



**NF-POGO Visiting Fellowship for  
Ship-board Training**

**Fellowship Report**

**Name of Trainee:** Founi Mesmin Awo

**Name of Supervisor (Parent Institution):** Prof. Isabelle Ansorge

**Supervisor (Host Institution):** Dr. Marcus Dengler

**Dates of Training:** 14 April to 13 May 2023

**Topic of Training:** *Variability of salinity in the tropical Angolan upwelling region during the cruise R/V Meteor M189*

**Section A**

**(To be completed by the fellow and returned to the POGO Secretariat)**

*Please note that this form will be passed on to the host and parent supervisor and when complete will be made publicly available on the [OTP](#) website;*

**1) Please provide a brief description of activities during the training period:**

The tropical Angolan and Benguela Upwelling Systems are a highly productive marine ecosystem in the southeast Atlantic. Fisheries are widely developed along the shores and are critical for economic security and the employment of local coastal communities. However, the physical processes behind these upwelling systems are complex and not fully understood. The objectives of the cruise R/V Meteor M189 were therefore to complete a physical-biogeochemical survey of the tropical Angolan and Benguela upwelling systems with state-of-the-art instruments to enhance and service the ocean observing system off southwest Africa. As a NF-POGO Shipboard Training fellow participant, my goals for joining the cruise were to experience “real” ocean data acquisition on a research vessel and to carry out research training project on the variability of ocean salinity along the Angolan coast during the cruise.

After an overview presentation of the cruise programme by the Chief Scientist at beginning of the cruise, several instruments were being set up for deployment during the first section along 23°S. Among these instruments, I was trained on the different components of the CTD/rosette system to take hydrographic measurements at different stations, the use of drifters to track the movement of internal waves, the microstructure profiler to make turbulence measurements. Different types of ADCP moorings were deployed to measure the ocean circulation. I gained skills in data acquisition using on-board instrumentation and water analysis methods such as salinometers to determine the salinity of water samples. I also acquired skills in the calibration of the two thermosalinographs (TSGs) that were continuously measuring Sea Surface Temperature (SST) and Sea Surface Salinity (SSS) during the cruise. Autonomous platforms such as gliders with various auxiliary sensors were deployed to sample the physical and biogeochemical parameters in the tropical Angolan upwelling region. Before a CTD

station, I used the protocol to carefully prepare for the deployment and monitoring of the CTD. I also learnt to accurately collect water samples from the Niskin bottles of the CTD for determining salinity and oxygen concentration that are used to calibrate conductivity and oxygen sensors of the CTD and to determine nutrient concentrations in the water column. I also became acquainted with setting up and deploying the microstructure sonde that allows to determine the dissipation rate of turbulent kinetic energy from very high-resolution current shear measurements. The dissipation rate of turbulent kinetic energy is the main physical parameters controlling diapycnal mixing in the ocean.

Near the end of cruise, I analysed the SSS and SST data recorded by the TSGs and compared it with a near real-time satellite product (Figure 1). The recorded data cover Angolan and Namibian waters from 23°S to 6°S, with gaps between 20°S and 17°S due to the TSG switching off at the end of the authorised measurement period in Namibian waters. Generally, higher temperatures above 29°C were measured in the Angolan water (7°S-17°S), while the temperatures dropped to below 19°C in the Namibia water (20°S-23°S) (Figure 1.a). The associated absolute wind forcing is weaker along the Angolan coast while it is stronger along the Namibian coast with a speed of around 12m/s (Figure 1.b).

