(One)Argo data for everyone

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Laboratory for Ocean Physics and Satellite remote sensing (LOPS)

IFREMER

Mastering the Argopy library for Argo Ocean Data Analysis

Presentation and Training Session

Based on Argopy version 1.3.1

Outline

The project, the team

Why argopy ?

Getting started

For those more familiar with Argo

For experts

The argopy project, the team

argopy was created in 2020 with the idea of making
Argo data easily accessible to everyone
(Maze & Balem, 2020: 10.21105/joss.02425)

argopy is an **open source** and **collaborative** software project

The codebase is licensed under the EUPL v1.2

open source initiative®

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- ⓘ Same license

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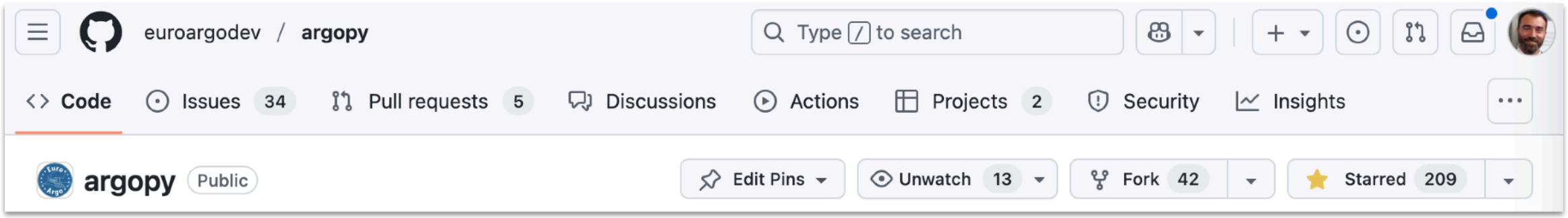
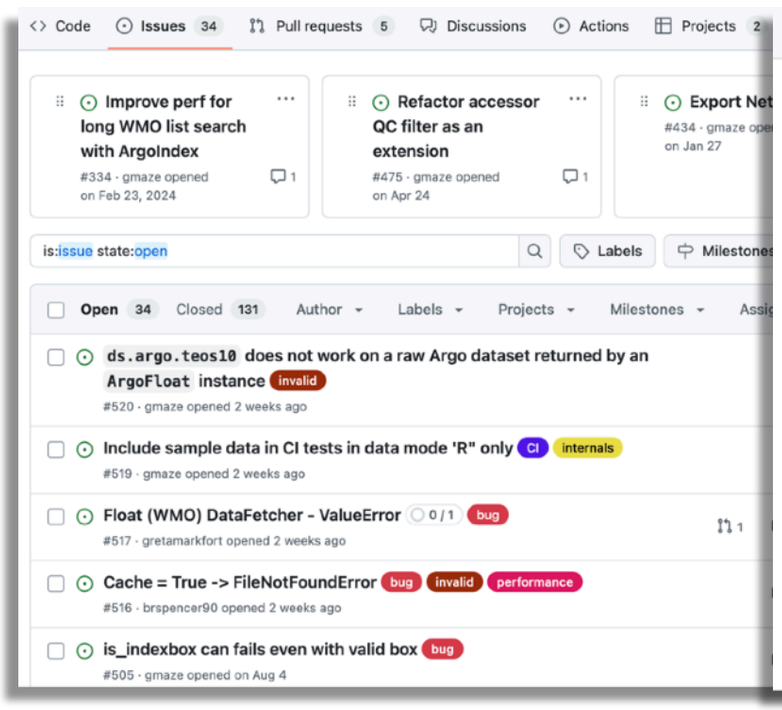
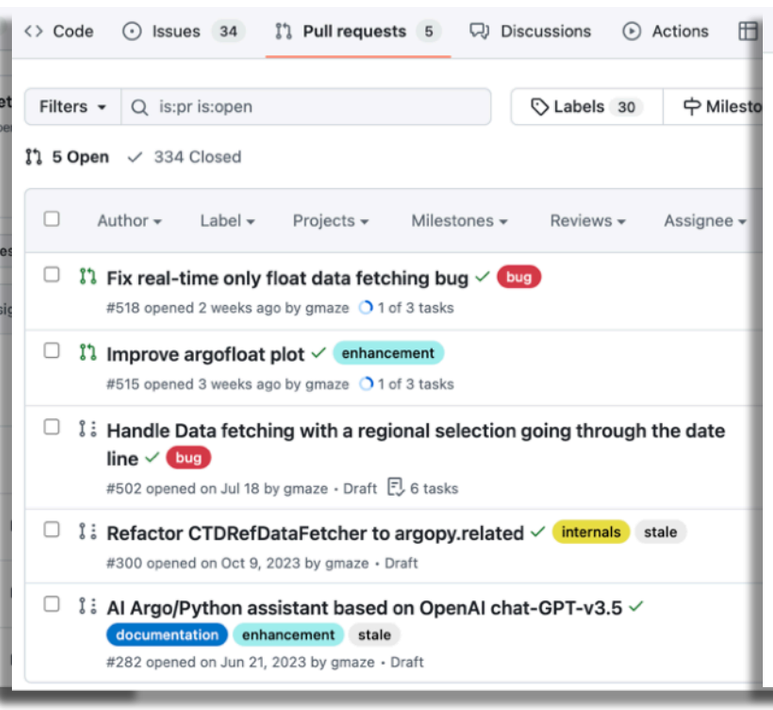
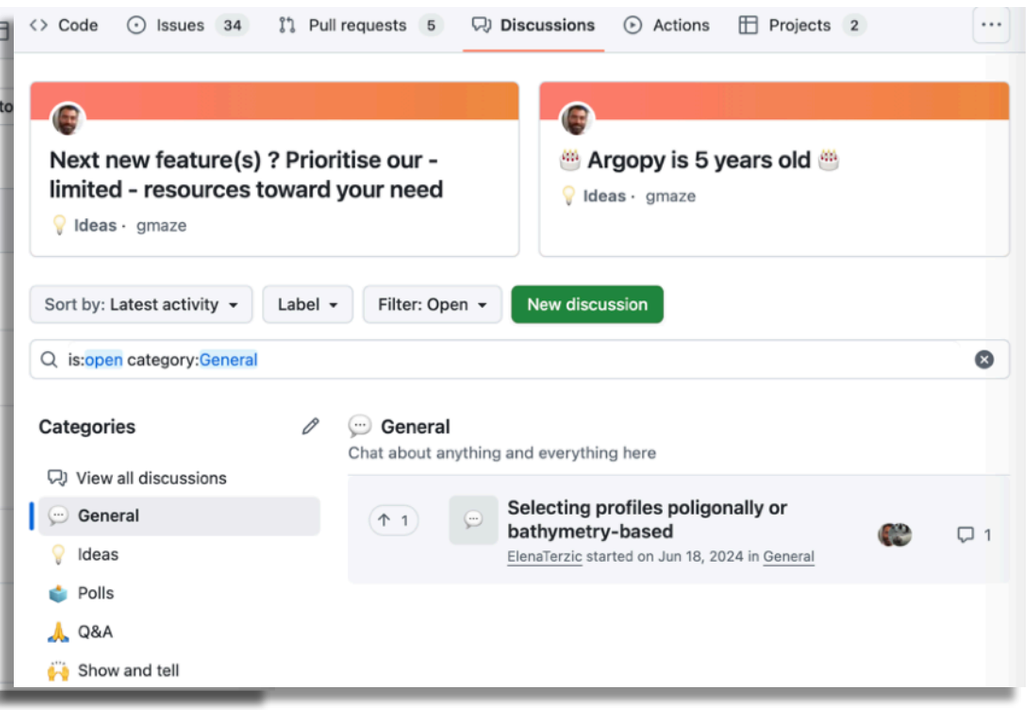
The project is hosted on https://github.com/euroargodev/argopy









