



Fig. 5. Comparison of the seasonal mean spatial structures of sea-surface temperature (°C) from the model and the PATHFINDER satellite SST database.

is observed during this 10-year simulation, with the generation of Agulhas rings, and the shedding of cyclonic eddies starting from the southern tip of the Agulhas Bank, Cape Peninsula and Cape Columbine. Off the west coast, the upwelling front shows an important variability, developing a series of meanders, plumes and filaments in a realistic manner.

We have analysed the average behaviour of the model solution, of its variability as well as a comparison of the outputs of the high-resolution model and either those of the low-resolution scheme or with observed data.<sup>10</sup> A generally reasonable agreement was found between the simulated and observed circulation structures, both at the surface and at deeper levels. In the southern part of the model domain a comparison with surface and subsurface data shows that the model reproduces cyclonic eddies in the lee of the Agulhas Bank in good agreement with observed features, in particular regarding vertical and horizontal scales.<sup>11</sup>

Although the model is forced by a repeated climatology (no inter-annual variability in the forcing fields), there are pronounced differences in the simulation outputs between individual years (for example, the thermal structure and the current fields of year 4 are significantly different from those of year 3 at the same time of year). Intrinsic mesoscale activity is the main contribution to this inter-annual variability,<sup>10</sup> and results from oceanic instability processes in the absence of added forced variability by synoptic and inter-annual atmospheric fluctuations. This is in agreement with previous studies of the dynamics of the California Current upwelling ecosystem.<sup>5,12</sup> However, when using our model to provide inputs to biological models, one should keep in mind that the response of the thermal structure and of the current fields to inter-annual atmospheric fluctuations has not yet been resolved by our simulations. How the inter-year variability observed in the model outputs compares with that resulting from contrasted atmospheric forcing (such as

a relaxed or intensified southeasterly wind regime) or remote oceanic forcing (such as Rossby or Kelvin waves generated outside the model domain) is still an open question.

The main discrepancy between the model outputs and observed data appears off the west coast region during summer, when simulated SSTs are significantly lower than those observed from satellites, whereas in winter there is better agreement (Fig. 5). By using wind data from a monthly climatology, the high-frequency variability (from days to weeks) of the wind is smoothed out. This results in a continuous and persistent upwelling-favourable wind forcing during the whole summer season. The pulsing pattern of the southeasterly wind is a well-known characteristic of the local wind in summer, however, resulting in the alternation of reduced and enhanced upwelling off the west coast. These variations in wind forcing could induce reversals in the alongshore currents<sup>13</sup> and warming close to the shore. The low spatial resolution (1° square) of the climatological wind fields does not resolve the medium-scale spatial structure of the wind. As a result, the onshore-offshore gradient of the wind in the coastal domain is not adequately represented. Both the low temporal and spatial resolution of the climatological wind used to drive the model contribute to enhancing the upwelling-favourable wind forcing along the coast and intensify the injection of cold water over the continental shelf in our simulations.

## Conclusion

Analysis of the 10-year run of the high-resolution configuration is currently being extended by focusing on the structure and variability of the west coast upwelling and on shear edge features along the Agulhas Bank that have been observed both in the simulations and in satellite data. New experiments are being conducted to investigate the response of the Cape Peninsula jet and of the west coast upwelling to high-frequency wind forcing as well as to an abrupt relaxation of the upwelling-favourable wind. This latter experiment is aimed at simulating the relaxation of the wind observed in December 1999 and at investigating its impact on the success of anchovy eggs and larvae transport to the west coast nursery grounds.<sup>14</sup>

The implementation of a 3-D hydrodynamic model in the southern Benguela using the ROMS numerical code has made available an advanced tool for efficiently and robustly simulating the circulation at high spatial resolution in the coastal domain. Coupling the hydrodynamic model to biological models is being done using two complementary approaches: a nutrient-phytoplankton-zooplankton model to simulate plankton production, and an individual-based model to investigate the fate of eggs and larvae within a 3-D advective environment.<sup>15</sup>

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## Update on AIDS: the scale of things to come

The Medical Research Council has released its latest survey on the extent of HIV/AIDS on mortality in South Africa.<sup>1</sup> The main findings are that the pattern of deaths from natural causes has shifted from the old to the young over the past decade, particularly for young women; men and women display different mortality patterns; these patterns can be described by various epidemiological models; it is believed that the future burden of the epidemic, in its different manifestations, is now broadly predictable from these models over the next decade; the anticipated patterns of mortality and prevalence will afford the practical benefit of optimum selective intervention strategies in different parts of the country.

The president of the MRC, Malegapuru Makgoba, writes that 'This report is a chilling reminder of how powerful stereotypes across society have colluded in creating the most explosive epidemic in the history of our country. Comprehensive, powerful and rigorous as these data are, they can be seized upon positively by individuals, government and society to intervene at many levels....'

The main source of information about the epidemic is the HIV seroprevalence surveys conducted by the Department of Health at antenatal clinics. The most recent official death statistics available are those only for 1996, however. The figures show that there has been a steady increase in adult mortality during the 1990s. The mortality of adult women has increased especially rapidly in the past few years; the death rate in the 25–29-year age range in 1999/2000 was approximately 3.5 times higher than in 1985.

It is estimated that in the year 2000, AIDS accounted for about 25% of all deaths in South Africa and has become the single biggest cause of death. Without effective preventative treatment, projections show that AIDS deaths can be expected to grow, within the next 10 years, to more than double the number of deaths due to other causes, resulting in perhaps as many as 7 million cumulative AIDS deaths in South Africa by 2010.

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The author for correspondence on the survey findings and analysis is D. Bradshaw, Burden of Disease Research Unit, Medical Research Council, P.O. Box 19070, 7505 Tygerberg.