

Western Indian Ocean Sea Level Project



South African National Report

Intergovernmental Oceanographic Commission

UNESCO

The Western Indian Ocean Sea Level Project is undertaken within the framework of the IOC-Sida-Flanders Marine Science Programme in the region and in response to the recommendation of the IOCINCWIO - IV. The project will produce a comprehensive report on sea level data and analysis in the region.



This National Report relates to South Africa and has been prepared by [Dr Howard Waldron](#) , Department of Oceanography, University of Cape Town, South Africa with information supplied by Capt. M. Thomson of the Hydrographic Office of the South African Navy. **Please note that the site map for Saldanha Bay is a draft copy only and no site map is available for Port Nolloth.**

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GENERAL OVERVIEW

The National Report for South Africa is in two parts:

- (I) Status of sea level observation and related activities.
- (II) Compilation of meteorological and oceanographic data during periods when stations have been, and are, operational.

(I)

STATUS OF SEA LEVEL OBSERVATION AND RELATED ACTIVITIES

1. Introduction

South Africa occupies 1 219 080 square kilometres at the southernmost tip of the African continent, stretching from the Limpopo River in the North to Cape Agulhas in the South. On the west coast border is the South Atlantic Ocean, while the eastern coastline runs along the Indian Ocean. In the north,

South Africa borders Namibia, Botswana and Zimbabwe, while Mozambique and Swaziland border on the North-East.

South Africa has a total population (as at 27 April 1994, according to the Central Statistical Service (CSS)) of approximately 40 284 640. (Regional population figures quoted in this document are also based on CSS figures).

South Africa is divided into 9 regions or provinces:

Western Cape, Eastern Cape, Northern Cape, Orange Free State, KwaZulu/Natal, North-West, Gauteng (formerly PWV), Eastern Transvaal, Northern Transvaal.

The South African coastline is approximately 3000 km in length and for aesthetic, recreational and economic reasons, it is an enormous national asset. In his PhD thesis (Dept of Oceanography, University of Cape Town, 1992, 215pp.), Peter Hughes divided the coastline into four geomorphological regions:

The West Coast: Namibia to St Helena Bay (120 km north of Cape Town). This is a dry semi-desert coastline with a low, wide and flat coastal plain cut by ephemeral rivers and salt pans. The shoreline is a combination of long sandy beaches interrupted by short sections of mixed rocky and sandy bays and promontories. The long axes of small log-spiral bays point in a north-westerly direction. Conditions are harsh and population densities are very low. The coast faces west-south-west to westerly.

The South-West Coast: St Helena Bay to Cape Agulhas (southernmost tip of Africa). Warm temperate climate with winter rainfall confined to orographic highs. The coastal plain is generally wide and bounded by a combination of long open sandy beaches and rocky headlands and cliffs which often hold small pocket beaches. The coastal plain tends to narrow towards the centre of the region where cliffed sections begin to predominate. The shoreline becomes rockier southwards and rivers are usually open for at least several months of the year. Population densities range from low in the north to high, centred around the Greater Cape Town area.

The South Coast: Cape Agulhas to Cape Padrone (50 km East of Port Elizabeth). Mixed rocky coastline with pocket beaches becoming sandier towards the east where large log-spiral bays become characteristic, pointing towards the north-east. The wide, flat and low coastal plain narrows towards the east and is cut by tidal inlets and estuaries with tidal reaches extending several tens of kilometres inland. Warm temperate climate, generally with all seasons rainfall and medium to high population densities in coastal towns, cities and resorts.

The East Coast: Cape Padrone to Mozambique. Linear trending monoclinical coastline with irregular, indented rocky section separated by linear or arcuate beaches, often coarse grained. The coastal plain is very narrow towards the south and rivers are deeply incised forming drowned river mouths rather than estuaries. North of Durban the coastal plain starts to widen again and the rivers become less deeply incised with wider floodplains. Barrier dunes are formed towards the north. The climate is subtropical with mostly unimodal summer rains. Population densities along the coast are medium, but high within 150 km north and south of Durban, decreasing northwards to low and very low near the Mozambique border.

The SA Naval Hydrographic Office was formed in 1954. Installation of the first of its own KENT float-type gauges followed in 1957 and the operation of certain SA Railways and Harbours gauges seems to have been taken over at about the same time. Occasional additions were made to the original network of KENT gauges using LEA, OTT and SIAP float-type gauges. Twelve tidal stations were in operation by 1989 but it was considered that most of the gauges were getting too old (Note that two of the original mechanical gauges continue in service in tandem with their modern replacements).

At this stage, the EMATEK Division of the CSIR was commissioned to design and construct acoustic Automatic Water Level recorders (AWLRs) incorporating barometers and temperature sensors. A total of eight were acquired but they never proved to be a success and after several years of perserverance, they were abandoned in 1996/97. The exception is the AWLR at Walvis Bay which operates successfully and has produced good, accurate datasets for the last two years.

The AWLRs were replaced with ten SRD acoustic gauges which were installed in 1996/97. These have produced continuous datasets but their accuracy is, in many cases, unacceptably variable. To date, this difficulty remains to be resolved and plans are well advanced for the acquisition of a new generation of float-actuated gauges to supplement the existing network.

The Bidston Observatory provided tidal predictions until 1964, at which stage the first South African Tide Tables (for 1965) were issued. These have been issued annually ever since.

2. Status of Sea Level Network

2.1 Installed and operational stations

This section gives details of the tide gauges at Port Nolloth, Saldanha Bay, Cape Town, Simon's Town, Mossel Bay, Knysna, Port Elizabeth, East London, Durban and Richards Bay. For the sake of completeness, a supplementary section has been completed giving details of tide gauges at Walvis Bay and Lüderitz. These are under the jurisdiction of Namibia but form part of the sea level network in a southern African context.

PORT NOLLOTH

Location:

- On the main jetty.

Photograph and Site Map:

Latitude and Longitude:

- 29°S 16° 52'E

Gauges previously installed (type, model, duration of operation):

- KENT float-type 1957 - 1995.
- LEA float-type December 1995 - May 1996.
- KENT float-type December 1996.

Gauge currently installed (type, model and serial number, year of installation):

- SRD Acoustic December 1996 to date.

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- N° 84.1: 3.533 m above MSL.
- "Gety": 3.005 m above MSL.
- "New GPS": 3.045 m above MSL.

All are bronze pegs, the former two installed by the Hydrographer in conjunction with the Director-General of Surveys and the latter by the University of Cape Town on 4 November 1997.

Benchmark levelling information (dates and details of levelling data):

- Last levelled 30 Sept. 1998.

Tide gauge transducer face was 4.461 m above MSL (5.385 m above Chart Datum).

Tide predictions for station performed by where and by whom:

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL
- WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory re PSMSL and WOCE.
- University of Hawaii re TOGA.
- ftp site at the University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette.

Data communication at station (satellite, email, fax, airmail):

- Modem and telephone line. Downloaded weekly at the Hydrographic Office.

Nearest meteorological station:

- Port Nolloth.

Other data available (precipitation, winds, sst, river runoff):

- Nil

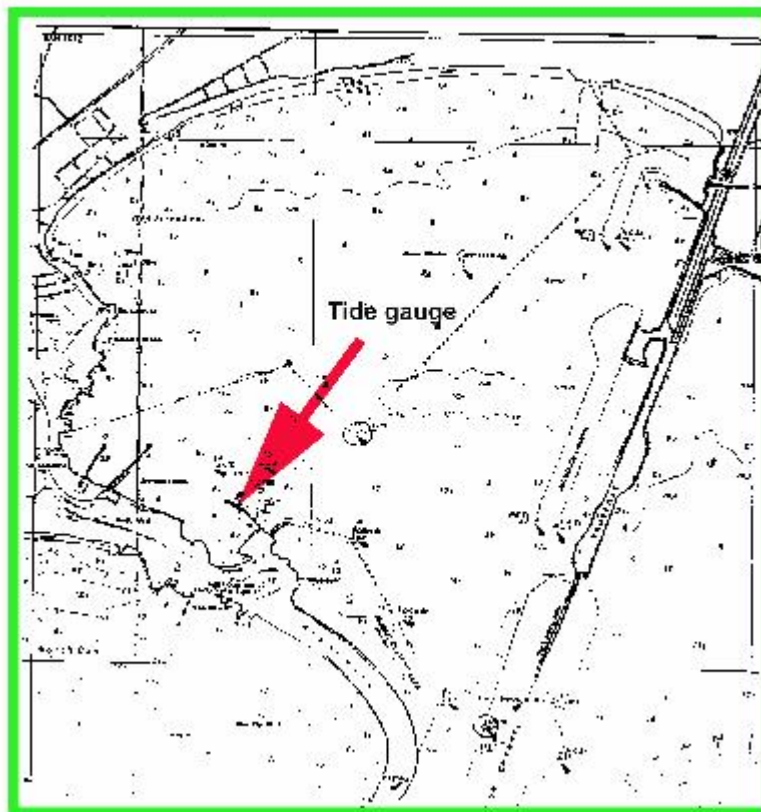
SALDANHA BAY

Location:

- On the short spur of the Small Craft Harbour breakwater. The harbour is below the Port Control Office at Hoedjies Punt.

