



## Introduction to Rglimclim practical sessions

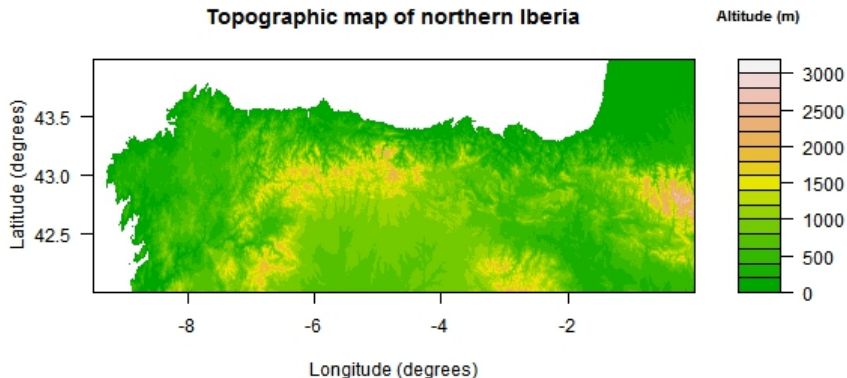
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# The study area: northern Iberia



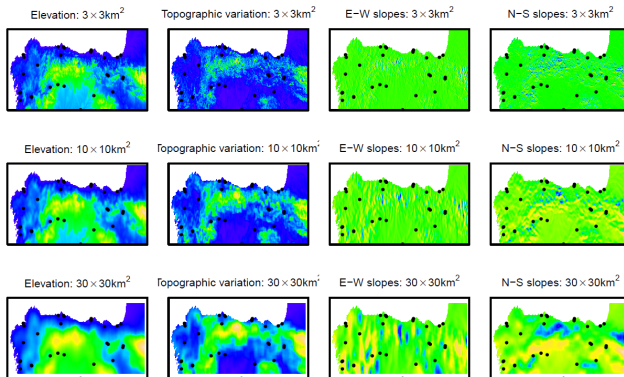
- Study area: 42°N–44°N, 9.5°W–0°W.
- Test region for VALUE validation framework  
(<http://www.value-cost.eu/validationTest>)

- **Daily precipitation & temperature** data, **27 stations** (after discarding #3911), **1960–2002** from EC&A dataset (<http://www.ecad.eu>), 'unblended' product
- **1km<sup>2</sup> topography** from GTOPO30 Digital Elevation Model ([http://webmap.ornl.gov/wcsdown/dataset.jsp?ds\\_id=10003](http://webmap.ornl.gov/wcsdown/dataset.jsp?ds_id=10003)).
- **Daily circulation indices, 1957–2002** (MSLP; 10m *u*, *v*, wind speed; 2m air temperature; 2m dewpoint temperature) from ERA40 ([http://apps.ecmwf.int/datasets/data/era40\\_daily/](http://apps.ecmwf.int/datasets/data/era40_daily/))
  - Averages over **region Z8** from Gutiérrez et al. (Int. J. Climatol., 2013)
- **Daily weather states, 1957–2002** (8-state *GrossWetterType* classification based on MSLP) from EU COST Action 733 (<http://cost733.geo.uni-augsburg.de/cost733wiki>)
  - Derived from ERA40
  - **Region D09 "Iberia / W Med"**

# Topographic indices computed from GTOPO30 data

For  $10\text{km}^2$ ,  $100\text{km}^2$  and  $1000\text{km}^2$  squares:

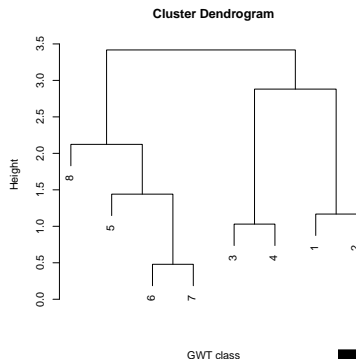
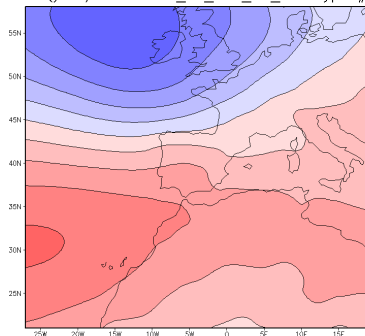
- Mean altitude
- Std dev altitude ('topographic variation')
- E-W slopes
- N-S slopes



# Weather states

- Originally 8 states: 1 N, 2 NE, 3 E etc.
- Three pairs merged using hierarchical clustering
- 5 aggregated states: 1 “N-NE”, 2 “E-SE”, 3 ‘S’, 4 “W-SW”, 5 “NW”

MSLP(year) for GWT09\_YR\_S01\_SP\_D09 type #01



# Building a weather generator

**Aim:** Generate simultaneous daily sequences of precipitation and temperature at any collection of locations in northern Iberia.

## Models:

- $R_{st}, T_{st}$ : precipitation & temperature at site  $s$  on day  $t$ .
- $P(R_{st} > 0) = \pi_{st}; \log\left(\frac{\pi_{st}}{1-\pi_{st}}\right) = \eta_{st}^{(\pi)}$
- $R_{st}|R_{st} > 0 \sim \text{Gamma}; \mathbb{E}(R_{st}|R_{st} > 0) = \mu_{st}^{(R)}; \log \mu_{st}^{(R)} = \eta_{st}^{(\mu^{(R)})}$ 
  - $\text{Var}(R_{st}|R_{st} > 0) = \alpha \mu_{st}^2, \alpha$  constant for all  $s, t$
- $T_{st} \sim N\left(\mu_{st}^{(T)}, \sigma_{st}^2\right); \mu_{st}^{(T)} = \eta_{st}^{(\mu^{(T)})}; \log \sigma_{st}^2 = \eta_{st}^{(\sigma^2)}$
- $\eta_{st}^{(\cdot)}$  is generic linear predictor i.e. linear combination of covariate values

# Task list

- Choose covariates for each model & estimate coefficients
- Specify inter-variable relationships (precipitation-temperature)
- Specify inter-site relationships

## Approach:

**Stage 1 (climatology)** Build multi-site generators for each variable individually but without atmospheric predictors

**Stage 2 (intervariable dependence)** Link precipitation and temperature generators

**Stage 3 (downscaling)** Include atmospheric predictor effects

**Model construction:** use data from 1960–1990

**Validation:** use data from 1991–2002

# Get ready to start

- Need **R** and **RStudio**, with additional packages
  - Instructions in preparatory material
- Download **WeatherGenerators.zip** from <http://www.value-cost.eu/TS3> & unpack to create  
HANDOUTS/  
**PRACTICALS/**  
PREPARATORY/
- Find **practicals handout** (RglimclimPracticals.pdf, in HANDOUTS/) and turn to **page 10**
- **Start RStudio**, change to **PRACTICALS/** directory and open file **ModelBuilding.r**

Additional archive **WGData.zip** contains all original data and code (download later if interested)