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Potential detectability of an anthropogenic climate change in a surrogate climate

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Anthropogenic climate change has been successfully detected on the global to continental scale for many climatic parameters. However, the detection of a human influence on parameters with high societal impact such as regional scale precipitation has not yet been achieved. A variety of reasons complicate detection and attribution at the regional scale, including the increasing variability with decreasing spatial aggregation, limitations in modelling regional-scale climate and the fact that long and homogeneous time series are rare. We circumvent the latter two complications by using long GCM simulations with historic and possible future forcings as pseudo-observations. Using these we investigate the potential detectability of climatic parameters over subcontinental-scale regions in Europe such as the Mediterranean and the Baltic Sea catchment area. The human influence on wintertime precipitation in the Baltic Sea catchment area for example, can be detected by the end of the 20th century under ideal conditions. However, if we mimic quasi-realistic conditions by estimating the anthropogenic signal from a different model simulation than the one taken as pseudo-observations, detection is delayed considerably. Furthermore, the long and homogeneous pseudo-observations used in this study allow us to investigate the differences in detecting a change against natural variability instead of detecting against internal variability as is presently done in most detection studies.