Supplementary Material

1. Validation of the Bayesian-DREAM(zs) calibration framework.

The developed Bayesian-DREAM(zs) calibration framework has been validated through a benchmark study case.

In the numerical experiments, the prior probability was assumed to follow a uniform distribution of U(-20, 20). The measured data was taken from The theoretical post probability distribution of this case is known and is shown in eqation S(1).

$$F(\mathrm{x}) = \frac{1}{6}\varphi(-8,1) + \frac{5}{6}\varphi(10,1) \qquad \mathrm{S}(1)$$

The R-statistics, RMSE, MAE and NSE trajectories during sampling are shown in Fig S1.The theoretical and Bayesian-DREAM(zs) inferred posterior distributions are shown in Fig S2. It could be seen that the two results agree very well.

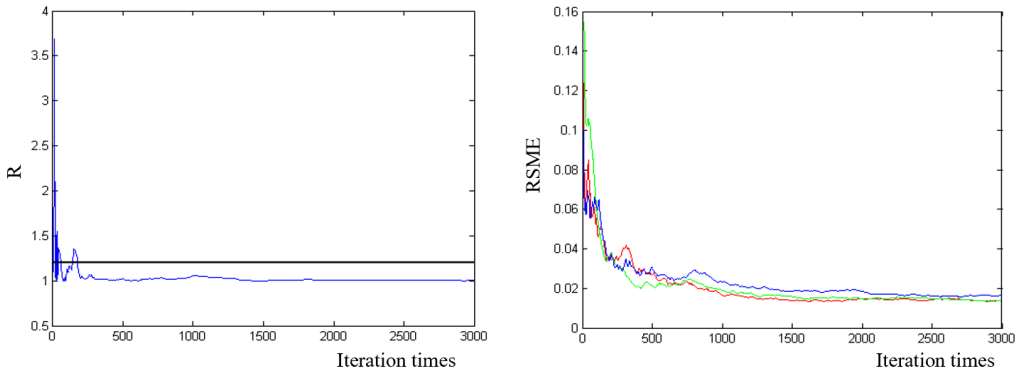


Fig. S1 The R-statistics and RMSE trajectories during sampling

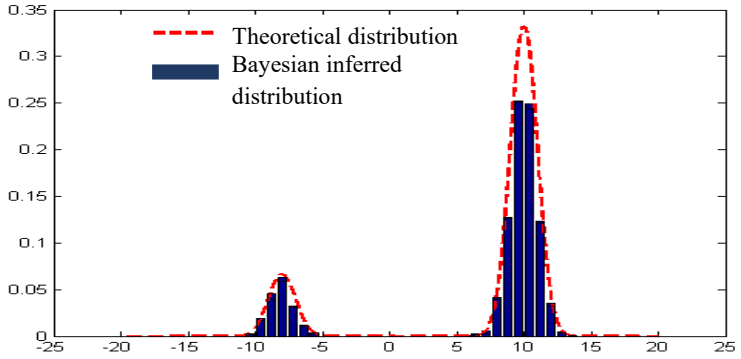
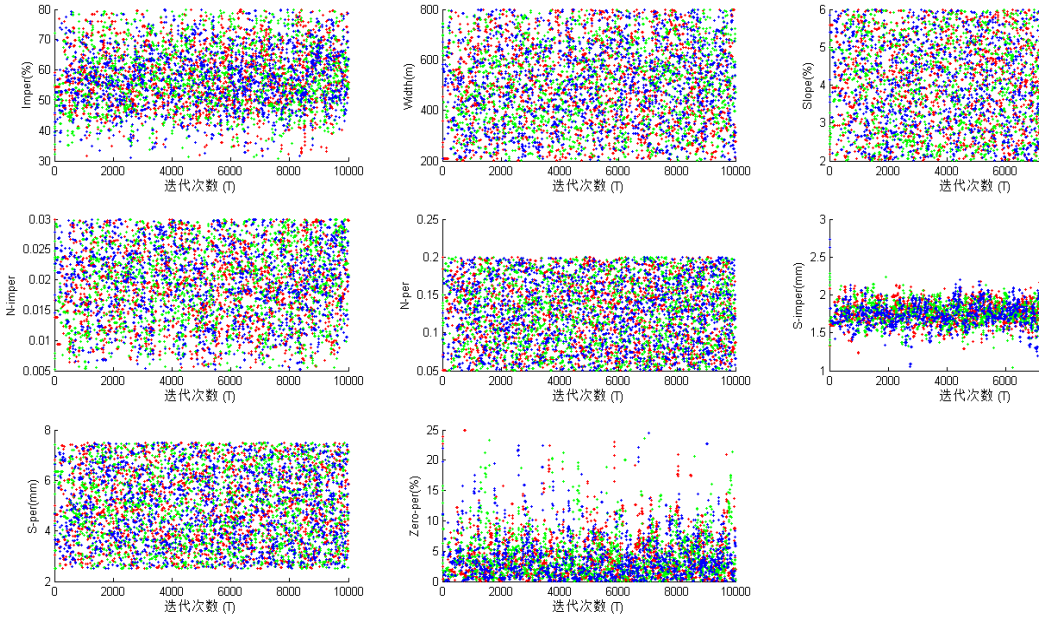
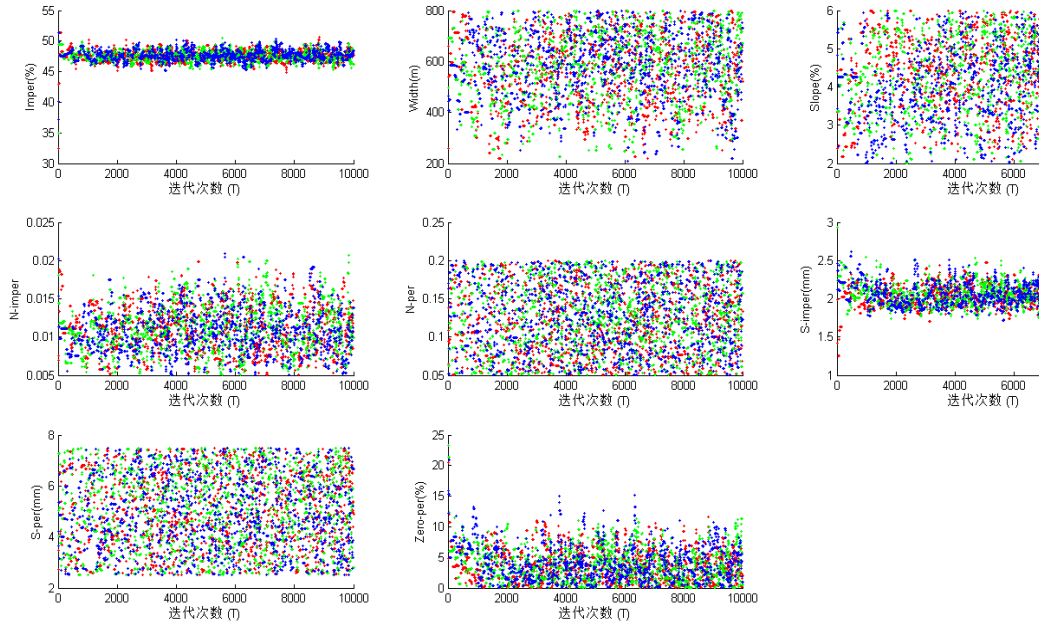