Photograph and Site Map:

Saldanha Bay



Latitude and Longitude:

- 33° 01'S 18° 58'E

Gauges previously installed (type, model, duration of operation):

- KENT float-type 1973 - 1986
- LEA float-type 1985

- SIAP float-type 1985 - 1996

Gauge currently installed (type, model and serial number, year of installation):

- SRD Acoustic 1996 to date

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- 15L3 - 84: 2.503 m above MSL installed by SA Railways and Harbours.
- "New GPS": 2.497 m above MSL installed by University of Cape Town November 1997.

Both are bronze pegs.

Benchmark levelling information (dates and details of levelling data):

- Latest levelling 28 July 1998.

Transducer face was 3.817 m above MSL (4.792 m above Chart Datum).

Tide predictions for station performed by where and by whom:

- Done by Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / WOCE
- University of Hawaii for TOGA
- ftp site at the University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette.

Data communication at station (satellite, email, fax, airmail):

- Via modem and telephone line. Downloaded weekly at Hydrographic Office.

Nearest meteorological station:

- Cape Columbine lighthouse.

Other data available (precipitation, winds, sst, river runoff):

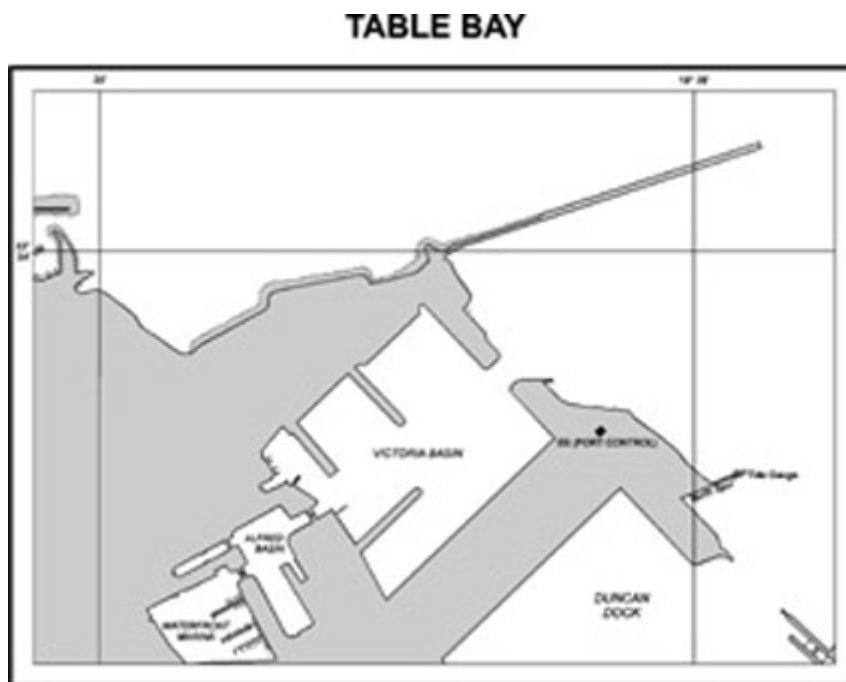
- Nil

CAPE TOWN

Location:

- End of North Spur, entrance to Duncan Basin, Table Bay Docks.

Photograph and Site Map:



Latitude and Longitude:

- 33° 54'S 18° 26'E

Gauges previously installed (type, model, duration of operation):

- Various SA Railways and Harbours gauges 1932 - 1971 (not continuous).
- KENT float-type 1967 - 1996.

Gauge currently installed (type, model and serial number, year of installation):

- SRD Acoustic December 1996 to date.

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- WF9: 2.331 m above MSL.
- WF10: 2.343 m above MSL

Installed by Chief Director, Surveys and Land Information prior to December 1996.

- "New GPS": October 1997 installed by the University of Cape Town.

All are bronze pegs.

Benchmark levelling information (dates and details of levelling data):

- Last done 29 July 1998.

Transducer face was 3.855 m above MSL (4.830 m above Chart datum).

Tide predictions for station performed by where and by whom:

- Done by the Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / GLOSS / WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / GLOSS / WOCE
- University of Hawaii for TOGA
- ftp site at University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette

Data communication at station (satellite, email, fax, airmail):

- Via modem and telephone line. Downloaded weekly at Hydrographic Office.

Nearest meteorological station:

- Cape Town International Airport.

Other data available (precipitation, winds, sst, river runoff):

- Nil.

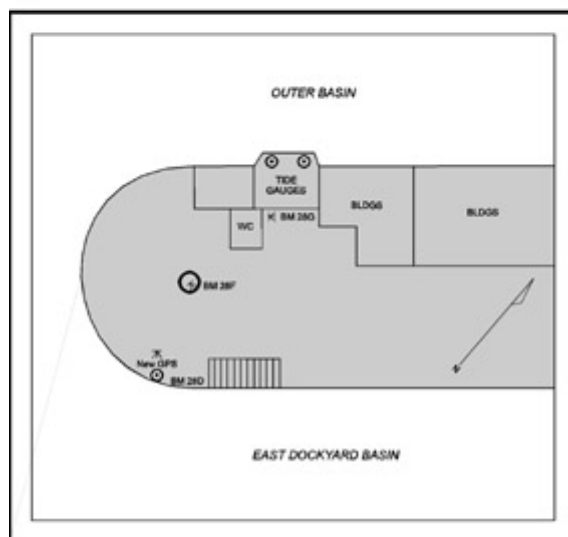
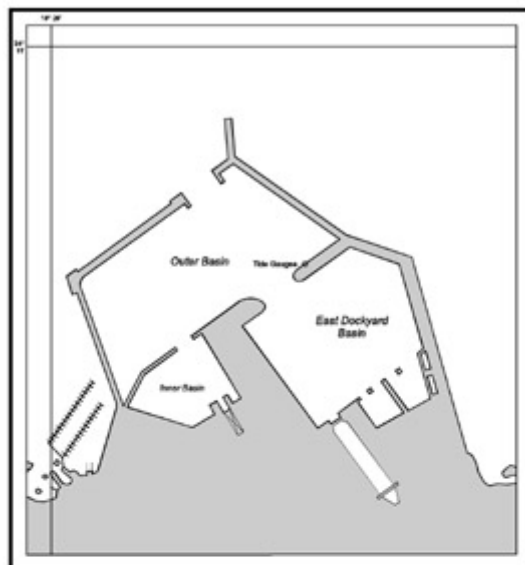
SIMON'S TOWN

Location:

- Tide gauge hut, North bullnose, Inner Basin, East Dockyard.

Photograph and Site Map:

SIMON'S TOWN



Latitude and Longitude:

- 34° 11'S 18° 26'E

Gauges previously installed (type, model, duration of operation):

- KENT float-type 1957 - 1983
- SIAP 1985 - 1995

Gauge currently installed (type, model and serial number, year of installation):

- LEA float-type 1984 to date
- SRD Acoustic 1996 to date

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- 28D: 2.733 m above MSL
- 28F: 3.889 m above MSL
- 28G: 2.763 m above MSL

Installed by the Chief Director, Surveys and Mapping.

Heights confirmed March 1998.

- "New GPS": 2.736 m above MSL.

Installed by the University of Cape Town

Benchmark levelling information (dates and details of levelling data):

- SRD Gauge last levelled 23 July 1998.

Transducer face was 3.989 above MSL (4.992 m above Chart Datum).

- LEA was last levelled 3 July 1998.

Tide gauge stilling well cover (TGZ) was 3.952 m above MSL (4.955 m above Chart datum).

Tide predictions for station performed by where and by whom:

- Done by the Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / WOCE
- University of Hawaii for TOGA

- ftp site at the University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette

Data communication at station (satellite, email, fax, airmail):

- LEA: by analogue trace, digitised at the Hydrographic Office.
- SRD: via modem and telephone line. Downloaded weekly at the Hydrographic Office.

Nearest meteorological station:

- Cape Town International Airport.

