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Processing steps for SBC LTER cruise CTD casts.

The main goal of these processing steps is to get all the CTD profiles associated with SBC LTER cruises (r/v Pt. Sur) into a format compatible with the Ocean Data View program. http://odv.awi-bremerhaven.de/ Even though some processing of the files is performed on board, only the raw data and calibrations are used as a starting point. All casts are reprocessed from scratch to maintain a uniform variable list and qaqc over time. All the processing steps are specific for each cruise and separate copies of all mfiles and SBE *.psa setup files and final output files are isolated with each set of cruise data.

Initial batch processing of *.dat and associated *.con files for a particular cruise is perfomed using SBE seasoft software. All the lter cruise_*.psa files must be run through once for one file to set path and confirm variable lists. The script below is run in Windows to batch process all files. Note that there are two deriviation steps. It is recommended that the Oxygen calculations be performed on the data prior to binaveraging. All other variable can be derived afterward. See the SBE Data Processing Manual for a complete explanation. It's available on line at http://www.seabird.com/.

file = (ex. LTER15_SBE_batchrun.txt)

```
@SBE batch processing for cruise 14 CTD casts
datcnv /i%1\*.dat /o%1
alignctd /i%1\*.cnv /o%1
celltm /i%1\*.cnv /o%1
filter /i%1\*.cnv /o%1
loopedit /i%1\*.cnv /o%1
derive /i%1\*.cnv /o%1 /p%1\ltercruise_deriveO2.psa
binavg /i%1\*.cnv /o%1
derive /i%1\*.cnv /o%1 /p%1\ltercruise_derive.psa
split /i%1\*.cnv /o%1
asciiout /i%1\*.cnv /o%1
```

The following is a typical list of variables ouput by the seasoft software (.asc) and the final column designations in the output (.txt) file. Note that the .asc column designations can change if other sensors are added to the mix. The designations for the voltage channels (.asc cols 14-21) can also change from cruise to cruise. Also note that each cast is split (SBE split) into an upcast and downcast. Two output files are generated for each cruise corresponding to this spit and, in addition, a .txt bottle file which will be described below

```
% variable list for LTER-cruise15 CTD profile data
%
% .txt  .asc  variables
% ----  ----  ---------
%                                    -- 8 ODV required columns--
% 1         Cruise name (ex LTER12)
% 2         Station (ex. CTD_grid22) (from .xls file)
% 3         Type (C)
% 4         mo/day/yr  (in that exact format for ODV)
% 5         hh:mm
```

```
% 6   3(1)  Longitude   (at start of cast)
% 7   2(1)  Latitude    (at start of cast)
% 8            bottom depth (from .xls file)
% 9   31    Depth sw m (from SBE output)
% 10        decimal year (yyyy.yyyyyyyyy)
% 11  3     Longitude   (continuous)
% 12  2     Latitude    (continuous)
% 13  4     prDM: Pressure, Digiquartz [db]
% 14  5     t090C: Temperature [ITS-90, deg C]
% 15  6     t190C: Temperature, 2 [ITS-90, deg C]
% 16  7     c0S/m: Conductivity [S/m]
% 17  8     c1S/m: Conductivity, 2 [S/m]
% 18  26    # scans / bin
% 19  10    flECO-AFL: Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
% 20  11    par: PAR/Irradiance, Biospherical/Licor
% 21  12    cpar
% 22  13    spar: SPAR/Surface Irradiance
% 23  14    v0: Voltage 0 (SBE43 O2)
% 24  15    v1: Voltage 1 (trans)
% 25  16    v2: Voltage 2 (par)
% 26  17    v3: Voltage 3 (free)
% 27  18    v4: Voltage 4 (fluor)
% 28  19    v5: Voltage 5
% 29  20    v6: Voltage 6 (altimeter)
% 30  21    v7: Voltage 7
% 31  22    xmiss: Beam Transmission, Chelsea/Seatech/Wetlab CStar [%]
% 32  23    bat: Beam Attenuation, Chelsea/Seatech/Wetlab CStar [1/m]
% 33  24    sbeox0Mm/Kg: Oxygen, SBE 43 [umol/Kg], WS = 2
% 34  25    sbeox0Mm/Kg: Oxygen, SBE 43   ml/l
% 35        YSI Beckman O2 (umol/kg) (not installed this cruise)
% 36        YSI Beckman O2 (ml/l)  (not installed this cruise)
% 37        YSI Beckman O2 temperature     "
%
%           --some more derived variables here--
%
% 38  27    potemp 00
% 39  28    potemp 11
% 40  29    sal00: Salinity [PSU]
% 41  30    sal11: Salinity, 2 [PSU]
% 42  32    sigma-?00: Density [sigma-theta, Kg/m^3]
% 43  33    sigma-?11: Density, 2 [sigma-theta, Kg/m^3]
% 44        sva: Specific Volume Anomaly [10^-8 * m^3/Kg] using density-00
% 45        sva: using density-11
% 46          upoly ISUS  ( not installed this cruise)
% 47        xderv1       -extra columns for future derivations
% 48        xderv2
% 49        xderv3   - all these = 99999 for now.
% 50            xderv4

--------------------------------------------------------------------------
Some more info.....

Here's a list of the required mfiles: (note that the cruise number can change)

lter15_cruise_CTD_process_all.m
lter15_cruise_CTD_process_onefile.m
get_summary_xls_info.m
```

