Package 'BIKER'

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Title Bayesian Inference of the K600 Evasion Rate

Version 1.0.0

Description Uses Bayesian inference + SWOT river measurements to estimate the normalized gas exchange velocity from rivers, no in situ info needed beyond a prior estimate on streamflow. Algorithm inputs are river width, water surface slope, the change in water surface area, and a prior estiate of average streamflow conditions. The algorithm returns the posterior mean (and 95% CIs) for the normalized river gas exchange velocity for the river reach over time. Note that prior hyperparameters are determined using just the SWOT observations, so all we need to provide BIKER are the SWOT observations and a mean flow estimate.

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Encoding UTF-8

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Biarch true

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SystemRequirements GNU make

RoxygenNote 7.1.2

URL `https://github.com/craigbrinkerhoff/BIKER`

BugReports `https://github.com/craigbrinkerhoff/BIKER/issues`

NeedsCompilation yes

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`BIKER-package` *The 'BIKER' package.*

Description

Uses Bayesian Inference + SWOT observations to estimate normalized gas transfer velocity from large rivers

References

Stan Development Team (2020). RStan: the R interface to Stan. R package version 2.19.3. https://mc-stan.org

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`biker_check_args` *Performs the following checks: - types: - everything else matrix - dimensions: - all matrices have same dimensions*

Description

Performs the following checks: - types: - everything else matrix - dimensions: - all matrices have same dimensions

Usage

```
biker_check_args(datalist)
```

Arguments

`datalist`	A list of biker data inputs

biker_check_nas *Add missing-data inputs to data list*

Description

Binary matrices indicating where data are/aren't missing are added to the data list. This is required in order to run ragged-array data structures in the stanfile.

Usage

```
biker_check_nas(datalist)
```

Arguments

datalist	a list of BIKER inputs

biker_data *Preprocess data for BIKER estimation*

Description

Produces a bikerdata object that can be passed to biker_estimate function

Usage

```
biker_data(w, s, dA, priorQ, max_xs = 30L, seed = NULL)
```

Arguments

w	Matrix of widths: time as columns, space as rows
s	Matrix of slopes: time as columns, space as rows
dA	Matrix of area above base area: time as columns, space as rows
priorQ	Mean annual flow prior for Q as a matrix
max_xs	Maximum number of cross-sections to allow in data. Used to reduce sampling time. Defaults to 30.
seed	RNG seed to use for sampling cross-sections, if nx ¿, max_xs.

`biker_estimate` *Estimate BIKER*

Description

Fits a BIKER model of one of several variants using Hamiltonian Monte Carlo.

Usage

```
biker_estimate(
  bikerdata,
  bikerpriors,
  cores = getOption("mc.cores", default = parallel::detectCores()),
  meas_error = FALSE,
  chains = 3L,
  iter = 1000L,
  pars = NULL,
  include = FALSE,
  ...
)
```

Arguments

`bikerdata`	A bikerdata object, as produced by `biker_data()`
`bikerpriors`	A bikerpriors object.
`cores`	Number of processing cores for running chains in parallel. See `?rstan::sampling`. Defaults to `parallel::detectCores()`.
`meas_error`	Should we run with latent variables accounting for uncertainity in SWOT measurements. LEAVE THIS OFF, IT IS IN ACTIVE DEVELOPMENT
`chains`	A positive integer specifying the number of Markov chains. The default is 3.
`iter`	Number of iterations per chain (including warmup). Defaults to 1000.
`pars`	(passed to `rstan::sampling()`) A vector of character strings specifying parameters of interest to be returned in the stanfit object. If not specified, a default parameter set is returned.
`include`	(passed to `rstan::sampling()`) Defaults to FALSE, which excludes parameters specified in `pars` from the returned model.
`...`	Other arguments passed to rstan::sampling() for customizing the Monte Carlo sampler

biker_extract *Extract posterior*

Description

Extracts posterior parameters from fit stan model

Usage

```
biker_extract(fitmodel, CI = 0.95, chainExtract = "all")
```

Arguments

`fitmodel`	A fitted BIKER stanmodel
`CI`	A postive integer between 0 and 1 indicating the confidence interval to return with the estimate. Default is 0.95.
`chainExtract`	Either an integer specifying which chain(s) to extract statistics from, or "all" (the default), in which case they are extracted from all chains.

