4. Weekly Report M98, Fortaleza-Walvis Bay

1.7.-28.7.2013

The scientific program of the last week of M98 focused on the shelf area off Angola. In the frame of the BMBF project SACUS (Southwest African Coastal Upwelling System and Benguela Niños), we will analyze the remote influence of the equatorial Atlantic on temperature and productivity in the coastal upwelling region off Southwest Africa. The connection between both regions may be established via wave propagation along the equator and further southward along the coast or via southward currents. During M98 we are concentrating on observing the variability of the Angola Current at about 11°S. Apart from underway measurements with the shipboard ADCPs, that represent only a snapshot of the actual flow field, we deployed several current meter moorings. Due to the large biological activity in the region and associated intense fisheries, we use special bottom shield moorings (Fig. 1).

Fig. 1: Two bottom shields equipped with profiling current meters (ADCPs) onboard Meteor prior to the deployment at the shelf off Angola. The instruments were deployed at water depths of 200 m and 500 m and will measure the flow field in the upper ocean until their recovery in 1.5 years.

Such bottom shields with the installed ADCPs and bottom pressure sensors sit on the sea floor and are well protected against the commonly used fishing gear. The moorings deployed during M98 will be recovered and redeployed in autumn 2014. By analyzing the hopefully then obtained current time series, we will gain for the first time knowledge on the seasonal to interannual variations of the strength and water mass characteristics (like e.g. salinity and oxygen) of the subsurface boundary currents.

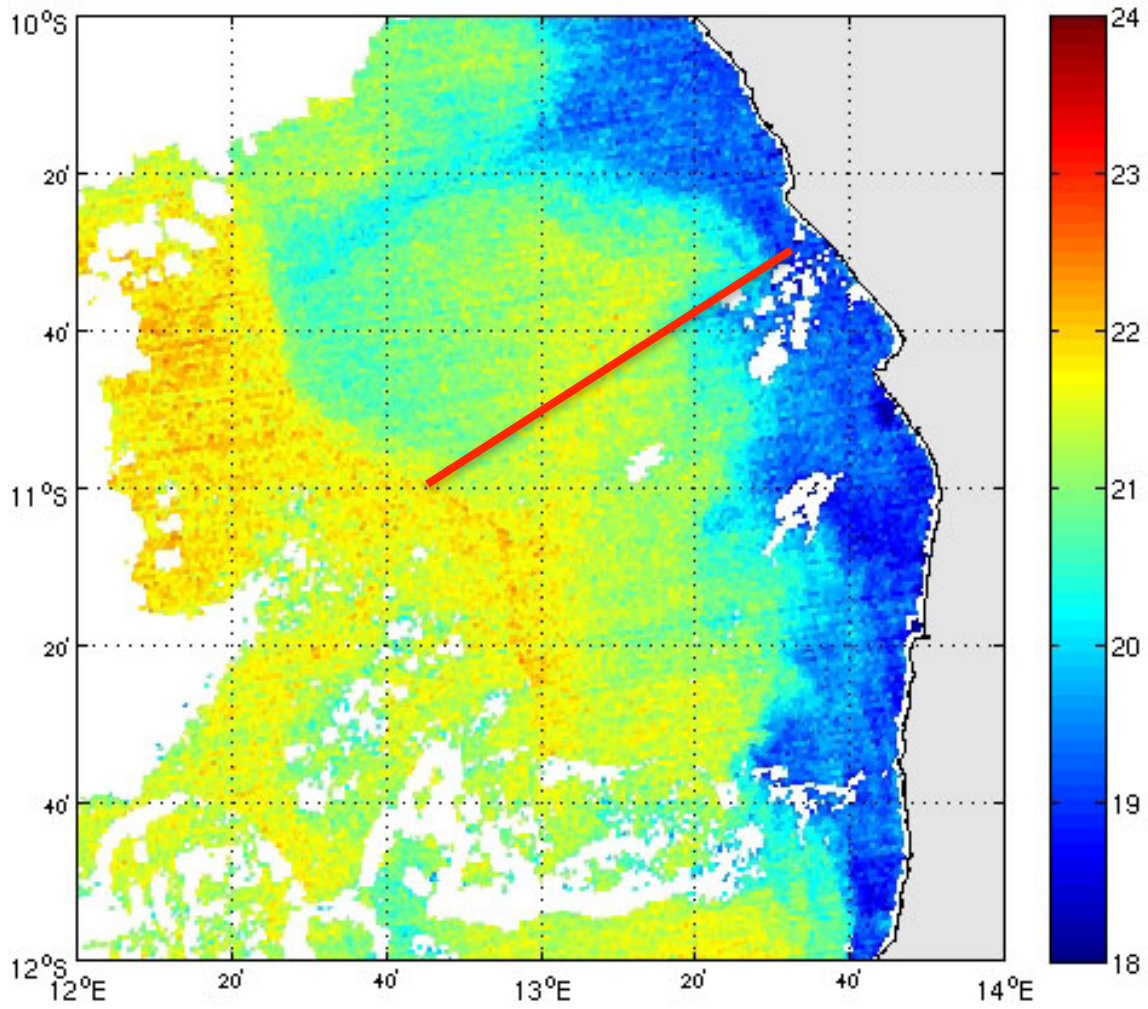

Fig. 2: Sea surface temperature in the observational region off Angola on July 20th, 2013 showing particularly cool water masses close to the coast. Along the red line we deployed our moorings and performed CTD, glider and microstructure stations as well as continuous measurements from aboard Meteor (MODIS SST data are provided by Dominique Dagorne, IRD, project partner within PREFACE).

