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Reconciling conflicting evidence for the cause of the observed early 21st century Eurasian Cooling

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Arctic amplification of global warming is accompanied by a dramatic decline in sea ice. This, in turn, has been linked to cooling over the Eurasian subcontinent over recent decades, most dramatically during the period 1998-2012. Such a coherent and pronounced cooling is a counterintuitive impact under global warming. Some studies have proposed a causal teleconnection from Arctic sea ice retreat to Eurasian wintertime cooling; others argue that Eurasian cooling is mainly driven by internal variability. Overall, there is an impression of strong disagreement between those holding the “ice-driven” versus “internal variability” viewpoints. We offer an alternative framing that shows that the sea ice and internal variability views can be compatible. Key to this is viewing Eurasian cooling through the dual lens of dynamics (linked primarily to internal variability with a small contribution from sea ice; cools Eurasia) and thermodynamics (linked to sea ice retreat; warms Eurasia). This framing, combined with recognition that there is uncertainty in the hypothesized mechanisms themselves, allows both viewpoints (and others) to co-exist and contribute to our understanding of Eurasian cooling. A simple autoregressive model shows that strong Eurasian cooling is consistent with internal variability, with some periods being more susceptible to strong cooling than others. Rather than posit a “yes-or-no” causal relationship between sea ice and Eurasian cooling, a more constructive way forward is to consider whether the cooling trend was more likely given the observed sea ice loss, as well as other sources of low-frequency variability. Taken in this way both sea ice and internal variability are factors that affect the likelihood of strong regional cooling in the presence of ongoing global warming. Improving our understanding of the underlying mechanisms is critical for quantifying regional responses and impacts as well as producing reliable near-term climate predictions.