

Johann R.E. Lutjeharms

The Agulhas Current

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with 187 figures, 8 in colour

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In memory of

Günther Dietrich

1911–1972

the first true oceanographer of the Agulhas Current system.

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Preface

In 1977 Paul Tchernia, the world-renowned French physical oceanographer, wrote a now well-known textbook on global descriptive oceanography¹ based on the lecture series that he had taught for ten years to students of the University of Paris VI. It dealt with all major ocean basins, their general circulation, hydrographic structure, water masses, the origin and formation of such water masses, etc. In its treatment of the anticyclonic circulation of the North Atlantic Ocean, this comprehensive treatise includes seven pages of discussion on the western boundary current of that basin, the Gulf Stream. The analogous current of the South Indian Ocean, the Agulhas Current, as well as its sources, are by contrast dealt with in but two, brief paragraphs.

The reason for this gross disparity is immediately apparent if a comparison is made between what was known about these two – otherwise comparable – currents at the time. Knowledge on the Agulhas Current, as measured by the number of research articles that had been published in the scientific literature, was in fact totally inadequate for more than the rather cursory discussion in the Tchernia text (viz. Figure 1). Even including early papers dealing with the currents of the South Indian Ocean *in toto*, papers on abyssal currents as well as atlases, not more than about 80 publications on the greater Agulhas Current system existed by the late 1970s.

This situation has, for a number of reasons, changed dramatically since then (Figure 1). Since the early 1980s about 13 papers, on average, have been published annually on the physics and chemistry of the Agulhas Current. These contributions have covered a wider range of disciplines

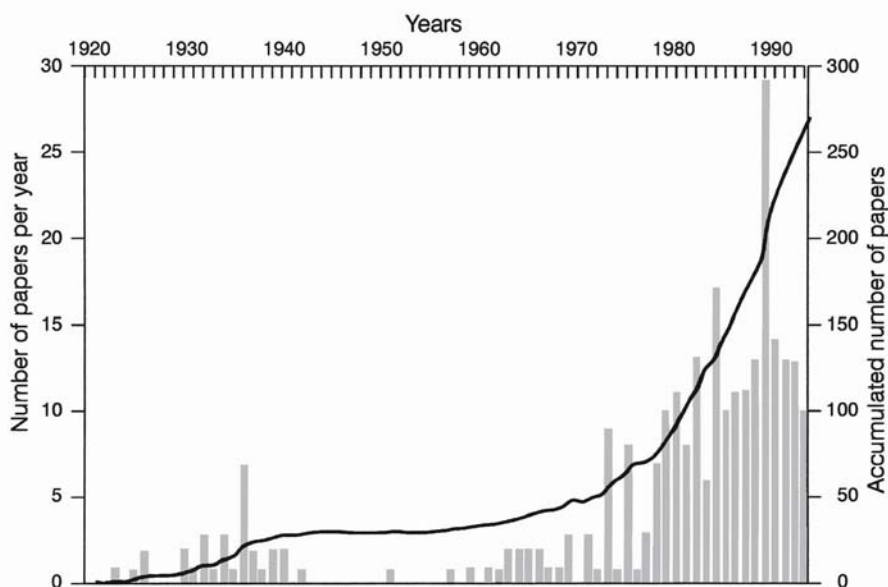


Figure 1. The number of research papers that have appeared per year with, as subject, the Agulhas Current or closely related topics (left ordinate). The continuous curve gives the accumulated total for these papers from 1920 onwards (right ordinate). These numbers are based on a number of bibliographies on the subject²⁻⁵. Note the peak in the publication rate in the 1930s; a secondary, but smaller peak in the 1960s due to the International Indian Ocean Expedition; and a noteworthy and persistent growth starting in the 1970s.

than ever before and have come from a large number of countries, including South Africa, the United States, Germany, the Netherlands, Britain, France, the Soviet Union, Mozambique and Portugal. Major advances have thus been made in the understanding of the hydrography, the kinematics, the dynamics and the chemistry of the current whilst numerical modelling of the broader current system has developed rapidly and is showing increasing promise.

This enormous increase in knowledge of the Agulhas Current system is quite unparalleled when compared to the contemporaneous growth in knowledge about analogous currents such as the Gulf Stream in the North Atlantic and the Kuroshio in the North Pacific Ocean. However, the annual number of publications concerning the western boundary currents of the northern hemisphere still exceeds by far those on the currents of the southern hemisphere. An analysis, for instance, of all publications that are represented in the *Aquatic Sciences and Fisheries Abstracts* and that include the names of these currents in their abstracts, shows that during the period 1988 to 1993, for example, 1074 papers had appeared on the Gulf Stream, 965 on the Kuroshio, 141 on the Agulhas Current, 71 on the Brazil Current and 69 on the East Australia Current. Those on the Agulhas Current were, however, from the lowest base by far. This implies that the actual growth in understanding of this current over the past two decades has probably exceeded any comparable growth in knowledge on the other currents.

This spurt in new information has led to a number of eminent oceanographers proposing that the time was ripe for a comprehensive, descriptive treatise on the greater Agulhas Current system. Such a monograph, it was suggested, should bring together and synthesise what has been learnt; particularly over these past few decades. More than this, it should be a user-friendly key to unlocking the wealth of information scattered throughout the primary literature. These are the aims of this book.

Acknowledgements

Anyone foolish enough to attempt to write a book soon recognises that no book is the product of the toil of but one individual. Even more so in the case of a wide-ranging review – as this monograph attempts to be – that is by definition the outcome of the efforts of a very large number of people. It is therefore incumbent on me to thank a veritable host of colleagues on whose work this compendium rests. Their names appear as authors to papers in the Reference List and in the Bibliography. A considerable number of them have become personal friends whom I owe an enormous debt of gratitude for many valuable and instructive conversations on the Agulhas Current system that have helped form my thinking. They may in consequence discover many ideas in these pages that originally were theirs and that I may have subconsciously absorbed and made my own. I therefore wish to apologise for any instances where proper acknowledgement may inadvertently be lacking.

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No academic goes on extended sabbatical leave, however well planned and prepared, without his closest colleagues having to carry a larger burden. I therefore wish to thank all in the Department of Oceanography at the University of Cape Town who have shouldered some of my tasks in my absence, in particular Professors Geoff Brundrit, Frank Shillington, Chris Reason, Dr John Largier, Mrs Lesley Staegemann, Mrs Helen King, Drs Mathieu Rouault and Isabelle Ansoerge and all members of the Ocean Climatology Research Group who made my absences possible and lightened the load.

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