Another key aspect of our research activities off Angola is the heat and freshwater budget of the upper ocean. This work represents a first contribution to the EU FP7 project PREFACE „Enhancing PREdiction oF Tropical Atlantic ClimatE and its impacts" that will start in November 2013. Within this project, we will try to understand the strong cooling of the near-surface waters close to the coast (Fig. 2), which abnormally occur during weak wind conditions. A possible explanation might be the breaking of tidally induced internal waves propagating onshore. Our

microstructure measurements on the shelf show strongly enhanced diapycnal mixing events that transport nutrients, CO_2, and N_2O toward the surface and heat downward. These waves could thus add a significant contribution to the cooling close to the coast (Fig. 3).

For most of us, who were in this relatively unexplored region of the tropical South Atlantic for the first time, this research cruise provided the opportunity to learn many new aspects regarding circulation and air-sea interaction not only from our successful measurements, but also from our Angolan cruise participants. They are very familiar with these phenomena and their often strong influence on productivity and fisheries.

On the afternoon before arriving in Walvis Bay, we again deployed our glider "deepy" and sent him on a mission towards the south. The glider will provide additional information for the upcoming research program of the next Meteor cruise (M99) led by Detlef Quadfasel from ZMAW, University of Hamburg. Our research cruise will end on Sunday morning in the port of Walvis Bay.

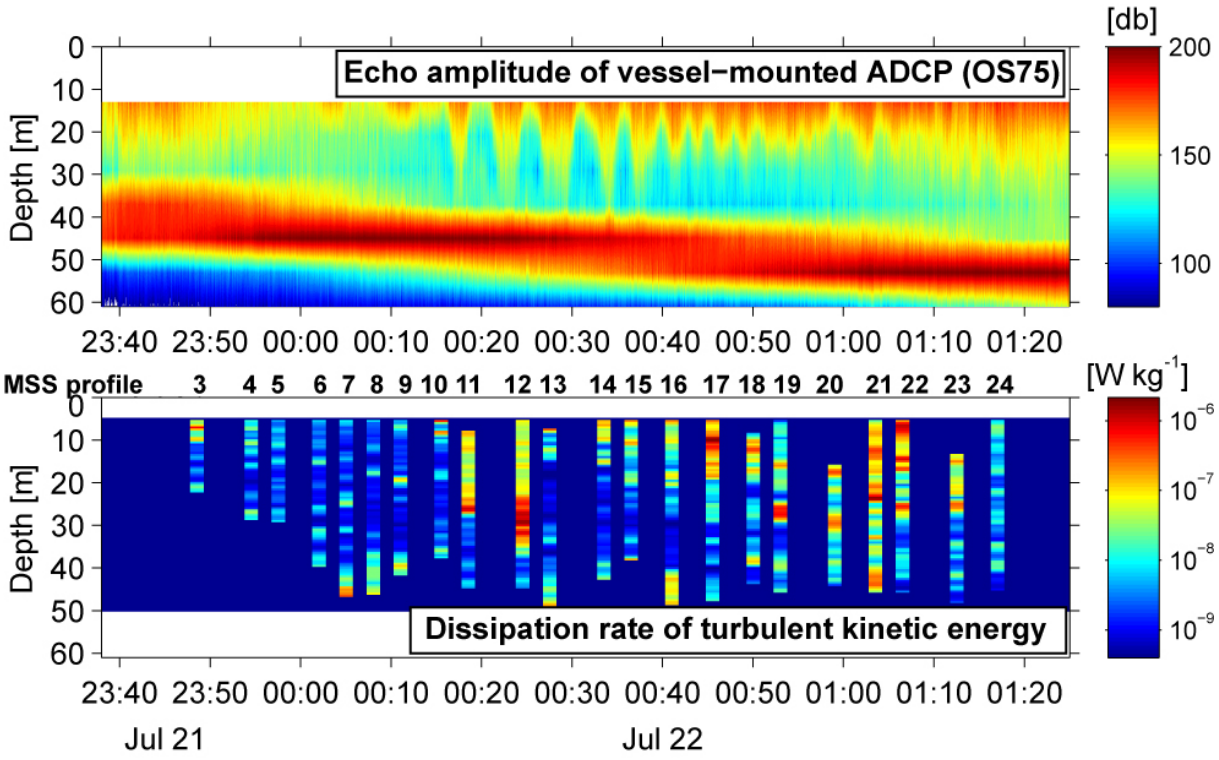

Fig. 3: Echo amplitude of the 75 kHz vessel mounted ADCP with signatures of internal waves propagating onshore (upper panel). The strong reflection at about 40 to 50 m depth marks the sea floor. Microstructure measurements taken along this transect show high dissipation rates of turbulent kinetic energy (mixing rates) particularly in the wave troughs (lower panel).

Finally, we would like to thank captain and crew of Meteor for the excellent working environment, the friendly atmosphere, and last but not least the great hospitality. We are looking forward to joining Meteor for our next research cruise.

Greetings from the tropics,
Peter Brandt and the participants of M98