1. weekly report SO 259-2

The Transit voyage of the R.V. Sonne from Capetown (RSA) to Emden (GER) is used to collect atmospheric reference data over oceans for evaluations of satellite retrievals and global modeling. In addition, there are plans to examine sampled property dependencies as a function of time or latitude and relationships between different atmospheric and/or to environmental properties. Central to this research are two small instruments that were brought along in a suitcase. One instrument captures the properties of aerosols (small atmospheric particles) and the other instrument monitors the properties of lower altitude clouds. The sampled properties of these instruments will also be placed in the context standard measurements on the ship (including meteorological instruments installed by the German weather service, DWD).

For the determination of the aerosol properties a MICROTOPS instrument, provided by the NASA is applied. Lower altitude cloud properties are captured by a camera-system developed at the Max-Planck Institut for Meteorology in Hamburg. Both instruments are shown in Figure 1.

Figure 1. the MICROTOPS sun-photometer with an associated GPS (left) and the cloud-camera box (right) with a normal (visible image) picture sensor and with a thermal (heat sensing) sensor

Sun-photometer measurements are only possible during the day, when the sun is not covered by (even thin) clouds. For the sampling, the instrument is directed by hand (with a small orientation device) towards the sun to register the solar intensity at selected solar wavelengths (not affected by significant trace-gas absorption). Larger reference solar intensities at the top of the atmosphere are defined by the (UTC-) time and latitude information, which is supplied by a GPS. From the solar intensity losses along the cloud-free atmospheric path the atmospheric aerosol content (via the optical thickness) can be accurately determined (after removing surface pressure related contributions by the scattering of air-molecules). Solar intensity losses are simultaneously sampled at several solar wavelengths, because the spectral dependence reveals information about the average aerosol particle size. In addition, also a

solar wavelength with strong absorption by water vapor is sampled, so that from comparisons to losses at a wavelength without water absorption, the total atmospheric water vapor content can be derived.

The camera-system has two sensors, both viewing in the upward direction. The normal (visual image) camera (with a frog-eye distortion) offers a general overview on cloud distributions during the day. More interesting though is the thermal camera - with only a limited (ca 35 degree) field-of-view. The thermal camera captures cloud cover, cloud structures as function of altitude, as the recorded cloud temperature in conjunction (with the air temperature at the ship) allows estimates for the cloud base altitude. In addition, this cloud information is continuously provided - day and night. A sample image by the thermal IR camera off the coast of South Africa is provided in Figure 2.

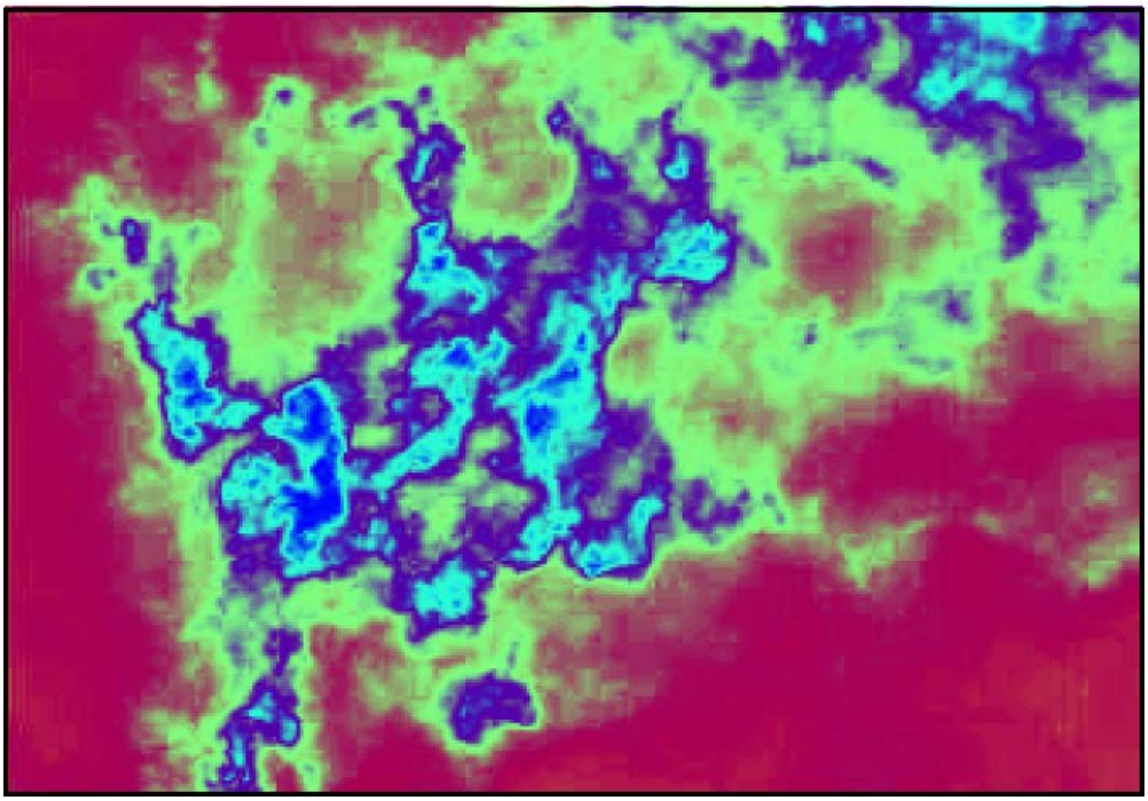

Figure 2 A thermal cloud camera image on Oct 14 at 18UTC, off the coast of South Africa. Light to dark blue colors indicate colder (near 40 deg C) background (largely cloud-free) regions, whereas red colors indicate warmer (near 0 degree C) lower altitude clouds (with a cloud base at approximately 1.5km).

Visible and thermal images are recorded every 10 seconds. For data processing the image is summarized at three different threshold temperatures (for distinctions between cloud-free and cloudy) by three parameters: total cloud cover, homogeneity (by the total length of the cloud boundaries) and mean cloud temperature.

As of up to now, everything goes as planned. Both instruments are operating. Data-processing and data preparation and data analysis will be the main challenge. Already the extraction of the three main cloud parameters as a function of three separation temperatures has become a major daily routine in order to account for changing surface temperatures. Hereby applying hourly temperature averages (from the ships DSHIP recordings) separation temperatures 15, 25 and 35 degree colder than the surface temperature are applied to extract cloud cover and cloud homogeneity at different altitudes.

When boarding the ship in Capetown (despite Friday the 13th) the weather was fabulous and gave away views at a cloud-free table-mountain, as illustrated in Figure 3.

Abbildung 3 RV SONNE in the harbor of Capetown with the table-mountain in the background

The RV Sonne offers, in comparison to other German Research vessels, a touch a luxury, with large single cabins, a floor-heated bathroom and even a glas door in the bath rather than shower curtains. Common places are relatively large, including a well-equipped atmospheric lab on top of the bridge. The crew is extremely nice and helpful and also has a good sense of humor.

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