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The Stability of the Arctic Sea Ice Cover

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The retreat of Arctic sea ice is one of the most dramatic signals of recent climate change in the observational record. It involves an amplifying factor associated with changes in the surface albedo (i.e., reflectiveness) called the ice-albedo feedback. If the ice-albedo feedback becomes dominant in the Arctic as the climate warms, a runaway feedback process or "tipping point" could occur in which the Arctic irreversibly transitions to an ice-free state. Such a transition occurs at a bifurcation point and is characterized by the presence of unstable climate states. Many studies have identified such instabilities in a range of idealized climate models during the past half century. However, evidence for these instabilities has been notably absent in simulations with the more complex global climate models (GCMs) that are currently used to project future climate change in response to increased greenhouse forcing. In this talk, I will propose a physical explanation for this discrepancy, drawing on a model that we developed to bridge the gap between the idealized models and the GCMs. The results help constrain whether such instabilities should be expected in nature.