Aquarius Version 2.0/Version 3.0 Comparisons

In order to get some sense of gross changes in the Aquarius salinity data between versions 2.0 and 3.0, I arbitrarily chose the year, 2012, and plotted some global maps from the level-3 bin files for that year. I also plotted difference maps to show how the changes varied regionally from version to version.

I used the h5dump program from The HDF Group (*http://www.hdfgroup.org/HDF5/doc/RM/Tools.html#Tools-Dump*) to read just three of the datasets that are stored in the level-3 files, namely `BinList`, `SSS`, and `SSS_bias_adj`.

```
h5dump -A Q20120012012366.L3b_YR_SCI_V3.0.main
.
.
.
   GROUP "Level-3 Binned Data" {
.
.
.
      DATASET "BinList" {
         DATATYPE  H5T_COMPOUND {
            H5T_STD_U32LE "bin_num";      ← bin number (yields geographical location)
            H5T_STD_I16LE "nobs";         ← number of observations per bin
            H5T_STD_I16LE "nscenes";      ← number of orbits per bin
            H5T_IEEE_F32LE "weights";     ← divides sum and sum_sq to yield mean and standard deviation
            H5T_STD_U64LE "flags_set";
         }
         DATASPACE  SIMPLE { ( 26620 ) / ( H5S_UNLIMITED ) }
      }
.
.
.
      DATASET "SSS" {
         DATATYPE  H5T_COMPOUND {
            H5T_IEEE_F32LE "SSS_sum";      ← divide by "weights" to get mean salinity
            H5T_IEEE_F32LE "SSS_sum_sq";   ← divide by "weights" and subtract square of mean to get variance of salinity
         }
         DATASPACE  SIMPLE { ( 26620 ) / ( H5S_UNLIMITED ) }
      }
      DATASET "SSS_bias_adj" {
         DATATYPE  H5T_COMPOUND {
            H5T_IEEE_F32LE "SSS_bias_adj_sum";     ← divide by "weights" to get mean salinity
            H5T_IEEE_F32LE "SSS_bias_adj_sum_sq"; ← divide by "weights" and subtract square of mean to get variance of salinity
         }
         DATASPACE  SIMPLE { ( 26620 ) / ( H5S_UNLIMITED ) }
      }
.
.
.
```

(*The `SSS_bias_adj` dataset is not present in Version 2.0.*)

For each bin number in the file, I computed the geographical corner coordinates using a slight variation of the logic presented in Appendix A of NASA Technical Memorandum 104566, Volume 32, Level-3 SeaWiFS Data Products: Spatial and Temporal Binning Algorithms (http://oceancolor.gsfc.nasa.gov/SeaWiFS/TECH_REPORTS/PreLPDF/PreLVol32.pdf). With these corner coordinates I could draw each bin as a little rectangle on the maps I made – using a color look-up table to represent different data values with different colors.

I made three separate comparisons each for the mean salinity and its standard deviation at each level-3 bin.

- V2.0 SSS *versus* V3.0 SSS
- V2.0 SSS *versus* V3.0 SSS_bias_adj
- V3.0 SSS *versus* V3.0 SSS_bias_adj

I also compared the number of observations per bin and number of orbits per bin between V2.0 and V3.0.

Finally, I gathered all of the level-3 2012 salinity means from V2.0 SSS, V3.0 SSS, and V3.0 SSS_bias_adj into classes that are 0.1 psu wide and plotted three histograms showing how many of the global measurements fell into each of the classes. I also constructed such histograms for each of the 7-day level-3 bin files (V3.0 only) and assembled them into an animated GIF.

It should be noted that in V2.0, the existing mask and flag use settings used as part of the binning procedure which populated the Level-3 cells, did not properly exclude all of the invalid observations. As a result, a small number of anomalously low or negative value observations were included. When taking a straight average of the Level-3 observations, the global mean salinity thus obtained was incorrectly lowered due to these outliers. In V3.0, an extensive review and evaluation of the mask and flag criteria was conducted, and improved screening means this error has been corrected and consequently the value of the global mean salinity that is computed from the Level-3 product is now as correct as we believe possible at this time.

All of these graphics are available at the following location.

ftp://samoa.gsfc.nasa.gov/pub/norman/Aquarius/V3.0_V2.0_comparison/

P1.2012_V3.0_SSS_mean-2012_V2.0_SSS_mean.png	V2.0 SSS vs. V3.0 SSS mean salinity differences
P2.2012_V3.0_SSS_bias_adj_mean-2012_V2.0_SSS_mean.png	V2.0 SSS vs. V3.0 SSS_bias_adj mean salinity differences
P3.2012_V3.0_SSS_bias_adj_mean-2012_V3.0_SSS_mean.png	V3.0 SSS vs. V3.0 SSS_bias_adj mean salinity differences
P4.2012_V3.0_SSS_stdev-2012_V2.0_SSS_stdev.png	V2.0 SSS vs. V3.0 SSS standard deviation differences
P5.2012_V3.0_SSS_bias_adj_stdev-2012_V2.0_SSS_stdev.png	V2.0 SSS vs. V3.0 SSS_bias_adj standard deviation differences
P6.2012_V3.0_SSS_bias_adj_stdev-2012_V3.0_SSS_stdev.png	V3.0 SSS vs. V3.0 SSS_bias_adj standard deviation differences
P7.2012_V3.0_nobs-2012_V2.0_nobs.png	V2.0 vs. V3.0 differences in number of observations per bin
P8.2012_V3.0_nscenes-2012_V2.0_nscenes.png	V2.0 vs. V3.0 differences in number of orbits per bin
P9.Q20120012012366.L3b_YR_SCI_V2.0_V3.0.hist.png	3 histograms of salinity: V2.0 SSS, V3.0 SSS, and V3.0 SSS_bias_adj
Aquarius_7D_salinity_histograms.anim.gif	A time series of 7-day salinity histograms (V3.0 SSS and SSS_bias_adj)
Aquarius_V2_V3_comparisons.pdf	This document