Fig. S2 The theoretical and Bayesian inferred posterior distributions

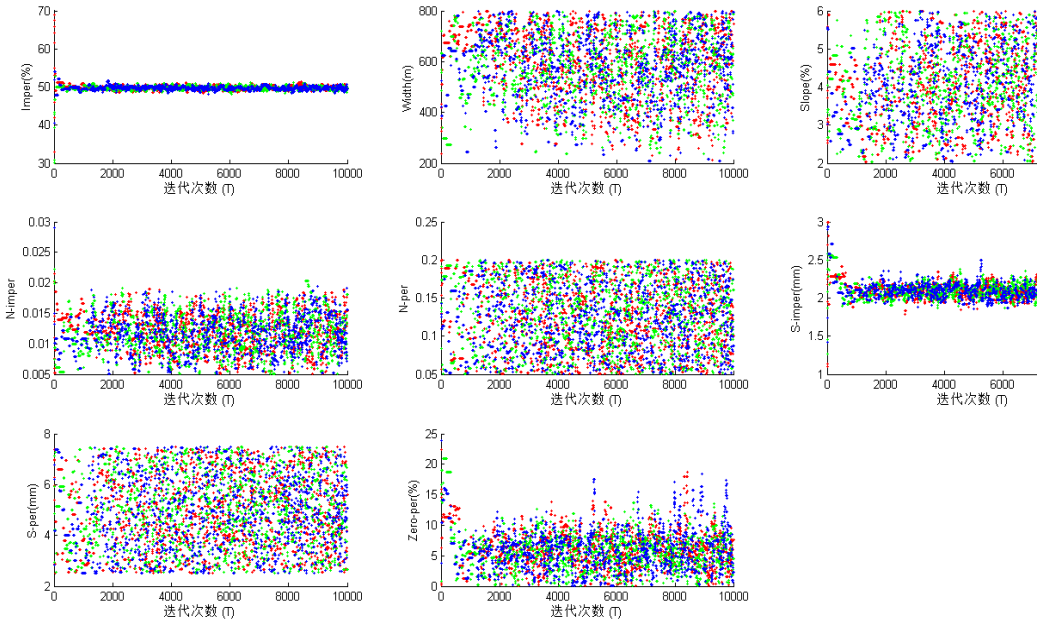
2. sampling trajectory of each parameter under nine rainfall intensities (R1 through R9).


Imper(%)
Width(m)
Slope(%)
N-imper
N-per
S-imper(mm)
S-per(mm)
Zero-per(%)
迭代次数 (T)

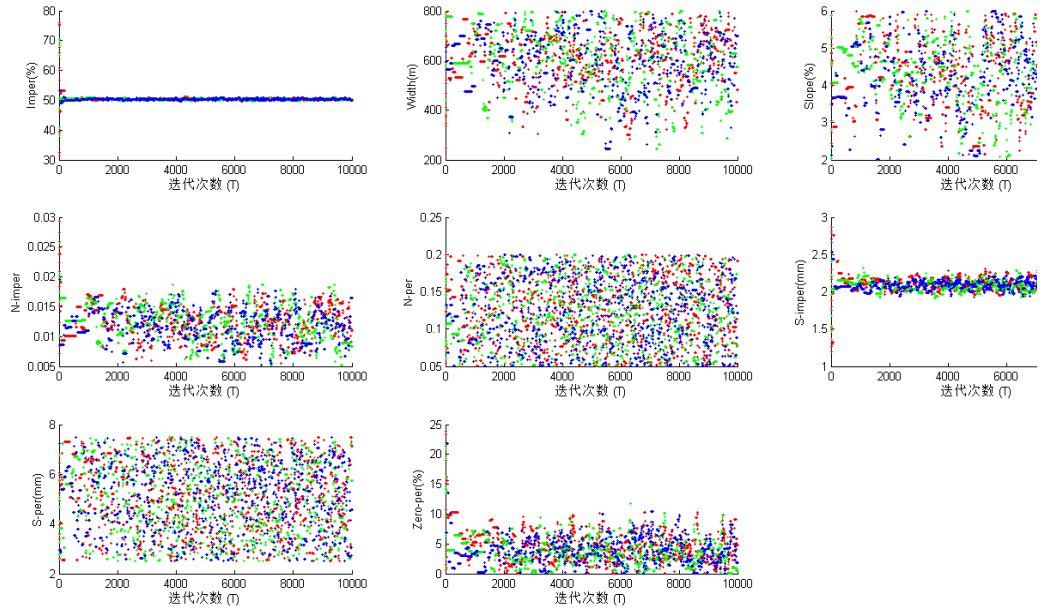
R1


Imper(%)
Width(m)
Slope(%)
N-imper
N-per
S-imper(mm)
S-per(mm)
Zero-per(%)
迭代次数 (T)

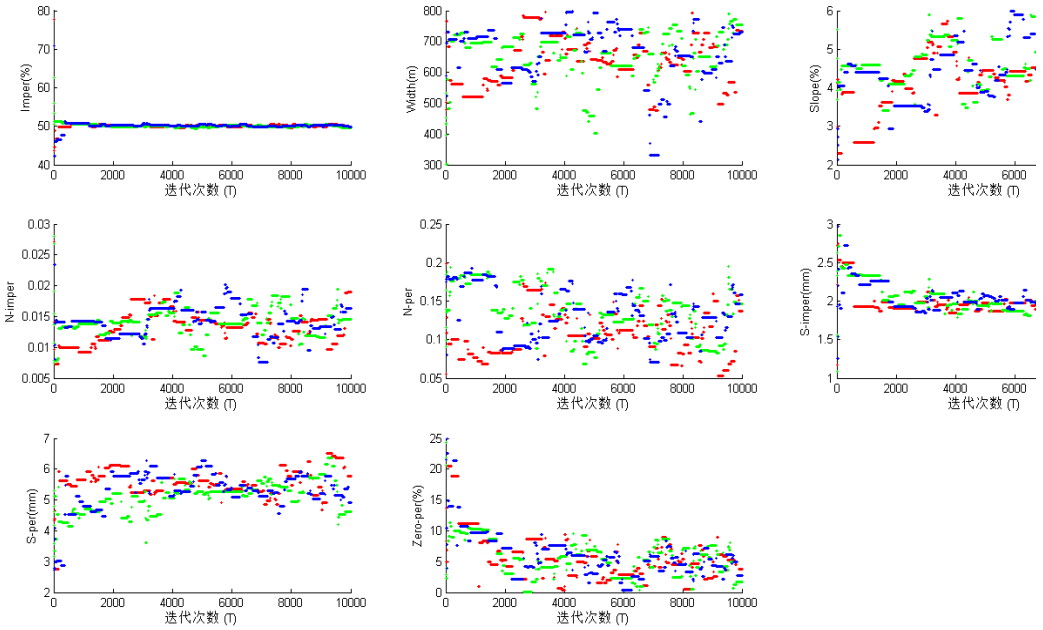
R2


Imper(%)
Width(m)
Slope(%)
N-imper
N-per
S-imper(mm)
S-per(mm)
Zero-per(%)
迭代次数 (T)

