$$\text{Subject parameter distribution: } \underbrace{\begin{bmatrix} \text{int1}_i \\ \text{int2}_i \\ \text{slope1}_i \\ \text{slope2}_i \end{bmatrix}}_{\boldsymbol{\phi}(i)} \approx \mathrm{N}\left(\begin{bmatrix} 3.354 \\ 4.33 \\ 0.467 \\ -0.011 \end{bmatrix}, \begin{bmatrix} 1.913 & -0.054 & 1.22 & -0.036 \\ -0.054 & 0.002 & -0.033 & 0.001 \\ 1.22 & -0.033 & 1.17 & -0.034 \\ -0.036 & 0.001 & -0.034 & 0.001 \end{bmatrix} \right)$$

$$\text{Initial latent states: } \underbrace{\begin{bmatrix} \text{eta1} \\ \text{eta2} \end{bmatrix} (t_0)}_{\boldsymbol{\eta}(t_0)} \sim \mathrm{N}\left(\underbrace{\underbrace{\begin{bmatrix} 3.354 \\ 4.33 \end{bmatrix}}}_{\text{T0MEANS}}, \underbrace{\underbrace{\begin{bmatrix} 1.913 & -0.054 \\ -0.054 & 0.002 \end{bmatrix}}_{\mathbf{Q^*}_{t0}}}_{\text{T0VAR}} \right)$$

$$\text{Deterministic change: } \underbrace{\mathrm{d}\begin{bmatrix} \text{eta1} \\ \text{eta2} \end{bmatrix} (t)}_{\mathrm{d}\boldsymbol{\eta}(t)} = \left(\underbrace{\underbrace{\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}}_{\mathbf{A}}}_{\text{DRIFT}} \underbrace{\begin{bmatrix} \text{eta1} \\ \text{eta2} \end{bmatrix} (t)}_{\boldsymbol{\eta}(t)} + \underbrace{\underbrace{\begin{bmatrix} 0.467 \\ -0.011 \end{bmatrix}}_{\mathbf{b}}}_{\text{CINT}} \right) \mathrm{d}t \quad +$$

$$\text{Random change: } \underbrace{\underbrace{\mathit{cholsdcor}\left\{ \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \right\}}_{\mathbf{G}}}_{\text{DIFFUSION}} \underbrace{\mathrm{d}\begin{bmatrix} W_1 \\ W_2 \end{bmatrix} (t)}_{\mathrm{d}\mathbf{W}(t)}$$

$$\text{Observations: } \underbrace{\begin{bmatrix} \text{y1} \\ \text{y2} \\ \text{y3} \end{bmatrix} (t)}_{\mathbf{Y}(t)} = \underbrace{\underbrace{\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & -34.971 \end{bmatrix}}_{\boldsymbol{\Lambda}}}_{\text{LAMBDA}} \underbrace{\begin{bmatrix} \text{eta1} \\ \text{eta2} \end{bmatrix} (t)}_{\boldsymbol{\eta}(t)} + \underbrace{\underbrace{\begin{bmatrix} 0 \\ 0 \\ 157.498 \end{bmatrix}}_{\boldsymbol{\tau}}}_{\text{MANIFESTMEANS}} + \underbrace{\underbrace{\begin{bmatrix} 0.409 & 0 & 0 \\ 0 & 5.309 & 0 \\ 0 & 0 & 0.536 \end{bmatrix}}_{\boldsymbol{\Theta}}}_{\text{MANIFESTVAR}} \underbrace{\begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \epsilon_3 \end{bmatrix} (t)}_{\boldsymbol{\epsilon}(t)}$$

$$\text{Latent noise per time step : } \Delta\left[W_{j\in[1,2]}\right](t-u) \sim \mathrm{N}(0, t-u) \quad \text{Observation noise: } \left[\epsilon_{j\in[1,2]}\right](t) \sim \mathrm{N}(0,1)$$

Linearised approximation of subject parameter distribution shown.

Indivividual specific notation (subscript i) only shown for subject parameter distribution – pop. means shown elsewhere.

cholsdcor converts lower tri matrix of std dev and unconstrained correlation to Cholesky factor covariance.

covsdcor = transposed cross product of cholsdcor, to give covariance.

See Driver & Voelkle (2018) p11.