

## RV Investigator

### ADCP Processing Report

<b>Voyage:</b>	in2020_v01
<b>Voyage title:</b>	Development of William's Ridge, Kerguelen Plateau: tectonics, hotspot magmatism, microcontinents, and Australia's Extended Continental Shelf
<b>Depart:</b>	BAE Henderson, 11:00 Friday 10 <sup>th</sup> January 2020
<b>Return:</b>	Freemantle, 08:00 Friday 6 <sup>th</sup> March 2020
<b>Chief Scientist:</b>	Prof Millard (Mike) Coffin
<b>Affiliation:</b>	IMAS, University of Tasmania

### Document History

Date	Version	Author	Comments
27/04/2022	1.0	Vito Dirita	Initial version



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## 1 Summary

The primary scientific operations of the voyage were multibeam survey, seismic lines and dredging of the William's and Broken Ridge features.

ADCPs were turned off intermittently to avoid interference with multibeam during surveys. On Jan the 15<sup>th</sup> the OS75 was reporting excessively high temperatures. According to Uni of Hawaii, this is most likely due to water ingress into the transducer indicating potential failure.

Temperatures eventually settled at full-scale (~97 deg C), which had a significant effect on calculated water velocities. Soundspeed was manually set to 1500 m/s (this is a setting sent to the deck box via UHDAS) for real-time processing, however special processing will be required for the period with bad temperatures and therefore bad soundspeed. Despite this, the OS75 worked well for the remainder of the voyage.

Thanks to a query from Richard Atkinson (and under instruction from Jules Hummon, UH) we shall update the transducer offsets in UHDAS, as these offsets have been surveyed to a very high level of accuracy in 2015; this will avoid the need for UHDAS's in-built transducer offset estimation, which is significantly less accurate.

Data was collected in two parts during the voyage for the following dates:

First Part: 10 Jan. 2020 – 18 Jan. 2020 (8 days)  
Second Part: 12 Feb. 2020 – 06 Mar. 2020 (24 days)

Note that there is no data from 19<sup>th</sup> Jan. to 11 Feb. Subsequently, two datasets have been created and processed separately for each part of the voyage.

Data was collected during the voyage but was stopped when it would have interfered with GSM mapping or OBS triangulation. The OS75 was turned off whilst in shallower water to prioritise mapping and the OS150. Data was collected using UHDAS and post-processed using CODAS.

Both the RDI Ocean Surveyor 150kHz ADCP and the RDI Ocean Surveyor 75kHz ADCP were run in narrowband. Internal triggering was used. The drop keel was at 2m below the waterline for the duration of the voyage.

See the voyage computing and electronics report for more details regarding data acquisition.

## 2 Processing Background

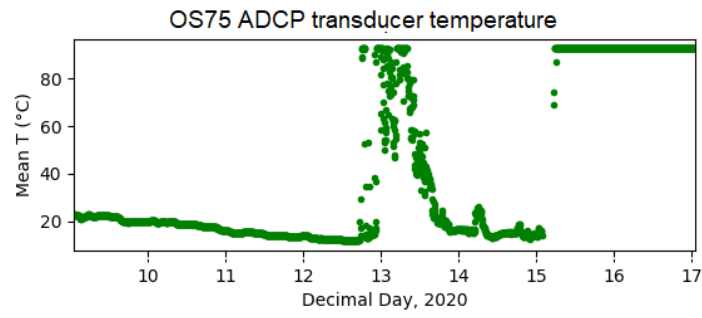
The University of Hawaii's CODAS software `codas_focal_20.04_vbox64.ova` was used for processing.

