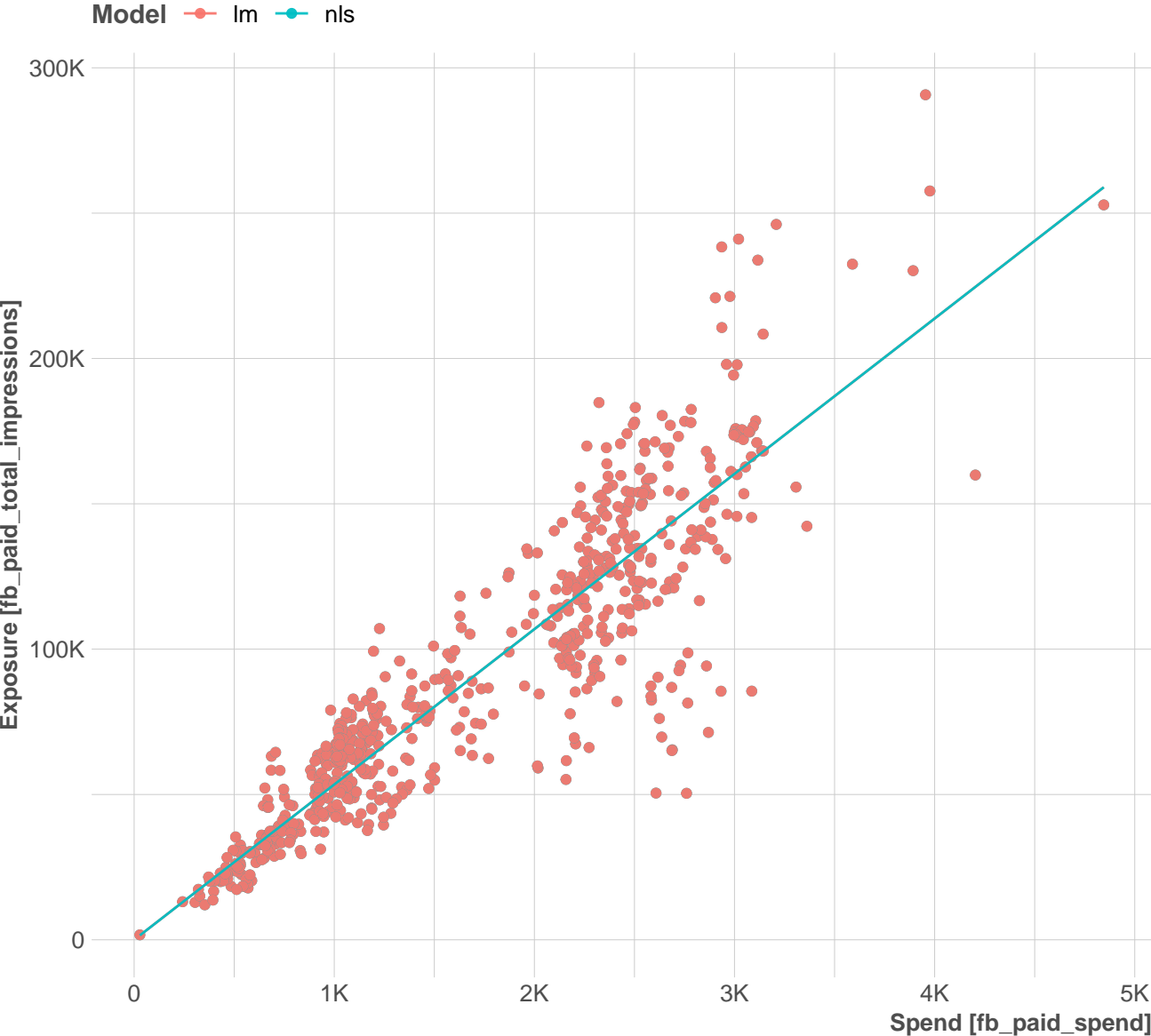
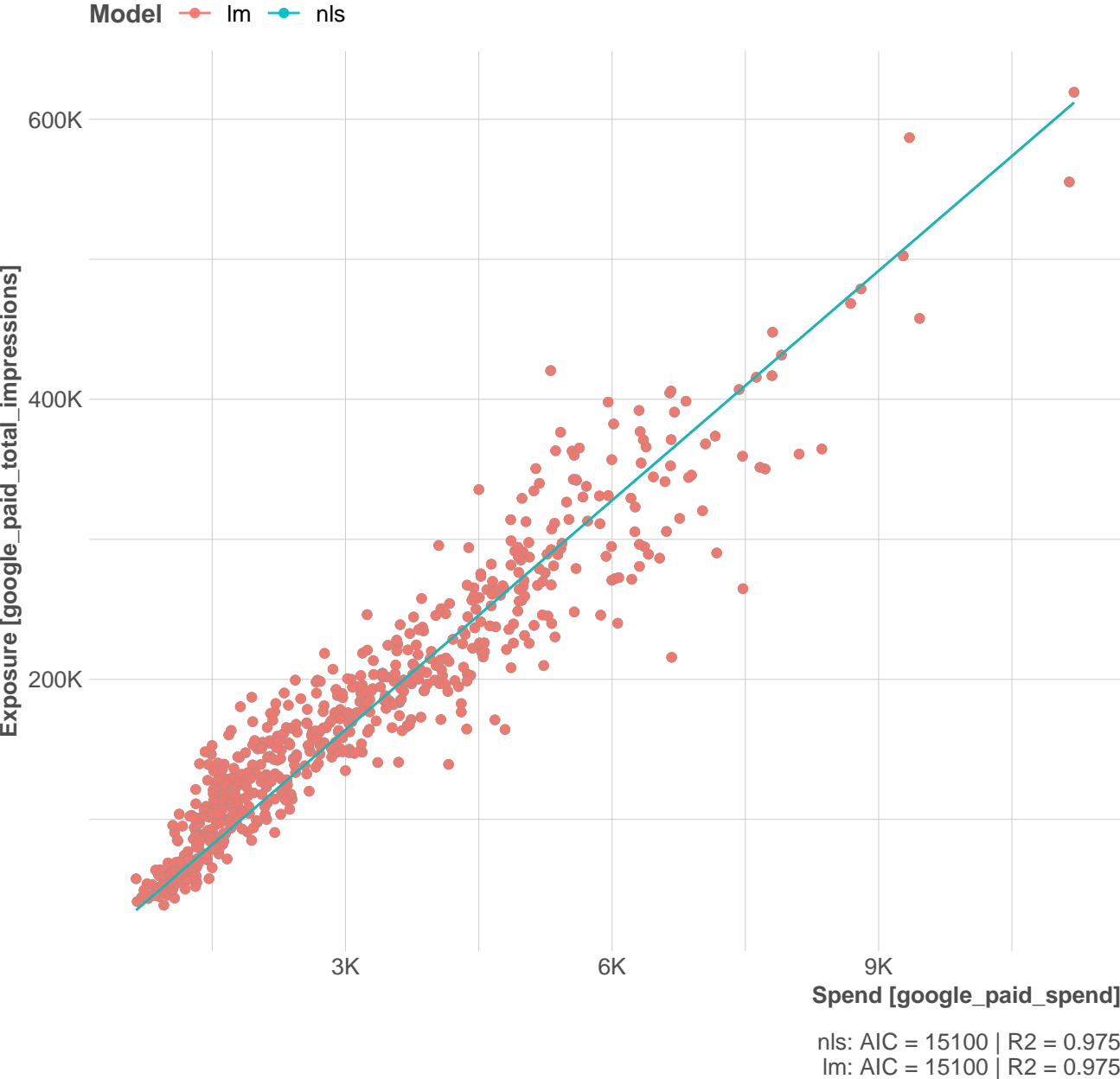


