

Appendix - Figures for Scenario 3

In this appendix we present simulation results for all parameter combinations in Scenario 3. Recall that in Scenario 3, data are simulated according to the model

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

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.

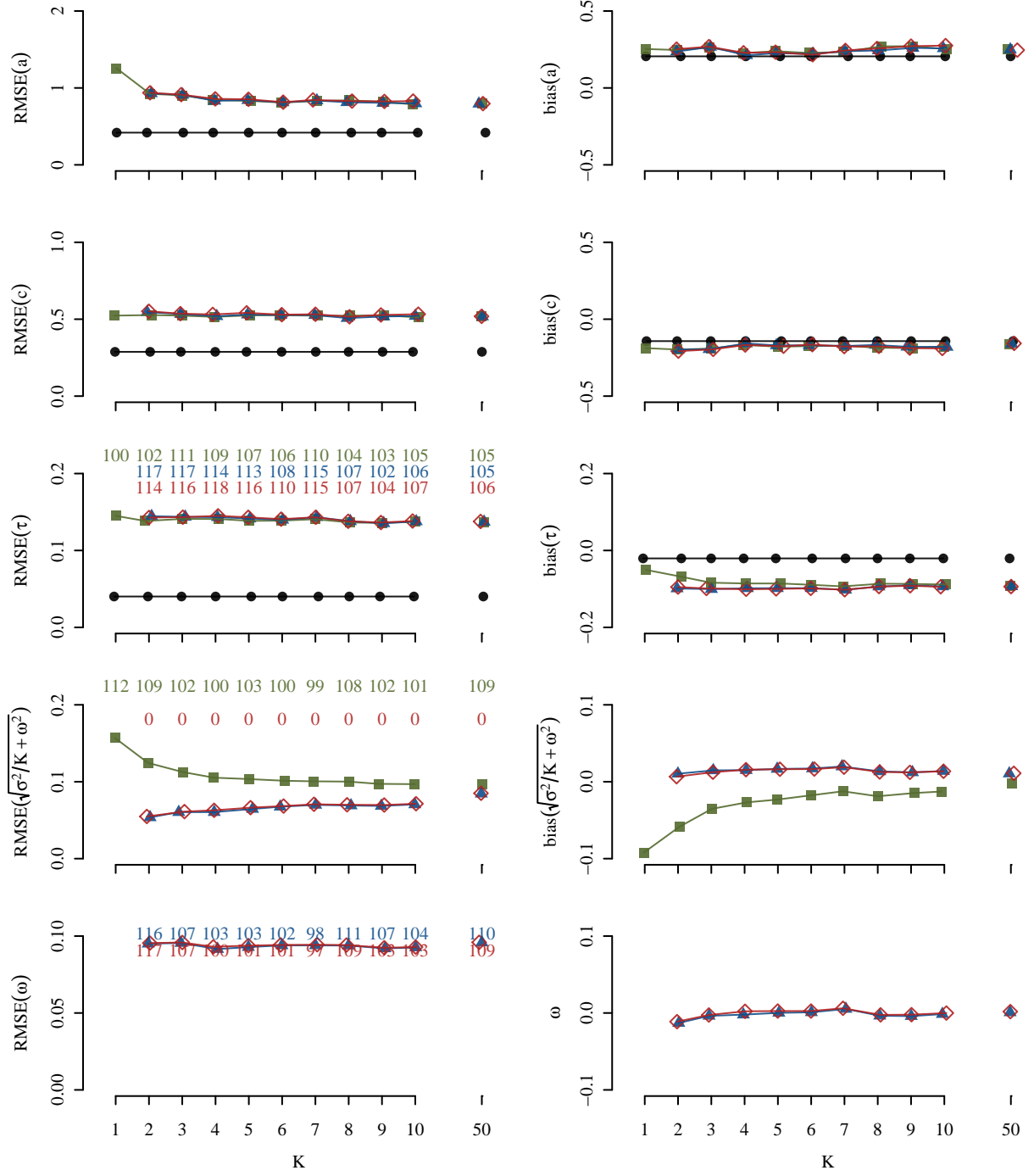


Figure D1: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.3$, $\tau = 0.2$, $\sigma = 0.2$, $\omega = 0.1$. The length of each of the 250 simulated series is 15. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

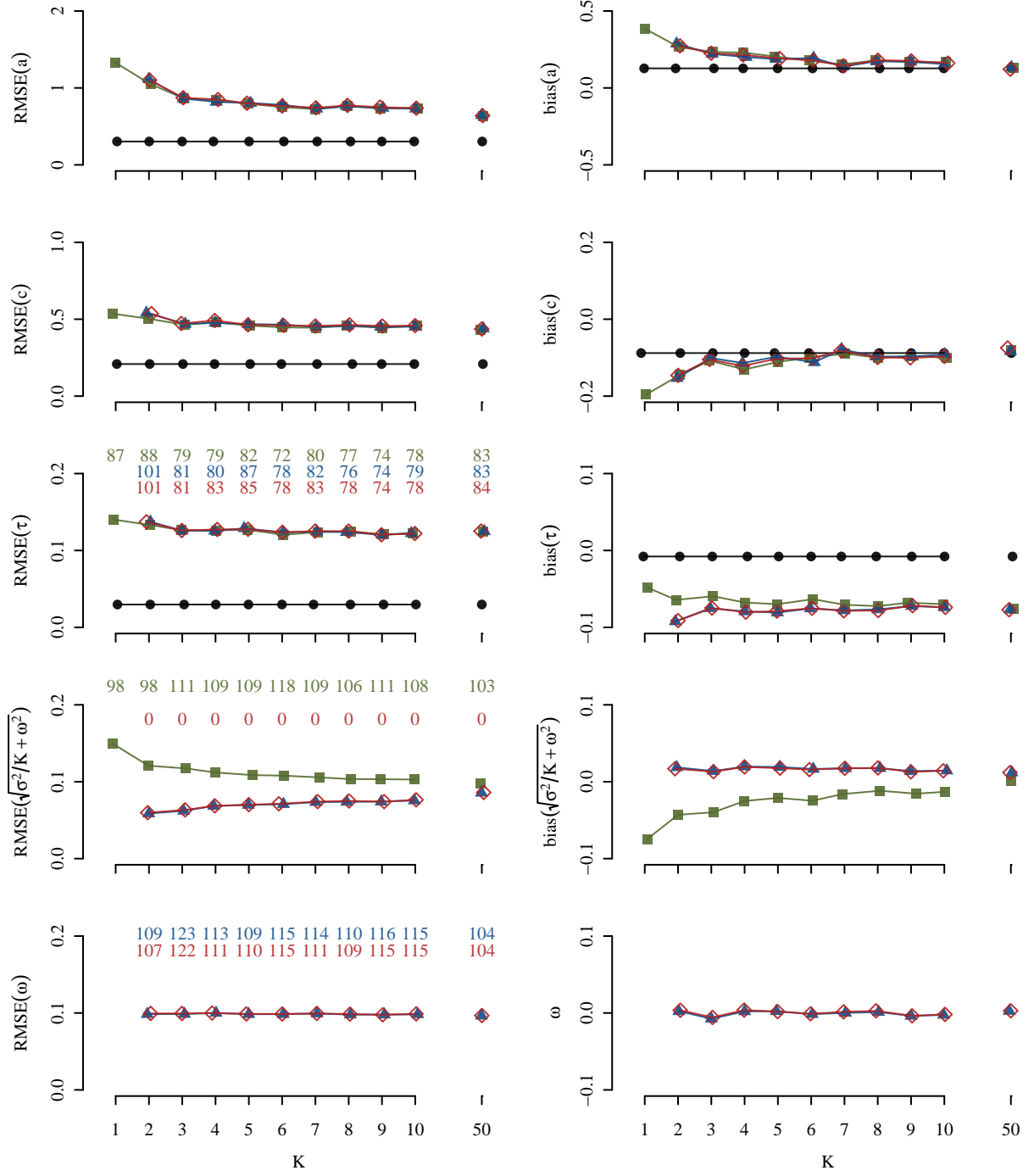


Figure D2: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.3$, $\tau = 0.2$, $\sigma = 0.2$, $\omega = 0.1$. The length of each of the 250 simulated series is 25. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

