A CASE STUDY OF BAYESIAN GEOSTATISTICS: BIOCLIMATIC CLASSIFICATION OF THE ISLAND OF CYPRUS

Antoni Barber[1], Xavier Barber[2], Asunción M. Mayoral[2], Javier Morales[2].

[1] IDENTIA Institute-International Center for Cultural and Social Development, Dénia-Alicante, Spain

[2] Applied Statistical Unit, CIO, Universidad Miguel Hernández. Elche-Alicante, Spain. xbarber@umh.es

BACKGROUND

We could consider Bioclimatology (or Phytoclimatology) as important sciences for the comprehension of the close relationship between climate and vegetation distribution, and therefore, the plant landscape. The combination of ombric and thermic parameters are decisive for plant distribution. Ina first step, Thus, bioclimatic ombrotypes have been stated for the Island of Cyprus according to the Rivas-Martínez's Worldwide Bioclimatic Classification System .

The aim of this work is to find a statistical model to define the ombroclimatic zones of Cyprus. A Bayesian model have been stated for the Io (Ombrothermic Index) along the whole island. By knowing the location and altitute a prediction of the Io can be obtained.

Data was summarized in terms of:

We have the climatological (Pluviometry and Temperature) and geographical (Height and Position) information on 58 meteorological stations distributed along the island, we calculated the IO as

IO = (Pp/Tp) ·10 → Pp = Annual Positive Precipitation and Tp = Annual Positive Temperature (Tp).

Using the altitude in 350 points distributed uniformly along the island, we will realize predictions for the IO.

THE MODEL

We consider a Bayesian Hierarchical Spatial Model with parametric vector given by $\boldsymbol{\theta} = (\boldsymbol{\beta}, \sigma^2, \tau^2, \phi)$

$$(I)\quad \mathbf{TrIO} \mid \boldsymbol{\theta}, \mathbf{W} \sim N\left(\mathbf{X}\boldsymbol{\beta} + \mathbf{W},\ \tau^2 \mathbf{I}\right)$$

$$\boldsymbol{\beta} = (\beta_0, \beta_1)^T \ ;\ \mathbf{X} = (\mathbf{1},\ HEIGHT)$$

$$(II)\ \mathbf{W} \sim N_n\left(0, \sigma^2 \mathbf{H}(\phi)\right)$$

$$\left(\mathbf{H}(\phi)\right)_{ij} = \rho(s_i - s_j) = \exp(-\phi d_{ij})$$

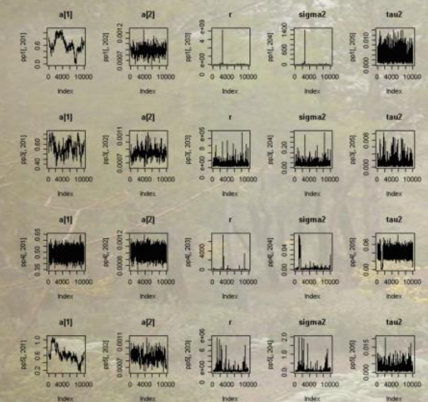
$$(III)\ p(\boldsymbol{\theta}) = p(\boldsymbol{\beta})\, p(\sigma^2)\, p(\tau^2)\, p(\phi)$$

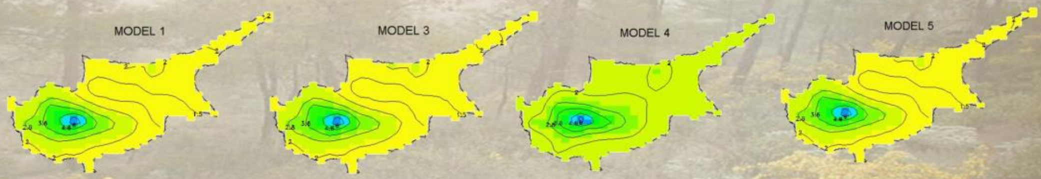
PRIORS CONSIDERED

In all models $p(\beta) \sim N(0,10000)$

	nugget $p(1/\tau^2)$	partial sill $p(1/\sigma^2)$	decay $p(\phi)$ (r = 3/ϕ)
M1	Gamma (0,001, 0,001)	Gamma (0,001, 0,001)	Gamma (0,001, 0,001)
M2	Gamma (0,5, 0,0005)	Gamma (0,5, 0,0005)	Gamma (0,5, 0,0005)
M3	Gamma (2, 0,001)	Gamma (2, 0,001)	Gamma (0,001, 0,001)
M4	Gamma (2, 0,001)	Gamma (2, 0,001)	Gamma (0,5, 0,0005)
M5	Gamma (0,5, 0,0005)	Gamma (0,5, 0,0005)	Gamma (0,001, 0,001)

THE FIT





MEAN (CR 95%)	M1	M2	M3	M4	M5
A_0					
a_1					
τ^2					
σ^2					
Range					