# Exposure–Spend Models Fit Comparison

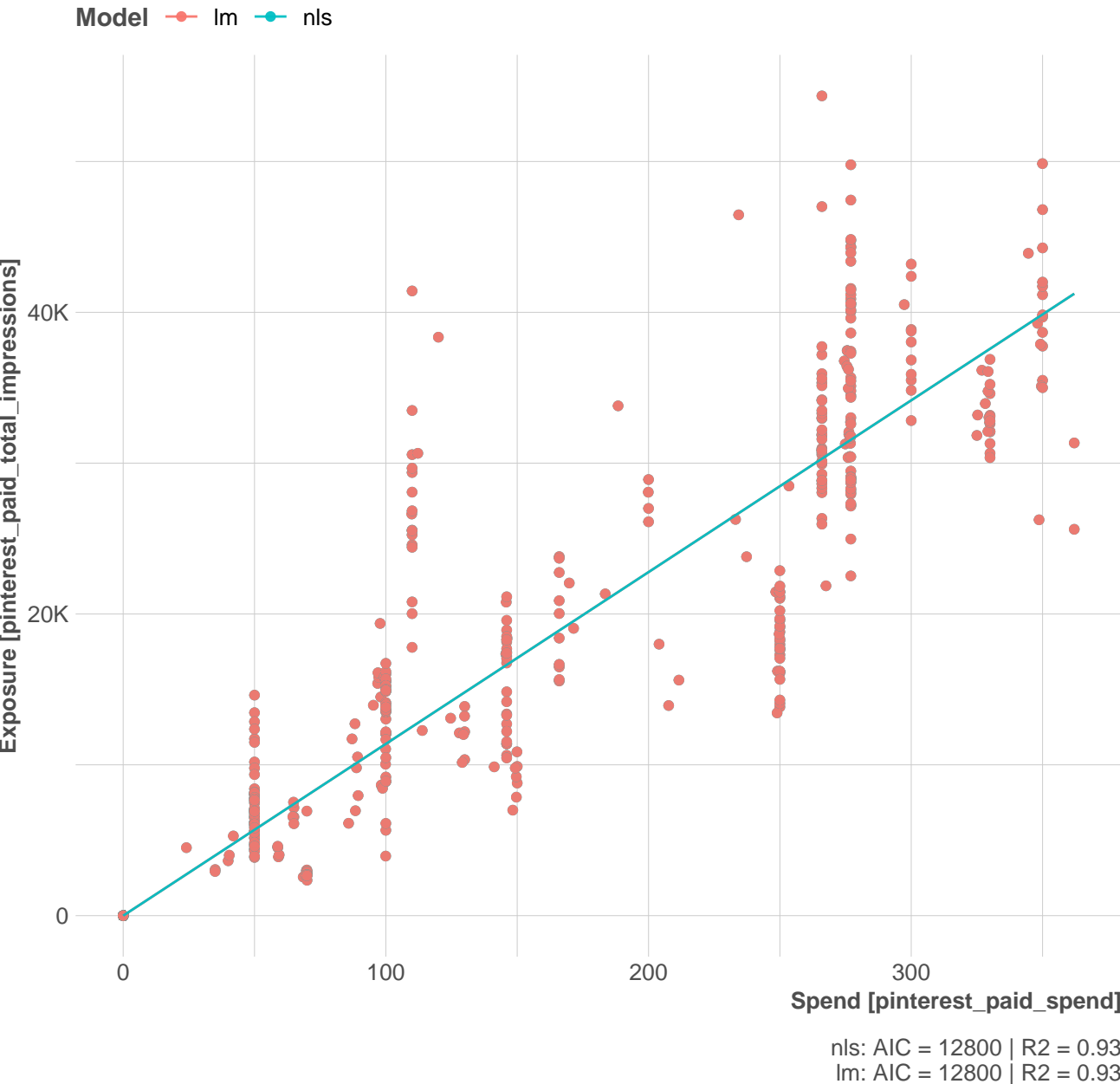


nls: AIC = 14700 | R2 = 0.956  
Im: AIC = 14700 | R2 = 0.956

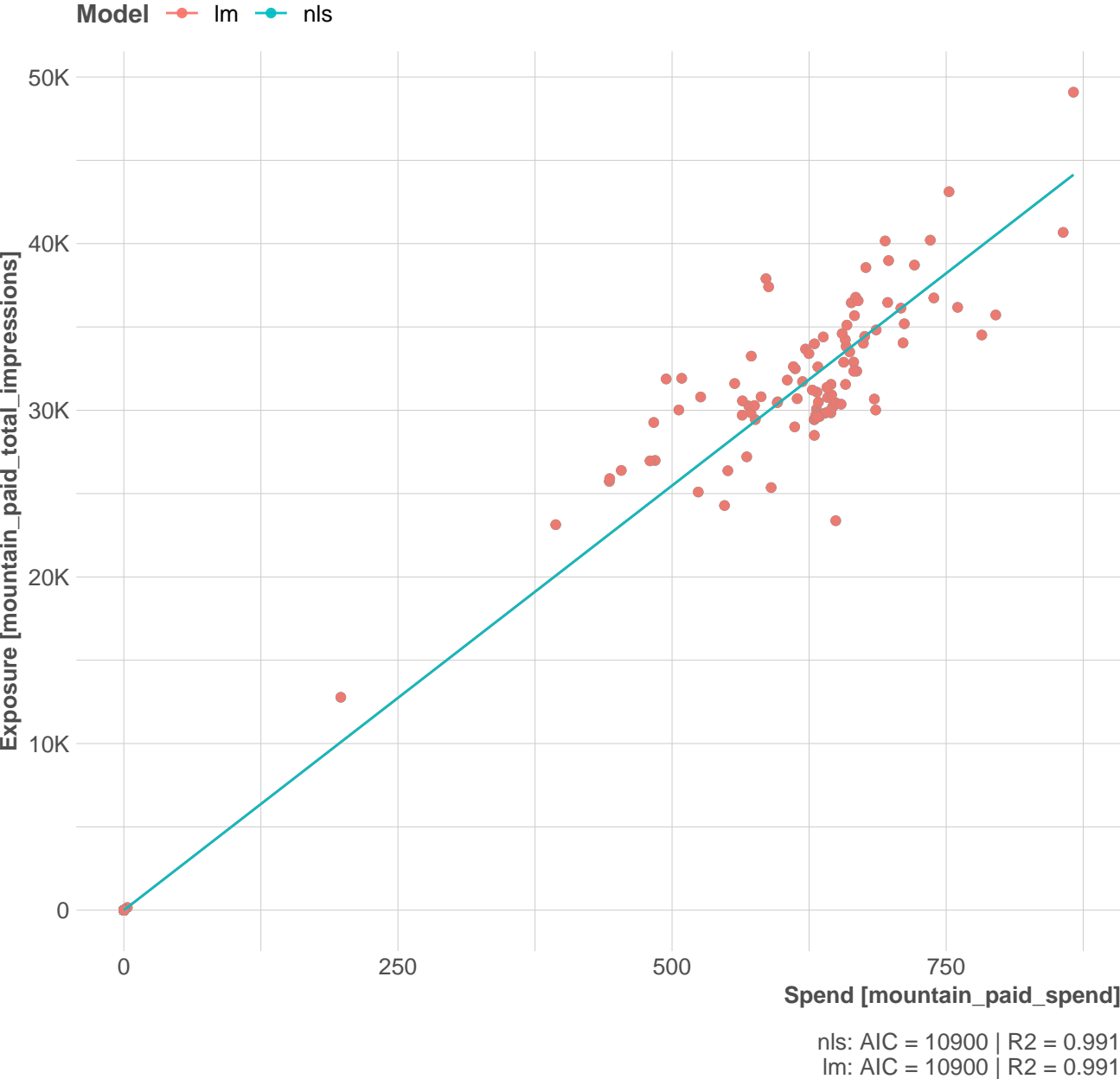
