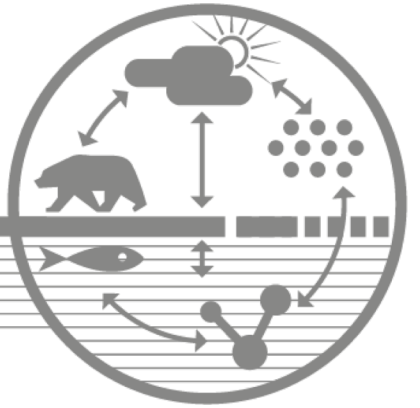
MOSAiC
International Arctic Drift Expedition



SENSOR(Web) and Overview of Metadata Flow in MOSAiC

MOSAiC Data Webinar for Chief Editors and Data Contact Persons

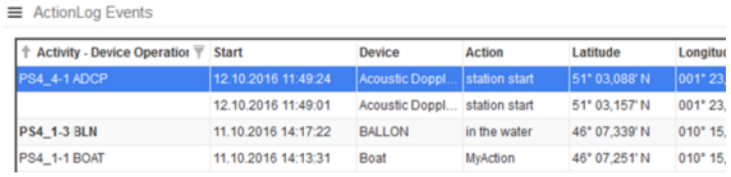
Janik Eilers, Antonia Immerz, AWI Data Centre

16.07.2019

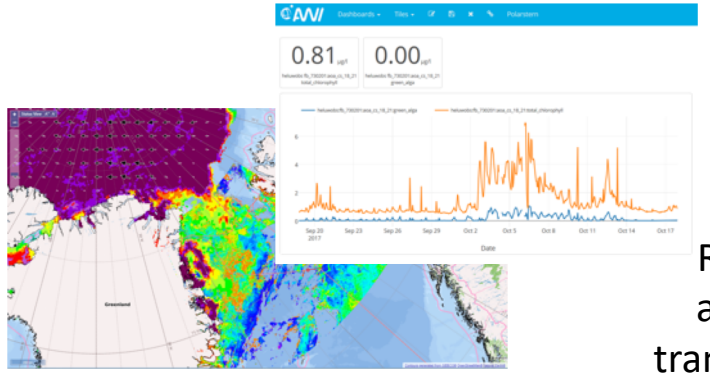
ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

Data Flow in MOSAiC

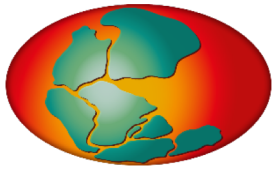
SensorWeb at AWI and onboard of Polarstern



Acquisition organized by MOSAiC groups.
DShip-ActionLog for Device-Operation ID management



DShip-Mapviewer and Dashboard at AWI and onboard of Polarstern



Raw and primary data archiving at AWI. Data transfers after legs or parts during legs

Sensor Metadata Description → Data Acquisition → Data Ingestion → Data Storage → Data Monitoring → Data Analysis → Data Archiving

Data transfer via satellite, local LAN, radio LAN as stream and/or in delayed mode

MOSAiC Central Storage and workspace

Using workspace and Marketplace (VM) e.g. with Jupyter Notebook (R or Python) or Bash-Script or or …?

Sensor metadata description (SensorWeb) is the basis for all parts!!!

MOSAiC International Arctic Drift Expedition

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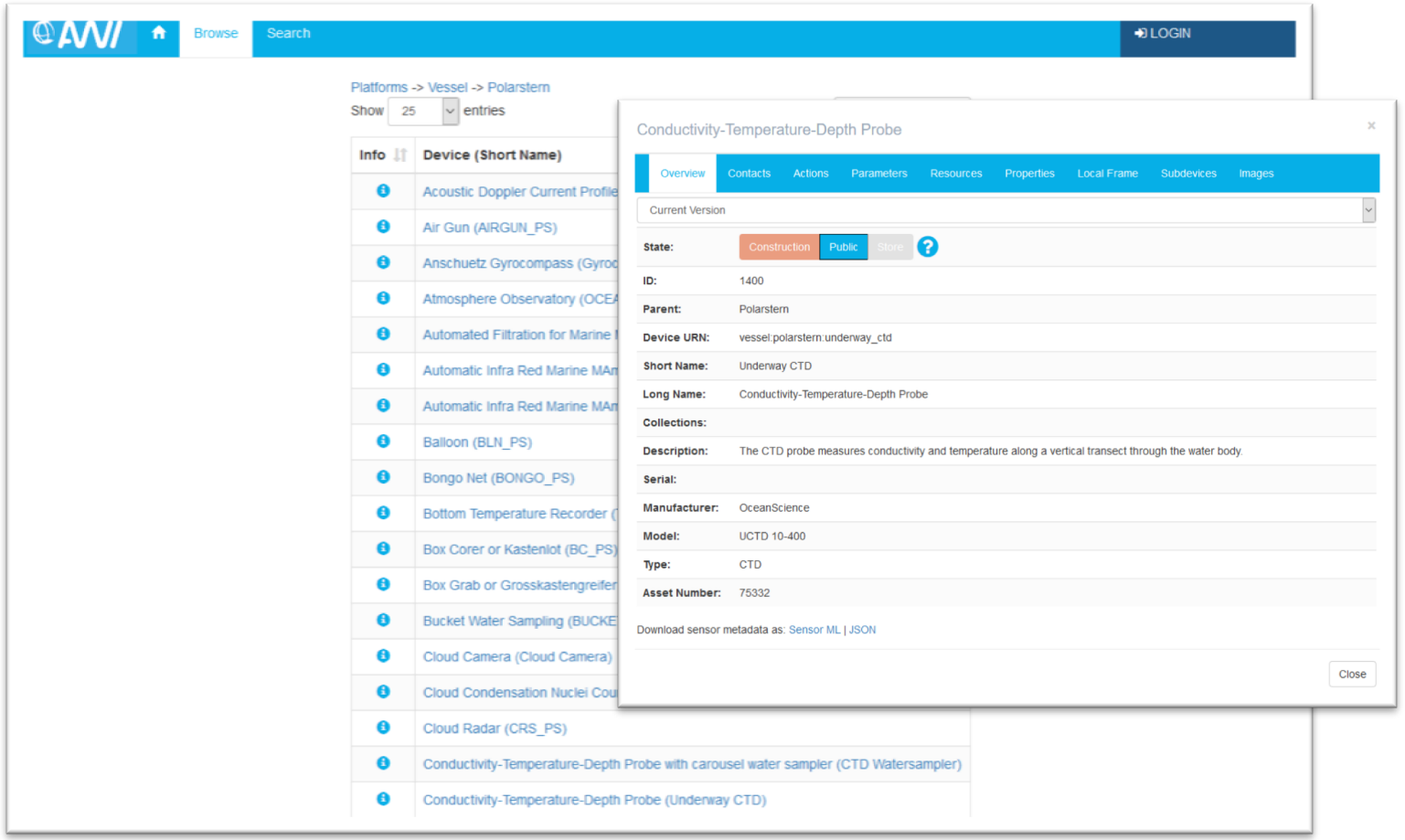
AWI

SENSOR

- ✓ Describe your sensor only once with SENSORWeb
- ✓ Then sensor data can be ingested, stored, monitored, analysed and archived



Sensor Metadata Description → Data Acquisition → Data Ingestion → Data Storage → Data Monitoring → Data Analytics → Data Archiving

HELMHOLTZ

What is SensorWeb

SENSOR

- Sensor Web manages metadata of
  - Research platforms
  - sensors
- Sensor Web does not manage measurement data

SENSOR

SensorWeb

- Sensor Information System - Create and manage meta data of devices and sensors

https://sensor.awi.de/?urn=vessel:polarstern:ctd_watersampler

Parent Item-Type: Vessel
Parent Item: RV Polarstern
Sub Item: CTD Watersampler

Overview
Long and short names
Manufacturer
Model-Nr.

