



# Water mass variability over the Mid-Atlantic Ridge in the North Atlantic as inferred from ARGO Data



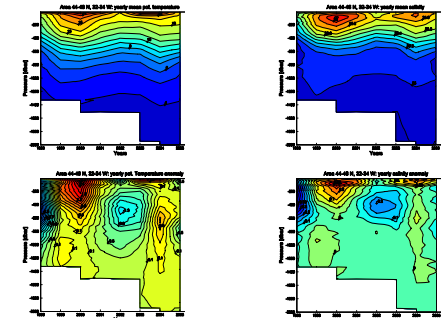
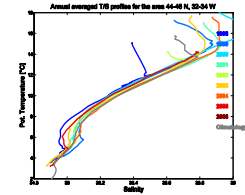
Birgit Klein, Klaus-Peter Koltermann and Gunda Wiczorek

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Variability over the Mid Atlantic Ridge in the North Atlantic is investigated using ARGO float data. Data are averaged into 2x2° fields and results are compared to timeseries from moored instruments. Mooring position is given by the \*.

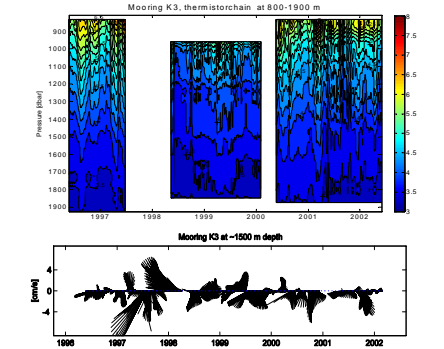
### Seasonal Variability:

The Argo data set shows considerable seasonal variability. In the Central Water range at 500 m the largest variations are seen in the south western corner of the investigation area associated with the path of the Gulf Stream. Highest salinities and temperatures (not shown) are found in summer and autumn and a disappearance of the signal in spring is noted. Seasonal variability is also seen at deeper levels down to the level of the Mediterranean Water.



### Interannual Variability:

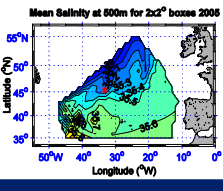
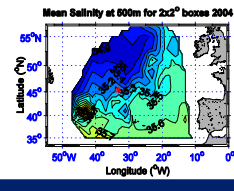
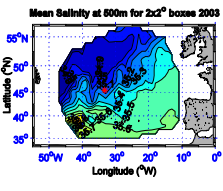
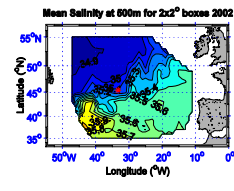
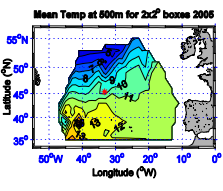
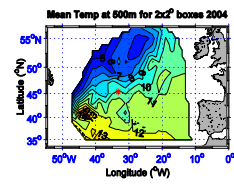
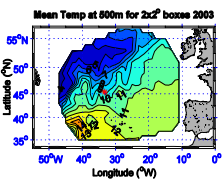
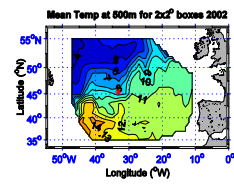
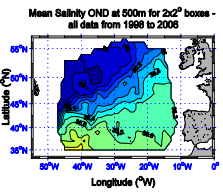
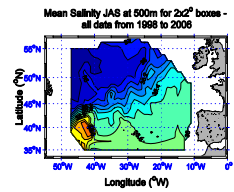
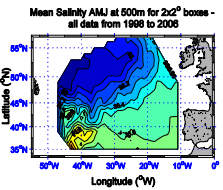
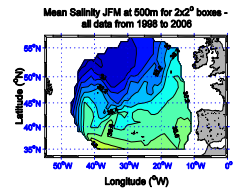
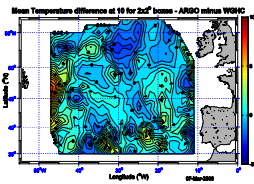
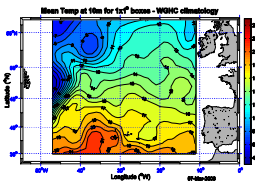
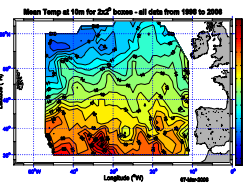
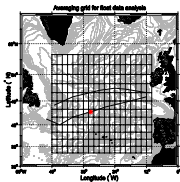
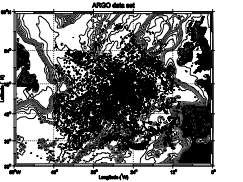
Since 2002 the coverage of the ARGO data set has been large enough to examine interannual variability. In the temperature and salinity fields at 500 m the year 2002 displays strong differences compared to the following years. In the south western corner it shows the strongest presence of warm and saline subtropical waters but in contrast it also appears that further to the north cold and less saline waters of subpolar origin have progressed to the south compared to the other years.



