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User Guide for downloading, installing, and running ANISOtime

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I. Guide for Windows users

1. Verify that you have the most recent version of Java installed on your machine

- a) If you don't already have Java on your machine, search for "Download Java" and download and install it.
- b) If you already have Java on your machine, go to the Java tab on your start menu, click to expand it, and click "update" to verify that Java is up to date.

NOTES:

- (1) This [page](#) provides useful information on Java.
- (2) The responsibility for supporting the free run-time environment for Java users is scheduled to shift from Oracle Corp. to an independent organization, and the details are not yet firmed up, but we are assuming that there will be continuing ongoing support.

2. Download and install ANISOTIME

- a) Download the "batch version of ANISOTIME for Windows" [here](#). It will be saved to the folder your browser defaults to, which will probably be the \DOWNLOAD folder. If you have previously downloaded one or more copies of the same or an earlier version of this file it may be saved with the name anisotime(1).bat or anisotime(2).bat, etc.
- b) Navigate to the place where the downloaded file is stored, either by using File Explorer, or using the download list of your browser, and open the folder where the download was stored.
- c) It is not essential, but for purposes of simplicity we assume in the following that i) you will move the anisotime.bat icon to your desktop; (ii) you will delete all old versions (if any) and change the file name to anisotime.bat if it is named something else (e.g., anisotime(1).bat). If you want to store it somewhere else, or to name it something else, the modifications to the following should be straightforward.

NOTE: In case you need it, here is a [link](#) to the top page of the download site for ANISOtime.

3. Launching ANISOtime in GUI mode

- a) Double click on the anisotime.bat icon to launch ANISOtime in GUI (graphical user interface) mode. The first time you launch ANISOtime (and the first time you launch each update) you will be asked to accept an End User Licensing Agreement (EULA).
- b) The first time you run ANISOtime it will download travel time catalogs for three Earth models: PREM (transversely isotropic), isotropic PREM, and AK135. We will assume from now on that the user is named "bill." The catalogs will be stored in the AppData folder for this user, namely C:\users\bill\AppData\Roaming\Kibrary\Share. If you want to look at these files using FileExplorer, you may have to select the "show hidden files" option.

NOTE: If your machine doesn't have enough memory (this shouldn't be a problem on newer machines) clicking on the ANISOtime icon will result in the program stopping almost immediately with an error message like "Error occurred during initialization of VM; Could not reserve

enough space for 2097152KB object heap” displayed. If this happens to you please use a newer machine that has more memory.

c) Using ANISotime in GUI mode: It should be clear how to set the sliders to select the model, phases, etc., etc., that you want. Having selected, then click COMPUTE. If you want to save the results click SAVE. You can store the files in a folder of your choosing. The format of the various output files is described in [APPENDIX D](#) of this manual.

4. Running ANISotime in CLI mode

a) First open a command prompt window. The easiest way to do this is to click the WINDOWS key on your keyboard (usually, third from left in the bottom row of keys, but this may vary), and enter 'cmd' into the search window.

b) Assuming the command prompt window has opened in the folder c:Users\bill, type “cd desktop” to get to the folder where anisotime.bat is located.

c) If you then type “anisotime” (i.e., with no arguments) then you can launch ANISotime in GUI mode.

d) The following is an example of a CLI command. You should be able to copy it into the command prompt window on your own machine and run it.

```
anisotime -h 10 -mod prem -deg 60
```

This command computes values for raypaths with epicentral distance of 60 deg from an event (depth 10 km) for the anisotropic PREM structure. If you want the output to be redirected to the file “hoge.txt” type “> hoge.txt” at the end of the above command line, i.e.,

```
anisotime -h 10 -mod prem -deg 60>hoge. txt
```

The output file hoge.txt can be used as the input file to other programs, such as Excel, for example. Adding “>hoge.txt” at the end of a command line can be used with any ANISotime command, including all of the following. We do not repeat this explicitly below.

e) Examples of command lines, with explanations of what they do, are given in [APPENDIX A](#) of this manual.