----> (the following are required since the SBE software will not calculate SVA for the secondary sensor group. These functions remove the need to generate sva in the .asc files)

SWsva.m
sw_dens.m
sw_dens0.m
sw_seck.m
sw_smow.m

----> lon/lat from .txt cols(6,7) are fixed throughout a cast and correspond to the position at the first ctd record. The lon/lat from .txt cols(11,12) are continuously updated and can be used to look at any drift during a cast.

----> .txt file cols(47-50) are for any unusual sensors added for a particular cruise.

----> missing value code in the .txt file - 99999.

The Ocean Data View program is a bit needy and demands a strict format for the first 8 columns in the .txt files. See cols .txt cols 1-8 above. Much of this info is available in an Excel spreadsheet created by Janice Jones which is accessed with the function get_summary_xls_info.m. Output arguments from this function are used to create .txt cols 2,4,5,8. The .xls summary sheet usually needs to be tidied up a bit and sometimes the function described above needs to be modified to accommodate a change in the number or placement of columns. See the top of the matlab function for a list of required modifications.

The final output files are named:

LTERnn_CTD_upcasts.txt
LTERnn_CTD_downcasts.txt

nn = two digit cruise number.

Another ODV importable file, LTERnn_CTD_bottledata.txt, is generated solely from the summary.xls sheet using mfile (get_bottle_xls_info_intoODV.m)
and includes water chemistry, pigment, and production data. The column designations are:

col{1} = Cruise number
col{2} = station info (ex CTDnnnPNBnnn)
col{3} = odv 'type' (B)
col{4} = mm/dd/yyyy
col{5} = hh:mm
col{6} = lon (dd.ddddd) (first record in downcast, use to merge files?
col{7} = lat (dd.ddddd)
col{8} = Depth (bottom)(m)
col{9} = Depth (target)(m)
col{10} = Depth (actual)(m)
col{11} = lon (handwritten during bottle firing)
col{12} = lat
col{13} = consecutive sample number

col{14} = cast file name
col{15} = rosette bottle number
col{16} = incubation light level (%)
col{17} = [PO4]
col{18} = [Si]
col{19} = [NO2 + NO3]]
col{20} = [NO2]
col{21} = [NH4]
col{22} = [POC]
col{23} = [PON]
col{24} = [13C]
col{25} = [15N]
col{26} = BSi
col{27} = LSi
col{28} = 14C light
col{29} = 14C dark
col{30} = 14C production
col{31} = total water column 1 production
col{32} = total chl
col{33} = Chl a
col{34} = phaeopigments
col{35} = pressure
col{36} = T00
col{37} = T11
col{38} = C00
col{39} = C11
col{40} = Sal00
col{41} = Den00
col{42} = Fluor
col{43} = Trans %
col{44} = Trams beam C
col{45} = O2 umol/kg
col{46} = O2 ml/l
col{47} = PAR
col{48} = CPAR
col{49} = SPAR
col{50} = misc. comments column