NAME

dbpick – waveform review, pick arrivals, and edit a CSS relational database

SYNOPSIS

dbpick [–sc *sta:chan***] [–ts** *tstart***] [–te** *tend***] [–tw** *twin***] [–noexist] [–nostarttalk] [–winfile** *winfile***] [–gaps** {*segment|zero|interp|none*}**]** *dbname*

DESCRIPTION

dbpick is an X-windows based interactive graphical program for displaying seismic waveforms, analyst picked phase arrivals and temporary predicted arrivals. **dbpick** also provides functionality for creating and/or editing phase arrivals. The data must be represented in a CSS (Center for Seismic Studies) relational database implemented as a set of ASCII flat files, each file corresponding to one of the CSS relations. Currently the program will work only with version 3.0 of the database schema. Editing causes immediate changes to the database flat files without copying to new files.

COMMAND LINE ARGUMENTS

dbname The name of the subject database. The database name is defined as the name of one of the flat relation files without the .relname suffix. For example, if the .wfdisc relation file name is ./foo.wfdisc then ./foo is the database name. This argument is required and must be the last argument in the command line.

–sc *sta:chan*

A station-channel sift key. This argument specifies the subset of station-channel data streams that will be available for analysis. This argument is optional and if it is not specified, then all station-channel values will be used. The asterisk (∗) character can be used in place of either *sta* or *chan* which matches anything. Thus -sc AAK:∗ would mean all channels for station AAK or -sc ∗:HHZ would mean all stations for channel HHZ. In addition, normal UNIX regular expression matching is used to match strings (ala ed or ex, so that -sc A..:..Z, for example, would match all 3-character channel codes ending in Z and all 3-character station codes beginning with A). The user should take care to deal properly with the shell interpreter when using the various metacharacters, as they can be substituted before program execution. If using the C-shell, a safe way to handle this is to place *sta:chan* between single quotes as follows: **–sc** *'sta:chan'*

–ts *tstart* A data sift start time. This argument specifies the subset of arrivals and waveform segments that will be available for analysis. Only arrivals and waveform segments with time later than *tstart* will be used. This argument is optional and if it is not specified, then waveform segment and arrival times will not be subject to start time sifting. The start time, *tstart*, can be specified in several different ways:

1. An epoch time in seconds since 00:00:00 1 Jan 1970 GMT.
2. A character string in 'year:month:day:hour:minute:second' form.
3. A character string in 'julianday:hour:minute:second' form.

–te *tend* A data sift end time. This argument specifies the subset of arrivals and waveform segments that will be available for analysis. Only arrivals and waveform segments with time earlier than *tend* will be used. This argument is optional and if it is not specified, then waveform segment and arrival times will not be subject to start time sifting. The end time, *tend*, can be specified in several different ways:

1. An epoch time in seconds since 00:00:00 1 Jan 1970 GMT.
2. A character string in 'year:month:day:hour:minute:second' form.
3. A character string in 'julianday:hour:minute:second' form.

–tw *twin* An initial time window in seconds for displaying the data. This argument is optional and, if not specified, a default time window is used.

–noexist A waveform existence flag. If this flag is given in the command line, then all station-channel streams will be displayed even those for which there are no existing waveform .w files.

–nostarttalk Disable startup dialog flag. If this flag is given in the command line, then the default startup dialog is omitted and the program goes immediately into interactive display mode. The startup dialog consists of a summary printout of the station-channels to be displayed, a prompt to determine if the user wants to look at the listed traces and a help printout explaining the interactive keyboard and mouse usage.

–winfile *winfile* A file into which will be written the main **dbpick** X-window id. This is used as a crude mechanism for broadcasting the **dbpick** X-window id for use in X-server based inter-process communication. This argument is optional and, if not specified, then the window id file is not created.

–gaps {*segment*|*zero*|*interp*|*none*}
Data gaps internal to waveform segments (typical for radio telemetered data) can be flagged for 2-byte integer and 4-byte integer data. The flagging is done by setting 2-byte data samples to the value 32767 and 4-byte data samples to the value 2147483647 which are the maximum integer values for the two formats. The way in which **dbpick** displays data gaps is determined by this argument. If this is specified as *segment*, then waveform data is re-segmented to elliminate internally flagged gaps (the gaps will appear as gaps on the display). If this is specified as *zero*, then internally flagged gap values are set to zero before being displayed. If this is specified as *interp*, then internally flagged gap values are interpolated. If this is specified as *none*, then **dbpick** will not look for internally flagged gaps and the display will show the waveform segments in their original form. This argument is optional and, if not specified, then the default gap processing is *segment*.