biker_priors *Establish prior hyperparameters for BIKER estimation*

Description

Produces a bikerpriors object that can be passed to biker_estimate function

Usage

```
biker_priors(bikerdata, ...)
```

Arguments

`bikerdata`	An object of class bikerdata, as returned by `biker_data`
`...`	Optional manually set parameters. Unquoted expressions are allowed, e.g. `logk_sd = cv2sigma(0.8)`. Additionally, any variables present in `bikerdata` may be referenced, e.g. `lowerbound_logk = log(mean(Wobs)) + log(5)`

classify_func *Geomorphic river classification*

Description

Classify river for expert framework

Usage

```
classify_func(Wobs)
```

Arguments

Wobs	observed widths matrix

compose_biker_inputs *Prepare biker object for stan model*

Description

"Decomposes" the structure of the bikerdata pbject into a form more easily read by the stan sampling functions (i.e. a big ole list)

Usage

```
compose_biker_inputs(bikerdata, priors = biker_priors(bikerdata))
```

Arguments

bikerdata	bikerdata object
priors	bikerpriors object

cv2sigma *CV to sigma*

Description

Convert coefficient of variation to sigma parameter of lognormal distribution

Usage

```
cv2sigma(cv)
```

Arguments

cv	Coefficient of variation

`estimate_A0SD` *logA0_sd prior estimation*

Description

Estimate median cross-sectional area SD prior hyperparameter using swot data

Usage

```
estimate_A0SD(Wobs)
```

Arguments

`Wobs`	Observed W,as a space-down, time-across matrix.

`estimate_logA0` *logA0_hat prior estimation*

Description

Estimate median cross-sectional area prior hyperparameter using swot data

Usage

```
estimate_logA0(Wobs)
```

Arguments

`Wobs`	Observed W,as a space-down, time-across matrix

`estimate_logk` *logk_hat prior estimation*

Description

Estimate k_hat prior hyperparameter using swot data

Usage

```
estimate_logk(Sobs, priorQ)
```

Arguments

`Sobs`	Observed S,as a space-down, time-across matrix
`priorQ`	mean annual flow estimate, single number

`estimate_logksd` *logk_sd prior estimation*

Description

Estimate k sd prior hyperparameter using swot data

Usage

```
estimate_logksd(Sobs)
```

Arguments

`Sobs`	Observed S,as a space-down, time-across matrix

`estimate_logn` *logn_hat prior estimation*

Description

Estimate manning's n prior hyperparameter using swot data

Usage

```
estimate_logn(Wobs, Sobs)
```

Arguments

`Wobs`	Observed W,as a space-down, time-across matrix
`Sobs`	Observed s, as a space-down, time-across matrix

`estimate_lognSD` *logn_sd prior estimation*

Description

Estimate manning's n SD prior hyperparameter using swot data

Usage

```
estimate_lognSD(Wobs)
```

Arguments

`Wobs`	Observed W,as a space-down, time-across matrix.

`estimate_lowerboundA0` *lowerbound_A0 prior estimation*

Description

Estimate median cross-sectional area lowerbound prior hyperparameter using swot data

Usage

```
estimate_lowerboundA0(Wobs)
```

Arguments

`Wobs`	Observed W,as a space-down, time-across matrix.

`estimate_upperboundA0` *Upperbound_A0 prior estimation*

Description

Estimate median cross-sectional area upperbound prior hyperparameter using swot data

Usage

```
estimate_upperboundA0(Wobs)
```

Arguments

`Wobs`	Observed W,as a space-down, time-across matrix.

`prior_settings` *Options manager for BIKER default prior settings for k600 model*

Description

Options manager for BIKER default prior settings for k600 model

Usage

```
prior_settings(..., .__defaults = FALSE, .__reset = FALSE)
```

Arguments

`...`	(Optional) named settings to query or set.
`.__defaults`	See `?settings::option_manager`
`.__reset`	See `?settings::option_manager`

`sample_xs` *Take a random sample of a bikerdata object's cross-sections.*

Description

Take a random sample of a bikerdata object's cross-sections.

Usage

```
sample_xs(bikerdata, n, seed = NULL)
```

Arguments

`bikerdata`	a bikerdata object, as returned by `biker_data()`
`n`	Number of cross-sections to
`seed`	option RNG seed, for reproducibility.