5. Updates of ANISotime

The program will check for updates every time it is launched and will automatically download and install the latest version if a new version is available. The user will be asked to accept the End User License Agreement (EULA) the first time they launch ANISotime and if the EULA is ever modified, but the original EULA otherwise also applies to all updates unless it is explicitly changed.

6. Questions and bug reports

The authors welcome questions and bug reports to ut-globalseis@googlegroups.com and will respond if possible, but make no legally binding promise to do so. Please use the title “ANISotime help” in your email.

II. Guide for macOS users

1. Verify that you have the most recent version of Java installed on your machine

- a) If you don't already have Java on your machine, search for "Download Java" and download and install it.
- b) If you already have Java on your machine, go to the Java tab on your start menu, click to expand it, and click "update" to verify that Java is up to date.

NOTES:

- (1) This [page](#) provides useful information.
- (2) The responsibility for supporting the free run-time environment for Java users is scheduled to shift from Oracle Corp. to an independent organization, and the details are not yet firmed up, but we are assuming that there will be continuing ongoing support.

2. Download and install ANISotime

- a) Download "ANISotime for macOS" [here](#). It will be saved to the folder your browser defaults to, which will probably be the ~/Downloads folder. If you have previously downloaded one or more copies of the same or an earlier version of this file it may be saved with the name anisotime(1), or anisotime(2), etc.
- b) Open the 'Terminal' app, and navigate to the place where the downloaded file is stored by typing `cd ~/Downloads` (or replacing ~/Downloads by the path to the folder where the file is stored).
- c) From the 'Terminal' app, change the user permissions of the file by typing `chmod +x anisotime`.

NOTE: In case you need it, here is a [link](#) to the top page of the download site for ANISotime.

3. Launching ANISOTIME in GUI mode

- a) From the 'Terminal' app, type `./anisotime`
- b) The first time you run ANISOTIME, a new directory ~/Kibrary will be created in your home folder, in which the raypath catalogs will be stored. ANISotime includes three standard Earth models: PREM (transversely isotropic), isotropic PREM, and AK135. When you compute the travel time for a standard Earth model for the first time, ANISotime will download the corresponding raypath catalog, and store it in ~/Kibrary/share/.
- c) Using ANISOTIME in GUI mode: It should be clear how to set the sliders to select the model, phases, etc., etc., that you want. Having selected, then click COMPUTE. If you want to save the results click SAVE. You can store the files in a folder of your choosing. The format of the various files is described on the GITHUB download page.

4. Running ANISOTIME in CLI mode

a) From the 'Terminal' app, type `./anisotime` followed by command line options.

b) The following is an example of a CLI command. You should be able to copy it into the command prompt window on your own machine and run it.

```
anisotime -h 10 -mod prem -deg 60
```

This command computes values for raypaths with epicentral distance of 60 deg from an event (depth 10 km) for the anisotropic PREM structure. If you want the output to be redirected to the file "hoge.txt" type "> hoge.txt" at the end of the above command line, i.e.,

```
anisotime -h 10 -mod prem -deg 60>hoge. txt
```

The output file hoge.txt can be used as the input file to other programs, such as Excel, for example. Adding ">hoge.txt" at the end of a command line can be used with any ANISotime command, including all of the following. We do not repeat this explicitly below.

c) Examples of command lines, with explanations of what they do, are given in [APPENDIX A](#) of this manual.

5. Updates of ANISotime

The program will check for updates every time it is launched and will automatically download and install the latest version if a new version is available. The user will be asked to accept the End User License Agreement (EULA) the first time they launch ANISotime and if the EULA is ever modified, but the original EULA otherwise also applies to all updates unless it is explicitly changed.

6. Questions and bug reports

The authors welcome questions and bug reports to ut-globalseis@googlegroups.com and will respond if possible, but make no legally binding promise to do so. Please use the title "ANISotime help" in your email.

