

## Appendix B - Figures for Scenario 1

In this appendix we present simulation results for all parameter combinations in Scenario 1. Recall that in Scenario 1, data are simulated according to the model

$$\begin{aligned}y_{it} &= x_t + \varepsilon_{it}, \quad \varepsilon_{it} \sim N(0, \sigma^2), \quad i = 1, \dots, K, \\x_{t+1} &= a + cx_t + \nu_t, \quad \nu_t \sim N(0, \tau^2), \quad t = 1, \dots, T - 1.\end{aligned}$$

The figures for each of the parameter combinations on the next few pages demonstrate the performance of parameter estimates under each of the three model fitting methods. The left columns give the root mean square errors (RMSE). These are measures of how close the parameter estimates are to true parameter values on average. The right columns give the bias of the estimates, i.e. the average deviation from the true values.

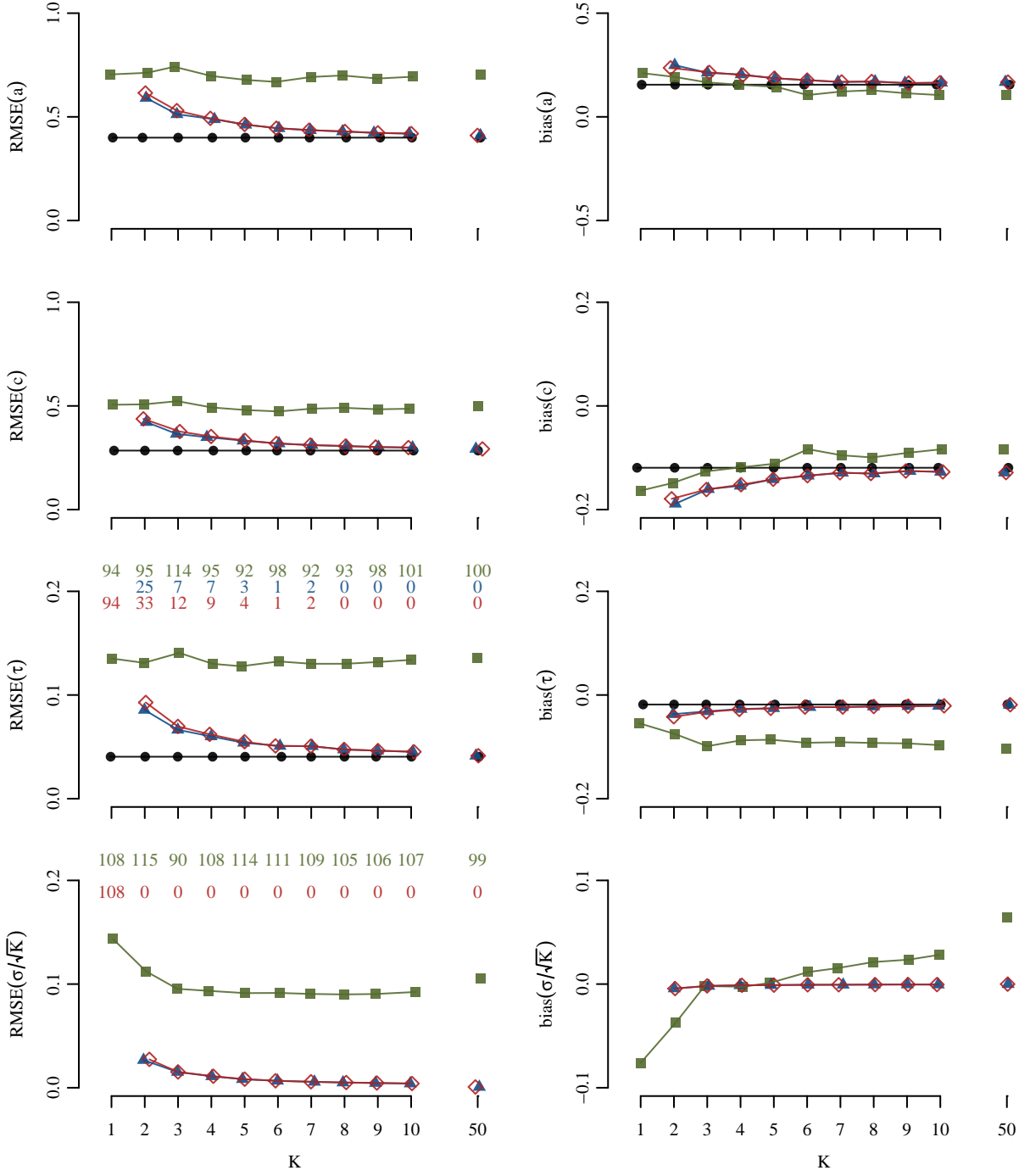


Figure B1: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.3$ ,  $\tau = 0.2$ ,  $\sigma = 0.2$ . The length of each of the 250 simulated series is 15. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

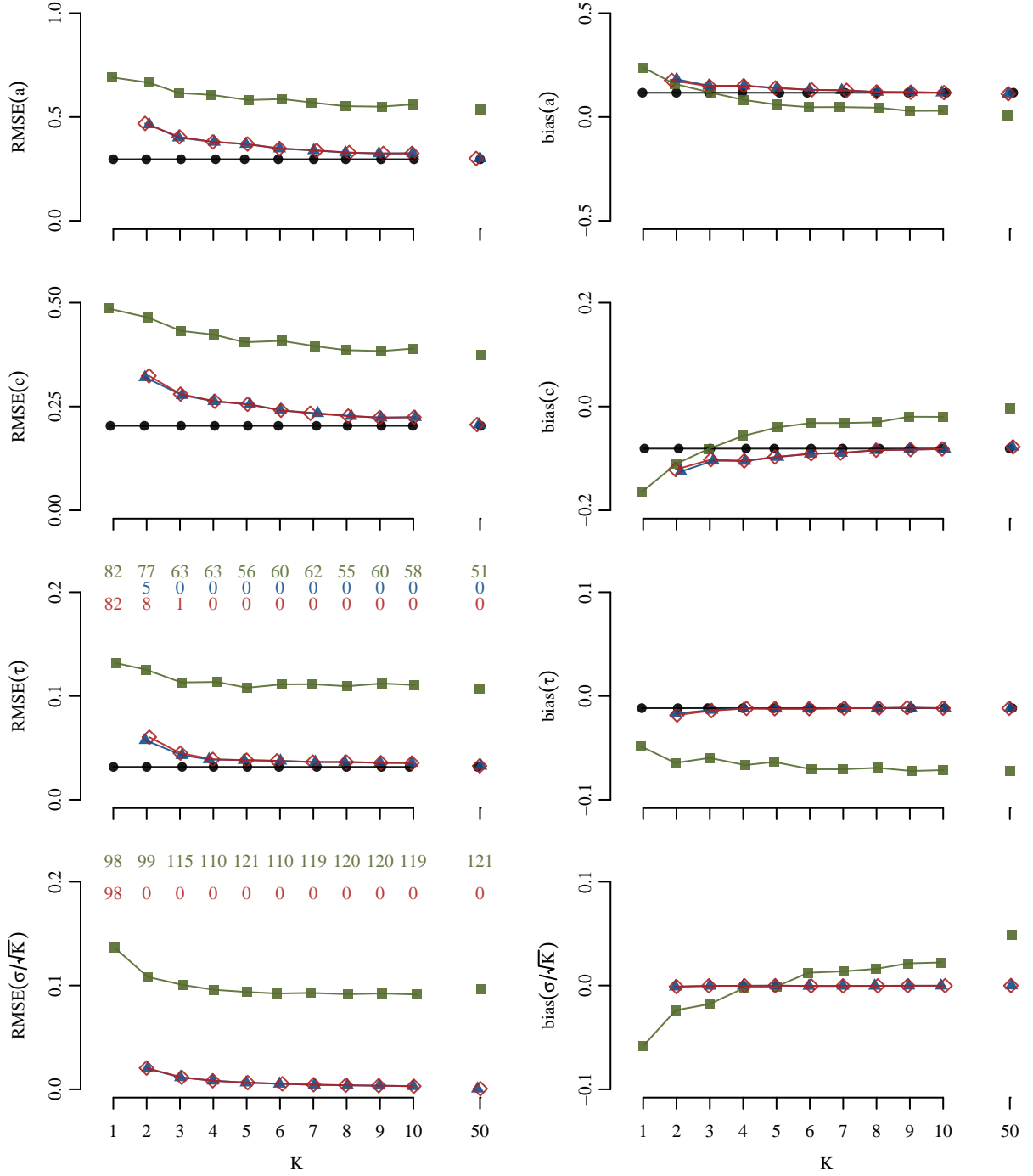


Figure B2: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.3$ ,  $\tau = 0.2$ ,  $\sigma = 0.2$ . The length of each of the 250 simulated series is 25. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