Subdevices
Altimeter
Lowered Acoustic Doppler Current Profiler
SBE32 water sampler
SBE3plus temperature sensor
SBE4 conductivity sensor
SBE43 oxygen sensor
Transmissiometer

Properties
- used for quality checks: e.g. Water temperature min/max values

Contact
Owner: AWI
Editor: Peter Gerchow
Engineer in Charge: Marius Hirsekorn
Principal Investigator: …
Data Scientist: …
Data Provider: …

Parameters
conductivity
temperature
altimeter
transmission
oxygen
pressure
fluorescence

Resources
- factsheets
- calibration certificates
- manuals

Actions
Deployment
Recovery

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SENSOR

Overview | Contacts | Actions | Parameters | Resources | Properties | Local Frame | Subdevices | Images | Ingest

2018-06-04 02:00:00 Mount Mounted to heluw1

SENSOR (2014). Sensor metadata for SST_CTD_183 of Station AWIPEV Underwater Observatory Svalbard Alfred Wegener Institute for Polar and Marine Research. https://hdl.handle.net/10013/sensor.82f77b6c-a35d-40ff-ba8d-65442cfb49e7#subItemID=1285&subItemEventID=3389

PIDs + Citation for all actions of type: calibration, comissioned, deployment, mount

https://hdl.handle.net/10013/sensor.82f77b6c-a35d-40ff-ba8d-65442cfb49e7#subItemID=1285&subItemEventID=3389

State:	public
ID:	1285
Parent:	Svalbard Underwater Node 2
Device URN:	station:svluwobs:svluw2:ctd_183
Short Name:	CTD_183
Long Name:	SST_CTD_183
Collections:	undefined
Description:	High quality, high accuracy multi parameter probe for oceanographic and li parameters.
Serial:	183
Manufacturer:	Sea and Sun Technology
Model:	CTD 90
Type:	CTD

Overview | Contacts | Actions | Parameters | Resources | Properties | Local Frame | Subdevices | Images | Ingest

Current Version

Show 25 entries Search:

ID	Name	E-Mail	Role	Organization
70	Cornelia Roder	cornelia.roder@awi.de	Editor	Alfred-Wegener-Institute

Showing 1 to 1 of 1 entries Previous 1 Next

Inherited Contacts

Show 25 entries Search:

ID	Name	Role	Organization	Inherited from
73	Alexandra Kraberg	Editor	Alfred-Wegener-Institute	Helgoland Underwater Observatory

Overview | Contacts | Actions | Parameters | Resources | Properties | Local Frame | Subdevices | Images

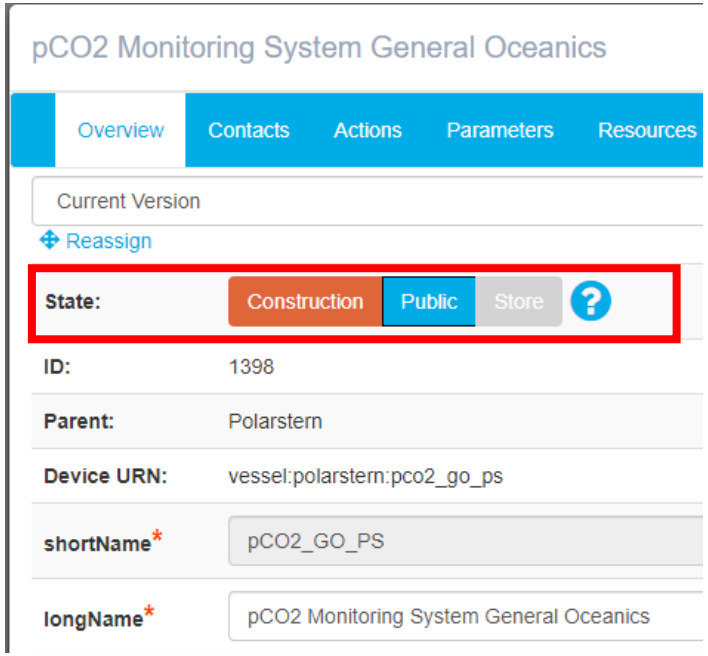
Current Version

Show 25 entries Search:

ID	Short Name	Name	Sensor Output Type	Units
861		Conductivity	conductivity	mS/cm
862		Salinity	salinity	PSU

SENSOR

Item State



Construction:

- Seen only by “editor” of this device under “My Devices”
- not Ready for publication

Public:

- Seen by everybody (no Login)
- Ready for publication
- Public devices should not be deleted. (Measured data would loose metadata)

Store:

- Device they are not in use
- Device at the store

Further Features

Facetted Search

SENSOR

Browse | Search | Device Store | My Devices | Create Item

Item type
MicroCAT (171)

Parameters
conductivity (12)
depth (9)
oxygen (9)
temperature (9)
water temperature (3)
See more...

Action type
Deployment (150)
Recovery (62)
Calibration (1)
Mount (1)
Unmount (1)

Action
NABOS/2309-1 (7)
NABOS/2409-1 (7)
NABOS/2409-2 (7)
NABOS/3008-1 (7)
HE451-2/2-1 (6)
See more...

Contact
Vernaleken, Jutta (150)
von Appen, Wilken-Jon (150)
Lochthofen, Normen (21)
Hattermann, Tore (12)
Scholz, Daniel (11)

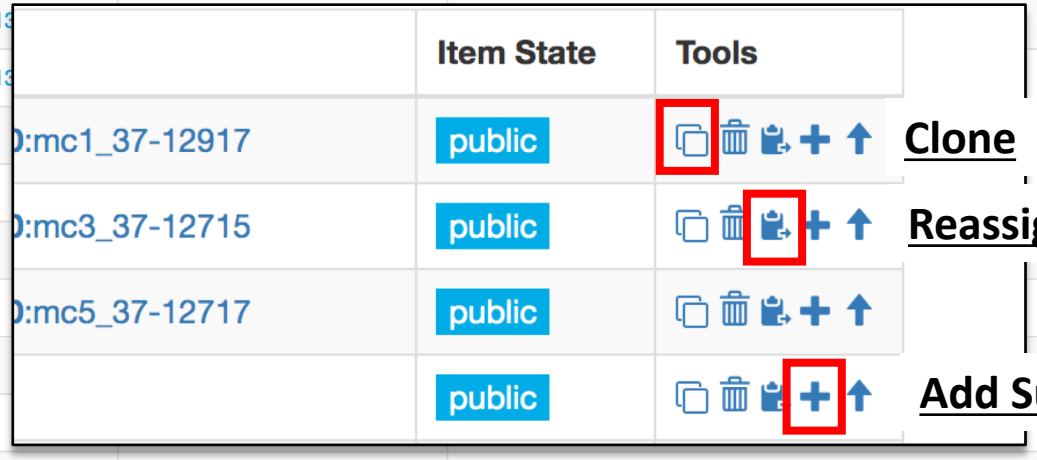
Collections
FRAM (2)

Search...