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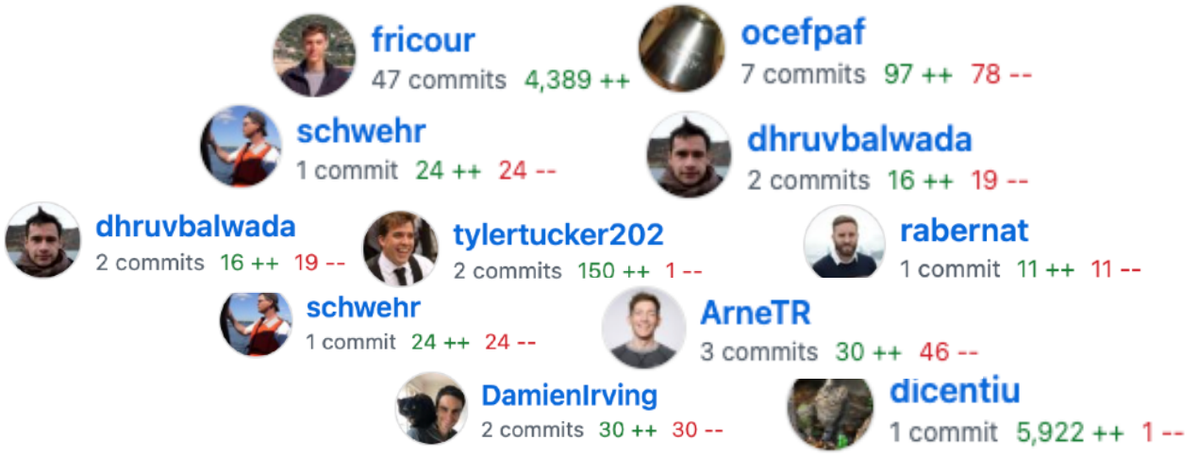
The team

Developers and maintainers:

- Guillaume Maze (PI, 60%)
- Kevin Balem (co-PI, 20%)
- Jade Dogo (80%-2026)
- Community enthusiasts



Support and expertise:

- Filipe Fernandes (distribution support)
- Raphaëlle Sauzède and LOV (expertise BGC)
- Catherine Schmechtig (expertise BGC)
- Léo Le Lonquer, Thierry Carval (data server support)

- Ifremer, SNO Argo-France, CNRS - LEFE/GMMC
- Euro-Argo RISE, Euro-Argo ONE

Outline

The project, the team

Why argopy ?