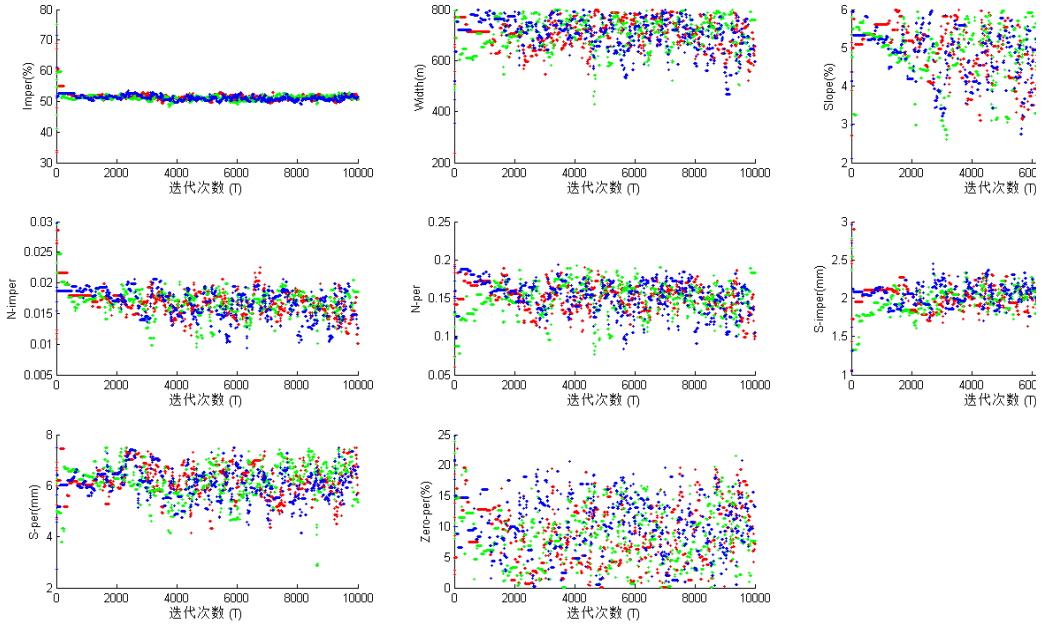
R3


Imper(%)
Width(m)
Slope(%)
N-imper
N-per
S-imper(mm)
S-per(mm)
Zero-per(%)
迭代次数 (T)

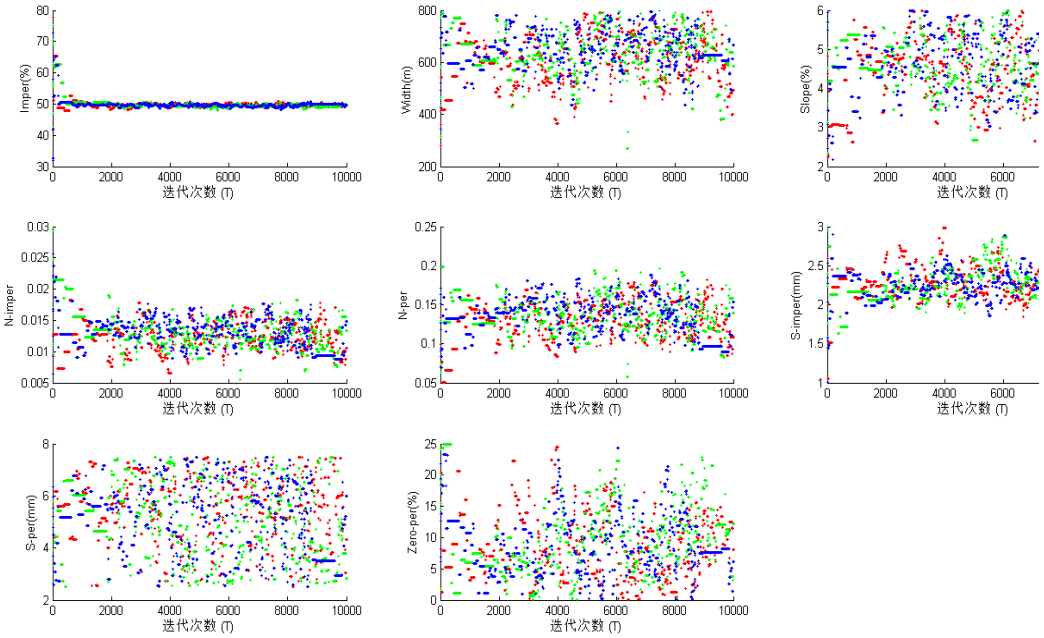
R4


Imper(%)
Width(m)
Slope(%)
N-imper
N-per
S-imper(mm)
S-per(mm)
Zero-per(%)
迭代次数 (T)