Selected facets: MicroCAT ✖

Sort by relevance | Sort alphanumerically

Info	Long Name	Short Name	URN	Item State	Tools
	MC1	MC1_37-12917	**mooring:fsw1_300234061031800**:mc1_37-12917	public	
	MC3	MC3_37-12715	**mooring:fsw1_300234061031800**:mc3_37-12715	public	
	MC5	MC5_37-12717	**mooring:fsw1_300234061031800**:mc5_37-12717	public	
	SBE-37 SM	SBE-37-SM_1606	**mooring:f4-16**:sbe-37-sm_1606	public	
	SBE37-SMP-ODO_13			public	
	SBE37-SMP-ODO_13			public	
	SBE-37 SM			public	
	SBE-37 SM			public	
	SBE-37 SMP			public	
	SBE-37 SM			public	
	SBE-37 SM			public	
	SBE-37 SMP			public	
	SBE-37 SMP	SBE-37-SMP_10935	**mooring:f5-16**:sbe-37-smp_10935	public	
	SBE-37 SMP	SBE-37-SMP_12502	**mooring:ak5-1**:sbe-37-smp_12502	public	
	SBE-37 SMP	SBE-37-SMP_12492	**mooring:ak5-1**:sbe-37-smp_12492	public	

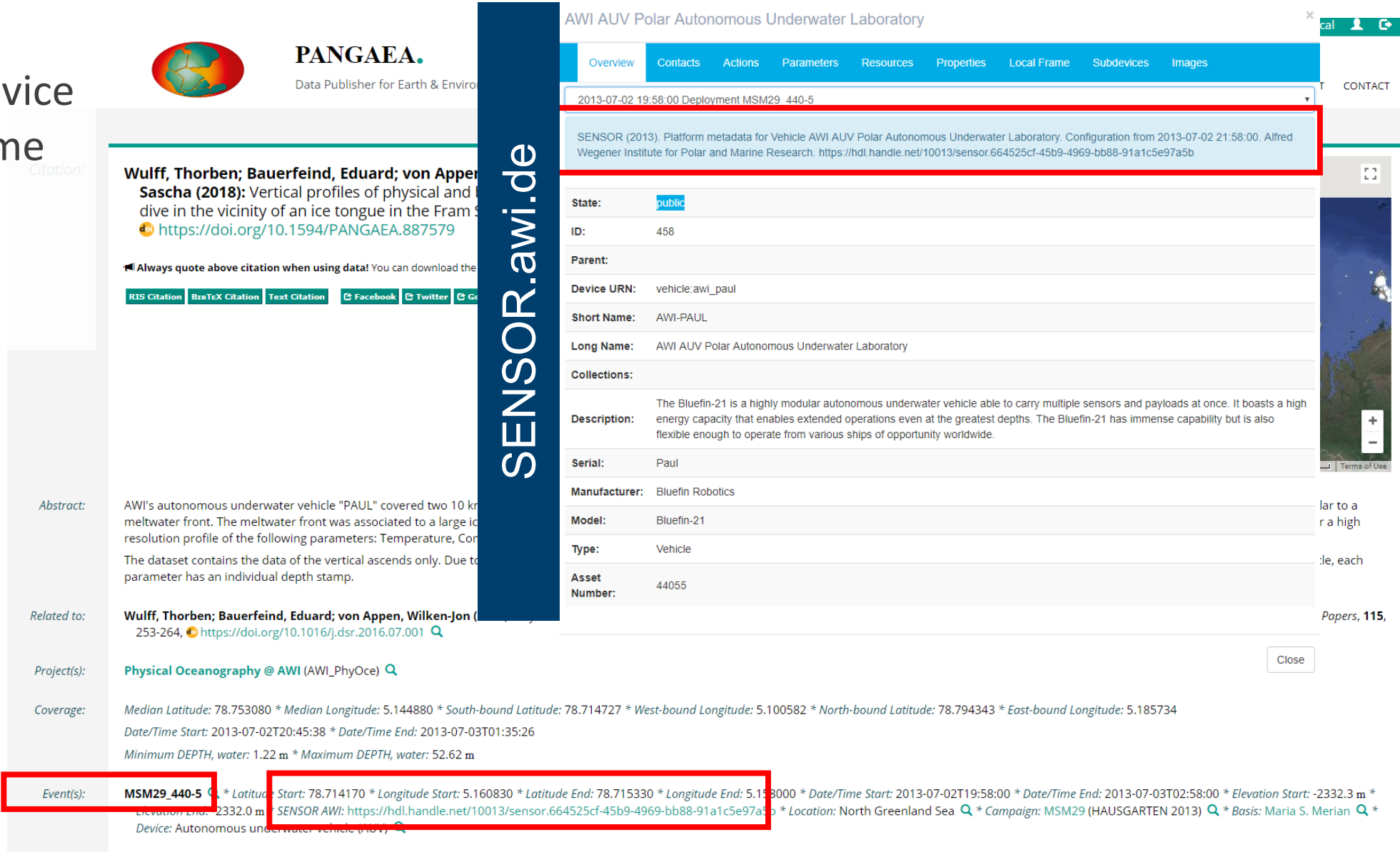


Showing 1 to 15 of 171 entries

« 1 2 3 4 5 6 7 8 9 »

Linking PANGAEA to SENSOR

- Configuration of device at measurement time linked directly SENSORWeb



(Former) PlatformTypes in SENSOR

- Aircraft
- Buoy
- Laboratory
- Mooring
- Pack Ice
- Satellite
- Small Boat
- Station
- TowedSystem
- Vehicle
- Vessel
- Model

Structure of an Item: Action Types in SENSOR

- Calibration (create version)
- Comissioned (create version)
- Configuration
- Decomissioned
- Deployment (create version)
- Information
- Maintenance
- Mission
- Mount (create version)
- Partial failure
- Recovery
- Total failure

Structure of an Item: Contact Roles

- Special function of roles:
  - Editor: can edit items, has write acess to raw data directory on MCS
  - Owner (special contact of the institute)
  - dship connector -> import sensors into DSHIP
  - Data Provider -> write acess to raw data directory on MCS
  - Device Contact -> Contact person for device!

- Other roles
  - Data Scientist
  - Engineer in Charge
  - Principal Investigator

Collections

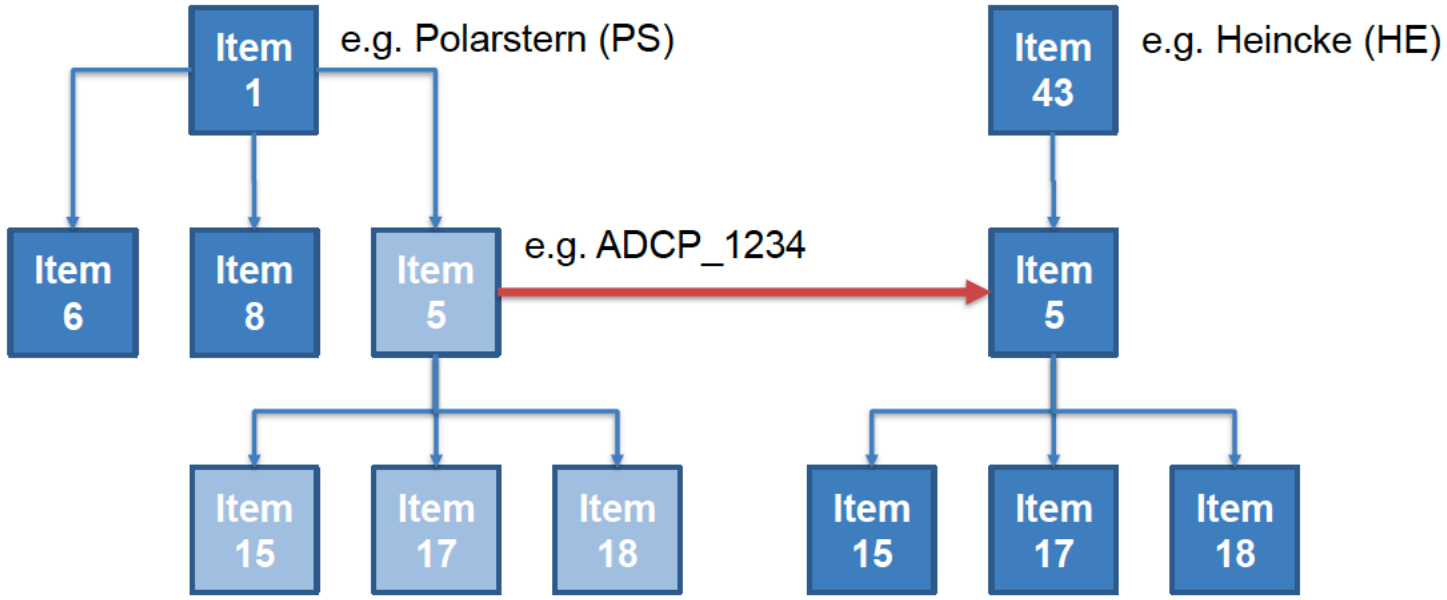
- MOSAiC-Aircraft
- MOSAiC-ATMOS
- MOSAiC-BGC
- MOSAiC-ECO
- MOSAiC-ICE
- MOSAiC-Modelling
- MOSAiC-OCEAN
- MOSAiC-RemoteSensing