# Exposure–Spend Models Fit Comparison



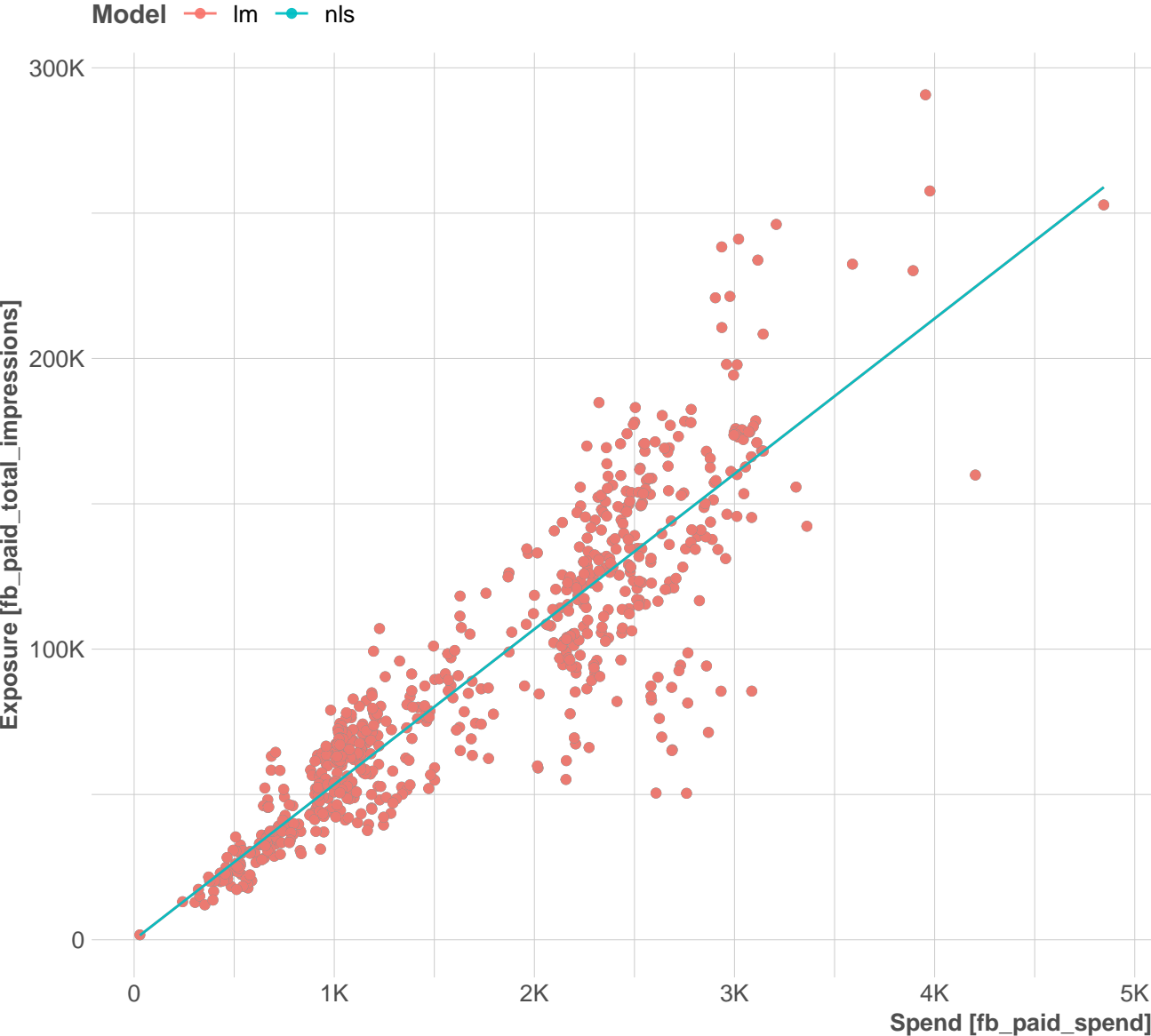
# Exposure–Spend Models Fit Comparison



# Exposure–Spend Models Fit Comparison

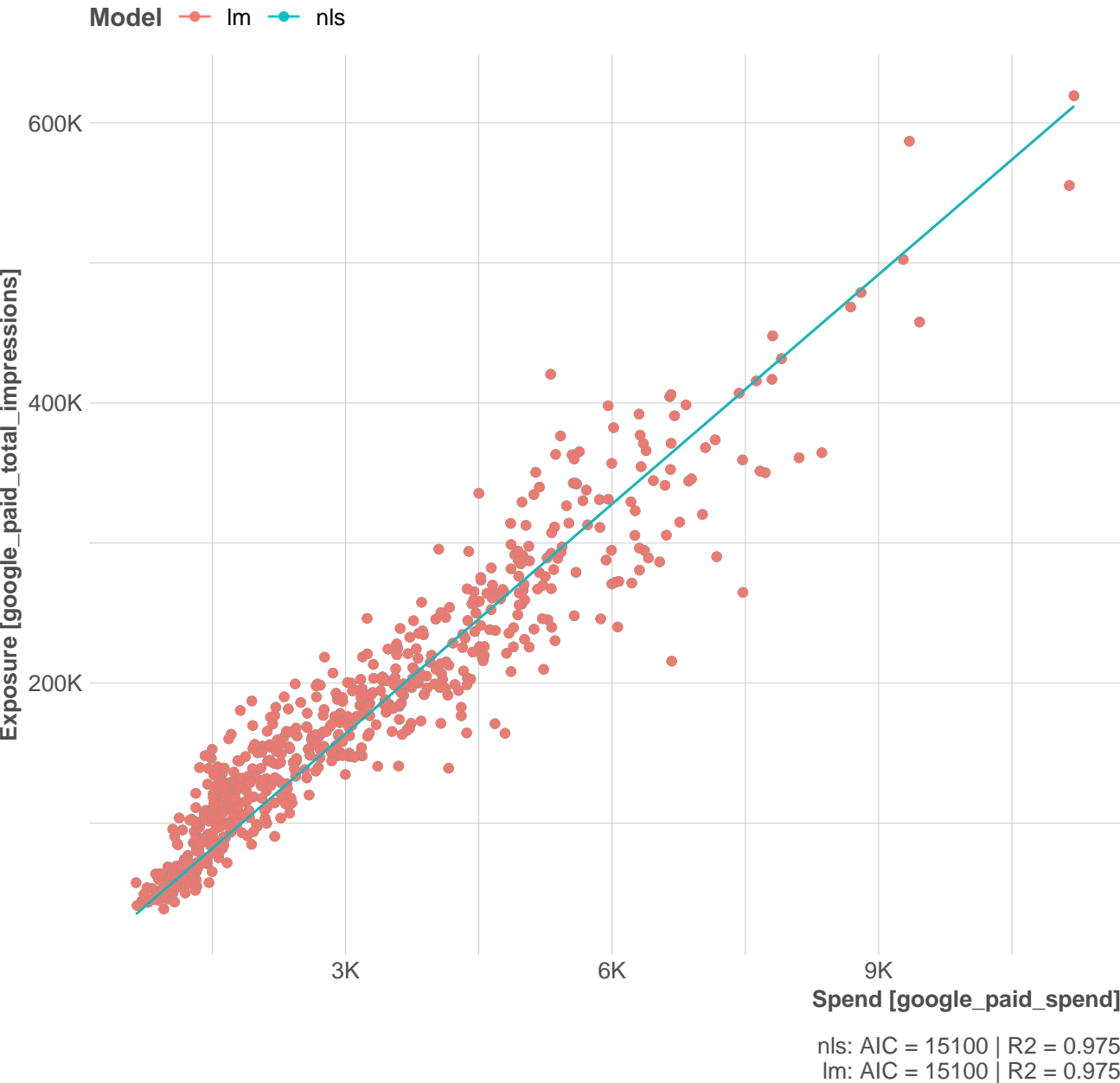