Other data available (precipitation, winds, sst, river runoff):

- Nil

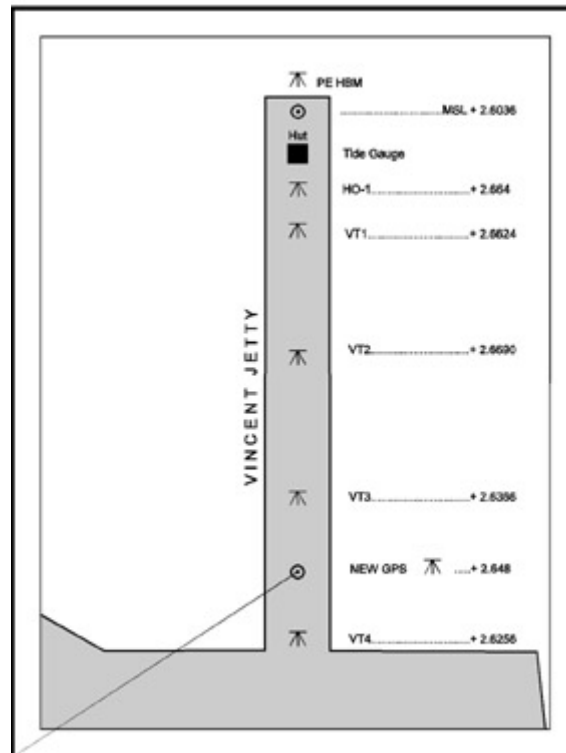
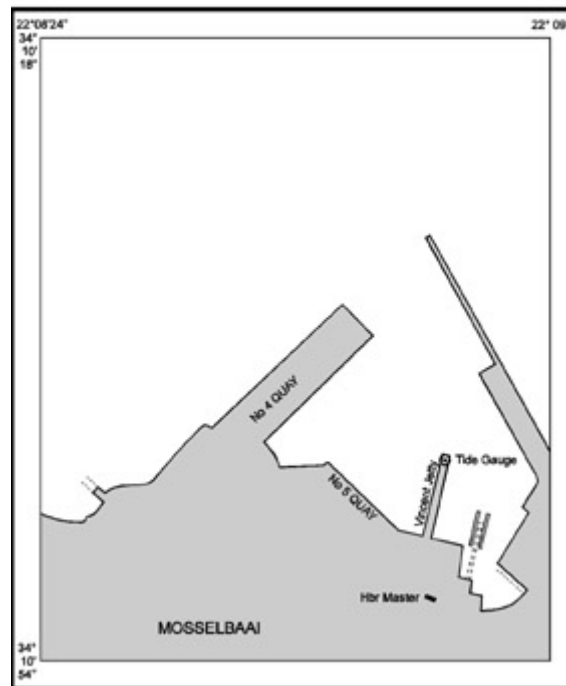
MOSSEL BAY

Location:

- Tide gauge hut at the end of Vincent Jetty.

Photograph and Site Map:

MOSSELBAAI



Latitude and Longitude:

- 34° 11'S 22° 08'E

Gauges previously installed (type, model, duration of operation):

- KENT float-type 1958 - 1996

Gauge currently installed (type, model and serial number, year of installation):

- SRD Acoustic 1996

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- PE HBM: 2.604 m above MSL
- VT-1: 2.662 m above MSL.

Installed by SA Railways and Harbours, date not known.

Levelled by the Director of Surveys and Mapping.

- HO-1: 2.664 m above MSL

Installed by Hydrographic Office, October 1993.

- "New GPS": 2.648 m above MSL

Installed November 1997 by the University of Cape Town.

Benchmark levelling information (dates and details of levelling data):

- Gauge last levelled 31 August 1998.

Transducer face was 3.581 m above MSL (4.744 m above Chart Datum).

Tide predictions for station performed by where and by whom:

- Done by Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / WOCE
- University of Hawaii for TOGA
- ftp site at University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette

Data communication at station (satellite, email, fax, airmail):

- Via modem and telephone line. Downloaded weekly at Hydrographic Office.

Nearest meteorological station:

- Cape St. Blaize Lighthouse.

Other data available (precipitation, winds, sst, river runoff):

- Nil

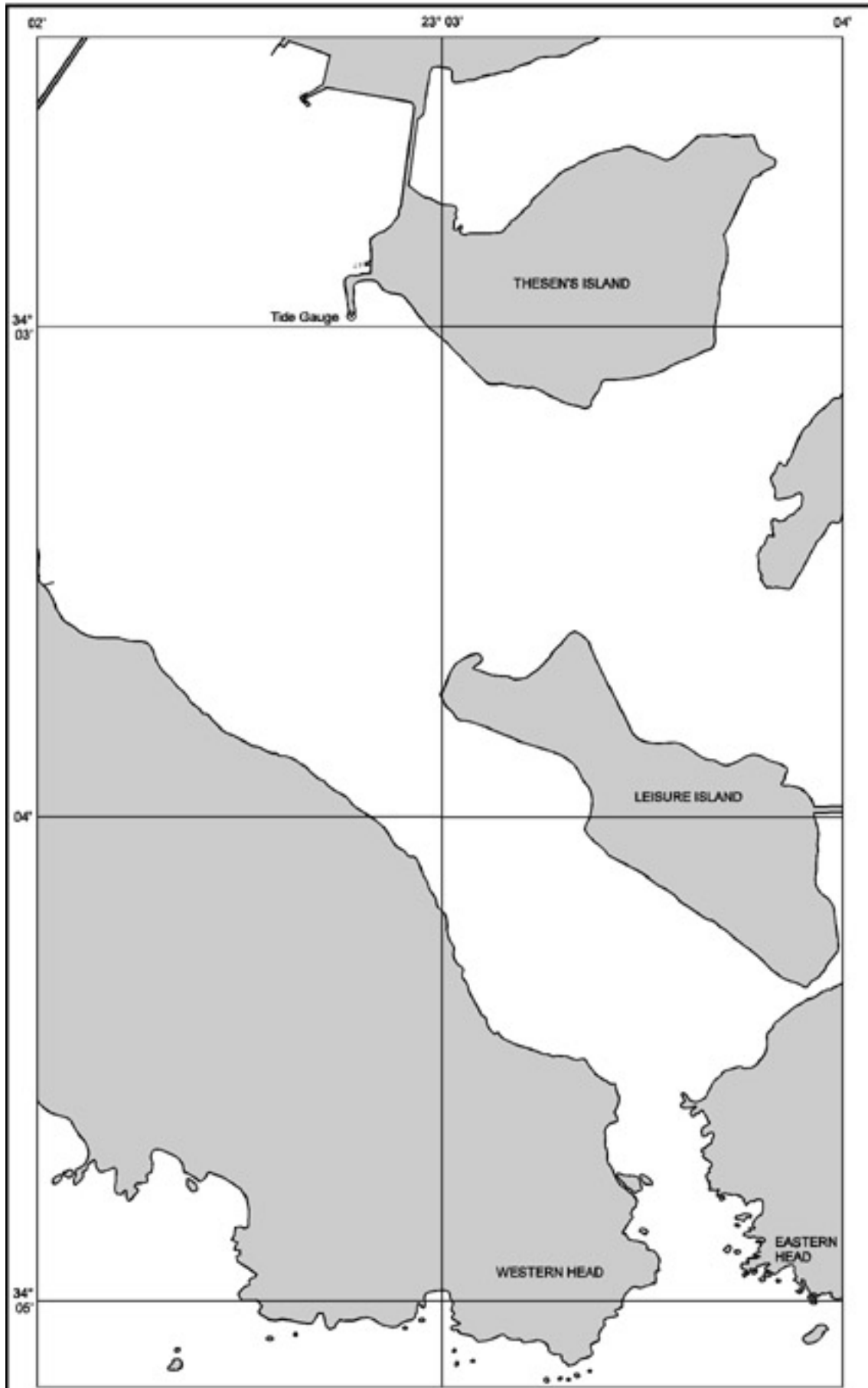
KNYSNA

Location:

- Southern end of Thesen's Jetty, Thesen Island.

Photograph and Site Map:

KNYSNA



Latitude and Longitude:

- 34° 03'S 23° 03'E

Gauges previously installed (type, model, duration of operation):

- KENT float-type 1960 - 1987 at old tide gauge site at the Heads.
- LEA float-type 1990 - 1996.

Gauge currently installed (type, model and serial number, year of installation):

- SRD Acoustic 1996 to date.

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- 36 JK A1: 3.470 m above MSL.
- 36 JK A2: 2.730 m above MSL.
- 36 JK A3 3.386 m above MSL.

All are bronze pegs.

All were last levelled by the Chief Director, Surveys and Land Information in April 1997.

Benchmark levelling information (dates and details of levelling data):

- SRD gauge last levelled 1 September 1998.

Transducer face was 3.557 m above MSL (4.605 m above Chart Datum).

Tide predictions for station performed by where and by whom:

- Done by Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / WOCE
- University of Hawaii for TOGA
- ftp site at University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette

Data communication at station (satellite, email, fax, airmail):

- Via modem and telephone line. Downloaded weekly at Hydrographic Office.

Nearest meteorological station:

- Knysna (automatic station).

Other data available (precipitation, winds, sst, river runoff):

- Nil.