Device URNs

- URN (Uniform ResourceName)
  - Unique name of an item
    - Example: vessel:ps:adcp
  - Composed of short names
  - The path to your data is based on the URN
    - Example: …/vessel/ps/adcp
  - It is human readable in contrast to a numeric ID
- Short name
  - catchy abbreviations of your item name
    - Polarstern-> PS
    - AcousticDoppler CurrentProfiler-> ADCP
  - can‘t be edited by a user, only admins can change the short name

Reassignment

- Items can be assigned to a different parent
  - Changes URN of device
  - May create a new version of device



Device URN change from vessel:**ps**:adcp_1234 to vessel:**he**:adcp_1234

Versioning

- Every time you add an action of type deployment, mount, calibration or commissioned, a version of your current sensor configuration is permanently stored
  - All versions get a citation with a persistent identifier (like DOI) and therefore can be referenced in publications
  - Deletion of versions is always critical
  - Versions can only be deleted by a system administrator
- Enter changes in the order they were done on the device / platform
  - This is a best practice, because once created versions cannot be modified afterwards
- Best Practice: Every device should be versioned before first device operation with action type ‚comissioned‘ and label ‚MOSAiC 122/Leg-No.‘

Data Flow in MOSAiC

ActionLog Events

Activity - Device Operatio	Start	Device	Action	Latitude	Longitu
PS4_4-1 ADCP	12.10.2016 11:49:24	Acoustic Doppl...	station start	51° 03,088' N	001° 23
	12.10.2016 11:49:01	Acoustic Doppl...	station start	51° 03,157' N	001° 23,
PS4_1-3 BLN	11.10.2016 14:17:22	BALLON	in the water	46° 07,339' N	010° 15,
PS4_1-1 BOAT	11.10.2016 14:13:31	Boat	MyAction	46° 07,251' N	010° 15,

SensorWeb at AWI and onboard of Polarstern

Acquisition organized by MOSAiC groups.
DShip-ActionLog for Device-Operation ID management

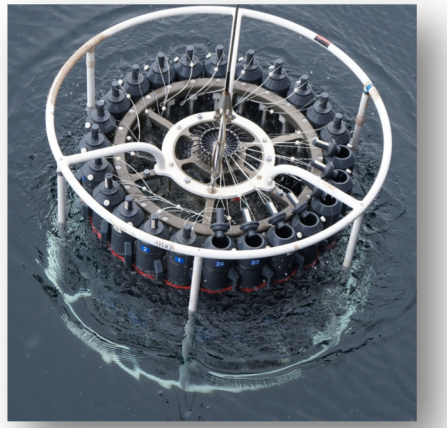
Sensor Metadata Description → Data Acquisition → Data Ingestion → Data Storage → Data Monitoring → Data Analytics → Data Archiving

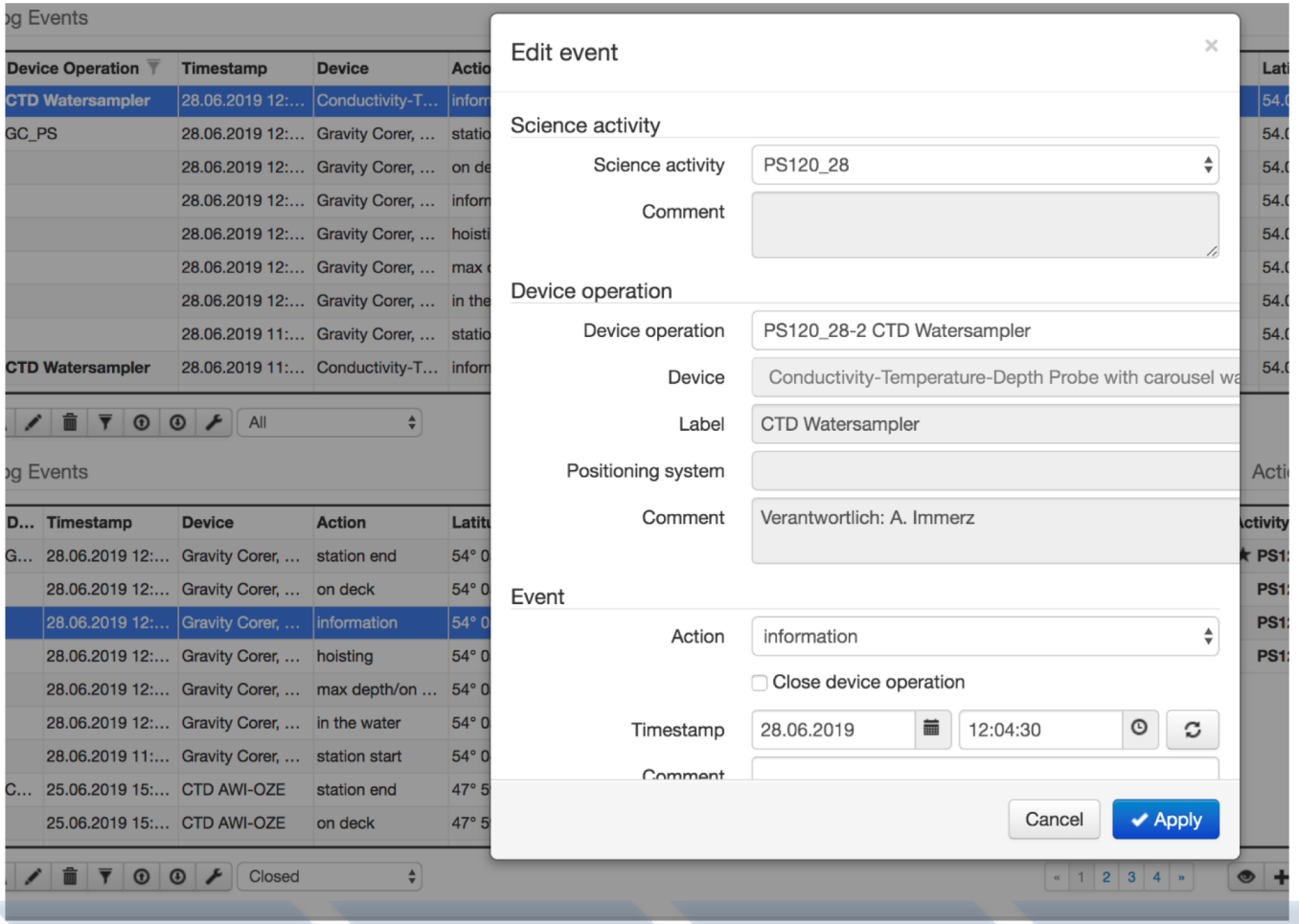
Sensor metadata description (SensorWeb) is the basis for all parts!!!

