

Ugu Lwethu - Our Coast. A profile of coastal KwaZulu-Natal

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9.5 Coastal Hazards

Hazardous events often significantly affect and alter the natural environment and render populations vulnerable to loss and injury. Vulnerability to these events manifests in a number of ways: vulnerability to a direct impact; vulnerability to indirect impacts; and vulnerability to maladaptation through failed attempts to adapt to hazards.¹

Coastal hazards can result in loss of infrastructure and properties, loss of resources and loss of unique coastal habitats. The risk of vulnerability is exacerbated by the combination of development pressures (*Section 9.2*) and stressed ecosystems. Coupled with the predicted effects of climate change (*Section 9.4*), the effects of hazard events become significantly higher and more costly to manage. Effects of sea-level rise and coastal erosion are of particular concern for KZN.

Sea level rise

Limited historical sea level rise analysis has been undertaken in South Africa, as records only date back as far as the 1950s and are of variable quality, with numerous gaps.^{2; 3} One of the earliest studies, based on data collected from 1960-1975, concluded that there were no significant trends in sea level change around the coast of South Africa.⁴ Later studies however, determined a long-term inter-annual trend along the west coast of South Africa and Namibia.⁵ The dataset was further extended, and it became evident that high sea level events propagated polewards from the equatorial Atlantic.⁶

Tidal records for southern Africa were recently reassessed and results showed that sea levels are rising around the southern African coastline, in line with current global trends.^{7; 8; 9}

Coastal erosion damage in Ballito from the 2007 storm surge event.



Photo: Simon Bundy

However, there are distinct regional differences in the estimated rate of sea level rise. On the west coast of South Africa/Namibia, sea level was seen to be rising by +1.87 mm per year; the south coast by +1.47 mm per year; and the east coast (KZN) by +2.74 mm per year. These differences were attributed to the difference in vertical crust movements between the east and west coasts of South Africa, and the different oceanographic processes occurring along the east and west coasts.⁹ (Section 2.3)

Sea-level rise is highest for the KZN coastline, which is a major cause for concern, as the majority of the coast comprises sandy shores (Section 3.2). Sandy shores are the most vulnerable to change, not only in the physical sense, but also from a biological viewpoint.¹⁰ Rising sea levels have the ability to cause a progressive retreat in the shoreline,¹¹ as is evident from historical shoreline records for KZN.¹²

Sea-level rise is a real threat, exacerbated by human interference with natural coastal functioning, and more recently climate change. Climate change projections give a good indication of potential future changes in sea level, but the resultant impacts are largely unknown.

Coastal erosion

The KZN coastline is generally eroding, as is the case with most of the world's coastlines, at rates of between 20 cm to 2 m per year.^{13; 14; 15; 16} In addition, there is considerable seasonal and episodic fluctuation of the high water mark.^{13; 14; 15; 16}

Coastal erosion is often portrayed negatively in the media, especially when beachfront properties and coastal infrastructure are threatened. Nevertheless, erosion is an intrinsic part of the natural coastal system, whereby a coast adjusts to the availability of sediment and the ambient wave and tide conditions, within the framework of the surrounding solid geology.

Coastal erosion events are driven by sea level rise and an apparent increase in wave height with time.^{17; 18} At Durban, the average significant wave height is 1.65 m, with an average swell direction of 121°. ¹⁹ A regional sand deficit, due to extensive droughts, sand mining, dam construction and

unwise coastal development, is exacerbating coastal erosion.^{20; 21; 22} Thus, coastal erosion will continue to increase along the KZN coast. An obvious exception to this rule is the stretch of coast between the Thukela River Mouth and Mtunzini, which has advanced seawards in historical times through the addition of sand from the Thukela River.

The KZN coastline experiences regular erosion on the normal spring high tide, which produces characteristic beach sand scarps, exacerbated by high swells.²³ Eight to 10 m swells have been recorded during mid-winter storms in the KZN Bight.²⁴ Tropical storm Imboa (early February, 1984) produced a significant wave height (Hs) of 9 m off Richards Bay.¹⁸ The high swell of March 2007 produced a wave height of 8.5 m off Richards Bay. Such a swell can be expected about once every 25 years,²⁵ which suggests that the event was unusual, but not extreme.

Coastal erosion is commonest in winter, being driven by southerly to south-easterly swells, which create a south to north littoral drift, triggering erosion in the southern parts of bays. In summer the direction reverses, causing a seasonal beach rotation;^{26; 27} but the winter pattern dominates over the long term.

The KZN coastline is also subject to longer-term erosion. The 18.6 and 4.4 year lunar cycles appear to drive coastal erosion, although the 18.6 year cycle appears to be the most prevalent.²⁷ During March and September 2006, scattered parts of the KZN coastline experienced strong equinoctial tidal erosion. The 18.6 year peak nodal tidal cycle occurred in October 2006, resulting in an astronomical tide of 2.3 m.



