

NATIONAL REPORT OF TANZANIA ON SEA LEVEL ACTIVITIES AND OBSERVING NETWORK

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BACKGROUND

The national report of Tanzania on sea level activities has been prepared for the Indian Ocean Sea Level Science Workshop and Fourteenth session of the Group of Experts for the Global Sea Level Observing System (GLOSS) at the National Institute of Oceanography in Goa, India during the week of 19-23 October 2015.

A: INTRODUCTION

Geographically, Tanzania is located in East Africa South of Equator between latitudes 1 to 12 degrees south and 29 and 41 degrees east. It is surrounded by Lake Victoria on the North, on the west is Lake Tanganyika and on the south west is Lake Nyasa. On the eastern side is found western Indian as seen in figure 1 below. It has an area of about 945,200 km² and coastal line of about 1424 km long with three major Islands called Mafia with an area of 518 km², Zanzibar (Unguja) with an area of 1,554 km² and Pemba with an area of about 980 km².

Tanzania is also known as United Republic of Tanzania has two sides, mainland and Isles (Zanzibar). On the mainland side there are three major ports positioned at Tanga, Dar es Salaam and Mtwara while on Isles side there are two operational ports at Zanzibar (Unguja) and Mkoani (Pemba). In those ports tide gauge stations were installed in order to provide sea level information in that area for various use. Among others are for navigation aid of vessels moving to and from the harbours, marine operations and sea level variability.



Figure 1: geographical location of Tanzania

B: STATUS OF OBSERVING NETWORK

The Observing network of sea level in Tanzania is currently consists of two operational and four non-operational (historical) tide gauge stations stations. Those stations are placed in harbour areas.

I. Operational stations:

Currently, operational tide gauge stations in Tanzania are Zanzibar and Mtwara. Zanzibar station (GLOSS Station No. 297) is located on the seaward end of the

main jetty in Zanzibar Harbour off the coast of Zanzibar town at Latitude $06^{\circ} 09.3'S$ and Longitude $039^{\circ} 11.4'E$. This station which is linked to UHSLC and IOC/GLOSS has been operating well since 1984 with few gaps in some days. A satellite sea level transmitting station (tide logger, float type) was installed in February 1993 and upgraded in July 2006 as seen in figure 2 below to accommodate three channels of sea level data collected and transmitted every 15 minutes. Apart from tidal measurements, it is one of the western Indian Ocean tide gauge stations that used for monitoring long term changes of sea level and sea level science studies in the region.



Fig. 2: Zanzibar Station as of July 2006

Mtwara station (GLOSS Station No. 9) was firstly installed in the main harbour sites between latitude $10^{\circ} 17'S$ and longitude $040^{\circ} 11'E$. Munro IH 109 floats type operated from 1959 to 1962 and Munro IH 40 from 1956 to 1957. In September 2009 Mtwara became operational station after reallocation of station to new position at latitude $10^{\circ} 16'7.9''S$ and longitude $40^{\circ} 12'1.3''E$ and installed Radar/Pressure (2)/VaisalaWXT510 Met.. Both the Zanzibar and Mtwara stations provide real time

sea level data to the Indian Ocean Tsunami Warning System. More information of Zanzibar and Mtwara stations are provided in table 1 below.



Fig. 3 Mtwara Port and the New Tide Gauge Hut

II. Non operational (historical) stations

There are four non operational (historical) tide gauge stations on Dar es Salaam port, Tanga port, Latham Island and Pemba Island.

Dar es Salaam tide gauge Station is located at the Ferry Terminal of the Dar es Salaam Harbour ($06^{\circ} 49.2'S$; $039^{\circ} 17.3'E$). This station was established since 1986 operated until 1990 when the instrument was damaged by a boat. An analogy SEBA float gauge was then installed in 1997 and it worked until 2001. The tide charts for this new instrument have however not been digitized todate. The digitizing interval for the analogue charts was hourly, daily values were obtained by filtering of the hourly data. A simple average of all daily values was used to obtain the monthly data.

