Assessing the risk of extreme hydrological phenomena

Summary

The Scientific Cooperation Agreement between Portugal and Slovakia aims at promoting collaboration and scientific knowledge interchange among researchers from both countries. For that purpose, relevant issues related to surface water were previously selected and submitted for approval.

In order to be eligible, the transnational cooperation projects must bring together not only senior researchers but especially young researchers, namely PhD students from the two countries involved.

Figure 1. Scientific Cooperation Agreement between Portugal and Slovakia.

Under the Scientific Cooperation Agreement between Portugal and Slovakia, the issues addressed were related to the detection of trends in long hydrological time series, the generation of synthetic flow series for ungauged Slovakian river sections and, especially, the characterization of meteorological droughts all over Slovakia.

In fact, droughts, as natural phenomena, are part of Earth's climate and occur virtually in all climatic zones without neither warning nor recognition of administrative borders or of political and economic differences. To understand their characteristics and consequences and to be able to model and forecast their occurrences are major issues to ensure a successful water resources policy, namely in countries and regions more prone to those extreme hydrological events. These issues become even more important under climatic change perspectives. Indeed, despite the low confidence in observed global-scale trends in droughts, due to lack of direct observations, dependencies of inferred trends on the choice of the definition for drought, and due to geographical inconsistencies in drought trends, their magnitude and frequency are likely to increase as well as for other extreme hydrological events.

In spite of their recurrent nature, droughts are among the most complex and simultaneously the least understood extreme hydrologic events and have been lagging behind the development of flood-related research.

Taking advantage of the knowledge and experience of the Portuguese team related to drought assessment, a comprehensive analysis of the meteorological droughts in Slovakia was done.

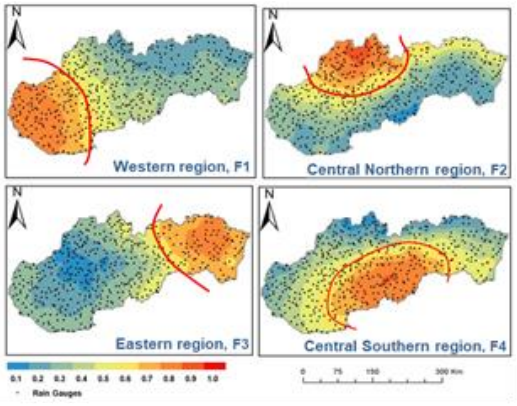

Figure 2. Homogenous regions in Slovakia in what concerns the meteorological droughts.

The analysis began with the definition, based on Principal Components Analysis, of the Slovakian homogenous regions regarding the temporal patterns of the droughts. For each homogenous region, the results obtained included the characterization of the temporal evolution of the area under drought and of the yearly frequency of the drought occurrences, through a new approach, the Kernel occurrence rate estimation method (KORE) coupled with bootstrap confidence band.

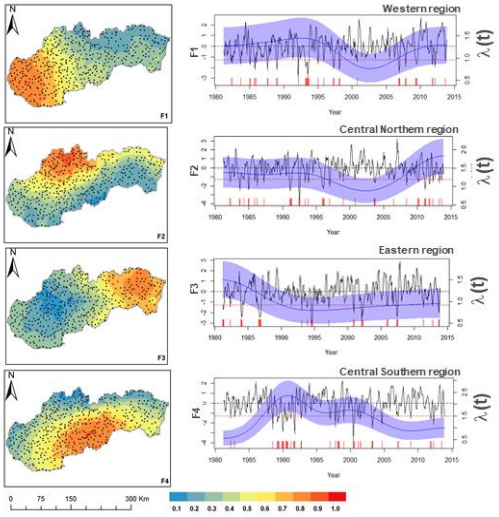

Figure 3. Frequency of the drought events in each homogeneous region.

CERIS : Civil Engineering Research and Innovation for Sustainability

Project Reference

SK-PT-2015-0007

Leading Institution

-

Partners

IST – Instituto Superior Técnico (Portugal), TUKE – Technical University of Kosice (Slovakia)

CERIS Principal Investigator

Maria Manuela Portela (maria.manuela.portela@tecnico.ulisboa.pt)

CERIS Research Team

José Pedro Saldanha Matos, Artur Tiago Silva, Ana Clara Santos

Funding

FCT – Fundação para a Ciência e a Tecnologia (Scientific Cooperation Agreement between Portugal and Slovakia)

Period

2016-2018

Total

-

CERIS

8 000.00€

Project Website

-

Surfaces of precipitation thresholds that can be used to identify droughts at their early stages of development were also developed.

The analysis showed that Slovakia is regularly affected by droughts, the more important ones tending to affect the whole country. However, there is no confirmation that the droughts became more frequent as most of Slovakia experienced more droughts in the past.

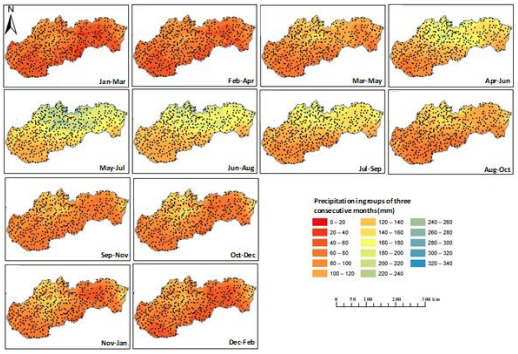

Figure 4. Precipitation in periods of 3 consecutive months corresponding to the severe drought threshold.

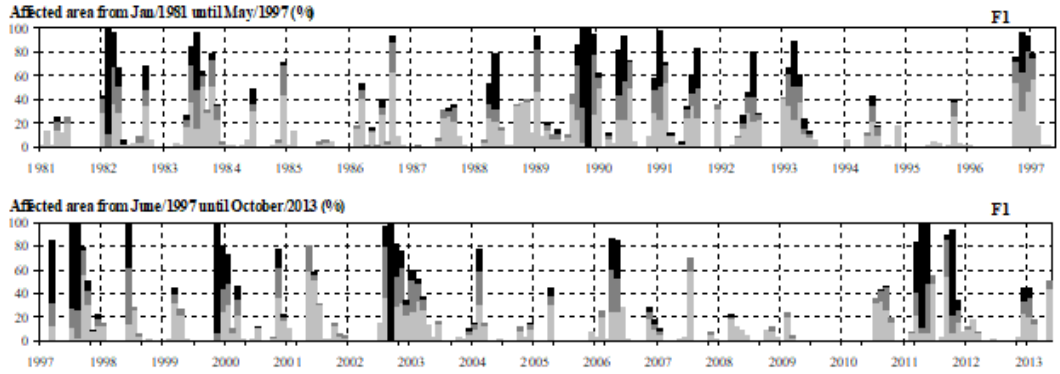

Figure 5. Western region (component F1). January 1981 to October 2013. Percentage of area affected by droughts from moderate drought (light grey) to severe and extreme drought (dark grey).