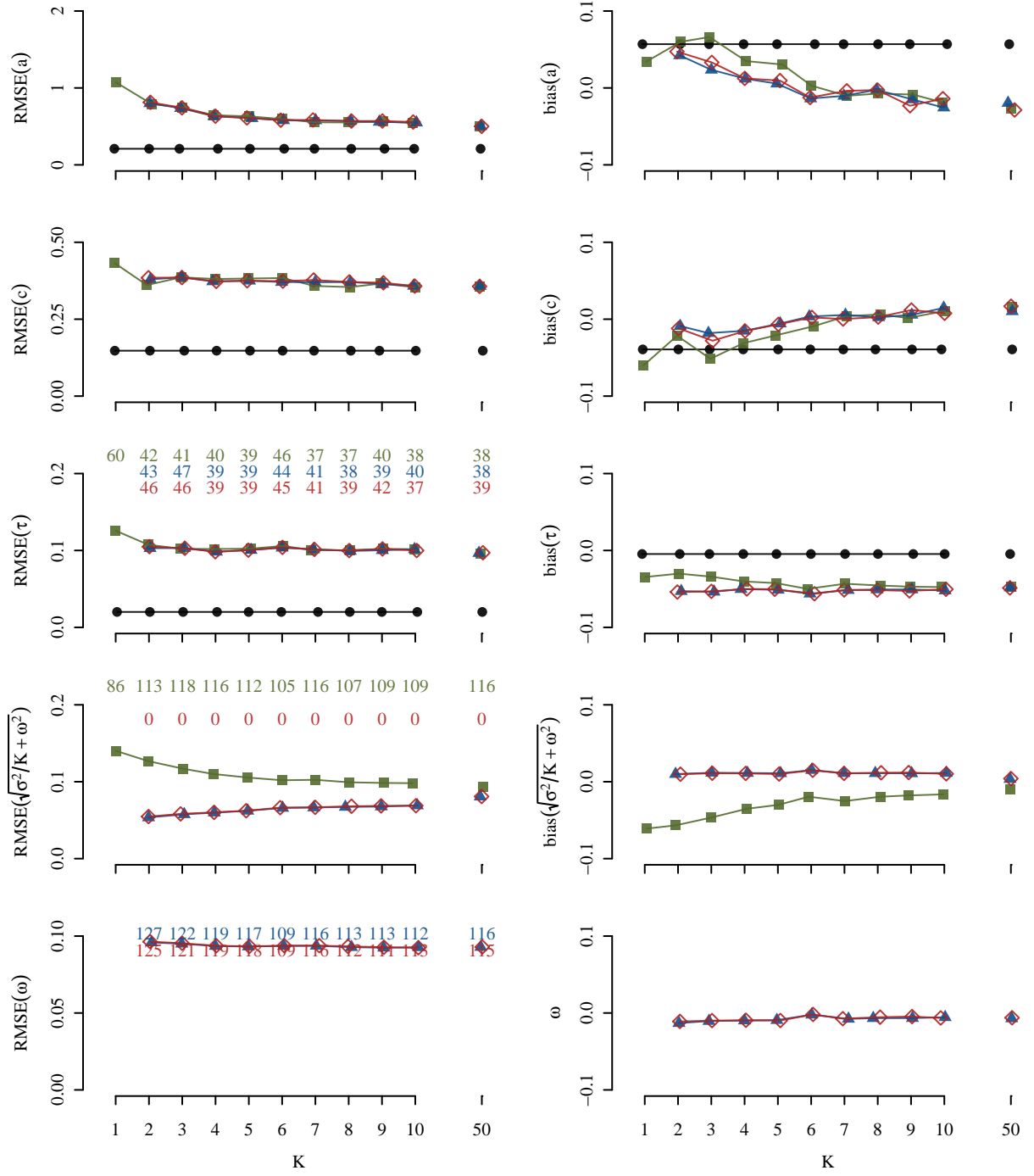


Figure D3: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.3$, $\tau = 0.2$, $\sigma = 0.2$, $\omega = 0.1$. The length of each of the 250 simulated series is 50. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

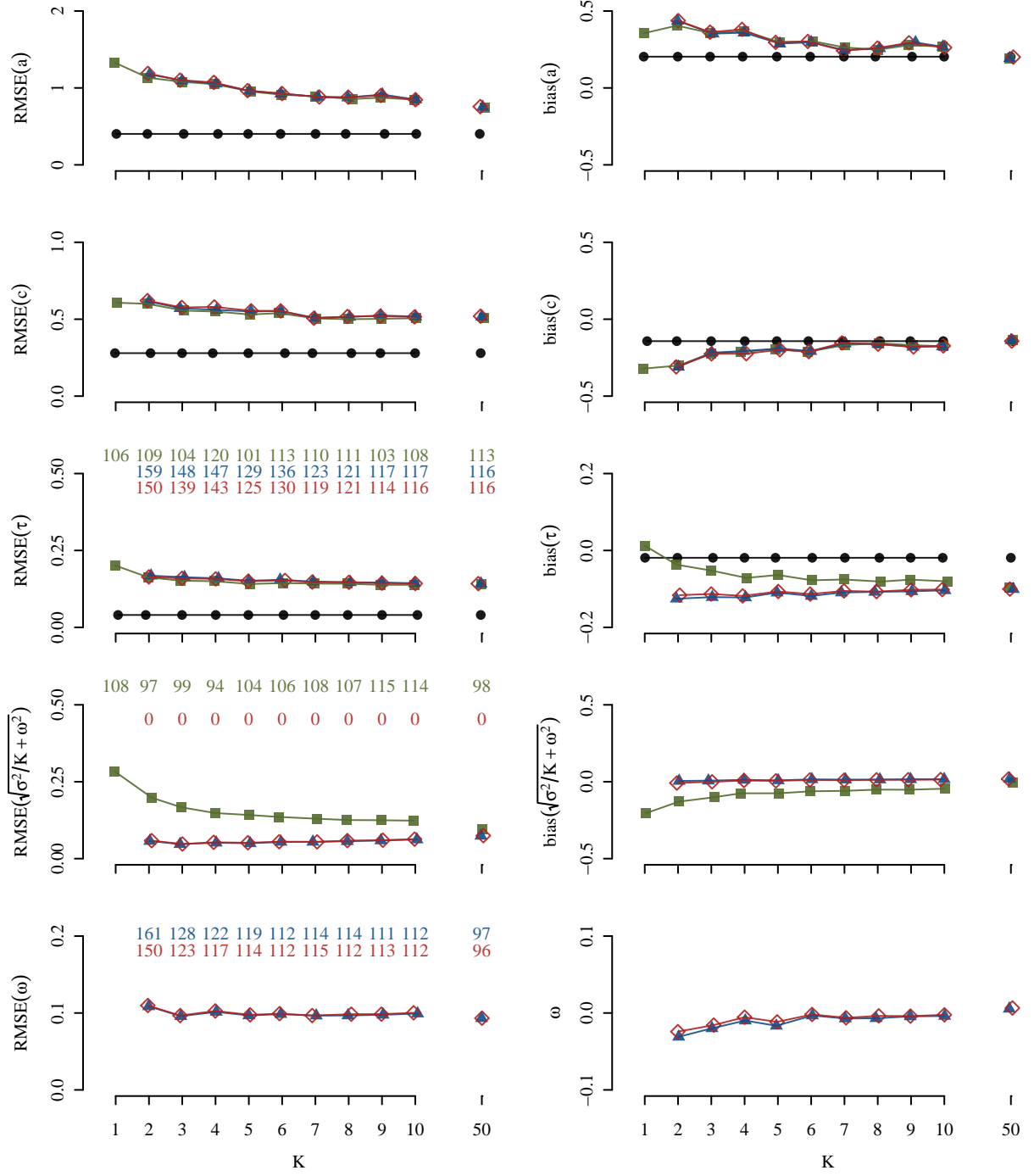


Figure D4: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.3$, $\tau = 0.2$, $\sigma = 0.4$, $\omega = 0.1$. The length of each of the 250 simulated series is 15. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

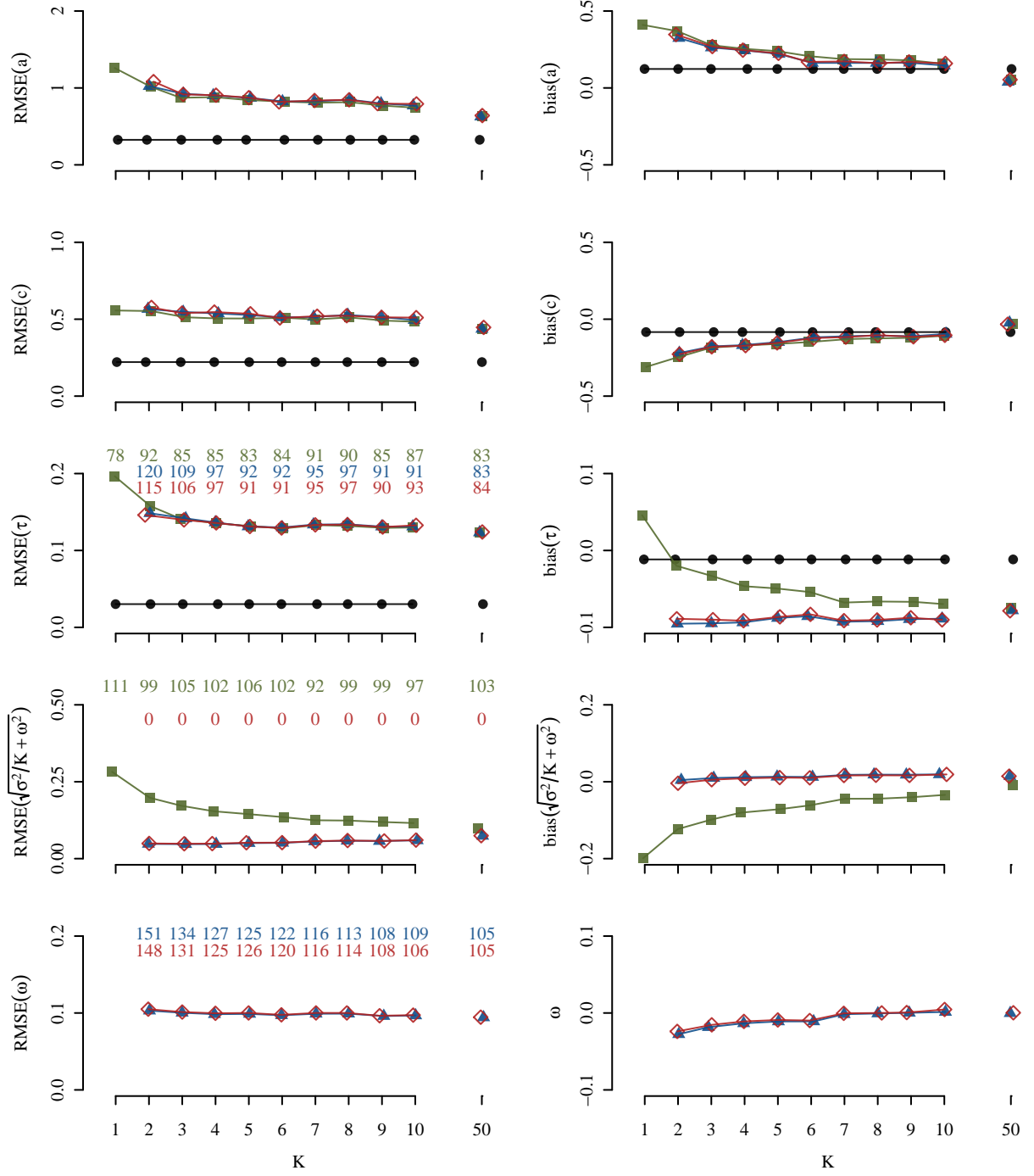


Figure D5: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.3$, $\tau = 0.2$, $\sigma = 0.4$, $\omega = 0.1$. The length of each of the 250 simulated series is 25. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