## 3 Processing Notes

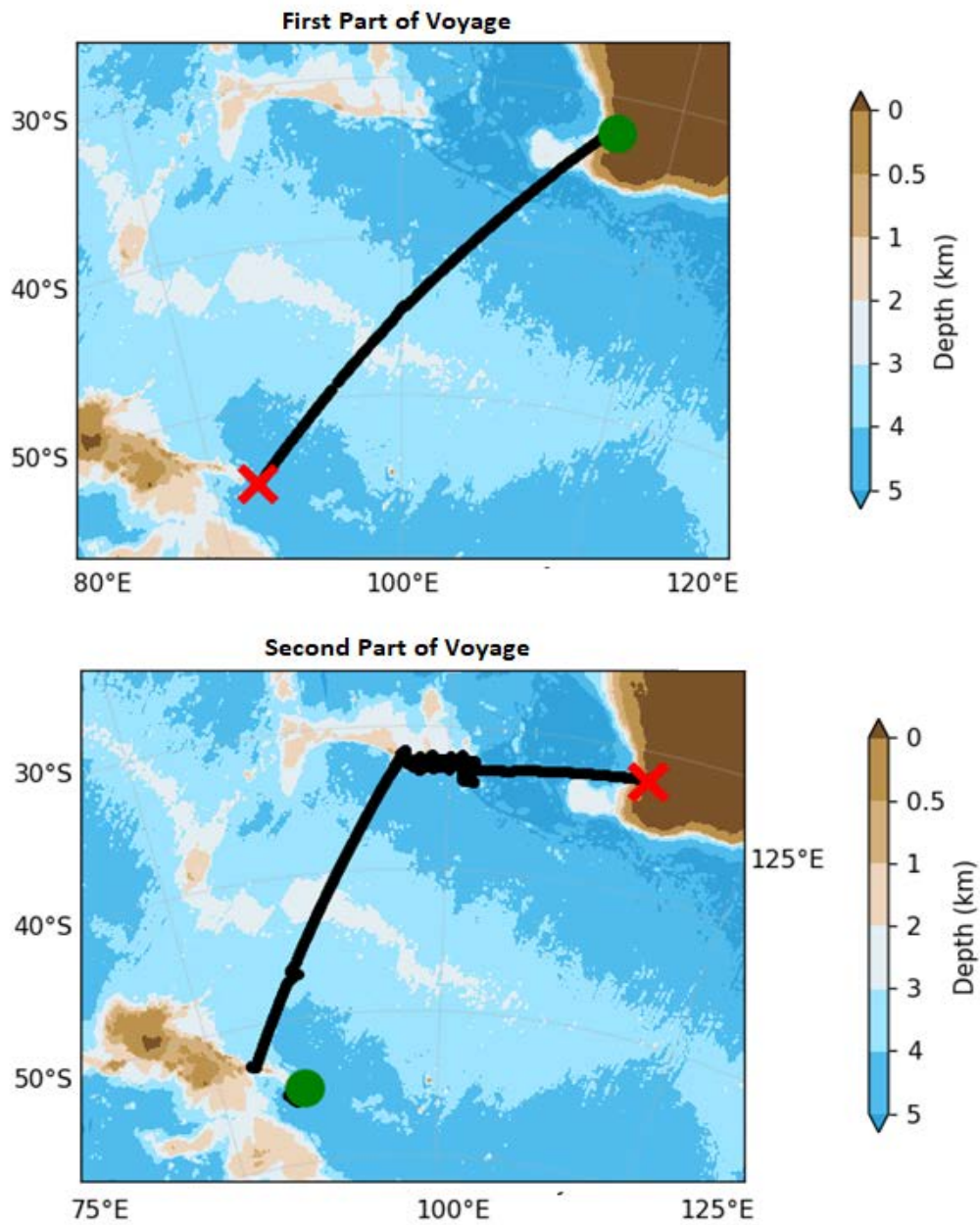
Only minor editing was required. A heading correction was applied to both ADCPs. Amplitude and phase rotation corrections were applied as follows, note that waterTrack was used for heading correction.

	OS75		OS150	
	Amplitude	Phase	Amplitude	Phase
First Part of Voyage	0.9981	0.0991	1.0037	0.0784
Second Part of Voyage	1.0010	0.2190	1.0090	-0.0885

The figure below shows the OS75 transducer temperature becoming excessive between day 12-13 and 15-17.



## 4. Area Covered



Please see the webpy\_bb and webpy\_nb folders for plots of collected data.