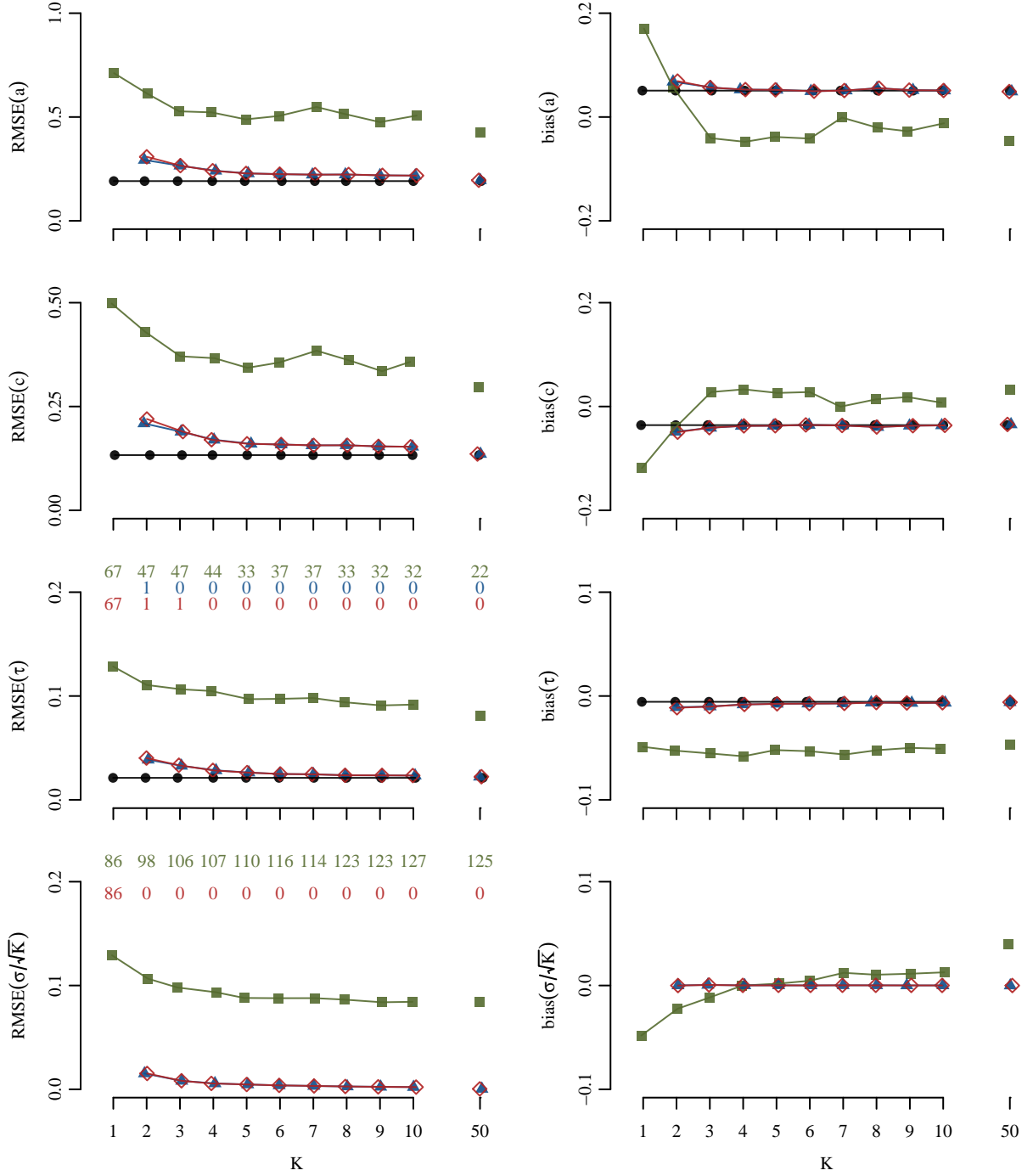


Figure B3: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.3$ ,  $\tau = 0.2$ ,  $\sigma = 0.2$ . The length of each of the 250 simulated series is 50. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

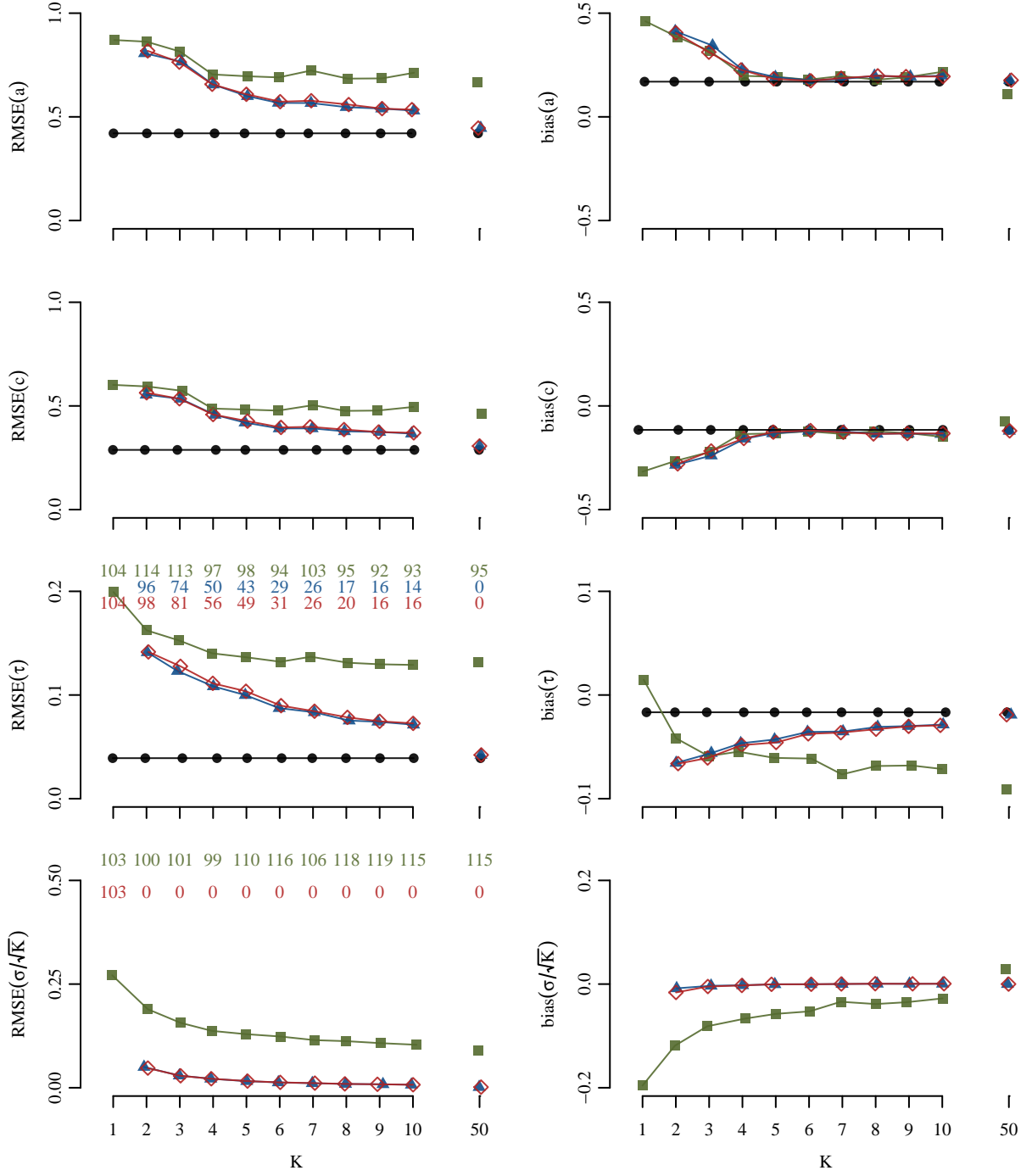


Figure B4: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.3$ ,  $\tau = 0.2$ ,  $\sigma = 0.4$ . The length of each of the 250 simulated series is 15. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

