Name: SOP for vessel:sonne:adcp_75khz_647271 (7494)
Version: 1.1
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Status: This is a **public version**. Certain sensitive information, such as server names, addresses, and exact paths and storage locations that is not meant for others than AWI associates was removed in that document.

Changelog:

1. 2022-08-25
   - initial publication
2. 2023-01-11
   - author ORCID addition
   - added changelog

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2. Purpose & Scope

Description: This SOP describes device configuration, parameter characteristics, transmission and processing of its output, ingest procedure, storage, data access possibilities, and publishing. Intended user groups are device owners, technicians, and data managers.
Comment: This item is managed and processed by the Deutsche Allianz Meeresforschung (German Marine Research Alliance), please see www.allianz-meeresforschung.de for further information.

3. Item Description

Short Name: ADCP_75kHz_647271
Long Name: Acoustic Doppler Current Profiler Ocean Surveyor 75 kHz
URN: vessel:sonne:adcp_75khz_647271
ID: 7494

UUID: e2500f07-c3d7-4040-b776-4ce2e66503ec
Description: Acoustic Doppler Current Profiler (ADCP) at 75 kHz with a maximum range of 700 m and a maximum ping rate of 0.7 Hz.
Serial No.: Transducer: 647271, Deck Unit: 27512
Manufacturer: Teledyne RD Instruments
PID/Handle: https://hdl.handle.net/10013/sensor.099ac948-c91e-46a8-876c-6b607b7a5178

4. Parameter Description

Short Name: current_east
Long Name: current east
full URN: vessel:sonne:adcp_75khz_647271:current_east
ID: 97140
UUID: 69624b5c-33a6-4894-9a69-f54c3f828cbb
Type: current speed
Unit: m/s
Comment:
Measurement Properties: none

Short Name: current_north
Long Name: current north
full URN: vessel:sonne:adcp_75khz_647271:current_north
ID: 97141
UUID: 0cd1493b-09a4-4e0c-858f-2fce427bce21
Type: current speed
Unit: m/s
Comment:
Measurement Properties: none

Short Name: current_up
Long Name: current up
full URN: vessel:sonne:adcp_75khz_647271:current_up
ID: 97142
UUID: 531d24d4-feee-46f4-ab3b-0449ea8d16fc
Type: current speed
Unit: m/s
Comment:
Measurement Properties: none

Short Name: depth
Long Name: depth
full URN: vessel:sonne:adcp_75khz_647271:depth
ID: 97143
UUID: c02d9ddd-b937-4ad7-b643-218a17937068
Type: depth
Unit: m

Comment:
Measurement Properties: none

Short Name: echo_intensity
Long Name: relative echo intensity
full URN: vessel:sonne:adcp_75khz_647271:echo_intensity
ID: 97144
UUID: 78e30359-3df2-4623-a538-f2f1b7338eb5
Type: intensity
Unit:
Comment:
Measurement Properties: none

Short Name: correlation
Long Name: correlation
full URN: vessel:sonne:adcp_75khz_647271:correlation
ID: 97145
UUID: 9ec49c63-f727-436d-b840-d342ba67f472
Type: intensity
Unit:
Comment:
Measurement Properties: none

Short Name: percent_good
Long Name: percent good
full URN: vessel:sonne:adcp_75khz_647271:percent_good
ID: 97146
UUID: 3e7953fe-e9c9-4a3f-a067-d3bdc8f6753f
Type: ratio
Unit: %
Comment:
Measurement Properties: none

Short Name: sound_speed
Long Name: sound speed
full URN: vessel:sonne:adcp_75khz_647271:sound_speed
ID: 97147
UUID: 85466e02-c1a4-46b5-b1d0-298824326d19
Type: sound velocity
Unit: m/s
Comment:
Measurement Properties: none

Short Name: temperature
Long Name: temperature
full URN: vessel:sonne:adcp_75khz_647271:temperature
ID: 97148

UUID: b0be0a82-5cc3-46da-bb05-fd711b17e617
Type: temperature
Unit: °C
Comment:
Measurement Properties: none

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5. Processing

The instrument measures upper-ocean water velocity profiles along the ship track using the principle of Doppler shift from scatterers in the water column (typically zooplankton or suspended particles in the water column). To obtain true ocean velocities, high-quality navigational (GPS and heading) and attitude (pitch and roll) data are required to eliminate the ship's movement from the velocity profiles. Raw data is stored in binary files using the acquisition software VmDas (Teledyne Marine 2022). Data conversion, single-ping editing and further post-processing is performed using the Python DAM ADCP Toolbox (Kopte 2022).

