2. weekly report SO 259-2

After one week into its voyage way from Capetown (RSA) to Emden (GER) the R.V. Sonne crossed the equator. Despite the promising name of the ship, direct sun-shine was the exception. Overcast low altitude cloud conditions were the rule. Thus, the scientific summary will start with a first cloud data analysis summary from thermal camera images in Figure 1. The cloud cover (cloud vs cloud-free) was determined for different threshold temperatures. If the thermal camera identifies a warmer temperature than the threshold temperature, that location is marked as cloud. Alternately a colder temperature is considered cloud-free. Assuming that the atmospheric temperature decreases below the clouds dry-adiabatically (that is at -10deg C per kilometer with altitude), then threshold temperatures of -10, -15, -25 and -35 deg C colder than the surface-temperature (as measured on the ship) corresponds to cloud-base altitude maxima of approximately 1.0, 1.5, 2.5 and 3.5km, respectively.

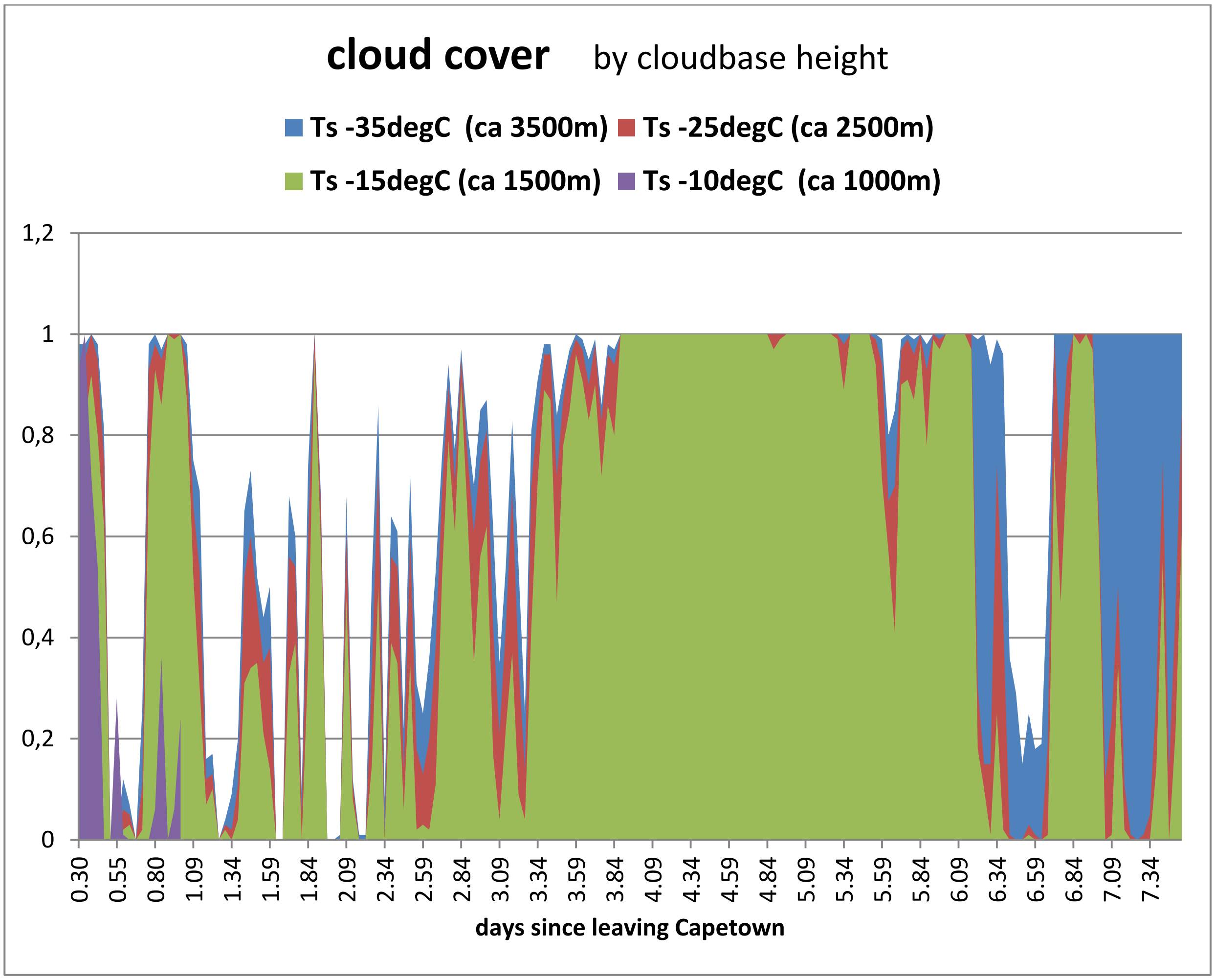

Figure 1 Hourly cloud cover fraction as a function of time (days since leaving Capetown from southern mid-latitudes to the equator. Cloud cover fractions are presented for different threshold temperatures (at 10, 15, 25 and 35 degrees C colder than the surface temperature). Dark blue indicates fractions with a cloud base below 1km, green below 1.5km, red below 2.5km and light blue below 3.5km.

Figure 1 now shows that only initially (during the first day after leaving Capetown) the cloud-base was below 1km (dark blue). From then on the lowest cloud-base was between 1.0 and 1.5km (green color) with only smaller fractions assigned additionally to mid (red) and higher altitude (light blue) clouds. Only near the tropics (when the view was not obstructed by lower clouds) the fraction of higher altitude cloud cover increased significantly.

The other (the ship's atmospheric data) complementing atmospheric instrument is the handheld operated MICROTOPS sun-photometer. Of course there are data-gaps, because sampling is neither possible during night and nor during overcast conditions (compare to cloud cover data of in Figure 1) - as a cloud-free views of the sun is required. Still these samples offer a meridional cross-section from the southern mid-latitudes to the equator. From the solar attenuation measurements at 380, 440, 675, 870 and 940 nm solar wavelength four different properties are extracted and plotted in Figures 2.