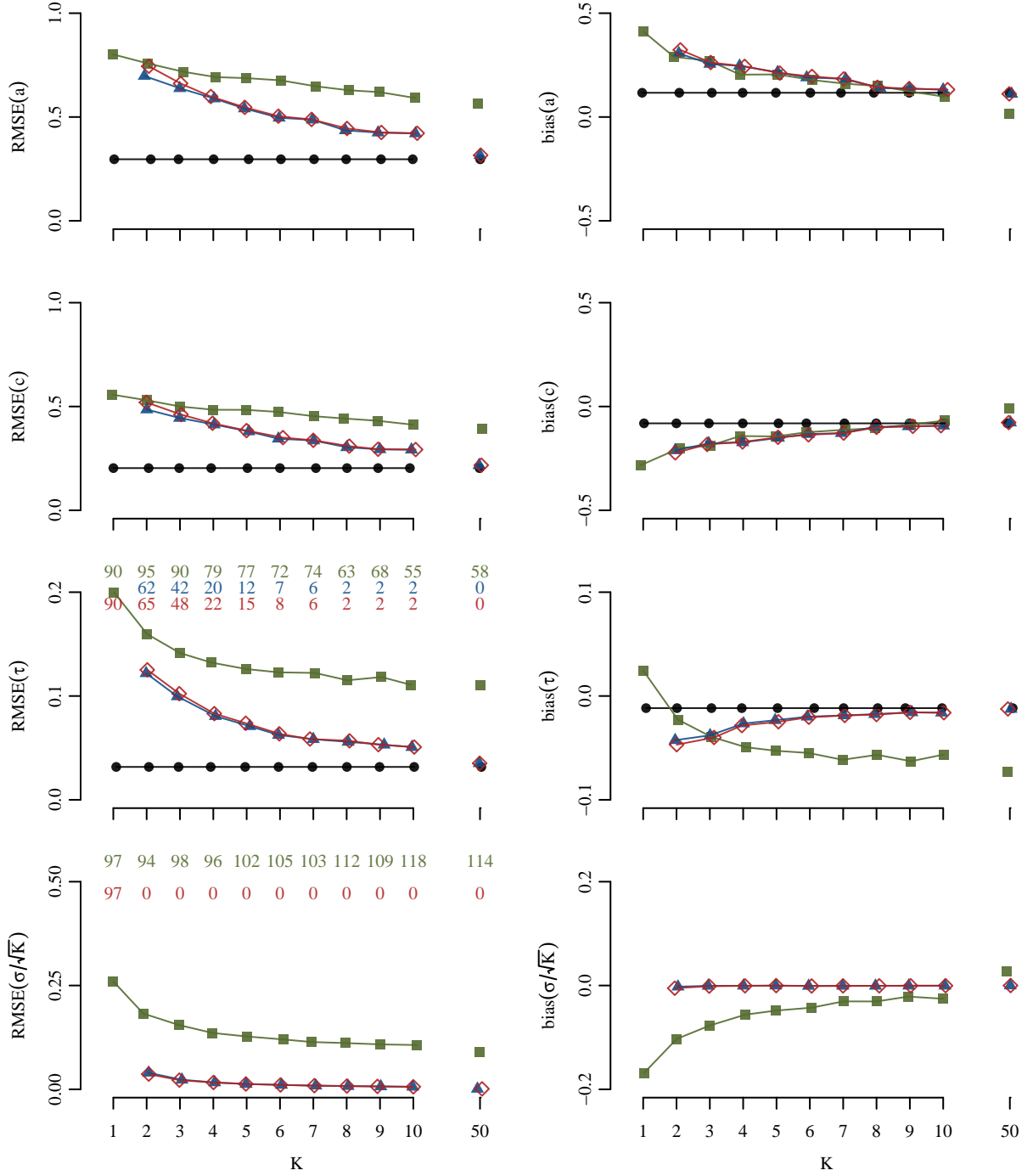


Figure B5: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.3$ ,  $\tau = 0.2$ ,  $\sigma = 0.4$ . The length of each of the 250 simulated series is 25. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

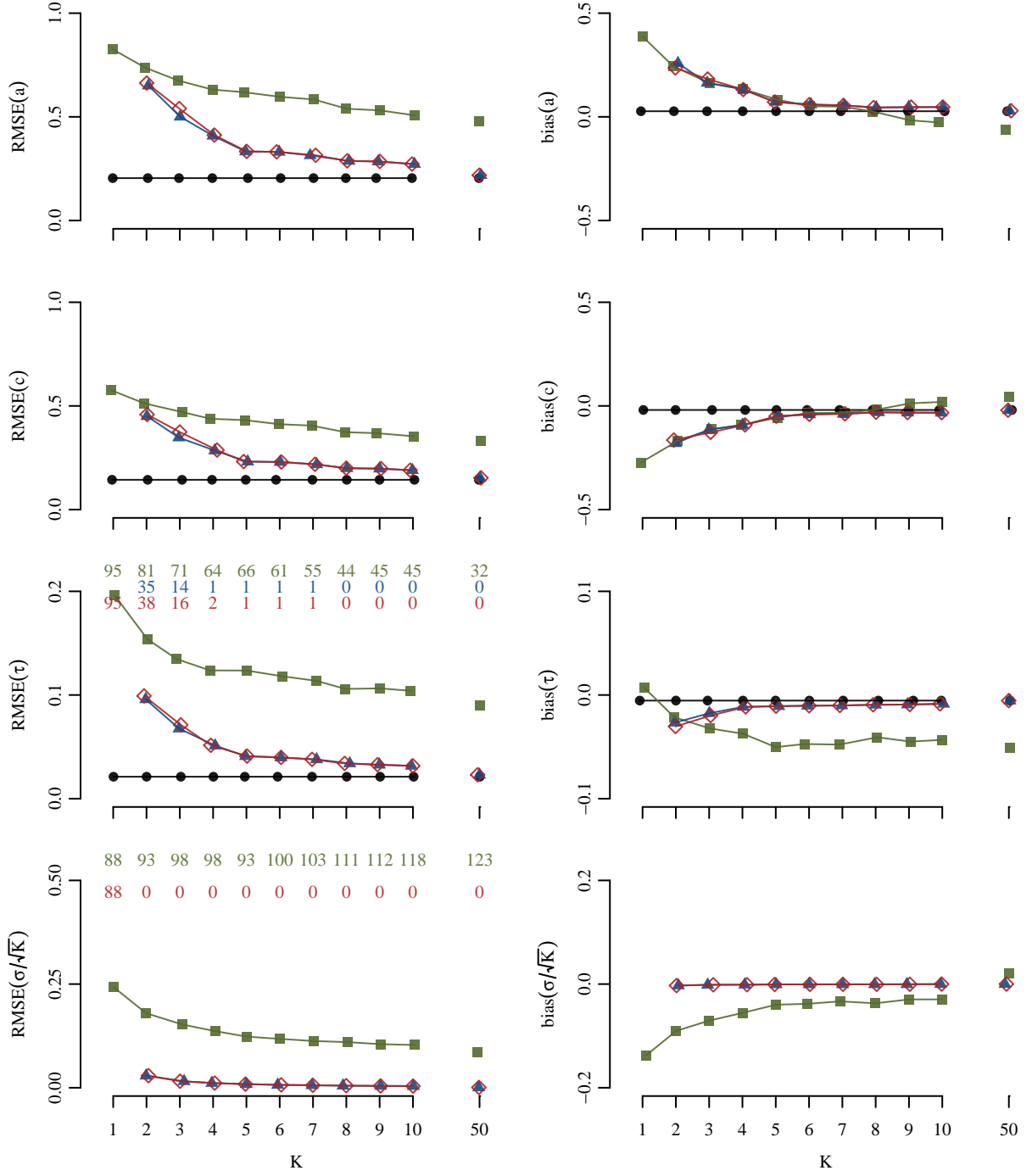


Figure B6: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.3$ ,  $\tau = 0.2$ ,  $\sigma = 0.4$ . The length of each of the 250 simulated series is 50. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

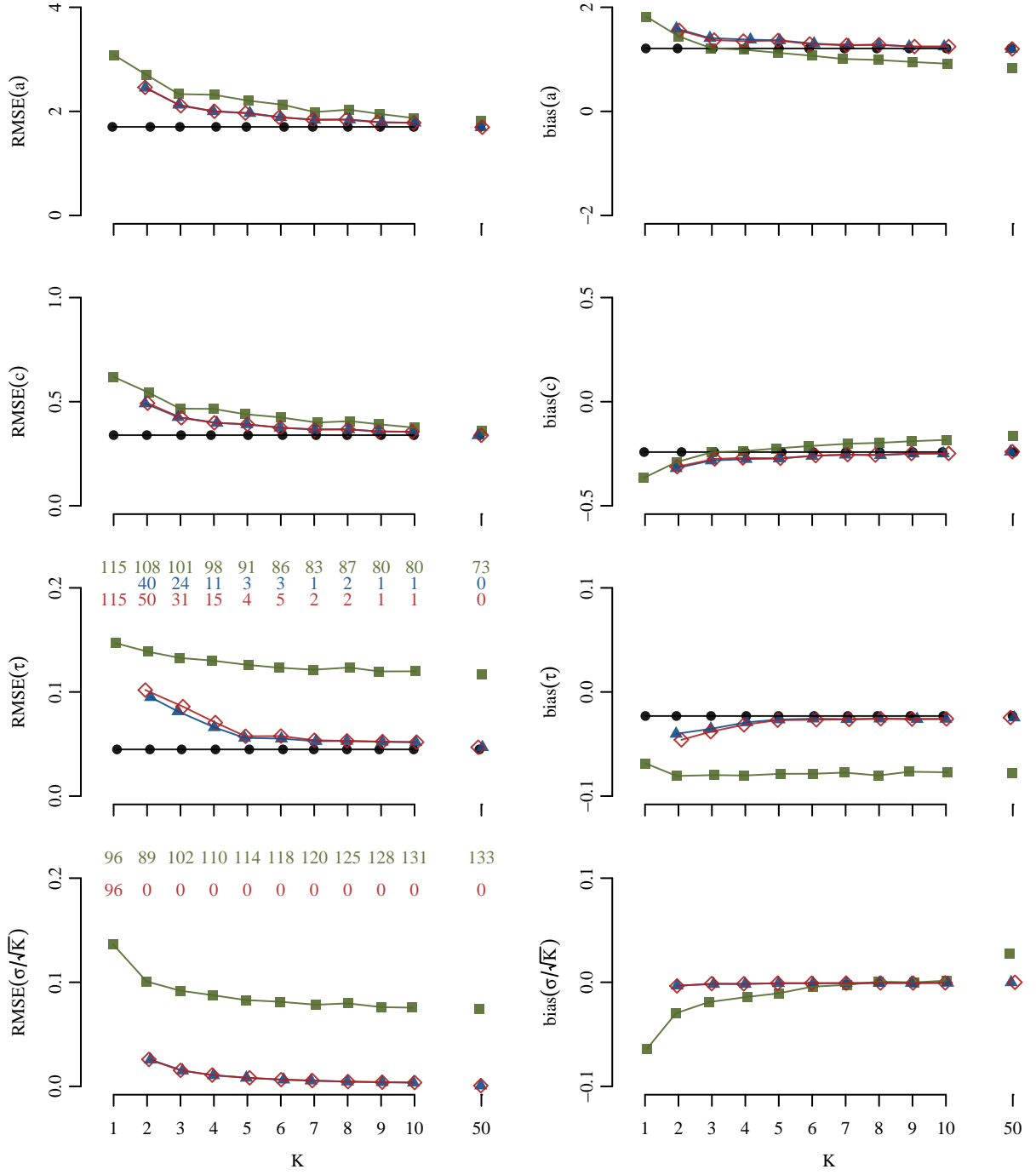


Figure B7: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.8$ ,  $\tau = 0.2$ ,  $\sigma = 0.2$ . The length of each of the 250 simulated series is 15. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.



