

Ranking	Score	Parameter	Baseline Concentration effect $\mu M$	Time to Peak effect $s$	Peak Concentration effect $\mu M$	Tau to Tail Ratio effect	Time to Baseline effect $s$
1	2.50	$k_{f,5}$	$\sim 0$	533	$7.54 \times 10^{-3}$	$3.62 \times 10^{-2}$	$1.74 \times 10^4$
2	2.20	$L_s$	$\sim 0$	971	$8.40 \times 10^{-3}$	$4.11 \times 10^{-2}$	2230
3	2.18	$k_{f,4}$	$\sim 0$	953	$7.98 \times 10^{-3}$	$4.13 \times 10^{-2}$	2090
4	2.00	$k_{f,16}$	$4.54 \times 10^{-2}$	2.43	0.107	$9.30 \times 10^{-6}$	2.43
5	2.00	$R_{pc}$	$4.35 \times 10^{-2}$	10.4	0.100	$3.39 \times 10^{-3}$	123
6	1.65	$G_d$	$\sim 0$	725	$5.95 \times 10^{-3}$	$3.11 \times 10^{-2}$	1680
7	1.42	$K_{d,2}$	$\sim 0$	630	$5.49 \times 10^{-3}$	$2.66 \times 10^{-2}$	1390
8	1.16	$k_{f,14}$	$3.72 \times 10^{-2}$	9.36	$3.42 \times 10^{-2}$	$5.54 \times 10^{-4}$	29.0
9	0.910	$k_{f,8}$	$1.92 \times 10^{-2}$	23.5	$3.55 \times 10^{-2}$	$4.89 \times 10^{-3}$	198
10	0.877	$k_{r,8}$	$1.93 \times 10^{-2}$	13.8	$3.41 \times 10^{-2}$	$4.44 \times 10^{-3}$	168
11	$8.27 \times 10^{-1}$	$Ca$	$1.83 \times 10^{-2}$	5.34	$3.66 \times 10^{-2}$	$2.81 \times 10^{-3}$	110
12	$7.99 \times 10^{-1}$	$P_c$	$1.83 \times 10^{-2}$	5.15	$3.49 \times 10^{-2}$	$2.35 \times 10^{-3}$	91.9
13	$7.30 \times 10^{-1}$	$k_{f,12}$	$\sim 0$	10.9	$5.05 \times 10^{-2}$	$9.28 \times 10^{-3}$	338
14	$7.11 \times 10^{-1}$	$P$	$1.87 \times 10^{-2}$	19.7	$2.08 \times 10^{-2}$	$3.10 \times 10^{-3}$	126
15	$6.42 \times 10^{-1}$	$k_{f,6}$	$\sim 0$	10.8	$4.81 \times 10^{-2}$	$6.79 \times 10^{-3}$	258
16	$5.48 \times 10^{-1}$	$k_{f,15}$	$\sim 0$	11.3	$5.53 \times 10^{-2}$	$6.31 \times 10^{-4}$	35.6
17	$5.28 \times 10^{-1}$	$PIP2$	$1.39 \times 10^{-2}$	2.41	$2.28 \times 10^{-2}$	$1.99 \times 10^{-4}$	8.79
18	$4.81 \times 10^{-1}$	$R$	$\sim 0$	8.6	$3.60 \times 10^{-2}$	$5.10 \times 10^{-3}$	197
19	$4.40 \times 10^{-1}$	$K_{m,14}$	$1.38 \times 10^{-2}$	5.36	$1.28 \times 10^{-2}$	$4.31 \times 10^{-3}$	16.4
20	$4.27 \times 10^{-1}$	$k_{f,10}$	$\sim 0$	6.62	$3.05 \times 10^{-2}$	$5.07 \times 10^{-3}$	187
21	$2.93 \times 10^{-1}$	$k_{f,9}$	$\sim 0$	5.28	$1.81 \times 10^{-2}$	$4.44 \times 10^{-3}$	177
22	$1.72 \times 10^{-1}$	$R_g$	$\sim 0$	2.73	$1.29 \times 10^{-2}$	$1.85 \times 10^{-3}$	69.7
23	$1.51 \times 10^{-1}$	$k_{f,7}$	$\sim 0$	4.14	$1.19 \times 10^{-2}$	$1.33 \times 10^{-3}$	50.1
24	$1.13 \times 10^{-1}$	$k_{f,13}$	$\sim 0$	3.81	$4.95 \times 10^{-2}$	$2.35 \times 10^{-3}$	99.7
25	$9.58 \times 10^{-2}$	$k_{r,10}$	$\sim 0$	1.42	$6.69 \times 10^{-2}$	$1.20 \times 10^{-3}$	41.5
26	$9.52 \times 10^{-2}$	$K_{d,11}$	$\sim 0$	6.43	$2.11 \times 10^{-2}$	$2.62 \times 10^{-3}$	90.4
27	$9.18 \times 10^{-2}$	$k_{f,11}$	$\sim 0$	6.24	$2.09 \times 10^{-2}$	$2.47 \times 10^{-3}$	103
28	$8.39 \times 10^{-2}$	$K_{m,15}$	$\sim 0$	2.19	$8.30 \times 10^{-3}$	$1.39 \times 10^{-4}$	6.55
29	$4.77 \times 10^{-2}$	$k_{r,9}$	$\sim 0$	$9.18 \times 10^{-1}$	$2.72 \times 10^{-3}$	$7.97 \times 10^{-4}$	32.6
30	$1.89 \times 10^{-2}$	$k_{f,1}$	$\sim 0$	8.54	$5.65 \times 10^{-5}$	$3.21 \times 10^{-4}$	31.3
31	$1.32 \times 10^{-2}$	$K_{d,4}$	$\sim 0$	1.53	$6.18 \times 10^{-5}$	$3.71 \times 10^{-4}$	35.1
32	$5.24 \times 10^{-3}$	$k_{f,2}$	$\sim 0$	2.29	$2.18 \times 10^{-5}$	$1.01 \times 10^{-4}$	3.87
33	$1.04 \times 10^{-3}$	$k_{f,3}$	$\sim 0$	$1.64 \times 10^{-1}$	$1.25 \times 10^{-5}$	$2.17 \times 10^{-5}$	3.97
34	$\sim 0$	$k_{r,3}$	$\sim 0$	$2.20 \times 10^{-4}$	$\sim 0$	$\sim 0$	$3.35 \times 10^{-3}$
35	$\sim 0$	$V_c$	$\sim 0$	$3.96 \times 10^{-4}$	$\sim 0$	$\sim 0$	$4.39 \times 10^{-5}$
36	$\sim 0$	$K_{d,1}$	$\sim 0$	$4.39 \times 10^{-5}$	$\sim 0$	$\sim 0$	0
37	0	$G_t$	0	0	0	0	0
38	0	$IP3$	0	0	0	0	0
39	0	$P_{cg}$	0	0	0	0	0
40	0	$P_g$	0	0	0	0	0
41	0	$R_t$	0	0	0	0	0
42	0	$R_{lg}$	0	0	0	0	0
43	0	$R_{lgp}$	0	0	0	0	0

Table S7: Model sensitivity analysis results: Ranked Parameters All parameters of the IP3 submodel are ranked by the sum of their proportion to the largest magnitude effect on each of the five objective functions of the Morris analysis. All values are to three significant figures.