IOC / OdinAfrica / GLOSS

Technical Visit to Madagascar and Comoros

28 April to 10 May 2006

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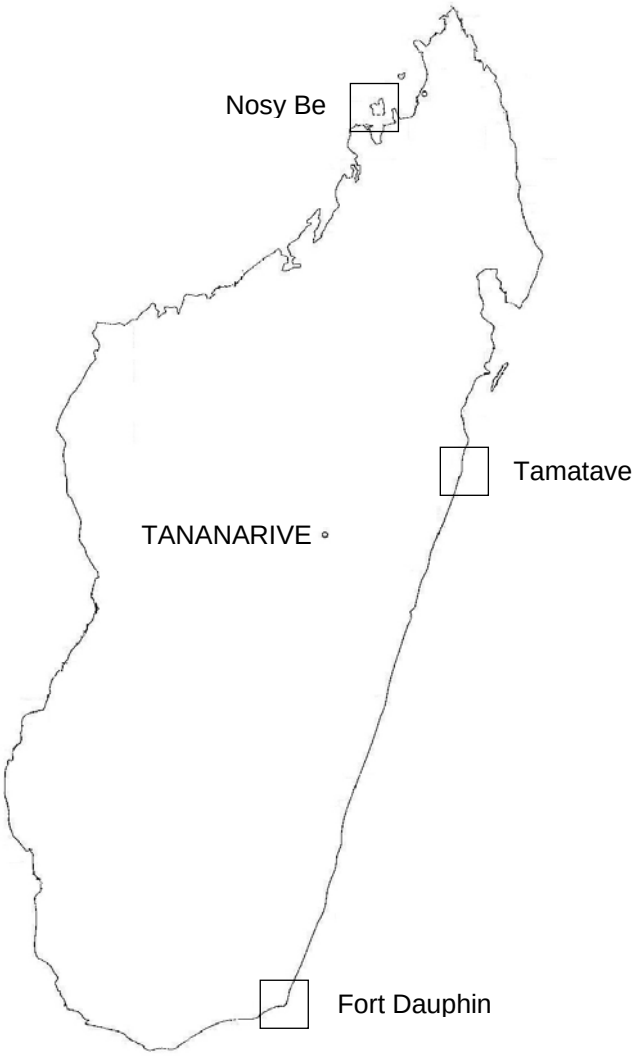
1. Schedule

The technical visit covered the period from Saturday 28 April to Tuesday 10 May 2006.

Madagascar	Hell-Ville (Nosy Be island)	29 April to 2 May
Madagascar	Tamatave (Toamasina)	3 May to 5 May
Madagascar	Fort-Dauphin (Talagnaro)	5 May to 7 May
Comoros	Moroni (Grande Comore)	8 May to 10 May



MADAGASCAR

2. Objectives

Determine suitable locations for new tide-gauge instrumentation for the OdinAfrica and GLOSS program.

Assess provision of mains electrical power, security and future safety of sea level equipment.

Location and details of geodetic survey bench marks near the possible future tide gauge.

Determine the location of existing tide-gauges.

Determine the skills in sea level observations of the station staff associated with the project.

Photograph each site and collect any relevant information

3. Additional material

Refer to various documents associated with this report :

Site photographs (digital files)
List of contacts

Additional documents for :

Madagascar :

IOC National Report “Sea level measurement and analysis in the western Indian ocean” – Madagascar – July 1999

Tide measurement station sheets from SHOM (French Hydrographic Office) for Nosy Be and Tamatave.

Plan of Fort-Dauphin (scanned) from the port master

Comores :

IOC National Report “Sea level measurement and analysis in the western Indian ocean” – Comores – July 1999

Tide measurement station sheets from SHOM (French Hydrographic Office) for Moroni.

4. HELL-VILLE (Nosy Be)

4.1 Introduction

Coastal Hell-Ville town is located in the south of Nosy Be island (North-west of Madagascar – 13°20'S / 48°15'E).

Tourism is in good shape in Nosy Be because of the presence of the natural reserve of LOKOBE and the well-know Nosy Komba and Nosy Tanikely islands (diving, hiking, sailing …).

A direct flight exists between the "Fascène" airport of Nosy Be and the "Ivato" airport of Tananarive.

The big problem of the town is power supply. There are several power cuts a day (several hours long). The power plant (Sirama company) installations of the island are more 30 years old and do not allow a constant supply.

4.2 CNRO

The "Centre National de Recherches Océanographiques" (CNRO) is under the Ministry of National Education and Research authority. The centre operating budget for the year 2006 has doubled in order (i) to repair retaining wall of some buildings damaged by a storm; and (ii) to rebuild the tide gauge pier (see section 4.4).

CNRO centre is apart from the Hell-Ville town. Access is difficult because of the bad condition of the road (about 4 km long). The road will be repaired this summer.

The director Mr Jean Paul TOUSSAINT escorted me to the centre jetty to check the tide gauge installation.

