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## **Short Cruise Report** **METEOR M179/1**

**Las Palmas (Spain) – Punta Arenas (Chile)**

**22.12.2021 – 12.01.2022**

**Chief Scientist: Dr. Jochen Wollschläger**

**Captain: Detlef Korte**



## Objectives

The rationale of the cruise M179/1 was the scientific utilization of the RV METEOR transit from Las Palmas (Spain) to Punta Arenas (Chile), the begin of the subsequent cruise M179/2. The transect is extraordinarily long and crosses a variety of different water masses and climate zones, thus it presented an ideal opportunity to obtain samples and data for a variety of purposes. As because of time reasons no station work could be done, it was planned to use only underway measurement systems and surface water samples from the ships seawater system.

One objective of the cruise was the validation of the R/V Meteor's thermosalinograph by taking regularly water samples that will be analyzed in the context of the DAM (Deutsche Allianz Meeresforschung) quality assurance efforts. The different water masses crossed promised to provide especially meaningful data in this respect.

Another focus of the cruise were bio-optical measurements. The optical properties of natural waters are largely determined by their optically active substances like phytoplankton (including its various pigments), chromophoric dissolved organic matter (CDOM), and non-algal particles (e.g. detritus and suspended sediments). Thus, hyperspectral measurements of the waters inherent and apparent optical properties were performed to map and characterize these constituents, with a focus on phytoplankton. The obtained bio-optical data are intended further to serve for large scale validation of satellite remote sensing products, which are often hindered by data availability in regions where no regular scientific measurements are conducted. Additionally, microscopic imaging was done for potential calibration of the hyperspectral bio-optical measurements in terms of taxonomy and to build up image libraries that foster a future automated classification of phytoplankton. Furthermore, this biogeographical mapping of phytoplankton should be related to the presence of essential vitamins to explain the observed distribution, as well as to the potential presence of phycotoxins, which have only been scarcely investigated in the open ocean.

Finally, as most of the participants of the transit cruise would also take part in the subsequent cruise M179/2, the transit was also an opportunity to set up and test instruments that will be used there as well as to train the student personnel.