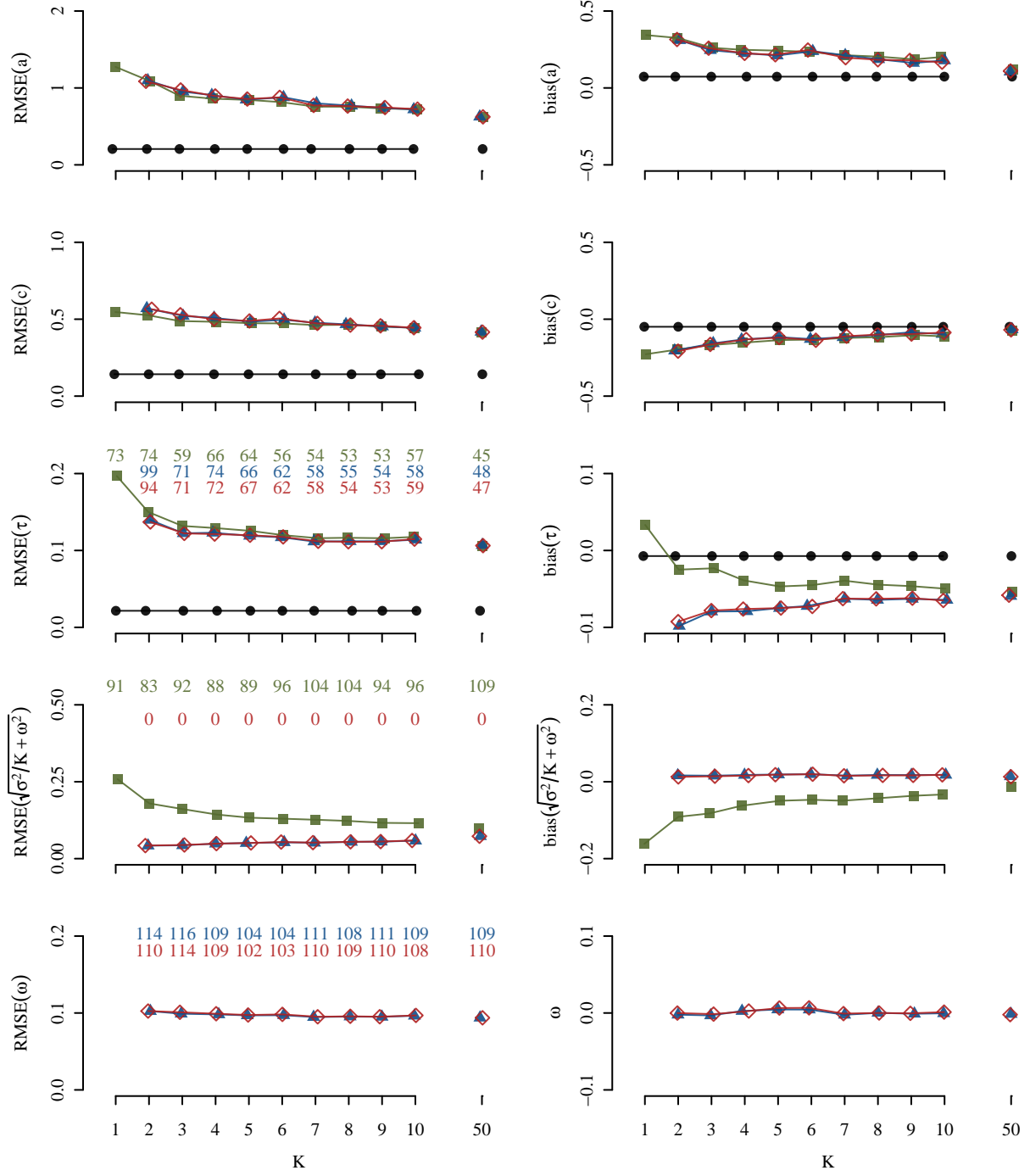


Figure D6: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.3$, $\tau = 0.2$, $\sigma = 0.4$, $\omega = 0.1$. The length of each of the 250 simulated series is 50. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

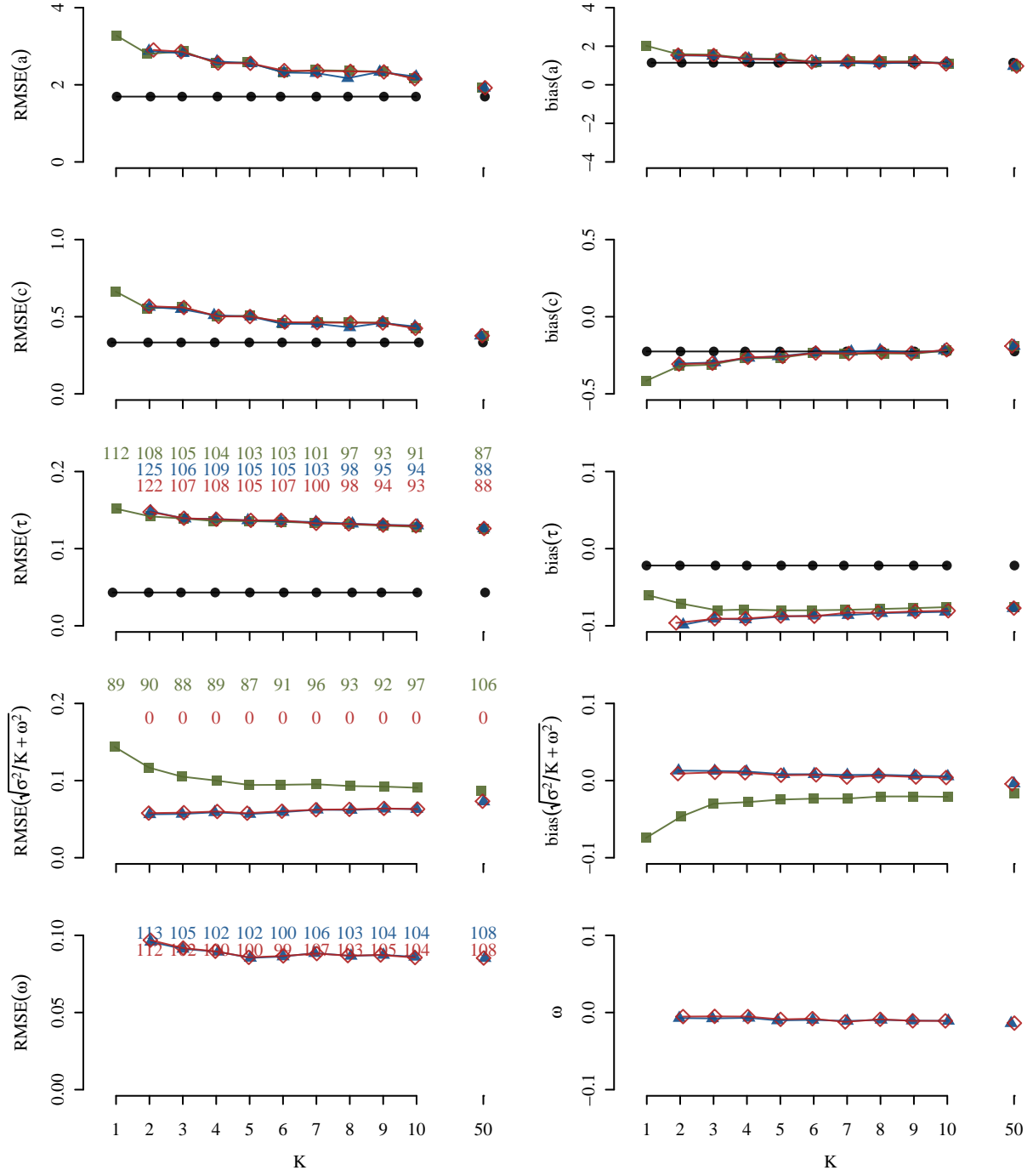


Figure D7: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.8$, $\tau = 0.2$, $\sigma = 0.2$, $\omega = 0.1$. The length of each of the 250 simulated series is 15. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