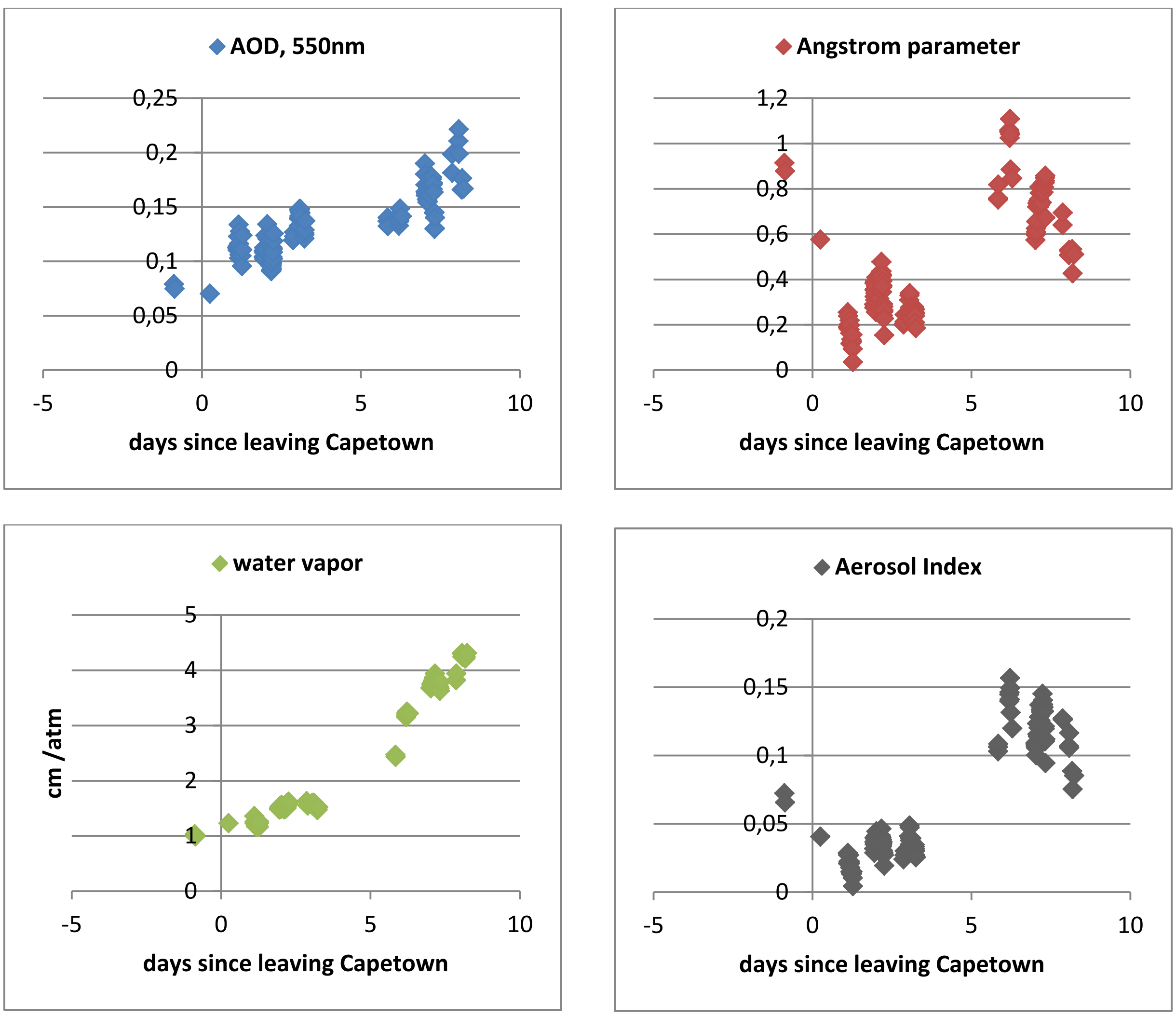

Figure 2 quality controlled data-product for AOD at 550nm, for the Angstrom parameter, for water vapor and the Aerosol-Index based on sunphotometer measurements from Capetown to the Equator.

AOD at 550nm. The aerosol optical depth (AOD) describes (as vertically normalized exponential decay term) the total aerosol content in the atmospheric column. Values at 550nm are not measured but most relevant for comparisons to global modeling and satellite retrievals. Thus a spectral interpolation with the Angstrom parameter was conducted. Values over oceans are usually near 0.1 - unless there are non-local contributions by aerosol loads advected from major sources.

Angstrom parameter. This parameter is the negative slope in ln(AOD) to ln(wavelength) space. Here the Angstrom parameter is based on data at 440and 870nm [AN=ln(AOD440/AOD870)/ln(87/44)]. Larger Angstrom values (>1.2 indicate smaller aerosol sizes (e.g. pollution), smaller values (<0.5) indicate larger aerosol sizes (e.g. dust or seasalt) and values near zero are related to even larger particles (e.g. clouds). Most of the times aerosol is a mixtures of smaller and larger aerosol sizes. Thus Angstrom parameters between 0.5 and 1 are most common over remote oceans.

Aerosol Index. The aerosol index is the product of AOD at 550 and Angstrom. The value is often used as a proxi for aerosol number (concentrations) which is the relevant property for water cloud modifications potential by aerosol.

water vapor. The total atmospheric water vapor is derived by comparing the solar attenuations in a spectral bands with (940nm) and without (870nm) water vapor absorption. Typical values at mid-latitudes are near 1cm/atm whereas values in the humid and warmer tropics are near 4cm/atm.

The time-series across latitudes of the southern hemisphere shows (as expected) relative low atmospheric aerosol loads which only slightly increase in the tropics. These higher values are potentially related to contributions by central and western African pollution and wildfires and consistent with higher Angstrom parameters). The Angstrom parameters in the sub-tropics are low and may be related to dust outflow off South-West Africa. Since AOD is small are also the Angstrom stays generally below 1, the aerosol Index small as well. The water vapor measurements show the expected increase towards the equator largely related to increases in temperatures and convective processes.

Plans for the next week are an extension of the presented time-series on our way to Las Palmas and investigations of relationships also to the standard ship data on temperatures, humidity, wind-speed and radiations, readily available by the ships "Dship" data-center.

Note, the sun-photometer data are sent each evening to the NASA data-center and can be downloaded within days at http://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html.

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