I met the two technicians (M. Adouhouri and M. Anjara Jean-René) that work with maintenance of the tide gauge. They have experience with the OTTR16 tide gauge maintenance. Some training may be needed to use digital sea level measuring equipment (such as radar gauges) and in quality control of sea level observations.

The main activity of CNRO is the control (counting) of catches of the local fisheries. The CNRO has at maximum 10 employees.

4.3 Port of Hell-Ville

Activities of the port of Hell-Ville are mainly associated with the trade of prawns. A ship comes once a week to load the freight destined for exports.

It was not possible to meet the port master. The port is very small and there is no suitable location for a new tide gauge (see appendix, figure 8). Security of the port is very limited.

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4.4 Tide gauge

The tide gauge (floating sensor OTT R16 model) was operational until May 2003. After a series of problems, the tide gauge was stopped in June 2003. After looking at the tide records, it appears that the floating sensor was blocked in the stilling well tube. The bottom of the stilling well is now buried in muddy sand. The tide gauge equipment has been removed from the tide house. The power supply of the tide house has been cut and the tide pole has disappeared.

Tide range is about 4 metres.

The pier was seriously damaged by the storm GAFILO in 2004. It must be rebuilt before any tide gauge installation. (See figure 1 below)

Figure 1 : Pier of CNRO (damaged by GAFILO storm) with the tide gauge hut

A tide bench mark has been located in the gate of the old entrance of CNRO. (See figure 2 at right)

It's a reliable TBM embedded by the French Hydrographic Office and can be used if needed.

The distance between the BM and the tide house is about 80 metres, and not too long for classic levelling.

Figure 2 : French Hydrographic Office BM

4.5 Conclusion

At present, there appears to be some conditions that severely limit the installation of a new tide gauge at Nosy Be;

- the pier of CNRO must be rebuilt before the construction of a new tide house. (This may be done this summer according to the director of CNRO)

- the power supply for the tide gauge must be maintained permanently. Solar panels are likely not sufficient to allow a tide gauge to function during several hours of power cut.

4.6 Contacts during the visit

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5. TAMATAVE (Toamasina)

5.1 Introduction

Coastal town of Tamatave is located in the east part of Madagascar.

5.2 Port of TAMATAVE (Toamasina)

The port of Tamatave is the main commercial port of Madagascar which handles 80 % of merchandise of the country. The port handles shipments of approximately 100 000 containers per year.

About 1 000 dockers are working there. Security is maintained by a control point at the port entrance and can be considered as a secured restricted area. A police station is also located within the port.

A visit of the port with the port master has been carried out in order to find a suitable location for a new tide gauge.

Several projects of pier extensions are planned in the years to come in order to increase the merchant capacity of the port. An oil terminal will be transferred to a location closer to the refinery.

5.3 Tide gauge

The old tide gauge installations (tide house, tide well and associated BM) have been destroyed and replaced by a fresh new car park in 2005 (see figure 3 below).

Figure 3 : The location of the old tide gauge is (approximately) just behind the van.

The old tide gauge has been found in a warehouse. It's an A-OTT model (20-154 s/n : 176444) initially installed by the French Institute ORSTOM in 1950s.

Tide range is about 50 cm in Tamatave port.

A staff (used as a tide pole) is embedded in a quayside of the harbour basin 1. But nobody has an idea of the offset between the tide pole zero and the chart datum. Readings are made at LW and HW and used for an interpolation calculation with the heights written in the French Tide Tables for Indian Ocean.

5.4 Conclusion

There are two elements which complicate an installation of a new tide gauge ;

- No bench mark (BM) within the harbour has been found. An old BM at the port entrance was not found again. The process to determine the sensors offset from the vertical datum is difficult to realize quickly. According to the FTM, a BM is present at the university but far from the port.
  A solution using an accurate GPS processing should be proposed the French Hydrographic Office (SHOM).

- There does not appear to be a suitable location to install a new tide gauge. Harbour basin 1 could be a good location but the state of the quaysides don't allow a perennial installation. A location in front of the harbour office could be selected but this site must be checked during a windy day to control wind effects.

- There does not appear to be personnel with tide gauge measurement skills among the port employees.

See appendix for more details.

5.5 Contacts during the visit

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Société d'exploitation du port de Toamasina

Mr **JAMI INJONA**
Pilot
Société d'exploitation du port de Toamasina

6. FORT-DAUPHIN (Talagnaro or Taloanaro)

6.1 Introduction

Coastal town of Fort-Dauphin is located in the south-east of Madagascar.

The main activity of Fort-Dauphin is the tourism because of presence (in the hinterland) of national park (Andohahela) and nature reserves (Nahampohana and Berenly).

6.2 Port of Fort-Dauphin

The port of Fort-Dauphin is very small (see figure 4). Merchant activities are practically nonexistent. The reasons are :

- the approaches of the port via Dauphine bay are extremely dangerous because of existence of many wrecks
- a steady (and sometimes heavy) swell sweeps across the harbour
- no industry in the vicinity of the town
- access roads to the town are in very bad conditions

Ships never berth alongside.