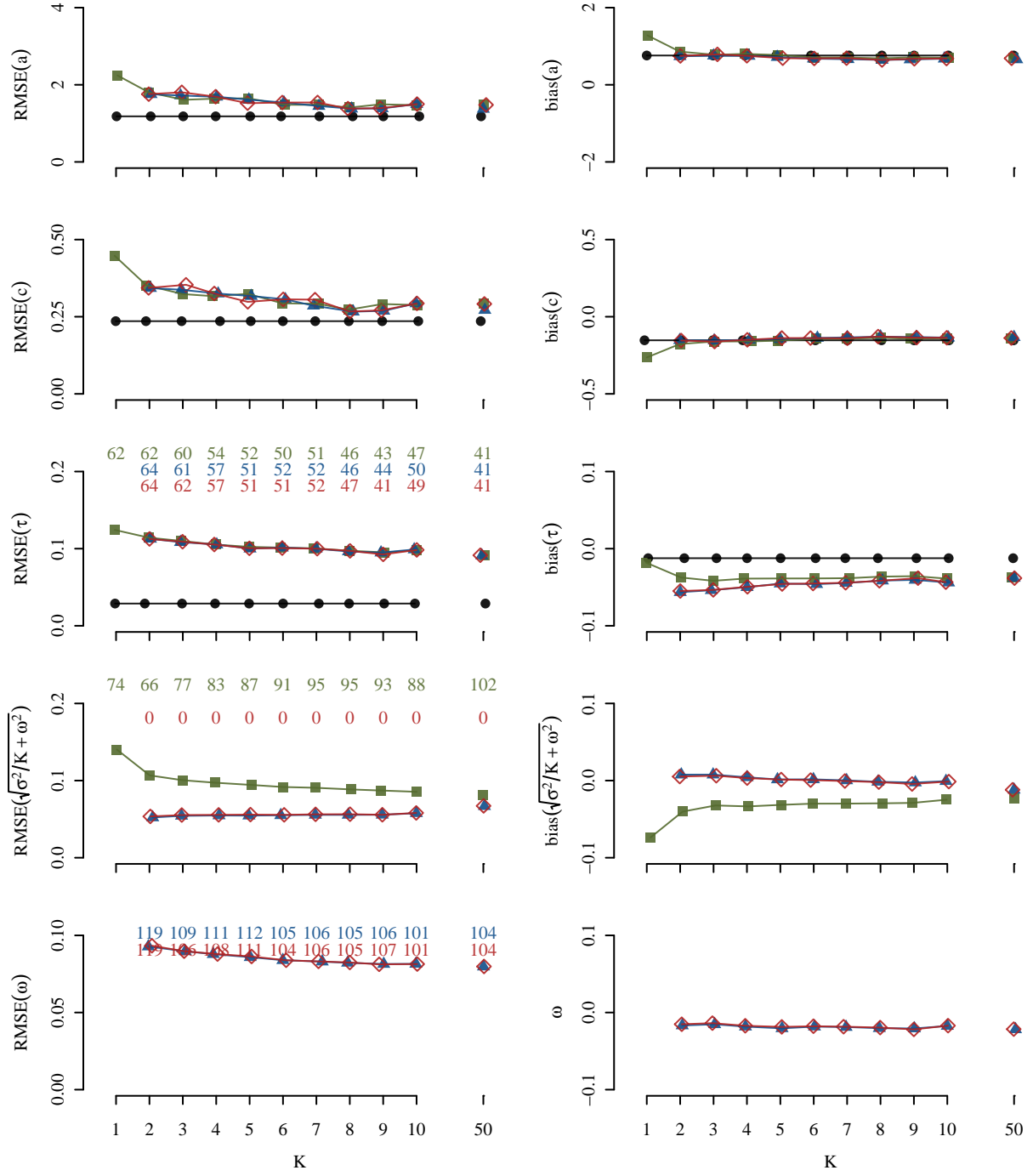


Figure D8: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.8$, $\tau = 0.2$, $\sigma = 0.2$, $\omega = 0.1$. The length of each of the 250 simulated series is 25. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

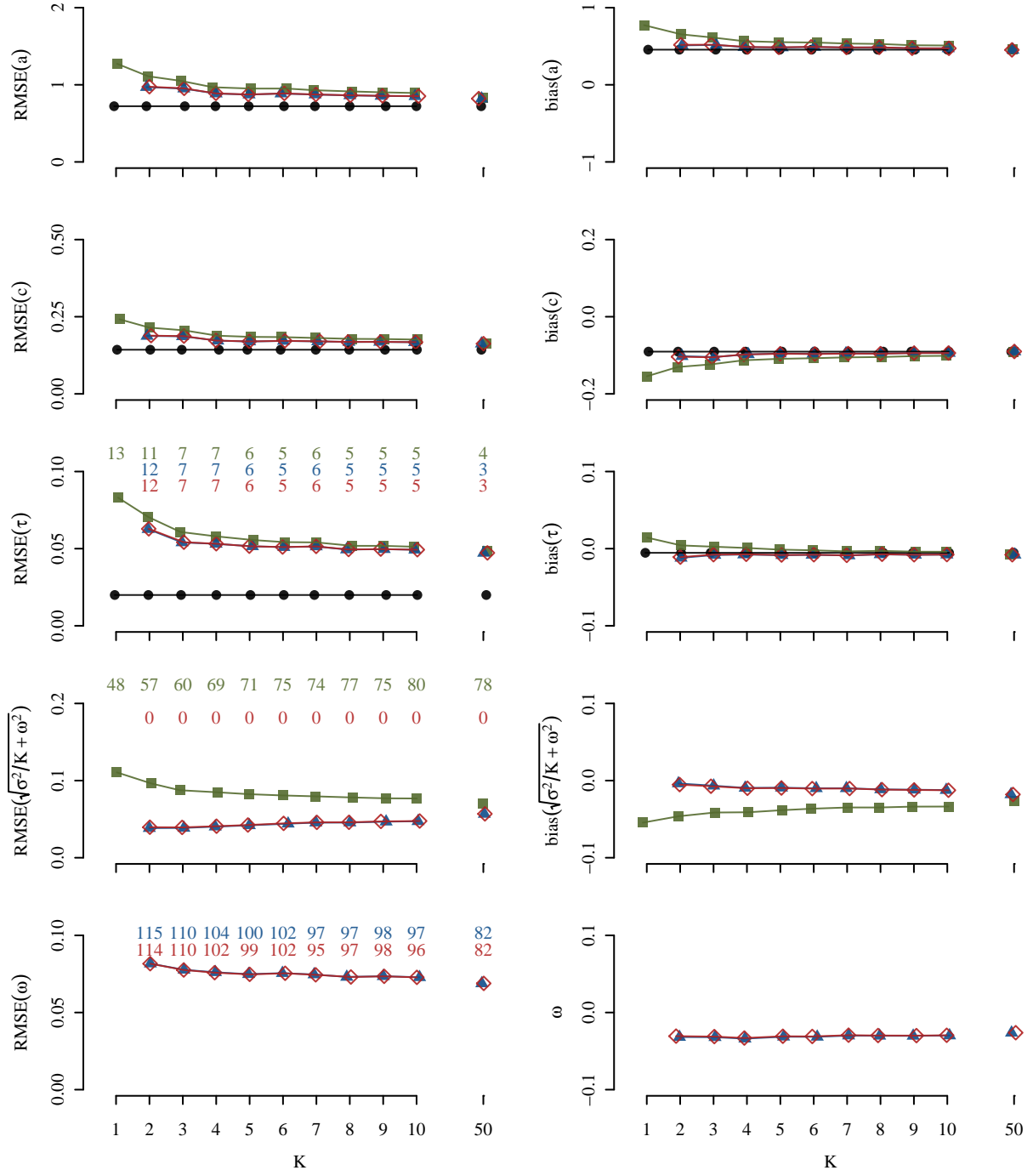


Figure D9: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.8$, $\tau = 0.2$, $\sigma = 0.2$, $\omega = 0.1$. The length of each of the 250 simulated series is 50. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