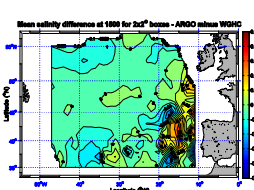
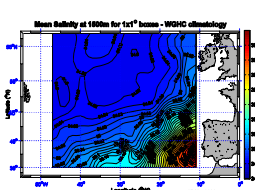
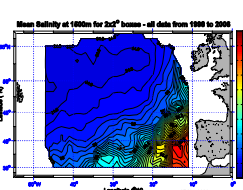
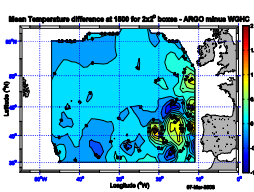
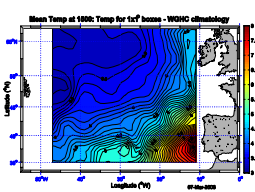
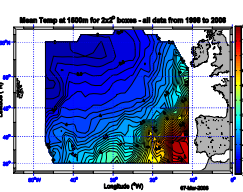
At the location marked by the red asterisk a mooring had been deployed which measured the temperature variability between 1000-2000 m from 1996-2002. For the surrounding 2x2° box from 44-46°N and 32-34°W synthetic timeseries have been computed which can be compared to the moored instruments.

The synthetic timeseries of TS curves for the 2X2° box at the mooring location shows interannual variations in the Central Waters and the Mediterranean outflow. 1998 displays the freshest TS curve for the entire period. At the same time the moored instruments also show the appearance of a cold anomaly at 1000-2000 m depth.

The temperature and salinity anomaly time series (computed with the WOCE climatology) show alternating periods of warm and cold anomalies. 2002 is characterized by cold and fresh anomalies compared to warm and salty anomalies in 2004 which was already seen from the horizontal fields at 500 m depth. In 1999 and 2004 the annual TS curves had shown a stronger Mediterranean Water influence. This is reflected in the anomaly time series by deeper maxima (H-800 m).



To obtain the horizontal fields the ARGO data have been sorted into 2x2° boxes and have been averaged over the period 1998-2006. The average surface fields derived from the ARGO data are in good correspondence with the climatological fields of the WOCE hydrography. Both show sharp temperature gradients associated with the Gulf Stream Front and some meandering over the Grand Banks. However, the difference fields reveal that the Gulf Stream axis has shifted position as can be seen from the positive temperature and salinity anomalies in that area.



At the 1500 m level the spreading Mediterranean Water is responsible for the huge temperature and salinity differences from west to east. Again there is good correspondence between the ARGO data and the WOCE climatology, although the ARGO data show a much stronger meandering of the water mass boundary between the Mediterranean Water and the Atlantic Water. This is reflected in the patches of large differences between the two data sets.