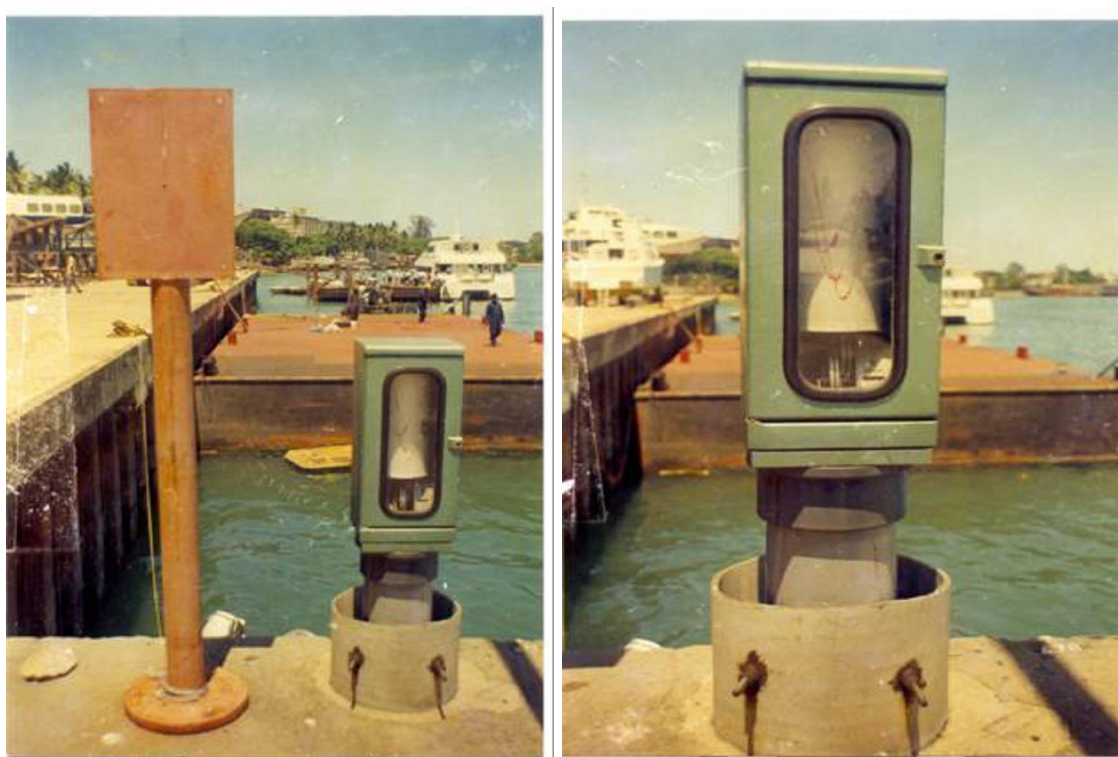


Fig. 4: Dar es Salaam Station Showing Leupold & Stevens (left) and SEBA (right)

The Tanga tide gauge station is located in Tanga Harbour area at $05^{\circ}.04S$ and $039^{\circ}.06E$ operated from 1962 to 1966. The Pemba Island station is located on Mkoani harbour at $05^{\circ}.21S$ $039^{\circ}.38E$. In that station the tide gauge was incorrectly installed in July 1991 and up to this moment it has never be in operation. The tide gauge at Latham Island was installed at $06^{\circ}.50S$ $039^{\circ}.50E$ as an offshore station, it was operational prior up to 1961. There is no supplementary information and data

for this station is not available. Latham Island is locally known as Fungu Kizimkazi is a small, oceanic and isolated island just about 300 m long. It is located 60 km east of Dar es Salaam and 66 km south-east of Zanzibar. The profiles for non-operational stations are in the table 2 below.

C. RESPONSIBLE AGENCIES OF TIDE GAUGE STATIONS

In Tanzania tide gauge stations are operated by individual institutions. The Zanzibar and Pemba island tide gauge stations are managed by the Zanzibar Department of Surveys and Urban Planning. The old tide gauge station at Mkoani in Pemba Island was also managed by the same department. The Dar es Salaam tide gauge station is administered by Tanzania Ports Authority (TPA), previously known as the Tanzania Harbours Authority (THA). Before installation of the new gauge in 1997, the Dar es Salaam Station was under the Institute of Marine Sciences of the University of Dar es Salaam. Old tide gauge stations of Mtwara, Tanga and Latham Island were both under the Division of Surveys and Mapping of the Ministry of Lands, Housing and Urban Development but new Mtwara station is under the responsibility of Tanzania Ports Authority in collaboration with the Land Survey Department in the Ministry of Lands and Human Settlements Development.

