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On a mechanism of the Indian Ocean subtropical dipole mode simulated in the CMIP3 models

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Southern African rainfall with its maximum during austral summer (December-February) is influenced by the Indian Ocean subtropical dipole mode (IOSD) events in the southern Indian Ocean. Because this region is very vulnerable to abnormal weathers, an accurate prediction is needed for the socio-economic benefit there. However, a few studies have adopted coupled general circulation models (CGCMs) to study the IOSD together with its influence. Toward an accurate prediction of the IOSD and its associated impact, the ability of CGCMs to simulate the IOSD is investigated using observation data and outputs from the 'twentieth-century climate in coupled models' (20c3m) control runs of CGCMs submitted to the Coupled Model Intercomparison Project, phase 3 (CMIP3). Also, causes of the model biases as well as the generation mechanism are examined.

Many models simulate the IOSD, but the location and shape of the sea surface temperature (SST) anomaly vary among models. This model bias is closely linked to the bias in simulating the anomalous strengthening and southward shift of the subtropical high. Regarding its generation mechanism, it is shown for the first time using CGCMs that the anomalously thin (thick) mixed layer associated with the anomalous subtropical high enhances (suppresses) warming by climatological shortwave radiation and leads to positive (negative) SST anomaly.

Keywords: Indian Ocean subtropical dipole, CMIP3 models, subtropical high, mixed-layer thickness