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A Linear Inverse Model (LIM) of the tropical Indo-Pacific climate system is used to suggest that a spuriously weak negative surface shortwave flux feedback on SSTs (the so-called cloud shielding effect) is likely behind the tendency of climate models to extend ENSO-related SST anomalies too far west into the western Pacific. This compromises seasonal and longer-term predictions around the globe through spurious teleconnections. A weak negative SW flux feedback over the maritime continent is also consistent with the rapidly developing mean cold tongue and easterly trade wind biases of many climate models over the western Pacific.
Our LIM is derived from observational atmospheric and oceanic reanalysis data for 1979-2018. It captures the essential features of ENSO and the MJO very well. Its predictable dynamics are clarified through systematic feedback denial experiments. Denying the negative SW feedback increases ENSO strength and extends it too far west. The strength of this negative feedback depends on the sensitivity of deep atmospheric convection and cloudiness to SST forcing, which is importantly influenced by the rectified effect (a “noise-induced drift”) of unresolved atmospheric diabatic processes. This rectified effect is implicitly included in our LIM, but is likely not well-represented in climate models. Increasing climate model resolution is therefore a possible, albeit expensive, approach to reducing model biases in this area as suggested by Williams et al. (QJRMS 2024). An alternative and much less expensive approach is to improve
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