1 Methods

Let L_t and R_t be the daily number of local cases and recovered cases. The model is then written thus

$$L_t \sim \text{NegBin}\left(\beta_t \cdot I_{t-1} \cdot \frac{S_{t-1}}{N}, \phi\right)$$
$$\ln(\beta_t) = \nu_t$$
$$\nu_t \sim \text{Normal}\left(2\nu_{t-1} - \nu_{t-2}, \sigma\right)$$
$$\nu_1 \sim \text{Normal}(-4, 2), \quad \nu_2 \sim \text{Normal}(-4, 2)$$
$$\sigma \sim \text{Exponential}(1)$$
$$\sqrt{\phi} \sim \text{Normal}_+(0, 1)$$

We model the recovery time using an exponential distribution, which is the same as modeling the number of recovered cases with a Poisson distribution.

$$R_t \sim \text{Poisson}\left(\gamma \cdot I_{t-1}\right)$$
$$\gamma \sim \text{Exponential}(1)$$

Having β_t and γ we can then calculate the effective reproduction ratio, r_t, as

$$r_t = \frac{\beta_t}{\gamma}$$