Agulhas rings—the backbone of the MOC

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During the present climate, the injection of salt into the South Atlantic via Agulhas rings is five times as much as that of the Mediterranean Outflow. The rings are, therefore, at least partly, responsible for the Atlantic relatively high salinity. Recent proxies analysis reveals that the injection of salty Agulhas rings into the South Atlantic during the Younger Dryas (when the MOC was not operational) was dramatically reduced compared to today's injection levels. The increase to today's levels occurred toward the end of the Younger Dryas and it has been suggested that the associated increase in salt influx to the Atlantic re-started the then-collapsed MOC.

We suggest that the injection variability is due to the slanting of the South African coastline relative to the east. This slanting varies widely with latitude—it is almost zero near the southernmost edge of the continent and nearly 90 at lower latitudes off Madagascar. When the reftroflection occurs above a critical coastline slant, there is no injection whereas below that angle, there is vigorous injection. This is because, in order for vigorous injection to occur, the already formed rings must be removed from the generation area quickly enough to make room for the newly-born rings waiting behind in the queue. Our suggestion is that the reftroflection occurred at a subcritical slant (low latitude) during glaciation and at a supercritical slant (high latitude) during interglacials. The specific retroflection latitude depends on the latitude where the wind stress curl vanishes and there are indications that, during glaciation, the curl vanished about 20 (or more) farther to the north than it does today.