Spatial models

- Set up
- Classifying spatial data
- Modeling areal data
- Modeling point-referenced data
- Spatial interpolation

Set up

Analysis of spatially distributed data is an area that has been heavily used in practical applications, specially over the last decades:

- Ripley (1981) - 252 pages
- Cressie (1993) - 900 pages

The models start by considering a region with sites or pixels

$$\{s_1, \ldots, s_d\}.$$

For each site, a variable of interest y_i is observed with mean $h(\theta_i)$, for some function h

$$E(y_i) = h(\theta_i)$$

Typically, it is assumed that there is an underlying pattern formed by the values of $\theta = (\theta_1, \ldots, \theta_d)'$ associated with the observed scene.

This pattern is corrupted by some random observation mechanism.

The main effort of the inference is to remove this observational noise and recover the underlying, unobserved scene.

Most models commonly assume observational independence conditional on the unobserved image θ, ie.

$$l(\theta) = f(y_1, \ldots, y_d | \theta_1, \ldots, \theta_d) = \prod_i f(y_i | \theta_i)$$

Other effects:

- Explanatory variables - fixed variation;
- Unstructured pixelwise random effects to account for unspecified data heterogeneity.