



Supplement of

Joint characterization of heterogeneous conductivity fields and pumping well attributes through iterative ensemble smoother with a reduced-order modeling strategy for solute transport

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24 Table S1 Values of Kullback-Leibler Divergence (KLD) between the sample
25 probability density functions of heads at the three reference points (i.e., I, II, and III)
26 at the final outer iteration through iES_FSM (h_{FSM}) and iES_ROM (h_{ROM}) with $n = 5$
27 (TC1), 10 (TC2), 20 (TC4), and 30 (TC6).

$\text{KLD}(h_{\text{ROM}} h_{\text{FSM}}), \text{KLD}(h_{\text{FSM}} h_{\text{ROM}})$	I	II	III
TC1	2.63, 1.70	3.40, 1.90	2.25, 1.66
TC2	2.01, 1.08	2.15, 1.10	1.21, 1.04
TC4	1.48, 1.35	1.56, 1.31	1.07, 1.01
TC6	1.27, 1.49	1.23, 1.34	0.79, 1.02

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29 Table S2 Values of Kullback-Leibler Divergence (KLD) between the sample
 30 probability density functions of solute concentrations at the three reference points (i.e.,
 31 I, II, and III) at the final outer iteration through iES_FSM (c_{FSM}) and iES_ROM (c_{ROM})
 32 with $n = 5$ (TC1), 10 (TC2), 20 (TC4), and 30 (TC6).

KLD($c_{ROM} c_{FSM}$), KLD($c_{FSM} c_{ROM}$)	I	II	III
TC1	0.32, 0.82	1.86, 1.92	1.25, 1.25
TC2	0.41, 0.34	1.42, 1.17	0.37, 0.71
TC4	0.28, 0.33	0.85, 1.14	0.24, 0.59
TC6	0.30, 0.32	0.93, 1.11	0.11, 0.43

34 Table S3 Values of Kullback-Leibler Divergence (KLD) between the sample
 35 probability density functions of x_{1,q_s} (x_{2,q_s} , or $\ln q_s$) obtained through iES_FSM
 36 ($p_{j\text{FSM}}, j = x_{1,q_s}, x_{2,q_s}, \text{ and } \ln q_s$) and iES_ROM ($p_{j\text{ROM}}$) with $n = 30$, considering N_m
 37 = 9, 18, and 55 (corresponding to TCs 18, 19, and 6, respectively).

$\text{KLD}(p_{j\text{ROM}} p_{j\text{FSM}}), \text{KLD}(p_{j\text{FSM}} p_{j\text{ROM}})$	$j = x_{1,q_s}$	$j = x_{2,q_s}$	$j = \ln q_s$
TC18	4.54, 5.51	4.68, 5.36	7.30, 7.80
TC19	2.02, 1.86	3.18, 3.67	7.21, 7.04
TC6	1.43, 0.78	3.49, 3.34	5.98, 6.70

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