D. GPS TECHNOLOGY IN THE NETWORK

At the moment there is no GPS technology employed in Tanzania sea level network. However, periodic leveling is carried out in the operational stations. Maintenance and leveling was last performed in February 2003 for Zanzibar station, and in July 1997 for Dar es Salaam station.

Table 1: Profile of Operational tide gauge Stations

| Station Name | Location | | Responsible Organisation | Collaborating Institution(s) | Type of gauge/ Manufacturer | Data Span | Mode of Transmission | Others Sensors | Remarks |
|--------------|--------------|-------------|---|-----------------------------------|--|----------------------|--|-----------------------|--|
| | Lat. | Long | | | | | | | |
| Zanzibar | 06.49S | 39.17E | Zanzibar Department of Surveys and Urban Planning. | UHSLC | Radar/Vegapuls Pressure/Druck Float/ Vaisala | March 1984 to date | Real time | Nil | No significant gaps, Connected to GTS |
| Mtwara | 10.17S | 40.11E | Tanzania Department of Surveys and Urban Planning | NIL | Munro IH 40; Munro IH 109 | 1956-1957; 1959-1962 | Delayed Mode | Nil | Only monthly & annual data are available |
| | 10°16'7.9"S; | 40°12'1.3"E | Tanzania Ports Authority; TZ Surveys & Mapping Division | GeoForschungs Zentrum (Germany) | Radar/Pressure (2) / Vaisala WXT510 Met | Sept-2009 to date | Real Time, (past 30, 15 min intervals) | Pressure (prs & prs2) | Connected to GTS |

Table 2: Profile of non-Operational tide gauge Stations

| Station Name | Location | | Responsible Organisation | Collaborating Institution(s) | Type of gauge/ Manufacturer | Data Span | Data Sensors | Remarks |
|-----------------------|----------|--------|--|---------------------------------------|--|-----------------------------|--------------|---|
| | Lat. | Long | | | | | | |
| Dar es Salaam | 06.49S | 39.17E | Institute of Marine Sciences (University of Dar es Salaam) | UHSLC, Tanzania Ports Authority (TPA) | Pressure/Leupold and Stevens, Model A-71 | 6 July 1986 to 30 Sept.1990 | Pressure | Analogue SEBA float gauge was installed in 1997 |
| Tanga | 05.04S | 39.06E | Tanzania Surveys and Mapping Division | Not Available | Munro IH 40 | 1962-1966 | Pressure | Only monthly & annual data is available |
| Pemba Island (Mkoani) | 05.21S | 39.38E | Zanzibar Dept of Surveys and Urban Planning | Not Available | Munro IH 109 | None | Pressure | No data is available |
| Latham Island | 06.50S | 39.50E | Not Available | Not Available | Not Available | None | Pressure | No data is available |

E. AVAILABILITY AND SPAN OF DATA FROM STATIONS

Below summarizes the availability of data from both operational and historical (non-operational) tide gauge stations in Tanzania.

| Name of Station | Span of Data | Data Sources |
|-----------------------|---|---------------------------|
| Zanzibar | 1 March 1984 to-date | UHSLC, PSMSL, NODC, GLOSS |
| Mtwara | 1956 to 1957; 1959 to 1962 September 2009 update | PSMSL, GLOSS |
| Dar es Salaam | 6 July 1986 to 30 September 1990 | UHSLC, PSMSL |
| | 8 July 1997 to-date (Unprocessed) | TPA |
| Tanga | 1962-1966 | PSMSL |
| Mkoani (Pemba Island) | NIL | Not available |
| Latham Island | NIL | Not available |

Table 3: Span of data and sources for Operational and Historical stations

ABBREVIATIONS

UHSLC: University of Hawaii Sea Level Centre
PSMSL: Permanent Service for Mean Sea Level
NODC: National Oceanographic Data Centre
GLOSS: Global Sea Level Observing System
TPA: Tanzania Ports Authority

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