How Do We Learn about Climate Sensitivity?

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One of the difficulties in setting a climatic policy target stems from the uncertainty in climate sensitivity. How the uncertainty in climate sensitivity might change in the future with the acquisition of new observations is an important input to current decision-making on climate policy. To gain insights into this problem, we analyze a historical case – namely, we look into how the best estimate of climate sensitivity and its uncertainty change over the historical period 1900-2000 as derived through an inverse analysis with the Aggregated Carbon Cycle, Atmospheric Chemistry, and Climate model (ACC2). Our results show that how we learn about climate sensitivity is significantly influenced by how we account for the uncertainty in radiative forcing. Furthermore, we show that the evolution of the best estimate of climate sensitivity contains periods of negative learning, regardless of how radiative forcing uncertainty is represented, unless decadal and multi-decadal variability in the temperature records is accounted for in the learning algorithm. Better prediction skills of the decadal and multi-decadal variability in temperature would allow faster learning on climate sensitivity in the future.