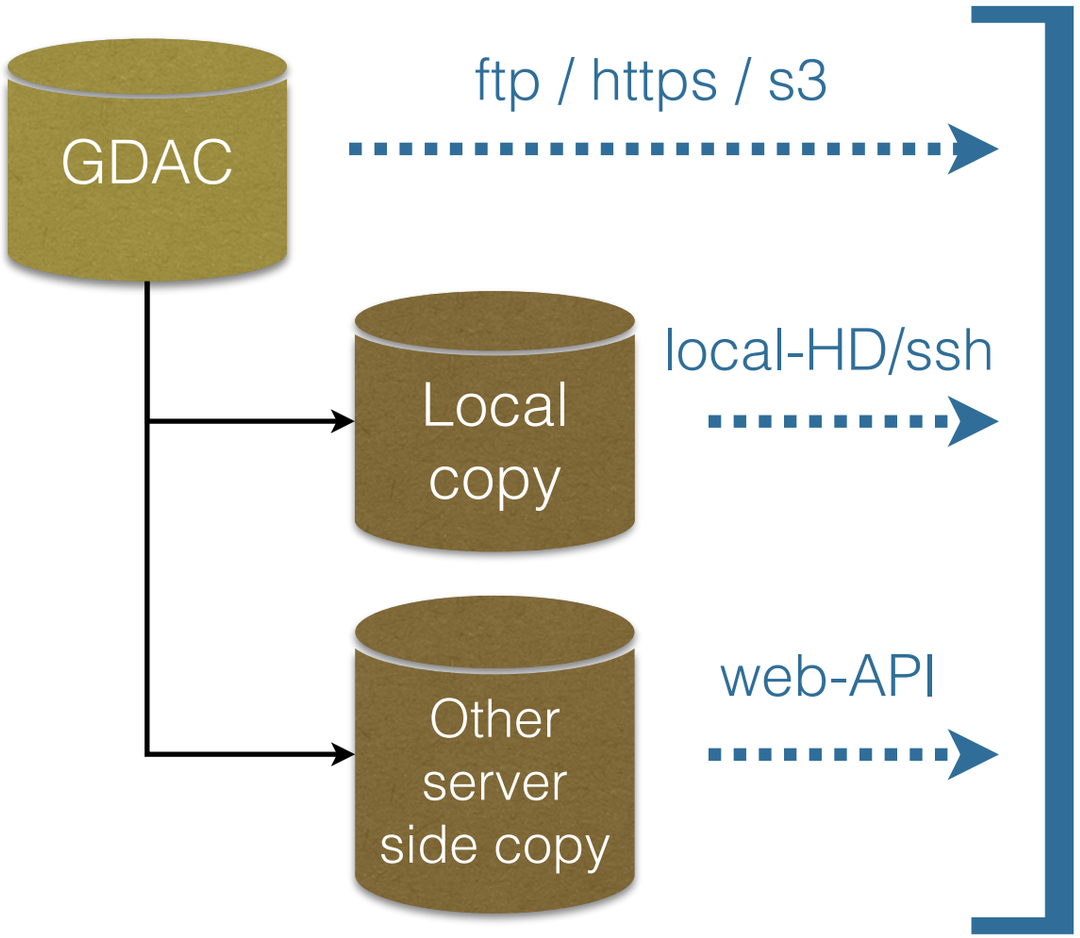
Getting started

For those more familiar with Argo

For experts

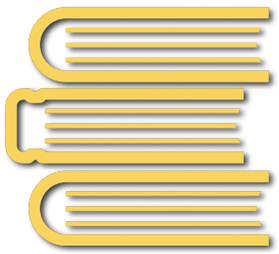
The problem to solve

Argo data sources and access protocols

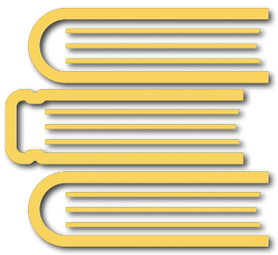


End-user standard workflow

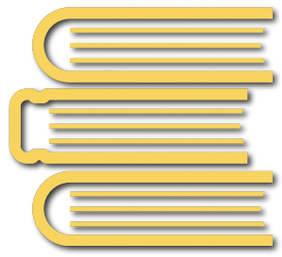
Users



Scripts to **fetch** data

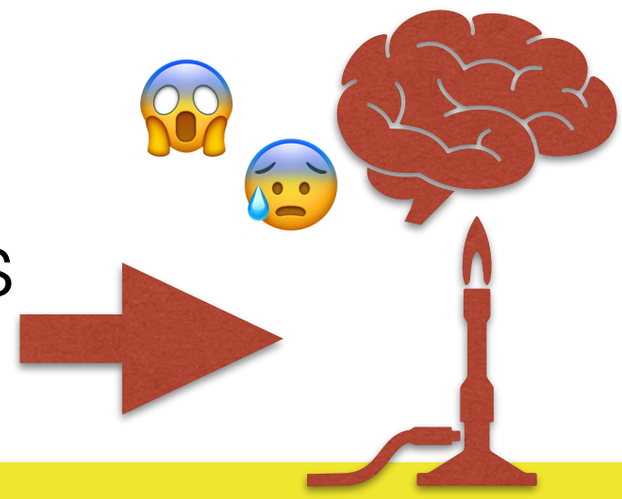


Scripts to **manipulate** data



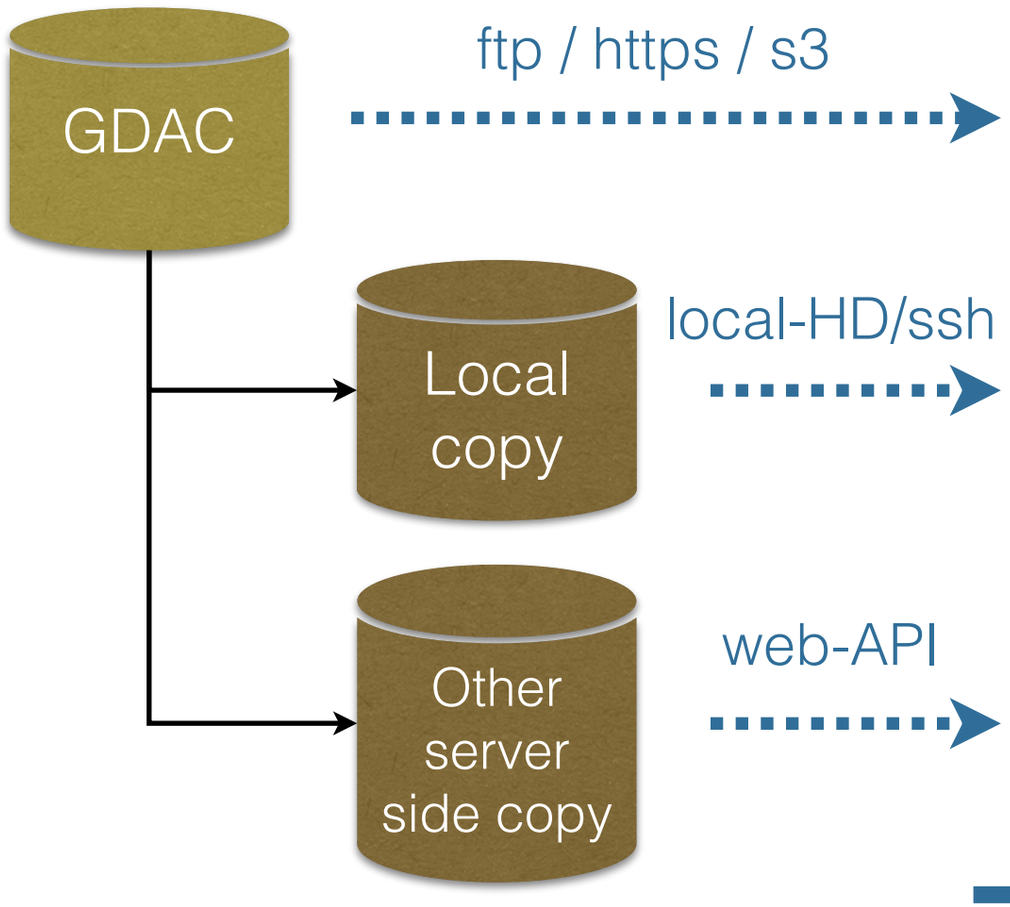
Scripts to **analyse** data

These steps require to learn:
format, vocabulary, conventions and protocols
for an increasingly numbers of (meta)/data sources

