$$k_{i,j}^{eff} = \alpha k_p k_{d,1}^i k_{d,2}^j \mathrm{e}^{(1-i-j)9/0.6}$$

$$\alpha = c_0^{-(i+j)}$$

$$k_p = 0.5 * 10^6\,\mathrm{M}^{-1}\mathrm{s}^{-1}$$

$$\begin{aligned}\frac{\partial[S_0]}{\partial t} &= k_p(-6[S_0]^2 - 8[S_0][S_1] - 6[S_0][S_2] - 6[S_0][S_3] - 4[S_0][S_4] - 6[S_0][S_5] - 4[S_0][S_6] \\ &\quad - 4[S_0][S_7] - 6[S_0][S_8] - 4[S_0][S_9] - 2[S_0][S_{10}]) + 2[S_1]k_{0,1}^{eff} + 2[S_2]k_{1,0}^{eff} + [S_3]k_{1,0}^{eff} \\ &\quad + [S_3]k_{0,1}^{eff} + 2[S_4]k_{1,0}^{eff} + [S_5]k_{1,0}^{eff} + [S_5]k_{0,1}^{eff} + 2[S_6]k_{1,0}^{eff} + 4[S_7]k_{1,1}^{eff} + 3[S_8]k_{2,0}^{eff} \\ &\quad + 2[S_9]k_{2,0}^{eff} + [S_9]k_{0,1}^{eff} + 2[S_{10}]k_{2,1}^{eff} + [S_{10}]k_{2,0}^{eff} + 2[S_{10}]k_{1,1}^{eff} + 6[S_{11}]k_{2,1}^{eff} - \delta[S_0] + Q\end{aligned}$$

$$\begin{aligned}\frac{\partial[S_1]}{\partial t} &= k_p([S_0]^2 - 8[S_0][S_1] - 8[S_1]^2 - 4[S_1][S_2] - 4[S_1][S_3] - 4[S_1][S_5] - 4[S_1][S_7]) - [S_1]k_{0,1}^{eff} \\ &\quad + [S_3]k_{1,0}^{eff} + [S_5]k_{1,0}^{eff} + 2[S_7]k_{2,0}^{eff} + [S_9]k_{2,0}^{eff} + 2[S_{10}]k_{3,0}^{eff} + 3[S_{11}]k_{4,0}^{eff} - \delta[S_1]\end{aligned}$$

$$\begin{aligned}\frac{\partial[S_2]}{\partial t} &= k_p(2[S_0]^2 - 6[S_0][S_2] - 4[S_1][S_2] - 6[S_2]^2 - 2[S_2][S_3] - 2[S_2][S_5] - 6[S_2][S_8] - 2[S_2][S_9]) \\ &\quad - [S_2]k_{1,0}^{eff} + [S_3]k_{0,1}^{eff} + 2[S_4]k_{0,1}^{eff} + [S_5]k_{0,1}^{eff} + 2[S_6]k_{0,1}^{eff} + 2[S_7]k_{0,2}^{eff} \\ &\quad + 3[S_8]k_{2,0}^{eff} + [S_9]k_{2,0}^{eff} + 2[S_{10}]k_{2,1}^{eff} + [S_{10}]k_{0,2}^{eff} + 6[S_{11}]k_{2,2}^{eff} - \delta[S_2]\end{aligned}$$

$$\begin{aligned}\frac{\partial[S_3]}{\partial t} &= k_p(4[S_0][S_1] + 2[S_0][S_2] - 6[S_0][S_3] - 4[S_1][S_3] - 2[S_2][S_3] - 2[S_3]^2) - [S_3]k_{1,0}^{eff} \\ &\quad - [S_3]k_{0,1}^{eff} + 2[S_4]k_{1,0}^{eff} + 2[S_7]k_{1,1}^{eff} + [S_9]k_{2,0}^{eff} + [S_{10}]k_{3,0}^{eff} + [S_{10}]k_{2,1}^{eff} \\ &\quad + 6[S_{11}]k_{4,1}^{eff} - \delta[S_3]\end{aligned}$$

