

# FS METEOR Cruise M189-2

16<sup>th</sup> May – 4<sup>th</sup> June 2023

Walvis Bay (Namibia) – Las Palmas (Spain)

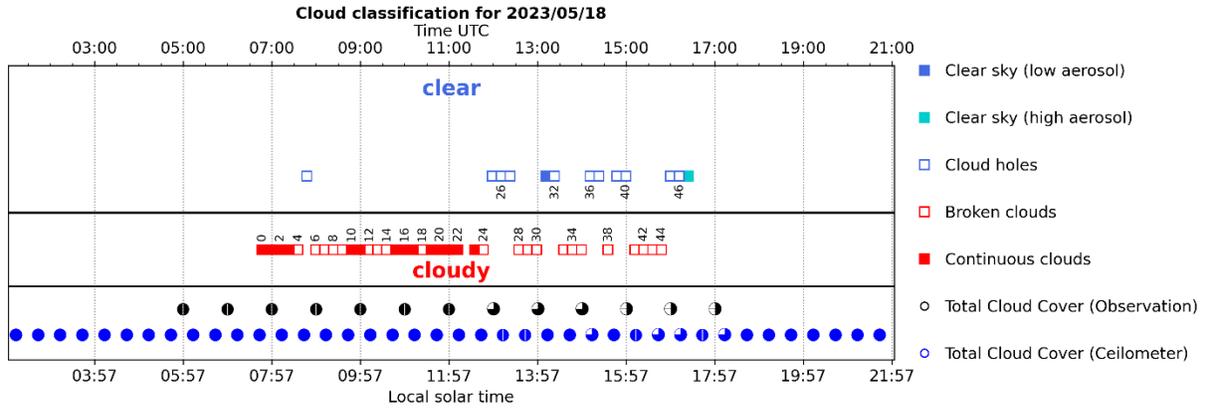


## 1. Weekly Report (15.05. to 21.05.2023)

The small scientific crew of M189-2 consists of four land lobbers, who eagerly start to explore the ship, and two sea dogs who immediately start with their working routine. The focus of the transit M189-2 is on atmospheric measurements of clouds, aerosols and trace gases. These data sets are mainly used for the validation of satellite measurements over the ocean, but are also fundamentally important for gaining knowledge of chemical processes in the marine boundary layer.

The cloud camera and the Tube MAX-DOAS instrument are mounted on the first day and intensely tested during the first days of the cruise. On the morning of the 18th May all measurement routines and the recordings of the MICROTOPS instrument are started as well. Here, dense clouds make it difficult to perform the measurements as direct sunlight is required for deriving the aerosol optical depth. For the Deutsche Allianz Meeresforschung (DAM) and the Institute for Geosciences in Kiel the crew has started ADCP instrument. The sampling for the TSG instrument is also performed by the atmospheric scientists after receiving a small crash course.

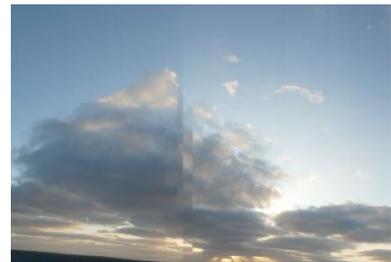
During the first days of travel valuable measurement data for the validation of the Tube MAX-DOAS cloud algorithm could be gathered. The algorithm that was developed in Mainz uses measured spectra in order to estimate the cloud cover. Being able to estimate the accuracy of this method is especially important when no other information on cloud coverage is available. Since a lot of independent cloud detection methods (ceilometer, weather observation and Tube MAX-DOAS) are deployed for this cruise, this is a unique opportunity to validate the cloud detection



09:00 UTC

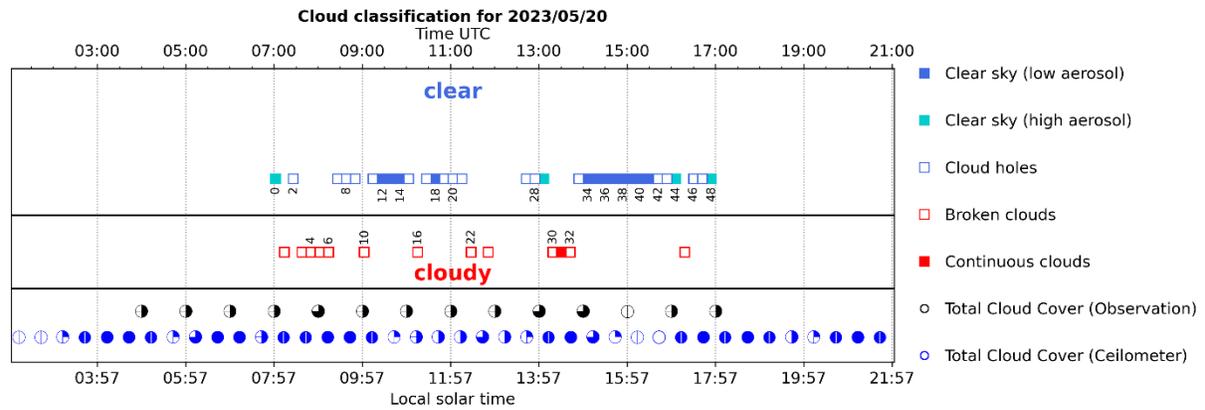


12:00 UTC

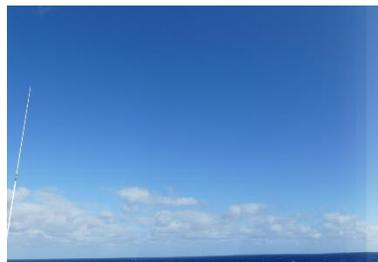


16:45 UTC

Fig. 1: Cloud observation from different sources on 2023-05-18: 1) Results of the Tube MAX-DOAS cloud detection algorithm, 2) cloud observations on board and 3) results of the ceilometer measurements.



08:45 UTC



15:00 UTC



17:45 UTC

Fig. 2: As Fig. 1, but for 2023-05-20.

algorithm. In addition, each method has its own advantages and disadvantages: The ceilometer only measures a single point in the sky and derives the cloud cover from the temporal development using its high temporal resolution. Since these measurements are performed automatic and don't need daylight, a continuous data set is created for each day. For the weather observations the whole sky is observed providing a comprehensive view on cloud. However, the observations can only be performed at daylight conditions, are suffering from a perception bias and require regular manual labour. Thus, this data set only consists of one measurement per hour. The Tube MAX-DOAS instrument effectively looks at one stripe of the sky from low elevation angles right above the horizon to the zenith view. This is a little more than the ceilometer but still much less representative than the weather observation. Figure 1 and 2 compare the results of all three methods on two exemplary measurement days. Generally, a very good agreement is observed which shows that the limited spatial resolution of the ceilometer and the Tube MAX-DOAS instrument play only a minor role in the determination of the cloud coverage. However, the weather observations are vital for the characterisation of cloud types. In the coming weeks, this validation will be continued in order to create a full statistical analysis and to enable the quantitative estimation of the quality of the used methods.

Warm greetings from the Atlantic in the name of all participants of the transit cruise M189-2,

Steffen Ziegler (Max-Planck-Institute for Chemistry, Mainz)