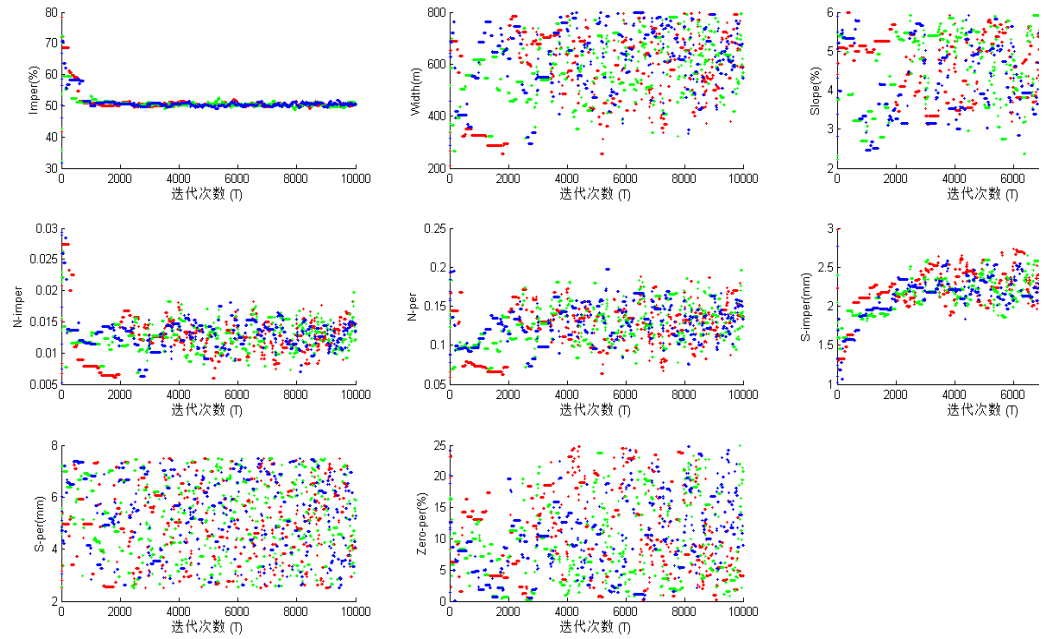
R5


Imper(%)
Width(m)
Slope(%)
N-imper
N-per
S-imper(mm)
S-per(mm)
Zero-per(%)
迭代次数 (T)

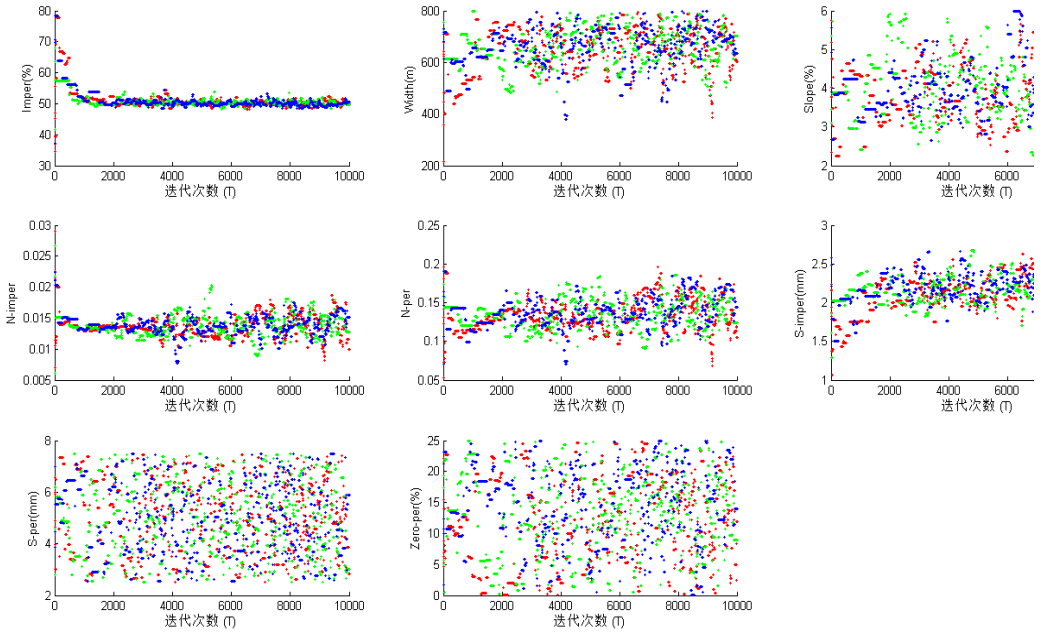
R6


Imper(%)
Width(m)
Slope(%)
N-imper
N-per
S-imper(mm)
S-per(mm)
Zero-per(%)
迭代次数 (T)

R7


Imper(%)
Width(m)
Slope(%)
N-imper
N-per
S-imper(mm)
S-per(mm)
Zero-per(%)
迭代次数 (T)