## 4 netCDF Data Headers

### 4.1 in2020\_v01\_os75nb.nc

```
codaspy:(os75nb)$ ncdump -h in2020_v01_os75nb.nc
netcdf in2020_v01_os75nb {
dimensions:
    time = 2261 ;
    depth_cell = 60 ;
variables:
    int trajectory ;
        trajectory:standard_name = "trajectory_id" ;
    double time(time) ;
        time:long_name = "Decimal day" ;
        time:units = "days since 2020-01-01 00:00:00" ;
        time:C_format = "%12.5f" ;
        time:standard_name = "time" ;
        time:data_min = 9.05070601851852 ;
        time:data_max = 17.0476736111111 ;
    double lon(time) ;
        lon:missing_value = 1.e+38 ;
        lon:long_name = "Longitude" ;
        lon:units = "degrees_east" ;
        lon:C_format = "%9.4f" ;
        lon:standard_name = "longitude" ;
        lon:data_min = 84.5904333333333 ;
        lon:data_max = 115.715975 ;
    double lat(time) ;
        lat:missing_value = 1.e+38 ;
        lat:long_name = "Latitude" ;
        lat:units = "degrees_north" ;
        lat:C_format = "%9.4f" ;
        lat:standard_name = "latitude" ;
        lat:data_min = -54.7803583333333 ;
        lat:data_max = -31.9602638888889 ;
    float depth(time, depth_cell) ;
        depth:missing_value = 1.e+38f ;
        depth:long_name = "Depth" ;
        depth:units = "meter" ;
        depth:C_format = "%8.2f" ;
        depth:positive = "down" ;
        depth:data_min = 29.94f ;
        depth:data_max = 974.f ;
    float u(time, depth_cell) ;
        u:missing_value = 1.e+38f ;
        u:long_name = "Zonal velocity component" ;
        u:units = "meter second-1" ;
        u:C_format = "%7.2f" ;
        u:data_min = -1.208074f ;
        u:data_max = 0.7304573f ;
    float v(time, depth_cell) ;
        v:missing_value = 1.e+38f ;
        v:long_name = "Meridional velocity component" ;
        v:units = "meter second-1" ;
        v:C_format = "%7.2f" ;
        v:data_min = -0.9227099f ;
        v:data_max = 0.6495216f ;
    short amp(time, depth_cell) ;
        amp:missing_value = 32767s ;
        amp:long_name = "Received signal strength" ;
        amp:C_format = "%d" ;
        amp:data_min = 10s ;
        amp:data_max = 216s ;
    byte pg(time, depth_cell) ;
        pg:missing_value = -1b ;
        pg:long_name = "Percent good pings" ;
        pg:C_format = "%d" ;
        pg:data_min = 0b ;
        pg:data_max = 100b ;
    byte pflag(time, depth_cell) ;
        pflag:long_name = "Editing flags" ;
        pflag:C_format = "%d" ;
        pflag:data_min = 0b ;
        pflag:data_max = 6b ;
    float heading(time) ;
```

```
        heading:missing_value = 1.e+38f ;
        heading:long_name = "Ship heading" ;
        heading:units = "degrees" ;
        heading:C_format = "%6.1f" ;
        heading:data_min = -143.3929f ;
        heading:data_max = 112.0197f ;
float tr_temp(time) ;
    tr_temp:missing_value = 1.e+38f ;
    tr_temp:long_name = "ADCP transducer temperature" ;
    tr_temp:units = "Celsius" ;
    tr_temp:C_format = "%4.1f" ;
    tr_temp:data_min = 12.05227f ;
    tr_temp:data_max = 92.56f ;
short num_pings(time) ;
    num_pings:long_name = "Number of pings averaged per ensemble" ;
    num_pings:units = "None" ;
    num_pings:C_format = "%d" ;
    num_pings:data_min = 59s ;
    num_pings:data_max = 142s ;
float uship(time) ;
    uship:missing_value = 1.e+38f ;
    uship:long_name = "Ship zonal velocity component" ;
    uship:units = "meter second-1" ;
    uship:C_format = "%9.4f" ;
    uship:data_min = -6.410347f ;
    uship:data_max = 2.390903f ;
float vship(time) ;
    vship:missing_value = 1.e+38f ;
    vship:long_name = "Ship meridional velocity component" ;
    vship:units = "meter second-1" ;
    vship:C_format = "%9.4f" ;
    vship:data_min = -5.220621f ;
    vship:data_max = 6.661789f ;

// global attributes:
:featureType = "trajectoryProfile" ;
:history = "Created: 2022-04-19 06:55:52 UTC" ;
:Conventions = "COARDS" ;
:software = "pycurrents" ;
:hg_changeset = "3211:63370479787a" ;
:title = "Shipboard ADCP velocity profiles" ;
:description = "Shipboard ADCP velocity profiles from in2020_v01_pt1 using instrument os75nb -
Short Version." ;
:cruise_id = "in2020_v01_pt1" ;
:sonar = "os75nb" ;
:yearbase = 2020 ;
:ship_name = "RV_Investigator" ;
:CODAS_variables = "\n",
    "Variables in this CODAS short-form Netcdf file are intended for most end-user\n",
    "scientific analysis and display purposes. For additional information see\n",
    "the CODAS_processing_note global attribute and the attributes of each\n",
    "of the variables.\n",
    "\n",
    "\n",
    "=====\n",
    "time          Time at the end of the ensemble, days from start of year.\n",
    "lon, lat      Longitude, Latitude from GPS at the end of the ensemble.\n",
    "u,v           Ocean zonal and meridional velocity component profiles.\n",
    "uship, vship  Zonal and meridional velocity components of the ship.\n",
    "heading       Mean ship heading during the ensemble.\n",