# Exposure–Spend Models Fit Comparison



nls: AIC = 14700 | R2 = 0.956  
Im: AIC = 14700 | R2 = 0.956

# Exposure–Spend Models Fit Comparison



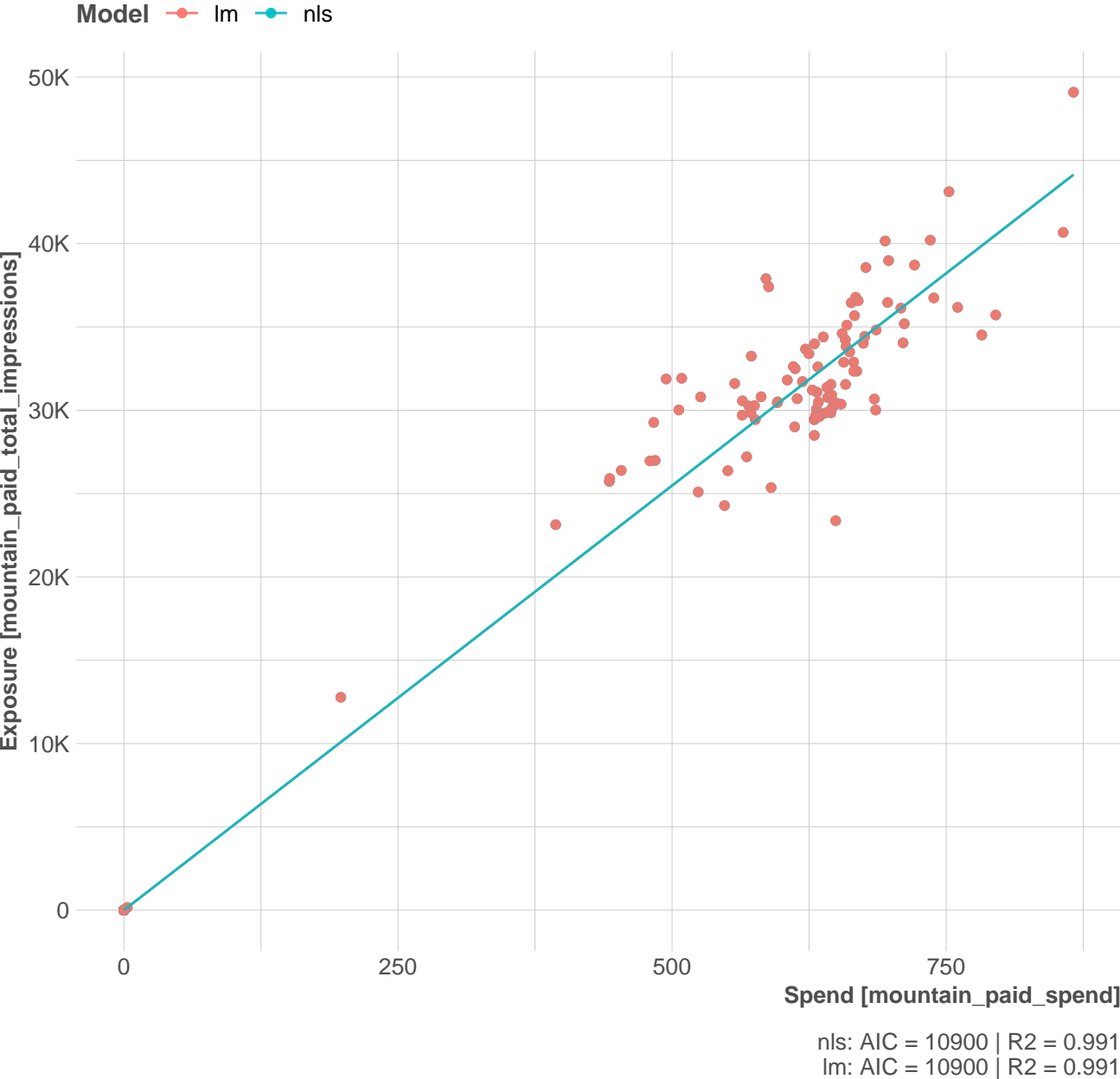