R8



R9

Fig. S3. The sampling trajectory of each parameter in the calibration process

3. R-statistic under nine rainfall intensities (R1 through R9).

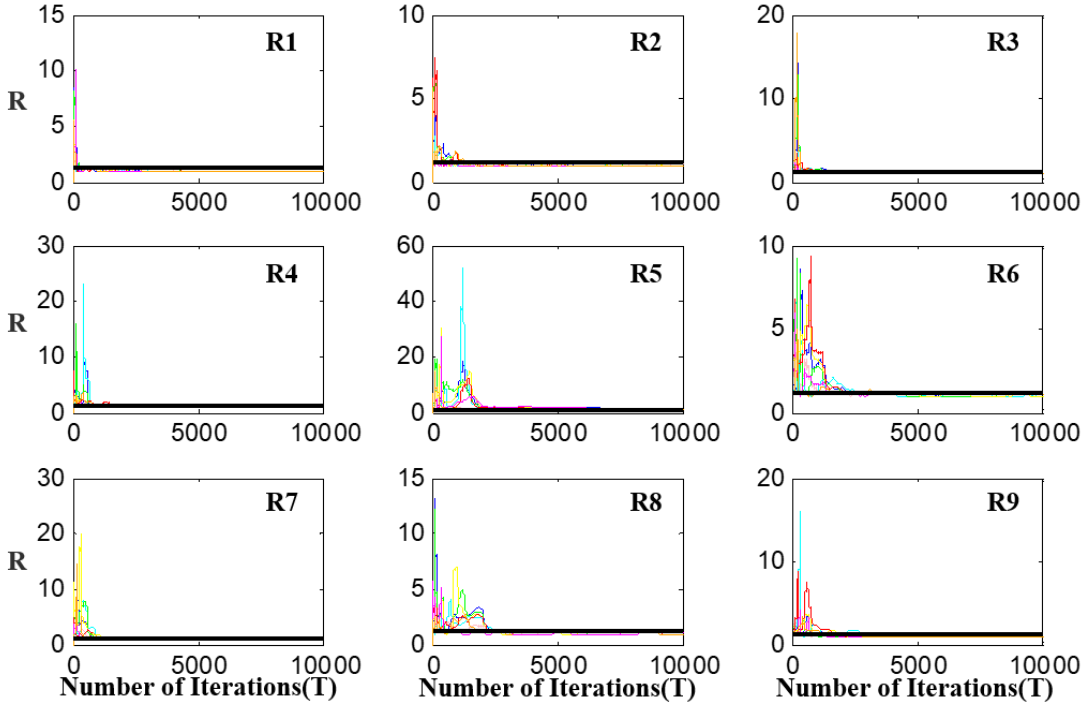


Figure. S4. The R-statistic trajectory in the sampling process

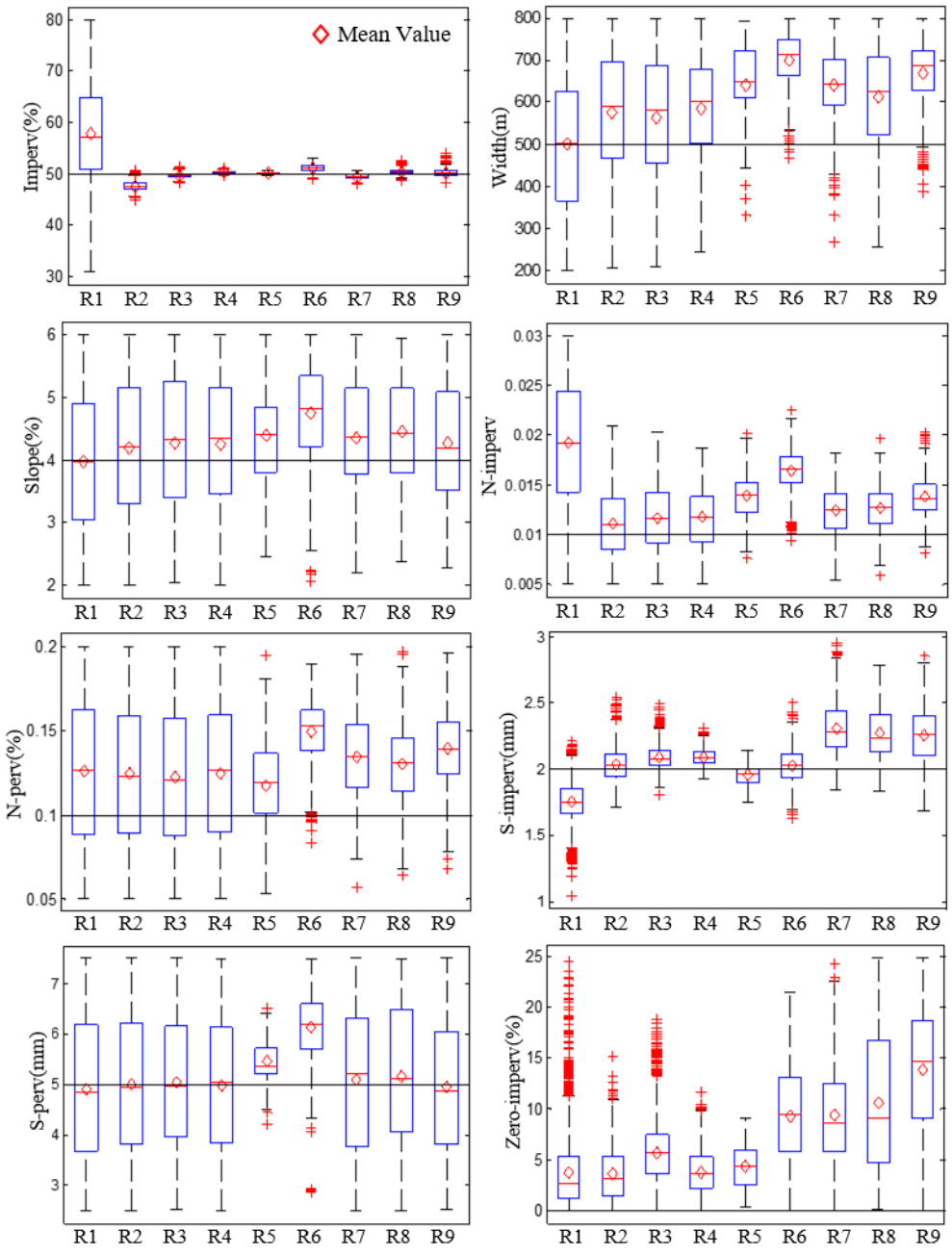


Fig. S5 The posterior distribution box map of studied parameters (solid line: true value of the parameter)

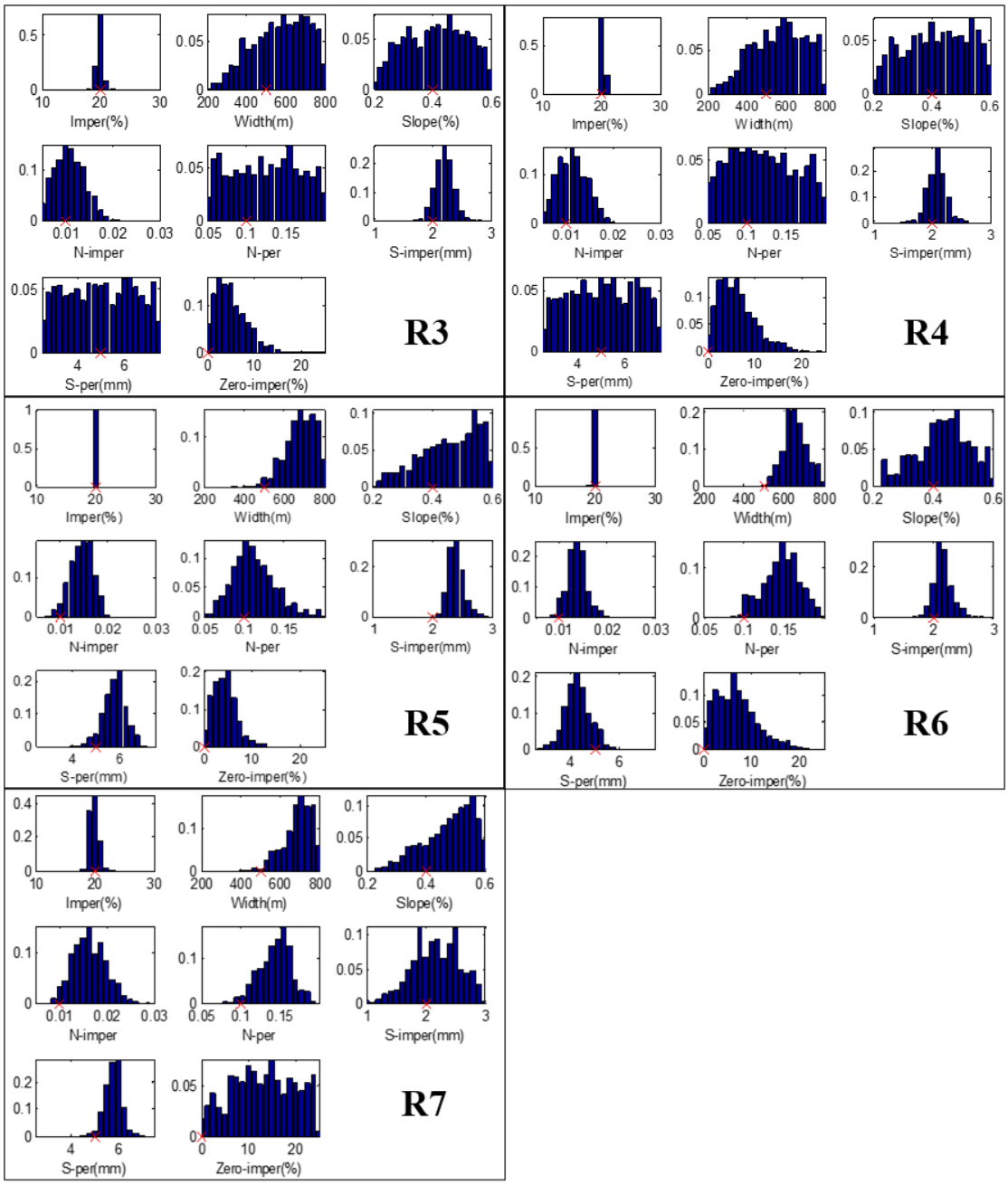


Fig. S6. The posterior distribution of eight parameters in various rainfalls (Type 1)

