

On the role of the Agulhas System in ocean circulation and climate

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The Agulhas Current and its leakage of warm, saline waters between the Indian and Atlantic Oceans forms an important component of the global thermohaline circulation. Over the past decade, evidence from observational, palaeoceanographic, and modelling studies has built up to suggest that the Agulhas System may be a trigger or feedback mechanism for past and present climate change. Proxy records from marine sediment cores show that Agulhas Leakage peaked during glacial terminations, suggesting leakage may have played an important role in the rapid transition from glacial to interglacial climates, presumably through its affect on the Atlantic Meridional Overturning Circulation (AMOC). Presently, a warming trend in the Agulhas System, accompanied by an increase in eddy kinetic energy indicative of more Agulhas Rings, points to increased leakage since the 1980's. Hindcast simulations which resolve the mesoscale features of the Agulhas System suggest an increase in Leakage of order 1 Sv per decade over this period, potentially leading to a significant strengthening of the AMOC. This is a profound finding, since it represents a plausible mechanism to stabilise the AMOC at a time when IPCC models which do not resolve Agulhas Leakage, predict a weakening. To date, there are large uncertainties in our understanding of the variability of the Agulhas System and its interplay with AMOC, Southern Hemisphere winds, and climate. We propose that sustained observations, high-resolution palaeoceanographic data, and climate process studies with high-resolution in the Agulhas region, are badly needed.