RESOURCE DATABASE

This program makes use of the X11 resource database software and a number of program parameters can be set by the user through the use of X11 resource files. The user can specify these resource parameters either through the normal X-window resource path (in *.Xresource or .Xdefaults* file or any other file that is loaded with **xrdb**), or in special resource files with name *.dbpickrc* that are always loaded by **dbpick** at run time. The program first looks for *.dbpickrc* in the user's home directory and then in the current working directory. If *.dbpickrc* files reside in both directories, then the contents of both files are read with the file in the current working directory overwriting parameters from the file in the user's home directory. A typical *.dbpickrc* file would be as follows:

```
dbpick.traceWindow.twin:300.0
dbpick.filter1.label:         0.1 HP
dbpick.filter1.tpad:          100.0
dbpick.filter1.lcoFreq:       0.1
dbpick.filter1.lcoOrder:   3
dbpick.filter1.ucoFreq:       0.0
dbpick.filter1.ucoOrder:   0
```

The resource names and values are defined as follows.

Resource Name	**Value**
dbpick.foreground	The trace display foreground color (on color terminals only). This can be specified either in the normal X-window fashion (e.g. 'red', '#ff348a'), or as a hue-lightness-saturation floating point triad (e.g. '240.0 0.5 1.0' for pure blue).
dbpick.background	The trace display background color (on color terminals only). This is specified as with the trace display foreground color.
dbpick.arrival.foreground	The normal arrival flag foreground color (on color terminals only).

This is specified as with the trace display foreground color.

dbpick.arrival.background — The normal arrival flag background color (on color terminals only). This is specified as with the trace display foreground color.

dbpick.selArrival.foreground — The 'selected' arrival flag foreground color (on color terminals only). This is specified as with the trace display foreground color.

dbpick.selArrival.background — The 'selected' arrival flag background color (on color terminals only). This is specified as with the trace display foreground color.

dbpick.traceWindow.twin — The initial trace display time window in seconds.

dbpick.filter#.label — The pull-down menu label for the #th filter. The '#' character is an integer in the range of 1 to 11 and represents the filter number.

dbpick.filter#.tpad — The filter transient time in seconds for the #th filter. This is used to lead the requested time window so that the filter transient has had a chance to decay.

dbpick.filter#.lcoFreq — The filter lower cutoff frequency in Hertz for the #th filter. If this is 0.0, then the filter is low-pass.

dbpick.filter#.lcoOrder — The filter lower cutoff order for the #th filter. This is the number of poles used in the low-band stage of the Butterworth filter.

dbpick.filter#.ucoFreq — The filter upper cutoff frequency in Hertz for the #th filter. If this is 0.0, then the filter is high-pass.

dbpick.filter#.ucoOrder — The filter upper cutoff order for the #th filter. This is the number of poles used in the high-band stage of the Butterworth filter.

dbpick.phase#.name — The pull-down menu label for the #th phase code. This pull-down menu appears whenever the middle mouse button is pressed on a phase flag and is used to name the phase. The '#' character is an integer in the range of 1 to 8 and represents the phase code number.

PROGRAM INTERACTION

Upon initial startup the station-channel values after sifting are displayed, along with the total number of existing waveform data samples, and the user is queried about continuing. If the user answers 'n', then the program exits and the user can try different sifting keys. (This startup dialog is suppressed if the **-nostarttalk** flag is specified in the command line.) If the user answers 'y', then a summary help listing is printed, the data is displayed in a graphical window and the program goes into command input mode. Command input mode is indicated by the prompt *dbpick*> displayed in the original text window and whenever this prompt is displayed the user may either enter text commands at the prompt or interact directly with the various graphical display windows through the mouse and keyboard. The currently implemented text commands are as follows:

fw — Time scroll the display to the first existing waveform.

nw — Time scroll the display to the next existing waveform.

