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**The signal and the noise: forced and unforced changes in temperature distributions and the probability of extremes<sup>1</sup>**

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Recent observed trends in climate variables are a combination of a forced climate change signal and unforced internal variability, or noise. In order to gain insight into important climate parameters such as climate sensitivity and make reasonable projections into the future, it is necessary to separate the forced signal from the random sampling of variability. Here, I focus on this goal in the context of the changing shape of daily temperature distributions. Because daily temperature distributions tend to be non-Gaussian, I will first introduce a non-parametric method based on quantile regression which summarizes changes in the shape of seasonal temperature distributions with a small set of basis functions. Next, I will explore the relative roles of circulation and the land surface in controlling the trends in daily temperature distributions in both the observations and the NCAR CESM1 Large Ensemble. In the context of the Large Ensemble, it is then possible to determine which trends – and which physical mechanisms associated with the trends – are the signal, and can reasonably be expected to continue into the future.

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