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Impacts of convection schemes on simulating tropical-temperate troughs over southern Africa

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Abstract

This study examines southern African summer rainfall and tropical temperate troughs (TTTs) simulated with three versions of an atmospheric general circulation model differing only in the convection scheme. All three versions provide realistic simulations of key aspects of the summer (November–February) rainfall, such as the spatial distribution of total rainfall and the percentage of rainfall associated with TTTs. However, one version has a large bias in the onset of the rainy season. Results from selforganizing map (SOM) analysis on simulated daily precipitation data reveals that this is because the occurrence of TTTs is underestimated in November. This model bias is not related to westerly wind shear that provides favourable conditions for the development of TTTs. Rather, it is related to excessive upper level convergence and associated subsidence over southern Africa. Furthermore, the model versions are shown to be successful in capturing the observed drier (wetter) conditions over the southern African region during El Nin˜o (La Nin˜a) years. The SOM analysis reveals that nodes associated with TTTs in the southern (northern) part of the domain are observed less (more) often during El Nin˜o years, while nodes associated with TTTs occur more frequently during La Nin˜a years.