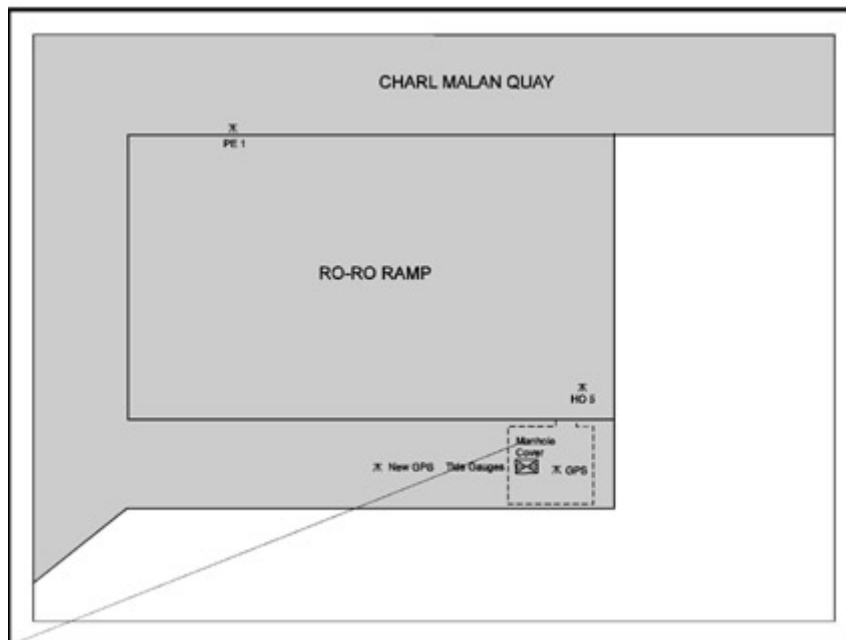
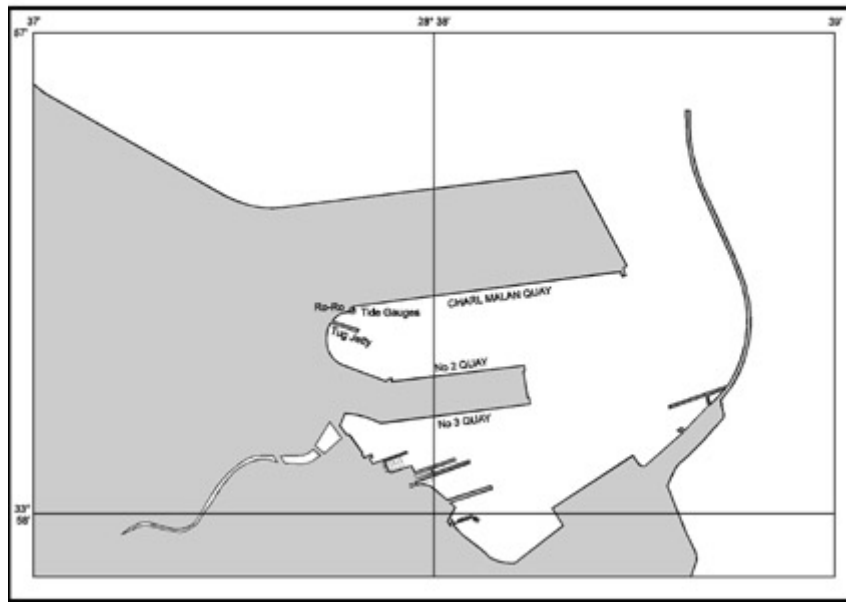
PORT ELIZABETH

Location:

- Inside the tide gauge hut on the side of the Ro-Ro berth at the base of the Charl Malan Quay.

Photograph and Site Map:

PORT ELIZABETH



Latitude and Longitude:

- 33° 58' S 25° 28' E

Gauges previously installed (type, model, duration of operation):

- SA Railways and Harbours gauges (not continuous) of various types 1937 - 1954.
- LEA float-type gauge 1954 - 1982.
- OTT float-type 1968 - 1997.

Gauge currently installed (type, model and serial number, year of installation):

- SRD acoustic gauge 1996 to date.

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- GPS: 4.378 m above MSL.

Installed by Chief Director, Surveys and Mapping 1989.

- "New GPS": 4.356 m above MSL.

Installed by the Hydrographic Office 3 March 1998.

Benchmark levelling information (dates and details of levelling data):

- Last done 2 September 1998.

Transducer face was 3.598 m above MSL (4.624 m above Chart Datum).

Tide predictions for station performed by where and by whom:

- Done by the Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / GLOSS / WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / GLOSS / WOCE.
- University of Hawaii for TOGA
- ftp site at the University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette.

Data communication at station (satellite, email, fax, airmail):

- Via modem and telephone line. Downloaded weekly at the Hydrographic Office.

Nearest meteorological station:

- Port Elizabeth Airport.

Other data available (precipitation, winds, sst, river runoff):

- Nil.

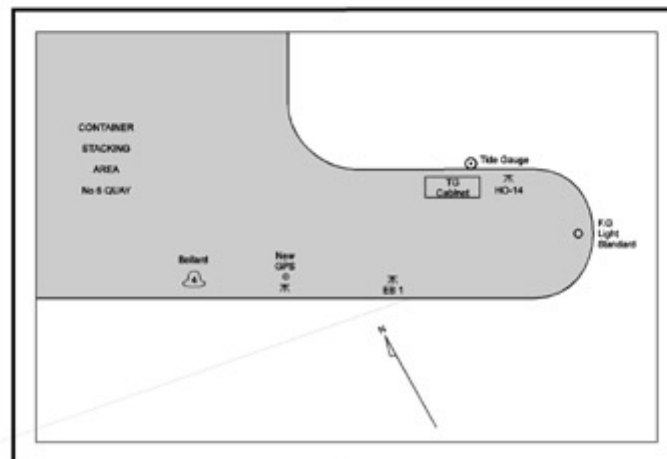
EAST LONDON

Location:

- KENT tide gauge is at the up-river end of N^o 3 Quay.
- SRD acoustic tide gauge is at the seaward end of N^o 6 (Container stacking) Quay.

Photograph and Site Map:

EAST LONDON



Latitude and Longitude:

- 33° 01'S 27° 55'E

Gauges previously installed (type, model, duration of operation):

- Various SA Railways and Harbours gauges from 1948 - 1983.

Gauge currently installed (type, model and serial number, year of installation):

- KENT float-type 1984 to date.
- SRD acoustic 1996 to date.

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

a. Adjacent to KENT tide gauge

- HO-8: 3.815 m above MSL.
- HO-9: 3.122 m above MSL.

Installed by the Hydrographic Office in October 1993.

- TG Stud: 3.128 m above MSL.

Installation date unknown.

b. Adjacent SRD tide gauge.

- HO-13: 3.941 m above MSL.
- HO-14: 3.503 m above MSL.
- EB1: 3.486 m above MSL.

Installed and levelled by the Chief Surveyor General in December 1996.

- "New GPS": 3.475 m above MSL.

Installed by Hydrographic Office 4 March 1998.

Benchmark levelling information (dates and details of levelling data):

- KENT tide gauge levelled 4 September 1998. TG base plate (TGZ) was 3.887 m above MSL (4.893 m above Chart Datum).
- SRD gauge last levelled 4 September 1998. Transducer face was 4.548 m above MSL (5.554 m above Chart Datum).

Tide predictions for station performed by where and by whom:

- Done by the Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / WOCE

- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / WOCE.
- University of Hawaii for TOGA
- ftp site at the University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette.

Data communication at station (satellite, email, fax, airmail):

- KENT analogue traces are digitised (at hourly heights) in the Hydrographic Office.
- SRD data are obtained via modem and telephone line and downloaded weekly at the Hydrographic Office.

Nearest meteorological station:

- East London Airport.

Other data available (precipitation, winds, sst, river runoff):

- Nil.

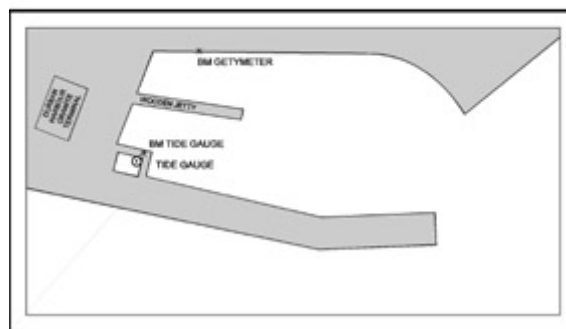
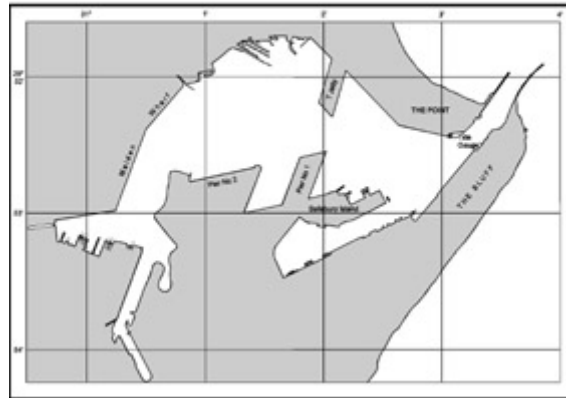
DURBAN

Location:

- In the tide gauge hut at the Tug Jetty (Small Craft Harbour) at the Point.

Photograph and Site Map:

DURBAN



Latitude and Longitude:

- 29° 52'S 31° 03'E

Gauges previously installed (type, model, duration of operation):

- LEA float-type 1952 - 1971.
- KENT float-type 1970 - 1996.

Gauge currently installed (type, model and serial number, year of installation):

- SRD acoustic tide gauge November 1996.

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- BM 483: 2.789 m above MSL.
- BM 875: 2.839 m above MSL.
- BM Getymeter: 2.679 M above MSL.

All were re-levelled in August 1995 by Surveys and Land Information.

- "New GPS": 2.8235 m above MSL.

Installed by the Hydrographic Office 5 March 1998.

All are brass pegs.

Benchmark levelling information (dates and details of levelling data):

- Gauges were last levelled on 7 September 1998. SRD gauge transducer face was 3.550 m above MSL (4.663 m above Chart Datum).

Tide predictions for station performed by where and by whom:

- Done by the Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / GLOSS / WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / GLOSS / WOCE
- University of Hawaii for TOGA
- ftp site at the University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette.

Data communication at station (satellite, email, fax, airmail):

- Via modem and telephone line. Downloaded weekly at the Hydrographic Office.

