LTERcruise_towed_CTD_processing

The 16 cruises utilized a few different towed vehicles with differing complements of instrumentation. Some of the SeaBird processing steps appear to have been performed aboard ship, while other earlier cruises produced raw files which were subsequently post processed using existing SeaBird processing modules with default values. The output seabird .asc data were converted to .mat files which had been stored with the archived images. The main points of interest for these data are that they were not bin averaged by depth but rather by time (1 second bins). Oxygen concentrations were calculated according to SeaBird's suggested method in that they were derived prior to bin averaging. All other derive variables were calculated after bin averaging.

The .mat files above are located in the /Working/ directory under each cruise directory. (ex. /internal/research/Ocean/Working/cruises/lter12/Scanfish_Files/images/)

Each cruise could potentially have a different complement of instrumentation and often produced files with different output variables in different columns. To standardize the final output products these files were reprocessed to conform to a set variable list in set columns all interpolated onto a common (5 second at this writing) time base.
(See mfile below for details)

File naming is LTERnn_Towed_CTD.txt where nn = cruise number.
The column designations for the final product files are:

1 Survey line,
2 Survey number,
3 date,
4 time,
5 matlab_time,
6 west_longitude,
7 north_latitude,
8 conductivity,
9 temperature,
10 pressure,
11 fluorescence,
12 beam_c,
13 depth,
14 potential_temperature,
15 salinity,
16 sigma_theta,
17 specific_volume_anomaly,
18 dissolved_oxygen');

QAQC: Since these cruises sampled a wide range of environments (ex. river plumes, red tide) only the most extreme values for these variables were removed from the data

sets. Data was excluded and replaced with a missing value code (99999) if it did not fall within the following ranges:

Conductity (0 to 7 S/m)
Temperature (4 to 24 C)
Pressure (0 to 120 dbar)
Fluor (0 to 100)
Beam_C (0 to 30 1/m)
Depth (0 to 130 m)
Potential temperature (4 to 24 C)
Salinity (20 to 40 PSU)
Sigma-t (10 to 30)
Specific volume anomaly SVA (0 to 1000)
Oxygen concentration (all data retained)

