**Program Name:**

PETOOL v2.0 (Parabolic Equation Toolbox v2.0)

**Licensing Provisions:**

GNU General Public License 3

**Program Description:**

A MATLAB-based one-way and two-way split-step parabolic equation software tool (PETOOL) with a user-friendly graphical user interface (GUI) for the analysis and visualization of radio-wave propagation over variable terrain and through homogeneous and inhomogeneous atmosphere.

**Program Development:**

The program has been developed in MATLAB Release R2019a (version 9.6), and has been tested on Windows 7 and 10.

“Partial Differential Toolbox”, “Curve Fitting Toolbox” and “Mapping Toolbox” are REQUIRED to run the program.

**Installation:**

1. Install MATLAB (http://www.mathworks.com/) Release R2017a or higher on your system to run the program.
2. Extract the file “PETOOL\_v2.zip” to your hard disk.
3. Run MATLAB software and choose the folder you have initially extracted PETOOL.
4. To run PETOOL, type **petool** in the MATLAB command window, or open **petool.m** with MATLAB editor and press F5.
5. Click the 2D or 3D analysis button on the small window opened after running the PETOOL. Depending on your choice, the main window of 2D or 3D analysis will appear.
6. Enter the input parameters and click “Run” button to start the analysis.

**\*\*\*\*\*** Please read the papers about the first and second versions and the user manual carefully before using the program. **\*\*\*\*\***

**What's New in v2.0:**

1. Several evaporation duct models have been developed.
2. Real atmosphere data have been included in the form of “Binary Universal Form for Representation (BUFR)” data.
3. Real terrain data have been incorporated into the toolbox in the form of “Digital Terrain Elevation Data (DTED)”.
4. A special add-on has been developed to generate a 3D coverage map of propagation factor/loss on real terrain data.

**Important Remark:**

The names of the directories (“User\_Files” directory and its sub-directories, and “Maps” directory) must not be changed at all.

**Journal Reference of the Previous Version:**

O. Ozgun, G. Apaydin, M. Kuzuoglu, and L. Sevgi, PETOOL: MATLAB-based one-way and two-way split-step parabolic equation tool for radiowave propagation over variable terrain, Computer Physics Communications 182 (2011) 2638–2654.

**Description of Files/Subdirectories in the Main Directory:**

|  |  |
| --- | --- |
| **File name(s)** | **Description** |
| petool.m | Main file to run PETOOL |
| mainwindow.m & .fig | Files that open the main window for 2D analysis |
| mainwindow2.m & .fig | Files that open the main window for 3D analysis |
| aboutgui.m & .fig | Files that open the “About” window to show the version number and contact info |
| Analysis\_Parameter.m & .fig | Files that open the window to enter angle parameters in 3D analysis |
| BUFR\_generation.m & .fig | External program that generates BUFR data |
| bulk.p | Function that computes bulk parameters in evaporation duct models (used in Evaporation\_Duct\_Models.p) |
| closereq\_mainwindow | Script that deletes internally used data files upon exiting |
| Coordinates.m & .fig | Files that open the window to enter initial and final coordinates on DTED map |
| createbufr.m | Function that is used in BUFR\_generation.m |
| duct\_params\_gui.m & .fig | Files that open the window to enter M-altitude pair in duct definition |
| elevated\_duct\_gui.m & .fig | Files that open the window to define the elevated duct |
| evaporation\_duct\_gui.m & .fig | Files that open the window to define the evaporation duct |
| Evaporation\_Duct\_Models.p | Function that computes the M profile and evaporation duct height using the evaporation duct models |
| filesave.m | Function that checks the values of the parameters during saving |
| fill\_duct\_window.m | Function that fills the parameter spaces in Atmosphere Parameters panel by using the data created by duct definition windows |
| gui\_crosshair.m | GUI interface for reading (x,y) values from a plot |
| gui\_height.m & gui\_plot\_height.m | Functions that are used to plot the propagation factor (or path loss) versus height (altitude) for a given range |
| gui\_range.m & gui\_plot\_range.m | Functions that are used to plot the propagation factor (or path loss) versus range for a given height (altitude) |
| guimousevalue.m | Function that finds the current point on the Cartesian plot when the user moves the mouse over the plot |
| guimousevalue\_polarplot.m | Function that finds the current point on the polar plot when the user moves the mouse over the plot |
| image\_gui.m & .fig | Files that open a figure window during .tiff file saving |
| polarPcolor.m | Function that plots a pseudocolor plot of matrix Z for a vector radius R and a vector angle theta |
| range\_angle\_plotanalysis.m & .fig | Files that open a window for azimuthal coverage map at an altitude |
| readbufr.m | Function that is used in evaporation duct window to read BUFR data |
| SSPE\_function.m | Main function that implements one-way and two-way SSPE algorithms |
| standard\_gui.m & .fig | Files that open the window to define the standard atmosphere |
| surface\_based\_duct\_gui.m & .fig | Files that open the window to define the surface based duct |
| surface\_gui.m & .fig | Files that open the window to define the surface duct |
| terrain\_gui2.m & .fig | Files that open the window to enter the range value for terrain definition |
| terrainparams\_gui.m & .fig | Files that open the window to enter the range-altitude pair for terrain definition |
| user\_defined\_duct\_gui.m & .fig | Files that open the window to define the user defined duct |
| warning\_gui.m & .fig | Files that open the warning window |
| defaultinputs.mat & inputfigs.mat | Data files that store default input values and image files |

“Maps” directory is used to store DTED files. The map for Turkey is provided by default.

“User\_Files” directory is used to store user files.

“MANUAL” directory includes the manual files, the readme file, the license file and two movie files that show the usage of PETOOL.

**Contact:**

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