ICYESS2013-44
Interdisciplinary Conference of Young Earth System Scientists
Hamburg, Germany, 22 – 25 September 2013

A sampling strategy to escape the dilemma of undersampling in marine science

S. Thomsen, T. Kanzow, and G. Krahmann
GEOMAR, Kiel, Germany (sthomsen@geomar.de)

In the ocean physical phenomena like currents and waves exhibit a wide range of sizes from millimetres to thousands of kilometres.
A lot is known about oceanic processes with sizes larger than ∼50 km, because they are resolved both by traditional observations made by research vessels and numerical global ocean model simulations. Also, small scale turbulent processes acting on millimetre to meter scales have been studied since decades. However, much less is known about processes occurring at the intermediate scale ranging from about 100 m to 10 km. The aim of this study is to investigate these processes because a strong coupling between physics and biogeochemistry exists on this scale. To do this via measurements is very challenging as the processes are associated with large temporal changes. Thus resolving these processes synoptically is very difficult as high resolution measurements are needed.

Electronical oceanic measurements (e.g. temperature) are very fast and consequently it is possible to make many samples. Instead, biogeochemical sampling (e.g. of nutrients) often depends on in-situ water samples, which later have to be analyzed by time consuming laboratory measurements. This fact limits the temporal and spatial sampling rate. Often only some hundred samples are taken during a research expedition of four weeks and thus the temporal and spatial variability cannot be resolved properly. This can introduce large uncertainties in the interpretation of an aquired data set. In order to understand processes on very small spatial and temporal scales much more data would be needed. However, this is not realistic for some very specific measurements.

Results of a research expedition are presented where a swarm of seven gliders was operated in the same area as the research vessel. Gliders are autonomously navigating underwater vehicles equipped with electronic sensors for e.g. temperature, salinity, chlorophyll and oxygen. The data set obtained by the gliders was transmitted via satellite to the research ship and analyzed there. In this way the location and size of interesting phenomena could be detected and adaptively sampled. Biogeochemical sampling requires a research ship as real water samples are needed. So in other words we were not blind anymore and were able to define a adaptive biogeochemical sampling strategy. This made the biogeochemical sampling much more effective and also representative.