Nearest meteorological station:

- Durban Airport.

Other data available (precipitation, winds, sst, river runoff):

- Nil.

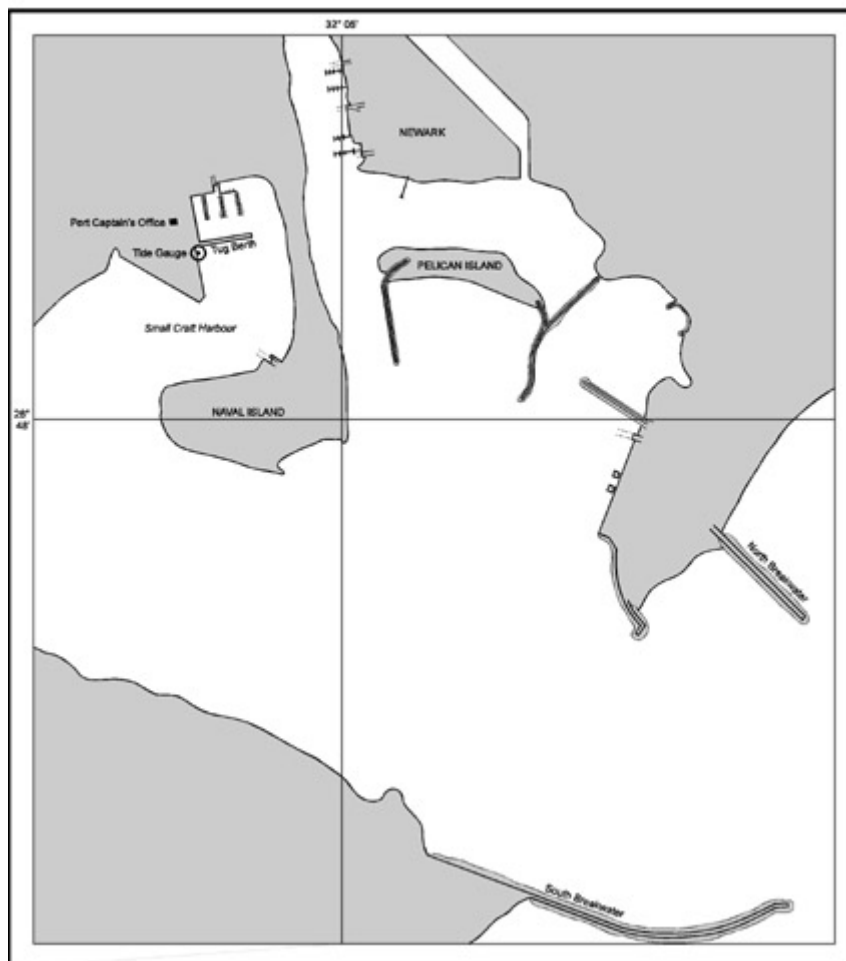
RICHARDS BAY

Location:

- At the base of the Tug Berth in the Small Craft Harbour.

Photograph and Site Map:

RICHARDS BAY



Latitude and Longitude:

- 28° 48'S 32° 05'E

Gauges previously installed (type, model, duration of operation):

- KENT float-type 1977 - 1984
- LEA float-type 1985 - 1987
- KENT (new site) 1989 - 1997

Gauge currently installed (type, model and serial number, year of installation):

- SRD acoustic tide gauge 1997 to date

Organisation responsible for tide gauge station (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- SCH3: 3.429 above MSL

Installed by SA Railways and Harbours.

- SAN 84.2: 3.422 m above MSL
- "New GPS": 3.459 above MSL

Installed by the Hydrographic Office.

All are bronze pegs.

Benchmark levelling information (dates and details of levelling data):

- Last done 7 September 1998. Transducer face was 4.242 m above MSL (5.447 above Chart Datum).

Tide predictions for station performed by where and by whom:

- Done by Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / WOCE

- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / WOCE
- University of Hawaii for TOGA
- ftp site at University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette

Data communication at station (satellite, email, fax, airmail):

- Via modem and telephone line. Downloaded weekly at Hydrographic Office.

Nearest meteorological station:

- Richards Bay (automatic weather station)

Other data available (precipitation, winds, sst, river runoff):

- Nil.

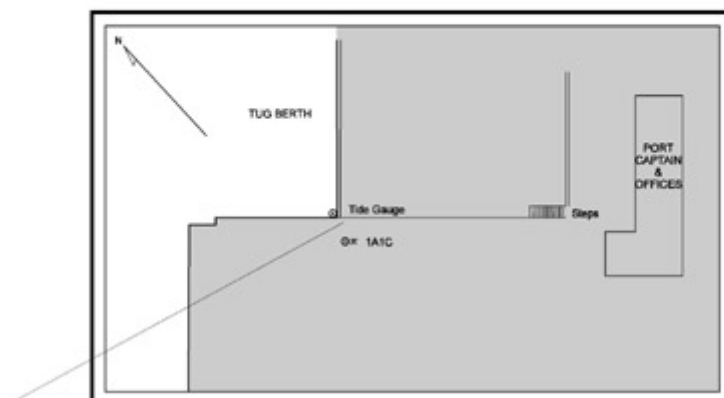
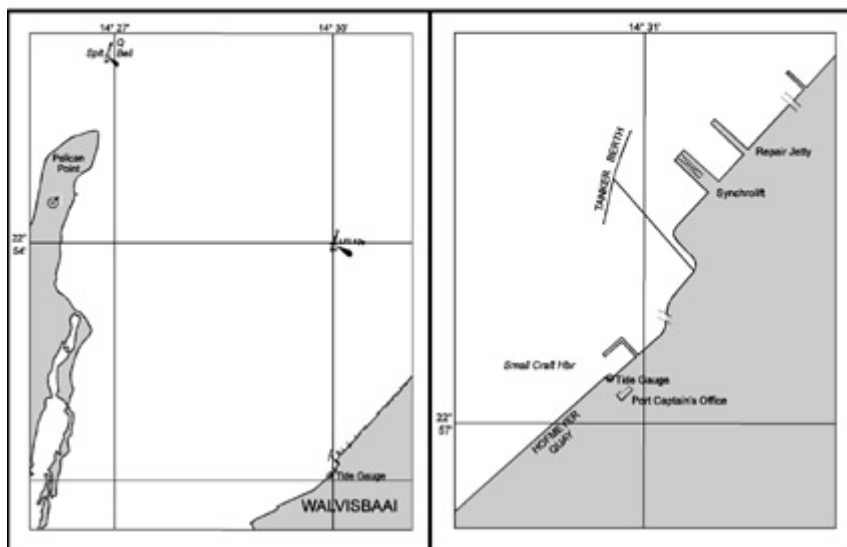
WALVIS BAY

Location:

- Previously under the synchrolift offices. Currently in the small craft basin opposite the Port Control offices.

Photograph and Site Map:

WALVISBAAI



Latitude and Longitude:

- Previously 22° 55'S 14° 30'E
- Currently 22° 57'S 14° 30'E

Gauges previously installed (type, model, duration of operation):

- OTT float-type 1976 - 1997

Gauge currently installed (type, model and serial number, year of installation):

- EMATEK acoustic AWLR 1989 to date. Adequate datasets only in 1997 and 1998 (possibly *et seq.*).

Organisation responsible for tide gauge station (name and address):

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- IAIC: 3.799 m above MSL. A brass stud set in the concrete of the harbour platform. It is a Surveyor-General benchmark and is the only benchmark adjacent to the present gauge.

Benchmark levelling information (dates and details of levelling data):

- The reference flange (TGZ) of the gauge is 0.200 m below benchmark IAIC. This was levelled on 7 October 1998.

Tide predictions for station performed by where and by whom:

- Done by Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / GLOSS / WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / GLOSS / WOCE
- University of Hawaii for TOGA
- ftp site at University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette

Data communication at station (satellite, email, fax, airmail):

- Via modem and telephone line. Downloaded weekly at Hydrographic Office.

Nearest meteorological station:

- Rooikop Airport (approx. 10 km inland).

Other data available (precipitation, winds, sst, river runoff):

Nil.

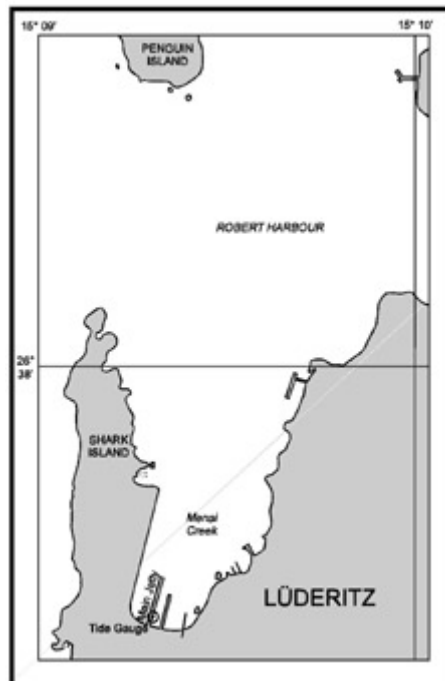
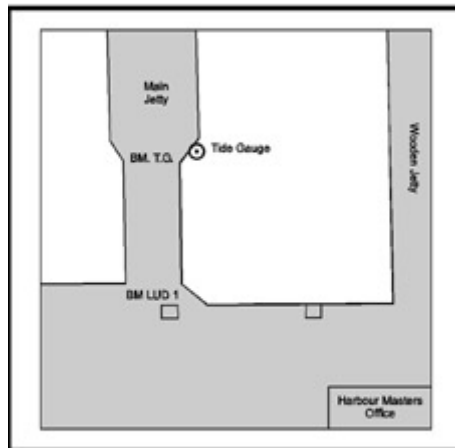
LÜDERITZ

Location:

- At the inshore end of the main concrete jetty.