# Exposure–Spend Models Fit Comparison



nls: AIC = 12800 | R2 = 0.93

lm: AIC = 12800 | R2 = 0.93

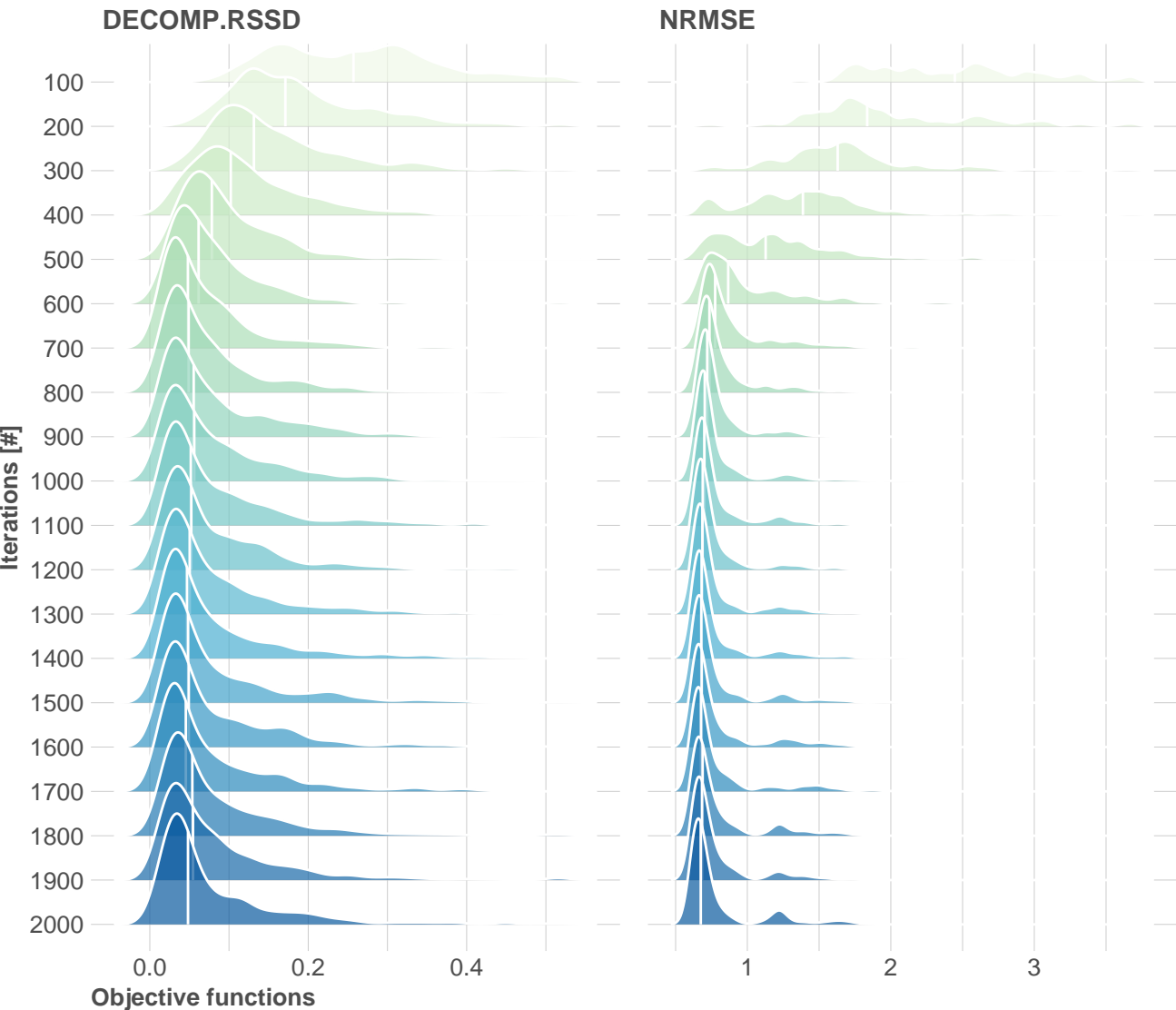
# Exposure–Spend Models Fit Comparison





# Objective convergence