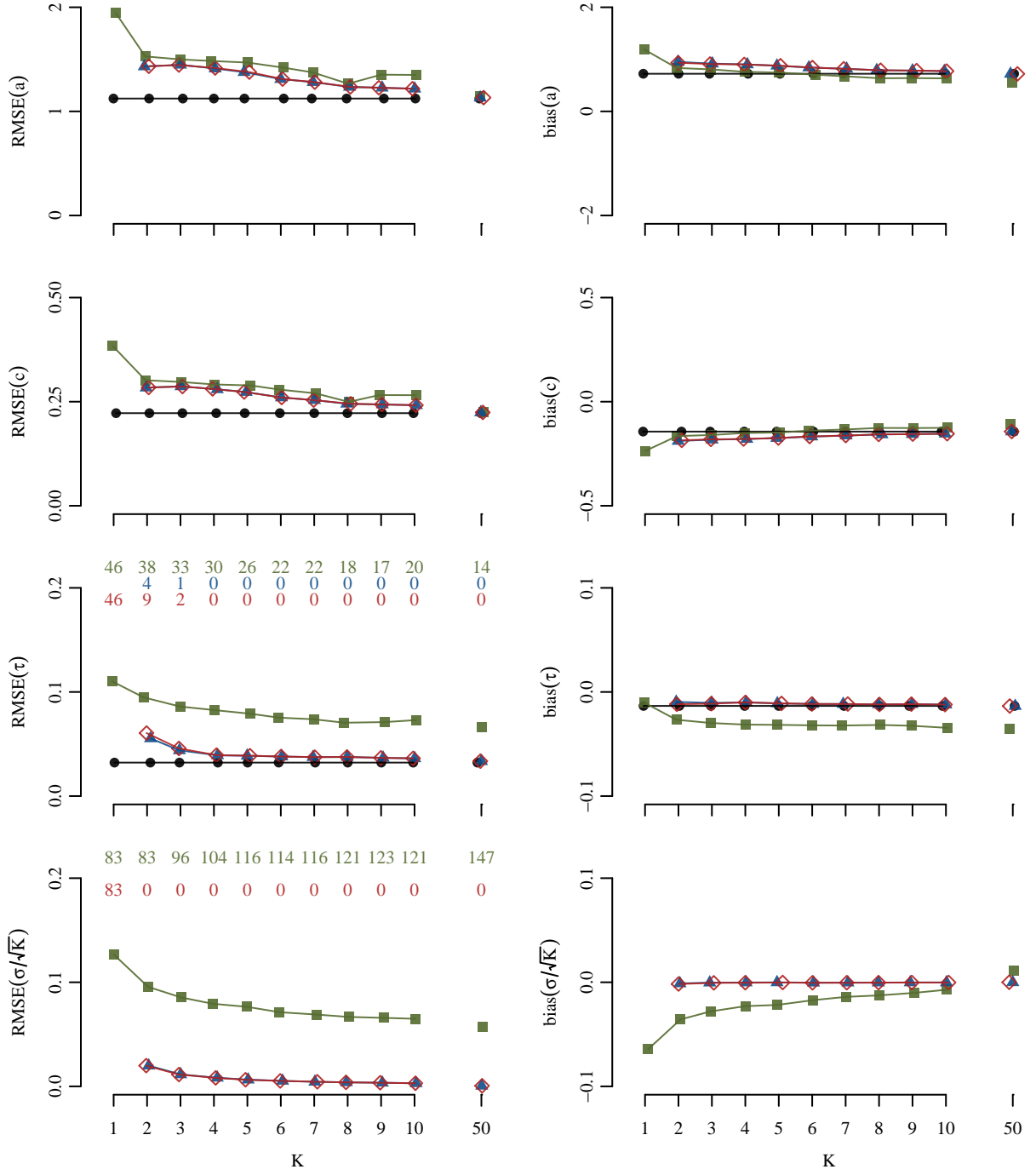


Figure B8: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.8$ ,  $\tau = 0.2$ ,  $\sigma = 0.2$ . The length of each of the 250 simulated series is 25. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

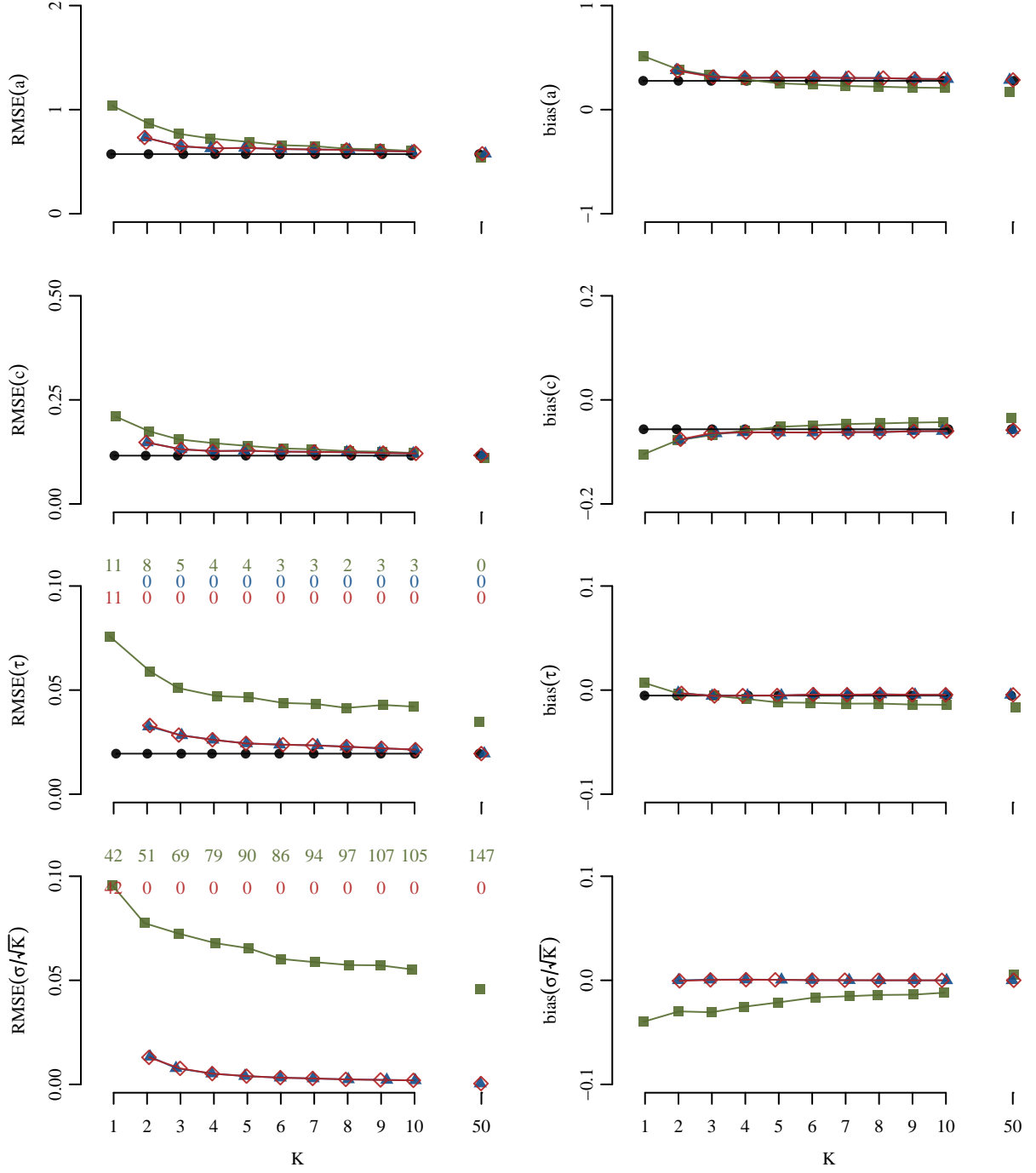


Figure B9: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.8$ ,  $\tau = 0.2$ ,  $\sigma = 0.2$ . The length of each of the 250 simulated series is 50. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

