# Difference BNSChydr v1.0 and v1.1

It turned out that the original hydrographic data product of the BNSC (v1.0,Hinrichs and Gouretski 2018) was erroneous. The errors occurred by accidentally reading obsolete files in two of the intermediate steps of the production procedure. By this, the basis of observations was altered. This happened after the quality control and interpolation of the observations on standard depths, in the step where the observations are sorted into the chosen grid (this affects temperature and salinity) and in the following step, the correction of the temporal sampling error (this affects only salinity).

This document illustrates and quantifies the differences between BNSCv1.0 and v1.1.

## 1 Difference in the number of occupied boxes

The difference in the number of occupied boxes varies between the parameters temperature and salinity. More boxes are occupied in the newly calculated BNSChydr version (v1.1) than in the old one (v1.0). Table 1 contains the overview of the fraction of the boxes additionally occupied in v1.1 with respect to the number of occupied boxes in v1.0. The fraction was temporally averaged for this purpose.

Table 1: Fraction of differently occupied boxes with concern to the intersection of boxes between BNSChydr v1.0 and BNSChydr v1.1 (1873-2015), temporally averaged

| | Temperatur | Salzgehalt |
|---|---|---|
| monatlich | <0.001% | 5.65% |
| jährlich | <1% | 4.86% |

## 2 Differences in the parameter values

Differences between the parameter values are quantified for the intersection of occupied boxes between the two versions of the data. Histograms of the absolute differences are displayed in Figure 1 . The value range exceeds the range displayed here. Values outside the range are included in the respective outer interval.

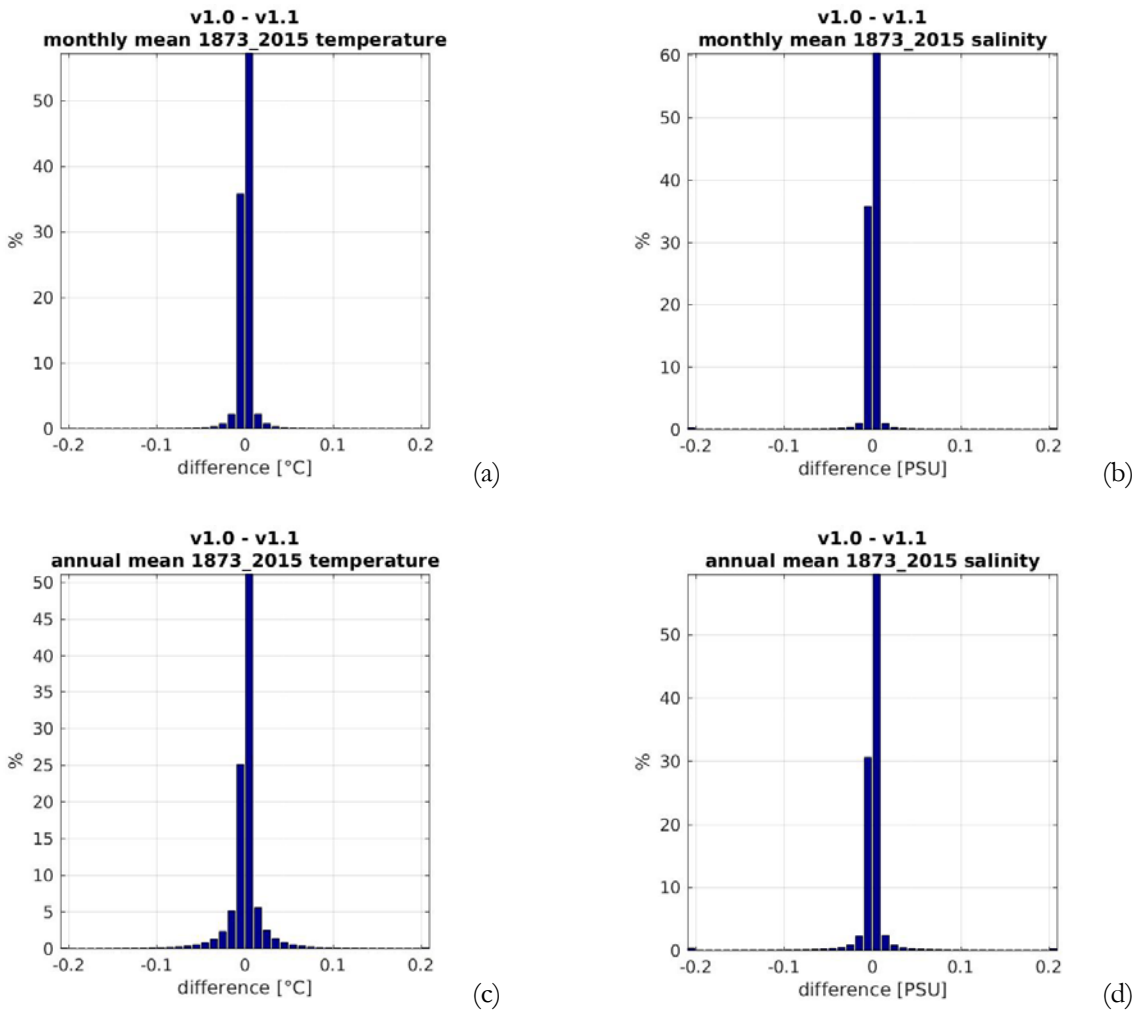


Figure 1: Histograms of the absolute differences between the old (v1.0) and the newly calculated version (v1.1) of the BNSChydr data product for the field of box averages for temperature ((a) ,(c)) and salinity ((b),(d)) in monthly ((a), (b)) and annual resolution ((c), (d)). Interval width: 0.01°C, respectively PSU. Values outside the displayed range are included in the outer two intervals.

