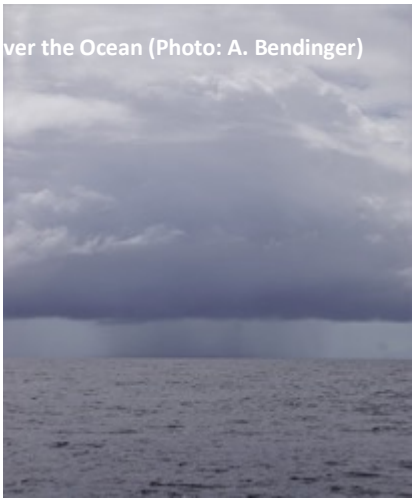
3. Weekly Report – MARIA S. MERIAN - MSM89

27.1. – 02.02.2020

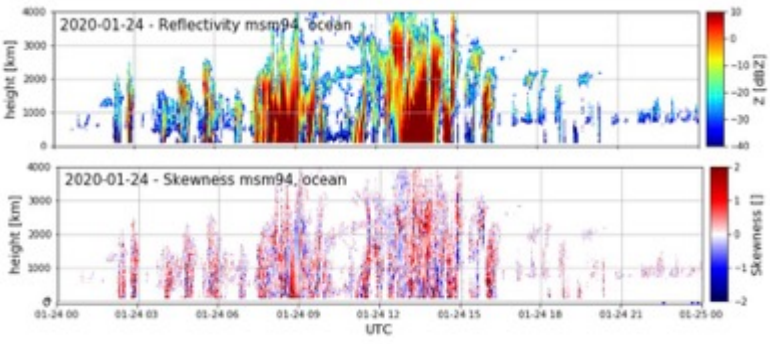

ver the Ocean (Photo: A. Bendinger)

Clouds are as fascinating as the sea. One likes to look at the clouds and maybe even wish to dive into this seemingly so soft mass and fly with it in the sky. Those who have ever flown through clouds with an airplane will soon notice that clouds are a particular shaky zone and what looked white and inviting from below is now grey and raindrops hit the windows. In short: it is often uncomfortable in the clouds. From a scientific point of view, every passenger for the duration of a flight through a cloud, crosses a zone of very high complexity in which many processes are intertwined. The interaction of these processes determines the "fate" of a cloud - does it continue to exist or does it dissolve? Tied to this are important questions like: Will it rain or not?


Installation of a radar (Photo: J. Karstensen)

On this expedition, we are interested in observing parameters that define clouds in order to describe and model them. The atmospheric researchers use remote sensing methods and direct measurements to track the clouds. The University of Cologne has installed a microwave radar unit on the MARIA S MERIAN which is a remote sensing method and measures vertically upwards - no easy task on a constantly moving ship. Therefore the radar is installed on a "stabilized" platform which, fed with the ship's orientation data, counteracts the movement of the ship at any moment. This way the platform always remains in the same orientation and the radar always looks in the same direction. The radar can measure signatures of precipitation as well as the liquid water content of the atmosphere, and thus also the liquid water content of clouds, up to a height of several kilometers.

Example graphics for Radar observations



What the observations on the MARIA S MERIAN show is that a higher liquid water content does not always mean that it is

raining out of the clouds. This raises the question: What factors control the tiny droplets of water in a cloud to form raindrops that fall to the sea surface at a speed of up to 20 km/h?


ARTHUS and a wind LIDAR (front) (Photo: J. Karstensen)

Radar can also detect precipitation from the cloud base down to the sea surface. The measurements show that the rain already evaporates on its way to the sea surface. So it does not reach the ground, but disappears at a height of about 100 meters. This is all the more astonishing as the humidity is also very high, making evaporation all the more difficult.

Another remote sensing method is LIDAR, which uses a laser beam to scan the atmosphere. The University of Hohenheim operates two wind LIDARs on board and the ARTHUS, a very high-resolution instrument for measuring the distribution of temperature and humidity. The aerosol content can also be deduced from the measurements.

Cloudkite launch is getting prepared

The most innovative platform for direct measurements is certainly the Cloudkite of the Max Planck Institute for Dynamics and Self-Organisation. The Cloudkite carries very complex measuring instruments which are placed directly into the clouds at altitudes of up to 2 km and for many hours. The data on condensation nuclei, raindrops, humidity, turbulence and much more are unique and will certainly revolutionize our knowledge of the processes in a cloud. The Cloudkite also provide important validation data for remote sensing methods.

Everyone on board is in good mood and the atmosphere and food are wonderful. On behalf of all participants Johannes Karstensen, GEOMAR

See cruise blog at: http://www.oceanblogs.org/msm89