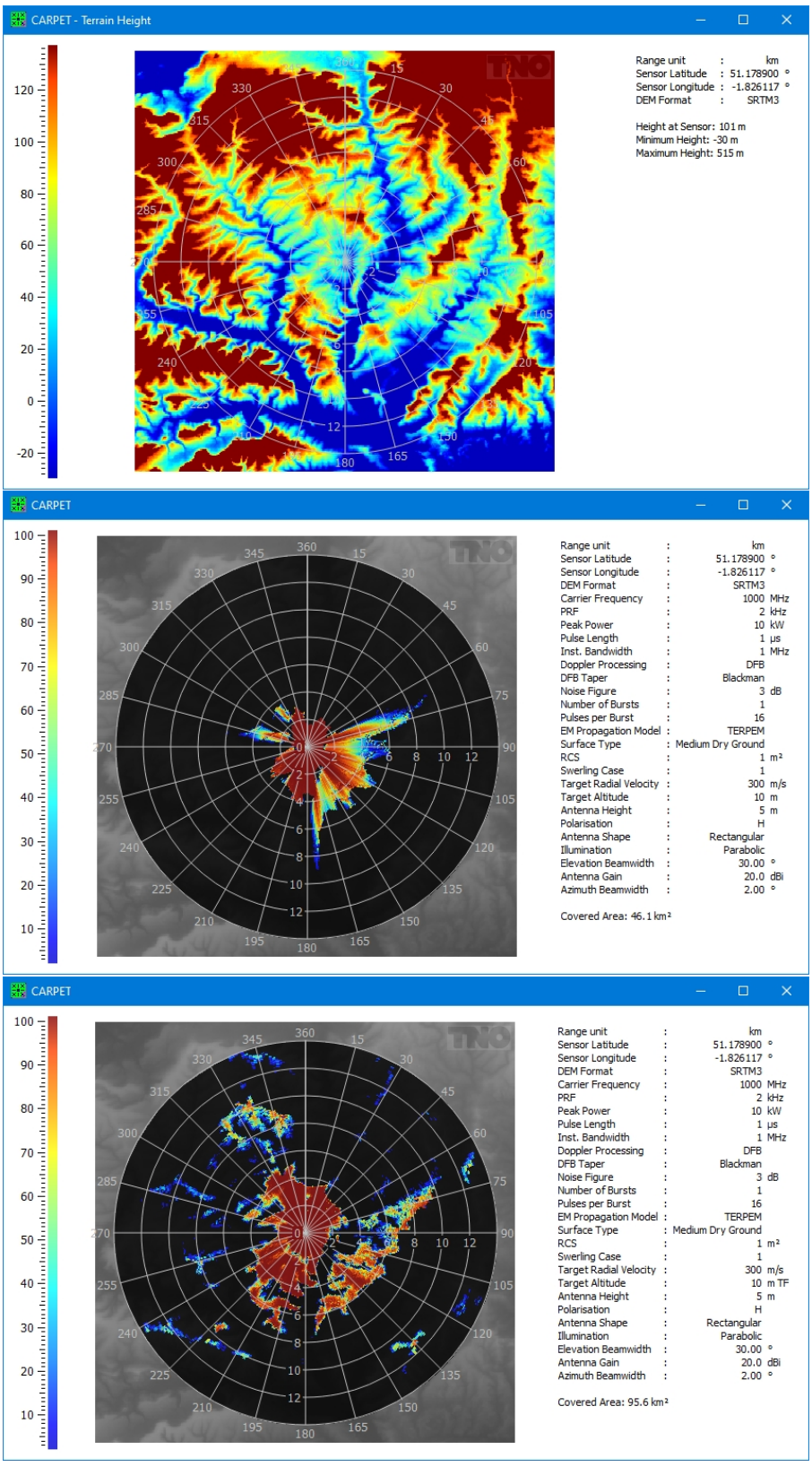

Figure 33: Top: terrain height diagram. Middle: Detection probability for a target that travels at a fixed altitude, *i.e.*, 10 m above the terrain at the location of the sensor. Bottom: Detection probability for a target that travels 10 m above the terrain ('terrain following'). Note the 'TF' suffix in the legend at Target Altitude.

