

$$\underbrace{\text{d} \begin{bmatrix} \text{ss_level} \\ \text{ss_velocity} \end{bmatrix}}_{\text{d}\boldsymbol{\eta}(t)}(t) = \left(\underbrace{\begin{bmatrix} 0 & 1 \\ -0.367 & -0.338 \end{bmatrix}}_{\substack{\mathbf{A} \\ \text{DRIFT}}} \underbrace{\begin{bmatrix} \text{ss_level} \\ \text{ss_velocity} \end{bmatrix}}_{\boldsymbol{\eta}(t)}(t) + \underbrace{\begin{bmatrix} 0 \\ 0 \end{bmatrix}}_{\substack{\mathbf{b} \\ \text{CINT}}} \right) \text{d}t \quad +$$

$$\underbrace{\text{cholsdcor} \left(\underbrace{\begin{bmatrix} 0 & 0 \\ 0 & 19.674 \end{bmatrix}}_{\substack{\mathbf{G} \\ \text{DIFFUSION}}} \right)}_{\text{cholsdcor}} \underbrace{\text{d} \begin{bmatrix} W_1 \\ W_2 \end{bmatrix}}_{\text{d}\mathbf{W}(t)}(t)$$

$$\underbrace{\begin{bmatrix} W_1 \\ W_2 \end{bmatrix}}_{\mathbf{W}(t+u)}(t+u) - \underbrace{\begin{bmatrix} W_1 \\ W_2 \end{bmatrix}}_{\mathbf{W}(t)}(t) \sim \text{N} \left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \text{u-t} & 0 \\ 0 & \text{u-t} \end{bmatrix} \right)$$

$$\underbrace{[\text{sunspots}]}_{\mathbf{Y}(t)}(t) = \underbrace{\begin{bmatrix} 1 & 0 \end{bmatrix}}_{\substack{\mathbf{\Lambda} \\ \text{LAMBDA}}} \underbrace{\begin{bmatrix} \text{ss_level} \\ \text{ss_velocity} \end{bmatrix}}_{\boldsymbol{\eta}(t)}(t) + \underbrace{[42.204]}_{\substack{\boldsymbol{\tau} \\ \text{MANIFESTMEANS}}} + \underbrace{[30.196]}_{\substack{\boldsymbol{\Theta} \\ \text{MANIFESTVAR}}} \underbrace{[\epsilon_1]}_{\boldsymbol{\epsilon}(t)}(t)$$

$$\underbrace{[\epsilon_1]}_{\boldsymbol{\epsilon}(t)}(t) \sim \text{N} \left([0], [1] \right)$$

cholsdcor = Function converting lower tri matrix of std dev and unconstrained correlation to Cholesky factor.

See Driver & Voelkle (2018) p11.