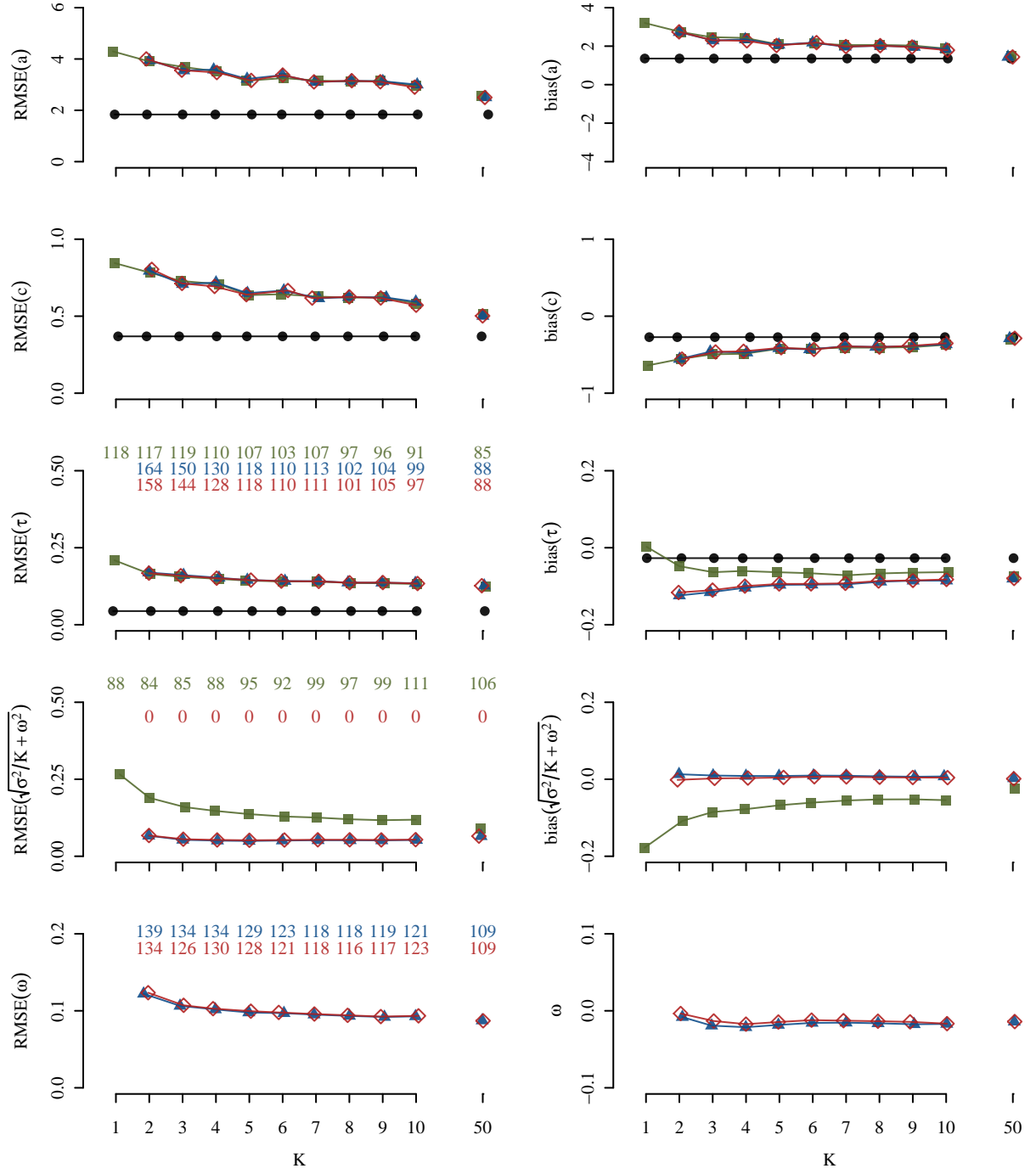


Figure D10: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.8$, $\tau = 0.2$, $\sigma = 0.4$, $\omega = 0.1$. The length of each of the 250 simulated series is 15. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

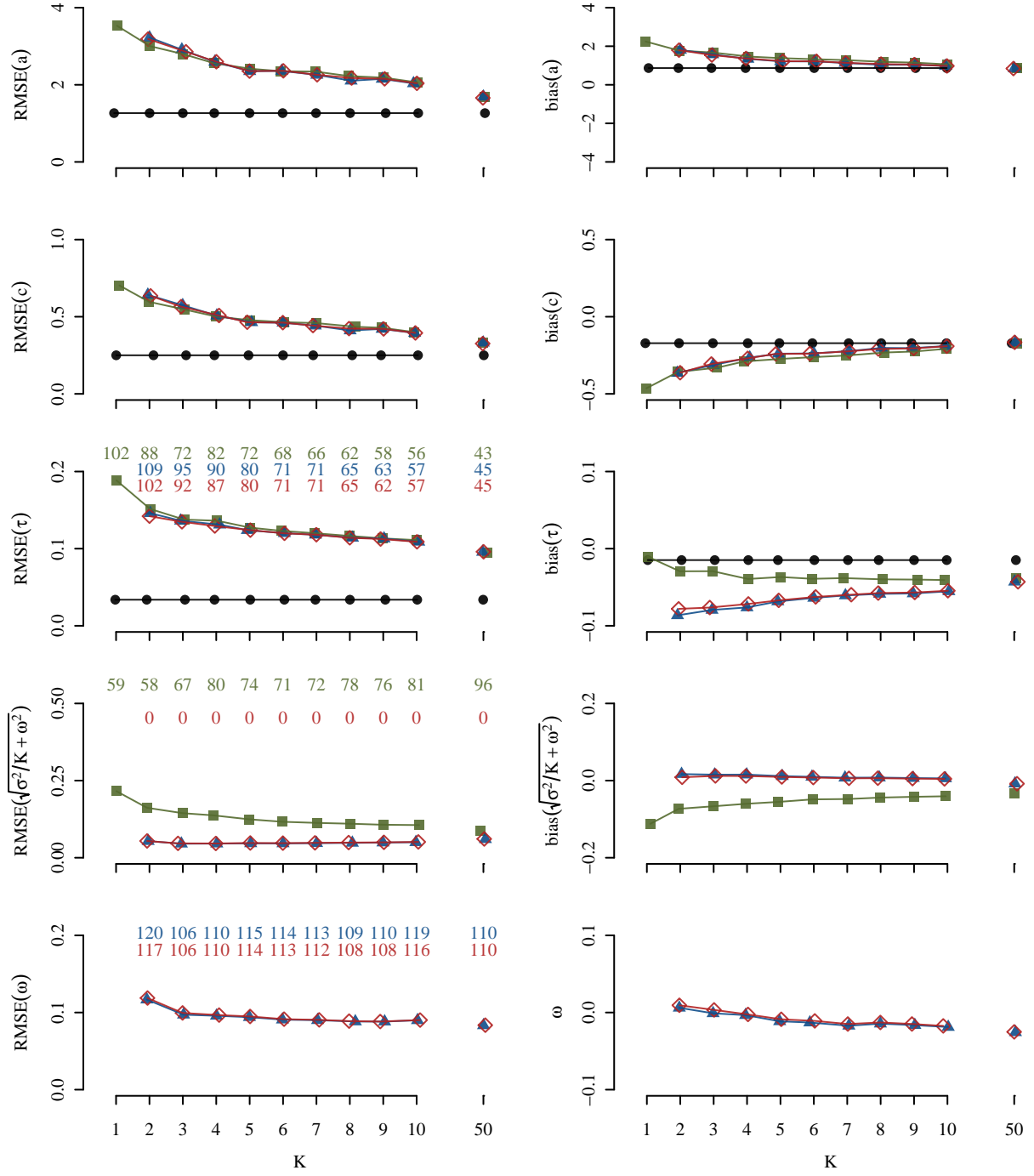


Figure D11: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.8$, $\tau = 0.2$, $\sigma = 0.4$, $\omega = 0.1$. The length of each of the 250 simulated series is 25. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

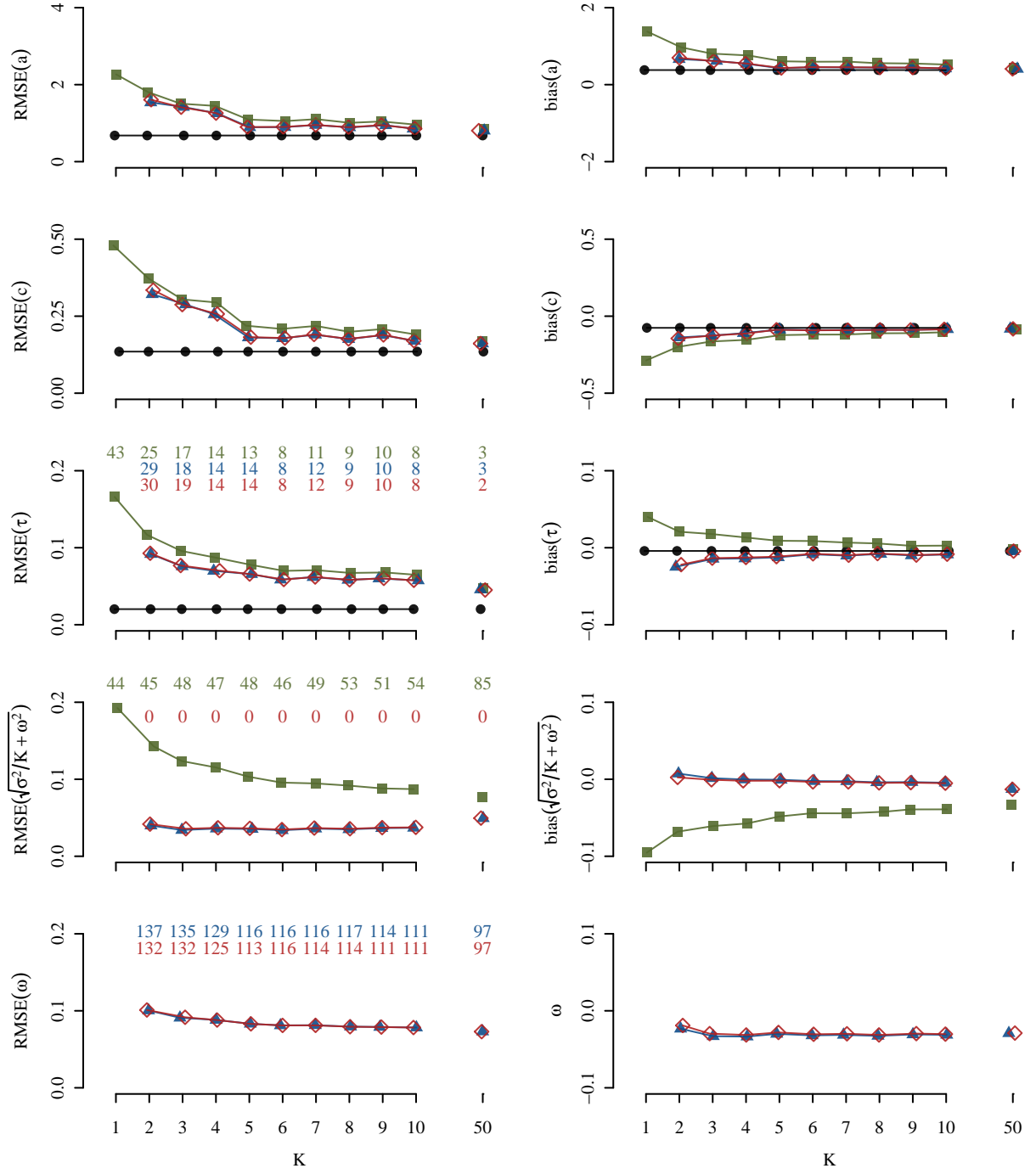


Figure D12: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 1$, $c = 0.8$, $\tau = 0.2$, $\sigma = 0.4$, $\omega = 0.1$. The length of each of the 250 simulated series is 50. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