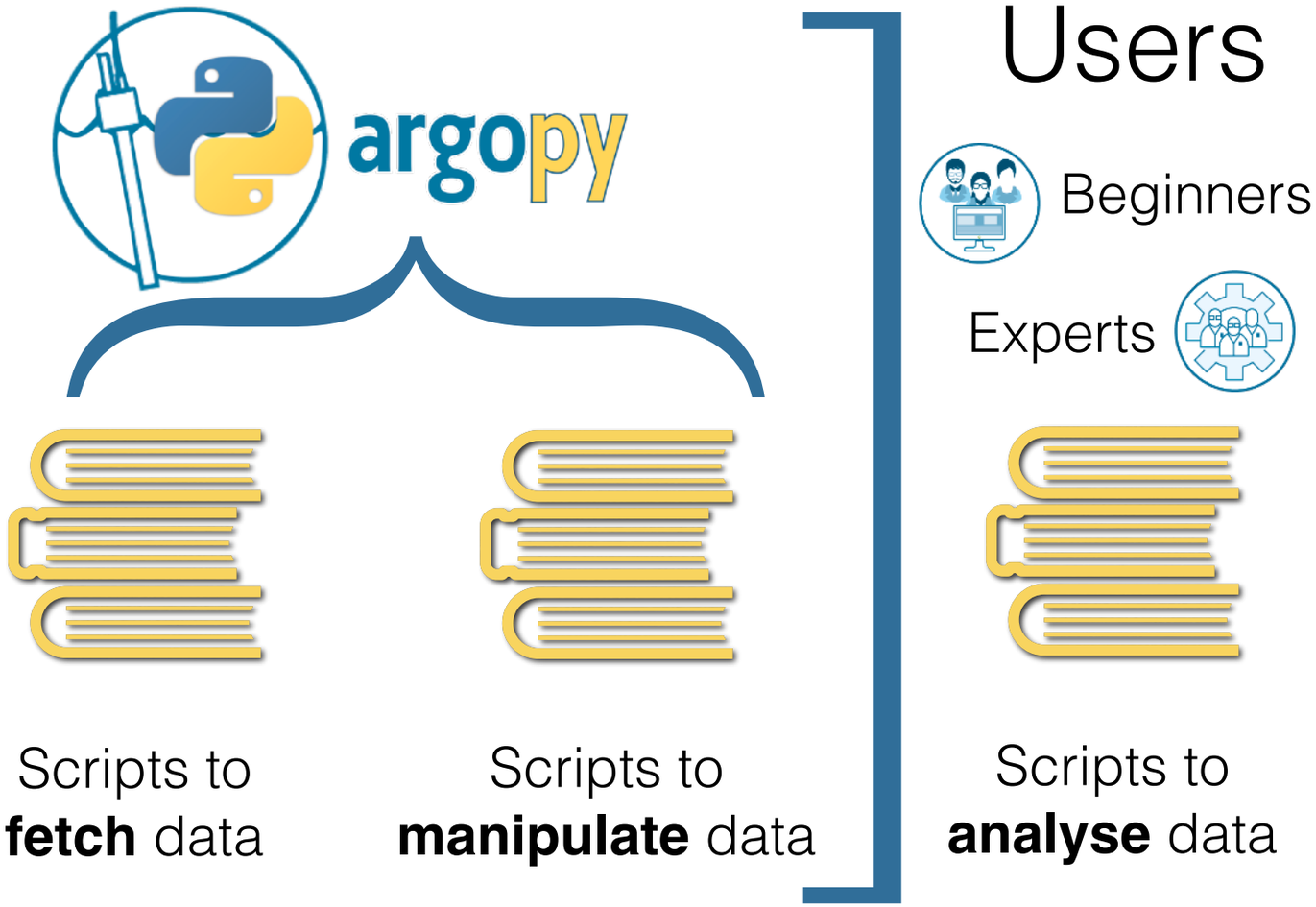


Solution proposed by argopy

Argo data sources and access protocols



End-user standard workflow



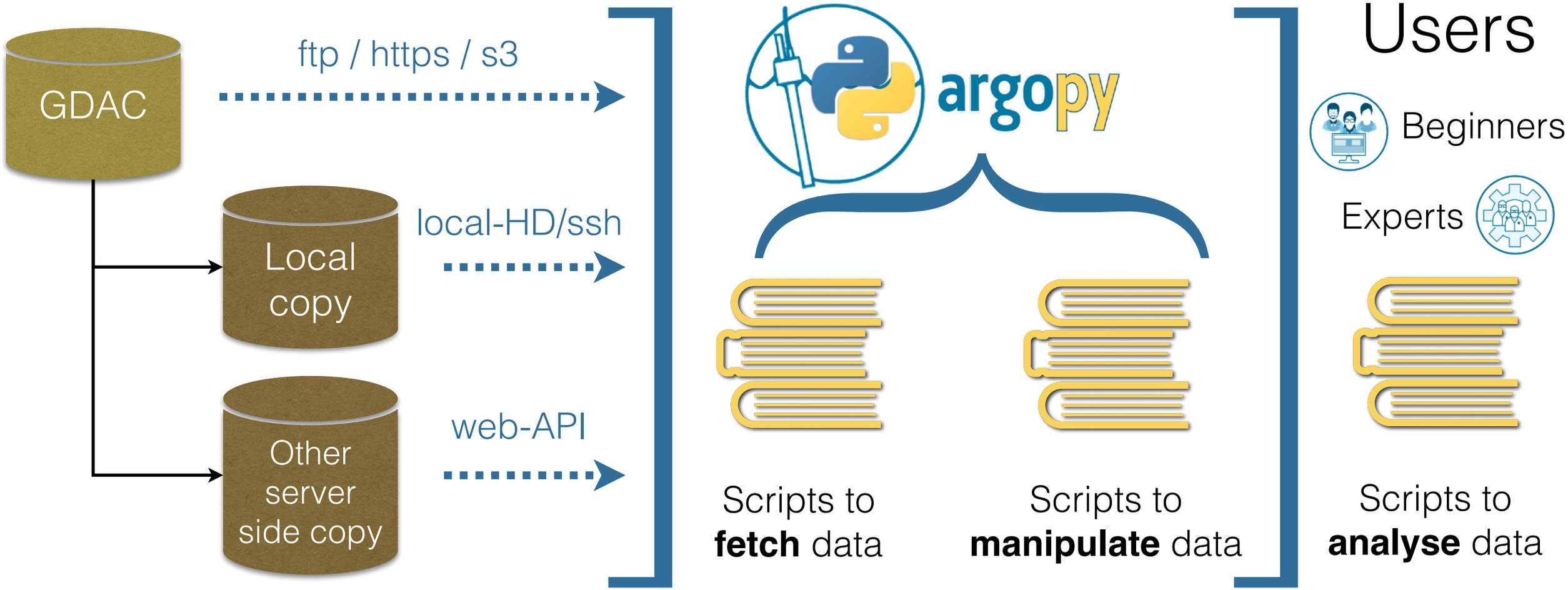
argopy let users decide how much of the Argo machinery to learn/see:
Less data wrangling, more analysis

