Package ‘bayfoxr’

October 12, 2022

Title  Global Bayesian Foraminifera Core Top Calibration
Version  0.0.1
Description  A Bayesian, global planktic foraminifera core top calibration to modern sea-surface temperatures. Includes four calibration models, considering species-specific calibration parameters and seasonality.
URL  https://github.com/brews/bayfoxr/
BugReports  https://github.com/brews/bayfoxr/issues
Depends  R (>= 3.4)
License  GPL (>= 3)
Encoding  UTF-8
LazyData  true
Suggests  testthat, knitr, rmarkdown
RoxygenNote  6.1.1
VignetteBuilder  knitr
NeedsCompilation  no
Author  Steven Malevich [aut, cre]
Maintainer  Steven Malevich <malevich@email.arizona.edu>
Repository  CRAN
Date/Publication  2019-02-06 15:53:33 UTC

R topics documented:

  bassriver ................................................................. 2
  get_available_forams .................................................. 2
  get_drawing ............................................................ 3
  plot.prediction ........................................................ 3
  prediction .............................................................. 4
  predict.plot .......................................................... 5
  predict_d18oc .......................................................... 5
  predict_seatemp ....................................................... 7
  quantile.prediction ..................................................... 8
  target_timeseries_pred ............................................... 8
**get_available_forams**

**Description**

Parse trace dataframe column names to get vector of available forams.

**Usage**

```r
get_available_forams(d)
```

**Arguments**

- `d`  
  Data frame containing MCMC trace draws. Column names are model parameters with foram group name separated from model parameters name by "__".

**Value**

Character vector of available foram names.
get_draws

Get MCMC trace draws.

Description

Get MCMC trace draws.

Usage

get_draws(foram = NULL, seasonal_seatemp = FALSE)

Arguments

foram

Optional. String or NULL. String indicating the foram species/subspecies to infer for hierarchical models. String must be one of "G. bulloides", "G. ruber white", "G. ruber pink", "G. sacculifer", "N. incompta", or "N. pachyderma sinistral". NULL indicates that a pooled model is desired.

seasonal_seatemp

Optional boolean indicating whether to use the seasonal sea-surface temperature calibrations. Default is FALSE, i.e. using annual SST calibrations.

Details

Four calibration models are available: an "annual pooled" model, a "seasonal pooled" model, an "annual hierarchical" model, and a "seasonal hierarchical" model. This function uses magic to determine which "pooled annual" model is used. Which is the simplest case with potential use for Deep Time reconstructions of nonexant foram species. Giving a valid string for foram will use a hierarchical model, which has foram-specific variability in calibration model parameters. Passing TRUE for seasonal_seatemp will use a model trained on season sea-surface temperatures. See reference paper for further details.

Value

Data frame with columns "alpha", "beta", "tau". Which are equal-length vectors of model parameter draws.

plot.prediction

Plot a prediction object.

Description

Plot a prediction object.

Usage

## S3 method for class 'prediction'
plot(...)

prediction

Arguments

...  Arguments passed on to predictplot.

See Also

predictplot

Examples

data(bassriver)

# Using the "pooled annual" calibration model:
sst <- predict_seatemp(bassriver$d18o, d18osw=0.0,
prior_mean=30.0, prior_std=20.0)

predictplot(x=bassriver$depth, y=sst, ylim=c(20, 40),
ylab="SST (°C)", xlab="Depth (m)"")

prediction  Constructor for S3 prediction class.

Description

Constructor for S3 prediction class.

Usage

prediction(ensemble)

Arguments

ensemble  A matrix (m x n) of the prediction posteriors. Where m is the number of values inferred and n is the number of trace draws.

Value

A prediction object.
predictplot

Simple plot of prediction with intervals.

Description
Simple plot of prediction with intervals.

Usage
predictplot(y, x = NULL, probs = c(0.05, 0.5, 0.95),
            poly_col = grDevices::rgb(0, 0, 0, 0.1), ...)

Arguments
- y: A prediction object to plot.
- x: Optional vector or NULL, indicating where prediction inferences fall along x-axis. Must be the same length as the inferred values in y.
- probs: Optional 3-member Vector of numerics indicating low, middle, and high probability intervals to plot. All must be <= 1.
- poly_col: Optional color for interval polygon.
- ...: Additional arguments passed to plot.

Examples
data(bassriver)

# Using the "pooled annual" calibration model:
sst <- predict_seatemp(bassriver$d18o, d18osw=0.0,
                       prior_mean=30.0, prior_std=20.0)
predictplot(x=bassriver$depth, y=sst, ylim=c(20, 40),
            ylab="SST (°C)", xlab="Depth (m)")

predict_d18oc
Predict d18O of foram calcite given seawater temperature and seawater d18O.

Description
Predict d18O of foram calcite given seawater temperature and seawater d18O.

Usage
predict_d18oc(seatemp, d18osw, foram = NULL, seasonal_seatemp = FALSE,
              drawsfun = get_draws)
predict_d18oc

Arguments

seattmp  Numeric or vector of observed sea-surface temperatures (°C).

d18osw  Numeric or vector of observed seawater d18O (% VSMOW).

foram  Optional. String or NULL. String indicating the foram species/subspecies to infer for hierarchical models. String must be one of "G. bulloides", "G. ruber", "T. sacculifer", "N. incompta", or "N. pachyderma". NULL indicates that a pooled model is desired.

seasonal_seatemp  Optional boolean indicating whether to use the seasonal sea-surface temperature calibrations. Default is FALSE, i.e. using annual SST calibrations.

drawsfuns  Optional function used to get get model parameter draws. Must take arguments for "foram" and "seasonal_seatemp" and return a list with members "alpha", "beta", "tau". This is for debugging and testing. See get_draws.

