

Package ‘Bchron’

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Type Package

Title Create chronologies based on radiocarbon and non-radiocarbon dated depths

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Author Andrew Parnell

Maintainer Andrew Parnell <Andrew.Parnell@ted.ie>

Description This package follows the work of Parnell and Haslett (2007; JRSSC). It runs MCMC, predictions and plots for radiocarbon (and non radiocarbon) dated sediment cores.

License GPL (>= 2)

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R topics documented:

Bchron-package	2
Bchroncalibrate	4
Bchronchangealcurve	4
Bchroncheck	5
Bchronconvergecheck	6
Bchronloaddata	6
BchronMCMC	7
Bchronmenu	8
Bchronpltdens	9
Bchronplotevent	10
Bchronplotter	10
Bchronplotterdatesonly	11
Bchronpredict	12
Bchronpredictevent	12

Bchronquickload	13
BchronreadEPD	14
Glendaloughdepths	15
GlendaloughEventDepthsAlnus	16
hdr2.den	16
IntCal04	17
newgraphwindow	17

Index	18
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Bchron-package	<i>Compound Poisson-Gamma chronologies for radiocarbon and non-radiocarbon dates</i>
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Description

Runs MCMC and predictive distributions for the monotonic piece-wise linear compound Poisson Gamma process. Before a run of the Bchron model can commence, the file structures must be in the correct format. Included in the package is an example set of data from Glendalough, Ireland. All other cores must be in a similar format for the routines to work.

Details

Package:	Bchron
Type:	Package
Version:	2.0
Date:	2008-04-28
License:	GPL (version 2 or later)

Installation instructions for basic and first time users:

1. Type library(Bchron)
2. Now create a directory on your C drive called Bchron (it needs to be directly on the c drive).
3. Within this directory, create three more called Input, Output and CalCurve.
4. Now navigate to C:\program files\R\R-XXXXXX\library\BChron\Data. In here there should be a file called Rdata.zip
5. Double click on it and move the files Glendalough.dat, GlendaloughEventDepthsAlnus.txt and Glendaloughdepths.txt to the input directory.
6. Move the IntCal04.bch file to the CalCurve directory.

Everything is now set up.

Example full model run (with Glendalough.dat):

1. At the command prompt in R, type library(Bchron)
2. Type Bchronmenu() and choose option 1.
3. If you've followed the steps above you should not need to change the default path, you just need to tell it that the file name is Glendalough.

4. Now choose option 2 to calibrate the radiocarbon dates.
5. Choose option 3 and short to do a run of the Bchron model.
6. Choose option 4 to run the prediction stage and create a plot of the data.

Once a satisfactory short run has been obtained, a long run should be undertaken. The long run will take much longer than the short run, but will only be required once.

Example event prediction stage (with GlendaloughEventDepthsAlnus.txt)

1. Type `Bchronmenu()` and choose Option 1.
2. Enter the data as instructed
3. Assuming a run of the Bchron model has already been done (as above) and that the file `GlendaloughEventDepthsAlnus.txt` is in the input directory, choose option 5
6. Check the output directory for `GlendaloughEventAgesAlnus.txt` which will contain 95% HDR age intervals for the depths of interest.

Other cores can be created in a spirit similar to that found in the `Glendalough.dat` file. This example input file has 5 radiocarbon dates (and the top of the core). The columns are tab delimited and represent the lab code of the sample, the radiocarbon age, the sample standard error, the depth (in cm) at which it was found, the thickness of the sample in cm. If the thickness is unknown, zero is acceptable. The next two columns contain the probabilities of being an outlier. The first probability identifies censored outliers as proposed by Christen (1994), the second indicates the probability an outlier is ignored completely by the Bchron model. The final column indicates whether this date is a radiocarbon date (type 1), a uniformly distributed date (type 2), or a normally distributed date (type 3). For uniform dates, the standard deviation value is taken to be the distance to the upper and lower limits. Type 3 dates are permitted to be outliers, with probabilities as given. Type 2 dates are not allowed to be outliers; the outlier probabilities for these dates are ignored.

Author(s)

Andrew Parnell <Andrew.Parnell@tcd.ie>

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

Christen, J. A. (1994). Summarizing a set of radiocarbon determinations: A robust approach. *Applied Statistics* 43 (3), 489 – 503.

See Also

[Bchronmenu](#)

Examples

```
## See Bchronmenu()
```

Bchroncalibrate *Unrestricted radiocarbon calibration of Bchron data*

Description

Runs standard radiocarbon calibration of determinations with no restrictions on their ordering.

