$$y \sim GP(0, \underbrace{C_d + C_e + \rho^2 \cdot P \cdot C_u \cdot P^T}_{K_y})$$

$$K_y = \rho^2 \cdot P \cdot C_u \cdot P^T + C_d + C_e$$

$$-\log(p(y)) = \frac{n}{2} \log 2\pi + \frac{1}{2} \log|K_y| + \frac{1}{2} (\rho \cdot P \cdot \bar{u} - y)^T \times K_y^{-1} (\rho P \bar{u} - y)$$

$$\frac{\partial K_y}{\partial \rho} = 2 \rho \cdot P \cdot C_u \cdot P^T$$

$$\frac{\partial K_y}{\partial \sigma_d} = \frac{\partial C_d}{\partial \sigma_d} \quad ; \quad C_d = \sigma_d^2 \cdot \exp\left(-\frac{1}{2 l_d^2} (x - x')^2\right)$$

$$= 2 \sigma_d \cdot \exp\left(-\frac{1}{2 l_d^2} (x - x')^2\right)$$

$$\frac{\partial K_y}{\partial l_d} = \frac{\partial C_d}{\partial l_d} = \sigma_d^2 \cdot \exp\left(-\frac{1}{2 l_d^2} \cdot (x - x')^2\right) \cdot \frac{1}{l_d^3} (x - x')^2$$

$\Rightarrow$ z.B. $\frac{\partial}{\partial l_d} - \log(p(y)) = -\frac{1}{2} tr\left((\alpha \alpha^T - K_y^{-1}) \cdot \frac{\partial K_y}{\partial l_d}\right)$

mit $\alpha = K_y^{-1} y$