Maze & Balem, 2020: 10.21105/joss.02425

Solution proposed by argopy

Argo data sources and access protocols

End-user standard workflow

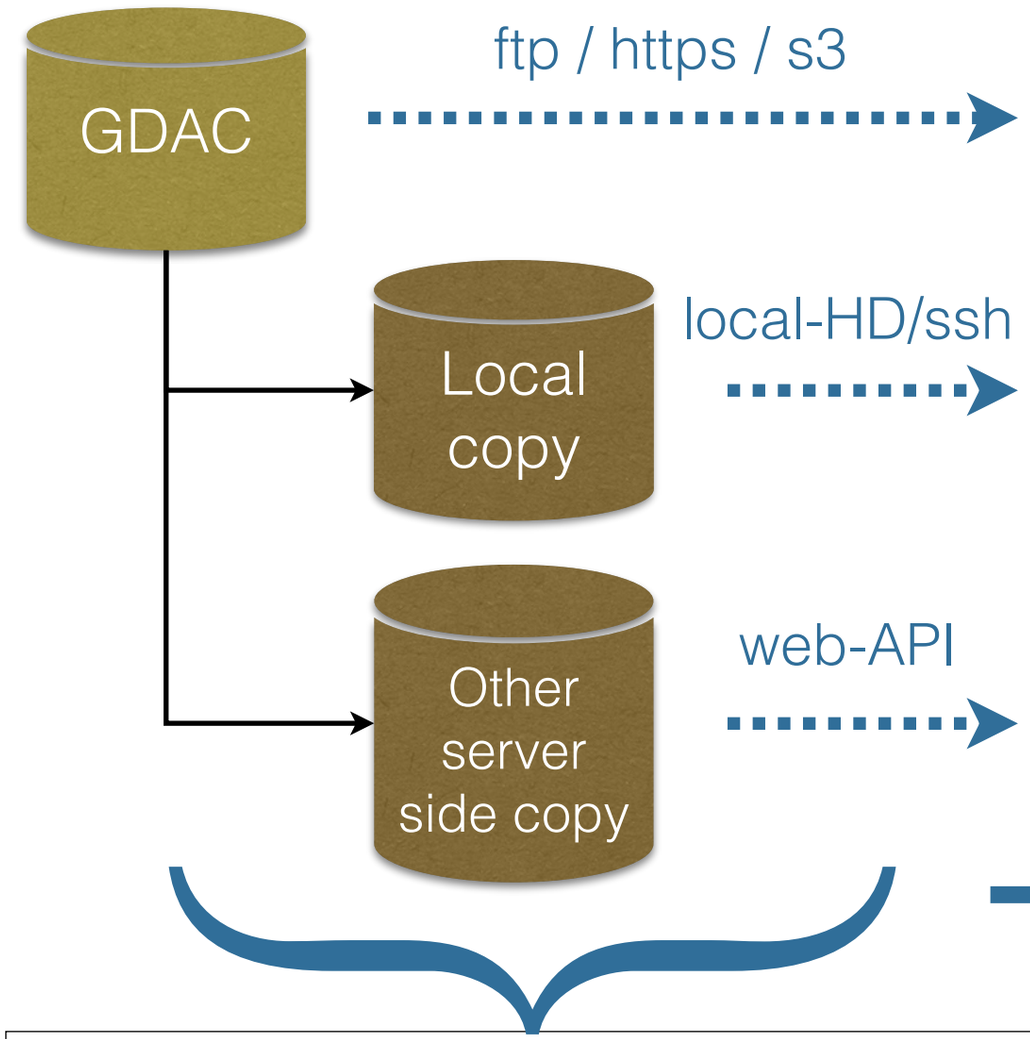


argopy let users decide how much of the Argo machinery to learn/see:
Less data wrangling, more analysis

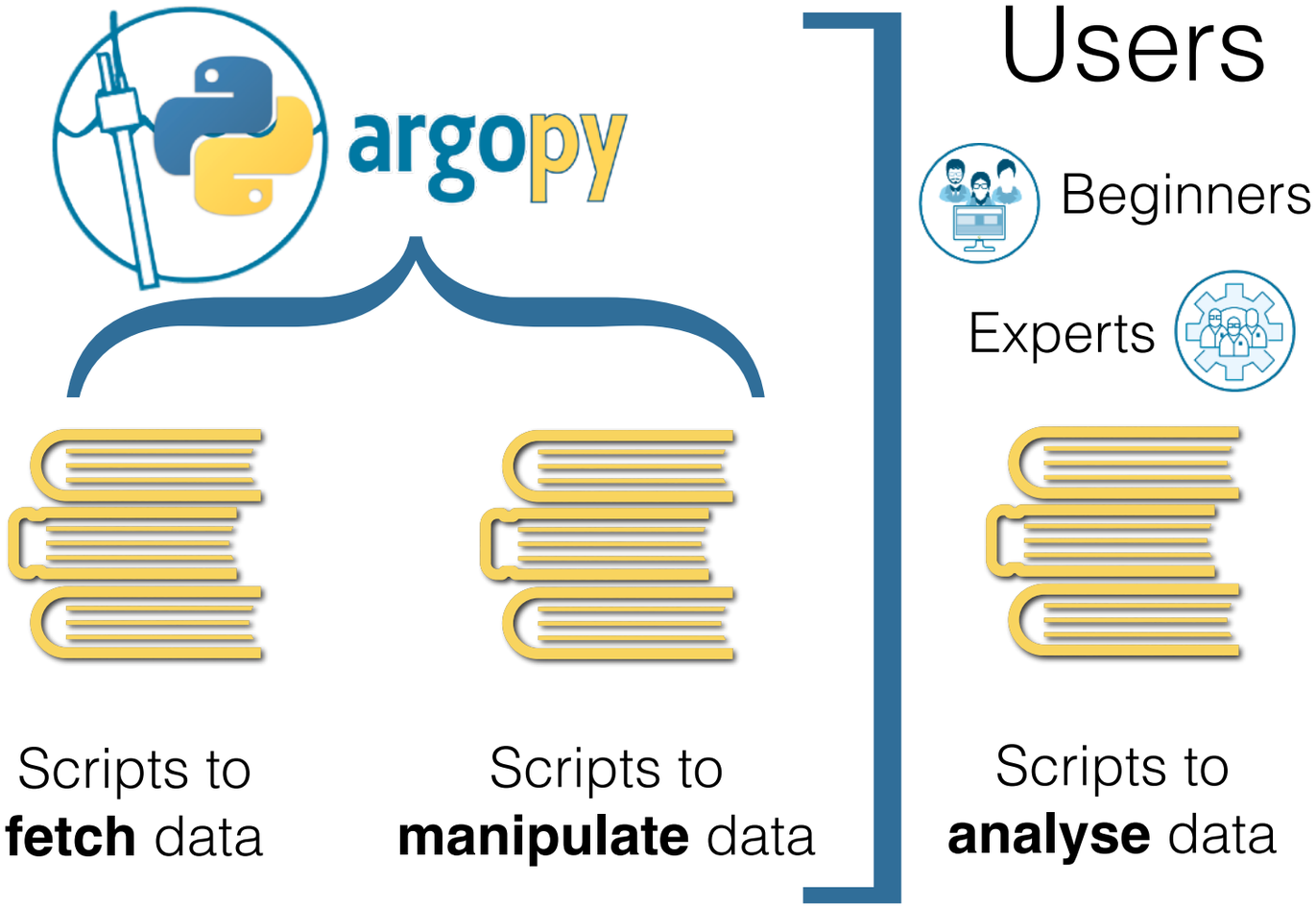
argopy can simplify Argo dataset with state of the art Argo Data Management recommendations for You !

Solution proposed by argopy

Argo data sources and access protocols



End-user standard workflow



1. ftp://usgodae.org/pub/outgoing/argo (data, index)
2. ftp://ftp.ifremer.fr/ifremer/argo (data, index)
3. https://data-argo.ifremer.fr (data, index)
4. http://erddap.ifremer.fr/erddap (data + Reference Data)
5. https://argovis.colorado.edu (data)
6. https://fleetmonitoring.euro-argo.eu (meta-data, dashboard)
7. https://dataselection.euro-argo.eu (trajectories)
8. https://co-insitucharts.ifremer.fr (dashboard)
9. https://vocab.nerc.ac.uk/collection (meta-data, vocabulary)
10. https://coastwatch.pfeg.noaa.gov/erddap (topography)
11. https://maps.biogeochemical-argo.com/bgcargo (dashboard)
12. https://www.ocean-ops.org (dashboard, deployment plan)
13. https://archimer.ifremer.fr / (ADMT documentation manuals)
14. https://www.seanoe.org/api/ (GDAC snapshot DOIs)
15. s3://argo-gdac-sandbox (data, index) > experimental
16. https://oem-lookup.rbr-global.com/api/v1 (sensor meta-data)
17. https://instrument.seabirdhub.com/api/argo-calibration (sensor meta-data)

argopy keeps track with ALL data sources and protocols for You !

argopy provides high-level methods to access Argo meta and related datasets

(as well as access protocols)

Outline

The project, the team
Why argopy ?