Usage

```
Bchroncalibrate(Bchrondata, iterations = 5e+05, burnin = 50000, thinby = 45, howman
```

Arguments

Bchrondata	A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.
iterations	Number of MCMC iterations required.
burnin	Number of discarded burn-in iterations.
thinby	Number of iterations to thin out.
howmany	Number of iterations before R reports back and updates the screen.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[BchronMCMC](#)

Bchronchangealcurve
Change Bchron radiocarbon calibration curve

Description

Allows the user to switch between calibration curves.

Usage

```
Bchronchangealcurve(Bchrondata)
```

Arguments

`Bchrondata` A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.

Details

The default calibration curve is IntCal04. Bchron uses a specific, yearly-interpolated version of this calibration curve to speed up computation. This function allows users to download other internationally-agreed calibration curves (as .14c files) and convert them into Bchron .bch format. The new .14c files must be put in the Bchron calcurve directory.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronloaddata](#)

Bchroncheck

Checking of Bchron data objects

Description

A quick check to make sure that the Bchron data object will run in [BchronMCMC](#).

Usage

```
Bchroncheck(Bchrondata)
```

Arguments

`Bchrondata` A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronloaddata](#)

Bchronconvergecheck

Convergence checking of Bchron output

Description

Allows convergence checking of both [BchronMCMC](#) and [Bchroncalibrate](#) output. Uses the Geweke convergence diagnostic from the coda package.

Usage

```
Bchronconvergecheck(Bchrondata = list(RUN = FALSE), CALDATES = FALSE)
```

Arguments

Bchrondata	A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.
CALDATES	TRUE if the calibrated dates are being checked (after a run of Bchroncalibrate), FALSE if a check of BchronMCMC is required.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronloaddata](#)

Bchronloaddata

Menu driven load of Bchron data

Description

A menu system walk through for creating a Bchron data structure which can then be run via [BchronMCMC](#).

Usage

```
Bchronloaddata(Bchronversion = 0)
```

Arguments

Bchronversion	The version number of Bchron (used for plotting).
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Details

This function allows the user to specify the names of the input files and the calibration curve to be used for a full run of [BchronMCMC](#) or [Bchroncalibrate](#).

Value

Returns a Bchrontdata object with some of the following

SHOULDRUN	(logical) Determines whether the BchronMCMC can be run.
path	(character) The path to the input, output and calcurve directories.
calibcurvefile	(character) The path to the calibration curve file.
bigcalsize	The number of entries in the calibration curve file.
lowcal	The lowest calendar age limit allowed on the calibration curve in k cal years BP (-0.005 for IntCal04).
highcal	The highest calendar age limit allowed on the calibration curve in k cal years BP (26 for IntCal04).
name	(character) The name of the input files for the core.
ddepthfile	(character) The path to the design depths file (the dates at which pollen was taken for a pollen core).
inputfile	(character) The path to the input file where the 14C dates are stored.
fullname	(character) The full name of the core.
calibdatesfile	(character) The path to the unrestricted calibrated dates file.
parsfile	(character) The path to the output file where the parameters are/will be stored.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronquickload](#)

BchronMCMC

Run Bchron model with MCMC

Description

Runs the compound Poisson-Gamma model for radiocarbon and non-radiocarbon dates

Usage

```
BchronMCMC(Bchrontdata, iterations = 0, burnin = 0, thinby = 1, howmany = 1)
```

Arguments

<code>Bchrondata</code>	A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.
<code>iterations</code>	Number of MCMC iterations required.
<code>burnin</code>	Number of discarded burn-in iterations.
<code>thinby</code>	Number of iterations to thin out.
<code>howmany</code>	Number of iterations before R reports back and updates the screen.

Details

The Bchron MCMC function fits a compound Poisson-Gamma distribution to the increments between the dated levels. This involves a stochastic linear interpolation where the age gaps are Gamma(2,beta) distributed, and the depth gaps are Exponential(lambda). Radiocarbon dates are updated within the function also by MCMC.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronloaddata](#)

Bchronmenu

Walkthrough menu system for the Bchron package

Description

A walkthrough menu system for the Bchron package. Allows users the ability to load in data, run the Bchron MCMC model, run predictions and plots, and look at event ages.

Usage

```
Bchronmenu()
```

Details

The Bchron menu system first creates a Bchrondata object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required. Using the menu system bypasses the need to create these objects.

