Ship-based thermodynamic profiles of the lower troposphere over the Atlantic Ocean

Within the framework of the OCEANET project, ship-based remote sensing observations of the atmosphere above the Atlantic Ocean have been performed on board of the German research vessels Polarstern and Meteor. Since 2007, 16 cruises have taken place, mostly between Bremerhaven (Germany) and Cape Town (South Africa) or Punta Arenas (Chile), respectively. In the next years, additional cruises will be performed.

The goal of these measurements is a better understanding of the atmospheric processes in the lower troposphere over the open ocean with a focus on temperature and water vapor profiles, as well as cloud properties in regions where data are scarce. The project was designed to measure the full atmospheric energy budget in different climate zones, including exchange processes at the sea surface. The main instrumentation on all cruises consisted of a passive microwave radiometer (MWR), a full sky imager, sun photometer, lidar ceilometer and broadband solar and infrared radiation measurements. In addition, a multi wavelength Raman lidar (Polly^{XT}) was on board of eight cruises. Spectral solar radiance and irradiance observations have been performed on five cruises.

With this dataset, a variety of topics can be addressed. This presentation will focus on temperature and water vapor profiles and their relation to ocean currents. We will show that temperature profiles within the marine boundary layer can be derived with high accuracy by using MWR and applying special retrieval algorithms from ship-based radiosondes. The combination of MWR data with water vapor profiles from Raman lidar and observations of cloud occurrence gives a unique insight in the exchange processes of the lower troposphere over the ocean, where satellites can only provide very coarse information.

The dataset is very well suited to validate satellite products over the sea. We will show the potential by comparing cloud statistics with SEVIRI and will discuss influences on the satellite retrieval performance by exploiting the thermodynamic profiles measured from the ship.

In addition, we will give a statistical overview of the meridional distribution of atmospheric water vapor and clouds over the Atlantic Ocean. With nearly ten years of measurements, always at the same time of the year, the variability of the atmospheric conditions in different climate zones (mid-latitudes, subtropical and tropical regions) can be quantified.