Getting started

For those more familiar with Argo
For experts

DataFetcher ↓

Load analysis-ready Argo data in memory

ds.argo ↓

Manipulate and compute complementary data

dashboards .plot() ↓

Quick data viz

https://argopy.readthedocs.io/en/latest/usage.html

How to use the DataFetcher ?

1- Select data

```
from argopy import DataFetcher

# Space/time domain
# [lon_min, lon_max, lat_min, lat_max, pres_min, pres_max, tmin, tmax]:
fetcher = DataFetcher().region([-75, -45, 20, 30, 0, 100, '2011-01', '2011-06'])

# One or more floats by WMO:
fetcher = DataFetcher().float([6902746, 6902755])

# One or more profiles by cycle CYCLE NUMBER (for one or more floats):
fetcher = DataFetcher().profile(6902746, [1,12])
```

2- Fetch data

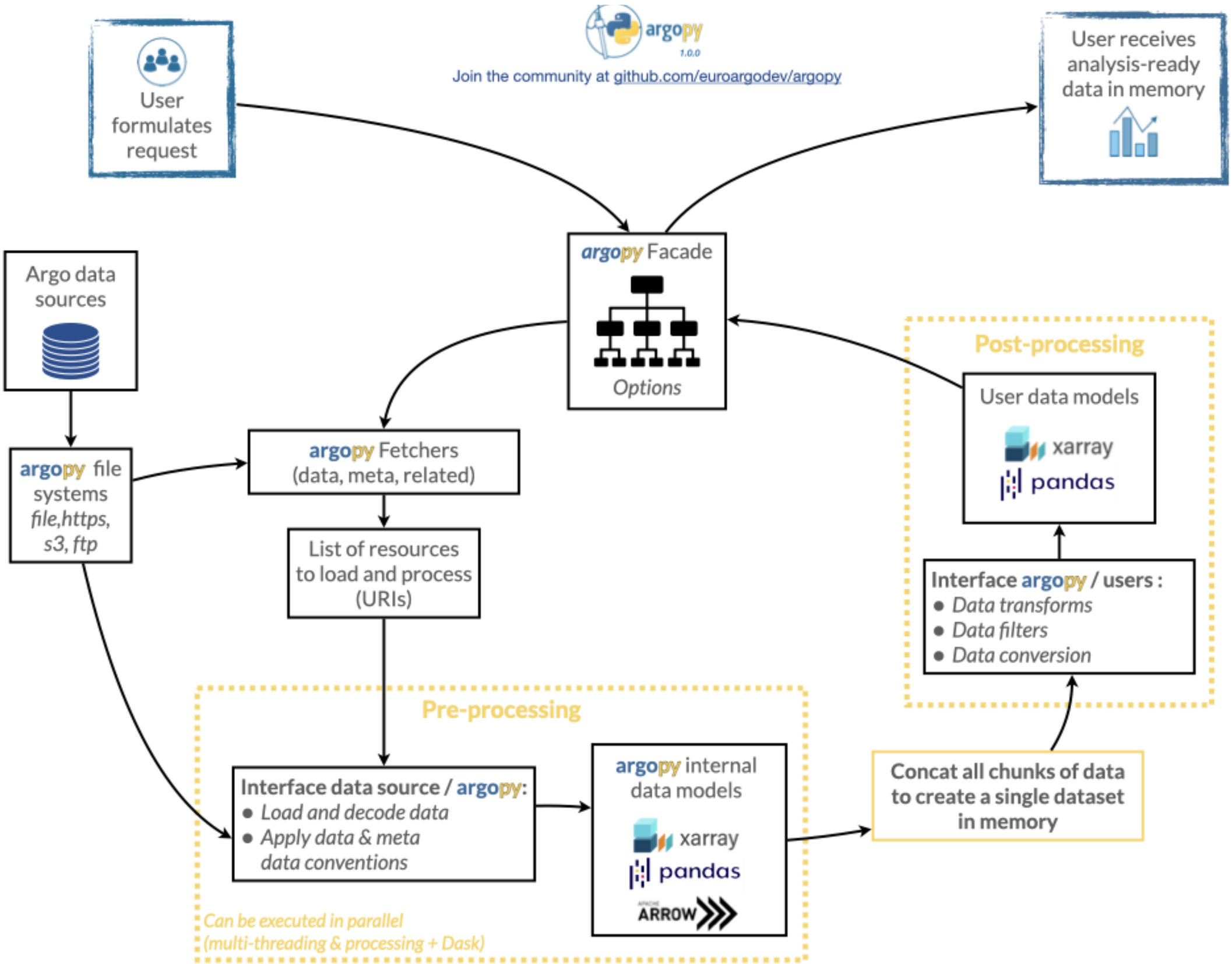
```
# Xarray Dataset (default argopy data model)
ds = fetcher.to_xarray()

# Pandas Dataframe
ds = fetcher.to_dataframe()

# netCDF4 dataset for legacy
ds = fetcher.to_dataset()
```

but not twice...

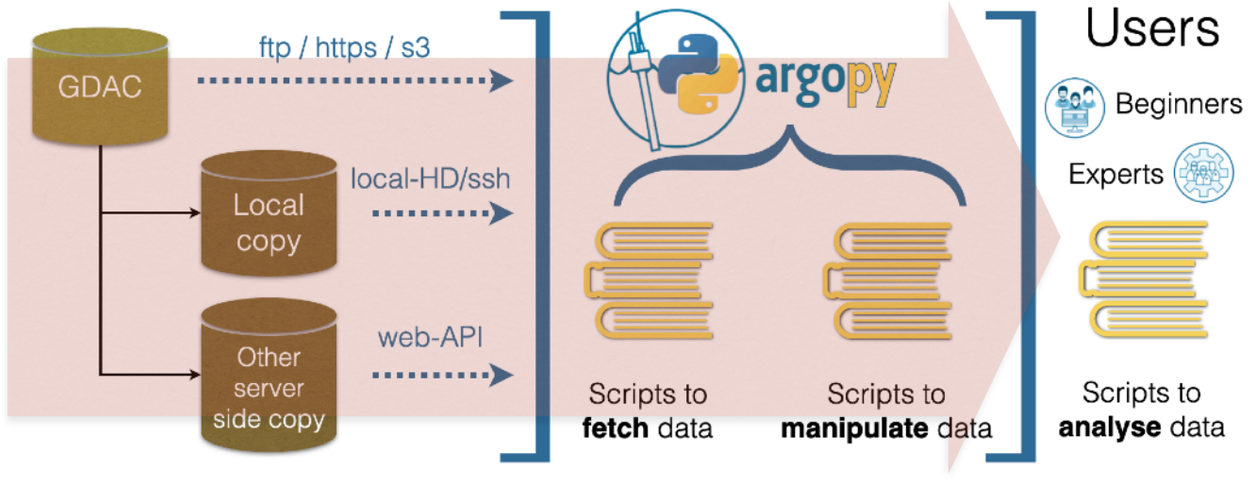
```
# Xarray Dataset
ds = fetcher.data
# Pandas DataFrame
df = fetcher.index
```

https://argopy.readthedocs.io/en/latest/user-guide/fetching-argo-data/index.html

How to use the DataFetcher ?