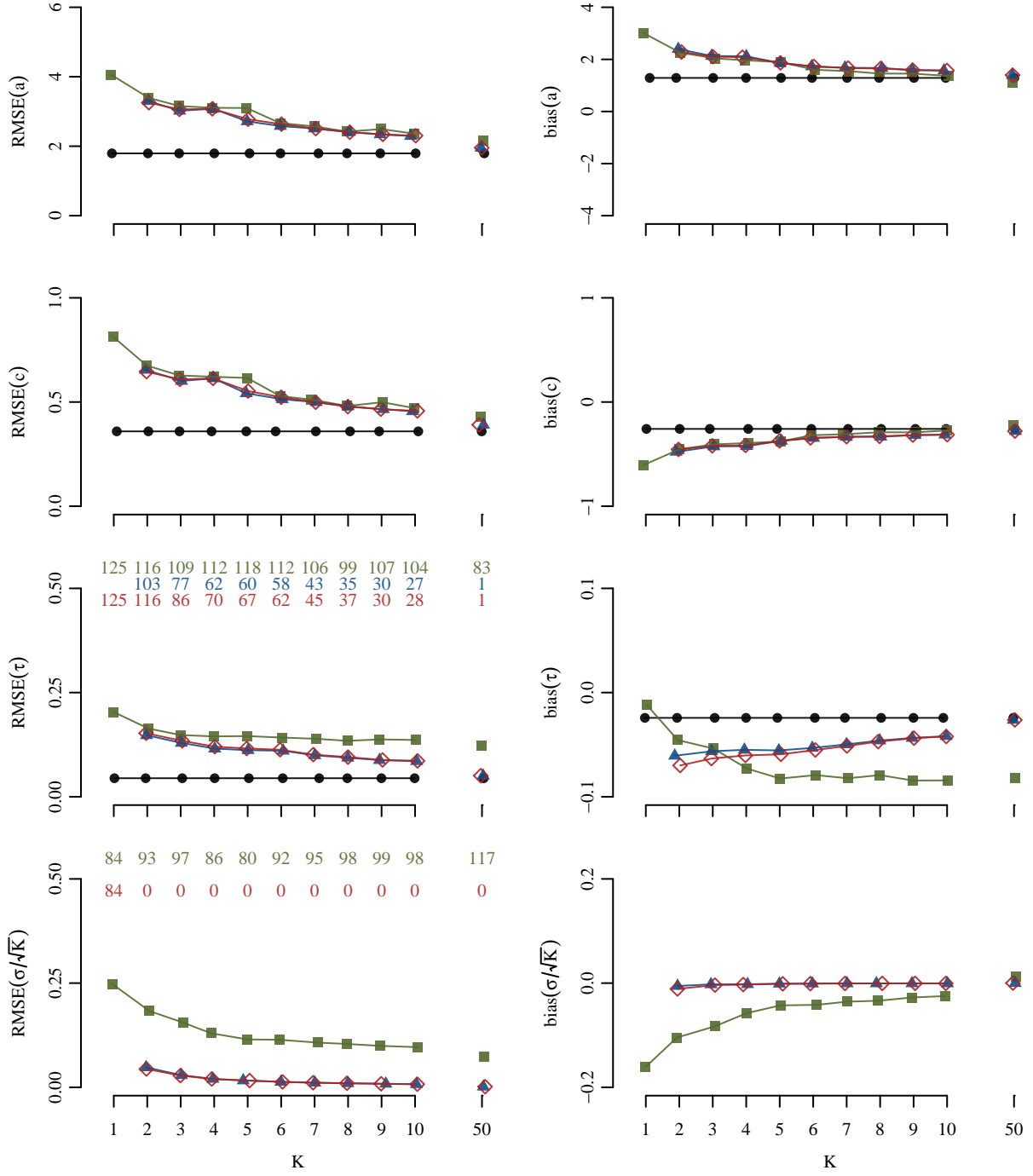


Figure B10: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.8$ ,  $\tau = 0.2$ ,  $\sigma = 0.4$ . The length of each of the 250 simulated series is 15. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

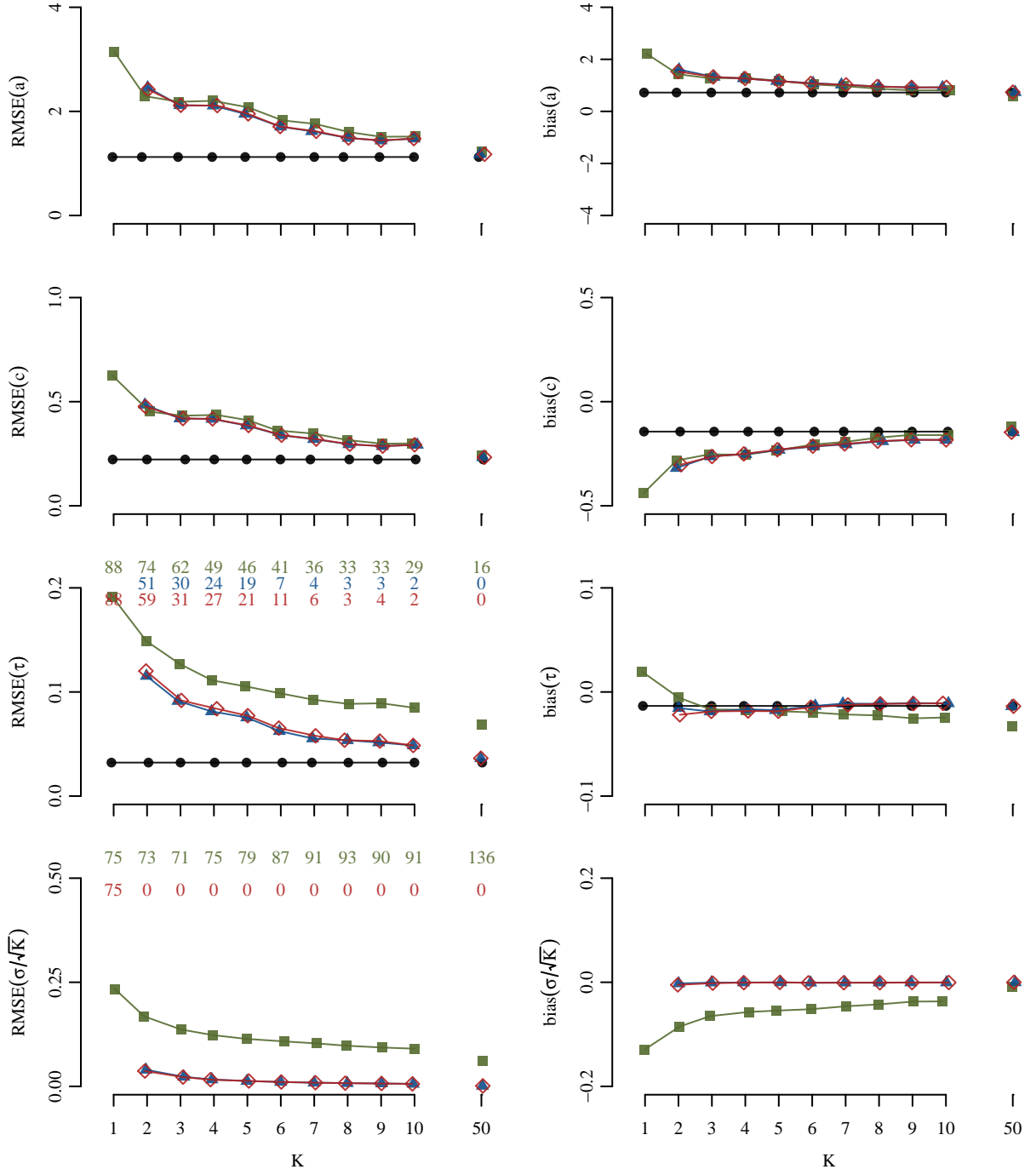


Figure B11: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.8$ ,  $\tau = 0.2$ ,  $\sigma = 0.4$ . The length of each of the 250 simulated series is 25. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