5.1. Acquisition

The mobile ADCP unit is installed in the starboard sounding shaft and connected to the deck unit in the Sounder Room. The sensor PC is also located in the Sounder Room. The software VmDas is installed on the sensor PC and is used for data acquisition. In VmDas, the desired configuration (consisting of a data option file [*.ini] and a settings file [*.txt]) is uploaded, specifying the communication with ADCP unit and auxiliary data streams, setting storage directory, file naming convention etc.

Auxiliary Files:
Name: *Ocean Surveyor / Ocean Observer Technical Manual*
Type: User Guide
Description: Software User's Guide describing usage of VmDas and detailed configuration options of the ADCP
URL: http://www.teledynemarine.com/Documents/Brand%20Support/RD%20INSTRUMENTS/Technical%20Resources/Manuals%20and%20Guides/Ocean%20Surveyor_Observer/Ocean%20Surveyor%20Technical%20Manual_Apr22.pdf
Last Modification: 2022

5.2. Extraction

Raw data files are continously written to HD, using the file naming convention (something of the form 'soXXX_OS3800Y_00000Z', XXX: expedition, Y: dataset number, Z: file number) and maximum file size (typically 10 MB) set in the configuration for the deployment. Each time data collection is started, VmDas will increment Y in the file naming convention by 1, each time the maximum file size is reached, a new file with Z incremented by 1 in the file naming convention is started.
Different file extensions storing different data, yet following the same naming convention are generated: *.ENR: Raw ADCP data in beam coordinates, *.ENS: ADCP data in beam coordinates screened for RSSI and correlation by VmDas, includes also navigation data merged into the ensembles from the *.NMS file, *.ENX: ADCP single-ping in Earth coordinates plus navigation data after a number of screening and pre-processing steps have been performed internally by VmDas, *.N1R/*.N2R/*.N3R: Raw NMEA files from different navigation sources, *.NMS: Binary format navigation data after being screened and pre-averaged, *.LTA: ADCP plus navigation data that has been

averaged using the long time period specified in the settings, *.STA: ADCP plus navigation data that has been averaged using the short time period specified in the settings.
All raw data files are automatically copied to the ship's mass data management system (MDM) by configured robocopy scripts.
Auxiliary Files: none

5.3. Conversion

Processing of binary ADCP data is carried out using the Python DAM ADCP Toolbox, which offers an integrated step-by-step procedure for the conversion of binary ADCP data into a quality-controlled data product of upper-ocean velocity profiles
Software: Kopte (2022)
Network Share Name: sonne/SOXXX/ ← *public version, input cropped*
Filename Convention: soXXX_OS3800Y_00000Z.ENX
In most cases (i.e. when acquisition worked flawlessly), the entry point for data processing using DAM ADCP Toolbox are the .ENX files, which contain pre-screened single-ping ADCP data in Earth-coordinates and navigation data in binary format. Deployment (ship/expedition/transducer depth/lever arms/..) and relevant processing information (processing directories/datasets/processing mode/processing parameters) are entered and modified/updated in os_settings.py - a function, which stores all relevant information in a json-dictionary and creates a list of files to be processed.
Using os_read_enx.py, the binary data is then converted file-wise and arranged in data structures, containing both measured parameters and meta data. The data is checked for completeness, clock drift of the sensor PC and quality of the navigation data. In an intermediate step, converted single-ping data are stored file-wise as netCDF following the file convention expanded by *_dat_[wt,bt].nc (either wt: watertrack calibration or bt: bottomtrack processing) in the processing directory.
Next, using os_edit_bottom.py, bottom signals are identified file-wise by manual screening of the backscatter signal in the *_dat_[wt,bt].nc files. If required, a mask is edited, marking all bins below the identified bottom depth and stored file-wise as netCDF following the file convention expanded by *_bot.nc.
If watertrack calibration is chosen in os_settings.py (i.e. files end with *_dat_wt.nc), processing continues with os_watertrack.py. Ship velocities are determined from GPS fixes for each single ping profile via central differences. A geometric compensation for the different positions of ADCP unit and GPS antenna relative to the midship position is applied. Depth-ranges marked as contaminated by the bottom are marked invalid by loading the corresponding _bot.nc file and applying the mask to the data. Potential interferences originating from the parallel operation of other hydroacoustic instruments are removed before averaging single-pings to form 60 sec ensemble averages. Following the water-track calibration of misalignment-angle and scale factor, which is applied to the ensemble averages, the derived ship velocities are substracted from the velocity profiles to obtain ocean velocities.
If bottomtrack processing is chosen in os_settings.py (i.e. files end with *_dat_bt.nc, bottom-track must have been enabled during data acquisition), processing continues with os_bottomtrack.py (instead of os_watertrack.py). Following the marking of bottom-contaminated bins, bottom-track velocities are substracted from the velocity profile for each single ping to obtain ocean velocities, followed by forming of 60 sec ensemble averages.
Final data is saved as netCDF files named soXXX_vmADCP_38kHz_01.nc, containing time, longitude, latitude and depth information as well as arrays with zonal and meridional velocity components, echo intensity, pings_per_ensemble, and quality flags.
os_aux_netcdf2ascii.py converts the netCDF file into a tab-limited text file named soXXX_vmADCP_38kHz_01.txt tailored for publication in PANGAEA.
Auxiliary Files:

