On Determining the Point of No Return in Climate Change
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Earth’s global mean surface temperature has increased by about 1.0 °C over the period 1880–2015. One of the main causes is thought to be the increase in atmospheric greenhouse gases. If greenhouse gas emissions are not substantially decreased, several studies indicate that there will be a dangerous anthropogenic interference with climate by the end of this century. However, there is no good quantitative measure to determine when it is “too late” to start reducing greenhouse gas emissions in order to avoid such dangerous interference. In this study, we develop a method for determining a so-called “point of no return” for several greenhouse gas emission scenarios. The method is based on a combination of aspects of stochastic viability theory and linear response theory; the latter is used to estimate the probability density function of the global mean surface temperature. The innovative element in this approach is the applicability to high-dimensional climate models as demonstrated by the results obtained with the CMIP5 (IPCC) ensemble.