    "depth         Bin centers in nominal meters (no sound speed profile correction).\n",
    "tr_temp       ADCP transducer temperature.\n",
    "pg            Percent Good pings for u, v averaging after editing.\n",
    "pflag         Profile Flags based on editing, used to mask u, v.\n",
    "amp           Received signal strength in ADCP-specific units; no correction\n",
    "              for spreading or attenuation.\n",
    "=====\n",
    "\n",
    " ;
:CODAS_processing_note = "\n",
    "CODAS processing note:\n",
    "=====\n",
    "\n",
    "Overview\n",
    "-----\n",
    "The CODAS database is a specialized storage format designed for\n",
    "shipboard ADCP data. \"CODAS processing\" uses this format to hold\n",
```

```

"averaged shipboard ADCP velocities and other variables, during the\n",
"stages of data processing. The CODAS database stores velocity\n",
"profiles relative to the ship as east and north components along with\n",
"position, ship speed, heading, and other variables. The netCDF *short*\n",
"form contains ocean velocities relative to earth, time, position,\n",
"transducer temperature, and ship heading; these are designed to be\n",
"\ready for immediate use\". The netCDF *long* form is just a dump of\n",
"the entire CODAS database. Some variables are no longer used, and all\n",
"have names derived from their original CODAS names, dating back to the\n",
"late 1980's.\n",
"\n",
"Post-processing\n",
"-----\n",
"CODAS post-processing, i.e. that which occurs after the single-ping\n",
"profiles have been vector-averaged and loaded into the CODAS database,\n",
"includes editing (using automated algorithms and manual tools),\n",
"rotation and scaling of the measured velocities, and application of a\n",
"time-varying heading correction. Additional algorithms developed more\n",
"recently include translation of the GPS positions to the transducer\n",
"location, and averaging of ship's speed over the times of valid pings\n",
"when Percent Good is reduced. Such post-processing is needed prior to\n",
"submission of \"processed ADCP data\" to JASADCP or other archives.\n",
"\n",
"Full CODAS processing\n",
"-----\n",
"Whenever single-ping data have been recorded, full CODAS processing\n",
"provides the best end product.\n",
"\n",
"Full CODAS processing starts with the single-ping velocities in beam\n",
"coordinates. Based on the transducer orientation relative to the\n",
"hull, the beam velocities are transformed to horizontal, vertical, and\n",
"error velocity components. Using a reliable heading (typically from\n",
"the ship's gyro compass), the velocities in ship coordinates are\n",
"rotated into earth coordinates.\n",
"\n",
"Pings are grouped into an \"ensemble\" (usually 2-5 minutes duration)\n",
"and undergo a suite of automated editing algorithms (removal of\n",
"acoustic interference; identification of the bottom; editing based on\n",
"thresholds; and specialized editing that targets CTD wire interference\n",
"and \"weak, biased profiles\". The ensemble of single-ping velocities\n",
"is then averaged using an iterative reference layer averaging scheme.\n",
"Each ensemble is approximated as a single function of depth, with a\n",
"zero-average over a reference layer plus a reference layer velocity\n",
"for each ping. Adding the average of the single-ping reference layer\n",
"velocities to the function of depth yields the ensemble-average\n",
"velocity profile. These averaged profiles, along with ancillary\n",
"measurements, are written to disk, and subsequently loaded into the\n",
"CODAS database. Everything after this stage is \"post-processing\".\n",
"\n",
"note (time):\n",
"-----\n",
"Time is stored in the database using UTC Year, Month, Day, Hour,\n",
"Minute, Seconds. Floating point time \"Decimal Day\" is the floating\n",
"point interval in days since the start of the year, usually the year\n",
"of the first day of the cruise.\n",
"\n",
"\n",
"note (heading):\n",
"-----\n",
"CODAS processing uses heading from a reliable device, and (if\n",
"available) uses a time-dependent correction by an accurate heading\n",
"device. The reliable heading device is typically a gyro compass (for\n",
"example, the Bridge gyro). Accurate heading devices can be POSMV,\n",
"Seapath, Phins, Hydrins, MAHRS, or various Ashtech devices; this\n",
"varies with the technology of the time. It is always confusing to\n",
"keep track of the sign of the heading correction. Headings are written\n",
"degrees, positive clockwise. setting up some variables:\n",
"\n",
"X = transducer angle (CONFIG1_heading_bias)\n",
"    positive clockwise (beam 3 angle relative to ship)\n",
"G = Reliable heading (gyrocompass)\n",
"A = Accurate heading\n",
"dh = G - A = time-dependent heading correction (ANCIL2_watrk_hd_misalign)\n",
"\n",
"Rotation of the measured velocities into the correct coordinate system\n",
"amounts to (u+iv)*(exp(i*theta)) where theta is the sum of the\n",
"corrected heading and the transducer angle.\n",