Photograph and Site Map:

LÜDERITZ



Latitude and Longitude:

- 26° 39'S 15° 09'E

Gauges previously installed (type, model, duration of operation):

- KENT float-type 1958 - 1998

Gauge currently installed (type, model and serial number, year of installation):

- SRD acoustic tide gauge 1997 to date

Organisation responsible for tide gauge station (name and address):

Organisation performing maintenance (name and address):

- The Hydrographer, SA Navy, Private Bag X1, Tokai 7966, RSA.

List and description of tide benchmarks (when installed and by whom):

- Tide gauge peg: 2.156 m above MSL.

Installed by the Hydrographer 1968.

- LUD1: 2.394 m above MSL.

Installed by the Namibian Surveyor General in April 1998.

Benchmark levelling information (dates and details of levelling data):

- Tide gauge was last levelled on 22 April 1998. Tide gauge base plate (TGZ) was 2.957 m above MSL.

Tide predictions for station performed by where and by whom:

- Done by Hydrographic Office.

Which projects the station is dedicated to (GLOSS, WOCE, PSMSL):

- PSMSL / WOCE
- TOGA

Data centres to which data is sent:

- Bidston Observatory for PSMSL / WOCE
- University of Hawaii for TOGA
- ftp site at University of Cape Town (a link from <http://www.sea.uct.ac.za/tidedata>).

Data format (analogue charts, diskettes):

- ASCII on diskette

Data communication at station (satellite, email, fax, airmail):

- Analogue trace posted weekly / fortnightly then analyzed and digitized at the Hydrographic Office.

Nearest meteorological station:

- Not known.

Other data available (precipitation, winds, sst, river runoff):

Nil.

2.2 Installed but not operational

- None.
-

2.3 Planned station(s)

- No additional stations are planned as part of the SA National Network.
 - It would be most desirable to establish a station on Marion Island but no suitable equipment has been identified and it is unlikely that national funds would be made available. We would seek advice from the IOC as to how this goal might be achieved.
 - Float-actuated gauges may be installed to run alongside SRD acoustic gauges at most stations. This development is dependent on budgetary considerations. Target installation date is August 1999.
-

3. Availability of data from the tide gauge stations

- Data available in digital form is listed below.
- Certain data exist prior to the digital set. This is available from the Hydrographic Office on request.
- Post-1990 data are available at the University of Cape Town ftp site (a link from <http://www.sea.uct.ac.za/tidedata>).

Observed, edited and calibrated hourly heights available in digital form.

- Walvis Bay (Namibia): 1959 - 1973, 1976 - 1997. 37 years
- Lüderitz (Namibia): 1958 - 1993, 1996 - 1997. 38 years
- Port Nolloth: 1958 - 1994, 1997. 37 years
- Alexander Bay: 1997. 1 year

- Saldanha Bay: 1973 - 1997. 25 years
 - Cape Town: 1967 - 1997. 31 years
 - Simon's Town: 1958 - 1997. 40 years
 - St Helena Bay: 1957 - 1963. 7 years
 - Hermanus: 1958 - 1964. 7 years
 - Mossel Bay: 1964 - 1997. 34 years
 - Knysna: 1966 - 1986, 1990, 1995 - 1997. 25 years
 - Port Elizabeth: 1973, 1978 - 1997. 25 years
 - East London: 1965 - 1973. 1975 - 1977, 1979, 1985 - 1997. 26 years
 - Durban: 1970 - 1997. 28 years
 - Richards Bay: 1977 - 1997. 21 years
-

4. Capacity available

4.1 Installation and maintenance of gauges

- The South African Navy has a broad range of experience in the installation and maintenance of mechanical and electronic tide gauges.

4.2 Analysis and interpretation of data

- Expertise in analysis and tide prediction at the Hydrographic Office is slender. Currently, it consists of the ability to run the existing analysis and prediction computer programme. Further interpretation has to be referred elsewhere. Sources available nationally include the University of Cape Town and the Council for Scientific and Industrial Research.
-

5. Sea level products

- The Hydrographic Office produces annual tidal predictions for the ports of South Africa and Namibia two years in advance. They are available in book form or on diskette (disk versions for 1998 and 1999 only in the form of heights and times of High Water and Low Water plus hourly heights. From 2000 onwards it will be in the form of complete publications). From mid-1999 it is intended to have the complete book available for the years 2000 and 2001 on the South African National Defence Force website with annual updates. Books are sold via Chart Agents at approx R 35-00 per copy and diskette versions are available from the Hydrographic Office at R 25-00 each plus postage.

6. Bibliography of sea level literature

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7. Recommendations

- It would be a great advantage to have barometers and seawater temperature sensors co-situate with the tidal stations. The South African Navy is unlikely to consider funding such a project in the immediate future.

(II)

COMPILATION OF OCEANOGRAPHIC AND METEOROLOGICAL DATA

- Enquiries regarding oceanographic data coincident with the deployment of tide gauges in the South African network should be directed to:

Dr Marten Gründlingh

Manager, SADCO, PO Box 320, 7599 Stellenbosch, South Africa

Tel (+27) (21) 887 5101 Fax (+27) (21) 887 5142

email mgrundli@csir.co.za

<http://fred.csir.co.za/ematek/sadco.html>

- A sub-set of available meteorological data has been presented here. Further detail in this regard can be obtained from the South African Weather Bureau (SAWB) as follows:

South African Weather Bureau (SAWB)

Information Section, Private Bag X097, Pretoria, Gauteng, RSA.

Tel (+27) (12) 309 3104 Fax (+27) (12) 309 3990

email climenq@cirrus.sawb.gov.za

Monthly means of Air Temperature (degrees C), Precipitation (mm), Air Pressure (at 0800 hrs [hPa]) and Wind (speed [m/s] and Direction [direction frequency per thousand for each of the eight main directions])

Saldanha Bay (Cape Columbine)

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	17.5	6	1007.2
February	17.5	4	1006.8
March	17.0	10	1008.0
April	16.3	20	1009.4
May	15.0	33	1011.1
June	13.6	47	1013.5
July	13.0	36	1014.8
August	13.2	38	1013.8
September	13.9	19	1012.1
October	15.0	12	1010.9
November	16.0	9	961.5
December	17.0	6	967.7
Annual	18.9 (mean)	240 (total)	1003.1 (mean)

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	37	5.0	32	5.0	4	4.1	94	8.1	568	8.9	135	6.1	25	4.0	59	4.6
February	35	5.1	41	4.4	7	4.7	98	8.3	578	8.4	96	5.7	29	4.3	57	4.7
March	46	4.8	41	3.9	16	4.6	115	7.2	537	8.1	98	5.3	26	3.6	56	4.6
April	61	5.5	72	4.1	21	4.0	139	6.9	417	7.1	82	5.1	29	3.8	84	4.6
May	112	6.5	113	5.0	32	4.7	141	5.9	280	6.5	71	4.8	33	5.3	125	5.7
June	143	7.4	153	5.8	47	4.3	135	5.6	210	6.0	50	5.6	36	7.1	127	6.5
July	111	6.7	122	5.5	46	4.0	152	6.0	235	6.2	61	5.6	41	6.8	133	6.6
August	93	7.2	65	5.3	33	5.0	150	6.4	286	7.2	95	5.9	44	7.0	145	7.2
September	67	6.8	33	4.8	17	4.3	138	6.5	382	8.0	106	5.6	48	4.8	143	6.1
October	56	5.6	31	4.4	11	6.8	117	7.4	449	8.5	136	5.9	46	5.2	86	5.7
November	41	5.2	33	4.8	3	5.6	100	8.2	556	9.1	119	6.2	30	4.5	74	5.2
December	37	5.5	22	4.6	5	5.5	78	8.4	559	9.2	150	6.2	36	4.7	71	5.5
Annual (mean)	70	6.3	63	5.0	20	4.5	121	6.9	421	8.1	100	5.7	35	5.3	97	5.8

Cape Town and Simon's Town (Cape Town International Airport)

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	20.9	15	1009.4
February	21.0	17	1008.8
March	19.8	20	1010.0
April	17.5	41	1011.5
May	14.8	69	1012.9
June	13.0	93	1015.8
July	12.2	82	1016.7
August	12.7	77	1016.3
September	14.0	40	1014.3
October	16.0	30	1013.4
November	18.4	14	1011.9
December	19.9	17	1009.8
Annual	16.7 (mean)	515 (total)	1012.6 (mean)