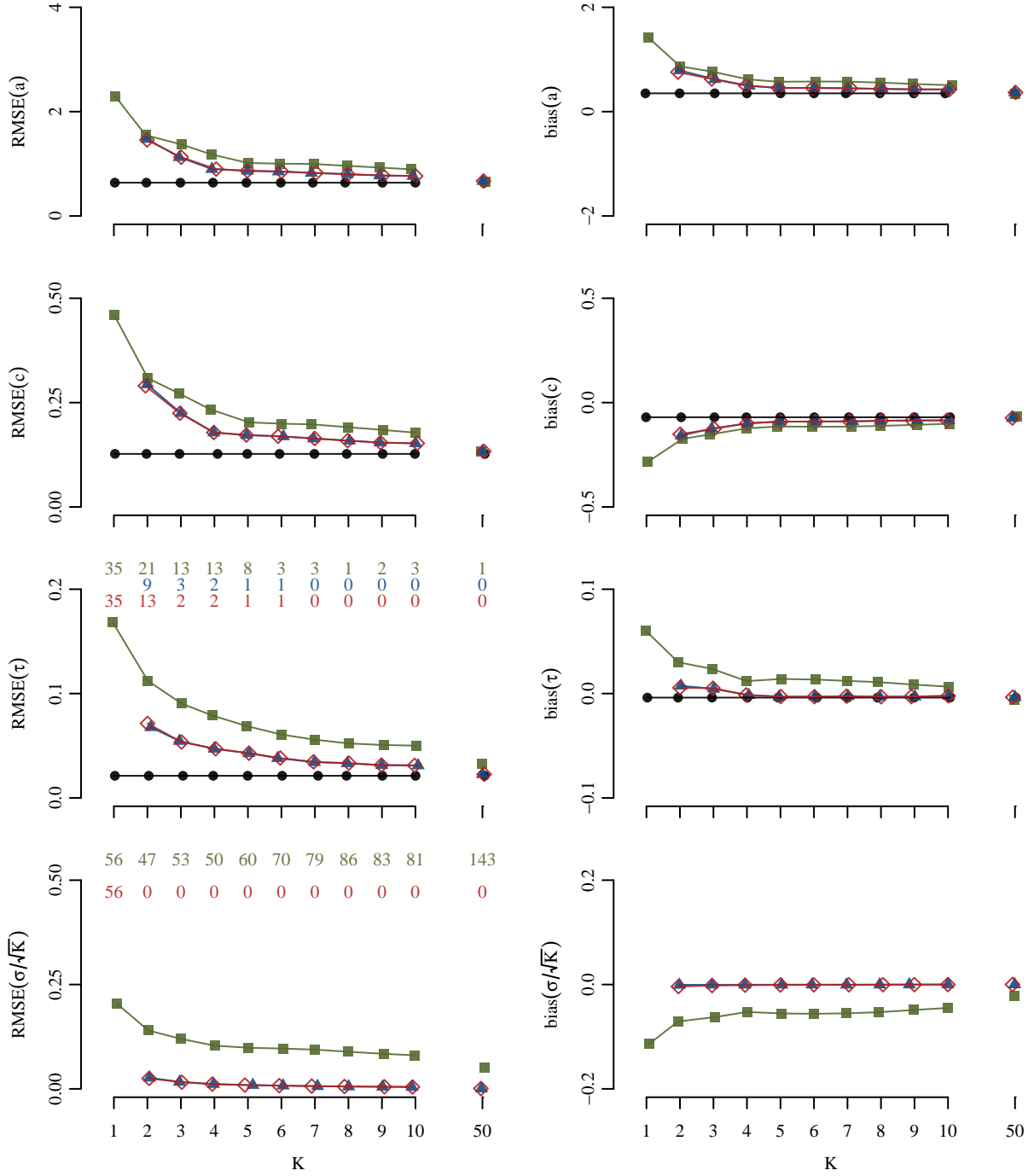


Figure B12: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 1$ ,  $c = 0.8$ ,  $\tau = 0.2$ ,  $\sigma = 0.4$ . The length of each of the 250 simulated series is 50. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

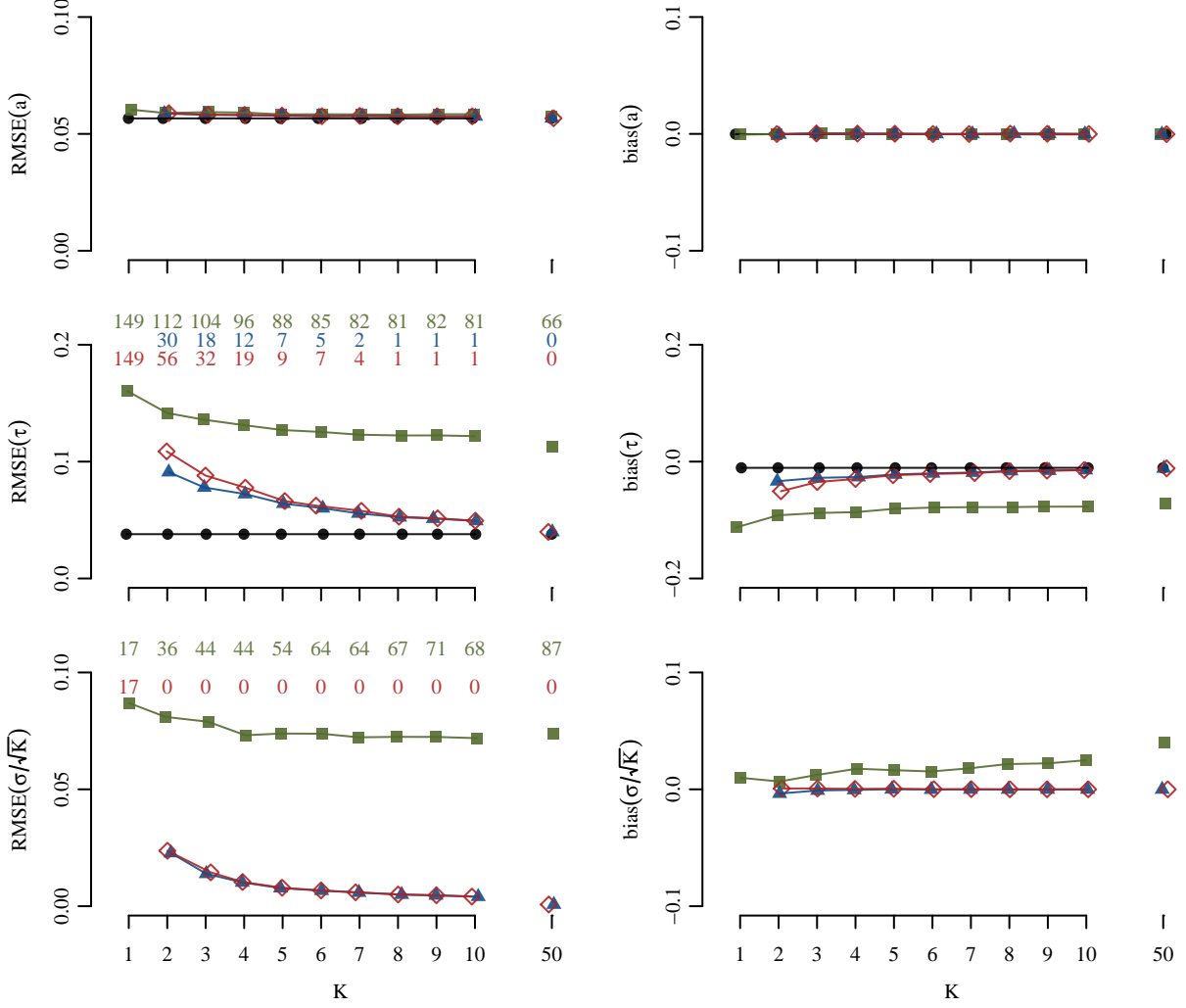


Figure B13: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 0$ ,  $c = 1$  (fixed in estimation),  $\tau = 0.2$ ,  $\sigma = 0.2$ . The length of each of the 250 simulated series is 15. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

