Response to Referee #2

Paragraph 2:
The reviewer suggests that we explore the shape of the distribution of our temperature data. The best way for us to do this is by drawing histograms using the detrended series, so we will create a supplement for this purpose. However, it is not necessary to establish Normality of all our temperature or residual series since the estimation and testing procedures we apply rely on asymptotic statistical theory, and in particular central limit theorems, which provide asymptotically valid critical values even if the underlying data series are not Gaussian.

The referee asks: "Which type of link is possible to derive between this model and the developing of the data in the sequence? This information is fundamental to understand something about the dynamics governing the investigate system and to intercept critical point (tipping points?) in the sequence." We find the question somewhat unclear, but we assume the referee is asking whether the trend model we employ is consistent with the underlying characteristics of the data itself. This is, indeed, the central question of the literature we are engaging with. As we discuss in the introduction, the IPCC routinely employs a trend model that the climate econometrics literature says is incompatible with the dynamics governing the temperature system, and within the climate econometrics literature there are conflicting claims about what model would be valid. We argue that a trend stationary representation similar to the one used by the IPCC is valid, but it calls into question the validity of the cointegration approach used in econometric-based attribution studies.

The referee points to a few other topics like tipping points and fractal processes. While interesting they are not directly related to our paper or the literature we are discussing so we are not able to review those topics. The types of trend breaks we are modeling may have some relation to bifurcations in dynamical systems but that's well beyond our scope.

Paragraph 3:
We are puzzled why the referee says autocorrelation was not sufficiently investigated. We discuss it in Sections 2.1, 3.2 and 3.3, and we present estimates in Figures 4—6. At every point in the analysis where autocorrelation matters we discuss it and take it into account, especially with regard to lag length selection in the unit root testing procedure. Although we did not report all the autocorrelation coefficients we computed (they number in the hundreds) we assure the referee that our treatment of this topic is exhaustive.