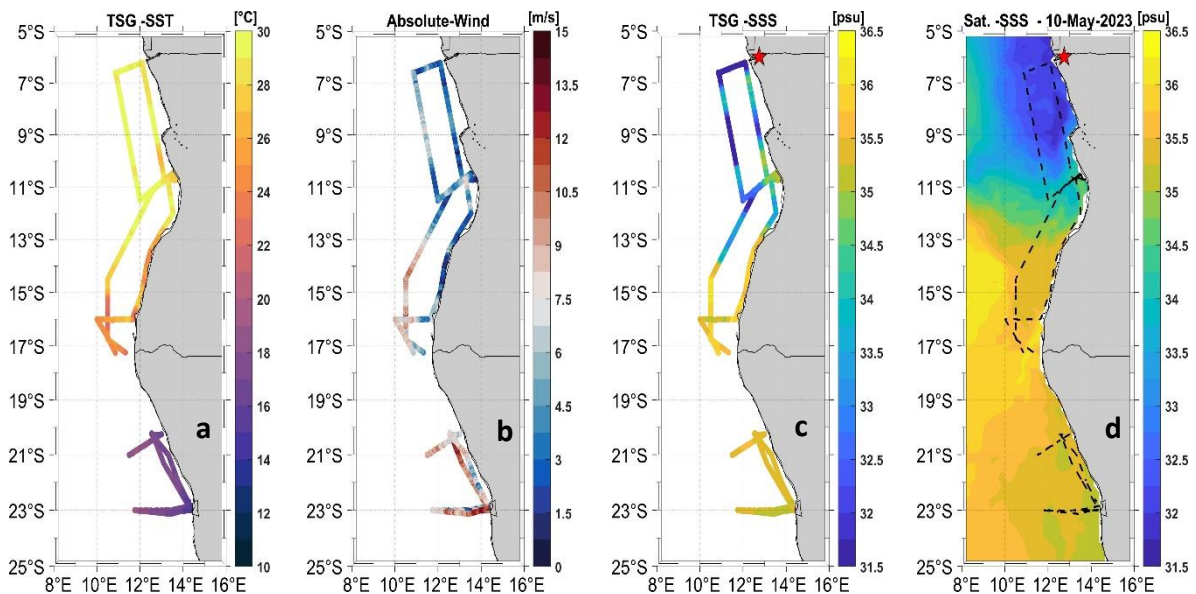


Figure 1: TSG measurements for temperature (a) and salinity (c), the absolute wind (b) in the Angolan and Namibian waters during the Meteor cruise M189. The near-real-time of SSS satellite product averaged in the week of 3rd to 10th May 2023. The tick line in figure 1.d is the cruise itinerary. The red star on Figure 1.c and 1.d (at 6.2°S, 12°E) represents the position of the Congo River mouth. The near-real-time weekly satellite products are publicly available on the Copernicus website via this link: [https://data.marine.copernicus.eu/product/MULTIOBS\\_GLO\\_PHY\\_S\\_SURFACE\\_MYNRT\\_015\\_013/description](https://data.marine.copernicus.eu/product/MULTIOBS_GLO_PHY_S_SURFACE_MYNRT_015_013/description)

Regarding the salinity, the TSGs measured values below 32 psu in the northern Angolan waters and relatively low salinity around 35 psu in Namibian waters (Figure 1.c). To better understand the SSS distribution off the coast, Figure 1.d presents the weekly averaged of SSS values from the near real-time satellite product that combines SSS images from multiple satellite sources. The weekly averaged SSS distribution (3rd to 10th May 2023) corresponds to the period of intense in-situ measurement



activities in the Angolan water. The satellite product confirms the presence of low salinity in the northern Angolan region, apparently originating from the Congo River outflow, with salinities below 32 psu (Figure 1.d). In the Namibian coast, the surface salinity is around 35 psu while in the Angola-Benguela frontal region (15°-19°S) the salinity is relatively high with values around 36 psu. The satellite product agrees well with the TSG measurements. Moreover, the cruise period (14th April to 13rd May) corresponds to the transition time when the physical processes following the seasonal Angolan upwelling maximum in austral winter (June to August) are occurring, leading to mixing of the upper water column along the Angolan coast. As observed for the TSG temperature (Figure 1.a), this mixing signature also seems to be observed for the salinity along the northern Angolan coast (Figure 1.c), where the low salinity intrusion is gradually disappearing along the coast, probably due to elevated mixing at the base of the mixed layer.

## **2) What applications of the training received do you envision at your parent institution?**

Based on the huge amount of data collected during cruise M189, my vision is to describe a set of physical conditions characterising the coastal waters during the R/V Meteor M189 cruise, especially the freshwater situation during the cruise, and to compare these with historical cruise data to evaluate our regional model study of the Angolan tropical upwelling system (Awo et al., 2022).

