Below formulation of susceptible infectious recovered (SIR) will use to simulate the flight data,

$$\frac{dS^{\alpha}(t)}{dt} = -\frac{S^{\alpha}(t)}{N^{\alpha}}\left(\frac{R_0^{\alpha}}{D_I^{\alpha}}I^{\alpha}(t) + Z^{\alpha}(t)\right) + T_{\alpha(S)} \tag{1}$$

$$\frac{dI^{\alpha}(t)}{dt} = -\frac{I^{\alpha}(t)}{D_I^{\alpha}} + T_{\alpha(I)} \tag{2}$$

- $T_{\alpha}(S)$ is $\sum_{\beta\neq\alpha}\left(L_{\beta\to\alpha}\frac{S^{\beta}}{N^{\beta}} - L_{\alpha\to\beta}\frac{S^{\alpha}}{N^{\alpha}}\right)$
- $T_{\alpha}(I)$ is $\sum_{\beta\neq\alpha}\left(L_{\beta\to\alpha}\frac{I^{\beta}}{N^{\beta}} - L_{\alpha\to\beta}\frac{I^{\alpha}}{N^{\alpha}}\right)$.
- S = S(t) represents the number of susceptible individuals
- I = I(t) represents the number of infected individuals
- R = R(t) represents the number of recovered individuals
- s(t) = S(t)/N is the susceptible fraction of the population
- I(t) = I(t)/N is the infected fraction of the population
- r(t) = R(t)/N is the recovered fraction of the population
- D_i is the infectious period
- R_0 is the basic reproductive number
- z(t) is the zoonotic force of infection