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	32	4.8	5	3.4	2	5.3	109	7.9	471	7.8	127	5.2	15	5.2	124	6.1
February	23	5.2	7	4.1	1	6.5	115	7.6	413	7.5	150	5.1	19	4.6	118	5.8
March	27	4.5	11	3.5	4	5.5	95	7.1	374	6.6	145	4.6	24	4.5	110	5.4
April	57	5.2	23	3.9	5	5.8	90	6.8	233	5.5	121	3.8	20	3.8	154	5.2
May	103	5.9	45	4.1	3	2.6	59	5.3	137	5.1	60	3.4	26	4.1	218	5.9
June	151	6.5	77	4.3	6	3.1	41	5.9	88	4.7	40	3.2	28	4.3	204	6.1
July	126	6.1	76	4.1	3	4.3	59	5.7	107	4.9	57	3.4	24	4.8	209	6.3
August	106	6.3	47	3.9	5	6.0	86	6.7	157	5.3	51	3.7	30	5.0	211	6.5
September	70	5.9	34	4.1	3	3.8	117	6.5	218	5.9	76	4.0	33	4.8	190	6.7
October	62	5.7	17	3.3	6	6.9	124	7.5	304	6.9	105	4.8	34	5.5	160	6.3
November	35	5.7	6	4.2	5	5.0	143	8.2	416	7.9	120	5.0	31	5.2	124	6.4
December	39	6.2	4	5.3	4	5.3	119	8.1	422	7.9	125	5.5	22	5.2	158	6.4
Annual (mean)	69	5.9	29	4.0	4	5.0	96	7.2	278	6.9	98	4.6	26	4.8	165	6.1

Mossel Bay (Cape St. Blaize)

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	20.9	18	1007.6
February	20.7	23	1007.6
March	19.8	31	1009.3
April	18.2	46	1009.8
May	16.8	37	1010.8
June	15.7	35	1012.9
July	15.0	29	1014.4
August	14.8	44	1013.6
September	15.3	29	1012.3
October	16.3	36	1011.6
November	17.9	32	1009.9
December	19.7	24	1008.1
Annual	17.7 (mean)	384 (total)	1010.7

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	14	3.3	29	6.5	108	10.0	213	7.6	130	6.2	346	6.8	49	5.0	49	3.5
February	15	3.5	39	5.1	115	9.5	203	7.5	120	5.8	306	6.3	55	5.4	64	3.8
March	22	3.8	46	5.1	120	8.8	152	6.7	120	5.5	273	5.9	62	4.9	91	3.8
April	36	3.6	53	4.2	102	8.2	86	5.4	75	4.6	269	5.5	108	5.3	159	4.3
May	42	4.2	57	4.3	62	6.3	49	5.5	43	4.4	249	5.1	156	5.5	273	4.6
June	54	4.3	57	4.2	37	6.1	20	3.9	29	4.2	212	5.2	185	5.5	334	5.3
July	41	4.5	48	4.9	52	7.4	39	5.1	30	4.1	252	5.1	156	5.6	298	5.0
August	34	4.2	49	4.9	74	7.2	65	6.5	47	6.3	287	6.0	148	5.8	230	4.9
September	27	3.8	47	5.2	91	8.9	89	6.4	74	5.7	310	6.3	121	5.4	157	4.4
October	21	4.0	37	5.8	127	9.9	123	7.4	91	6.1	350	6.6	89	5.6	94	4.2
November	15	3.4	32	5.6	118	9.3	194	7.6	111	5.9	336	6.5	64	5.6	57	3.9
December	16	3.1	34	5.3	101	9.6	201	7.4	119	5.9	361	6.8	55	5.7	46	3.9
Annual (mean)	28	4.0	44	5.0	92	8.8	120	7.0	82	5.6	296	6.1	104	5.5	154	4.6

Knysna (George Airport)

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	24.4	134	991.7
February	24.6	113	991.5
March	23.9	120	992.8
April	21.7	73	993.5
May	19.1	59	994.7
June	16.8	28	997.3
July	16.6	39	997.9
August	17.7	62	997.8
September	19.3	73	996.1
October	20.4	98	995.7
November	21.8	108	994.0
December	23.4	102	991.9
Annual	20.8 (mean)	1009 (total)	994.6 (mean)

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	2	1.8	5	3.9	153	5.1	152	4.6	122	4.1	113	4.7	80	4.1	24	3.1
February	0	0.0	8	4.2	166	5.1	122	4.4	125	3.9	100	4.3	71	4.3	26	4.5
March	3	2.5	5	2.1	113	4.6	116	4.1	102	3.5	75	4.2	67	4.6	33	3.0
April	7	3.4	6	2.0	62	4.0	87	3.4	83	3.2	60	4.9	86	5.4	51	4.5
May	20	5.2	10	1.7	41	3.7	51	2.7	59	2.7	63	4.6	111	5.3	130	4.8
June	24	5.9	7	2.3	31	3.4	31	2.7	43	2.7	52	3.8	151	5.3	172	4.7
July	24	4.8	14	2.7	44	3.3	41	3.5	52	3.1	51	4.0	142	5.3	141	4.3
August	14	8.0	13	2.4	67	4.2	67	3.7	71	3.3	66	4.4	134	5.5	107	4.1
September	14	5.0	15	2.1	75	4.7	94	4.2	84	3.3	79	4.8	131	5.2	66	4.2
October	7	4.3	5	3.3	140	4.9	100	4.7	102	3.6	110	5.3	111	4.8	55	3.9
November	4	2.5	3	2.1	163	5.3	125	4.7	117	4.1	106	4.7	103	4.4	25	4.2
December	1	3.0	5	2.7	144	4.7	145	4.5	123	4.0	118	4.6	91	4.9	20	4.0
Annual (mean)	10	5.2	8	2.6	100	4.7	94	4.2	90	3.6	83	4.6	107	5.0	71	4.3

Port Elizabeth

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	21.7	36	1007.1
February	21.6	40	1006.9
March	20.7	54	1007.9
April	18.7	58	1009.2
May	16.6	59	1010.5
June	14.7	62	1013.1
July	14.3	47	1013.5
August	14.7	64	1013.5
September	15.7	62	1012.0
October	17.0	59	1011.4
November	18.5	49	1009.6
December	20.3	34	1007.2
Annual	17.9 (mean)	624 (total)	1010.2 (mean)

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	10	3.4	58	5.2	219	7.1	82	5.0	77	5.6	295	7.2	126	6.8	9	3.1
February	9	3.4	58	5.6	235	7.2	76	4.9	55	5.1	271	7.2	131	6.8	8	3.4
March	12	2.8	65	4.9	198	6.5	63	4.7	50	4.9	239	6.6	153	6.6	13	3.5
April	15	3.3	71	4.6	147	5.7	35	4.2	36	4.8	210	7.0	207	6.1	25	3.6
May	24	3.8	62	4.4	62	5.2	13	3.4	27	4.3	187	6.5	256	6.2	61	3.7
June	40	4.1	69	4.2	35	4.8	8	3.7	18	4.8	150	6.3	276	6.0	103	3.9
July	36	3.9	73	4.8	44	5.5	12	5.0	21	5.2	171	6.7	266	6.0	87	4.3
August	23	4.1	67	4.9	89	6.3	23	5.9	34	4.6	214	7.1	248	6.6	55	3.7
September	17	4.0	72	5.7	136	6.6	36	5.5	45	5.2	236	7.7	231	7.0	31	3.4
October	14	3.5	71	6.3	196	7.5	53	5.4	61	5.6	251	8.2	195	7.3	15	3.9
November	12	2.9	70	5.5	210	7.5	74	5.4	62	5.7	273	7.9	164	7.4	8	3.1
December	8	3.5	57	5.5	196	7.2	72	5.4	84	5.8	299	7.8	144	7.3	8	2.5
Annual (mean)	18	3.7	66	5.1	147	6.8	46	5.0	48	5.3	233	7.3	200	6.6	35	3.8

East London

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	22.0	69	999.6
February	22.1	92	999.7
March	21.3	105	1001.0
April	19.5	83	1002.1
May	17.7	52	1003.8
June	15.9	40	1006.4
July	15.6	47	1006.9
August	15.9	78	1006.4
September	16.7	80	1004.7
October	17.7	102	1003.9
November	19.1	110	1002.0
December	20.7	63	999.8
Annual	18.7 (mean)	921 (total)	1003.0

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	15	4.9	212	7.0	161	6.4	58	3.7	90	4.9	222	6.1	81	4.8	5	3.9
February	17	4.8	237	6.8	159	7.0	46	3.7	78	5.2	193	6.3	103	5.0	6	3.3
March	30	3.9	213	6.1	125	6.2	35	3.3	69	4.7	184	6.1	136	4.6	25	3.1
April	62	3.7	154	5.7	78	5.5	36	3.0	70	4.3	152	6.4	194	5.0	64	3.4
May	87	3.9	80	5.3	53	4.8	29	2.9	58	4.1	140	6.5	237	5.4	150	3.8
June	100	4.2	58	5.2	43	4.4	29	2.4	47	3.7	107	6.6	258	5.9	217	4.2
July	96	4.4	87	5.5	48	4.9	34	2.6	55	3.8	126	6.7	242	5.7	187	4.1
August	76	4.4	121	5.8	66	5.6	40	3.5	71	4.5	147	6.8	245	5.8	115	4.1
September	45	4.3	172	6.5	97	6.3	39	3.8	74	5.4	193	7.2	204	5.6	41	3.8
October	23	4.2	208	7.3	143	6.7	43	4.1	69	5.4	230	7.3	157	5.8	19	3.7
November	17	4.2	200	7.3	155	6.9	47	3.7	89	5.0	236	6.7	110	5.8	11	3.6
December	11	4.8	202	7.0	146	6.5	54	3.7	92	5.1	234	6.8	91	5.4	7	3.3
Annual (mean)	48	4.2	162	6.5	106	6.3	41	3.5	72	4.8	180	6.6	172	5.5	71	4.0

