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What are the main sources for the spread of climate model warming projection?

Abstract

Climate models forced by increasing greenhouse gas concentrations unanimously project a long-term warming of Earth's surface. The magnitude of this warming diverges substantially between models, which is termed as the inter-model warming projection spread (WPS). Cloud feedback has been postulated as the main cause of the large inter-model WPS. We examine the global warming projection under the RCP8.5 scenario reported in the Intergovernmental Panel on Climate Change (IPCC) fifth assessment report. We find that the inter-model spreads of surface albedo and water vapor feedbacks are the key contributors to the inter-model WPS. Surface turbulent sensible and latent heat flux feedbacks cancel out part of the inter-model spreads surface albedo and water vapor feedbacks, and therefore act to suppress the inter-model WPS. Despite of its large amplitude, the inter-model spread of cloud feedbacks exhibit little correlation with the inter-model WPS. Because different models exhibit different combinations of cancellations between cloud feedbacks and other feedback processes, the impact of the inter-model spread of cloud feedbacks does not play a major role in causing the inter-model WPS.

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