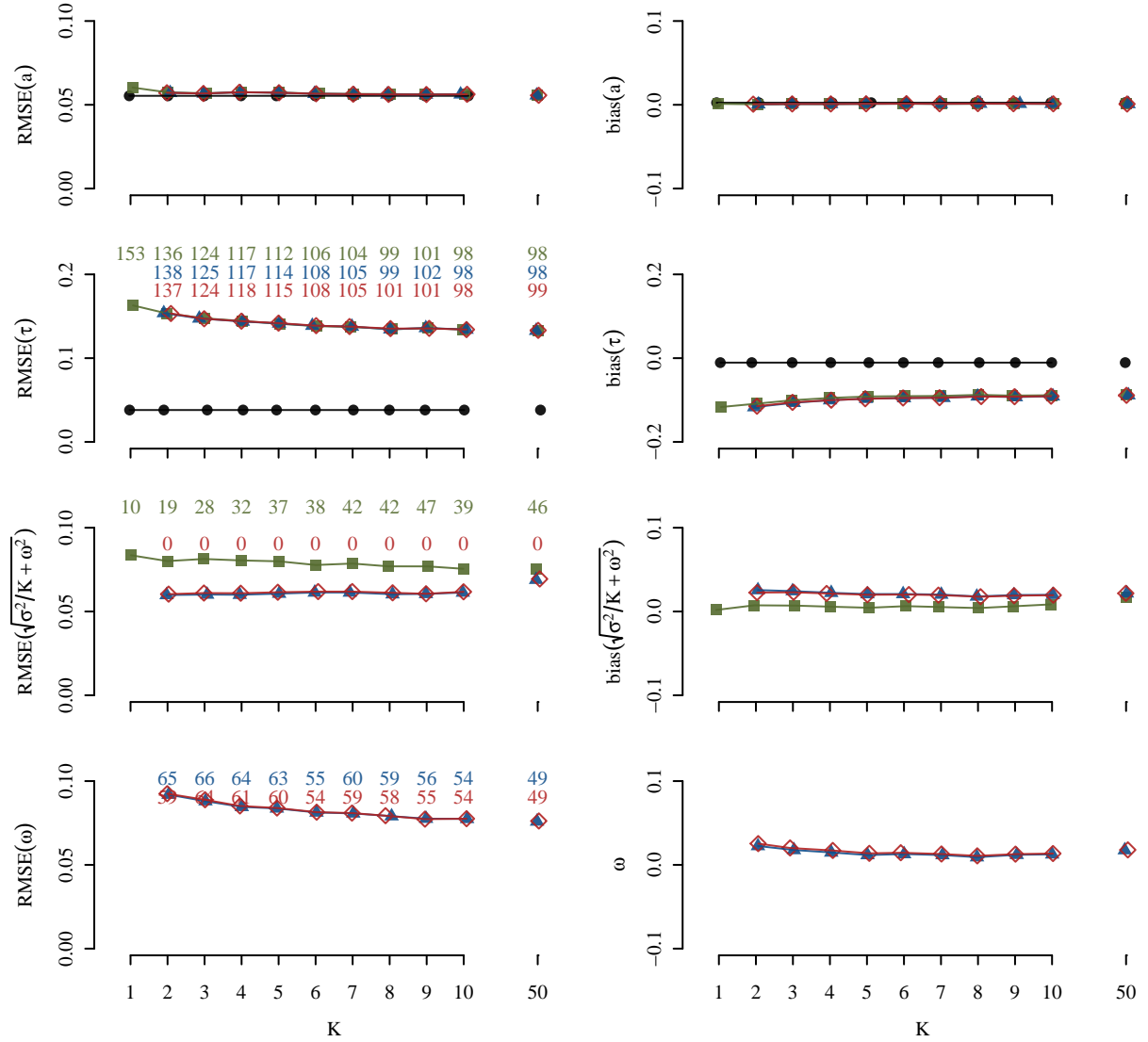


Figure D13: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 0$, $c = 1$ (fixed in estimation), $\tau = 0.2$, $\sigma = 0.2$, $\omega = 0.1$. The length of each of the 250 simulated series is 15. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

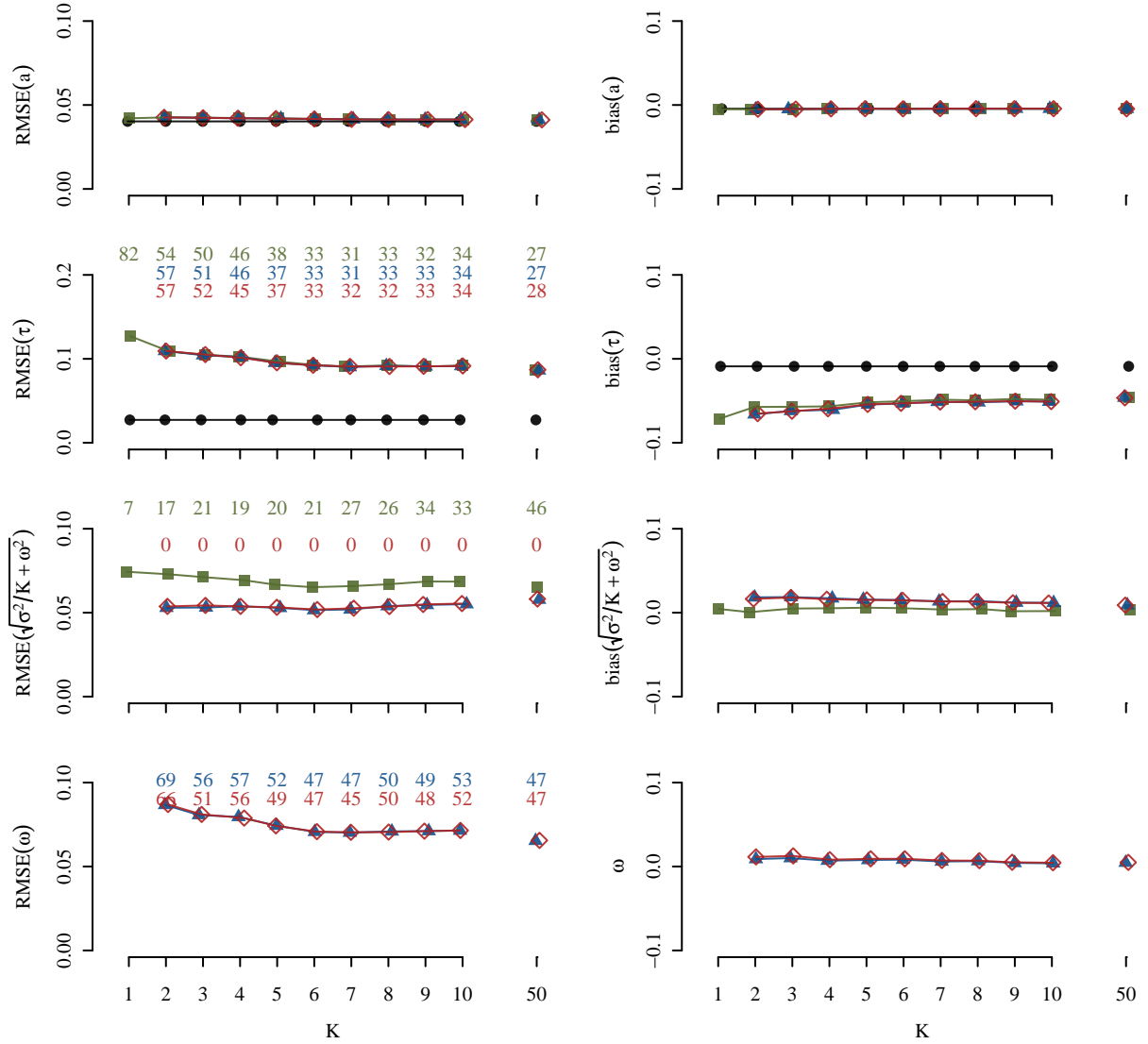


Figure D14: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 0$, $c = 1$ (fixed in estimation), $\tau = 0.2$, $\sigma = 0.2$, $\omega = 0.1$. The length of each of the 250 simulated series is 25. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

