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Global warming or not? The relative roles of externally forced versus internally generated decadal climate variability

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The last decade has been marked by very little globally averaged warming trend. This has led some to conclude that global warming has stopped for good. However, there have been previous decades when there was little or no global temperature increase set against the background of a longer term warming trend. This raises the issue of the relative roles of internally generated decadal climate variability and externally forced climate system response. The mid-1970s climate shift is given as an example of globally averaged temperatures dramatically rising after a period of little warming. Results show that this shift was part internally generated, related to a transition from a negative to positive phase of the Interdecadal Pacific Oscillation (IPO), and part externally forced by increasing greenhouse gases (GHGs) with a possible contribution from solar forcing. To better understand the recent period of little warming, 21st century simulations with CCSM4 are analyzed to show that during decades of slightly negative global temperature trend, the IPO is in a negative phase, along with reductions of Antarctic Bottom Water (AABW) formation and a weaker Atlantic Meridional Overturning Circulation (AMOC). Thus, during hiatus decades, the excess heat being trapped in the system due to increasing GHGs goes into the deep ocean. Conversely, decades in the model when there is an unusually large positive global temperature trend show the opposite response. This highlights the importance of understanding relative contributions of external forcing and internally generated variability for the decadal climate prediction problem, and examples are given from initialized hindcasts to illustrate this point.