Mfile = Reformat_scanfish_files_4_database_SingleFilePerCruise.m

```
clear all
close all
clc

addpath /data01/pisco/ucsb/shared-files/transfer/Chris/mfile_library/
addpath /data01/pisco/ucsb/shared-files/transfer/Chris/mfile_library/sbchan_map/

plot_switch = 1;
interval = 5; % new time base interval in seconds
outdir = '/data02/users/gots/scratch/';


for ii = 1:16

list = fuf(['/data02/users/gots/temp6/ALLsfish_files/LTER',num2str(ii),'_*.mat'],'detail');

   % these will hold the concatenated data
   Sline = [];
   Ssvy = [];
   Sdata = [];
   Sdate_str = [];
   Stime_str = [];

   for jj = 1:length(list)

      load(list{jj})

%          time:
%           lon:
```

```
%           lat:
%          cond:
%          temp:
%         press:
%  fluor (volts):
%        beam_c:
%         depth:
%        potemp:
%           sal:
%     sigmaTheta:
%           sva:
%        oxygen:

      data = data(isfinite(data(:,1)),:);  % some nans appear in time column(?)


      switch ii
         case 1
            col = [1 4 3 5 6 7 12 10 999 14 13 15 999 999];
            year = 2001;
         case 2
            col = [1 4 3 5 6 7 12 10 999 14 13 15 999 999];
            year = 2001;
         case 3
            col = [1 4 3 5 6 7 999 10 16 14 13 15 999 999];
            year = 2002;
         case 4
            col = [1 4 3 5 6 7 12 10 999 14 13 15 999 999];
            year = 2002;
         case 5
            col = [1 4 3 5 6 7 12 10 999 14 13 15 999 999];
            year = 2002;
         case 6
            col = [1 4 3 5 6 7 999 18 16 21 23 22 24 999];
            year = 2003;
         case 7
            col = [1 4 3 5 6 7 12 10 999 14 13 15 999 999];
            year = 2003;
         case 8
            col = [1 4 3 5 6 7 21 19 16 26 28 27 29 24];
            year = 2003;
         case 9
            col = [1 4 3 5 6 7 23 21 16 29 30 31 999 27];
            year = 2004;
         case 10
            col = [1 4 3 5 6 7 21 19 16 26 28 27 29 24];
```

```
        year = 2004;
    case 11
        col = [1 4 3 5 6 7 21 19 16 26 28 27 29 24];
        year = 2004;
    case 12
        col = [1 4 3 5 6 7 21 19 16 26 27 28 29 24];
        year = 2005;
    case 13
        col = [1 4 3 5 6 7 21 19 16 27 28 29 30 25];
        year = 2005;
    case 14
        col = [1 4 3 5 6 7 18 17 14 23 24 25 26 21];
        year = 2005;
    case 15
        col = [1 4 3 5 6 7 20 19 16 26 27 28 29 24];
        year = 2006;
    case 16
        col = [1 4 3 5 6 7 20 19 16 26 27 28 29 24];
        year = 2006;
end



out = nan(size(data,1),14);

% change julian day to matlab time
out(:,1) = datenum(repmat(year,size(data,1),1), ones(size(data,1),1), data(:,1));

% reorder 'data' columns
for kk = 2:14
    if col(kk)~=999
        out(:,kk) = data(:,col(kk));
    end
end

% sort times into ascending if necessary
out = sortrows(out,1);

junk = find(diff(out(:,1))>1/(24*60)); % start index of region to be removed after
interpoloation
if ~isempty(junk)
    bad_rng = [out(junk,1), out(junk+1,1)];
else
    bad_rng = [];
end
clear junk
```

```
%qaqc
out((out(:,4)<0 | out(:,4)>7),4) = nan; % conductivity
out((out(:,5)<4 | out(:,5)>24),5) = nan; % temp
out((out(:,6)<0 | out(:,6)>120),6) = nan; % pressure
out((out(:,7)<0 | out(:,7)>100),7) = nan; % fluor
out((out(:,8)<0 | out(:,8)>30),8) = nan; % beam_c
out((out(:,9)<0 | out(:,9)>130),9) = nan; % depth
out((out(:,10)<4 | out(:,10)>24),10) = nan; % potemp
out((out(:,11)<20 | out(:,11)>40),11) = nan; % sal
out((out(:,12)<10 | out(:,12)>30),12) = nan; % sigma-t

if sum(isfinite(out(:,13)))==0; % if sva wasn't output with the data, recalculate
   disp('recalculating SVA')
   out(:,13) = SWsva(out(:,11),out(:,5),out(:,6));
end
out((out(:,13)<0 | out(:,13)>1000),13) = nan; % sva
