RV *Investigator*

ADCP Processing Report

Voyage #:	IN2018_v06
Voyage title:	Status and recovery of deep-sea coral communities on seamounts in iconic Australian marine reserves
Depart:	08:00 Hobart, Friday 23 November 2018
Return:	08:00 Hobart, Wednesday, 19 December 2018
Chief Scientist:	Dr Alan Williams
Affiliation:	CSIRO
Report compiled by:	Karl Malakoff

Contents

1 Summary

Data was collected during in2018_v06 for the entire voyage. Data was collected using UHDAS and post-processed using CODAS.

Data was collected with the RDI Ocean Surveyor 75kHz and 150kHz ADCP, which were run in narrow band mode with 16m and 8m bins respectively. Bottom tracking was turned on while in shallow water for personal transfers and departing and arriving in Hobart. The ADCPs were occasionally turned off to reduce noise while troubleshooting USBL issues resulting in some gaps in the data.

Internal triggering was used as external triggering was found to be unstable on previous voyages.

The port drop keel was at 2m 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 was used for data post-processing. Revision 2833:145c35feab49 dated 06 Dec 2018 was used.

3 Processing Notes

Overall data quality was good for the duration of the voyage.

There are small gaps in data caused by a low percent good on ping returns.

Some profiles were edited out, both manually and using CODAS's automatic processing. The dataset was not rotated.

There are some gaps in the data due to the ADCP's being turned off to reduce noise while troubleshooting the USBL.

The os75nb dataset required significant editing using the seabed selector tool to edit out the tops of seamounts which were not detected as the seabed automatically.

Very little ringing was found or wire interference was found.

4 netCDF Data Headers

```
netcdf os150nb {
dimensions:
        time = 6830 ;
        depth_cell = 60 ;
variables:
        int trajectory ;
                trajectory:standard_name = "trajectory_id" ;
        double time(time) ;
                time:long_name = "Decimal day" ;
                time:units = "days since 2018-01-01 00:00:00" ;
                time:C_format = "%12.5f" ;
                time:standard_name = "time" ;
                time:data_min = 325.961724537037 ;
                time:data_max = 351.7565625 ;
        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 = 146.001525 ;
                lon:data_max = 148.953166666667 ;
        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 = -44.4200416666667 ;
                lat:data_max = -41.1840888888889 ;
        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 = 17.93f ;
                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 = -0.6097069f ;
                u:data_max = 0.6496426f ;
        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 = -0.8897853f ;
                v:data_max = 0.4286123f ;
        short amp(time, depth_cell) ;
                amp:missing_value = 32767s ;
                amp:long_name = "Received signal strength" ;
                amp:C_format = "%d" ;
                amp:data_min = 22s ;
                amp:data_max = 230s ;
        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 = -179.9457f ;
                heading:data_max = 179.8946f ;
        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 = 12.86884f ;
                tr_temp:data_max = 17.48232f ;
        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 = 36s ;
                num_pings:data_max = 252s ;
        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 = -6.477341f ;
                uship:data_max = 6.48337f ;
        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 = -6.177792f ;
                vship:data_max = 6.147163f ;

// global attributes:
                :featureType = "trajectoryProfile" ;
                :history = "Created: 2019-01-21 04:36:07 UTC" ;
                :Conventions = "COARDS" ;
                :software = "pycurrents" ;
                :hg_changeset = "2833:145c35feab49" ;
                :title = "Shipboard ADCP velocity profiles" ;
                :description = "Shipboard ADCP velocity profiles from in2018_v06 using instrument
os150nb" ;
                :cruise_id = "in2018_v06" ;
                :sonar = "os150nb" ;
                :yearbase = 2018 ;
                :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+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\n",
                    "value     value      bottom   Good       bin\n",
                    "-------+----------+--------+----------+-------+\n",
                    "000         0\n",
                    "001         1                            bad\n",
                    "010         2                 bad\n",
                    "011         3                 bad        bad\n",
                    "100         4         bad\n",
                    "101         5         bad                bad\n",
                    "110         6         bad      bad\n",
                    "111         7         bad      bad        bad\n",
                    "-------+----------+--------+----------+-------+\n",
                    "" ;
}
```

```
netcdf os75nb {
dimensions:
        time = 6830 ;
        depth_cell = 60 ;
variables:
        int trajectory ;
                trajectory:standard_name = "trajectory_id" ;
        double time(time) ;
                time:long_name = "Decimal day" ;
                time:units = "days since 2018-01-01 00:00:00" ;
                time:C_format = "%12.5f" ;
                time:standard_name = "time" ;
                time:data_min = 325.961747685185 ;
                time:data_max = 351.756574074074 ;
        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 = 146.001408333333 ;
                lon:data_max = 148.953075 ;
        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 = -44.4199638888889 ;
                lat:data_max = -41.1841638888889 ;
        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 = 29.93f ;
                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 = -0.5663481f ;
                u:data_max = 0.6783309f ;
        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 = -0.8855901f ;
                v:data_max = 0.4524989f ;
        short amp(time, depth_cell) ;
                amp:missing_value = 32767s ;
                amp:long_name = "Received signal strength" ;
                amp:C_format = "%d" ;
                amp:data_min = 7s ;
                amp:data_max = 218s ;
        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 = -179.9514f ;
                heading:data_max = 179.895f ;
        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 = 12.99114f ;
                tr_temp:data_max = 17.59f ;
        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 = 19s ;
                num_pings:data_max = 133s ;
        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 = -6.479661f ;
                uship:data_max = 6.496838f ;
        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 = -6.195288f ;
                vship:data_max = 6.168536f ;

// global attributes:
                :featureType = "trajectoryProfile" ;
                :history = "Created: 2019-01-21 04:36:02 UTC" ;
                :Conventions = "COARDS" ;
                :software = "pycurrents" ;
                :hg_changeset = "2833:145c35feab49" ;
                :title = "Shipboard ADCP velocity profiles" ;
                :description = "Shipboard ADCP velocity profiles from in2018_v06 using instrument
os75nb" ;
                :cruise_id = "in2018_v06" ;
                :sonar = "os75nb" ;
                :yearbase = 2018 ;
                :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+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\n",
"value     value      bottom   Good       bin\n",
"-------+----------+--------+----------+-------+\n",
"000         0\n",
"001         1                             bad\n",
"010         2                  bad\n",
"011         3                  bad       bad\n",
"100         4         bad\n",
"101         5         bad                 bad\n",
"110         6         bad      bad\n",
"111         7         bad      bad       bad\n",
"-------+----------+--------+----------+-------+\n",
"" ;
}
```