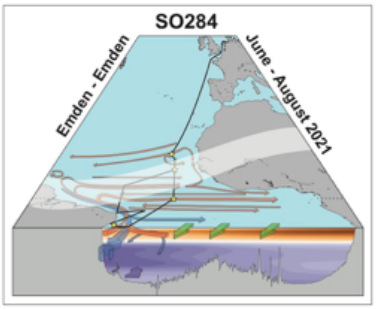
SONNE 284

Mooring Rescue



Emden - Emden, 27.06. - 17.08.2021

03. WEEKLY REPORT

12.07. - 18.07.2021

In the Southern Hemisphere!

This week we have reached the southern hemisphere and are now on our way to our mooring array off the coast of Brazil. By crossing the equator, we have left the rain of the Intertropical Convergence Zone (ITCZ) behind us for the present and have reached the region of the southeast trade winds (see Fig. 1). The Intertropical Convergence Zone with its heavy precipitation and especially the associated doldrums with their often weak but changeable winds used, in former times, to be a challenge for maritime travel and is now a challenge for climate models. For this reason, among others, the meteorological measurements on board during the passage of the doldrums is one area of key interest. Until we reached the equator, we therefore carried out radiosonde ascents every two to three hours. The detailed evaluation of the collected data has begun and we can already recognise the first characteristic features of the ITCZ, such as the high atmospheric instability, which enables the formation of clouds up to 15 km high.

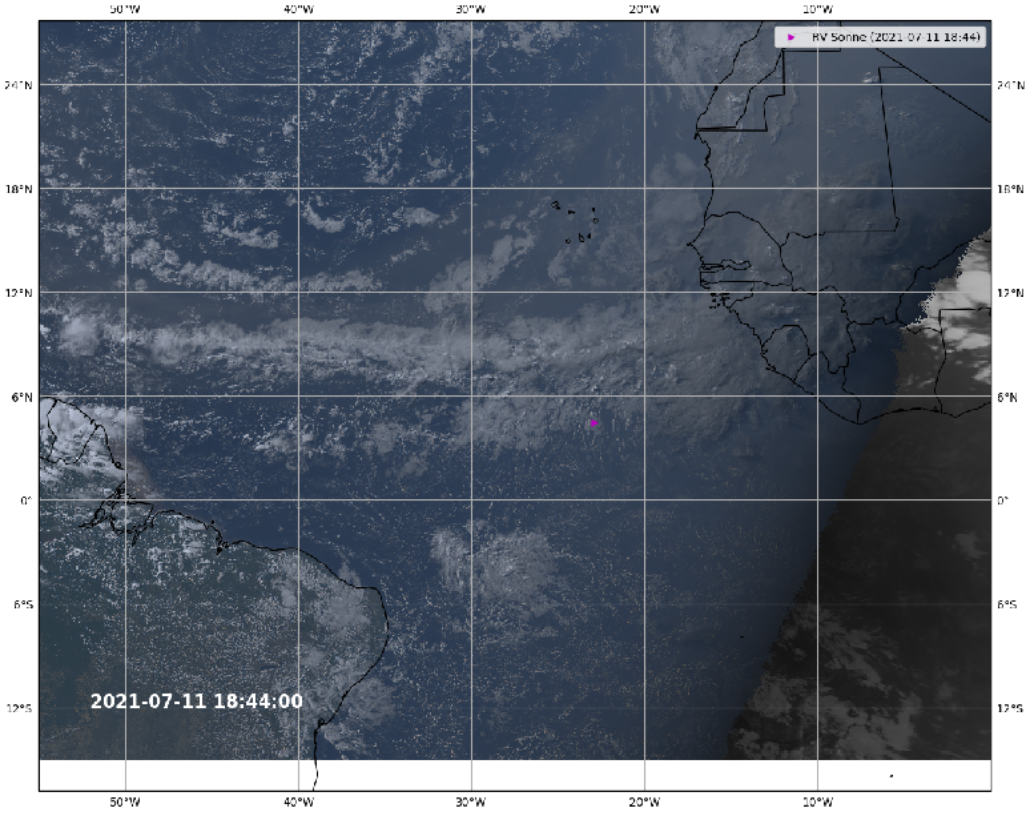


Fig. 1: Satellite image with position of RV Sonne during a radiosonde ascent at the southern edge of the ITCZ (satellite image from GOES-16)