pw — Time scroll the display to the previous existing waveform.

fa — Time scroll the display to the first phase arrival with an existing waveform.

na — Time scroll the display to the next phase arrival with an existing waveform.

pa — Time scroll the display to the previous phase arrival with an existing waveform.

fe — Select the first event in the **origin** table and time scroll the display to the origin time of that event.

ne — Select the next event in the **origin** table and time scroll the display to the origin time of that event.

pe Select the previous event in the **origin** table and time scroll the display to the origin time of that event.

dw delete channels with no waveforms in the display.

tfit Toggle the time window fit mode. When time window fit mode is enabled, the trace display time window is automatically adjusted so that it exactly fits the waveform segments being currently displayed.

sfit Fit the trace display in the vertical station-channel direction. This causes all station-channels to be displayed.

sc *sta:chan* Display only those traces that match *sta:chan*. This is the keyboard equivalent of the **-sc** command option, except that all station-channel data streams remain available.

ts *time* Display the station-channel data streams starting at *time*. Time must be in one of the formats specified for the **-ts** command option.

tw *time* Change the primary display time window to *time* seconds.

ph *phase* Change the default phase code for newly created arrivals to *phase*.

gp {*segment*|*zero*|*interp*|*none*}
Change the gap processing. See the description of the **-gaps** command line argument.

oa *dbname* Open a secondary **arrival** database with name *dbname*. This can be used to display alternative phase arrivals from another database along with the arrivals in the primary database. The alternative arrivals are displayed as overlay arrivals in the same manner as predicted arrivals. These secondary arrivals are not available for editing.

oe *dbname* Open another database with name *dbname* that will provide the current event list from the **origin** table. By default the event list is taken from the **origin** table in the primary database, but the event list can be changed with this command. An example of this would be to open a PDE database to search for small events that might not have been picked and associated in the primary database.

se *orid* Select an event from the current event database by specifying the *orid* field in the **origin** table. If the event is found, then it becomes the current event and an event summary printout is listed.

sp *phase_list* Select a list of phases for the current event and display the predicted phase arrival times as overlay arrivals in the waveform displays. The *phase_list* is a comma separated list of phase codes, such as *P,S* or the key word *basic* can be used to select a large set of phases that covers just about everything. The software used to compute theoretical travel times is taken from the program **ttimes** as distributed by the IRIS DMC and the phase code specifications given here are identical to those that would be specified for **ttimes**.

tc *time_corr* A time correction in seconds that will be applied to overlay arrivals (either predicted travel times or from the secondary arrival database) before they are displayed. This can be used to time shift all overlay arrivals to get a better match with the data.

tse Time scroll the display window to the current event origin time.

ae Find an event in the current event database that associates with the arrivals in the primary display window. This will attempt to find the event which produces the minimum time residuals with the displayed arrivals. This is particularly useful for finding PDE events that associate with arrival picks.

sa *on*/*off* Show/hide arrival pick flags. If *on*, then the arrival flags are displayed and if *off*, then the arrival flags are not displayed.

soa *on*/*off* Show/hide overlay arrival flags. If *on*, then the overlay arrivals are displayed and if *off*, then the overlay arrivals are not displayed.

sw *on*/*off* Show/hide waveforms. If *on*, then the waveforms are displayed as normal wiggle plots and if *off*, then the waveforms are displayed as horizontal bars. This is useful for temporarily disabling the wiggle plot display of waveforms so that the display can be manipulated quickly. A typical use of this is to time fit the display over the entire database time range (which can be as long as a year) to produce a coverage chart.

cts *on*/*off* Display amplitude units in counts or physical units. If *on*, then the amplitude units are displayed in counts (or the raw units of the actual waveform sample values). If *off*, then the amplitude units are displayed in physical units of nanometers, nanometers/sec or nanometers/sec/sec.

help Display a list of available text commands.

quit Exit the program.

In addition to entering text commands at the command prompt, the user can also enter certain commands directly by typing single keys while the mouse pointer is in the graphical display window. These keys can be thought of as accelerators and for the most part they simply replace typing at the command prompt. The accelerator keys are as follows. (Note that some window managers may not allow this behavior by default. When using SUN's OpenLook window manager, olw or olwm, for instance, the line
OpenWindows.FocusLenience: True
must appear in the user's *.Xdefaults* file in order for the accelerator keys to work.)