How to use the DataFetcher ?



argopy *is currently designed to process Argo data on client side:*

1. transcript your **data selection** into a machine-2-machine requests (whatever the data location & protocol to use)
2. possibly chunk requests for parallel execution
3. **retrieve** raw/original Argo data from specified **location**
4. filter & transform raw data according to **user mode** selection (DM & QC)
5. possibly merge chunks of data into a single dataset
6. return **analysis ready** dataset

3 DataFetcher options let you choose how much details/jargon to see...

How to use the DataFetcher ?

Choose a dataset

argopy provides access to **physical** and **BGC** parameters
Use the option **`ds`** to choose your favorite

`'phy'` is for physical parameters (pressure, temperature, salinity)
This is the default choice

```
from argopy import DataFetcher

fetcher = DataFetcher(ds='phy')
```

`'bgc'` is for biogeochemical parameters (e.g.: `'DOXY', 'CHLA'`, etc ...)

```
fetcher = DataFetcher(ds='bgc')
```

But since they are about 120 possible BGC parameters, **argopy** provides additional options to restrict which one to fetch:

```
fetcher = DataFetcher(ds='bgc',
                      params='DOXY')

fetcher = DataFetcher(ds='bgc',
                      params='all',
                      measured=['DOXY', 'BBP700'])
```

https://argopy.readthedocs.io/en/latest/user-guide/fetching-argo-data/index.html

How to use the DataFetcher ?

Choose a data source

argopy can get access to Argo data from the following sources:

- ⭐ the Ifremer **`erddap`** server (Default)
- 🌐 all Argo **`gdac`** servers:
  - `'https'` ➡ `https://data-argo.ifremer.fr`
  - `'us-https'` ➡ `https://usgodae.org/pub/outgoing/argo`
  - `'ftp'` ➡ `ftp://ftp.ifremer.fr/ifremer/argo`
  - `'s3'` ➡ `s3://argo-gdac-sandbox/pub`
- 🌐 a **local folder** with the GDAC content (copy/rsync)
- 👁️ the **`argovis`** server

Use the option **`src`** to choose your favorite

```
from argopy import DataFetcher

fetcher = DataFetcher(src='erddap')
fetcher = DataFetcher(src='https')
fetcher = DataFetcher(src='gdac', host='/home/ref/argo-gdac')
```

```
with argopy.set_options(src='argovis', argovis_api_key='guest'):
    fetcher = DataFetcher()
```

```
argopy.set_options(src='ftp')
fetcher = DataFetcher()
```

https://argopy.readthedocs.io/en/latest/user-guide/fetching-argo-data/data_sources.html

How to use the DataFetcher ?

Data source features in argopy

		erddap	gdac	argovis
		⭐	🌐	👁️
Access Points:				
	🗺️ region	X	X	X
	🤖 float	X	X	X
	⚓ profile	X	X	X
User mode:				
	🏄 expert	X	X	
	🚤 standard	X	X	X
	🚣 research	X	X	
Dataset:				
	core (T/S)	X	X	X
	BGC	X	~	
	Deep	X	X	X
	Trajectories			
	Reference data for DMQC	X		

https://argopy.readthedocs.io/en/latest/user-guide/fetching-argo-data/data_sources.html

How to use the DataFetcher ?

Choose a user mode

argopy provides 3 user modes:

🏄 **`expert`** mode: return all the Argo data, without post-processing

🏊 **`standard`** mode: simplifies the dataset, remove most of its jargon and return a priori good data

🚣 **`research`** mode: simplifies the dataset to its heart, preserving only data of the highest quality for research studies

Use the option **`mode`** to choose your favorite

```
from argopy import DataFetcher

fetcher = DataFetcher(mode='research')
```

E.g.:

🏄 **expert**

```
PSAL
PSAL_QC
PSAL_ADJUSTED
PSAL_ADJUSTED_QC
PSAL_ADJUSTED_ERROR
DATA_MODE
```

🏊 **standard**

```
PSAL
PSAL_QC
PSAL_ERROR
DATA_MODE
```

🚣 **research**

```
PSAL
PSAL_ERROR
```

https://argopy.readthedocs.io/en/latest/user-guide/fetching-argo-data/user_mode.html

How to use the ds.argo accessor ?

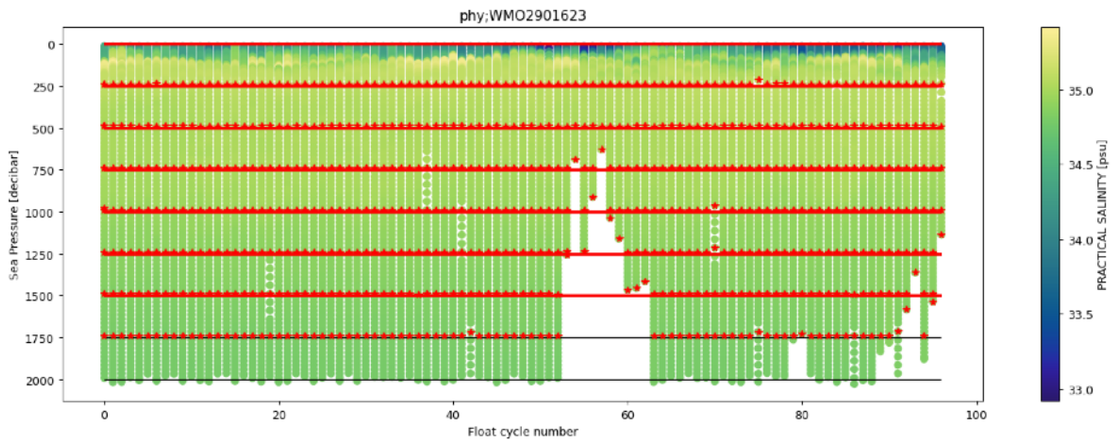
Now that you fetched Argo data in memory,
you can **manipulate** your dataset with **ds.argo** methods