As the data provided by the radiosondes is of central importance to us, it was a big problem when suddenly the data transmission of some of the sondes stopped at an altitude between 10 km and 15 km. Normally, one expects to receive measurement data up to an altitude of about 25 km. To solve the problem as quickly as possible, we tried various possibilities, but we did not have a real solution until an onboard build bi-quad antenna was added to our antenna (see Fig. 2). Since its

installation, the antenna has led to a considerable improvement in data transmission, so we would like to take this opportunity to thank the WTD once again for their great support!
In addition to our regular radiosonde launches, we have conducted two more launches in the last

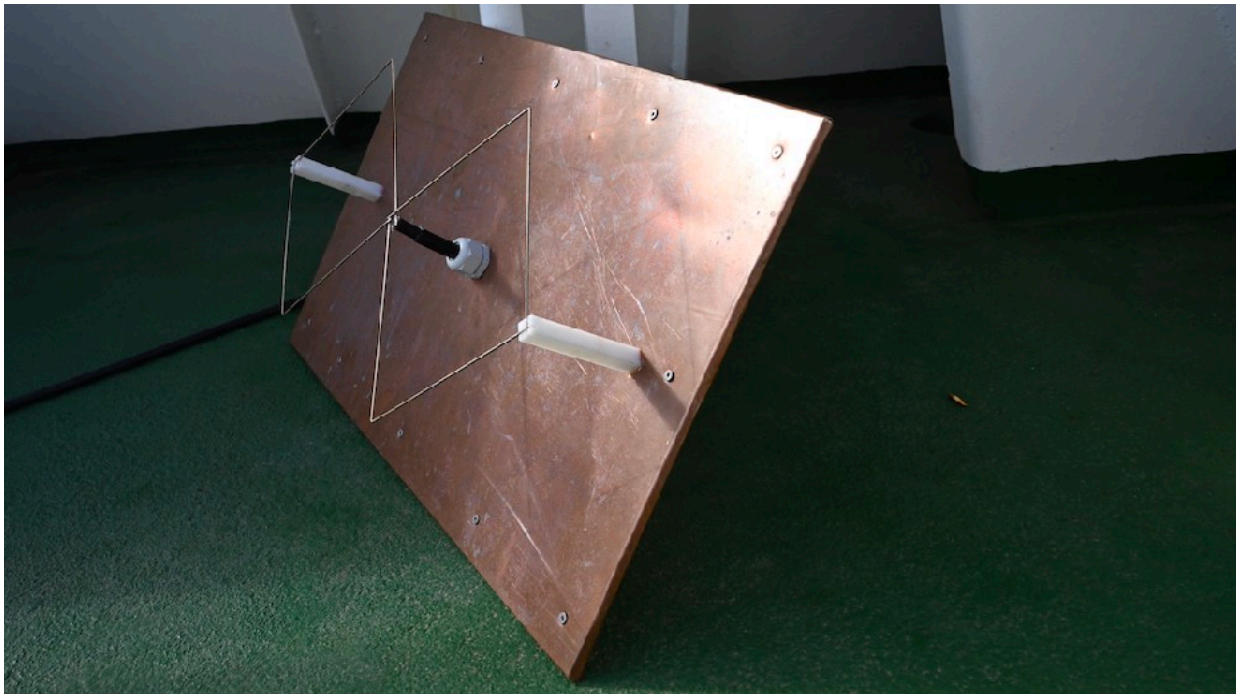


Fig. 2: *Bi-Quad antenna built on board to amplify the measured radiosonde signal (© Julia Windmiller)*

two weeks to validate the Aeolus satellite. Launched in 2018, the ESA satellite mission is the first to provide vertical profiles of the wind from space measured with a lidar instrument. To verify the quality of the satellite product, which is also used for weather forecasting, comparative measurements from radiosondes are very valuable, especially over the ocean where there is little other data. A comparison measurement requires very good coordination of the ship's track with the satellite's trajectory. Thanks to the good cooperation with the bridge, we were already able to