by iterations quantiles

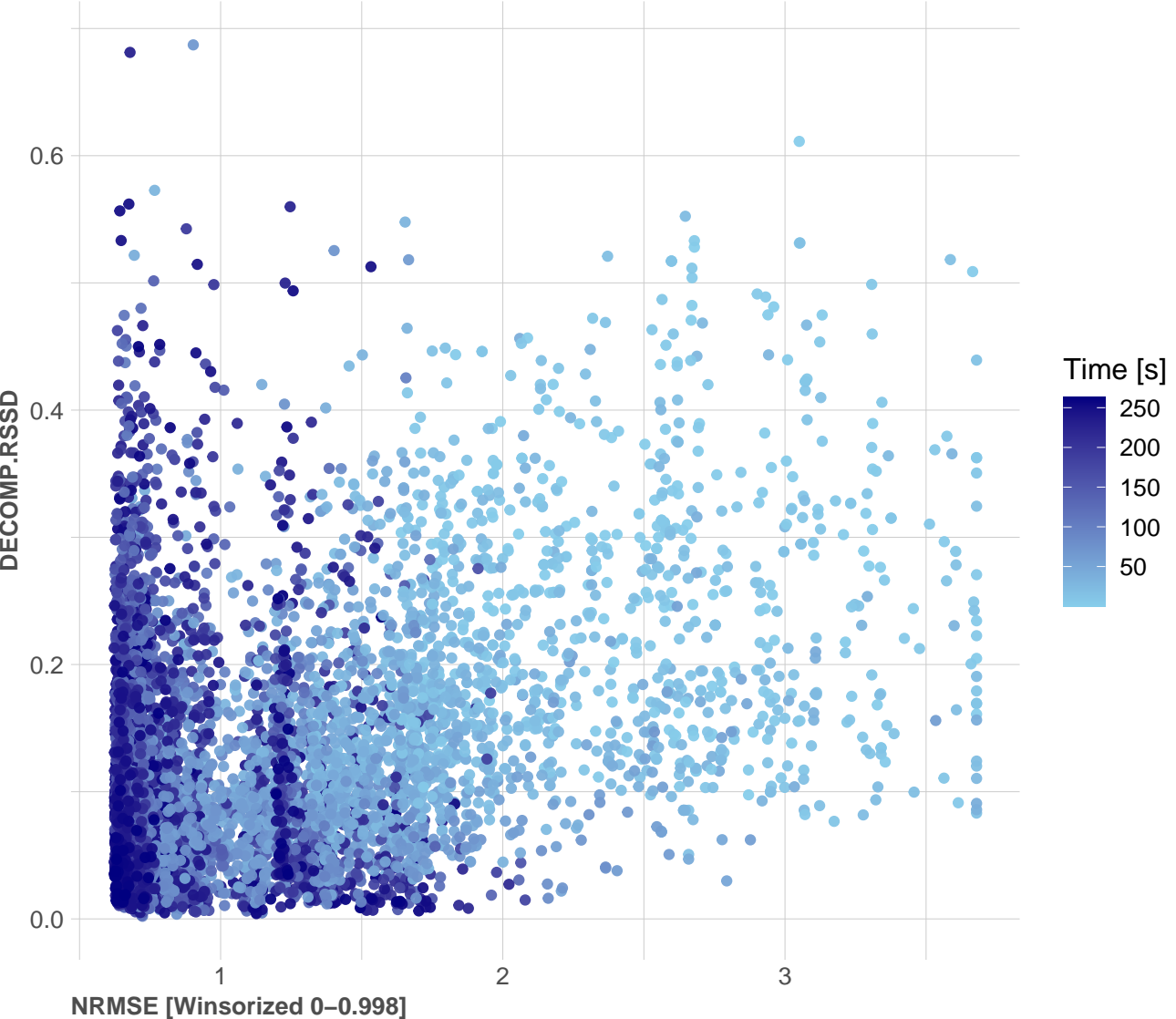
5 trials with 2000 iterations each using TwoPointsDE



DECOMP.RSSD converged: sd@qt.20 0.081 <= 0.092 & |med@qt.20| 0.048 <= 0.073  