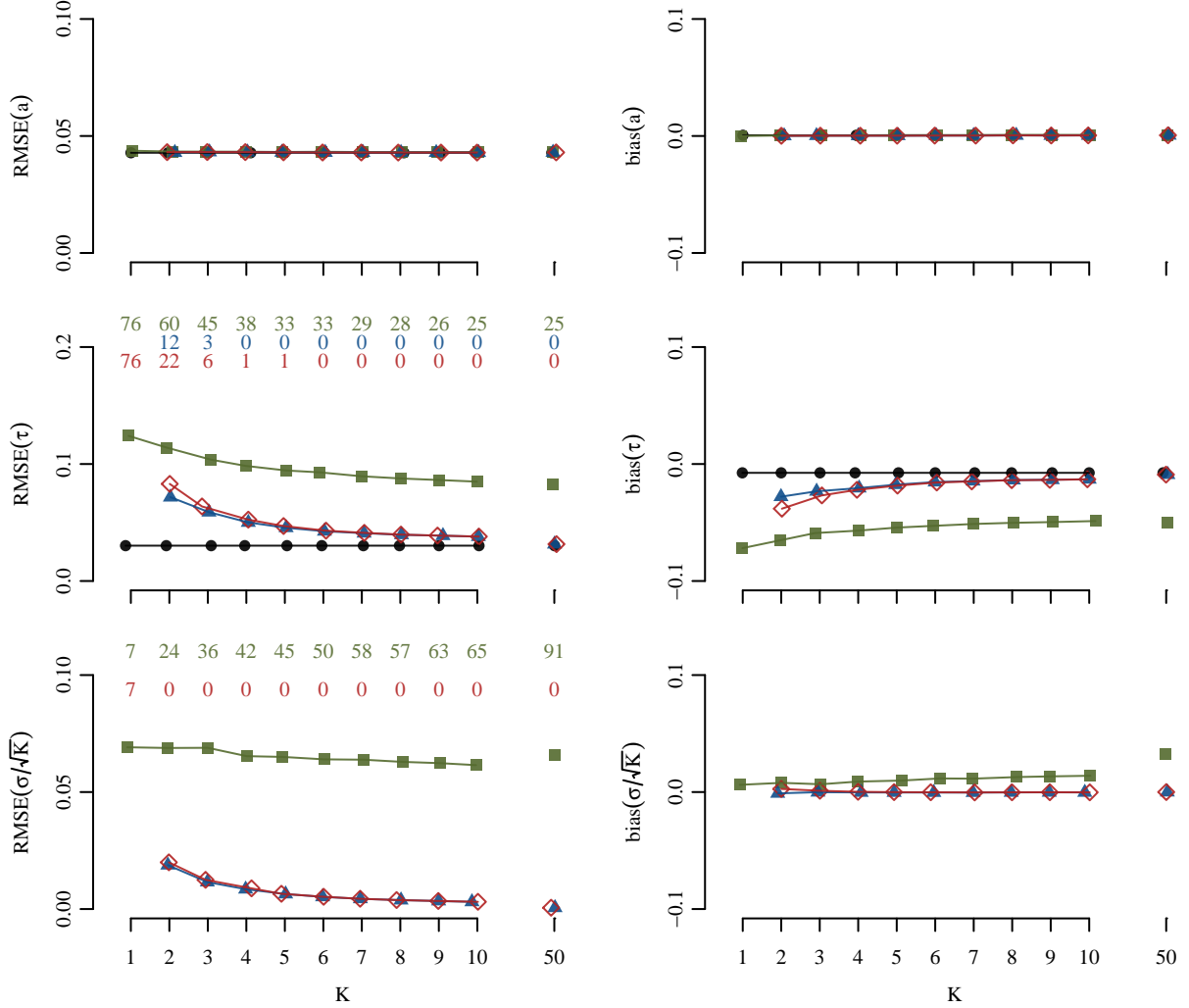


Figure B14: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 0$ ,  $c = 1$  (fixed in estimation),  $\tau = 0.2$ ,  $\sigma = 0.2$ . The length of each of the 250 simulated series is 25. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

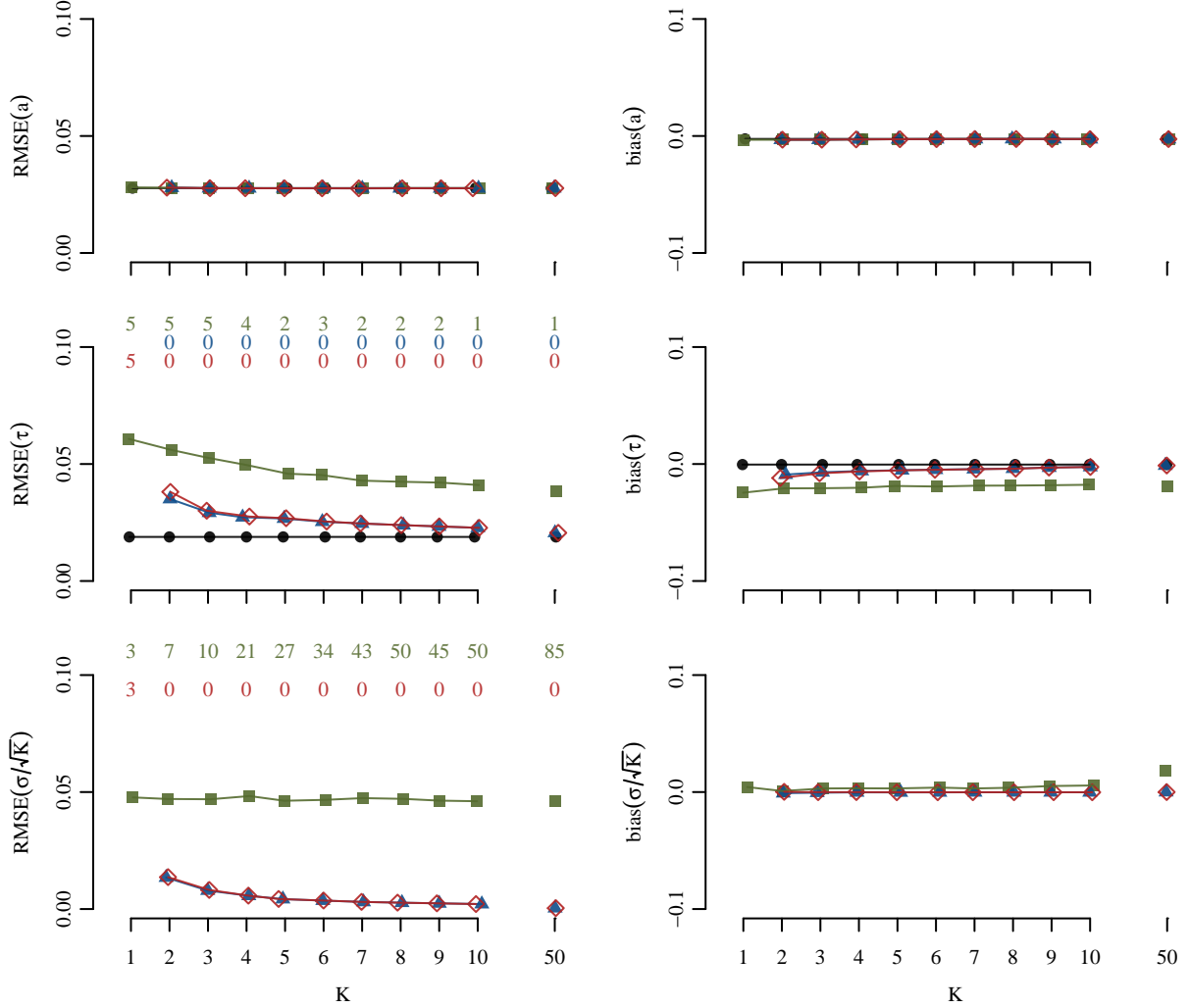


Figure B15: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 0$ ,  $c = 1$  (fixed in estimation),  $\tau = 0.2$ ,  $\sigma = 0.2$ . The length of each of the 250 simulated series is 50. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.



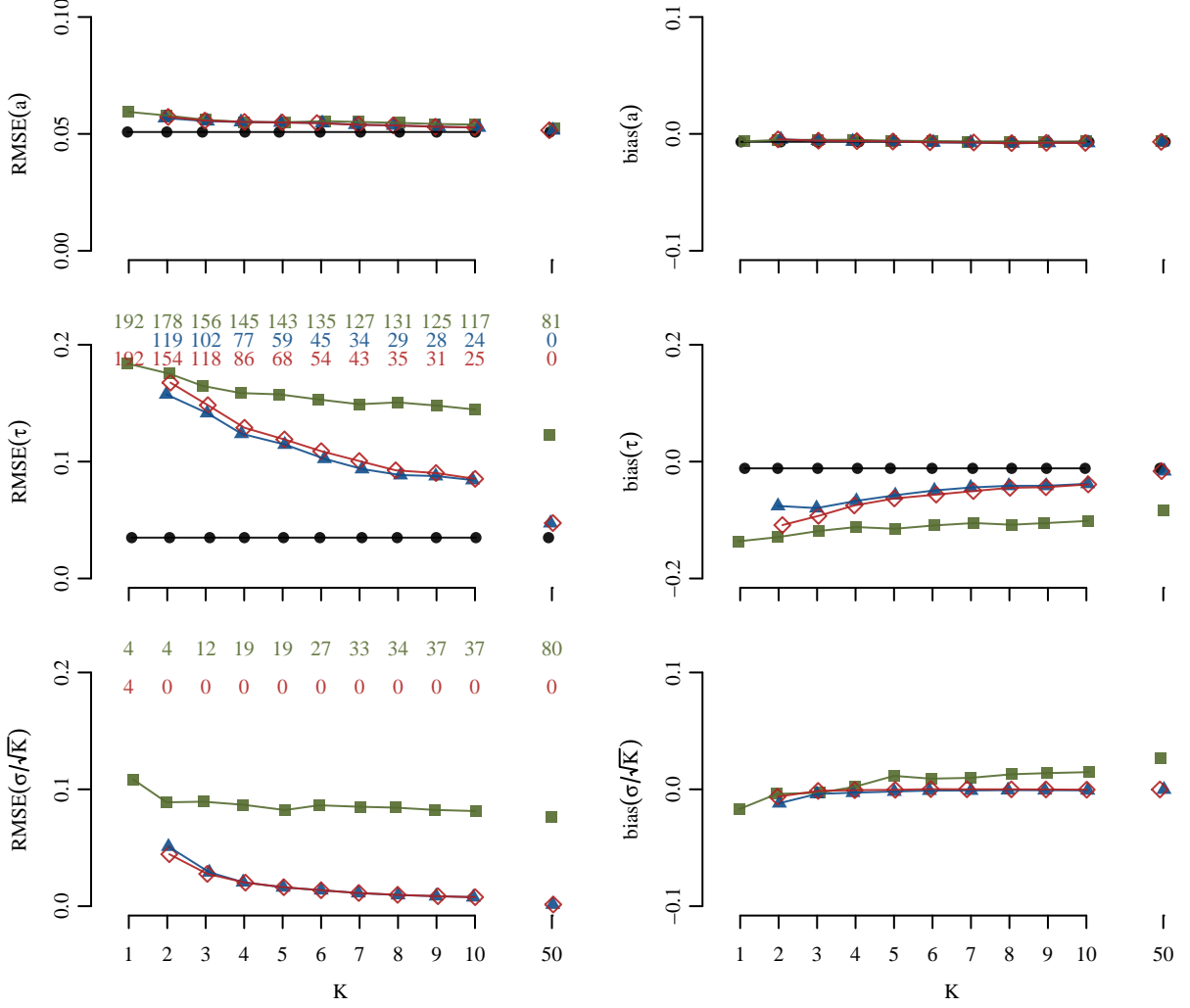


Figure B16: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 0$ ,  $c = 1$  (fixed in estimation),  $\tau = 0.2$ ,  $\sigma = 0.4$ . The length of each of the 250 simulated series is 15. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

