Subject parameter distribution:

$$\underbrace{\begin{bmatrix}\text{T0\_WR}_i\\ \text{T0\_AX}_i\\ \text{b\_WR}_i\\ \text{b\_AX}_i\end{bmatrix}}_{\boldsymbol{\phi}(i)} \sim \text{tform}\left\{\text{N}\left(\begin{bmatrix}\text{raw\_T0\_WR}\\ \text{raw\_T0\_AX}\\ \text{raw\_b\_WR}\\ \text{raw\_b\_AX}\end{bmatrix}, \begin{bmatrix}\text{rawPCov\_1\_1} & \text{rawPCov\_2\_1} & \text{rawPCov\_3\_1} & \text{rawPCov\_4\_1}\\ \text{rawPCov\_2\_1} & \text{rawPCov\_2\_2} & \text{rawPCov\_3\_2} & \text{rawPCov\_4\_2}\\ \text{rawPCov\_3\_1} & \text{rawPCov\_3\_2} & \text{rawPCov\_3\_3} & \text{rawPCov\_4\_3}\\ \text{rawPCov\_4\_1} & \text{rawPCov\_4\_2} & \text{rawPCov\_4\_3} & \text{rawPCov\_4\_4}\end{bmatrix}\right)\right\}$$

Initial latent state:

$$\underbrace{\begin{bmatrix}\text{WR}\\ \text{AX}\end{bmatrix}(t_0)}_{\boldsymbol{\eta}(t_0)} \sim \text{N}\left(\underbrace{\begin{bmatrix}\text{T0\_WR}\\ \text{T0\_AX}\end{bmatrix}}_{\text{T0MEANS}}, \underbrace{UcorSDtoCov\left\{\begin{bmatrix}0.001 & 0\\ 0 & 0.001\end{bmatrix}\right\}}_{\underset{\text{T0VAR}}{\mathbf{Q}^*_{t0}}}\right)$$

Deterministic change:

$$\underbrace{\text{d}\begin{bmatrix}\text{WR}\\ \text{AX}\end{bmatrix}(t)}_{\text{d}\boldsymbol{\eta}(t)} = \left(\underbrace{\begin{bmatrix}\text{WR\_WR} & \text{WR\_AX}\\ \text{AX\_WR} & \text{AX\_AX}\end{bmatrix}}_{\underset{\text{DRIFT}}{\mathbf{A}}}\underbrace{\begin{bmatrix}\text{WR}\\ \text{AX}\end{bmatrix}(t)}_{\boldsymbol{\eta}(t)} + \underbrace{\begin{bmatrix}\text{b\_WR}\\ \text{b\_AX}\end{bmatrix}}_{\underset{\text{CINT}}{\mathbf{b}}}\right)\text{d}t \quad +$$

Random change:

$$\underbrace{UcorSDtoChol\left\{\begin{bmatrix}\text{var\_WR} & 0\\ \text{cov\_WR\_AX} & \text{var\_AX}\end{bmatrix}\right\}}_{\underset{\text{DIFFUSION}}{\mathbf{G}}}\underbrace{\text{d}\begin{bmatrix}W_1\\ W_2\end{bmatrix}(t)}_{\text{d}\mathbf{W}(t)}$$

Observations:

$$\underbrace{\begin{bmatrix}\text{GAD1}\\ \text{GAD2}\\ \text{GAD3}\\ \text{GAD4}\\ \text{GAD5}\\ \text{GAD6}\\ \text{GAD7}\end{bmatrix}(t)}_{\mathbf{Y}(t)} = \underbrace{\begin{bmatrix}1 & 0\\ \text{F1} & 0\\ \text{F2} & 0\\ \text{F3} & 0\\ 0 & 1\\ 0 & \text{F4}\\ 0 & \text{F5}\end{bmatrix}}_{\underset{\text{LAMBDA}}{\boldsymbol{\Lambda}}}\underbrace{\begin{bmatrix}\text{WR}\\ \text{AX}\end{bmatrix}(t)}_{\boldsymbol{\eta}(t)} + \underbrace{\begin{bmatrix}0\\0\\0\\0\\0\\0\\0\end{bmatrix}}_{\underset{\text{MANIFESTMEANS}}{\boldsymbol{\tau}}} \quad +$$

Observation noise:

$$\underbrace{\begin{bmatrix}\text{ME1} & 0 & 0 & 0 & 0 & 0 & 0\\ 0 & \text{ME2} & 0 & 0 & 0 & 0 & 0\\ 0 & 0 & \text{ME3} & 0 & 0 & 0 & 0\\ 0 & 0 & 0 & \text{ME4} & 0 & 0 & 0\\ 0 & 0 & 0 & 0 & \text{ME5} & 0 & 0\\ 0 & 0 & 0 & 0 & 0 & \text{ME6} & 0\\ 0 & 0 & 0 & 0 & 0 & 0 & \text{ME7}\end{bmatrix}}_{\underset{\text{MANIFESTVAR}}{\boldsymbol{\Theta}}}\underbrace{\begin{bmatrix}\epsilon_1\\ \epsilon_2\\ \epsilon_3\\ \epsilon_4\\ \epsilon_5\\ \epsilon_6\\ \epsilon_7\end{bmatrix}(t)}_{\boldsymbol{\epsilon}(t)}$$

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

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.