As displayed in the histograms, the differences are small: More than 96% of the boxes (temporally and spatially integrated) display a difference in temperature (salinity), in a range between -0.05°C and +0.05°C (-0.05PSU and -0.05PSU), this is true for the monthly and annual resolution.

Table 2 and Figure 2 offer a closer look at the absolute differences that lie outside the range of the histograms. Table 1 contains the arithmetic mean and standard deviation of the difference values whose absolute value is greater than 0.2 °C, respectively PSU. Positive and negative differences are regarded separately, as well as the two parameters and the two different temporal resolutions. The arithmetic mean and standard deviation define the threshold value of extreme differences (mean value plus one standard deviation for positive differences and mean value minus one standard deviation for the negative ones). Figure 2 displays the geographical position of boxes containing these extreme differences. For temperature, there are only a few extreme differences occurring in coastal regions. For salinity, extreme differences mainly occur in regions with strong horizontal gradients in the transition zone between North and Baltic Sea and along the coasts. This holds true for the annual and monthly resolution. Additionally, the maximum and minimum of these differences are given ("max" in blue and "min" in red) and geographically marked with a blue, respectively red, circle.

Table 2: Mean and standard deviation of the difference (v1.0-v1.1, 1873-2015) in the value range > 0.2°C/PSU (blue) and < -0.2 °C/PSU (red) for temperature and salinity for the two different temporal resolutions which define the threshold values of extreme differences

| (v1.0-v1.1)> 0.2 | temperature [°C] | salinity [PSU] |
|---|---|---|
| monthly | 0.24+0.04 | 1.24+1.2 |
| annual | 0.68+0.39 | 3.13+1.87 |
| (v1.0-v1.1)< -0.2 | temperature [°C] | salinity [PSU] |
| monthly | -0.25-0.08 | -1.78-1.43 |
| annual | -0.63-0.42 | -3.62-2.26 |

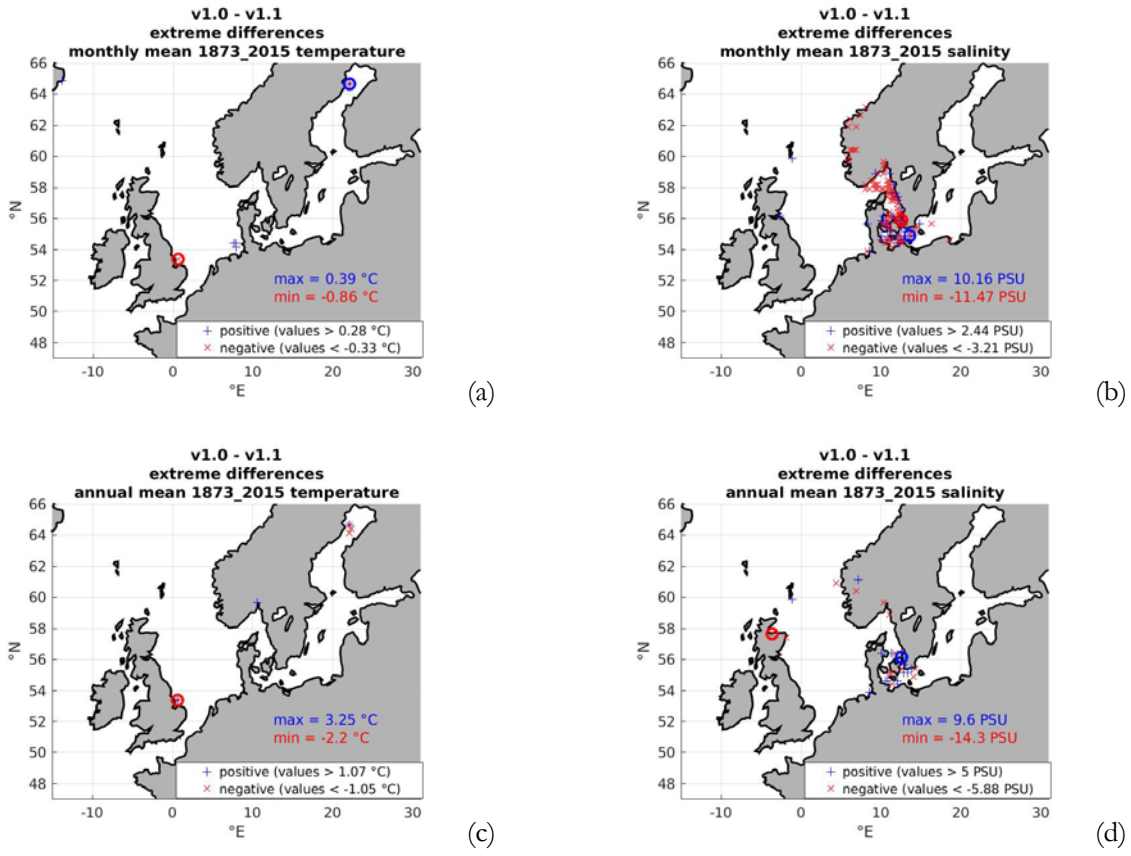


Figure 2: geographical positions of the extreme differences (v1.0-v1.1) for the fields of temperature ((a), (c)) and salinity ((b), (d)) box averages in monthly ((a), (b)) and annual resolution ((c), (d)). Additionally, the extreme values of the difference are displayed in blue and red („min“, „max“) and their geographically position (marked with a circle in respective color). In case of (c), the two positions coincide.