```

```
"\n",
"theta = X + (G - dh) = X + G - dh\n",
"\n",
"\n",
"Watertrack and Bottomtrack calibrations give an indication of the\n",
"residual angle offset to apply, for example if mean and median of the\n",
"phase are all 0.5 (then R=0.5). Using the \"rotate\" command,\n",
"the value of R is added to \"ANCIL2_watrck_hd_misalign\".\n",
"\n",
"new_dh = dh + R\n",
"\n",
"Therefore the total angle used in rotation is\n",
"\n",
"new_theta = X + G - dh_new\n",
"           = X + G - (dh + R)\n",
"           = (X - R) + (G - dh)\n",
"\n",
"The new estimate of the transducer angle is: X - R\n",
"ANCIL2_watrck_hd_misalign contains: dh + R\n",
"\n",
"=====\n",
"\n",
"Profile flags\n",
"-----\n",
"Profile editing flags are provided for each depth cell:\n",
"\n",


| binary | decimal | below  | Percent |     |
|--------|---------|--------|---------|-----|
| value  | value   | bottom | Good    | bin |
| 000    | 0       |        |         |     |
| 001    | 1       |        |         | bad |
| 010    | 2       |        | bad     |     |
| 011    | 3       |        | bad     | bad |
| 100    | 4       | bad    |         |     |
| 101    | 5       | bad    |         | bad |
| 110    | 6       | bad    | bad     |     |
| 111    | 7       | bad    | bad     | bad |


"\n",
";
}
```

