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Differentiating velocity with respect to time allows for autocorrelation in time and spatially-varying drift in the model.

(Continuous Time Correlated Random Walk, Johnson et al. 2008)

At time t and location $\{X(t), Y(t)\}'$,

$$\begin{bmatrix} \dfrac{dv_x(t)}{dt} \\ \dfrac{dv_y(t)}{dt} \end{bmatrix} = \beta \begin{bmatrix} (\mu_x - v_x(t)) \\ (\mu_y - v_y(t)) \end{bmatrix} + \sigma \begin{bmatrix} \dfrac{dW_{v_x}(t)}{dt} \\ \dfrac{dW_{v_y}(t)}{dt} \end{bmatrix}$$

Mean drift

Instantaneous velocity at time t (damping force)

Controls autocorrelation

Derivative of Brownian motion

We will numerically approximate (Euler-Maruyama)

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How can we understand this equation?

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