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A Hierarchical Bayesian Model for Regression-Based Climate-Change Detection and Attribution

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Climate change detection and attribution methodology has evolved substantially within the climate community over the last decades and has started to attract the attention of statisticians. We propose to add to this development by presenting a Bayesian hierarchical statistical model for regression-based climate-change detection and attribution, which accounts for uncertainty in both the climate model and the observational data. The proposed model addresses some of the challenges of current approaches such as high-dimensional covariance estimation and how to optimally choose the truncation of basis function expansions. Another feature of the proposed model is the comprehensive treatment and propagation of uncertainties from all components of the model. We apply the methodology to data from a previously analyzed and published study of tropospheric and stratospheric temperature change, which includes a 400-member ensemble of remotely sensed temperature observations. We discuss common and dissimilar features of the approaches and their influence on the resulting conclusions.