
Algorithm S1: The pseudo code for MH and CopMH algorithm

(i) initial set $N=20000$

For $K=1$: $\mathbf{X}_1 = \{x_{1,j}\} = \{runif(x_{j,min}, x_{j,max})\} j = 1,2,3,4,5$

(ii) Generate an initial Markov chain

For $K \leq 1000$: $\mathbf{Y}_{k+1}[j] = 0.5 * rnorm(1, \mathbf{X}[k,j], 0.05 \times \mathbf{X}[k,j]) j = 1,2,3,4,5$;

Run Hymod with model parameters $\mathbf{Y}_{k+1}$, and obtaine the simulated observations $\mathbf{Q}_{sim}^*$.

Then calculate $ratio(k+1)$ according to equation (7)

if $(runif(1) < ratio[k+1,]) \{ \mathbf{X}[k+1,] = \mathbf{Y}_{k+1} \}$

else $\{ \mathbf{X}[k+1,] = \mathbf{X}[k,] \}$

$K = K+1$

(iii) Uniformization

$norm_x[i,j] = pnorm(\mathbf{X}[i,j], mean(\mathbf{X}[kk:kk-999,j]), sd(\mathbf{X}[kk:kk-999,j])) i=1,2,3,...,1000;$

$j=1,2,3,4,5 ; kk=kk+100$

(iv) Fitting D-vine copula model

$fam1 = rep(5,10)$

$par1 = CDVineSeqEst(norm_X[(kk-999):kk,], fam1, type=2, method="itau")par

(v) Generate candidate $\mathbf{Y}_{k+1}^*$ according to D-vine copula model

$y_copula = CDVineSim(1, fam1, par1, type=2)$

$\mathbf{Y}_{k+1}^*[j] = qnorm(y_copula[j], mean(\mathbf{X}[(kk-999):kk,j]), sd(\mathbf{X}[(kk-999):kk,j]))$

(vi) Generate propose candidate $\mathbf{Y}_{k+1}^*$ for CopMH

$\mathbf{Y}_{k+1}^*[j] = 0.5 * rnorm(1, \mathbf{X}[k,j], 0.05 \times \mathbf{X}[k,j]) + 0.5 \times qnorm(y_copula[j], mean(\mathbf{X}[(kk-999):kk, j]), sd(\mathbf{X}[(kk-999):kk, j]))$

(vii) Generation of the Markov chain

Run Hymod with model parameters Y_{k+1}^* , and obtaine the simulated observations Q_{sim}^* .

Then calculate $ratio(k + 1)$ according to equation (7). Loop iteration until $K=20000$.

if ($runif(1) < ratio[k+1,]$) $\{x[k+1,] = Y_{k+1}^*\}$

else $\{x[k+1,] = x[k,]\}$

$K = K + 1$
