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Regional climate change detection based on smooth temporal patterns

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Detection is the process of demonstrating that an observed change is significantly different than can be explained by natural internal variability.

We introduce an original method for climate change detection, called Temporal Optimal Detection (TOD) method, consisting in searching for a smooth temporal response pattern to a given forcing in observations. The temporal patterns are first evaluated non-parametrically from coupled general circulation models (CGCMs) outputs using a regularisation technique. Then the presence of the deduced patterns in the observations is inferred via a statistical test, assuming that the internal variability as the same properties as an AR1 process. This method allows to study the spatial distribution of the change, without providing any spatial guess pattern.

We illustrate the method by applying it on two real homogenised temperature dataset covering, respectively, France and the Mediterranean basin. A multimodel detection is performed in both cases, using a large ensemble of CGCMs for estimating the temporal patterns. The ability of the method to provide a successful climate change detection at regional scales is then discussed. We show in particular that the TOD method could be used to highlight a climate change signal over smaller regions than the ones studied in the last IPCC assessment report.