5. IPCC reporting (Key collaborators, Elwandle, SANBI, UCT and other national marine experts)

Wayne and Juliet were part of a team, contracted by the IPCC through SANBI, to write the marine country report for South Africa's second national communication on climate change. A complete document was written by the team, under the leadership of Dr Angus Paterson and a summary was then produced for SANBI. Juliet is currently working with Dr Paterson and Dr Nikki James on editing the more detailed document.

5.1. Report on sea level rise around South Africa

With the help of SA experts on sea-level rise, Wayne wrote the section on sea-level rise that consisted of trends, impacts and adaptation for South Africa. A summary of the report is as follows:

Mather et al. (2009) reported that sea-level is rising around the South African coast in agreement with current global trends, but there are regional differences. The west coast is rising by +1.87 mm.yr-1, the south coast by +1.47 mm.yr-1 and the east coast by +2.74 mm.yr-1. The eustatic level rise is found to be lower along the west coast (+0.42 mm.yr-1) but higher along the south (+1.57 mm.yr-1) and (+3.55 mm.yr-1) east coasts. These differences were attributed to regional differences in vertical crust movements and large scale oceanographic processes off the east and west coasts (including Agulhas and Benguela Currents).

With a rise in sea-level and possible increase in the frequency and intensity of sea storms, the South African coastline is expected to experience (Hughes et al. 1991): increased exposure to more intense and more frequent extreme events; increased saltwater intrusion and raised groundwater tables; greater tidal influence; increased flooding, with greater extent and frequency; and increased coastal erosion.

South Africa has in general very little adaptive capacity in developed coastal areas to a threat in sea-level rise, other than relatively expensive upgrades or replacements to existing coastal infrastructures. The undeveloped areas have more adaptive capacity; for South Africa, the best policy in the long-term in these areas appears to be to allow coastal processes to progress naturally. This strongly emphasizes the need for South Africa to set and implement measures before the damage becomes too costly to repair (Theron 2007).

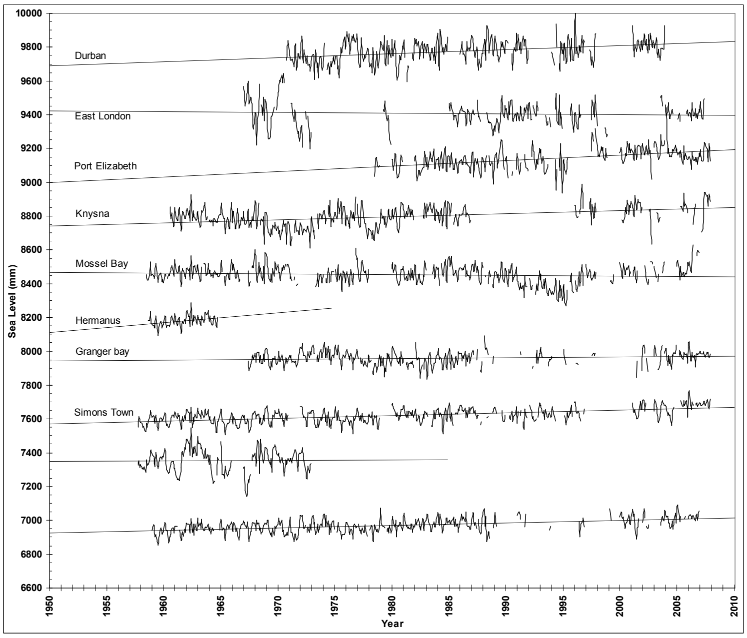

Fig. 5.1: South African tide gauge time series from the PSMSL (Permanent Service for Mean Sea Level) database, 1959-2006 (Mather et al. 2009).

5.2. An overview of the physical marine environment and forcings

Juliet co-authored this chapter with Prof Reason, a summary is below:

The El Niño Southern Oscillation is the dominant type of natural variability influencing the oceans and global climate on time scales of several months to several years. In general, during the summer of a positive ENSO (El Niño) event, the tropical Indian Ocean warms, the mid-latitude Indian Ocean cools, the central South Atlantic warms but the midlatitude South Atlantic cools, the subtropical jet moves north and South Africa is mainly dry. Roughly the reverse patterns occur during the cold ENSO (La Niña) event. Most severe droughts over subtropical southern Africa seem to either be due to strong El Niño events (Lindesay 1988; Mason and Jury 1997; Reason et al. 2000) or to regional anomalies over the southeast Atlantic (Mulenga et al. 2003; Tennant and Reason 2005). Other key ocean features and variability are shown in Table 1.
Unfortunately, our ability to predict the strength, the duration and the impact of ENSO events is not particularly good and sometimes these events can coincide with other natural variability elsewhere in the global oceans, thereby confusing the signal in certain regions.

	South Atlantic	South Indian
Key oceanographic features	Benguela upwelling, Luderitz Upwelling, Angola-Benguela Front.	Agulhas Current system (retroflection, return current and eddy shedding), Mozamibque channel eddies, Rossby waves, East Madagascar current, Natal pulses
Key variability patterns	ENSO, Benguela Ninos, Southern Annular Mode, Subtropical dipole, Pacific South America pattern	Monsoons, ENSO, Madden-Julian Oscillation, Southern Annular Mode tropical and subtropical dipole, thermocline ridge

Table 1: Key oceanographic and variability patterns in the South Atlantic and Indian Oceans.

It should be stated at the outset that climate variability over southern Africa is complex with a multitude of forcing factors that interact with each other and wax and wane in their importance through the record. There are currently severe deficiencies in the monitoring of key oceanic systems influencing South African weather and climate. Although ocean monitoring systems such as the Pilot Research Moored Array in the Tropical Atlantic; Servain et al. 1998) could give advance warning of a developing Benguela Nino event event, current statistical forecasting schemes used in South Africa (Landman and Mason 2001) do not capture these events, or indeed perform satisfactorily over the South Atlantic as a whole. In the Indian Ocean, the RAMA moored array is helping to understand variability in the Tropics, however an increased understanding of the Agulhas Current is needed in order to improve its resolution in ocean models, many global ocean and coupled models are unable to resolve this intense feature. Work is being done with higher resolution, nested models, that have been successful in resolving the Agulhas and it's mesoscale features, however, given that we are yet unable to explain the cause of a Natal pulse within the system, or even categorically state how the East Madagascar Current terminates, we are far from being able to provide successful predictions of the oceanic region.

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