



On the Invalidity of the Ordinary Least Squares Estimate of the Equilibrium and Transient Climate Sensitivities

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The equilibrium and transient climate sensitivities are one of the most important indicators of climate change, which are often estimated from global mean surface temperature, ocean heating rate, and radiative forcing via the ordinary least squares method or its Bayesian alternative. From a statistical point of view, the ordinary least squares method is inappropriate because both the dependent and independent variables possess a trend; the regression error is correlated with the independent variable; and the autocorrelation in the regression error is ignored in the computation of standard errors. To address these issues, the statistical nature of the trend must be specified. With assuming the trend to be stochastic, I employ the dynamic ordinary least squares method and the canonical co-integration regression method. With assuming the trend to be deterministic with a changing slope, I devise and use a simple procedure to correct for bias in the ordinary least squares estimate and obtain standard errors robust to autocorrelation in the regression error. The estimation results suggest that the ordinary least squares method substantially underestimates the equilibrium and transient climate sensitivities and the associated confidence intervals are too narrow. These findings are robust across multiple data sets that are frequently used in the literature.