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Indonesian Throughflow variability in CMIP5 models

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The Indonesian Throughflow (ITF) is an integral component of the Earth's climate. The state of ocean and atmospheric circulations, and thus climate variability, is dependent upon changes in the ITF which impact on heat and salt balance across the Indo-Pacific oceans. Understanding its variability and link with major drivers of Indo-Pacific climate variability however remains elusive due to limited direct observational data. A multi-model ensemble approach is needed to help bridge this gap. Using 20 models that participated in the Coupled Model Intercomparison Project fifth instalment (CMIP5), and an ocean reanalysis as a reference, we find that local processes in the Indian Ocean side play a more dominant role on ITF variability than the El Nino Southern Oscillation (ENSO). This is corroborated by the high inter-model correlation between the variability amplitude of the ITF and that of the zonal winds south of the Maritime Continent, but not with ENSO amplitude. The Indian Ocean forcing is associated with surface-intensified transport anomaly, while the ENSO forcing primarily with anomalous subsurface transport. These links are substantiated by the mean state change under greenhouse warming in that the projected weakening of the ITF is found robust only at subsurface, consistent with the lack of inter-model consensus in the change of the Indian Ocean local wind forcing.