Title: Variability and Potential Predictability of Natural Hazards over Europe and the Mediterranean: Heat Waves and Droughts (VAPOP-HD)

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Abstract

This project aims at the analysis of physical factors in the climate system responsible for the variability of natural hazards over Europe and the Mediterranean. The focus in this project is laid on the occurrence of heat waves and its combination with severe droughts.

Heat waves and droughts will have an enormous impact on different aspects of society, economy and health leading to severe natural damages and to large insured as well as uninsured losses. For example, the Russian heat wave in 2010 or the major European heat wave in Summer 2003, which was the fifth costly event for the last 30 years in Germany with over all 1,650 Mill US$ losses for the economy (MunichRe, 2012). Additionally, the warm temperature anomalies in June and August 2003 and the accumulated precipitation deficits from the preceding spring to summer were causing approximately 30,000 deaths, including nearly 15,000 in France. Under anthropogenic climate change scenarios, the probability of such severe events is assumed to increase up to the end of this century. An example is the extremely hot summer of 2007 in south-east Europe which was shown probably to be a normal summer by the end of this century. This project aims at the identification and analysis of forcing mechanisms for the genesis of severe heat waves and droughts, which can then be used to understand potential predictability in coupled forecast suites, and diagnose the actual quality of the respective forecasts. This is aimed at on a seasonal to inter-seasonal to even decadal climate predictions time scales.

Project description

The occurrence of severe natural hazards like heat waves will be steered by physical factors in the climate system on different timescales. Thus, the actual occurrence of an event is the consequence of the interaction of different (partly unknown) factors on different timescales.

From a seasonal to inter-seasonal perspective, this project aims at the identification and analysis of forcing mechanisms for the genesis of severe heat waves and droughts, which can then be used to understand potential predictability in coupled forecast suites, and diagnose the actual quality of the respective forecasts. By identifying differences in forecast skill between models, information about the important processes and its representativeness in certain forecast models can be assessed.

On longer time scales, from an end-user perspective, decadal climate predictions would be very important in filling the gap left by seasonal and centennial climate scenarios. Indeed, some studies have shown that decadal fluctuations may potentially be predicted, although with varying levels of skill for different regions or variables. Previous work found significant skill for storm track variability prediction over the Pacific, but not for the Atlantic from a model study. Especially the variability of occurrence and intensity of extreme events would be very important to know, since these have significant impacts on society. However, studies on decadal variability of extremes are rare. The aim of this project is to improve our knowledge about the decadal variability of frequency, intensity or spatial distribution of extreme events and processes shaping these characteristics of extreme events occurrence.

Thus, this project aims at the following objectives:

1. Identification of relevant steering processes for the variability of occurrence of extreme heat waves and droughts on seasonal to decadal timescales
2. Analyzing the actual available seasonal skill (quality) of recent forecasts and available hindcasts
3. Identifying reasons for poor/high seasonal forecast skill in the respective model suites
4. Linking decadal climate variability and its influence on the frequency and intensity of extreme heat waves and droughts to observed and upcoming future developments in anthropogenic climate change

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