Geophysical Research Abstracts
Vol. 19, EGU2017-4900-1, 2017
EGU General Assembly 2017

Indian Ocean sources of Agulhas leakage

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We examine the mean pathways, transit timescales, and transformation of waters flowing from the Pacific and the marginal seas through the Indian Ocean (IO) on their way toward the South Atlantic within a high-resolution ocean/sea-ice model. The model fields are analysed from a Lagrangian perspective where water volumes are tracked as they enter the IO. The IO contributes 12.6 Sv to Agulhas leakage, which within the model is 14.1 $\pm$ 2.2 Sv, the rest originates from the South Atlantic. The Indonesian Through-flow constitutes about half of the IO contribution, is surface bound, cools and salinificates as it leaves the basin within 1–3 decades. Waters entering the IO south of Australia are at intermediate depths and maintain their temperature-salinity properties as they exit the basin within 1.5–3.5 decades. Of these waters, the contribution from Tasman leakage is 1.4 Sv. The rest stem from recirculation of Subantarctic Mode Water formed within the IO. The marginal seas export 1.0 Sv into the Atlantic within 1.5–4 decades, and the waters cool and freshen on-route. However, the model's simulation of waters from the Gulfs of Aden and Oman are too light and hence overly susceptible to upper ocean circulations. In the Cape Basin, Agulhas leakage is well mixed. On-route, temperature-salinity transformations occur predominantly in the Arabian Sea and within the greater Agulhas Current region. Overall, the IO communicates at least 7.9 Sv from the Pacific to the Atlantic, thereby quantifying the strength of the upper cell of the global conveyor belt.