Reference:

Awo, F. M., Rouault, M., Ostrowski, M., Tomety, F. S., Da-Allada, C. Y., & Jouanno, J. (2022). Seasonal cycle of sea surface salinity in the Angola upwelling system. *Journal of Geophysical Research: Oceans*, 127, e2022JC018518. <https://doi.org/10.1029/2022JC018518>

## **3) Please provide your comments on the Fellowship Programme.**

The NF-POGO Shipboard Training Fellowship was a great opportunity to gain my first real experience of ocean data acquisition and life on board a research vessel. I was very excited to join the RV Meteor cruise to carry out the ambitious M189 cruise programme with the scientific team on board. I gained a lot on research experience on cruise and strengthened my collaboration with GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany for my research project and for future work. The NF-POGO Shipboard Training Fellowship is an excellent capacity strengthening program and suitable to make a dream of many young oceanographers come true that are willing to experience their first ocean data acquisition on a research vessel. I am still looking forward to being part of future research cruises to broaden again my cruise experience.

### **PRINT NAME**

Founi Mesmin Awo

---

**Date:** 06/10/2023

**Section B**

**(To be completed by host supervisor and returned to the POGO Secretariat)**

*Please note that this form will be passed on to the parent supervisor and trainee and when complete will be made publicly available on the [OTP](#) website;*

**1) Please provide your comments on the performance of the trainee.**

Dr. Awo was very enthusiastic about all aspects of data sampling and eager to learn about the preparation and deployment of instruments to observe the ocean. During his watch period, we thus assigned him to the deployment and preparation of a variety of different observatories such as CTD, moving vessel profiler, turbulence measurements with a microstructure profiler, handling of gliders and mooring equipment. In the off-watch period, he learned how to calibrate thermosalinograph data using salinity values from the CTD and from water samples measured by salinometers as reference. Additionally, he compared the calibrated data to salinity data from satellite retrievals. To achieve these goals, he worked independently on complex topics, developed a clear understanding of the elaborated calibration methods and interacted with other scientists on board. It was a great pleasure working with him.

**2) Is this exchange likely to lead to future collaboration with the trainee's parent institution? If so please give example(s) of how this collaboration may be pursued.**

Dr. Awo was engaged in a postdoctoral program at the Tutu Nansen Centre of the University of Cape Town, South Africa, when he became POGO fellow and joined the cruise. Within the Physical Oceanography Division at GEOMAR, we enjoyed a fruitful collaboration with the former supervisor of Dr. Awo, Prof. Mathieu Rouault, who unfortunately passed away just recently. Nevertheless, Dr. Awo is planning a research visit at GEOMAR in autumn this year, during which he will collaborate with colleagues at our research division to investigate the impact of salinity on fish stocks in the Angola-Benguela upwelling region. I envision that the fruitful collaboration with Dr. Awo and his future supervisor is of long-lasting nature and will be maintained in the future.

**3) Please provide your comments on the Fellowship Programme.**

The NF-POGO Fellowship for Ship-Board Training is an ideal program for students from developing countries and from countries in transition to experience oceanographic data collection at sea and to



interact with researchers, technicians and students from developed countries. This experience as such is in many aspects of great benefit for the fellow's career. The targeting of post-graduate students is exemplary due to their high level of receptiveness and professional qualification. A prominent outcome of the NF-POGO-GEOMAR Fellowship program was that we learned from each other while advancing our knowledge about ocean science integrated in the cultural and political dimension of the human, country and ocean interactions.

**PRINT NAME**

**Marcus Dengler**

---

**Date:**

**June 7<sup>th</sup>, 2023**

**SECTION C**

**(To be completed by parent supervisor and returned to the POGO Secretariat)**

*Please note that this form will be passed on to the host supervisor and trainee and when complete will be made publicly available on the [OTP](#) website;*

**1) Do you agree with the above comments and do you have any additional feedback you wish to provide?**

Fully supported – Dr. Founi Mesmin Awo is an invaluable contribution to the Oceanography Department at University of Cape Town and this fellowship is an extremely important opportunity for Mesmin to grow his academic and research career.

**PRINT NAME**

**Prof Isabelle Ansorge – Head of Oceanography Department, University of Cape Town, South Africa**

---

**Date: June 7<sup>th</sup>, 2023**