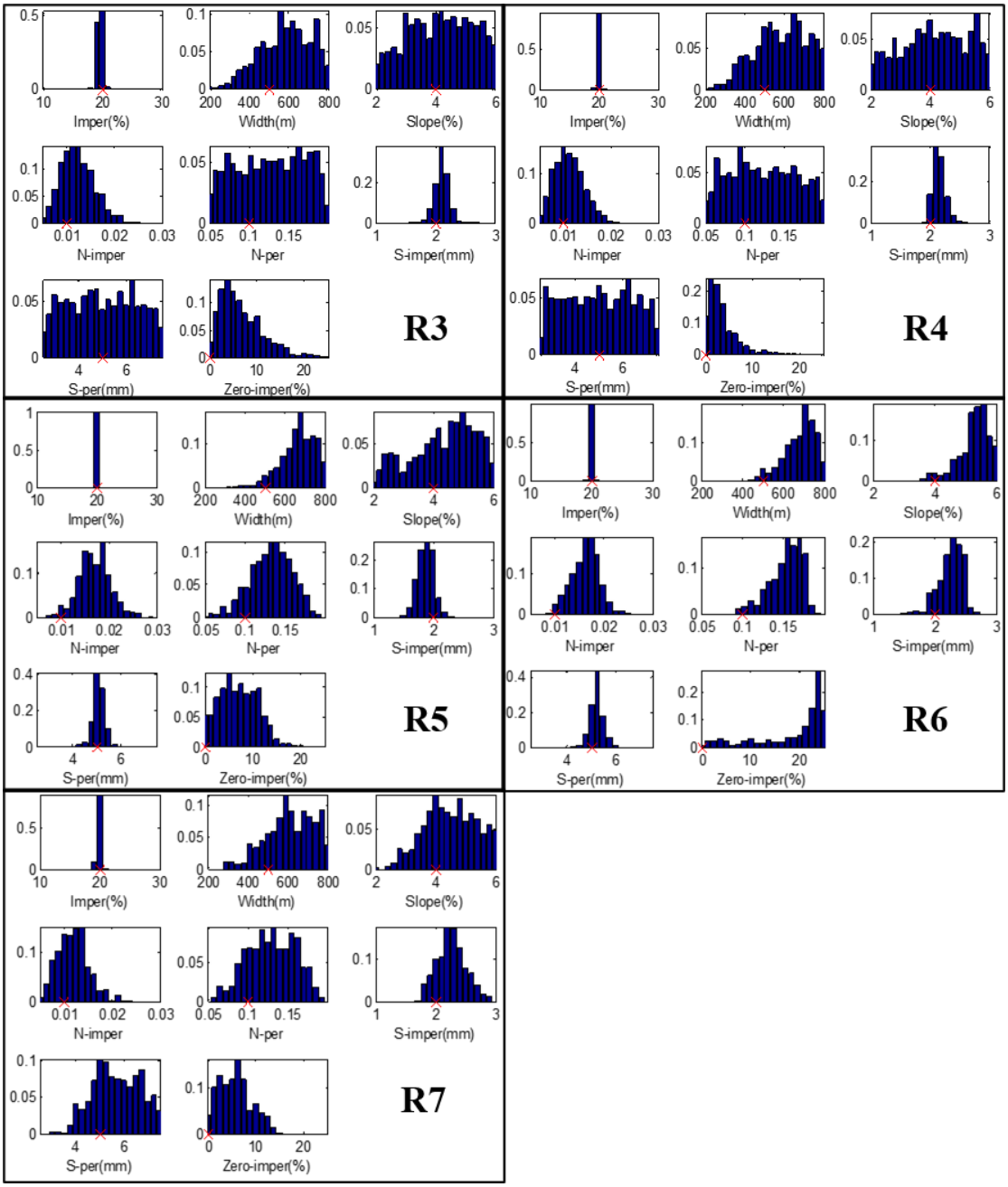


Fig. S7. The posterior distribution of eight parameters in various rainfalls (Type 2)