III. Guide for Unix/Linux users

1. Verify that you have the most recent version of Java installed on your machine

- a) If you don't already have Java on your machine, search for "Download Java" and download and install it.
- b) If you already have Java on your machine, go to the Java tab on your start menu, click to expand it, and click "update" to verify that Java is up to date.

NOTES:

- (1) This [page](#) provides useful information.
- (2) The responsibility for supporting the free run-time environment for Java users is scheduled to shift from Oracle Corp. to an independent organization, and the details are not yet firmed up, but we are assuming that there will be continuing ongoing support.

2. Download and install ANISOtime

- a) Download "ANISOtime for Linux" [here](#). It will be saved to the folder your browser defaults to, which will probably be the ~/Downloads folder. If you have previously downloaded one or more copies of the same or an earlier version of this file it may be saved with the name anisotime(1), or anisotime(2), etc.
 - b) Open the 'Terminal' app, and navigate to the place where the downloaded file is stored by typing `cd ~/Downloads` (or replacing ~/Downloads by the path to the folder where the file is stored).
 - c) From the 'Terminal' app, change the user permissions of the file by typing `chmod +x anisotime`.
- NOTE: In case you need it, here is a [link](#) to the top page of the download site for ANISOtime.

3. Launching ANISOTIME in GUI mode

- a) From the 'Terminal' app, type `./anisotime`
- b) The first time you run ANISOTIME, a new directory ~/Kibrary will be created in your home folder, in which the raypath catalogs will be stored. ANISOtime includes three standard Earth models: PREM (transversely isotropic), isotropic PREM (isotropic), and AK135. When you compute the travel time for a standard Earth model for the first time, ANISOtime will download the corresponding raypath catalog, and store it in ~/Kibrary/share/.
- c) Using ANISOTIME in GUI mode: It should be clear how to set the sliders to select the model, phases, etc., etc., that you want. Having selected, then click COMPUTE. If you want to save the results click SAVE. You can store the files in a folder of your choosing. The format of the various files is described on the GITHUB download page.

4. Running ANISOTIME in CLI mode

a) From the 'Terminal' app, type `./anistime` followed by command line options.

b) The following is an example of a CLI command. You should be able to copy it into the command prompt window on your own machine and run it.

```
anistime -h 10 -mod prem -deg 60
```

This command computes values for raypaths with epicentral distance of 60 deg from an event (depth 10 km) for the anisotropic PREM structure. If you want the output to be redirected to the file "hoge.txt" type "> hoge.txt" at the end of the above command line, i.e.,

```
anistime -h 10 -mod prem -deg 60>hoge. txt
```

The output file hoge.txt can be used as the input file to other programs, such as Excel, for example. Adding ">hoge.txt" at the end of a command line can be used with any ANISotime command, including all of the following. We do not repeat this explicitly below.

c) Examples of command lines, with explanations of what they do, are given in [APPENDIX A](#) of this manual.

5. Updates of ANISotime

The program will check for updates every time it is launched and will automatically download and install the latest version if a new version is available. The user will be asked to accept the End User License Agreement (EULA) the first time they launch ANISotime and if the EULA is ever modified, but the original EULA otherwise also applies to all updates unless it is explicitly changed.

6. Questions and bug reports

The authors welcome questions and bug reports to ut-globalseis@googlegroups.com and will respond if possible, but make no legally binding promise to do so. Please use the title "ANISotime help" in your email.

APPENDIX A—Examples of Command Line Interface (CLI) usage

Here are some examples of command lines, with explanations of what they do.

#Ex-1 `anisotime -h 10 -mod prem -deg 60`

This command computes values for raypaths with an epicentral distance of 60 deg from an event with source depth 10 km for the anisotropic PREM structure.

#Ex-2 `anisotime -h 10 -mod prem -deg 10 -ph P`

This command computes values for P phase at an epicentral distance of 10 deg from an event (depth 10 km) for the anisotropic PREM structure.

