

## 4<sup>th</sup> Weekly Report M131, Recife-Walvis Bay

07.10.-12.11.2016

At the end of the fourth week of METEOR cruise M131, we have finished our research program in our northernmost research area between 11°S and 6°S composed of high-resolution measurements at CTD and microstructure stations, mooring work, glider deployments and recoveries as well as continuous measurements with both underway CTD systems on board. In the middle of the work program, a reception in the port of Luanda was planned since a while. The organisation of the reception was only possible because of the great help of the INIP (*Instituto Nacional de Investigação Pesqueira Republica de Angola*) and the German Embassy in Luanda. The visit of METEOR was very well received in Angola. We could welcome aboard METEOR two ministers, the Minister for Fisheries Dra. Victoria Barros Neto and the Minister for Science and Technology Maria Cândida Teixeira, and the state secretary for aquaculture Dr. Carlos Martinó Cordeiro (Fig. 1). Correspondingly large was the interest by the media with several interviews given to journalists from press and television.



**Fig. 1:** During the reception aboard METEOR in the port of Luanda on October 25. From left: captain Rainer Hammacher, Dra. Victoria Barros Neto – Minister for Fisheries, chief scientist Peter Brandt, Maria Cândida Teixeira – Minister for Science and Technology, Rainer Müller – German Ambassador in Angola, Dr. Carlos Martinó Cordeiro – State Secretary for Aquaculture, Paulo Coelho (photo: SvN).

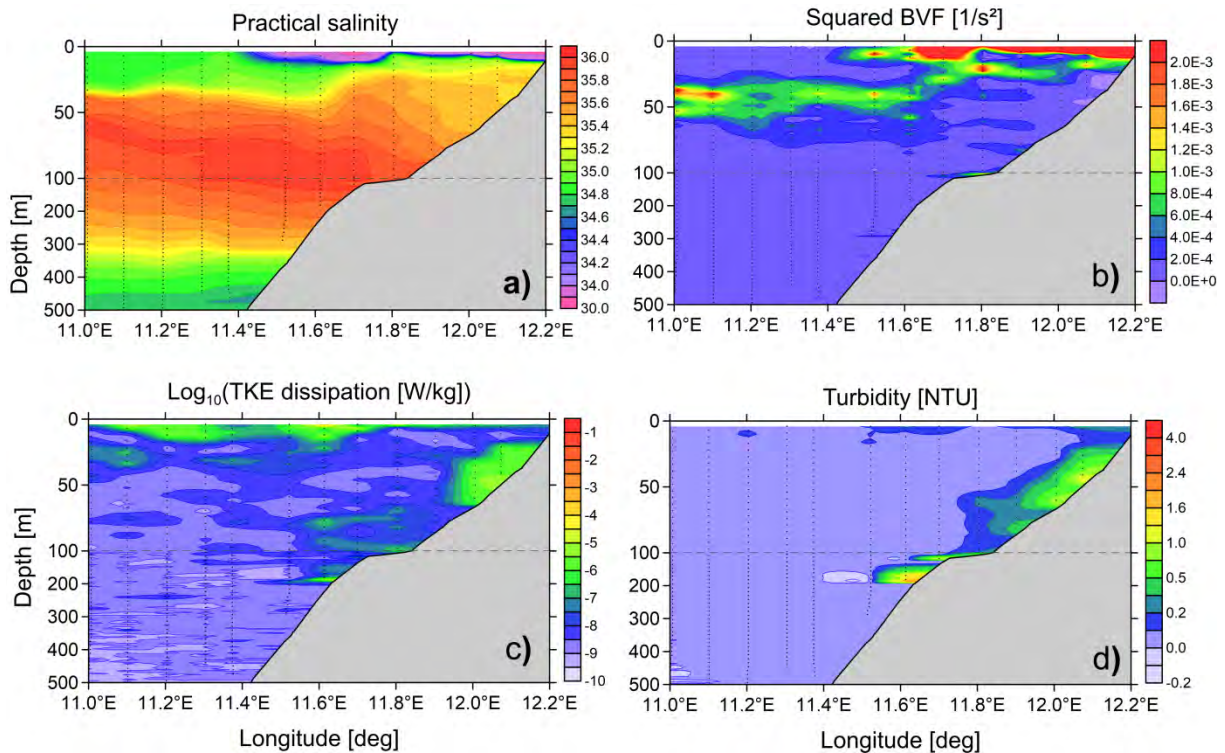
In her speech, the fishery minister Dra. Victoria Barros Neto pointed toward the importance of climate change, which represents a grand challenge for the socio-economic development of Angola. The marine ecosystem has been threatened by the consequences of the phenomenon El Niño and the global temperature rise. The minister was pleased about the good collaboration with German marine research institutes and particularly thanked the German government for the support to investigate the dynamics of the marine ecosystem of Angola. After the welcome speeches, which were given besides the fishery minister by captain Rainer Hammacher and the German Ambassador, I had the possibility together with Paulo Coelho from our crew to present our research topics and the work at sea. We have discussed the recent warming of about 1°C during the period from 1950 to 2010 in the waters off Angola during the winter period, but similarly the large interannual variability cause by the irregular occurrence of Benguela Niños. Another point that might become important in the future is the reduction of subsurface oxygen in the oxygen minimum zone off Angola. Such deoxygenation was diagnosed from historical data for the last 50 years. The oxygen at the minimum in about 400m further decreased and the low oxygen zone rose toward the surface thereby shrinking the habitat of hypoxia-intolerant species and possibly leads to a reduction of biodiversity.