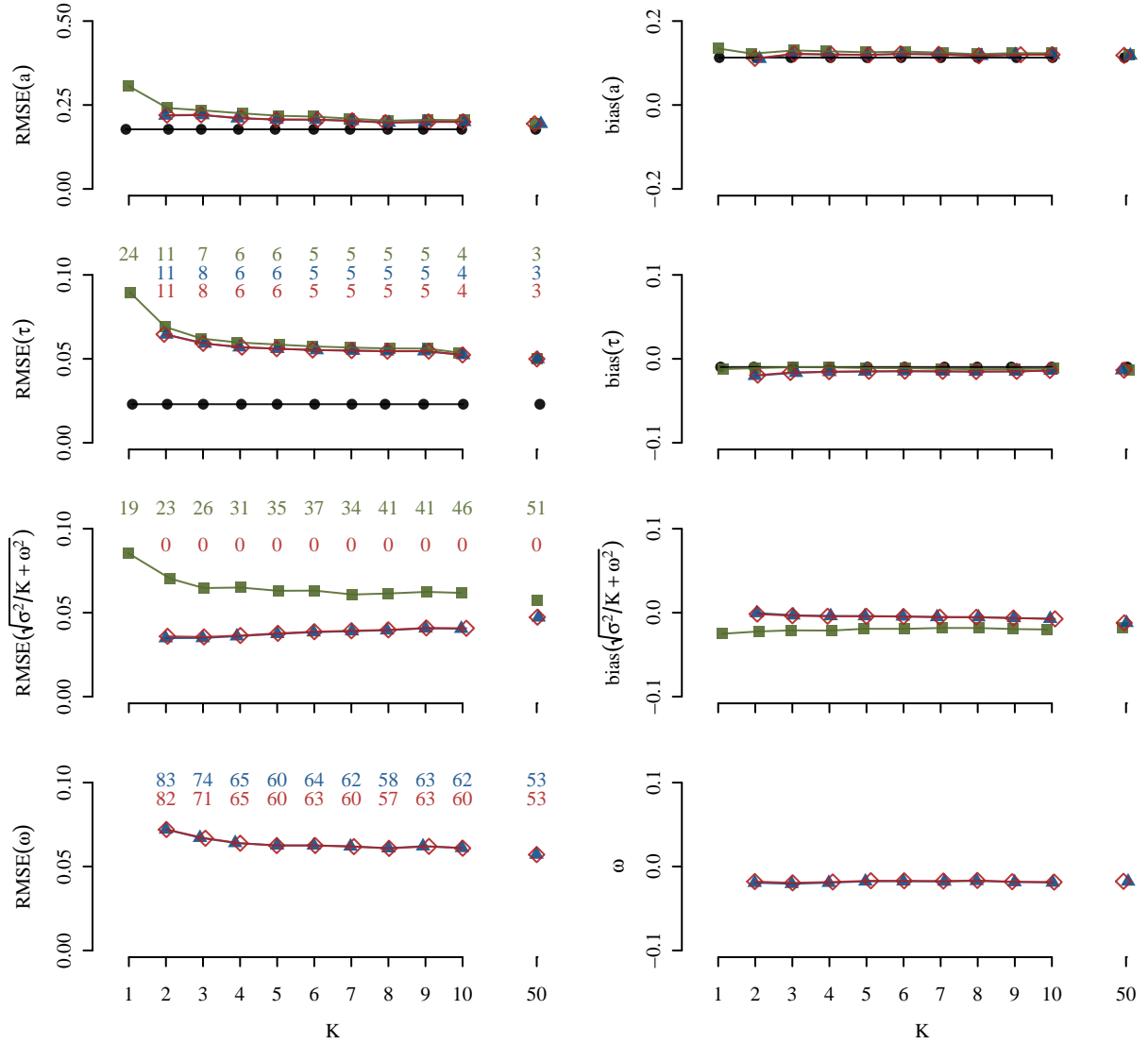


Figure D15: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 0$, $c = 1$ (fixed in estimation), $\tau = 0.2$, $\sigma = 0.2$, $\omega = 0.1$. The length of each of the 250 simulated series is 50. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

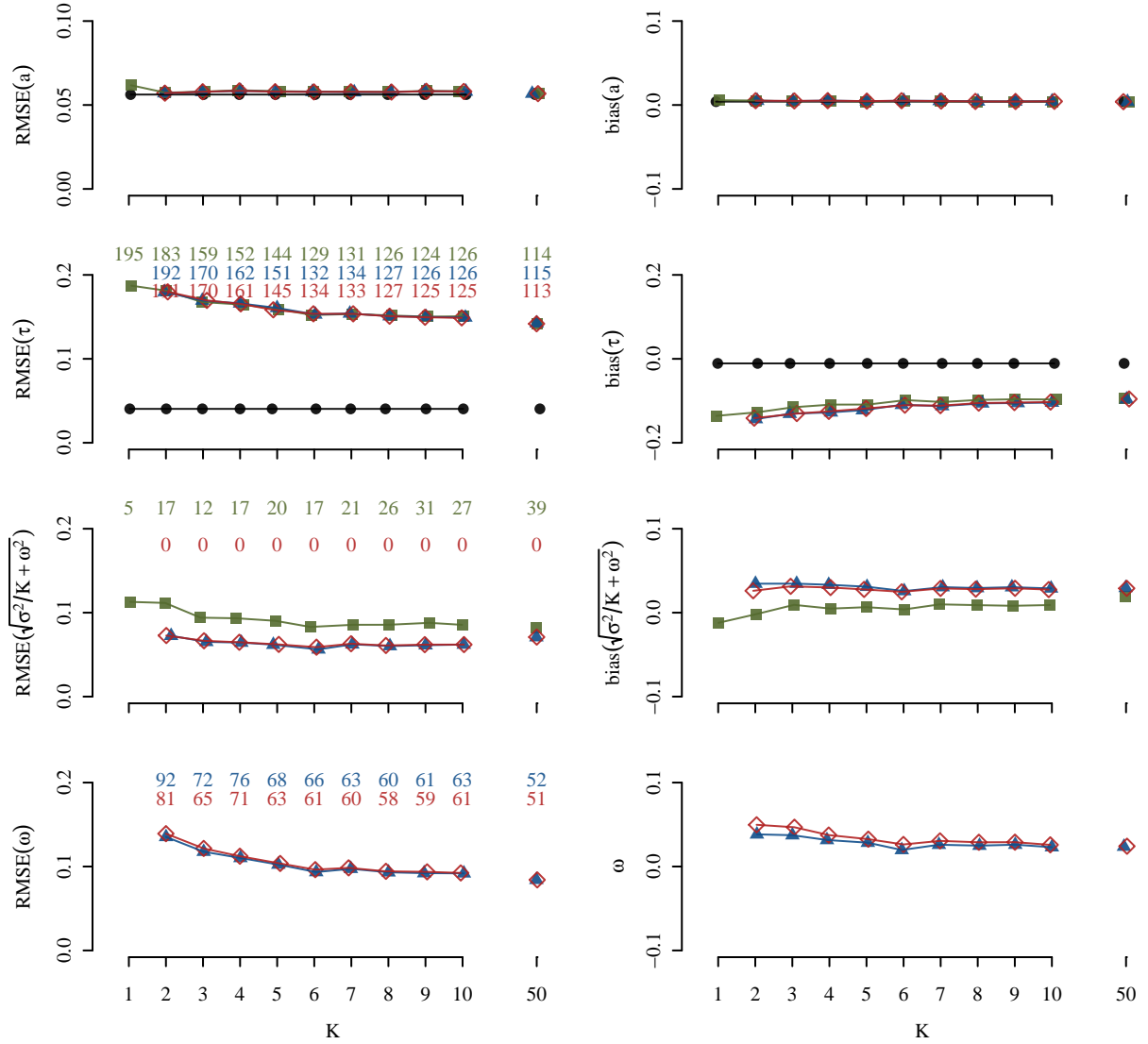


Figure D16: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 0$, $c = 1$ (fixed in estimation), $\tau = 0.2$, $\sigma = 0.4$, $\omega = 0.1$. The length of each of the 250 simulated series is 15. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

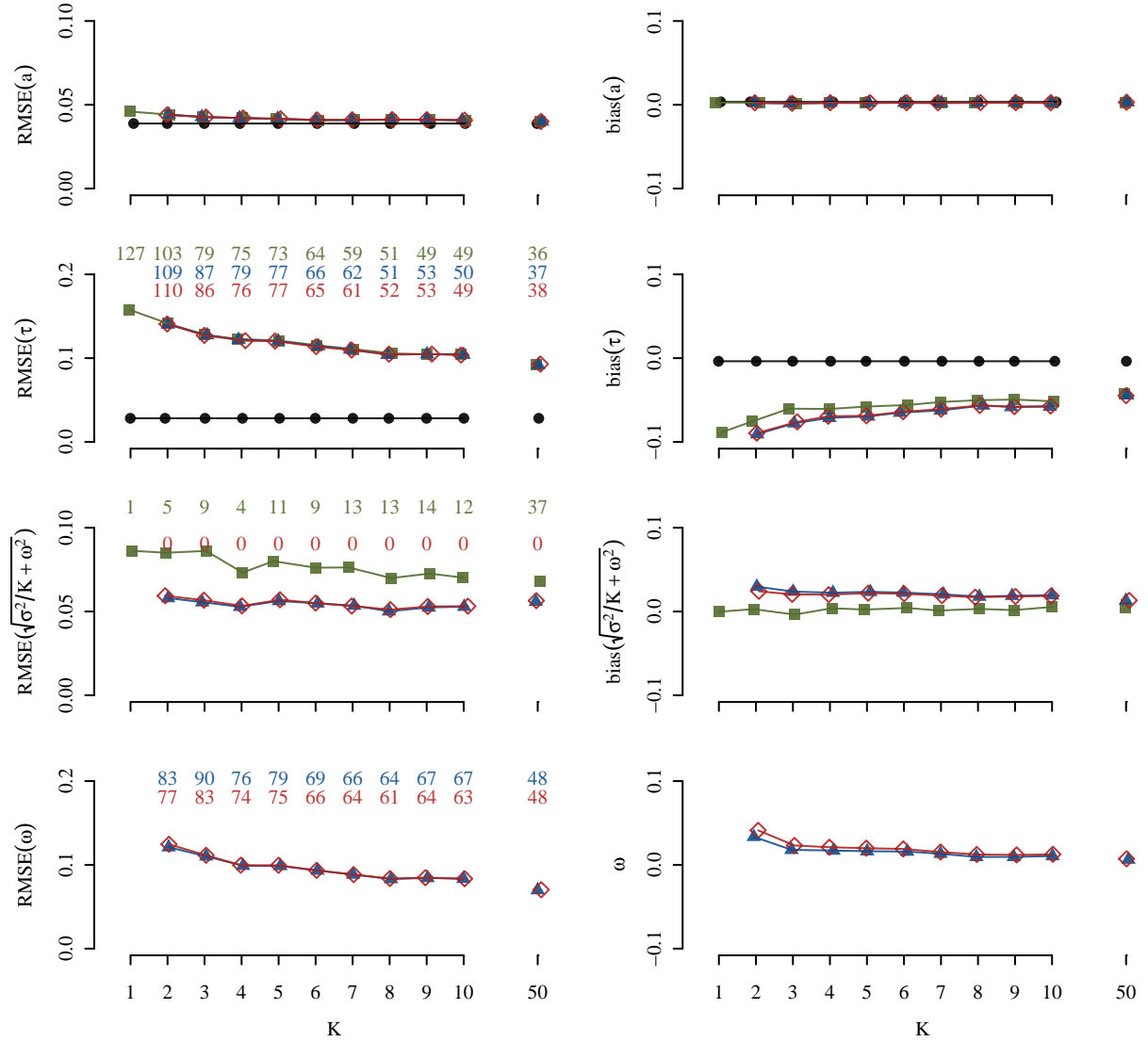


Figure D17: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 0$, $c = 1$ (fixed in estimation), $\tau = 0.2$, $\sigma = 0.4$, $\omega = 0.1$. The length of each of the 250 simulated series is 25. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

