Subject parameter distribution:

$$\underbrace{\begin{bmatrix} \text{T0m\_eta1}_i \\ \text{T0m\_eta2}_i \\ \text{mm\_Stress}_i \\ \text{mm\_Stress2}_i \\ \text{mm\_Quality}_i \end{bmatrix}}_{\boldsymbol{\phi}(i)} \sim \text{tform} \left\{ \text{N} \left(\begin{bmatrix} \text{raw\_T0m\_eta1} \\ \text{raw\_T0m\_eta2} \\ \text{raw\_mm\_Stress} \\ \text{raw\_mm\_Stress2} \\ \text{raw\_mm\_Quality} \end{bmatrix}, \begin{bmatrix} \text{rawPCov\_1\_1} & \text{rawPCov\_2\_1} & \text{rawPCov\_3\_1} & \text{rawPCov\_4\_1} & \text{rawPCov\_5\_1} \\ \text{rawPCov\_2\_1} & \text{rawPCov\_2\_2} & \text{rawPCov\_3\_2} & \text{rawPCov\_4\_2} & \text{rawPCov\_5\_2} \\ \text{rawPCov\_3\_1} & \text{rawPCov\_3\_2} & \text{rawPCov\_3\_3} & \text{rawPCov\_4\_3} & \text{rawPCov\_5\_3} \\ \text{rawPCov\_4\_1} & \text{rawPCov\_4\_2} & \text{rawPCov\_4\_3} & \text{rawPCov\_4\_4} & \text{rawPCov\_5\_4} \\ \text{rawPCov\_5\_1} & \text{rawPCov\_5\_2} & \text{rawPCov\_5\_3} & \text{rawPCov\_5\_4} & \text{rawPCov\_5\_5} \end{bmatrix} \right) \right\}$$

Initial latent state:

$$\underbrace{\begin{bmatrix} \text{eta1} \\ \text{eta2} \end{bmatrix}(t_0)}_{\boldsymbol{\eta}(t_0)} \sim \text{N} \left(\underbrace{\begin{bmatrix} \text{T0m\_eta1} \\ \text{T0m\_eta2} \end{bmatrix}}_{\text{T0MEANS}}, \underbrace{UcorSDtoCov \left\{ \begin{bmatrix} 0.001 & 0 \\ 0 & 0.001 \end{bmatrix} \right\}}_{\underbrace{\mathbf{Q}^*{}_{t0}}_{\text{T0VAR}}} \right)$$

Deterministic change:

$$\underbrace{\begin{bmatrix} \text{eta1} \\ \text{eta2} \end{bmatrix}(t)}_{\boldsymbol{\eta}(t)} = \left(\underbrace{\begin{bmatrix} \text{drift\_eta1} & \text{drift\_eta1\_eta2} \\ \text{drift\_eta2\_eta1} & \text{drift\_eta2} \end{bmatrix}}_{\underbrace{\mathbf{A}}_{\text{DRIFT}}} \underbrace{\begin{bmatrix} \text{eta1} \\ \text{eta2} \end{bmatrix}(t)}_{\boldsymbol{\eta}(t-1)} + \underbrace{\begin{bmatrix} 0 \\ 0 \end{bmatrix}}_{\underbrace{\mathbf{b}}_{\text{CINT}}} \right) +$$

Random change:

$$\underbrace{UcorSDtoChol \left\{ \begin{bmatrix} \text{diff\_eta1} & 0 \\ \text{diff\_eta2\_eta1} & \text{diff\_eta2} \end{bmatrix} \right\}}_{\underbrace{\mathbf{G}}_{\text{DIFFUSION}}} \underbrace{\begin{bmatrix} W_1 \\ W_2 \end{bmatrix}(t)}_{\mathbf{w}(t)}$$

Observations:

$$\underbrace{\begin{bmatrix} \text{Stress} \\ \text{Stress2} \\ \text{Quality} \end{bmatrix}(t)}_{\mathbf{Y}(t)} = \underbrace{\begin{bmatrix} 1 & 0 \\ 0 & 0 \\ \text{stressLoading} & 1 \end{bmatrix}}_{\underbrace{\boldsymbol{\Lambda}}_{\text{LAMBDA}}} \underbrace{\begin{bmatrix} \text{eta1} \\ \text{eta2} \end{bmatrix}(t)}_{\boldsymbol{\eta}(t)} + \underbrace{\begin{bmatrix} \text{mm\_Stress} \\ \text{mm\_Stress2} \\ \text{mm\_Quality} \end{bmatrix}}_{\underbrace{\boldsymbol{\tau}}_{\text{MANIFESTMEANS}}} +$$

Observation noise:

$$\underbrace{\begin{bmatrix} \text{mvarStress} & 0 & 0 \\ 0 & \text{mvarStress2} & 0 \\ 0 & 0 & \text{mvarQuality} \end{bmatrix}}_{\underbrace{\boldsymbol{\Theta}}_{\text{MANIFESTVAR}}} \underbrace{\begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \epsilon_3 \end{bmatrix}(t)}_{\boldsymbol{\epsilon}(t)}$$

System noise distribution per time step: $\left[W_{j\in[1,2]}\right](t) \sim \text{N}(0,1)$

Observation noise distribution: $\left[\epsilon_{j\in[1,2]}\right](t) \sim \text{N}(0,1)$

Note: *UcorSDtoChol* converts lower tri matrix of standard deviations and unconstrained correlations to Cholesky factor, *UcorSDtoCov* = transposed cross product of UcorSDtoChol, to give covariance, See Driver & Voelkle (2018) p11.
Individual specific notation (subscript i) only shown for subject parameter distribution – pop. means shown elsewhere.