Author(s)

Andrew Parnell <Andrew.Parnell@tcd.ie>

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronloaddata](#), [Bchronquickload](#)

Bchronplotdens *Event density plotting for Bchron data*

Description

Not meant for use other than via [Bchronplotevent](#)

Usage

```
Bchronplotdens(datesfile, fullname, outfile, eventname, vers = 0)
```

Arguments

datesfile	Character string containing file and path to ages of event.
fullname	The full name of the core (used for plotting).
outfile	Character string specifying path and name of file for highest posterior density regions of the age of the event.
eventname	Name of the event.
vers	Bchron version number (used for plotting).

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronloaddata](#), [Bchronquickload](#)

Bchronplotevent *Plot event ages in Bchron.*

Description

Creates plots of the ages of events.

Usage

```
Bchronplotevent(Bchrondata)
```

Arguments

`Bchrondata` A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronpredictevent](#)

Bchronplotter *Produce Bchron chronology plots*

Description

Produces colour and B/W plots of a chronology

Usage

```
Bchronplotter(Bchrondata, colours = c("yellow", "orange", "red"), lwidths = c(3, 3,
```

Arguments

`Bchrondata` A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.

`colours` Colours used for the 95, 75 and 50 percent highest posterior density regions (HDRs).

`lwidths` Widths of the lines used for the 95, 75 and 50 percent HDRs.

`asklimits` Whether to request plotting ranges in terms of depths and ages.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronpredict](#)

Bchronplotterdatesonly

Produce Bchron plots of calibrated radiocarbon dates

Description

Produces colour and B/W plots of the independently calibrated radiocarbon dates.

Usage

```
Bchronplotterdatesonly(Bchrondata, asklimits = FALSE)
```

Arguments

Bchrondata	A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.
asklimits	Whether to request plotting ranges in terms of depths and ages.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronplotter](#)

Bchronpredict *Predict ages for depths in a Bchron core*

Description

Performs stochastic Poisson-Gamma linear interpolation on the output of a run of the [BchronMCMC](#).

Usage

```
Bchronpredict(Bchrondata = list(SHOULDRUN = FALSE))
```

Arguments

`Bchrondata` A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.

Details

Produces a file `*chrons.txt` which contains sample chronologies for each of the design depths.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronplotter](#)

Bchronpredictevent *Predict the ages of events in Bchron*

Description

Estimates the ages of specific depths in a Bchron core. Useful for event identification.

Usage

```
Bchronpredictevent(Bchrondata)
```

Arguments

`Bchrondata` A Bchron data object with fields for the the input and output files, the name of the core being used, the details of the calibration curve, and details of the model run required.

Details

Produces a file AeventagesB.txt where A is the name of the core and B is the name of the event. File contains sampled ages for this event. Note that the depths of the event in the core can be specified in terms of ranges for scenarios where the event is not easily identified.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronplotevent](#)

Bchronquickload *Quick loading of Bchron data*

Description

A shortcut to [Bchronloaddata](#) for advanced users.

Usage

```
Bchronquickload(name, fullname = NULL, path = "c:/Bchron", calibName = "IntCal04",
```

Arguments

name	Name of the files which contain the input data details (eg "Glendalough")
fullname	Full name fo the core
path	The path to the input, output and calcurve directories.
calibName	The name of the calibration curve.
Bchronversion	The version number of Bchron (optional; used for plotting only).
check	Whether data checks should be performed on the data.

Details

Output should be analogous to the [Bchronloaddata](#) function.

Value

Returns a Bchrondata object with some of the following

SHOULDRUN	(logical) Determines whether the BchronMCMC can be run.
path	(character) The path to the input, output and calcurve directories.
calibcurvefile	(character) The path to the calibration curve file.
bigcalsize	The number of entries in the calibration curve file.
lowcal	The lowest calendar age limit allowed on the calibration curve in k cal years BP (-0.005 for IntCal04).
highcal	The highest calendar age limit allowed on the calibration curve in k cal years BP (26 for IntCal04).
name	(character) The name of the input files for the core.
ddepthfile	(character) The path to the design depths file (the dates at which pollen was taken for a pollen core).
inputfile	(character) The path to the input file where the 14C dates are stored.
fullname	(character) The full name of the core.
calibdatesfile	(character) The path to the unrestricted calibrated dates file.
parsfile	(character) The path to the output file where the parameters are/will be stored.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronloaddata](#)

BchronreadEPD

Reading in of European pollen database (EPD) data

Description

A menu driven function that creates Bchron-style input files from European Pollen Database (EPD) data. Note that the EPD data must be saved to a file containing only the dating information.

