

# Package ‘spFFBS’

May 9, 2026

**Title** Spatiotemporal Propagation for Multivariate Bayesian Dynamic Learning

**Version** 0.0-2

**Description** Implementation of the Forward Filtering Backward Sampling (FFBS) algorithm with Dynamic Bayesian Predictive Stacking (DYNBPS) integration for multivariate spatiotemporal models, as introduced in “Adaptive Markovian Spatiotemporal Transfer Learning in Multivariate Bayesian Modeling” (Presicce and Banerjee, 2026+) <[doi:10.48550/arXiv.2602.08544](https://doi.org/10.48550/arXiv.2602.08544)>. This methodology enables efficient Bayesian multivariate spatiotemporal modeling, utilizing dynamic predictive stacking to improve inference across multivariate time series of spatial datasets. The core functions leverage ‘C++’ for high-performance computation, making the framework well-suited for large-scale spatiotemporal data analysis in parallel computing environments.

**LinkingTo** Rcpp, RcppArmadillo

**Imports** spBPS, Rcpp (>= 1.1.1), foreach, tictoc, abind

**Suggests** doParallel, mniw, MBA, ggplot2, patchwork, reshape2, knitr, rmarkdown

**License** GPL (>= 3)

**Encoding** UTF-8

**RoxygenNote** 7.3.3

**VignetteBuilder** knitr

**URL** <https://lucapresicce.github.io/spFFBS/>

**NeedsCompilation** yes

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**Repository** CRAN

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sample_index	<i>Function to sample integers (index)</i>
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**Description**

Function to sample integers (index)

**Usage**

```
sample_index(size, length, p)
```

**Arguments**

size	<b>integer</b> dimension of the set to sample
length	<b>integer</b> number of elements to sample
p	<b>vector</b> sampling probabilities

**Value**

**vector** sample of integers

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spFFBS	<i>spFFBS: Spatiotemporal Bayesian Pipeline (friendly interface)</i>
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**Description**

A user-friendly, modular wrapper for running a Bayesian spatiotemporal filtering + weighting pipeline, with optional backward sampling, forecasting, and spatial interpolation.

**Usage**

```
spFFBS(
  Y,
  G,
  P,
  D,
  grid = list(tau = NULL, phi = NULL),
  prior,
  do_BS = FALSE,
  do_forecast = FALSE,
  do_spatial = FALSE,
  L = 200,
  tnew = NULL,
  spatial = NULL,
  num_threads = 1,
  verbose = TRUE
)
```

**Arguments**

Y	Response data (3D array or cube).
G	System matrix (cube).
P	Observation matrix (cube).
D	Spatial distance matrix.
grid	List with elements: <ul style="list-style-type: none"> <li>• tau: numeric vector</li> <li>• phi: numeric vector</li> </ul>
prior	Prior list for forward filter (m, C, nu, Psi)
do_BS	Logical: run backward sampling? (default: FALSE)
do_forecast	Logical: run temporal forecasts? (default: FALSE)
do_spatial	Logical: run spatial interpolation? (default: FALSE)
L	Number of posterior samples (default 200)
tnew	Forecast horizon (default 5)
spatial	Optional list for spatial: list(crd = , crdtilde = , Xtilde = )
num_threads	Number of cores for parallel computing (default: 1)
verbose	Logical; print progress messages to the console? (default: TRUE)

**Value**

A list with the components executed according to the flags.

**Examples**

```
n <- 50
t <- 5
p <- 2
q <- 2

Y <- array(rnorm(n*q*t), dim = c(n, q, t))
P <- array(rnorm(n*(p+n)*t), dim = c(n, (p+n), t))
G <- array(rnorm((p+n)*(p+n)*t), dim = c((p+n), (p+n), t))
coords <- matrix(runif(n*2), ncol = 2)
D <- as.matrix(dist(coords))

priors <- list("m" = matrix(0, n+p, q),
             "C" = diag(p+n),
             "nu" = 3,
             "Psi" = diag(q))

hyperpar <- list(tau = 0.5, phi = 1)

res <- spFFBS(Y = Y, G = G, P = P, D = D, grid = hyperpar, prior = priors)
```

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