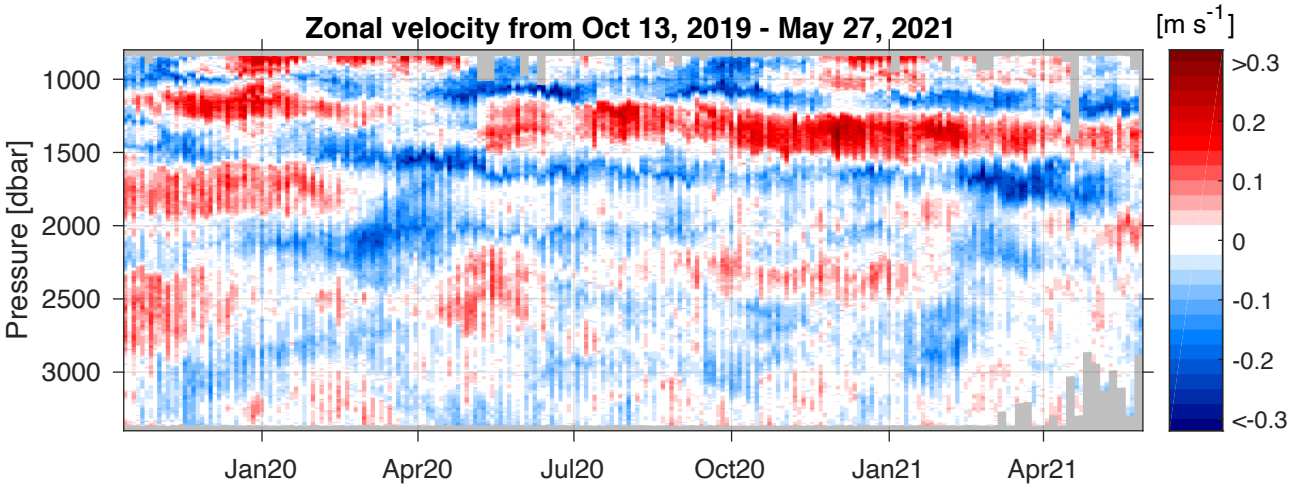


Fig. 3: *Time series of east-west currents (red eastward, blue westward) measured at the mooring on the equator at 23°W (© Philip Tuchen)*

carry out two successful comparison measurements which have provided data for validation.
Arriving at the equator, our next long-term mooring awaited us. Here at 23°W, equatorial currents have been measured since December 2000, initially as part of the international PIRATA programme. Since 2006, the mooring has been operated by GEOMAR - still in cooperation with

PIRATA. The equatorial current system has a special significance in the climate system due to various aspects. Near the surface, the strongest current, the Equatorial Undercurrent (EUC), flows eastwards and supplies the equatorial upwelling in the equatorial cold tongue. Measurements of this mooring have shown that the EUC has increased by about 20% over the last 10 years, contributing in particular to an improved oxygen supply to the otherwise oxygen-poor eastern Atlantic. We are curious to see how this time series will continue. The deeper currents are characterised by the so-called equatorial deep jets. These bands of eastward and westward currents are particularly visible in the anchored profiler data (Fig. 3). The currents change direction with a period of about 4.5 years and also have an influence on the climatic events at the surface. During the last mooring period, the profiler, which drives the mooring wire up and down, surveyed the entire planned depth range of about 850 to 3300m particularly well. Unfortunately, the profiler stopped measuring on 27 May 2021 with then empty batteries - a small loss that can be attributed to the delay in the mooring uptake due to the CORONA pandemic.
In addition to the physical measurements, biogeochemical measurements were also carried out on the mooring using oxygen optodes and an underwater vision profiler. The latter instrument is also deployed on an Argo deep drifter (Fig. 4) and, in contrast to the instruments moored at fixed depths, is designed to record profiles of particle number and size as well as recordings of plankton species from the surface to 2000m depth.
Besides our scientific programme, we enjoyed the beautiful weather in the trade wind area with a

Fig. 4: *Deployment of an Argo float with an Underwater-Vision-Profiler. These measurements are intended to determine the number and size of sinking particles and to obtain images of different plankton species (© David Menzel).*

barbecue on Thursday evening. With fantastic weather and self-caught fish, it was a really nice evening for which we would like to thank particularly the cooks and stewards.
Now we are preparing for the next days with numerous moorings and send our warmest greetings to those at home from the coast of Brazil.

At sea, 18.07.201
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Scientific lead SO-284