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VOCALS/Southeast Pacific science: Southeast Pacific stratocumulus in two versions of the Community Atmosphere Model

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The Community Atmosphere Model is the atmospheric component of the Community Earth System Model, the global climate model maintained by the National Center for Atmospheric Research. There are two current versions of the CAM (versions 4 and 5), which profoundly differ in their parameterized physics. Both versions have biases in subtropical clouds, which are primarily low-level clouds that are infamously difficult to capture in large-scale models. Using a short-term forecast framework, we investigate a conspicuous aspect of these clouds: subtropical stratocumulus. October 2006 in the southeast Pacific is chosen for this study, corresponding to the annual peak in stratocumulus extent of the largest subtropical cloud deck and also with a previous comparison of models (PreVOCA). Forecasts begin from a realistic state supplied by numerical weather prediction analyses, giving the models a fair chance to foster realistic clouds. The large-scale circulation slowly evolves over the course of the 5-day forecasts, but the clouds quickly transition toward models' long-term biases. Comparing with observations and conceptual expectations of these clouds, we evaluate the stratocumulus of these models. The CAM5 shows substantial improvements over CAM4, but both models show biases that may impact long-term climate simulations and projections.