MOSAiC International Arctic Drift Expedition

DSHIP-ActionLog

- ✓ Logs science activities and device operations during cruise
- ✓ Logging can be easily done in Webbrowser (real time) or using the IceFloeNavi-APP (delayed)





Sensor Metadata Description | **Data Acquisition** | Data Ingestion | Data Storage | Data Monitoring | Data Analytics | Data Archiving

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Data Flow in MOSAiC

ActionLog Events

Activity - Device Operatio	Start	Device	Action	Latitude	Longitu
PS4_4-1 ADCP	12.10.2016 11:49:24	Acoustic Doppl...	station start	51° 03,088' N	001° 23
	12.10.2016 11:49:01	Acoustic Doppl...	station start	51° 03,157' N	001° 23,
PS4_1-3 BLN	11.10.2016 14:17:22	BALLON	in the water	46° 07,339' N	010° 15,
PS4_1-1 BOAT	11.10.2016 14:13:31	Boat	MyAction	46° 07,251' N	010° 15,

SensorWeb at AWI and onboard of Polarstern

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DShip-ActionLog for Device-Operation ID management

Sensor Metadata Description → Data Acquisition → Data Ingestion → Data Storage → Data Monitoring → Data Analysis → Data Archiving

Data transfer via satellite, local LAN, radio LAN as stream and/or in delayed mode

MOSAiC Central Storage and workspace

Sensor metadata description (SensorWeb) is the basis for all parts!!!

MOSAiC Central Storage (MCS)

- Central Storage for raw data and data products on board Polarstern
- Naming convention of device area is derived from SensorWeb
- Data transferred to in Bremerhaven for common access by MOSAiC consortium members

Device Area
(Raw Data)

Workspace Area

platforms

vessel
polarstern
ctd_watersampler
SBE3plus temperature sensor
exdata
DSHIP-DEVICEOPERATION-ID
SensorFile.xxx
FerryBox
exdata
DSHIP-DEVICEOPERATION-ID
SensorFile.xxx
vehicle
BEAST
ECO-Triplet Fluorometer
…

Tasks

Coring
Site 1
Quicklooks
Processed Data
Combined Datasets
Site 2
DN
…

SnowPits
Site 1
Site 2
DN
ROV

Team-Folders

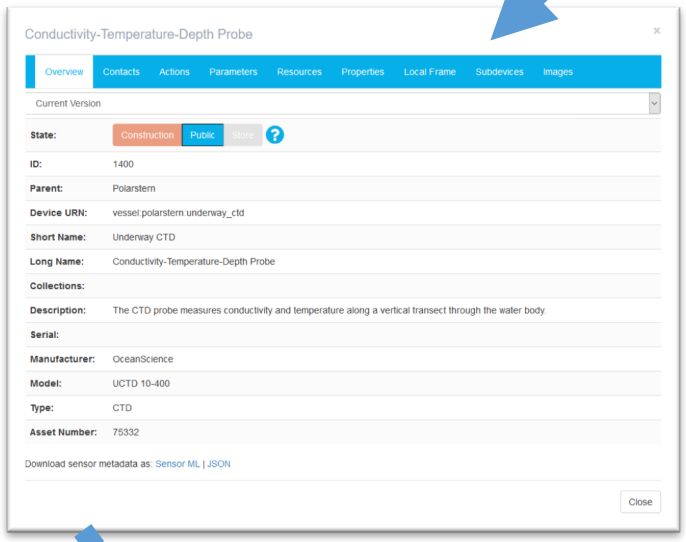
OCEAN
ICE
ATMOS
…

Data Fow in more detail

Devices has to be created in SENSOR (only once)

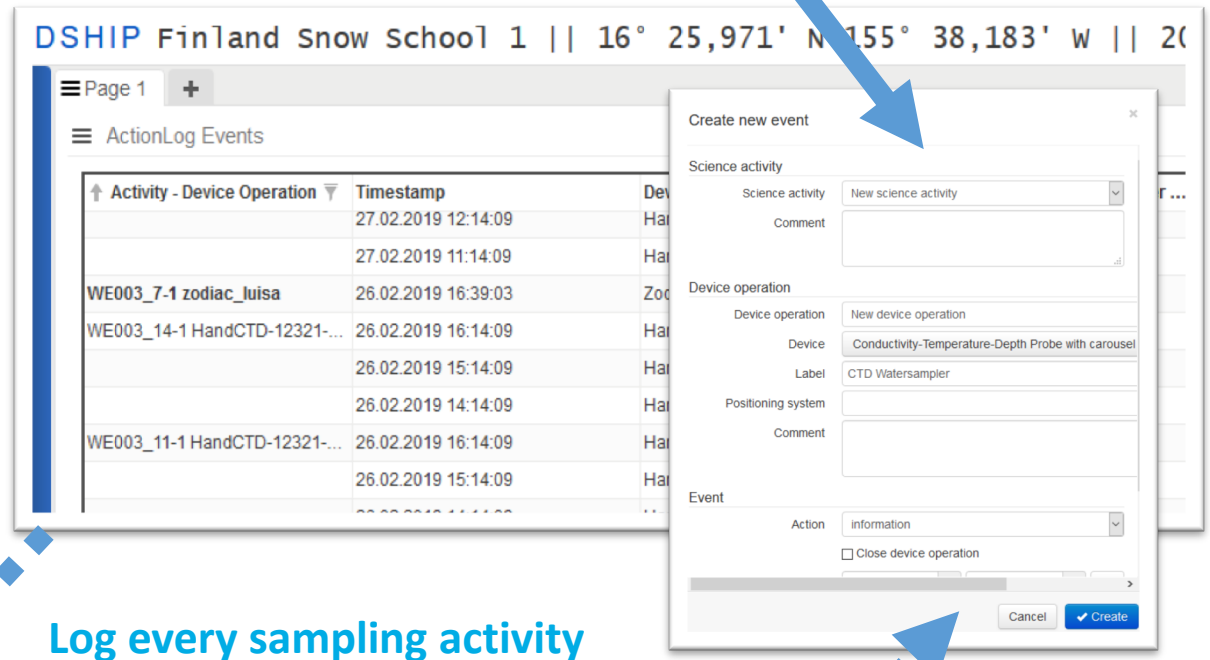
Log every device operation

SENSOR.fs-polarstern.de



background Synching (device & device operation)

DSHIP-ActionLog



Background creating directories (device & device operation)

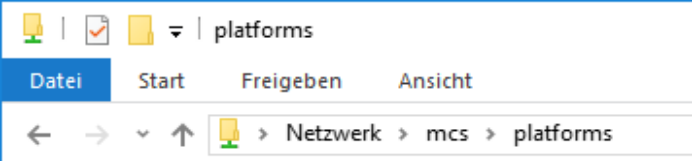
Log every sampling activity

Storage MCS

vessel/polarstern/ctd_watersampler/SBE3plus_temperature_sensor/exdata/DEVICEOPERATION_ID/

IceFloeNavi-App

manually Synching (device & device operation)



- vehicle
- vessel
  - polarstern
    - adcp
    - aimmms_0001
    - aimmms_0002
    - airgun_ps
    - autofim_10001_125
    - bc_ps
    - bln_ps
    - bongo_ps
    - bow_sonic_3d
    - bucket_ps
    - canberra-awi-det_2
    - ccnc_ps
    - cloud_camera
    - crds_ghg_ship_bow
    - crs_ps
    - ctd_watersampler
      - altimeter
        - exdata
          - PS120_28-1
          - PS120_28-2
      - exdata
        - PS120_28-1
        - PS120_28-2
      - ladcp
      - sbe3plus