## 4.2 in2020\_v01\_os150nb.nc

```
codaspy:(os150nb)$ ncdump -h in2020_v01_os150nb.nc
netcdf in2020_v01_os150nb {
dimensions:
    time = 2304 ;
    depth_cell = 60 ;
variables:
    int trajectory ;
        trajectory:standard_name = "trajectory_id" ;
    double time(time) ;
        time:long_name = "Decimal day" ;
        time:units = "days since 2020-01-01 00:00:00" ;
        time:C_format = "%12.5f" ;
        time:standard_name = "time" ;
        time:data_min = 9.0506944444444 ;
        time:data_max = 17.0476736111111 ;
    double lon(time) ;
        lon:missing_value = 1.e+38 ;
        lon:long_name = "Longitude" ;
        lon:units = "degrees_east" ;
        lon:C_format = "%9.4f" ;
        lon:standard_name = "longitude" ;
        lon:data_min = 84.5905388888889 ;
        lon:data_max = 115.716091666667 ;
    double lat(time) ;
        lat:missing_value = 1.e+38 ;
        lat:long_name = "Latitude" ;
        lat:units = "degrees_north" ;
        lat:C_format = "%9.4f" ;
        lat:standard_name = "latitude" ;
        lat:data_min = -54.7802944444444 ;
        lat:data_max = -31.9602583333333 ;
    float depth(time, depth_cell) ;
        depth:missing_value = 1.e+38f ;
        depth:long_name = "Depth" ;
```



```
    depth:units = "meter" ;
    depth:C_format = "%8.2f" ;
    depth:positive = "down" ;
    depth:data_min = 17.94f ;
    depth:data_max = 489.99f ;
float u(time, depth_cell) ;
    u:missing_value = 1.e+38f ;
    u:long_name = "Zonal velocity component" ;
    u:units = "meter second-1" ;
    u:C_format = "%7.2f" ;
    u:data_min = -0.7818644f ;
    u:data_max = 0.8060451f ;
float v(time, depth_cell) ;
    v:missing_value = 1.e+38f ;
    v:long_name = "Meridional velocity component" ;
    v:units = "meter second-1" ;
    v:C_format = "%7.2f" ;
    v:data_min = -1.154876f ;
    v:data_max = 0.7341182f ;
short amp(time, depth_cell) ;
    amp:missing_value = 32767s ;
    amp:long_name = "Received signal strength" ;
    amp:C_format = "%d" ;
    amp:data_min = 20s ;
    amp:data_max = 229s ;
byte pg(time, depth_cell) ;
    pg:missing_value = -1b ;
    pg:long_name = "Percent good pings" ;
    pg:C_format = "%d" ;
    pg:data_min = 0b ;
    pg:data_max = 100b ;
byte pflag(time, depth_cell) ;
    pflag:long_name = "Editing flags" ;
    pflag:C_format = "%d" ;
    pflag:data_min = 0b ;
    pflag:data_max = 6b ;
float heading(time) ;
    heading:missing_value = 1.e+38f ;
    heading:long_name = "Ship heading" ;
    heading:units = "degrees" ;
    heading:C_format = "%6.1f" ;
    heading:data_min = -143.3916f ;
    heading:data_max = 112.4481f ;
float tr_temp(time) ;
    tr_temp:missing_value = 1.e+38f ;
    tr_temp:long_name = "ADCP transducer temperature" ;
    tr_temp:units = "Celsius" ;
    tr_temp:C_format = "%4.1f" ;
    tr_temp:data_min = 2.823534f ;
    tr_temp:data_max = 22.86894f ;
short num_pings(time) ;
    num_pings:long_name = "Number of pings averaged per ensemble" ;
    num_pings:units = "None" ;
    num_pings:C_format = "%d" ;
    num_pings:data_min = 119s ;
    num_pings:data_max = 251s ;
float uship(time) ;
    uship:missing_value = 1.e+38f ;
    uship:long_name = "Ship zonal velocity component" ;
    uship:units = "meter second-1" ;
    uship:C_format = "%9.4f" ;
    uship:data_min = -6.093477f ;
    uship:data_max = 2.401375f ;
float vship(time) ;
    vship:missing_value = 1.e+38f ;
    vship:long_name = "Ship meridional velocity component" ;
    vship:units = "meter second-1" ;
    vship:C_format = "%9.4f" ;
    vship:data_min = -5.212858f ;
    vship:data_max = 6.670744f ;

// global attributes:
    :featureType = "trajectoryProfile" ;
    :history = "Created: 2022-04-19 06:56:34 UTC" ;
    :Conventions = "COARDS" ;
    :software = "pycurrents" ;
