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Ship-based remote sensing of the atmosphere and surface energy budget observations on board RV Polarstern 2008 to 2009: An Overview

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Within the framework of the Leibniz-project OCEANET the Atlantic transects of RV Polarstern from North-Germany to Southern Chile or South Africa and back are utilized to measure the full energy-budget and material exchange at the sea surface as well as the state of the upper ocean and the troposphere. The presentation focuses on the atmospheric and energy budget related part of OCEANET. The atmospheric composition is inferred from a combination of microwave radiometer, full sky imager, sun-photometer, lidar (since fall 2009), and several other temporarily accompanying instruments. Standard pyranometer and pyrgeometer are used to obtain the downwelling surface radiation. The turbulent fluxes of heat, momentum, humidity and CO2 are measured to close the energy and mass budget at the sea surface. Finally, satellite observations from the geostationary METEOSAT are converted into top-of-atmosphere radiation fluxes along the ship cruise.
The scientific focus of the atmospheric component of OCEANET is on determining the radiative effects at the surface and at the TOA as a function of cloud and aerosol properties of the atmosphere under a variety of different maritime synoptical and climatological conditions. Cloud cover, cloud type and cloud liquids water path are inferred from sky imager and microwave radiometer observations. With 1647 Wm-2 the largest ever on Polarstern observed downwelling solar radiation has been measured during the cruise ANT-XXVI/1 in fall 2009. The combination of different sun-photometer and the lidar device prove very valuable in obtaining aerosol load and spatial distributions. A dust plume from the Sahara as well as several bio-aerosol advections from Patagonia could be observed.
Examples of aerosol and cloud radiative effects for marine cumulus clouds and other cloud types, dust plumes, aerosol layers will be discussed.