

## Spatial Data Analysis

### Lab Exercise 2

Pen & paper problems

2.

$$\begin{aligned} C(h : \theta) &= Cov(\epsilon(s+h), \epsilon(s)) \\ &= Cov(\epsilon_{ME}(s+h) + \epsilon_{NE}(s+h), \epsilon_{ME}(s) + \epsilon_{NE}(s)) \\ &= E[(\epsilon_{ME}(s+h) + \epsilon_{NE}(s+h))(\epsilon_{ME}(s) + \epsilon_{NE}(s))] - E[\epsilon_{ME}(s+h) + \epsilon_{NE}(s+h)] E[\epsilon_{ME}(s) + \epsilon_{NE}(s)] \\ &= E[\epsilon_{ME}(s+h)\epsilon_{ME}(s)] + E[\epsilon_{ME}(s+h)\epsilon_{NE}(s)] + E[\epsilon_{NE}(s+h)\epsilon_{ME}(s)] + E[\epsilon_{NE}(s+h)\epsilon_{NE}(s)] \\ &= E[\epsilon_{ME}(s+h)\epsilon_{ME}(s)] + E[\epsilon_{ME}(s+h)\epsilon_{NE}(s)] + E[\epsilon_{NE}(s+h)\epsilon_{ME}(s)] + E[\epsilon_{NE}(s+h)\epsilon_{NE}(s)] \\ &\quad - E[\epsilon_{ME}(s+h)] E[\epsilon_{ME}(s)] - E[\epsilon_{ME}(s+h)] E[\epsilon_{NE}(s)] - E[\epsilon_{NE}(s+h)] E[\epsilon_{ME}(s)] - E[\epsilon_{NE}(s+h)] E[\epsilon_{NE}(s)] \\ &= Cov(\epsilon_{ME}(s+h)\epsilon_{ME}(s)) + Cov(\epsilon_{NE}(s+h)\epsilon_{NE}(s)) \\ &\quad + E[\epsilon_{ME}(s+h)\epsilon_{NE}(s)] - E[\epsilon_{ME}(s+h)] E[\epsilon_{NE}(s)] + E[\epsilon_{NE}(s+h)\epsilon_{ME}(s)] - E[\epsilon_{NE}(s+h)] E[\epsilon_{ME}(s)] \\ &\text{due to independence} \\ &= Cov(\epsilon_{ME}(s+h)\epsilon_{ME}(s)) + Cov(\epsilon_{NE}(s+h)\epsilon_{NE}(s)) \\ &\quad + E[\epsilon_{ME}(s+h)] E[\epsilon_{NE}(s)] - E[\epsilon_{ME}(s+h)] E[\epsilon_{NE}(s)] + E[\epsilon_{NE}(s+h)] E[\epsilon_{ME}(s)] - E[\epsilon_{NE}(s+h)] E[\epsilon_{ME}(s)] \\ &= Cov(\epsilon_{ME}(s+h)\epsilon_{ME}(s)) + Cov(\epsilon_{NE}(s+h)\epsilon_{NE}(s)) \\ &= C_{ME}(h : \theta) + C_{NE}(h : \theta) \end{aligned}$$