**Fig. 2:** Deployments of a bottom shield with an acoustic current meter (75kHz Longranger ADCP). The form of the shield is aimed to prevent damage from fishing activities. This time, we added a 1km bottom line that can help during the recovery in case of a damage of the release inside the shield (photo: SvN).

Directly after the reception in Luanda, we continued our mooring work at 11°S. Two moorings with Longranger ADCPs (one installed in a buoyancy sphere as shown in the last weekly report and one in the bottom shield, Fig. 2) were deployed to observe

the variability of the Angola current. The observed velocities will be additionally used to estimate the strength of the internal wave field. Internal waves that are generated by the tidal currents are associated with energetic velocity fluctuations of about 20-min period. They travel below the surface toward the coast. When reaching shallow waters, they might break thereby inducing mixing and upward transport of nutrients required for the large biological productivity of the marine ecosystem.



**Fig. 3:** Salinity (a), vertical stratification (b), turbulence (c) and turbidity (d) as measured with the microstructure probe in the area of the Congo outflow at about 6°S (figure by Volker Mohrholz).

During the recent week we performed observations of turbulent mixing along cross-shore transects off the Congo river mouth (Fig. 3) and at 11°S. For these measurements the Microstructure profiler was deployed after each CTD station. The first preliminary analysis of gathered data depict a strong stratification off the Congo river mouth, which is caused by both the intense heating of the surface mixed layer and the fresh water discharge of the Congo river. Near the coast the strong vertical density stratification suppresses the usually high vertical mixing in the surface layer, which is observed along the offshore stations. Hot spots of intense turbulent mixing were found in the near bottom layers at the shelf edge as well as close to the coast. At the shelf edge, the enhanced turbulent mixing is mainly caused by breaking internal waves. The high mixing rates in the bottom layer near the coast cannot be attributed to particular physical processes yet. It will be a focus of the subsequent data analysis to uncover the contributing processes. In both areas the high turbulence in the bottom layer caused resuspension of sediment particles, seen in strongly enhanced turbidity. The present currents can transport the remobilized

sediment particles down the continental slope. This may contribute to the longterm storage of carbon in the deep ocean.

Now we already approach our research area off Namibia. There has been a longstanding cooperation between IOW and MFMR, NatMIRC (Ministry of Fisheries and Marine Resources, National Marine Information and Research Center). Blessing Kamwi from NatMIRC is on board with us and reports about his experiences.

For Blessing Kamwi, 28 years old, this is the first cruise on METEOR: „In 2014 I had the chance to be on a cruise with the research vessel „Sonne“ in the Indian Ocean. Life and work at sea are great and you learn a lot. This cruise with „Meteor“ is different, because we have other instruments like the Underway CTD or the Gliders on board. These kind of scientific devices we do not have at our Institute in Namibia – and yes, for sure, it is really great to do all this research work in my „home ocean“ and to learn more about the physical processes in the upwelling areas at the coast of Angola and Namibia.

When I was young I lived with my family far away from the ocean, but one day we visited my uncle in Walvis Bay and it was him, who took me to the sea and went with us to an aquarium. There it all started . . .

So it was really nice to see how happy the kids were, when they visited Meteor in the port of Angola shortly before the official reception began. Maybe one day, some of them will become oceanographers too – you never know.

I studied at the University of Namibia, later I went to the University of Cape Town to study physical oceanography. At the moment I work for the Ministry of Fisheries & Marine Resources based in Swakopmund, in the environmental section, subsection physical and chemical oceanography. There are not so many oceanographers in my home country and I am glad that I am one of them, because I want to contribute to the knowledge and understanding of the ocean. On this cruise with „Meteor“ my interest is focused on ADCP data processing and I really enjoy the teamwork with my German colleagues. I want to learn more about modelling and of course I would love to go to Germany one day to get some more training at one of the German institutes.”

On Saturday we had our barbecue, which we would like to have in the warm waters of Angola before we approach the windy and cool coastal region off Namibia. The prepared meals were delicious, similarly as they were during the first part of the cruise and particularly also for our vegetarians on board: many thanks to the team in the ship’s kitchen.

Greetings from the tropics,  
Peter Brandt and the cruise participants of M131