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Climate Change Detection and Attribution: Joint fingerprinting and Bayesian decision

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During the past years, several innovations have been introduced to the optimal finger printing technique currently in use for detecting and attributing observed climate change. We propose the use of regression parameters for the model variables within the Bayesian climate change detection and attribution approach by by Min et al. "A Bayesian decision method for climate change signal analysis." Met. Zet. 13 (2004): 421-436 and an optimization with respect to these regression parameters of the posterior probability. This joins the optimal fingerprinting with the Bayesian decision method. A methodological problem is the estimation of non-singular covariance matrices for the necessary full description of Gaussian probability densities. We propose the use of the GLASSO method based on its success in recent work in verification of ensemble weather prediction. Finally, the posterior decision probabilities for one of the four evaluated scenarios of 20th century climate change (pre industrial cntrl, full forcing, natural forcing, anthropogenic forcing) given the observations can be reformulated into the factual/counterfactual attribution probabilities of necessity PN and sufficiency PS. The first one turns out to be independent of the subjective priors for the individual four scenarios while the second strongly depends on them. The approach will be applied to the 20th century “extreme event” of the global mean temperature change of near surface temperature anomalies.