    :hg_changeset = "3211:63370479787a" ;
```

```
:title = "Shipboard ADCP velocity profiles" ;
:description = "Shipboard ADCP velocity profiles from in2020_v01_pt1 using instrument os150nb
- Short Version." ;
:cruise_id = "in2020_v01_pt1" ;
:sonar = "os150nb" ;
:yearbase = 2020 ;
:ship_name = "RV_Investigator" ;
:CODAS_variables = "\n",
    "Variables in this CODAS short-form Netcdf file are intended for most end-user\n",
    "scientific analysis and display purposes. For additional information see\n",
    "the CODAS_processing_note global attribute and the attributes of each\n",
    "of the variables.\n",
    "\n",
    "\n",
    "=====\n",
    "time          Time at the end of the ensemble, days from start of year.\n",
    "lon, lat      Longitude, Latitude from GPS at the end of the ensemble.\n",
    "u,v           Ocean zonal and meridional velocity component profiles.\n",
    "uship, vship  Zonal and meridional velocity components of the ship.\n",
    "heading       Mean ship heading during the ensemble.\n",
    "depth         Bin centers in nominal meters (no sound speed profile correction).\n",
    "tr_temp       ADCP transducer temperature.\n",
    "pg           Percent Good pings for u, v averaging after editing.\n",
    "pflag         Profile Flags based on editing, used to mask u, v.\n",
    "amp           Received signal strength in ADCP-specific units; no correction\n",
    "              for spreading or attenuation.\n",
    "=====\n",
    "\n",
    " " ;
:CODAS_processing_note = "\n",
    "CODAS processing note:\n",
    "=====\n",
    "\n",
    "Overview\n",
    "-----\n",
    "The CODAS database is a specialized storage format designed for\n",
    "shipboard ADCP data. \"CODAS processing\" uses this format to hold\n",
    "averaged shipboard ADCP velocities and other variables, during the\n",
    "stages of data processing. The CODAS database stores velocity\n",
    "profiles relative to the ship as east and north components along with\n",
    "position, ship speed, heading, and other variables. The netCDF *short*\n",
    "form contains ocean velocities relative to earth, time, position,\n",
    "transducer temperature, and ship heading; these are designed to be\n",
    "\"ready for immediate use\". The netCDF *long* form is just a dump of\n",
    "the entire CODAS database. Some variables are no longer used, and all\n",
    "have names derived from their original CODAS names, dating back to the\n",
    "late 1980's.\n",
    "\n",
    "Post-processing\n",
    "-----\n",
    "CODAS post-processing, i.e. that which occurs after the single-ping\n",
    "profiles have been vector-averaged and loaded into the CODAS database,\n",
    "includes editing (using automated algorithms and manual tools),\n",
    "rotation and scaling of the measured velocities, and application of a\n",
    "time-varying heading correction. Additional algorithms developed more\n",
    "recently include translation of the GPS positions to the transducer\n",
    "location, and averaging of ship's speed over the times of valid pings\n",
    "when Percent Good is reduced. Such post-processing is needed prior to\n",
    "submission of \"processed ADCP data\" to JASADCP or other archives.\n",
    "\n",
    "Full CODAS processing\n",
    "-----\n",
    "Whenever single-ping data have been recorded, full CODAS processing\n",
    "provides the best end product.\n",
    "\n",
    "Full CODAS processing starts with the single-ping velocities in beam\n",
    "coordinates. Based on the transducer orientation relative to the\n",
    "hull, the beam velocities are transformed to horizontal, vertical, and\n",
    "\"error velocity\" components. Using a reliable heading (typically from\n",