Overview | Contacts | Actions | Parameters | Resources | Properties | Local Frame | Subdevices | Images | Ingest

Current Version

Show 25 entries Search:

ID	Type	Label	Date	Lat/Long/elevation	Tools
4630	Information	PS120_28-2	2019-06-28T12:51:52+02:00	54.408908° / -7.934236 / 21.3	
4603	Recovery	PS120_25-15	2019-06-24T17:51:52+02:00	44.482408° / -10.965533° / 4941 m	

ActionLog Events

Activity - Device Operation	Timestamp	Device	Action	Latitude	Longitude	Depth (m)	Speed (kn)	Course
PS120_28-2 CTD Watersampler	28.06.2019 12:...	Conductivity-T...	information	54° 04,977' N	007° 58,006' E	21.3	1.0	285.0
PS120_27-1 GC_PS	28.06.2019 12:...	Gravity Corer, ...	station end	54° 05,044' N	007° 57,271' E	22.4	9.3	257.9
	28.06.2019 12:...	Gravity Corer, ...	on deck	54° 05,015' N	007° 58,072' E	21.2	0.0	36.8
	28.06.2019 12:...	Gravity Corer, ...	information	54° 05,009' N	007° 58,069' E	20.9	0.2	233.5
	28.06.2019 12:...	Gravity Corer, ...	hoisting	54° 05,011' N	007° 58,078' E	21.2	0.1	305.1
	28.06.2019 12:...	Gravity Corer, ...	max depth/on ...	54° 05,011' N	007° 58,076' E	20.8	0.3	110.0
	28.06.2019 12:...	Gravity Corer, ...	in the water	54° 05,010' N	007° 58,073' E	21.0	0.4	94.5
	28.06.2019 11:...	Gravity Corer, ...	station start	54° 04,345' N	007° 58,260' E	20.7	7.3	45.8
PS120_28-1 CTD Watersampler	28.06.2019 11:...	Conductivity-T...	information	54° 03,956' N	007° 57,546' E	22.2	13.7	48.6
PS120_27-2 topAWI	28.06.2019 11:...	Towed Ocean ...	information	54° 03,575' N	007° 57,025' E	23.2	13.9	30.2

DSHIP-ActionLog

Structure

- Expedition (per Leg)
  - Science Activity (weekly)
    - Device Operation

Device Operation ID:

<Campaign/Expedition-Leg>_
<Science Activity>-
<No. of Device Operation within Science Activity>

Display in ActionLog:

<Campaign/Expedition-Leg>_<Science Activity>-<Number of Device Operation within Science Activity> <Shortname>
(e.g. PS120_28-2 CTD Watersampler“)

ActionLog Events

Activity - Device Operation	Timestamp	Device	Action	Latitude	Longitude	Depth (m)	Speed (kn)	Course	Latitude (deg)	Longitude (deg)	Wind Dir	Wind Velocity	Transp
PS120_28-2 CTD Watersampler	28.06.2019 12:...	Conductivity-T...	information	54° 04,977' N	007° 58,006' E	21.3	1.0	285.0	54.082946	7.966764	295.0	4.8	
PS120_27-1 GC_PS	28.06.2019 12:...	Gravity Corer, ...	station end	54° 05,044' N	007° 57,271' E	22.4	9.3	257.9	54.084065	7.954517	330.0	5.2	
	28.06.2019 12:...	Gravity Corer, ...	on deck	54° 05,015' N	007° 58,072' E	21.2	0.0	36.8	54.083582	7.967863	314.0	4.1	
	28.06.2019 12:...	Gravity Corer, ...	information	54° 05,009' N	007° 58,069' E	20.9	0.2	233.5	54.083486	7.967815	310.0	5.2	
	28.06.2019 12:...	Gravity Corer, ...	hoisting	54° 05,011' N	007° 58,078' E	21.2	0.1	305.1	54.083523	7.967969	321.0	3.2	
	28.06.2019 12:...	Gravity Corer, ...	max depth/on ...	54° 05,011' N	007° 58,076' E	20.8	0.3	110.0	54.083511	7.967926	309.0	4.4	
	28.06.2019 12:...	Gravity Corer, ...	in the water	54° 05,010' N	007° 58,073' E	21.0	0.4	94.5	54.083504	7.967879	309.0	4.4	
	28.06.2019 11:...	Gravity Corer, ...	station start	54° 04,345' N	007° 58,260' E	20.7	7.3	45.8	54.072423	7.971005	318.0	6.7	
PS120_28-1 CTD Watersampler	28.06.2019 11:...	Conductivity-T...	information	54° 03,956' N	007° 57,546' E	22.2	13.7	48.6	54.065936	7.959104	317.0	7.6	
PS120_27-2 topAWI	28.06.2019 11:...	Towed Ocean ...	information	54° 03,575' N	007° 57,025' E	23.2	13.9	30.2	54.059586	7.950411	316.0	7.9	

All

« 1 2 3 4 »

Extract from DHIP Archive (dms.awi.de)

	A	B	C	D	E	F	G	H	I	J	
1	**Campaign**	**Station - Device Operation**	**Device Types**	**Device Types Code**	**Device**	**Device Code**	**Date/Time (Start)**	**Action (Start)**	**Latitude (deg) (Start)**	**Longitude (deg) (Start)**	**D**
2	PS118	PS118_0_Underway-10	Thermosalinograph	TSG	Thermosalinograph Keel	TSG_KEEL	20.02.19 08:54	profile start	-57.897.329	-61.533.381	0
3	PS118	PS118_0_Underway-13	Magnetometer	MAG	Magnetometer	MAG	20.02.19 09:03	profile start	-57.908.644	-61.514.114	3
4	PS118	PS118_5-3	Video,Multi Corer	VIDEO,MUC	Video Multi Corer	TVMUC	04.03.19 18:32	station start	-64.983.699	-57.751.797	4
5	PS118	PS118_5-4	Multi Corer,Video	MUC,VIDEO	Video Multi Corer	TVMUC	04.03.19 20:26	station start	-64.981.029	-57.746.836	0
6	PS118	PS118_6-5	Plankton Net	PLA	Epibenthossledge	EBS	05.03.19 16:58	station start	-64.973.826	-57.786.732	0
7	PS118	PS118_6-6	Plankton Net	PLA	Epibenthossledge	EBS	05.03.19 19:07	station start	-64.970.863	-57.798.089	0
8	PS118	PS118_6-7	Bottom Net	BN	Agassiz Trawl	AGT	05.03.19 21:31	station start	-64.964.397	-57.836.353	0
9	PS118	PS118_6-8	Remotely Operated Vehicle	ROV	Remotely Operated Vehicle	ROV	06.03.19 00:54	station start	-64.953.392	-57.795.686	0
10	PS118	PS118_9-4	Plankton Net	PLA	Epibenthossledge	EBS	12.03.19 14:24	station start	-64.017.813	-55.918.205	4
11	PS118	PS118_9-5	Plankton Net	PLA	Epibenthossledge	EBS	12.03.19 15:50	station start	-64.019.655	-55.901.400	4
12	PS118	PS118_9-6	Bottom Net	BN	Agassiz Trawl	AGT	12.03.19 17:43	station start	-64.023.801	-55.918.680	4

Extract of Device Operation in ActionLog:

<Campaign/Expedition-Leg>_<Science Activity>-<Number of Device Operation within Science Activity>

(e.g. PS120_28-2“)