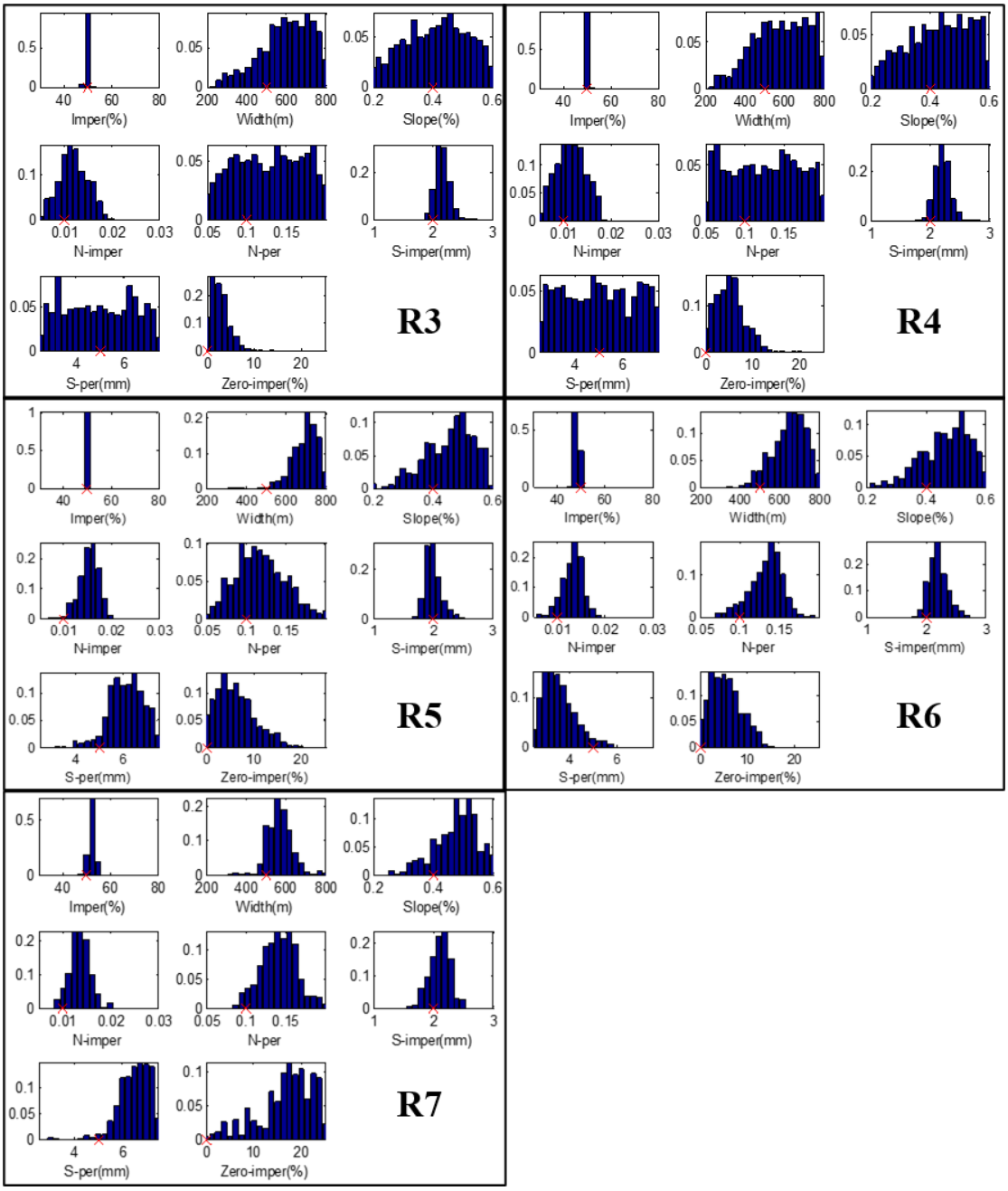


Fig. S8. The posterior distribution of eight parameters in various rainfalls (Type 3)

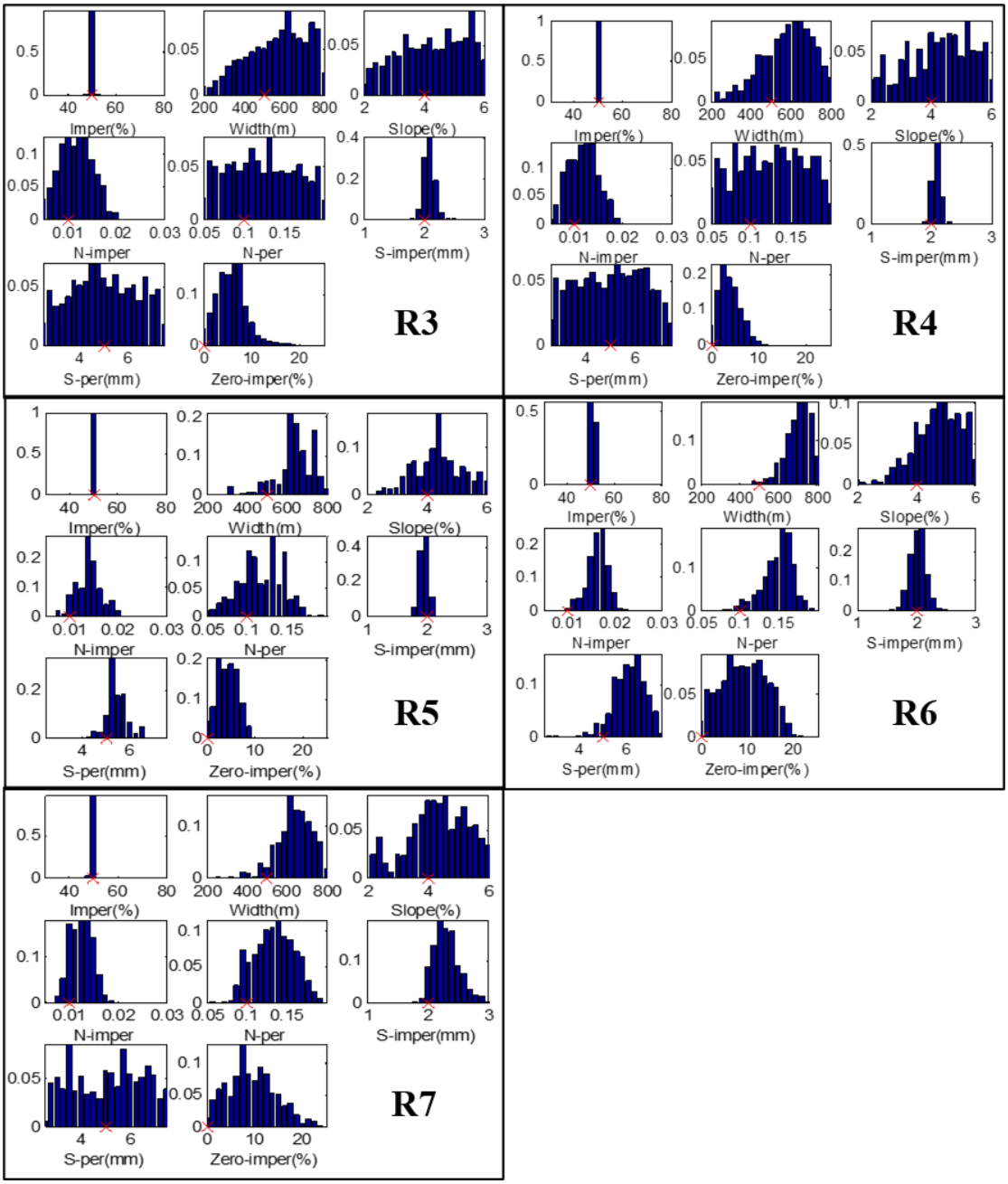


Fig. S9. The posterior distribution of eight parameters in various rainfalls (Type 4)