    "the ship's gyro compass), the velocities in ship coordinates are\n",
    "rotated into earth coordinates.\n",
    "\n",
    "Pings are grouped into an \"ensemble\" (usually 2-5 minutes duration)\n",
    "and undergo a suite of automated editing algorithms (removal of\n",
    "acoustic interference; identification of the bottom; editing based on\n",
    "thresholds; and specialized editing that targets CTD wire interference\n",
    "and \"weak, biased profiles\". The ensemble of single-ping velocities
```

```

"is then averaged using an iterative reference layer averaging scheme.\n",
"Each ensemble is approximated as a single function of depth, with a\n",
"zero-average over a reference layer plus a reference layer velocity\n",
"for each ping. Adding the average of the single-ping reference layer\n",
"velocities to the function of depth yields the ensemble-average\n",
"velocity profile. These averaged profiles, along with ancillary\n",
"measurements, are written to disk, and subsequently loaded into the\n",
"CODAS database. Everything after this stage is \"post-processing\".\n",
"\n",
"note (time):\n",
"-----\n",
"Time is stored in the database using UTC Year, Month, Day, Hour,\n",
"Minute, Seconds. Floating point time \"Decimal Day\" is the floating\n",
"point interval in days since the start of the year, usually the year\n",
"of the first day of the cruise.\n",
"\n",
"\n",
"note (heading):\n",
"-----\n",
"CODAS processing uses heading from a reliable device, and (if\n",
"available) uses a time-dependent correction by an accurate heading\n",
"device. The reliable heading device is typically a gyro compass (for\n",
"example, the Bridge gyro). Accurate heading devices can be POSMV,\n",
"Seapath, Phins, Hydrins, MAHRS, or various Ashtech devices; this\n",
"varies with the technology of the time. It is always confusing to\n",
"keep track of the sign of the heading correction. Headings are written\n",
"degrees, positive clockwise. setting up some variables:\n",
"\n",
"X = transducer angle (CONFIG1_heading_bias)\n",
"    positive clockwise (beam 3 angle relative to ship)\n",
"G = Reliable heading (gyrocompass)\n",
"A = Accurate heading\n",
"dh = G - A = time-dependent heading correction (ANCIL2_watrk_hd_misalign)\n",
"\n",
"Rotation of the measured velocities into the correct coordinate system\n",
"amounts to (u+i*v)*(exp(i*theta)) where theta is the sum of the\n",
"corrected heading and the transducer angle.\n",
"\n",
"theta = X + (G - dh) = X + G - dh\n",
"\n",
"\n",
"Watertrack and Bottomtrack calibrations give an indication of the\n",
"residual angle offset to apply, for example if mean and median of the\n",
"phase are all 0.5 (then R=0.5). Using the \"rotate\" command,\n",
"the value of R is added to \"ANCIL2_watrk_hd_misalign\".\n",
"\n",
"new_dh = dh + R\n",
"\n",
"Therefore the total angle used in rotation is\n",
"\n",
"new_theta = X + G - dh_new\n",
"           = X + G - (dh + R)\n",
"           = (X - R) + (G - dh)\n",
"\n",
"The new estimate of the transducer angle is: X - R\n",
"ANCIL2_watrk_hd_misalign contains: dh + R\n",
"\n",
"=====\n",
"\n",
"Profile flags\n",
"-----\n",
"Profile editing flags are provided for each depth cell:\n",
"\n",


| binary | decimal | below  | Percent |     |
|--------|---------|--------|---------|-----|
| value  | value   | bottom | Good    | bin |
| 000    | 0       |        |         |     |
| 001    | 1       |        |         | bad |
| 010    | 2       |        | bad     |     |
| 011    | 3       |        | bad     | bad |
| 100    | 4       | bad    |         |     |
| 101    | 5       | bad    |         | bad |
| 110    | 6       | bad    | bad     |     |
| 111    | 7       | bad    | bad     | bad |


"\n",
" " ;

```

}