F Time scroll the display to the first existing waveform. Same as 'fw' prompt command.

N Time scroll the display to the next existing waveform. Same as 'nw' prompt command.

P Time scroll the display to the previous existing waveform. Same as 'pw' prompt command.

f Time scroll the display to the first phase arrival with an existing waveform. Same as 'fa' prompt command.

n Time scroll the display to the next phase arrival with an existing waveform. Same as 'na' prompt command.

p Time scroll the display to the previous phase arrival with an existing waveform. Same as 'pa' prompt command.

e Select the next event in the **origin** table and time scroll the display to the origin time of that event. Same as the 'ne' prompt command.

t Toggle the time window fit mode. Same as the 'tfit' prompt command.

s Fit the trace display in the vertical station-channel direction. Same as the 'sfit' prompt command.

a Redraw the arrival flags.

r Repaint window.

R Redraw and repaint window.

All other commands and interaction take place directly within the graphical display windows. The main display window initially shows all of the selected station-channel data streams with phase arrival flags. Control buttons appear at the top of the window. The effects of mouse pointer and button events in the display windows depend on where the mouse is currently located.

The **Main Window** control buttons are as follows.

Traces Causes the trace display pull-down menu to appear. Items selected from this menu control how the traces are displayed on the window. See **Station Region** for information on selecting traces.

Select — Changes the display to contain the selected traces. If no traces were selected then the display will not change.

Delete — Changes the display to contain the unselected traces. If no traces were selected then the display will not change.

Original — Causes all traces to be displayed.

SelectAll — Selects every trace in the display.

DeleteAll — Unselects every trace in the display.

Zoom — Changes the display to show only the range of selected traces. The other traces are still part of the display, and may be reached with the scroll bar.

NewWin — Creates a new display window containing the selected traces.

If new display windows have been previously created, then they will appear as button items in this menu:

Window# — Puts the selected traces in the existing Window#.

Amp — Causes the amplitude scale mode pull-down menu to appear. Items selected from this menu control how trace amplitudes are scaled within the displayed.

Fixed — Fixes the trace amplitude scale to the current display. These scale factors remain unchanged as the display is modified.

Auto — Automatically scales each trace individually.

Auto0 — Automatically scales each trace individually while constraining zero amplitude to be in the middle of each trace display.

Auto1 — Automatically scales the first trace and uses that same scale factor for the other traces in the display.

AutoA — Searches for the largest peak to peak amplitude for all of the displayed traces, automatically scales that trace and uses that same scale factor for the other traces in the display.

AGC — Applies time varying automatic gain control to the displayed traces.

Clip Off/On — Toggles clipping mode. If clipping is on, then the display will clip outside of the trace display sub-window. (Note that this does not necessarily imply actual clipping of the data.) If clipping is off, then the waveform wiggles can overlap adjacent trace display sub-windows.

Invert — Reverses the polarity of all of the traces.

Gain=1 — Displays the traces at normal amplitude

Gain x N — Increases the current gain of the traces by N. Note that this is cumulative.

Gain / N — Decreases the current gain of the traces by N. Note that this is cumulative.

Filter — Causes the filter pull-down menu to be displayed. Items selected from this menu control which, if any, filter is applied to the data before it is displayed. The filter parameters can be defined through the X11 resource files described previously.

None — Displays the traces without any filtering.

Freq **LP** — Applies a low-pass filter with the corner frequency at *Freq*.

Range **BP** Applies a band-pass filter with the corner frequencies at *Range*.

Add Arrivals Causes the mouse to be placed in add-arrival mode. While in this mode the mouse buttons have the following effect:

Left Mouse One arrival is added, at the position of the mouse, and the mouse reverts to the normal state.

Middle Mouse The middle button causes the mouse to revert to the normal state, without adding an arrival.

Right Mouse The right button adds an arrival, at the position of the mouse, with the mouse remaining in add-arrival mode.

Done Closes the window containing the button.

The **Trace Region** is the area, excluding the arrival flags, where the traces are displayed Within this region the mouse acts as follows:

Left-Click The left mouse button causes the traces to be time scrolled to the left so that the mouse position is shifted to the left edge of the screen.

