Predicting future uncertainty constraints on global warming projections

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Projections of global mean temperature changes (d*T*) in the future are associated with intrinsic uncertainties. Much climate policy discourse has been guided by “current knowledge” of the d*T*s uncertainty, ignoring the likely future reductions of the uncertainty, because a mechanism for predicting these reductions is lacking. By using simulations of Global Climate Models from the Coupled Model Intercomparison Project Phase 5 ensemble as pseudo past and future observations, we estimate how fast and in what way the uncertainties of d*T* can decline when the current observation network of surface air temperature is maintained. At least in the world of pseudo observations under the Representative Concentration Pathways (RCPs), we can drastically reduce more than 50% of the d*T*s uncertainty in the 2040s by 2029, and more than 60% of the d*T*s uncertainty in the 2090s by 2049. Under the highest forcing scenario of RCPs, we can predict the true timing of passing the 2°C (3°C) warming threshold 20 (30) years in advance with errors less than 10 years. These results demonstrate potential for sequential decision-making strategies to take advantage of future progress in understanding of anthropogenic climate change.

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