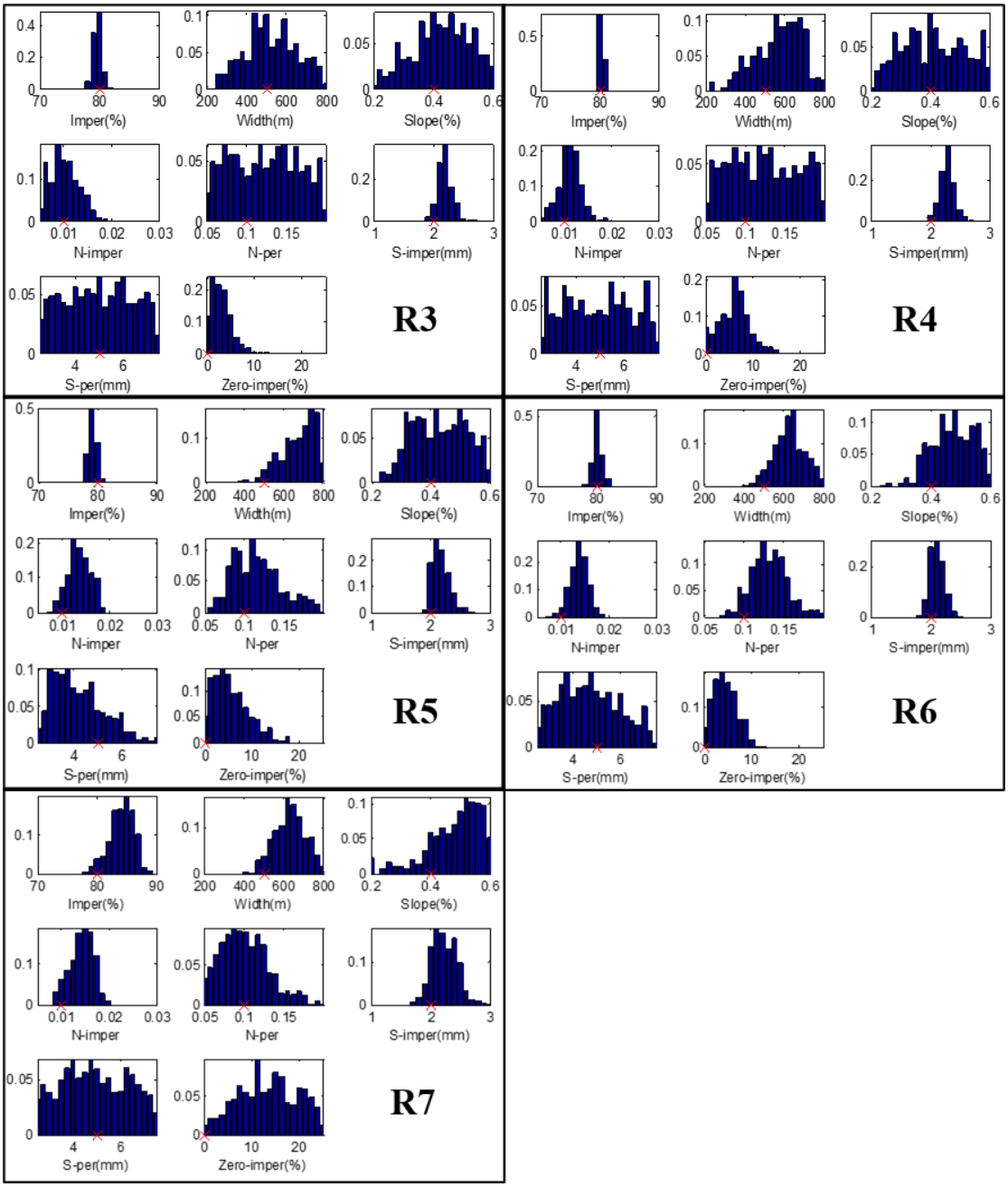


Fig. S10. The posterior distribution of eight parameters in various rainfalls (Type 5)

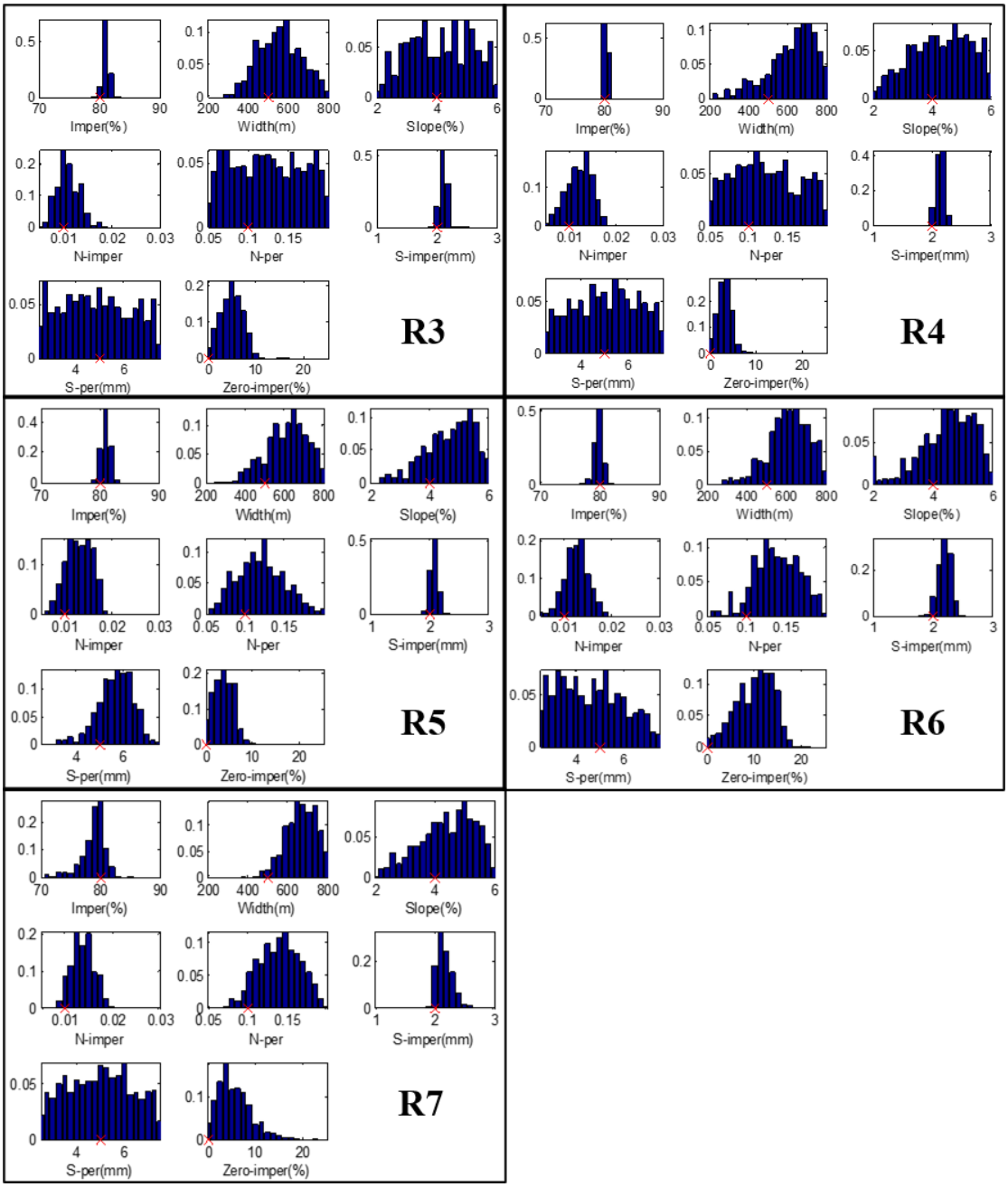


Fig. S11. The posterior distribution of eight parameters in various rainfalls (Type 6)