A visit of the port installations was organized with the port master. There isn't any guard to ensure the security of the port. Any gate also. Many damaged containers, neglected within harbour, are used by poor people as habitation.

Figure 4 : View of the Fort-Dauphin port.

6.3 Tide gauge

The old tide gauge installed by the French organisation ORSTOM has not been in operation since 1973). The stilling well has been found (20 cm of diameter). See appendices for more details.

The National Institute of Geodesy and Cartography of Madagascar (FTM) and the Centre National des Recherches sur l'Environnement (CNRE) have installed a floating sensor tide gauge at the end of the main pier but the instrument stopped functioning correctly in 1998. In 2001, a big fissure (crack) appeared in the tide house wall and the equipment has been recovered. The tide gauge hut collapsed in 2002. It's difficult to find the exact location of the corresponding ruins without an accurate plan (see figure 5 below).

Figure 5 : Ruins (probably) of the old tide house installed by CNRE and FTM (at the end of the main pier).

The BM installed by FTM has been located, embedded in the retaining wall of the port entrance lighthouse (see figure 6 below).

Figure 6 :

Bench Mark (rivet) embedded in the retained wall of the lighthouse.

6.4 Conclusion

Installation of a tide gauge at this location poses several serious challenges that need to be addressed:

- Port security is very limited.

- There is a strong swell within the harbour. Pressure and radar sensors records will be probably can be difficult to process because of an irregular variation of water level. Winds have to be taken into account.

- There is presently little human capacity dedicated to maintaining a tide gauge and processing sea level data.

There are plans to construct a new port. The selected location is closer to the airport in the south part of bay “of Gallions”. The construction of a seawall is mandatory to protect correctly the new port and several yeas of port constructions are envisioned.

6.5 Contacts during the visit

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Mr **RAJAONARIVELO** Jean-Claude
Port master since 2001

7. Moroni (Grande Comore - COMORES)

7.1 Introduction

« Grande-Comore » island (as known as Njazidja) is the larger volcano island of the COMORES archipelago (Indian Ocean).

Coastal town of Moroni is located in the west part of the island (43°14,5' E – 11°42'S).

Figure 6 : Archipelago of COMORES

7.2 Port of Moroni

Port of Moroni is the only commercial port of the island. The first jetty was built by France in 1954. A second quay (called "grand quai" – 80 metres long) was added in 1991 in order to increase the merchant capacity of the port (see appendices for more details).

Vessels with draft less than 4.2 metres can berth alongside (L.O.A. less than 65 m).

Harbour basins bottoms are increasingly by debris and trash reducing water depth. Dredging operations (in order to clean the basins) are often scheduled but not regularly completed.

The north part of the new quay is sinking slowly in water. The south part doesn't offer enough space and enough water depth to install the tide house and the tide gauge well (see figure 7).

Figure 7 : South part of the “grand quai”

Security of the harbour is ensured by the presence of a police station located within the harbour. Moreover, guards of a private security company are present during the night.

There isn’t any problem of power supply.

7.3 Tide gauge

No tide gauge is in operation at Moroni.

Only an old bench mark (1953) could still be present, embedded in the lighthouse building of the islet “Souadzou” (or “Souazou”) (see figure 8).

Figure 8 : Souadzou islet with ruins of the lighthouse.

The lighthouse is in ruins and the power supply is probably cut. Moreover water depths around the islet seem not to be sufficiently deep for a tide gauge installation. It was not possible for me to check the islet installation. Among the local contacts, nobody knew of the existence of the bench mark on the lighthouse.

Tide range is about 4 metres.

7.4 Other sites for installation

Sites listed by the mission report n°13 of UNESCO (July 2005) has been visited in the north of the island. These sites are “Mitsamiouli” and “Bangua Kouni”. For both sites, the tide gauge installation must be considered as too difficult to realize. Very shallow waters do not allow an installation alongside the coast. The only solution could be to build offshore tide gauge huts (fully self sufficient with power) far from the coastline. No security is secured and installations could be easily be damaged by a storm. The sites therefore seem highly unlikely candidates for installation.

7.5 Conclusion

Although an acceptable level of security and facilities, the harbour of Moroni does not offer a real suitable location for a tide gauge installation.

7.6 Contacts during visit

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Permanent Representative of Comoros With WMO
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8 Appendix

Figure 9 : View of the port of Hell-Ville

Figure 10 : View of the harbour office of Tamatave
(Could be a location for the new tide gauge ; easy power supply, in front of the pilot office, … but no protection again waves (or swell) from wind and tide house to build).

Figure 11 : View of the main pier of the port of Fort-Dauphin

Figure 12 : View of the new pier of the port of Moroni
(at left behind, the old first pier of the port)
There is not enough water depth to install the tide gauge here and the concrete blocks are collapsing into water