Your Role as a Chief Editor

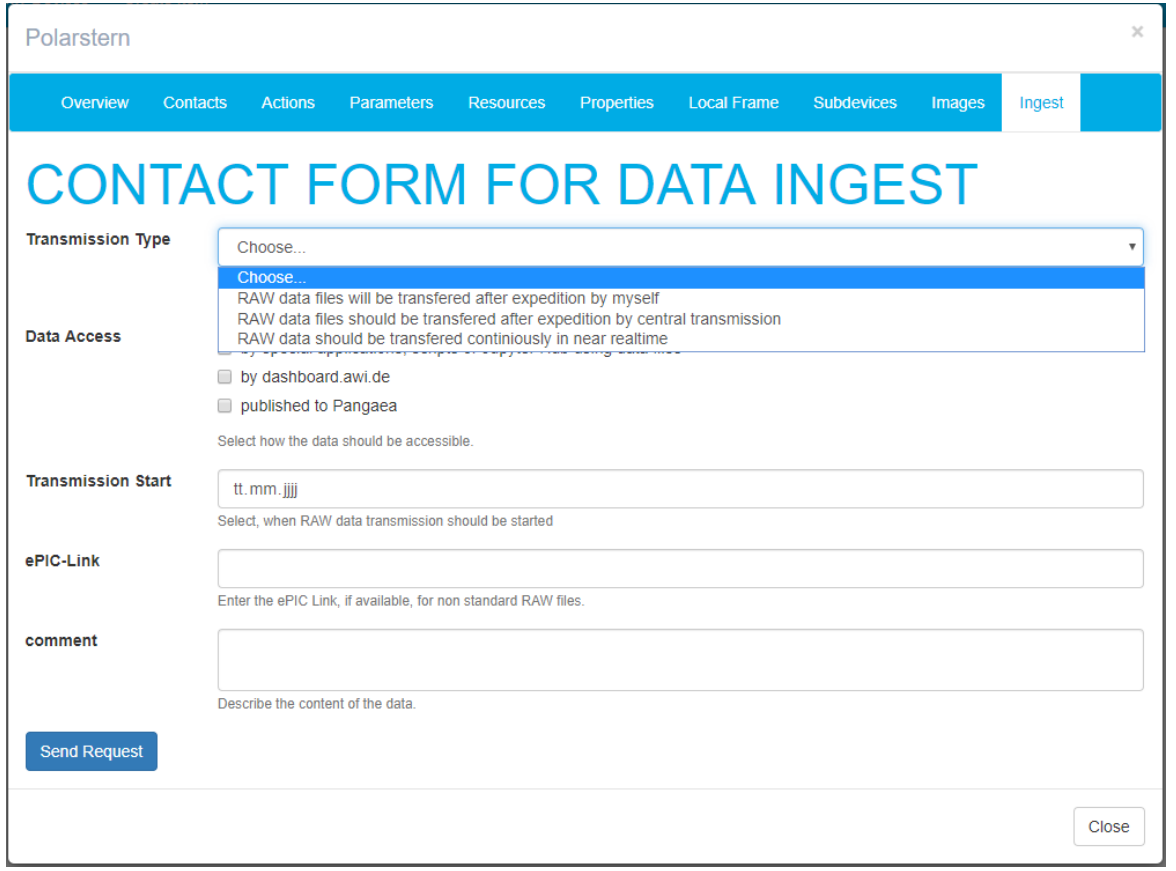
- Collect list of devices to be entered in SENSOR for your team
- Act as a multiplicator for SENSOR in team.
  - spread knowledge on updates of SENSOR in team.
  - Filter questions which can already be answered by you for your team
    - Best practices
    - Best configuration of instruments
    - Where to get documentation
  - Spread knowledge
    - on best practices in SENSOR specific for team
    - How SENSOR, DSHIP and MCS relate
  - Act as first contact for questions on SENSOR for team.
- Monitor devices in SENSOR for your team to ensure best practices are followed
  - All roles mentioned
  - Correct configuration

Your Role as a Data Contact Person on Board

- Act as a multiplicator for knowledge
  - on best practices in SENSOR specific for team
  - on SENSOR, DSHIP, MCS on Board
  - how SENSOR, DSHIP and MCS relate
- First contact for questions regarding SENSOR
  - Know Best practices
  - Help reassigning, editing (and entering new) devices
  - Where to get documentation
- Keep an eye on data for your team.
  - Is raw data being stored in MCS appropriately and in time?

Ingest

1. RAW data files will be transfered after expedition by myself (USB-Disk)
2. RAW data files should be transfered after expedition by central transmission (Tape)
3. RAW data should be transfered continiously in near realtime (NRT)



Near Real Time (NRT)

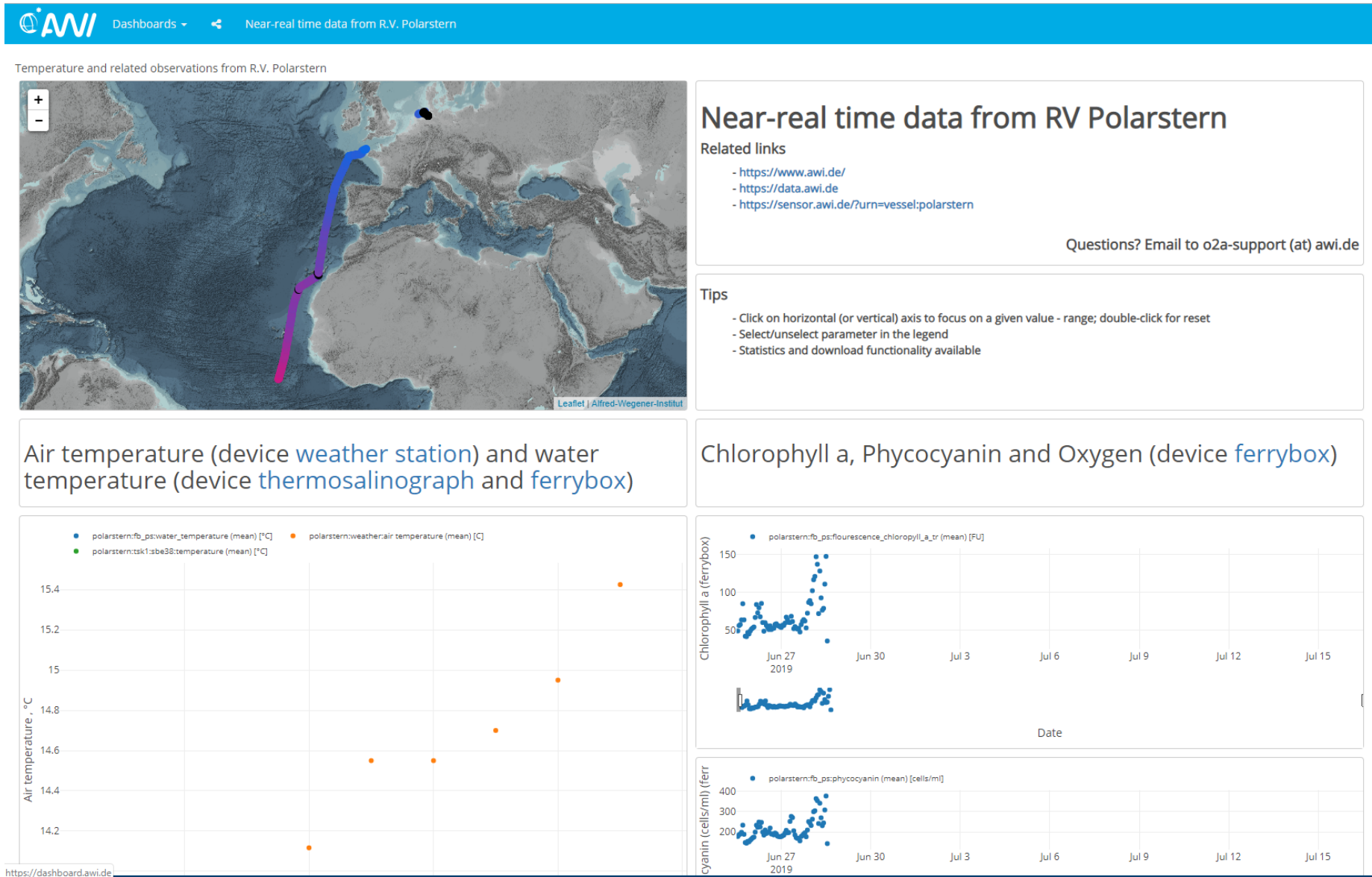
datetime	vessel:polarstern:tsk1:salinity [psu]	vessel:polarstern:tsk1:sbe38:temperature [°C]
2019-02-28 15:50:00.000	34.1234	2.443
2019-02-28 15:50:01.000	34.1345	2.564
2019-02-28 15:50:02.000	34.1456	2.544