NRMSE converged: sd@qt.20 0.26 <= 0.55 & |med@qt.20| 0.68 <= 1.3

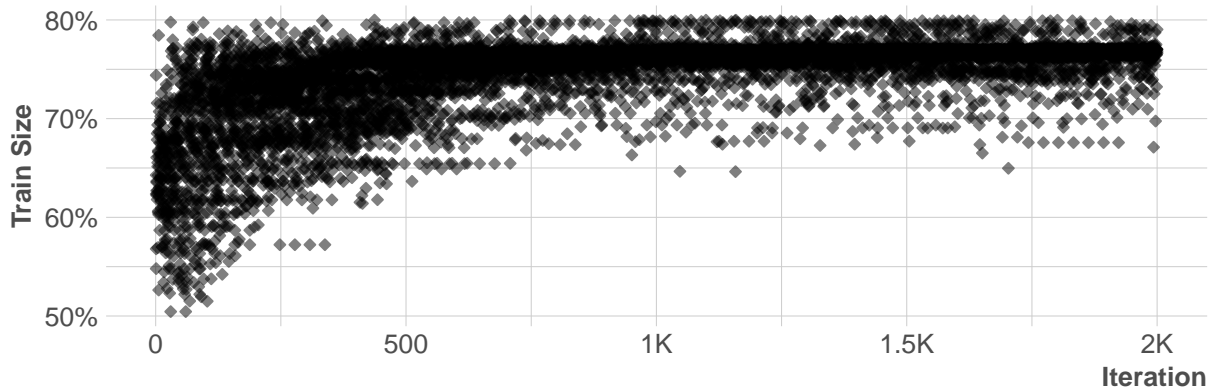
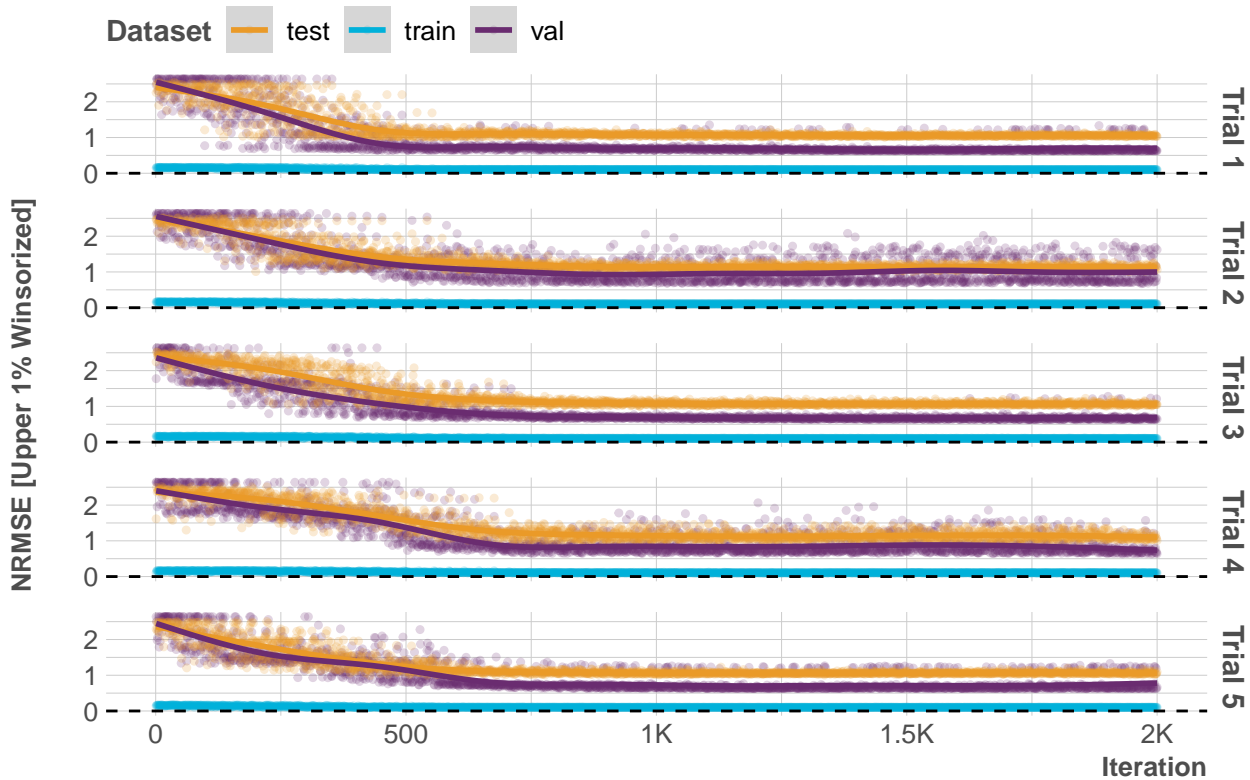
# Multi-objective evolutionary performance

