FS METEOR

Expedition M203 “BOWTIE”

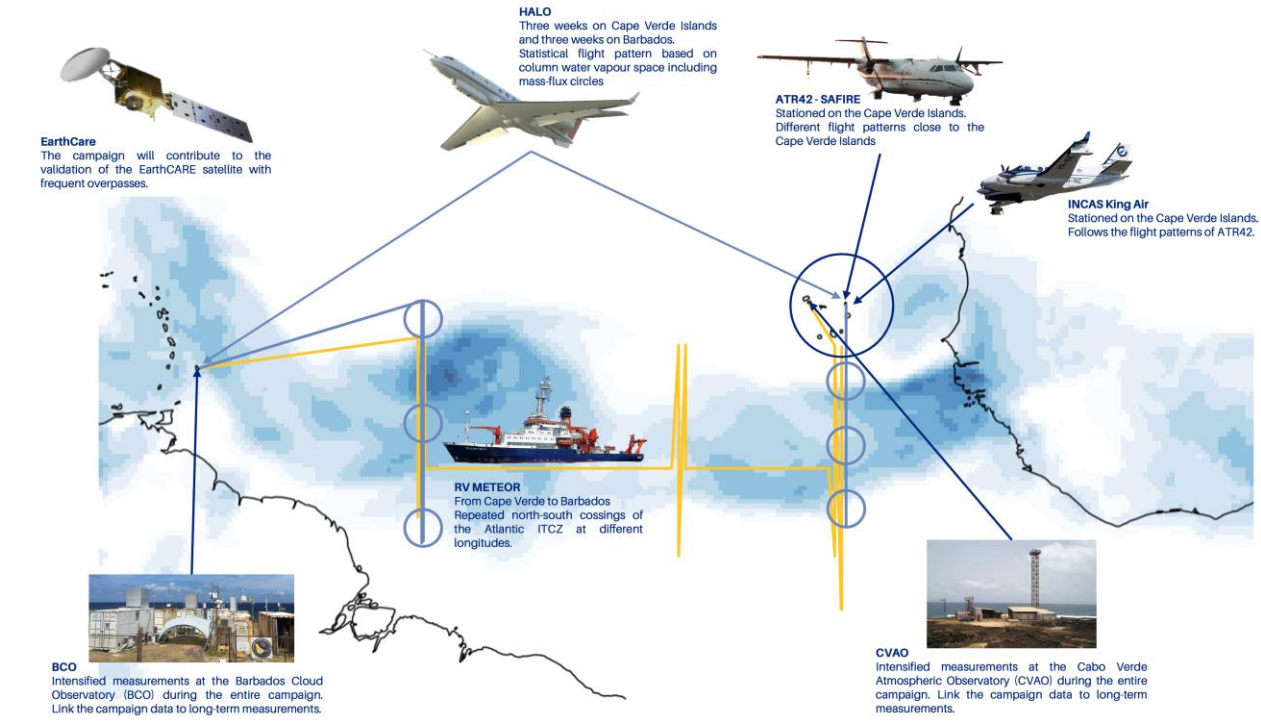
10. August 2024 — 24. September 2024 | Mindelo — Bridgetown

1 . Weekly Report (10.08.2024 — 11.08.2024)

Where the trade winds of the Northern and Southern Hemisphere meet near the equator, the Intertropical Convergence Zone (ITCZ) forms. A several degrees wide band forms like a belt around the globe which is characterised by very light and variable winds with embedded pronounced precipitation generated by convective storms. These storms tend to organise into larger clusters, and tend to concentrate along the northern and southern edges. These regions were coined doldrums by sailors and were of great interest for pre-20th century maritime travel, especially in the tropical Atlantic. With the rise of steam ships, the scientific focus shifted from the calm and variable winds of that region to the heavy precipitation. Today, coarse numerical models of the climate system struggle to represent these large-scale features of the general circulation, but they can be simulated if fine enough resolutions of few kilometres are used, which resolve the relevant processes for convection within the doldrums and their interaction with the upper ocean.

With the FS METEOR M203 BOWTIE expedition we seek to understand how air- and water-mass properties and small-scale weather systems in atmosphere and ocean impact the large-scale structure and dynamics of the inter-tropical convergence zone with particular focus on the variability of the Atlantic ITCZ. BOWTIE will provide spatially resolved cross sections of the ITCZ from the upper ocean to the tropopause. Cross sections will be made by transecting the ITCZ from north to south in the eastern, central and western Atlantic, while continuously sampling the atmospheric state with a large set of instruments profile the atmosphere. The characteristics of the upper ocean are sampled continuously with shipboard instrumentation and during CTD stations every degree travelled, complemented by autonomous profiling observatories and drifters that will be deployed at each of the transects. Additionally, biogeochemical parameters in the ocean, aerosols in the atmosphere and the exchange of trace gases between the atmosphere and ocean will be measured.

M203 BOWTIE is part of a large set of international campaigns, which are coordinated under the name ORCESTRA - Organized Convection and EarthCare Studies over the Tropical Atlantic which all operate within the tropical Atlantic region in August and September 2024 (see figure below). Exactly 50 years after the Atmospheric Research Program's Atlantic Tropical Experiment (GATE) - the largest atmospheric field experiment to date - was conducted south of the Cape Verde Islands, the international science community is again visiting this region, this time with much more advanced measurement techniques. Besides FS METEOR, three airborne platforms (the German research aircraft HALO, a French research aircraft, and a Romanian research aircraft, operated by Norwegian researchers), two island-



ORCESTRA campaign overview with the main measurement platforms, as well as preliminary flight and ship tracks plotted above the total water vapor field (ERA5) on 15th of August 2001 indicating the location of the ITCZ.

based measurement stations on either side of the Atlantic (on Mindelo in the Cape Verde Islands and on Barbados) and the recently launched EarthCare satellite contribute to this initiative. On FS METEOR two separately funded campaigns additionally contribute to M203 and strengthen BOWTIE. Through the US National Science Foundation (NSF)-funded project PICCOLO (Process Investigation of Clouds and Convective Organization over the atLantic Ocean) the SEA-POL (Sea-Going Polarimetric) radar is installed on FS METEOR to observe precipitation and related variables in a radius of 200km around the ship. The project STRINQS (Soundings and TuRbulent eddy measurements in the ITCZ with a Network of QuadcopterS) from the TU Delft in the Netherlands adds a swarm of drones to the BOWTIE instrumentation to observe atmospheric conditions close the sea surface.

The scientific team of M203 consists of 27 scientists from 12 institutions in 5 countries. The plan was to leave Mindelo early in the morning on the 10th of August to steam directly South to the Inter Tropical Convergence Zone (ITCZ) to start the scientific program. Unfortunately, five containers - three with scientific equipment, two with provisions for the ship - were delayed and are now scheduled for arrival on the 12th of August in Mindelo. One of the containers contains a Raman Lidar System, which must be calibrated in port before departure. At the current time, we anticipate departure from Mindelo on the 13th of August.

Despite these delays, some scientific equipment was already installed on the ship over the last few days, including the large SEA-POL radar (which resembles a soccer ball). The radar antenna and radome were assembled by the radar team (which required fastening more

The SEA-POL radar antenna is installed on the forecastle deck of FS METEOR in the port of Mindelo.

than 600 screws) at the port of Mindelo over the course of the last week and was installed on forecastle deck of FS METEOR (see picture).

We eagerly anticipate departing soon. Greetings from all participants of M203 from aboard the FS METEOR in the Porto Grande of Mindelo!

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