%out((out(:,14)<0 | out(:,14)>7),14) = nan; % O2

% generate a nice time base for this file and
% interpolate all data into it
junk = datevec(out(1,1));
t_min = datenum(junk(1),junk(2),junk(3),junk(4),junk(5),0);

junk = datevec(out(size(out,1),1));
t_max = datenum(junk(1),junk(2),junk(3),junk(4),junk(5)+1,0);
clear junk

new = (t_min : interval/(24*60*60) : t_max)';
new = [new,nan(size(new,1),13)];
new(:,2:14) = interp1q(out(:,1),out(:,2:14),new(:,1));

% remove interpolated data gaps (if any)
if ~isempty(bad_rng)
   disp(['removed contrived data from ',num2str(size(bad_rng,1)),' gaps']);
   for bb = 1:size(bad_rng,1)
      bad = find(new(:,1)>=bad_rng(bb,1) & new(:,1)<=bad_rng(bb,2));
      new(bad,2:14) = nan;
   end % of bb loop
   clear bad_rng
end



 %--------------------------------------
```

```
if plot_switch
   figure(1)
   set(gcf,'position',[50 600 300 300])
   plot(new(:,2),new(:,3),'+')
   title(list{jj})

   figure(2)
   set(gcf,'position',[50 50 900 400])
   for ll = 4:14
      subplot(2,6,ll-3)
      plot(new(:,1),new(:,ll))
   end
   pause(2)
   close all
end
%---------------------------------------
clear data out col* t_min t_max year


date_str = datestr(new(:,1),29);
time_str = datestr(new(:,1),13);

% check first 12 rows for all nans and remove if necessary
[r,c] = find(isfinite(new(1:12,2:14)));
rec1 = min(r);  clear r c

% check last 12 rows for same
[r,c] = find(isfinite(new((size(new,1)-11):size(new,1),2:14)));
rec2 = size(new,1) - (12-max(r));  clear r c

new = new(rec1:rec2,:);
date_str = date_str(rec1:rec2,:);
time_str = time_str(rec1:rec2,:);
clear rec1 rec2

new(isnan(new)) = 99999;

% add two columns to 'new' (line code and survey number)
junk = regexp(list{jj},'_','split');
line = repmat(upper(junk{4}),size(new,1),1);
svy = repmat(str2num(junk{6}(1)),size(new,1),1);

Sline = [Sline;line];
Ssvy = [Ssvy;svy];
Sdata = [Sdata;new];
Sdate_str = [Sdate_str;date_str];
```

```
    Stime_str = [Stime_str;time_str];

    clear date_str time_str fn1 fname pp qq fid svy junk data col line

  end % for jj list loop

    if ii<10
      CruiseID = ['0',num2str(ii)];
    else
      CruiseID = num2str(ii);
    end

    fname = ['LTER',CruiseID,'_Towed_CTD.txt'];
    disp(fname)

    fclose all;
    fid = fopen([outdir,fname],'w');
    fprintf(fid,'%s\n','line, survey, date, time, matlab_time, west_longitude,
north_latitude, conductivity, temperature, pressure, fluorescence, beam_c, depth,
potential_temperature, salinity, sigma_theta, specific_volume_anomaly,
dissolved_oxygen');

    fmt{1}  = '%s,';  % line -
    fmt{2}  = ' %d,';  % survey -
    fmt{3}  = ' %s,';   % date -
    fmt{4}  = ' %sZ,';   % time -
    fmt{5}  = ' %12.5f,'; % matlab time -
    fmt{6}  = ' %8.4f,';  % lon -
    fmt{7}  = ' %7.4f,';  % lat -
    fmt{8}  = ' %6.4f,';  % cond -
    fmt{9}  = ' %7.4f,';  % temp -
    fmt{10} = ' %6.2f,';  % pressure -
    fmt{11} = ' %6.3f,';  % fluor -
    fmt{12} = ' %6.3f,';  % beam c -
    fmt{13} = ' %6.2f,';  % depth -
    fmt{14} = ' %7.4f,';  % potemp -
    fmt{15} = ' %7.4f,';  % salinity -
    fmt{16} = ' %7.4f,';  % sigma-t -
    fmt{17} = ' %7.3f,';  % sva -
    fmt{18} = ' %7.3f';   % O2


    % once again since we have both numbers and strings we have to loop through each
record
    for pp = 1:size(Sdata,1)
      for qq = 1:18
```

```
        if qq == 1
           junk = Sline(pp,:);
        elseif qq == 2
           junk = Ssvy(pp);
        elseif qq == 3
           junk = Sdate_str(pp,:);
        elseif qq == 4
           junk = Stime_str(pp,:);
        else
           junk = Sdata(pp,qq-4);
        end

        fprintf(fid,fmt{qq},junk);
        clear junk

        end % of qq loop

        fprintf(fid,'\n');

    end % of pp loop



end % of ii cruise loop

return
```