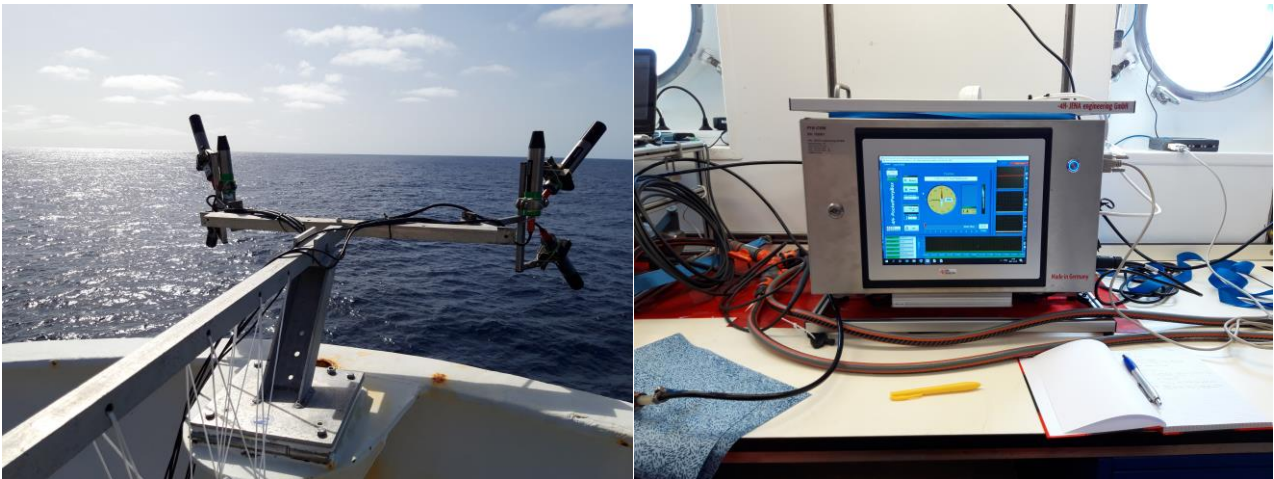
## Narrative

The first days of the cruise were used to unload the containers and set up both laboratories and underway measurement systems. The latter consisted of a Pocket-FerryBox with additional sensors for optical nitrate determination, as well as two setups of radiometers mounted on the ship's bow (Fig.1). The FerryBox was connected to the ship's seawater system and sampled the surface water from approx. 4 m depth continuously in flow-through mode for temperature, salinity, dissolved oxygen, FDOM, turbidity, and chlorophyll-a. The radiometer installations consisted each of three hyperspectral radiometers: One irradiance sensor measuring overall downwelling light, one upward directed radiance sensor measuring light coming from the sky, and one downward looking radiance sensor measuring light emerging from the sea surface. From the measurements of these three instruments, remote sensing reflectance and thus ocean color can be calculated. In turn, this enables the use of ocean color algorithms for calculating the concentration of optically active substances. Two setups were used in order to minimize impact of sunglint on the data.

In the laboratories (Fig. 2), a spectrofluorometer, a spectrophotometer, and a point-source integrating-cavity absorption meter (PSICAM) were set up for the measurement of the optical properties (absorption and fluorescence) of the dissolved and particulate water constituents. In order to relate these measurements to concentrations, water samples were also filtered for suspended particulate matter and chlorophyll-a concentration. Sample aliquots were taken for traditional microscopy but also analyzed microscopically onboard with a FlowCam. For vitamin analysis, discrete water samples were concentrated on columns which were subsequently frozen for transport after the cruise. Samples for all these parameters were obtained twice a day (in the morning and afternoon). For vitamins and phytoplankton, additional samples were taken during midnight. Phycotoxin samples were obtained using SPATT (Solid Phase Adsorption Toxin Tracking) filter bags that were continuously flushed with water from the ship's seawater system for a period of one to two days and then frozen for later analysis. Salinity samples for evaluation of the ship's thermosalinograph were obtained daily in the morning.

Sampling and underway measurements were only performed in international waters, as we did not apply for research permits of individual countries. This required an interruption of the measurements for two days from 24.12.2021 to 26.12.2021, as it was required to re-plan the track of the ship through the Exclusive Economic Zone (EEZ) of the Cape Verde Islands to save time in case of bad weather conditions later during the cruise. These occurred in the third week of the cruise and made it necessary to temporarily remove the radiometers from the ship's bow. However, the daily laboratory sampling was not affected.

We arrived in Punta Arenas at the 12.01.2022, but the measurements had to be stopped already three days before as we arrived the EEZ of Argentina. However, this offered enough time to pack equipment no longer needed and prepare the laboratories for the subsequent cruise M179/2.



**Fig. 1: Underway measurement systems. Left: radiometer setup. Right: Pocket-FerryBox**



**Fig. 2: Laboratory measurements. Left: SPATT-sampling for phycotoxins. Right: Fluorometer, photometer, and FlowCam (from left to right).**

## **Acknowledgements**

We would like to thank captain and crew of the RV METEOR for a great cruise and their kind support during that time.

## List of participants

1. Jochen Wollschläger	Chief Scientist, Bio-Optics	ICBM
2. Bernd Krock	Deputy Chief Scientist, Phycotoxins	AWI
3. Marina Arregui	Vitamins, Phycotoxins	AWI
4. Fuat Dursun	Vitamins	AWI
5. Claudia Thölen	FerryBox	ICBM
6. Michelle Albinus	ADCP	ICBM

### Institutes:

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- AWI: Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Am Handelshafen 12, 27570 Bremerhaven

### **Station list**

Not applicable. Because M179/1 was the transit cruise to the study area of the subsequent M179/2, only underway measurements were performed.