Middle-Drag Dragging the middle mouse button causes the traces to follow the movement of the mouse in time.

Right-Click The right mouse button causes the traces to be time scrolled to the right so that the mouse position is shifted to the right edge of the screen.

Shift-Left-Click Holding the SHIFT key while clicking the left mouse button causes a sequence to be initiated that controls expansion (or zoom-in) of the time scale. After the initial mouse Shift-Left-Click, a reverse video box will track the mouse cursor until one of the three mouse buttons is clicked again. If the left or right button is clicked, then the time scale expands so that the delineated reverse video box fills the new display window. If the middle mouse button is clicked, then the zoom-in action is aborted.

Shift-Right-Click
Holding the SHIFT key while clicking the right mouse button causes a sequence to be initiated that controls contraction (or zoom-out) of the time scale. After the initial mouse Shift-Right-Click, a reverse video box will track the mouse cursor until one of the three mouse buttons is clicked again. If the left or right button is clicked, then the time scale contracts so that the current display time window maps to the delineated reverse video box in the new window. If the middle mouse button is clicked, then the zoom-out action is aborted.

The **Station Region** is the area to the left of the traces where the *Station*/*Channel* information is displayed. Within this region the mouse acts as follows:

Left-Click or **Left-Drag**
Pressing and/or dragging the left mouse button in this region causes the specified traces to be selected/unselected.

The **Arrival Region** is the area within an arrival flag. Within this region the mouse acts as follows:

Left-Drag Pressing and ‘‘dragging’’ the left mouse button in this region causes the arrival time to be changed until the button is released.

Shift-Left-Drag Pressing and ‘‘dragging’’ the left mouse button in this region while simultaneously holding down the SHIFT key causes the arrival time uncertainty to be changed until the button is released.

Control-Shift-Left-Drag
Pressing and ‘‘dragging’’ the left mouse button in this region while simultaneously holding down the SHIFT and CONTROL keys causes the arrival amplitude and period to be changed until the button is released. The amplitude and period

measurements are made automatically on the trace as displayed (i.e. with filtering if so specified) by picking the closest trough-peak to the mouse cursor. The amplitude and period measurement is written to the database after the application of an instrument response correction when the mouse button is released. Note that these measurements will not be written to the database if the instrument response cannot be found for that trace (and an error message is printed).

Middle-Click of **Middle-Drag**
Pressing the middle button causes a phase pop-up menu to appear and the selection of a menu item will cause the arrival phase to be changed.

Right-Click of **Right-Drag**
Pressing the right mouse button causes an arrival editing pop-up menu to appear with the following options:

Window Create a new window with the same time scale

Magnify Create a new time magnified window

Delete Delete the arrival.

The magnification window allows the user to make more sensitive interactive measurements than would be possible in the original window. All changes in the arrival flags are synchronized among the windows. The secondary windows behave in all aspects like the original window.

The **Scroll Region** is the area around the scroll bars. Within this region the mouse has the following effects:

Right Mouse Pressing the right mouse button within this region causes the scroll pull-down menu to appear. The items and their effects are defined as follows:

Time Fit Rescales the time axis to fit the entire time range of the database.

Time ZoomIn Time zoomin. Increases the magnification along the time axis.

Time ZoomOut Time zoomout. Decreases the magnification along the time axis.

Trace Fit Rescales the trace axis so that all traces are visible within the window.

Trace ZoomIn Trace zoomin. Increases the magnification along the trace axis.

Trace ZoomOut Trace zoomout. Decreases the magnification along the trace axis.

ENVIRONMENT

The environment variables **JSPC**, **SCHEMA_DIR**, **TAUP_PATH**, and **TAUP_TABLE** are used by this program. See jspcenv(5) for descriptions of these environment variables.

BUGS

In many cases where changes are made to a display by typing in a command or through interactive mouse input, the other displays may not be updated as one might expect. This occurs, for example, when arrival flags are hidden through the **soa off** typein command, which will cause the arrivals in the primary display window to be hidden but not in the other windows. The other windows can be brought up to date by repainting the windows (with the R key command in each window).

SEE ALSO

dbintro(1), dbschema(5), jspcenv(5)