Details

Four calibration models are available: an "annual pooled" model, a "seasonal pooled" model, an "annual hierarchical" model, and a "seasonal hierarchical" model. This function uses magic to determine which "pooled annual" model is used. Which is the simplest case with potential use for Deep Time reconstructions of nonexant foram species. Giving a valid string for foram will use a hierarchical model, which has foram-specific variability in calibration model parameters. Passing TRUE for seasonal_seatemp will use a model trained on season sea-surface temperatures. See reference paper for further details.

Value

A prediction instance for inferred foraminiferal calcite d18O (% VPDB).

See Also

predict_seatemp, predictplot

Examples

# Infer d180c for a G. bulloides core top sample using annual hierarchical model.
# The true, d180c for this sample is -2.16 (% VPDB).
delo_ann <- predict_d18oc(seatemp=28.6, d18osw=0.48, foram="G. bulloides")
head(quantile(del0_ann, probs=c(0.159, 0.5, 0.841)))  # ± 1 standard deviation

# Now using seasonal hierarchical model:
delo_sea <- predict_d18oc(seatemp=28.6, d18osw=0.48, foram="G. bulloides",
seasonal_seatemp = TRUE)
head(quantile(del0_sea, probs=c(0.159, 0.5, 0.841)))  # ± 1 standard deviation
**predict_seatemp**

Predict sea-surface temperature given d18O of foram calcite and seawater d18O.

**Description**

Predict sea-surface temperature given d18O of foram calcite and seawater d18O.

**Usage**

```r
predict_seatemp(d18oc, d18osw, prior_mean, prior_std, foram = NULL,
seasonal_seatemp = FALSE, drawsfun = get_draws)
```

**Arguments**

- `d18oc`: Numeric or vector of observed foram calcite d18O (% VPDB).
- `d18osw`: Numeric or vector of observed seawater d18O (% VSMOW).
- `prior_mean`: Numeric indicating prior mean for sea-surface temperature (°C).
- `prior_std`: Numeric indicating prior standard deviation for sea-surface temperature (°C).
- `foram`: Optional. String or NULL. String indicating the foram species/subspecies to infer for hierarchical models. String must be one of "G. bulloides", "G. ruber", "T. sacculifer", "N. incompta", or "N. pachyderma". NULL indicates that a pooled model is desired.
- `seasonal_seatemp`: Optional boolean indicating whether to use the seasonal sea-surface temperature calibrations. Default is FALSE, i.e. using annual SST calibrations.
- `drawsfun`: Optional function used to get get model parameter draws. Must take arguments for "foram" and "seasonal_seatemp" and return a list with members "alpha", "beta", "tau". This is for debugging and testing.

**Details**

Four calibration models are available: an "annual pooled" model, a "seasonal pooled" model, an "annual hierarchical" model, and a "seasonal hierarchical" model. This function uses magic to determine which "pooled annual" model is used. Which is the simplest case with potential use for Deep Time reconstructions of nonexant foram species. Giving a valid string for `foram` will use a hierarchical model, which has foram-specific variability in calibration model parameters. Passing `TRUE` for `seasonal_seatemp` will use a model trained on season sea-surface temperatures. See reference paper for further details.

**Value**

A prediction instance for inferred sea-surface temperature (°C).

**See Also**

`predict_d18oc`
Examples

```
data(bassriver)

# Using the "pooled annual" calibration model:
sst <- predict_seatemp(bassriver$d18o, d18osw=0.0, prior_mean=30.0, prior_std=20.0)
head(quantile(sst))  # Show only the top few values

predictplot(x=bassriver$depth, y=sst, ylim=c(20, 40), ylab="SST (°C)", xlab="Depth (m)"
```

quantile.prediction  Quantiles for a prediction.

Description

Quantiles for a prediction.

Usage

```## S3 method for class 'prediction'
quantile(x, ...)
```

Arguments

- `x`  A prediction object.
- `...`  Arguments to be passed on to `quantile`.

Description

Internal function for `predict_seatemp()`.

Usage

```
target_timeseries_pred(d18osw_now, alpha_now, beta_now, tau_now, proxy_ts,
prior_mu, prior_inv_cov)
```
**target_timeseries_pred**

**Arguments**

- **d18osw_now**: Numeric or vector giving seawater d18O. Note, should be in units (% VPDB).
- **alpha_now**: Numeric, alpha model parameter.
- **beta_now**: Numeric, beta model parameter.
- **tau_now**: Numeric, tau model parameter.
- **proxy_ts**: Numeric or vector of proxy time series (foram d18O).
- **prior_mu**: Matrix (n X 1) giving prior mean.
- **prior_inv_cov**: Matrix (n X x) giving prior inverse covariance matrix.

**Value**

Sample of time time series vector conditional on the other args
Index

* datasets
  bassriver, 2

bassriver, 2

get_available_forams, 2
get_draws, 3, 6

plot.prediction, 3
predict_d18oc, 5, 7
predict_seatemp, 6, 7
prediction, 4
predictplot, 4, 5, 6

quantile.prediction, 8

target_timeseries_pred, 8