Usage

BchronreadEPD ()

Details

This function allows the user to cut or save data direct from the EPD and then transform it into a Bchron-style input file. Note that some of the features of the data (such as top dates, or non-radiocarbon dates) may not be preserved, so manual editing of these files may be necessary.

Value

Creates a .dat file (as specified by the user) which contains the radiocarbon dates and depths.

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

See Also

[Bchronloaddata](#)

Glendaloughdepths *Pollen (or design) depths for Glendalough core*

Description

A single column file giving the depths at which pollen was counted for the Glendalough core in Co Wicklow, Ireland. The task of the model is to estimate the calendar age of the core at these depths.

Usage

```
Glendaloughdepths
```

Format

A single column file with 150 rows

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

GlendaloughEventDepthsAlnus

Supplementary depths for the Glendalough core.

Description

A two column file giving the depths in cm at which the Alnus rise may have occurred throughout the deposition history of the core. Note that these need not be the same as the ddepths.

Usage

GlendaloughEventDepthsAlnus

Format

A single column file with 6 rows

References

Haslett and Parnell (2008), A simple monotone process with application to radiocarbon-dated depth chronologies. *Applied Statistics* 57 (5), 1–20.

hdr2.den

Highest density region plots for Bchron output.

Description

Adapted from `hdr.den` in the `hdrcode` package which is a pre-requisite for the `Bchron` package to work. Produces plots of the highest density regions for ages at desired depths throughout the core.

Usage

```
hdr2.den(x = NULL, prob = c(50, 95, 99), den = NULL, h = NULL, ylab = "", ...)
```

Arguments

<code>x</code>	Simulations from the density of interest.
<code>prob</code>	Probability regions
<code>den</code>	The density for <code>x</code> . If not given, is automatically calculated
<code>h</code>	Bandwidth
<code>ylab</code>	The y-axis label
<code>...</code>	Other arguments passed to the <code>plot</code> command.

Value

A plot of the density for together with 50%, 95% and 99% highest posterior density regions.

`IntCal04`*Interpolated Northern hemisphere Intcal04 calibration curve*

Description

A two column file giving the radiocarbon age and standard error for every calendar year starting at -5 years BP (AD1955)

Usage`IntCal04`**Format**

A two column matrix containing 26006 observations

Source`Intcal04`**References**

Reimer, P.J., M.G. Baillie, E. Bard, A. Bayliss, W.W. Beck, C.J. Bertrand, P.G. Blackwell, C.E. Buck, G.S. Burr, K.B. Cutler, P.E. Damon, R.L. Edwards, R.G. Fairbanks, M. Friedrich, T.P. Guilderson, A.G. Hogg, K.A. Hughen, B. Kromer, G. McCormac, S. Manning, C.B. Ramsey, R.W. Reimer, S. Remmele, J.R. Southon, M. Stuiver, S. Talamo, F. Taylor, J.v.d. van der Plicht, and C.E. Weyhenmeyer (2005), Intcal04 terrestrial radiocarbon age calibration, 0-26 cal kyr bp. *Radiocarbon*, 46(3), 1029-1058.

`newgraphwindow`*Opens a new graphics window on a variety of platforms*

Description

Opens a new graphics window on a variety of platforms

Usage`newgraphwindow()`**Details**

Not intended for use outside [Bchronmenu](#)

Author(s)

Andrew Parnell

Index

*Topic **datasets**

- Glendaloughdepths, [14](#)
- GlendaloughEventDepthsAlnus, [15](#)
- IntCal04, [16](#)

*Topic **dplot**

- Bchron-package, [1](#)
- Bchroncalibrate, [3](#)
- Bchronchangealcurve, [4](#)
- Bchroncheck, [5](#)
- Bchronconvergecheck, [5](#)
- Bchronloaddata, [6](#)
- BchronMCMC, [7](#)
- Bchronmenu, [8](#)
- Bchronplotdens, [8](#)
- Bchronplotevent, [9](#)
- Bchronplotter, [10](#)
- Bchronplotterdatesonly, [10](#)
- Bchronpredict, [11](#)
- Bchronpredictevent, [12](#)
- Bchronquickload, [12](#)
- BchronreadEPD, [14](#)
- hdr2.den, [15](#)

