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The Agulhas Current system; a beloved, lifelong mistress (Fridtjof Nansen Medal Lecture)

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The Agulhas Current is in many respect a typical western boundary current, but in many other respects it has characteristics that are unique and that are not shared by any other western boundary current. In this Fridtjof Nansen Medal Lecture I trace the development of our understanding of these characteristics of the greater Agulhas Current system over the past 40 years and point out key elements that require urgent research attention if we are properly to understanding and the system and its role in the global ocean circulation.

The major discovery during this period has been the retroflection of the Agulhas Current at its south-western termination and the shedding of rings as the retroflection loop is occluded. These rings drift into the South Atlantic where most of them decay near their point of origin. This ring-shedding process has been shown to be the main mechanism by which the global thermohaline conveyer belt is continued south of Africa. Having negotiated the Agulhas retroflection, the remaining water of the Agulhas Current is carried eastwards in the Agulhas Return Current. It has now been shown that this turbulent current is totally eroded by about 70ž E. The trajectory of the Agulhas Current proper is by comparison exceedingly stable. It undergoes only an intermittent, singular meander, the Natal Pulse. This unusual feature has been shown to play an important role in the shedding of Agulhas rings, far downstream. The triggering of the Natal Pulse may come about by disturbances emanating from the source regions of the Agulhas Current itself.

One of these source regions has been thought to be a Mozambique Current, but recent dedicated research cruises have shown that such a current does not exist, but instead there is a train of southward moving eddies in the Mozambique Channel. These eddies

may in time trigger Natal Pulses. Another source of the Agulhas Current was thought to be the southern limb of the East Madagascar Current. Over the last 40 years it has been shown that this current does not directly continue towards the Agulhas Current but retroflects. It may also be the source of eddies that eventually trigger Natal Pulses and subsequently Agulhas rings.

In conclusion it is seen that the greater Agulhas Current system is a complex, interactive system with global implications. A large number of crucial processes and interactions in the system are not yet understood and will form the basis for exciting new research ventures in the years to come.