EMS Annual Meeting Abstracts
Vol. 10, EMS2013-154-1, 2013
13th EMS / 11th ECAM

High-resolution climate projections for precipitation extremes in Iberia from a multi-model ensemble and its uncertainties

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Precipitation extremes may lead to strong impacts like drought, floods and landslides. Climate change projections have suggested an increase in precipitation extremes in the next decades. The Iberian Peninsula is one of the most vulnerable regions in Europe to precipitation extremes, as it is affected not only by severe droughts, but also by extremely intense rainfall episodes. The present study aims at assessing possible changes in three precipitation extreme indices: R5D (highest consecutive 5-day precipitation total), R95T (fraction of total precipitation in days with precipitation amounts above the 95th percentile of the baseline distribution) and CDD (number of consecutive dry days). These indices are computed over Iberia using gridded daily precipitation (at a spatial resolution of ∼25 km) from a 15-member multi-model RCM ensemble (ENSEMBLES project) for the periods 1961-2000 (historical runs) and 2001-2098 (A1B emission scenario). The analysis is carried out for the full year, winter (DJF), spring (MAM), summer (JJA) and autumn (SON), separately. Trends in the period 1961-2098, as well as changes in medians between either near-future (2021-2050) or distant-future (2068-2098) climates with respect to the baseline climate (1961-1990) are identified. Trends are estimated by the Theil-Sen linear trend and tested by the Mann-Kendall test, while the significance of the changes in medians is tested by the Mann-Whitney test. Model uncertainties are assessed by non-parametric spread measures. The results highlight the overall trend to drier conditions in both total precipitation and R5D, particularly in spring and autumn, with a high agreement between RCMs. The R95T suggests a decrease in the contribution of extreme precipitation to summer (autumn) total amounts in the northern (southern) half of Iberia. Lastly, the CDD patterns reveal an overall increase in the dry period lengths, mainly in summer and for near-future climate. The probability distribution functions for the recent-past and future periods are also analysed for several sub-regions within Iberia. Acknowledgments: This work is supported by European Union Funds (FEDER/COMPETE - Operational Competitiveness Programme) and by national funds (FCT - Portuguese Foundation for Science and Technology) under the projects FCOMP-01-0124-FEDER-022692 and PTDC/AAC-CLI/111733/2009.