Name: "Shipboard ADCP Measurements"
Type: Manual
Description: Guidelines and general information on the acquisition and processing of shipboard ADCP data
URL: https://repository.oceanbestpractices.org/handle/11329/385
Last Modification: 2010

6. Ingest

Ingest is part of the O2A process chain (Koppe et al. 2015, Gerchow et al. 2017) and is the starting point to collect, store, and redistribute data and metadata.
Protocol: MDM
Project path: *public version, input removed*
Campaign Data: yes
Filename Convention: per campaign
Expected Data Interval: per campaign
Ingest Data Interval: per campaign
Mapping: -
Save Directory: -
json/xml: -
Script: several in parts manual steps
Script calls:

- `ssh ltosrv2.awi.de`
- `sudo mount /dev/sdXX /mnt/hddext[0,1,2,3,4]`
- `sudo chmod -R a+r /mnt/hddext[0,1,2,3,4]`
- `sudo su - ingest`
- `cd /opt/rdif_2.0/MDM_Extractor/scripts`
- `./extractor.sh /mnt/hddext[0,1,2,3,4] /mnt/hddext[0,1,2,3,4] ...`
- `./completeness.sh platform campaign`

Repository: https://gitlab.awi.de/data-logistics-support/MDM_Extractor

7. Storage

7.1. Raw Data

Location *public version, input cropped*
Backup Policy: AWI snapshot and backup policy.

7.2. Near Real-Time Data

Info: no NRT for this workflow
Service: link to near real-time data service

7.3. Publications and further Reading

Publication: Kopte et al. 2021, Quack et al. 2022, Rixen et al. 2022, Achterberg et al. 2022
Further Reading: This device and workflow is part of DAM, please check https://www.allianz-meeresforschung.de/ for further information.

References

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Gerchow, Peter, Roland Koppe, Ana Macario, Antonie Haas, Christian Schäfer-Neth, Hans Pfeiffenberger, and Angela Schäfer (Nov. 2017). "O2A - Data Flow Framework from Sensor Observations to Archives". In: *EPIC3 Digital Infrastructures for Research 2017, Brussels, 2017-11-30-2017-12-01Brusseles, DI4R 2017 conference*. Brusseles: DI4R 2017 conference. URL: https://indico.egi.eu/indico/event/3455/session/1/contribution/114/material/slides/1.pdf (visited on 01/21/2020).

Koppe, Roland, Peter Gerchow, Ana Macario, Antonie Haas, Christian Schäfer-Neth, and Hans Pfeiffenberger (June 2015). "O2A: A Generic Framework for Enabling the Flow of Sensor Observations to Archives and Publications". In: *OCEANS 2015 Genova*. DOI: 10.1109/OCEANS-Genova.2015.7271657. URL: https://epic.awi.de/id/eprint/38295/.

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Kopte, Robert, Saskia Brix, Simon Tewes, and James Taylor (Sept. 2021). "ADCP current measurements (38 kHz) during RV SONNE cruise SO280". en. In: DOI: 10.1594/PANGAEA.935638. URL: https://doi.pangaea.de/10.1594/PANGAEA.935638 (visited on 07/15/2022).

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Rixen, Tim, Robert Kopte, and Tim Dudeck (Feb. 2022). "ADCP current measurements (75 kHz) during RV SONNE cruise SO285". en. In: DOI: 10.1594/PANGAEA.940763. URL: https://doi.pangaea.de/10.1594/PANGAEA.940763 (visited on 07/15/2022).

Teledyne Marine (Apr. 2022). *Ocean Surveyor / Ocean Observer Technical Manual*. en. URL: http://www.teledynemarine.com/Documents/Brand%20Support/RD%20INSTRUMENTS/Technical%20Resources/Manuals%20and%20Guides/Ocean%20Surveyor_Observer/Ocean%20Surveyor%20Technical%20Manual_Apr22.pdf (visited on 06/30/2022).