$$\frac{\partial[S_4]}{\partial t} = k_p(2[S_0][S_3] - 4[S_0][S_4] + [S_2]^2) - 2[S_4]k_{1,0}^{eff} - [S_4]k_{0,1}^{eff} + [S_{10}]k_{2,1}^{eff} - \delta[S_4]$$

$$\frac{\partial[S_5]}{\partial t} = k_p(4[S_0][S_1] + 2[S_0][S_2] - 6[S_0][S_5] - 4[S_1][S_5] - 2[S_2][S_5] - 2[S_5]^2) - [S_5]k_{1,0}^{eff} - [S_5]k_{0,1}^{eff} + 2[S_6]k_{1,0}^{eff} + 2[S_7]k_{1,1}^{eff} + [S_9]k_{2,0}^{eff} + [S_{10}]k_{3,0}^{eff} + [S_{10}]k_{2,1}^{eff} + 6[S_{11}]k_{4,1}^{eff} - \delta[S_5]$$

$$\frac{\partial[S_6]}{\partial t} = k_p(2[S_0][S_5] - 4[S_0][S_6] + [S_2]^2) - 2[S_6]k_{1,0}^{eff} - [S_6]k_{0,1}^{eff} + [S_{10}]k_{2,1}^{eff} - \delta[S_6]$$

$$\frac{\partial[S_7]}{\partial t} = k_p(2[S_0][S_3] + 2[S_0][S_5] - 4[S_0][S_7] + 4[S_1]^2 - 4[S_1][S_7] + [S_2]^2) - 4[S_7]k_{1,1}^{eff} - [S_7]k_{2,0}^{eff} - [S_7]k_{0,2}^{eff} + [S_{10}]k_{2,0}^{eff} + 3[S_{11}]k_{4,0}^{eff} - \delta[S_7]$$

$$\frac{\partial[S_8]}{\partial t} = k_p(2[S_0][S_2] - 6[S_0][S_8] - 6[S_2][S_8] - 6[S_8]^2) - 3[S_8]k_{2,0}^{eff} + [S_9]k_{0,1}^{eff} + [S_{10}]k_{0,2}^{eff} + 2[S_{11}]k_{0,3}^{eff} - \delta[S_8]$$

$$\frac{\partial[S_9]}{\partial t} = k_p(2[S_0][S_3] + 2[S_0][S_5] + 6[S_0][S_8] - 4[S_0][S_9] + 4[S_1][S_2] - 2[S_2][S_9]) - 3[S_9]k_{2,0}^{eff} - [S_9]k_{0,1}^{eff} + 2[S_{10}]k_{1,1}^{eff} + 6[S_{11}]k_{2,2}^{eff} - \delta[S_9]$$

$$\frac{\partial[S_{10}]}{\partial t} = k_p(4[S_0][S_4] + 4[S_0][S_6] + 4[S_0][S_7] + 4[S_0][S_9] - 2[S_0][S_{10}] + 4[S_1][S_3] + 4[S_1][S_5] + 2[S_2][S_3] + 2[S_2][S_5] + 6[S_2][S_8]) - 4[S_{10}]k_{2,1}^{eff} - [S_{10}]k_{2,0}^{eff} - 2[S_{10}]k_{1,1}^{eff} - 2[S_{10}]k_{3,0}^{eff} - [S_{10}]k_{0,2}^{eff} + 6[S_{11}]k_{2,1}^{eff} - \delta[S_{10}]$$

$$\frac{\partial[S_{11}]}{\partial t} = k_p(2[S_0][S_{10}] + 4[S_1][S_7] + 2[S_2][S_9] + [S_3]^2 + [S_5]^2 + 3[S_8]^2) - 6[S_{11}]k_{2,1}^{eff} - 3[S_{11}]k_{4,0}^{eff} - 6[S_{11}]k_{2,2}^{eff} - 6[S_{11}]k_{4,1}^{eff} - [S_{11}]k_{0,3}^{eff} - \delta[S_{11}]$$