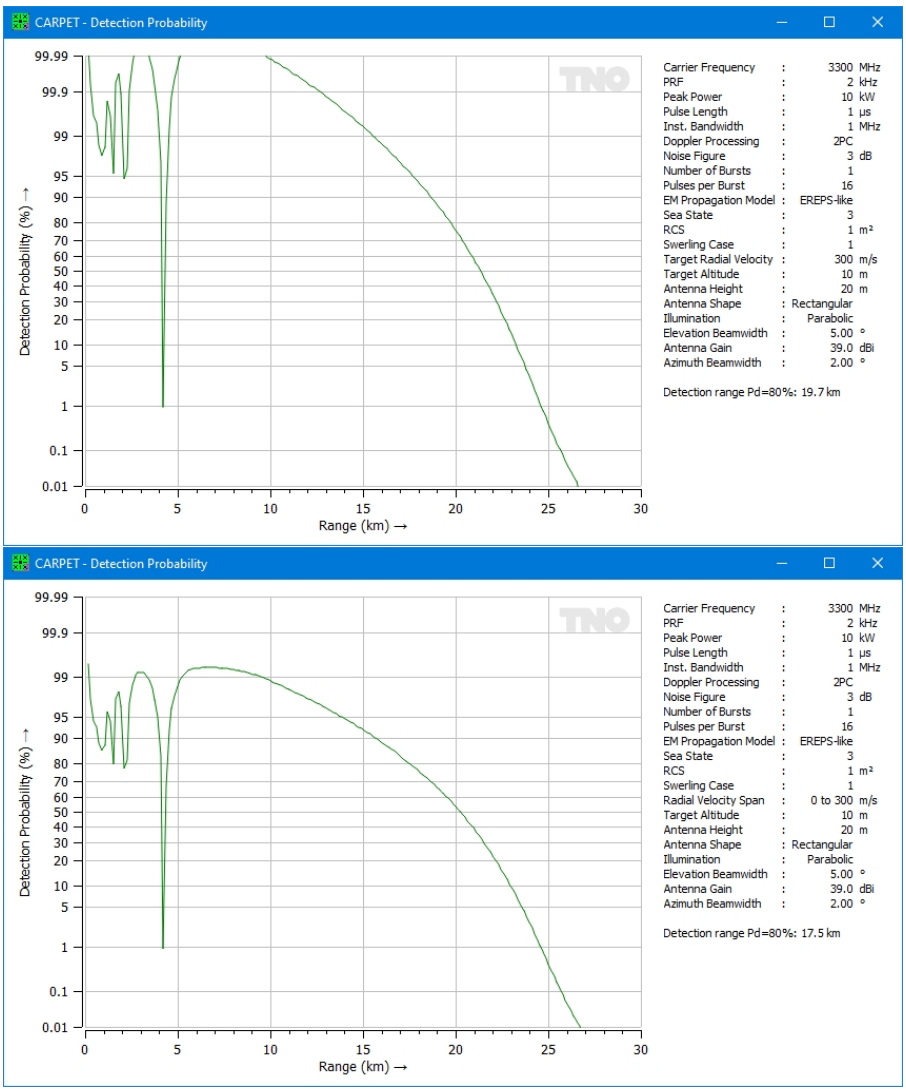

Figure 34: Top: Single dwell detection probability versus range, for a fixed radial velocity (300 m/s). Bottom: Single dwell detection probability versus range, averaged over radial velocity. The velocity span is from 0 to 300 m/s, as indicated in the legend.

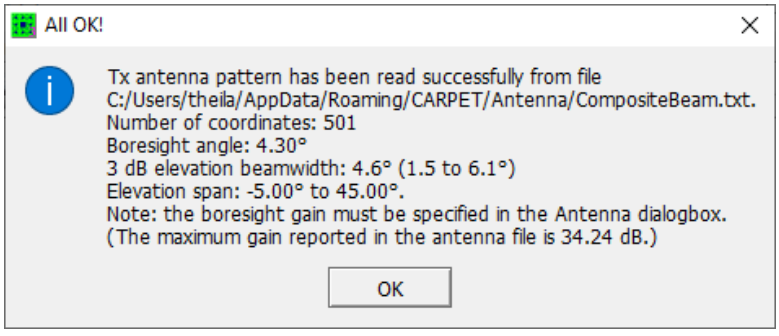

Figure 35: Dialogbox that provides feedback of the imported antenna pattern.

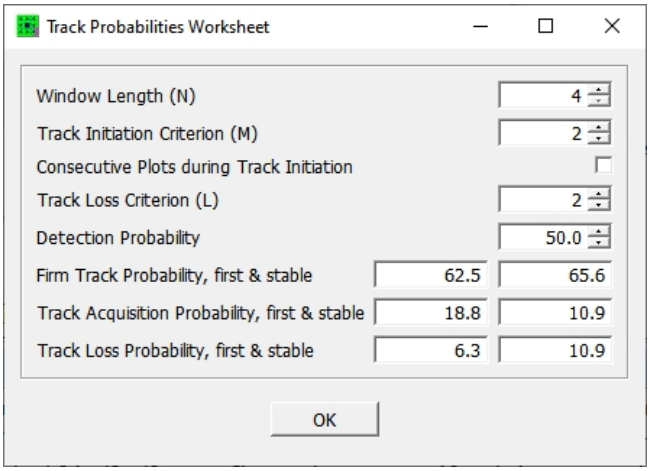

Figure 36: Track Probabilities worksheet.

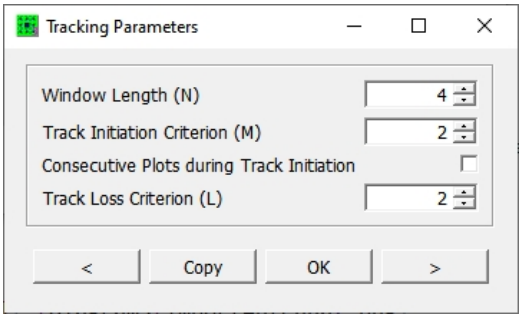

Figure 37: Tracking Parameters dialogbox.