#Ex-3A `anisotime -h 30 -mod prem -deg 30 -ph S -SH`

This command computes values for S phase raypaths at an epicentral distance of 30 deg from an event (depth 30 km) for the anisotropic PREM structure. The “-ph S -SH” option means that the values computed are for quasi-SH waves.

#Ex-3B `anisotime -h 30 -mod prem -deg 30 -ph S -SV`

The same as #Ex-3A except that the “-ph S -SV” option means that the values computed are for quasi-SV waves.

#Ex-4 `anisotime -h 30 -mod iprem -deg 100 -ph Pdiff`

This command computes values for Pdiff phase at an epicentral distance of 100 deg from an event (depth 30 km) for the isotropic PREM structure.

#Ex-5 `anisotime -h 30 -mod iprem -deg 30 -ph P, S`

This command computes values for P and S phases at an epicentral distance of 30 deg from an event (depth 30 km) for the isotropic PREM structure.

#Ex-6 `anisotime -h 30 -mod iprem -ph ScS -rs 30, 50, 1 -o scs.rcs`

This command creates a file scs.rcs which includes record section values for the ScS phase at epicentral distances from 30 to 50 deg with an interval of 1 deg, for an event (depth 30 km) for the isotropic PREM structure.

#Ex-7 `anisotime -h 30 -mod iprem -deg 220 -ph PKJKP`

This command computes values for the PKJKP phase at an epicentral distance of 220 deg from an event (depth 30 km) for the isotropic PREM structure.

#Ex-8 `anisotime -h 30 -mod iprem -deg 30 -ph P, S -eps -o out`

This command creates raypath figures in the folder out (under the same folder where anisotime.bat is stored, say, DESKTOP) for P and S phases with an epicentral distance of 30 deg from an event (depth 30 km) for the isotropic PREM structure.

#Ex-9A `anisotime -mod miasp91_aniso.poly`

This create a new raypath catalog from the Polynomial Structure file “miasp91_aniso.poly”

#E-9B `anisotime -mod miasp91_aniso.nd`

This create a new raypath catalog from the Named Discontinuity structure file “miasp91_aniso.nd”

#Ex-10 `anisotime -help`

This command shows a full list of all options

APPENDIX B—Complete List of Command Line Arguments

- -dec Number of decimal places for output.
- -deg Epicentral distance Δ [deg].
- -h Depth of source [km] (default:0)
- -mod Structure (default:prem)
- -help Prints the usage. This option has the highest priority.
- -ph, --phase Seismic phases (default:P,PCP,PKiKP,S,ScS,SKiKS)
- -p Ray parameter
- -v, --version Shows information of the tool. This option has the 2nd highest priority.
- -SH Computes travel time for SH (default:SH)
- -SV Computes travel time for SV (default:SH)
- -dD Parameter for a catalog creation ($d\Delta$).
- -dR Integral interval [km] (default:10.0)
- -eps output path figure
- -o Directory for a record section. It must not exist before the launch.
- --delta show only epicentral distances
- --rayp show only ray parameters
- --time show only travel times
- -rc, --read-catalog Path of a catalog for which travel times are computed.
- -rs, --record-section start,end[,interval) [deg] Computes a table of a record section for the range.

APPENDIX C—Example input files for catalog creation for new models

A detailed description of the Polynomial Structure and Named Discontinuity Structure file formats can be found in the electronic supplement of the ANISOtime paper.

Example 1: Polynomial Structure mode: [miasp_aniso.poly](#)

Example 2: Named Discontinuity Structure mode: [miasp_aniso.nd](#)

APPENDIX D—Format of output files

CLI output

The format for the standard ANISotime CLI output (e.g., for commands #Ex-1 to #Ex-5 and #Ex-7 in [APPENDIX A](#)) is as follows:

Phase name	Ray parameter (s/deg)	Distance (deg)	Travel time (s)
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Record Section file

The format of the output for a record section file (e.g., for command #Ex-6 in [APPENDIX A](#)) is the same as the CLI output (above).

