CARTs for the investigation of extreme events in relation to circulation and land-climate interactions

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This study introduces Classification And Regression Trees (CARTs) as a new tool to explore the relationships between different climate and extreme event patterns in a multi-model ensemble. Patterns of circulation (represented by average levels and variabilities of sea level pressure, SLP) and land-surface conditions (diagnosed from the surface water balance) from ENSEMBLES simulations over Europe are systematically screened for their relevance to extreme event patterns (summer heat waves and droughts) under present day (ERA40) and future (A1B) climate conditions. A CART analysis of the ERA40 reanalysis complements the results for the present day simulations. Since the analysis yields a rather qualitative output, the model bias problems encountered when studying ensemble averages are alleviated. In many models strong heat waves and droughts concur with low variabilities of SLP and high water balance deficits both in present and future, where the relation with SLP variability is more robust than the one with the water balance. However, for the change patterns (A1B minus ERA40) the analysis indicates that the most robust feature is the link between aggravating heat waves and increasing surface water deficits.