

The CHIME SVIIvR Model

November 18, 2022

$$S' = -\beta SI - \beta SI_v - v_r S \quad (1)$$

$$V' = v_r S - v_s VI - v_s VI_v \quad (2)$$

$$I' = \beta SI + \beta SI_v - \gamma I \quad (3)$$

$$I'_v = v_s VI + v_s VI_v - \gamma I_v \quad (4)$$

$$R' = \gamma I + \gamma I_v \quad (5)$$

with 4 rates: β, v_r, v_s, γ

To convert to BiLayer, make rate parameters that occur in more than one term in the same equation unique; the equations now becomes:

$$S' = -\beta_1 SI - \beta_2 SI_v - v_r S \quad (6)$$

$$V' = v_r S - v_{s1} VI - v_{s2} VI_v \quad (7)$$

$$I' = \beta_1 SI + \beta_2 SI_v - \gamma_1 I \quad (8)$$

$$I'_v = v_{s1} VI + v_{s2} VI_v - \gamma_2 I_v \quad (9)$$

$$R' = \gamma_1 I + \gamma_2 I_v \quad (10)$$

Now we have 7 rates: $\beta_1, \beta_2, v_{s1}, v_{s2}, v_r, \gamma_1, \gamma_2$
 where $\beta_1 = \beta_2, v_{s1} = v_{s2}$ and $\gamma_1 = \gamma_2$.