Case 2:

Same as Case 1, but now

$$\varepsilon \boldsymbol{F} \eta \equiv \eta \mathbf{A} \begin{pmatrix} \Psi_r \\ \Psi_i \end{pmatrix} = \eta r_S \mathbf{I} \begin{pmatrix} \Psi_r \\ \Psi_i \end{pmatrix}.$$

Again, $\mathrm{C} \approx 2\tau_d \eta_o^{\,2}$,

with $\tau_d \approx 4\mathrm{d}$ and $\eta_o \approx (4\mathrm{d})^{-1}$,

and the equivalent SDE is of the form

$$d\boldsymbol{\Psi} = \mathsf{L}\boldsymbol{\Psi}\, dt + \mathsf{A}\eta_o (\sqrt{2\tau_d})\, \boldsymbol{\Psi} \bullet dW + \boldsymbol{S}_{\boldsymbol{ext}}.$$