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Understanding global climate feedbacks: how do they vary with timescale?

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The strength of large scale atmospheric feedbacks (in particular those due to water vapour, clouds, lapse rate and surface albedo) determine the climate 'sensitivity' - the magnitude of the global response to greenhouse gas forcing. Quantifying, understanding and evaluating climate change feedbacks remain critical tasks for quantifying projection uncertainty, assessing confidence in models and narrowing the range of future projections. A particular difficulty with secular climate change feedbacks is the timescale under which they operate: decades to centuries, making them extremely difficult to evaluate and validate against observations. Complicating the picture further that some aspects of 'feedback' appear to be simply extremely rapid adjustments to applied (say CO2) forcing, while others respond to temperature changes - true feedbacks. Furthermore, temperature changes themselves occur on many timescales, from seasonal to decadal, each producing a 'feedback' response. How do 'feedbacks' across these timescales differ and how do they compare with secular timescale feedbacks? This study addresses these two related issues by considering how feedback strength and structure vary with timescale in models. Implications for both the understanding and evaluation of climate change feedbacks from shorter timescale variability and response will be discussed.