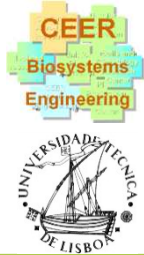


## Mathematics Department

### Statistical modeling and inference of environmental data

CMA - Centro de matemática e aplicações/  
Estatística e análise de risco



## Elsa Moreira (Post-Doc)

- (2008) Ph.D in Mathematics with speciality in Statistics;
- (2004) Master in Statistics;
- (1991) Degree in applied Mathematics (FCT/UNL);
- Participation in 4 research projects in the environment and climate area;
- 12 papers in international peer review journals with an accumulated impact factor of 13.9, 55 citations and 5 papers in conference proceedings.

## Objectives

Research in statistics and stochastic methods, focusing applications in environmental and health sciences, namely:

1- Drought risk evaluation and prediction and their relation with climate change. We try answer questions like: Are droughts occurrence and severity aggravating? There are periods with many severe droughts alternating with other periods almost without droughts? i.e., there is cyclicity in droughts? Etc.

2- Analysis of variance and mixed effects models with random sample sizes and its applications in medical sciences. Ex: The number of patients that arrive to a hospital with different pathologies during a fixed time span can be considered as random, since it can't be known in advance. In the study for comparing those pathologies, a special ANOVA considering that the sample dimensions are random must be used.

## Methodology

- Several techniques time series spectral analysis are being used to identify the existence of cycles (see figures in the right), trends and will also used to perform seasonal forecasts of droughts.

Another approach used in the prediction of droughts will be the Markov chains and loglinear modelling of drought class transitions driven by atmospheric-oceanic regimes and indices (NAO, AO, ENSO) which produce a set of probabilistic and categorical forecasts of drought classes. The climatically driven Markov chains for drought class transitions is a novelty in the domain of stochastic drought modelling.

- To extend the random sample size ANOVA to the mixed effects models, a wider class of models call L-orthogonal extensions will be used.

## Expected Results

Contribute to the assessment and improvement of the predictability of drought indices in Portugal, at scales ranging from a month to a year, in order to address the different types of droughts (hydrologic, meteorological, agricultural). Also, long term drought forecast (e.g. decadal or more) will be addressed. Products consist of climatic data, maps and reports on predictions of probable drought conditions 1 to 3 months ahead and also seasonal. Research results include a Drought Monitor for disseminating updated information on droughts early warning that will be available to the public through the CEER webpage the weather page of the IDL.

Scientific results will be diffused through national and international conferences and papers in peer review journals.