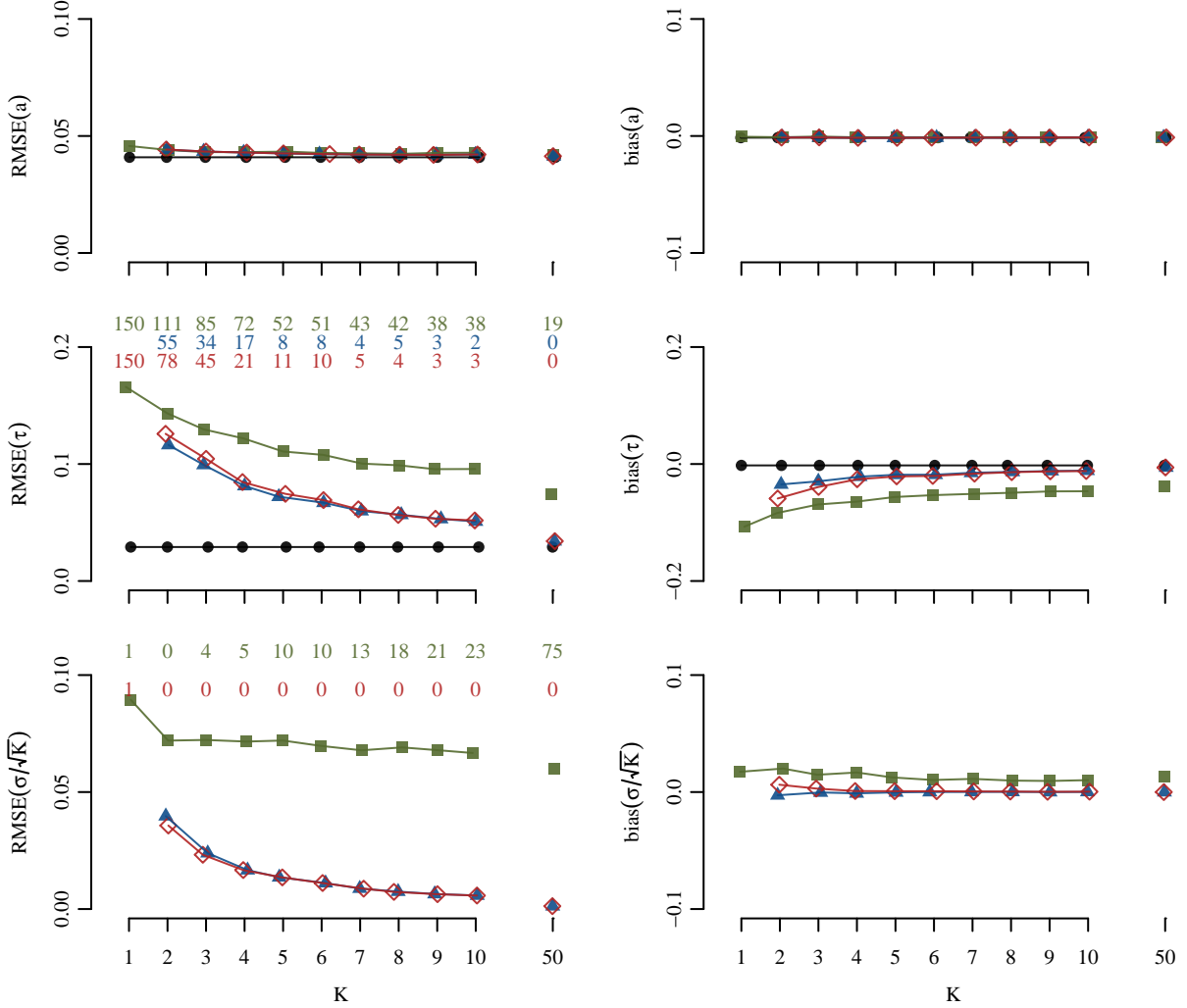


Figure B17: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 0$ ,  $c = 1$  (fixed in estimation),  $\tau = 0.2$ ,  $\sigma = 0.4$ . The length of each of the 250 simulated series is 25. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.

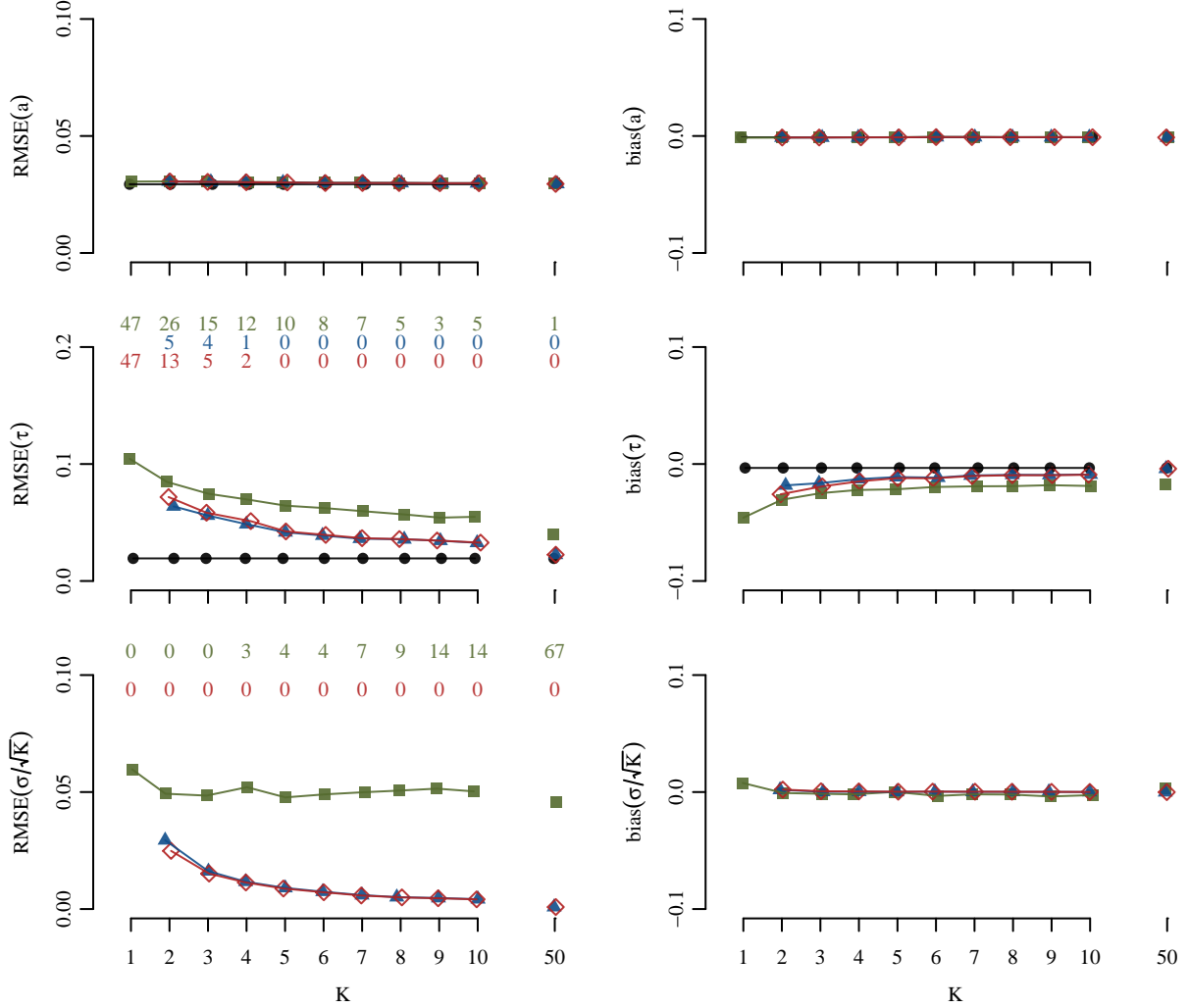


Figure B18: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 1 as a function of the number of sites ( $K$ ) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are  $a = 0$ ,  $c = 1$  (fixed in estimation),  $\tau = 0.2$ ,  $\sigma = 0.4$ . The length of each of the 250 simulated series is 50. The number of boundary estimates for  $\tau$  and  $\sigma/\sqrt{K}$  are given above the corresponding RMSE panels. First row of numbers (in green) are the number of boundary estimates under partial ML (using a numerical threshold of 0.001 to define the boundary), second row (blue) under pseudo ML and third row (red) under full ML.