- **Transmission Methods**
  - E-Mail
  - sftp
  - ftp
  - smb (Windows-Share)
  - rsync (only Download)

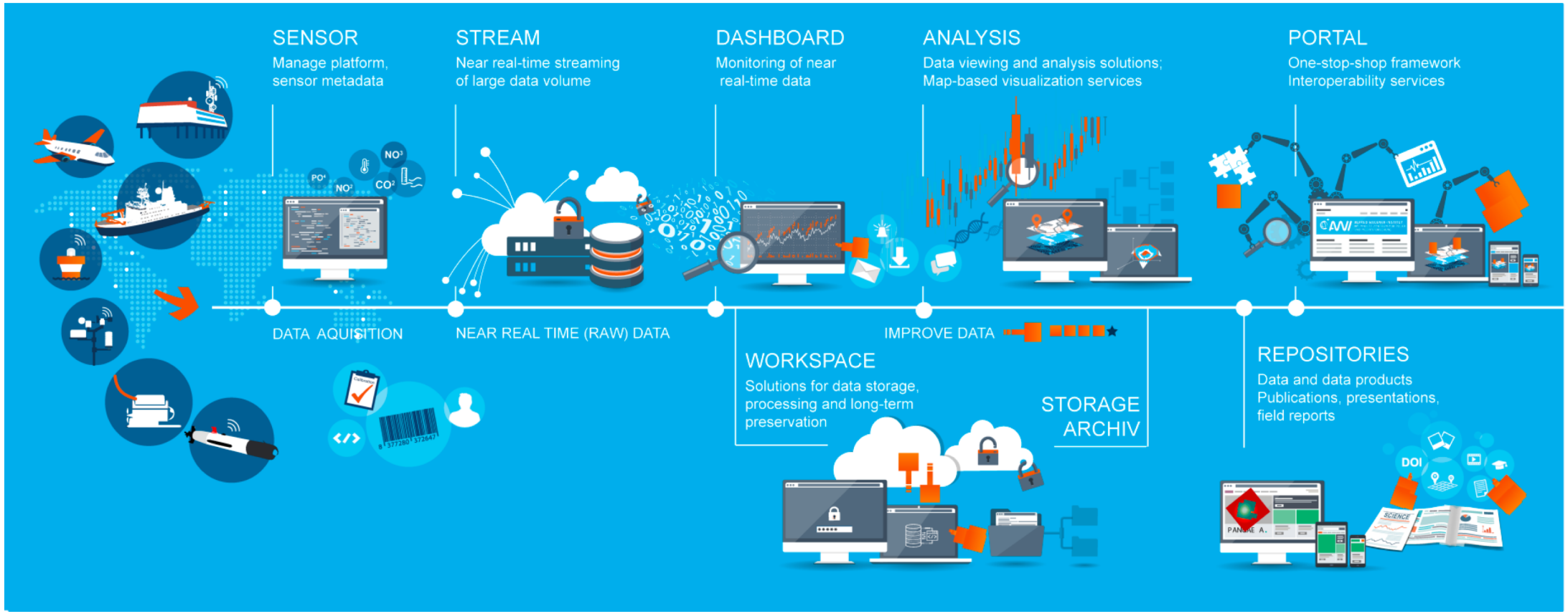
Dashboard

- 2D graph
- Heatmap
- Map widgets color-coded paramterts
- and more tools…

- Share your Dashboards
  - With a group
  - Open to all (Public)

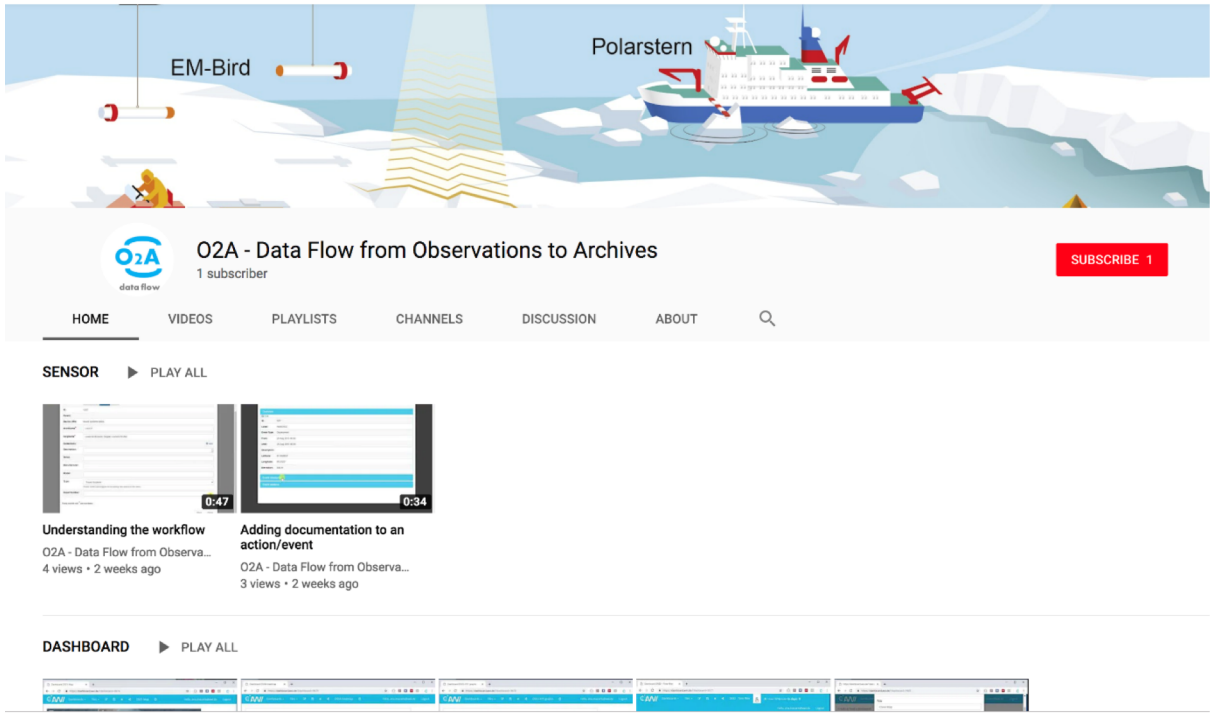


O2A Framework



References and Further Documentation

- https://spaces.awi.de/display/DM



- sensor.awi.de
- pangaea.de
- https://www.youtube.com/channel/UCljKBoLBJqy8XASA3QKrRxA/