*Topic **models**

- Bchron-package, [1](#)
- Bchroncalibrate, [3](#)
- Bchronchangealcurve, [4](#)
- Bchroncheck, [5](#)
- Bchronconvergecheck, [5](#)
- Bchronloaddata, [6](#)
- BchronMCMC, [7](#)
- Bchronmenu, [8](#)
- Bchronplotdens, [8](#)
- Bchronplotevent, [9](#)
- Bchronplotter, [10](#)
- Bchronplotterdatesonly, [10](#)
- Bchronpredict, [11](#)
- Bchronpredictevent, [12](#)
- Bchronquickload, [12](#)

- BchronreadEPD, [14](#)

*Topic **nonparametric**

- Bchron-package, [1](#)
- Bchroncalibrate, [3](#)
- Bchronchangealcurve, [4](#)
- Bchroncheck, [5](#)
- Bchronconvergecheck, [5](#)
- Bchronloaddata, [6](#)
- BchronMCMC, [7](#)
- Bchronmenu, [8](#)
- Bchronplotdens, [8](#)
- Bchronplotevent, [9](#)
- Bchronplotter, [10](#)
- Bchronplotterdatesonly, [10](#)
- Bchronpredict, [11](#)
- Bchronpredictevent, [12](#)
- Bchronquickload, [12](#)
- BchronreadEPD, [14](#)
- hdr2.den, [15](#)

*Topic **package**

- Bchron-package, [1](#)
- Bchroncalibrate, [3](#)
- Bchronchangealcurve, [4](#)
- Bchroncheck, [5](#)
- Bchronconvergecheck, [5](#)
- Bchronloaddata, [6](#)
- BchronMCMC, [7](#)
- Bchronmenu, [8](#)
- Bchronplotdens, [8](#)
- Bchronplotevent, [9](#)
- Bchronplotter, [10](#)
- Bchronplotterdatesonly, [10](#)
- Bchronpredict, [11](#)
- Bchronpredictevent, [12](#)
- Bchronquickload, [12](#)
- BchronreadEPD, [14](#)

*Topic **programming**

- Bchron-package, [1](#)
- Bchroncalibrate, [3](#)

- Bchronchangealcurve, 4
- Bchroncheck, 5
- Bchronconvergecheck, 5
- Bchronloaddata, 6
- BchronMCMC, 7
- Bchronmenu, 8
- Bchronplotdens, 8
- Bchronplotevent, 9
- Bchronplotter, 10
- Bchronplotterdatesonly, 10
- Bchronpredict, 11
- Bchronpredictevent, 12
- Bchronquickload, 12
- BchronreadEPD, 14
- newgraphwindow, 16
- *Topic smooth**
 - Bchron-package, 1
 - Bchroncalibrate, 3
 - Bchronchangealcurve, 4
 - Bchroncheck, 5
 - Bchronconvergecheck, 5
 - Bchronloaddata, 6
 - BchronMCMC, 7
 - Bchronmenu, 8
 - Bchronplotdens, 8
 - Bchronplotevent, 9
 - Bchronplotter, 10
 - Bchronplotterdatesonly, 10
 - Bchronpredict, 11
 - Bchronpredictevent, 12
 - Bchronquickload, 12
 - BchronreadEPD, 14
 - hdr2.den, 15
- Bchron (*Bchron-package*), 1
- Bchron-package, 1
- Bchroncalibrate, 3, 5, 6
- Bchronchangealcurve, 4
- Bchroncheck, 5
- Bchronconvergecheck, 5
- Bchronloaddata, 4, 5, 6, 6, 8, 9, 12–14
- BchronMCMC, 4–6, 7, 11, 13
- Bchronmenu, 3, 8, 16
- Bchronplotdens, 8
- Bchronplotevent, 8, 9, 12
- Bchronplotter, 10, 11
- Bchronplotterdatesonly, 10
- Bchronpredict, 10, 11
- Bchronpredictevent, 9, 12
- Bchronquickload, 7–9, 12
- BchronreadEPD, 14
- Calibration (*IntCal04*), 16
- ddepths (*Glendaloughddepths*), 14
- EventDepths
 - (*GlendaloughEventDepthsAlnus*), 15
- Glendaloughddepths, 14
- GlendaloughEventDepthsAlnus, 15
- hdr2.den, 15
- IntCal04, 16
- newgraphwindow, 16