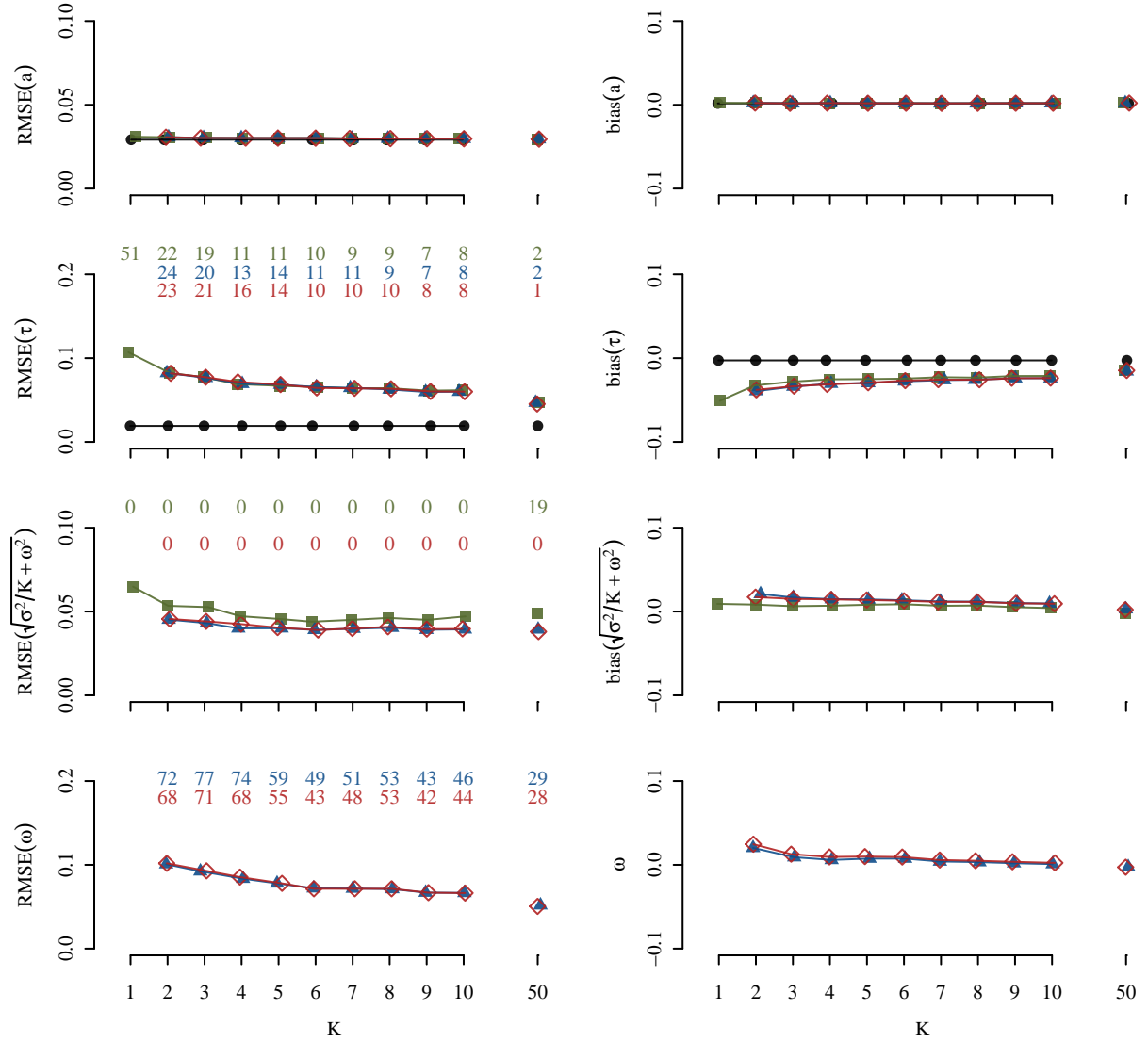


Figure D18: Root mean square errors (left panels) and bias (right panels) of the parameters under scenario 3 as a function of the number of sites (K) for partial ML (green squares), pseudo ML (blue triangles), full ML (red diamonds) and under perfect sampling (no observation error, black circles). Points were slightly jittered along the x-axis to reduce the amount of overlap. True parameter values are $a = 0$, $c = 1$ (fixed in estimation), $\tau = 0.2$, $\sigma = 0.4$, $\omega = 0.1$. The length of each of the 250 simulated series is 50. The number of boundary estimates for τ , $\sqrt{\sigma^2/K + \omega^2}$ and ω 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.

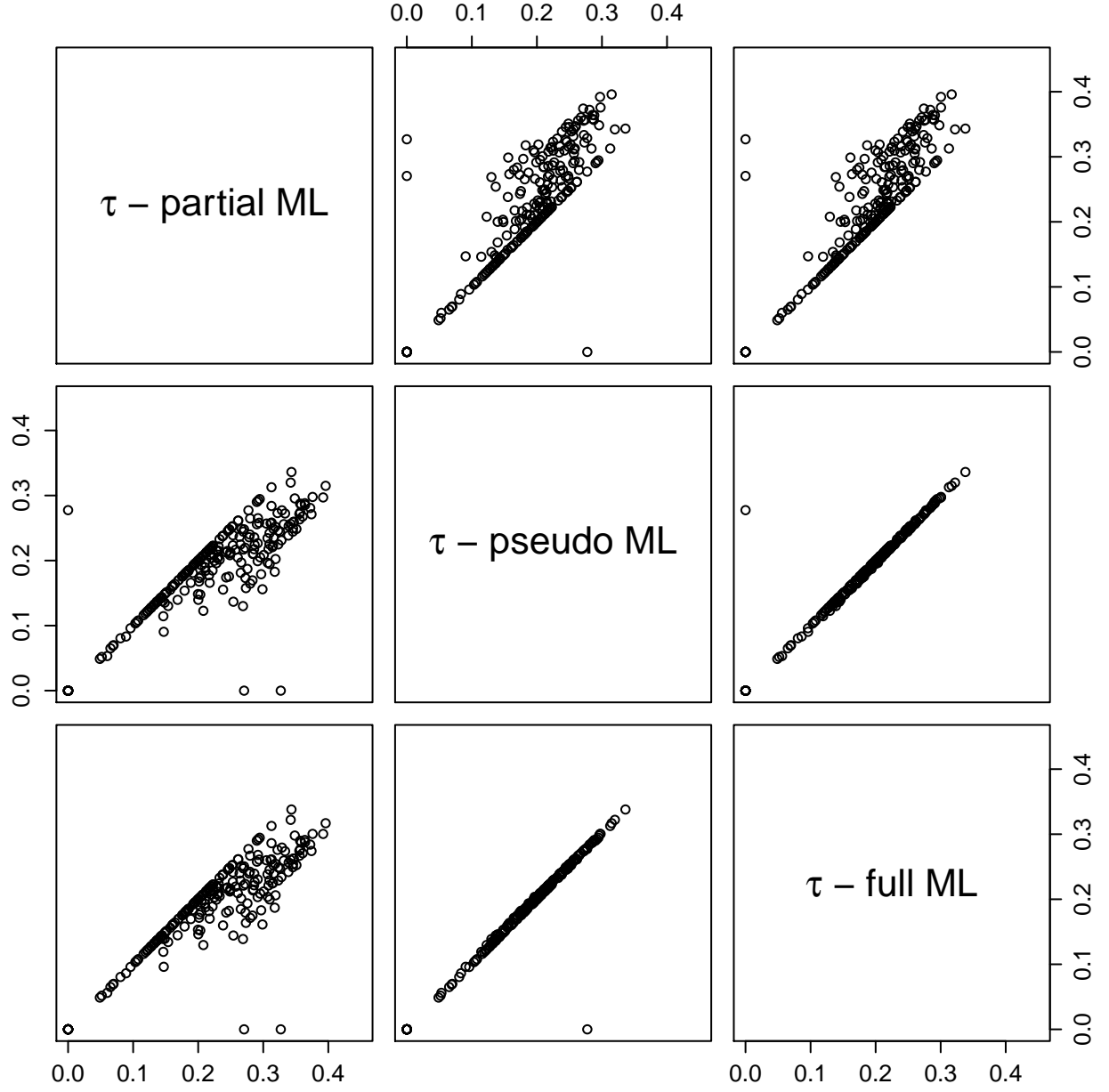


Figure D19: Pairwise comparisons of partial, pseudo and full ML estimates of for 250 simulated data sets with 3 replicate observations and true parameters $a = 1$, $c = 0.8$, $\tau = 0.2$, $\sigma = 0.4$ and $\omega 0.1$.