Photo: Simon Bundy

The impacts of coastal erosion are becoming more prevalent along the KZN coast.



This very high tide was due to the Moon and Sun being at their closest to Earth and coinciding with the Spring Equinox. During this time, Eastmoor Crescent in Durban suffered severe erosion (up to 30 m of beach loss). Historical photographs indicate that this location underwent similar erosion during 1989.

Coastal adaptation

In order to cope with and address coastal hazards such as short and long-term erosion and sea level rise, coastal systems and populations need to adapt. In this context, “adaptation” refers to an adjustment in natural or human systems as a response to actual or expected impacts, which moderates harm or exploits beneficial opportunities.²⁸ In the last twenty years, four global approaches to managing coastal vulnerability and risk have been developed: 1) defend, 2) managed retreat, 3) do nothing, or 4) accommodate.²⁹ The “defend” approach ensures that the risk of damage and loss is reduced by decreasing the probability of impact; this includes a range of hard, and more recently soft, engineering techniques that ensure the protection of infrastructure and properties landward. This is the most often used approach, particularly in areas where properties and resources offer high economic return.^{28; 29}

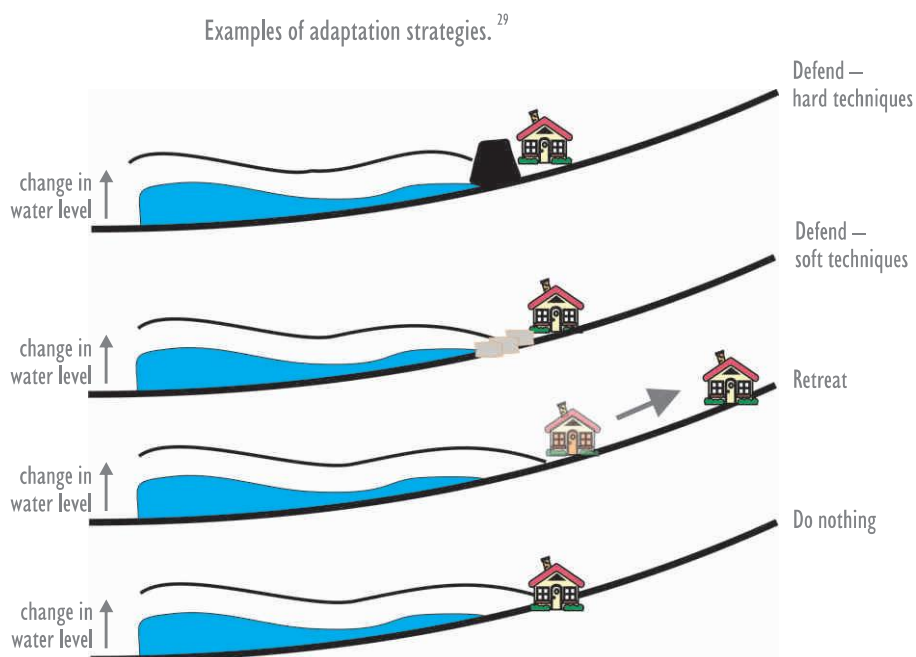
The “managed retreat” approach is focused on making space for natural coastal processes and functioning, while at the same time considering socio-economic, tourist and environmental

factors. It ensures that infrastructure that is located in vulnerable areas and/or is hindering coastal processes is removed from harm’s way, either entirely, or retreated in a planned, well-managed way, over time.²⁹

The “do nothing” approach is an approach that allows the natural functioning of the coast to continue without any intervention, ultimately resulting in the loss of any infrastructure in its path. This approach is rarely planned, but often adopted when it is too late for alternative interventions and when the cost-benefit analysis shows that the cost of defence exceeds the value of the properties to be protected.

The “accommodate” approach relates more to social change. Society’s ability to cope with the effects of the event is taken into account. This approach relates to the implementation of emergency response strategies and early warning systems.²⁸ Both the managed retreat and do nothing approaches take into consideration aspects of the accommodation approach as part of their management strategies.

Coastal hazards are exacerbated by changing environmental conditions coupled with increased coastal development and the transformation of natural habitats, the effects of which are usually unevenly distributed, with vulnerable groups being likely to suffer a disproportionate share of the impacts.



There are also indirect effects such as tourism losses, re-allocation of the fiscus towards disaster relief at the expense of planned development programmes and higher insurance premiums for coastal property.

The 2007 KZN storms affected the coastline and many of its beaches, resulting in a loss to the province’s tourism sector. In addition there is a risk to human life when storms accentuate higher sea levels. ■