5 trials with 2000 iterations each using TwoPointsDE



DECOMP.RSSD converged:  $\text{sd}@qt.20$  0.081  $\leq$  0.092 &  $|\text{med}@qt.20|$  0.048  $\leq$  0.073  
NRMSE converged:  $\text{sd}@qt.20$  0.26  $\leq$  0.55 &  $|\text{med}@qt.20|$  0.68  $\leq$  1.3

# Time-series validation & Convergence

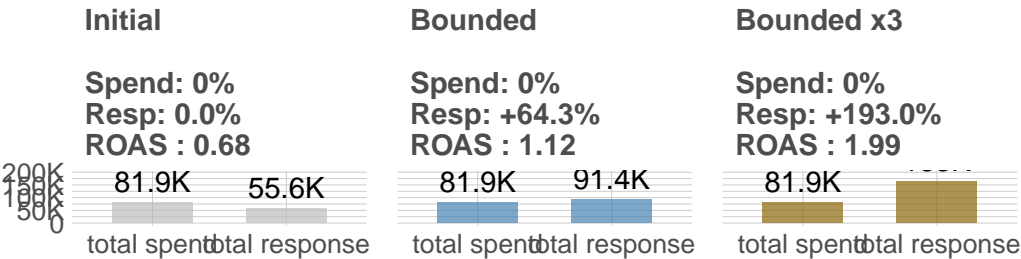


# Budget Allocation Onepager for Model ID 1\_1707\_1

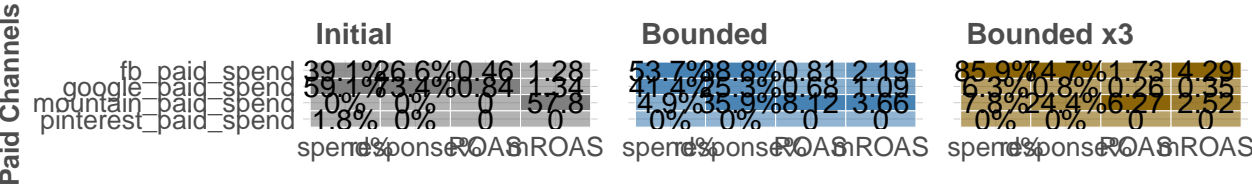
Adj.R2: train = 0.6559, val = 0.7159, test = 0.5686 | NRMSE: train = 0.1008, val = 0.6108, test = 0.6108

Simulation date range: 2023-12-31 to 2024-01-29 (30 days) | Scenario: max\_response

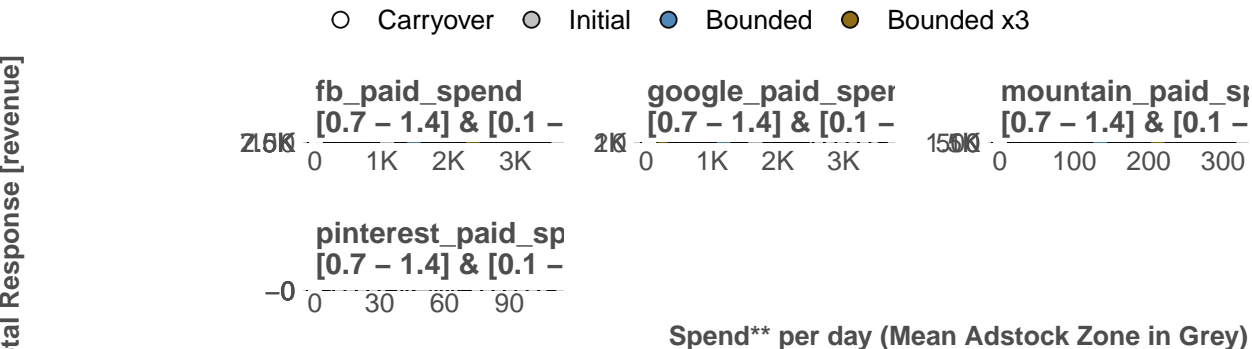
## Total Budget Optimization Result



## Budget Allocation per Channel\*



## Simulated Response Curve for Selected Allocation Period



\* ROAS = total response / raw spend | mROAS = marginal response / marginal spend

\* When reallocating budget, mROAS converges across media within respective bounds

\*\* Dotted lines show budget optimization lower-upper ranges per media