Durban (Durban Airport)

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	24.4	134	1012.0
February	24.6	113	1012.1
March	23.9	120	1013.8
April	21.7	73	1015.3
May	19.1	59	1017.2
June	16.8	28	1020.0
July	16.6	39	1020.7
August	17.7	62	1020.0
September	19.3	73	1017.9
October	20.4	98	1016.8
November	21.8	108	1014.7
December	23.4	102	1012.2
Annual	20.8 (mean)	1009 (total)	1016.1

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	56	4.8	242	6.4	74	5.2	38	3.8	158	6.0	166	5.3	14	2.7	13	3.7
February	75	4.6	240	6.0	86	5.4	35	4.0	141	6.3	151	5.4	12	3.1	11	3.7
March	79	4.8	215	6.6	67	5.0	35	3.7	123	6.3	154	5.1	22	3.3	15	3.9
April	60	4.5	153	6.2	60	4.5	30	4.0	112	6.7	135	4.7	28	3.1	20	2.9
May	43	4.2	110	5.6	53	4.0	20	3.6	98	6.6	131	5.4	35	3.1	29	2.4
June	51	4.4	114	5.7	51	4.0	22	3.5	99	6.5	112	5.2	27	3.6	22	3.0
July	58	4.7	116	6.2	48	3.9	31	4.0	108	6.6	122	5.4	25	4.0	23	2.9
August	74	5.4	145	6.8	50	4.9	29	4.0	130	7.3	140	5.8	25	4.0	23	3.4
September	84	5.7	195	7.1	49	5.5	29	4.2	144	6.9	183	6.0	24	3.7	17	3.9
October	86	5.7	233	7.2	60	5.3	32	5.0	164	6.8	188	6.1	24	3.5	17	4.6
November	71	5.8	245	6.7	69	5.3	37	4.1	168	6.3	166	6.2	17	3.3	15	3.1
December	60	5.4	252	6.6	71	5.2	43	3.8	180	6.1	151	6.1	12	3.3	10	3.0
Annual (mean)	66	5.1	188	6.5	62	4.9	32	4.0	135	6.5	150	5.6	22	3.4	18	3.3

Richards Bay

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	25.2	172	1008.8
February	25.0	167	1009.1
March	24.6	107	1010.5
April	22.5	109	1011.6
May	20.0	109	1013.5
June	17.7	57	1016.3
July	17.6	60	1017.5
August	19.0	65	1016.3
September	20.3	77	1013.7
October	21.3	105	1014.0
November	22.7	114	1011.7
December	24.5	86	1009.1
Annual	21.7 (mean)	1228	1012.7

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	24	5.3	366	7.2	99	6.5	56	6.3	70	7.4	210	7.9	19	5.4	83	5.5
February	35	5.9	316	6.4	67	6.2	102	7.2	129	8.2	137	8.0	41	4.5	94	4.7
March	34	6.6	326	6.4	64	5.4	68	6.4	49	7.1	193	7.9	49	4.0	133	5.5
April	56	6.4	281	6.2	44	5.3	33	7.7	67	8.9	130	8.1	78	5.1	167	5.1
May	43	5.7	197	5.9	22	5.7	29	7.1	100	8.0	176	8.5	93	5.2	197	5.0
June	67	5.5	200	5.8	26	4.2	15	8.0	89	7.6	163	8.1	107	5.6	200	5.1
July	29	4.9	194	5.7	50	4.1	47	4.8	82	8.2	190	8.9	104	5.2	201	5.0
August	42	5.2	239	6.6	55	6.2	58	5.7	103	8.5	139	7.1	61	5.4	203	5.5
September	60	6.4	267	7.1	63	7.1	46	5.9	69	7.1	195	8.1	78	6.1	126	5.9
October	65	6.3	253	7.3	74	5.6	76	6.6	120	7.3	161	7.8	57	5.1	117	5.8
November	58	6.8	311	7.2	75	5.8	86	6.8	86	7.4	172	7.6	39	4.5	108	6.5
December	28	6.5	329	6.9	73	6.3	65	6.0	73	6.0	208	7.5	22	4.6	129	5.8
Annual (mean)	45	6.0	273	6.6	59	5.8	57	6.5	86	7.7	173	8.0	62	5.2	147	5.4

Walvis Bay (Pelican Point)

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	17.6	1	1011.3
February	17.9	2	1010.5
March	17.2	5	1011.1
April	15.7	1	1012.3
May	15.6	1	1014.2
June	15.2	2	1016.8
July	14.1	0	1017.2
August	13.2	0	1017.1
September	13.2	0	1015.7
October	14.0	0	1014.5
November	15.3	1	1013.6
December	16.6	0	1012.0
Annual	15.5 (mean)	13 (total)	1013.9 (mean)

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	33	4.2	16	2.3	3	1.3	29	2.2	164	5.0	323	5.2	140	2.8	127	3.7
February	30	3.6	9	2.2	7	1.8	38	2.4	185	5.4	319	5.0	134	2.9	107	3.4
March	25	3.9	11	1.9	6	1.8	55	3.6	234	6.0	335	5.8	95	2.7	68	2.8
April	19	3.1	12	2.7	20	2.3	77	2.8	260	5.9	339	6.2	59	2.8	50	2.8
May	21	3.4	36	3.8	35	3.0	101	3.1	275	5.8	269	5.6	51	3.1	50	2.8
June	24	3.8	41	4.0	67	3.4	97	3.4	263	6.2	232	5.5	58	2.7	52	3.3
July	35	4.1	37	3.3	42	3.1	95	3.4	254	6.5	259	6.3	50	2.6	56	3.1
August	34	4.3	23	2.9	27	2.2	88	3.3	256	7.0	298	7.0	57	2.5	69	3.4
September	44	4.1	20	2.6	21	1.8	82	3.4	215	7.0	308	7.3	75	3.3	85	3.2
October	32	4.2	18	2.9	15	1.8	74	2.8	252	7.4	335	7.5	65	2.4	78	3.4
November	40	4.3	16	2.4	11	1.9	46	3.0	192	6.1	340	6.5	92	2.7	116	3.4
December	35	4.2	15	2.4	11	1.9	37	3.0	173	5.1	362	6.0	114	3.1	114	3.6
Annual (mean)	31	4.0	21	3.1	22	2.6	68	3.1	227	6.2	310	6.2	83	2.8	81	3.3

Lüderitz (Diaz Point)

	Air Temperature (Deg C)	Precipitation (mm)	Air Pressure (hPa)
January	17.7	1	1011.1
February	17.8	2	1010.3
March	17.4	3	1011.4
April	16.3	2	1012.9
May	15.5	2	1015.1
June	15.1	3	1018.1
July	14.1	2	1018.3
August	13.7	2	1018.0
September	13.9	1	1016.1
October	14.7	1	1014.9
November	15.8	0	1013.5
December	17.0	1	1011.8
Annual	15.7 (mean)	20 (total)	1014.3 (mean)

Wind data: Average direction frequency per thousand (N) and the average speed (V = m/s) for each of the eight main directions.

	N		NE		E		SE		S		SW		W		NW	
	N	V	N	V	N	V	N	V	N	V	N	V	N	V	N	V
January	31	3.3	6	2.1	12	2.6	122	6.0	493	10.4	182	10.0	31	2.6	47	3.2
February	26	3.7	3	3.1	9	2.5	141	6.0	441	9.8	192	8.4	42	3.0	59	3.6
March	20	3.5	5	4.1	17	3.1	138	5.4	457	8.8	191	7.6	32	2.8	35	3.4
April	39	3.5	9	4.1	30	3.1	139	5.6	396	7.0	169	6.4	30	2.8	56	3.7
May	32	3.9	18	3.3	60	4.3	135	4.5	369	6.4	163	6.0	35	2.4	50	5.0
June	45	4.8	40	4.5	90	5.3	136	4.7	290	6.1	143	5.4	35	2.8	69	4.3
July	53	4.4	35	4.1	74	4.4	136	4.8	330	6.8	144	5.5	41	2.6	50	4.4
August	52	4.8	25	3.9	49	4.5	148	5.9	375	8.4	150	6.7	39	2.4	71	4.8
September	53	4.2	13	3.9	29	2.4	149	6.5	410	9.5	144	7.7	39	2.5	78	4.6
October	45	4.1	11	2.9	19	3.4	150	6.8	453	10.4	141	8.2	41	2.2	69	4.1
November	44	3.4	6	2.7	10	2.3	126	7.9	486	11.4	139	8.4	44	2.7	71	3.8
December	31	3.2	6	2.6	18	6.0	123	6.4	498	10.8	161	9.8	43	3.8	60	3.4
Annual (mean)	39	4.0	15	3.8	35	4.2	137	5.9	417	9.1	160	7.6	38	2.7	60	4.1