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Common model biases reduce CMIP5's ability to simulate the recent Pacific La Niña-like cooling

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Over the recent three decades sea surface temperate (SST) in the eastern equatorial Pacific has decreased, which helps reduce the rate of global warming. However, most CMIP5 model simulations with historical radiative forcing do not reproduce this Pacific La Niña-like cooling. Based on the assumption of "perfect" models, previous studies have suggested that errors in simulated internal climate variations and/or external radiative forcing may cause the discrepancy between the multi-model simulations and the observation. But the exact causes remain unclear. Recent studies have suggested that observed SST warming in the other two ocean basins in past decades and the thermostat mechanism in the Pacific in response to increased radiative forcing may also play an important role in driving this La Niña-like cooling. Here, we investigate an alternative hypothesis that common biases of current state-of-theart climate models may deteriorate the models' ability and can also contribute to this multi-model simulations-observation discrepancy. Our results suggest that underestimated inter-basin warming contrast across the three tropical oceans, overestimated surface net heat flux and underestimated local SST-cloud negative feedback in the equatorial Pacific may favor an El Niño-like warming bias in the models. Effects of the three common model biases do not cancel one another and jointly explain $\sim$50% of the total variance of the discrepancies between the observation and individual models' ensemble mean simulations of the Pacific SST trend. Further efforts on reducing common model biases could help improve simulations of the externally forced climate trends and the multi-decadal climate fluctuations.