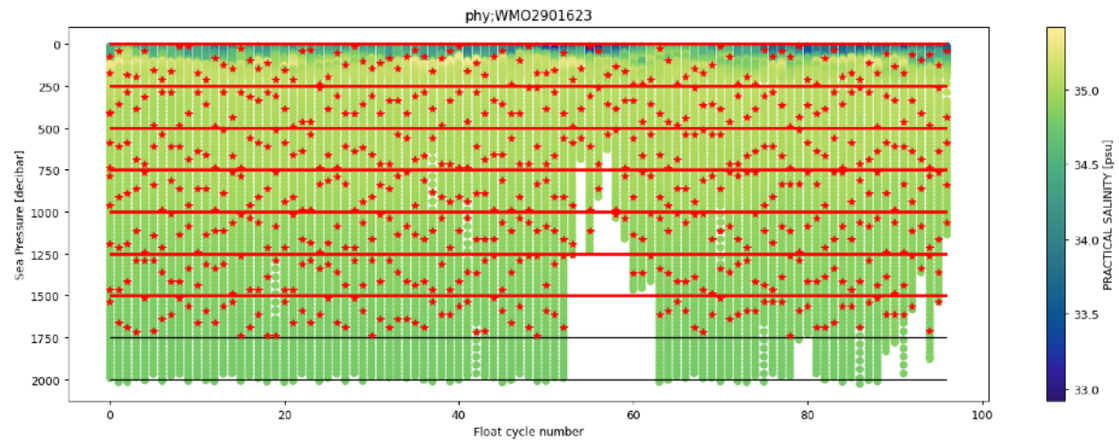
Work with a collection of points (default) vs a collection of profiles:

```
ds.argo.point2profile()
ds.argo.profile2point()
```

Vertical re-gridding:

```
std = [0,100,200,500]   # in db
dsp.argo.interp_std_levels(std)

b = np.arange(0., 2000., 250.0)   # in db
ds.argo.groupby_pressure_bins(bins=b, select='deep')
ds.argo.groupby_pressure_bins(bins=b, select='random')
```





https://argopy.readthedocs.io/en/latest/user-guide/working-with-argo-data/data_manipulation.html

How to use the ds.argo accessor ?

Now that you fetched Argo data in memory,
you can **compute** complementary data with **ds.argo** methods

Compute standard variables:

```
ds.argo.teos10(['SA', 'CT', 'CNDC']) # 'SIG0', 'N2', 'PV', 'PTEMP', 'SOUND_SPEED'
```

Compute BGC optical modeling variables:

```
dsp.argo.optic.Zeu()  # Depth of the euphotic zone
dsp.argo.optic.Zeu(method='percentage', max_surface=5.)
dsp.argo.optic.Zeu(method='KdPAR', layer_min=10., layer_maz=50.)

dsp.argo.optic.Zpd()  # First optical depth

dsp.argo.optic.Z_iPAR_threshold(threshold=15.)  # Depth where PAR>=threshold

dsp.argo.optic.DCM()  # Search and qualify a Deep Chlorophyll Maxima
dsp.argo.optic.DCM_depth()  # Search and qualify a Deep Chlorophyll Maxima
```

Compute BGC nutrient and carbonate system variables:

CANYON-MED available:

```
ds.argo.canyon_med.predict()
ds.argo.canyon_med.predict('PO4') # "NO3", "DIC", "SiOH4", "AT", "pHT"
```

CANYON-B and CONTENT ready, will be released in v1.4.0 by the end of 2025

```
ds.argo.canyon_b.predict()
ds.argo.content.predict()
```

How to use the ds.argo accessor ?

Now that you fetched Argo data in memory,
you can **compute** complementary data with **ds.argo** methods

Compute your own “per profile” diagnostic:

```
ds.argo.reduce_profile(your_diag, params=['PRES', 'TEMP', 'PSAL'])
```

argopy takes care of efficient/parallelized, diagnostic computation on your collection of Argo profiles

Example:

```
def max_salinity_depth(pres, psal, max_layer=1000.):
    # A dummy function returning depth of the maximum salinity above max_layer
   idx = ~np.logical_or(np.isnan(pres), np.isnan(psal))
    idx = np.logical_and(idx, pres<=max_layer)
    if np.any(idx):
        return pres[idx][np.argmax(psal[idx])]
    else:
        return np.NaN

# Apply reduce function on all profiles of the dataset:
ds.argo.reduce_profile(max_salinity_depth, params=['PRES', 'PSAL'], max_layer=700)
```

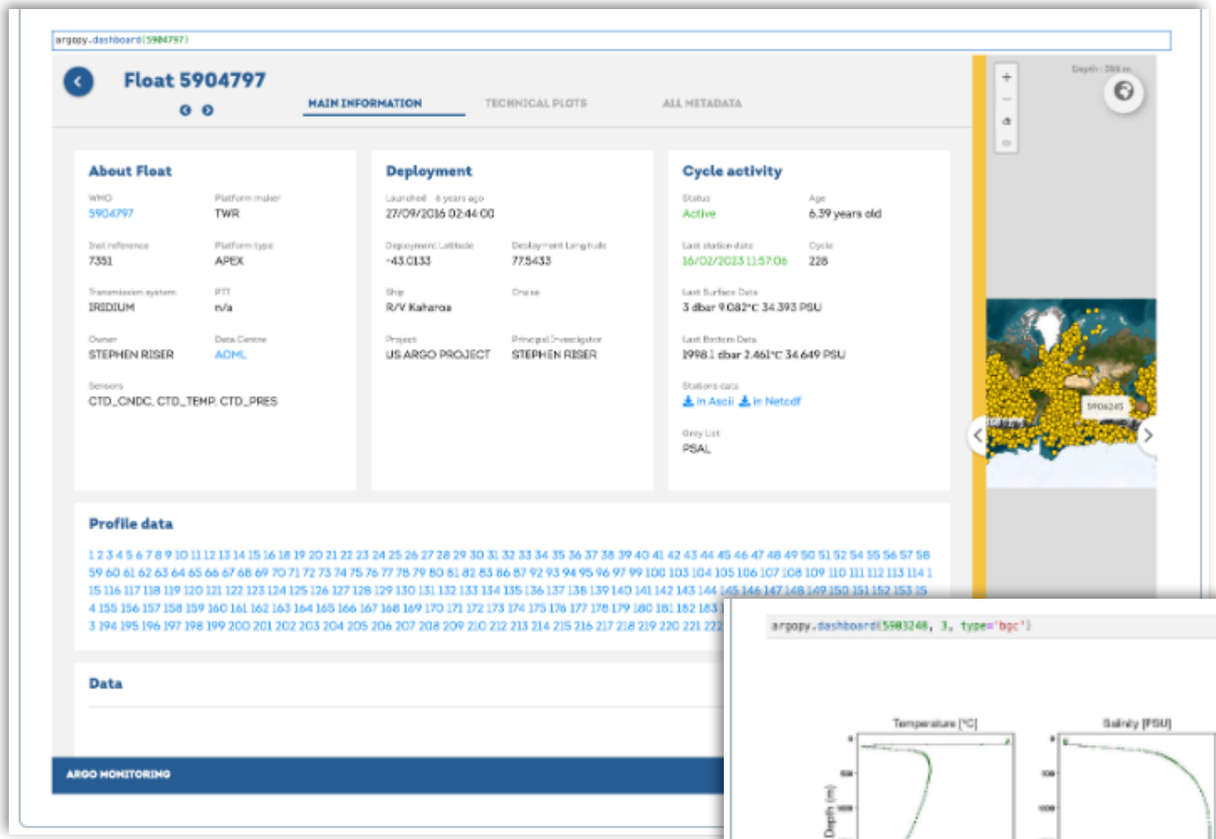
How to use argopy ?

Visualise data

Get a **`dashboard`** link or inserted into your notebook, for your selection:

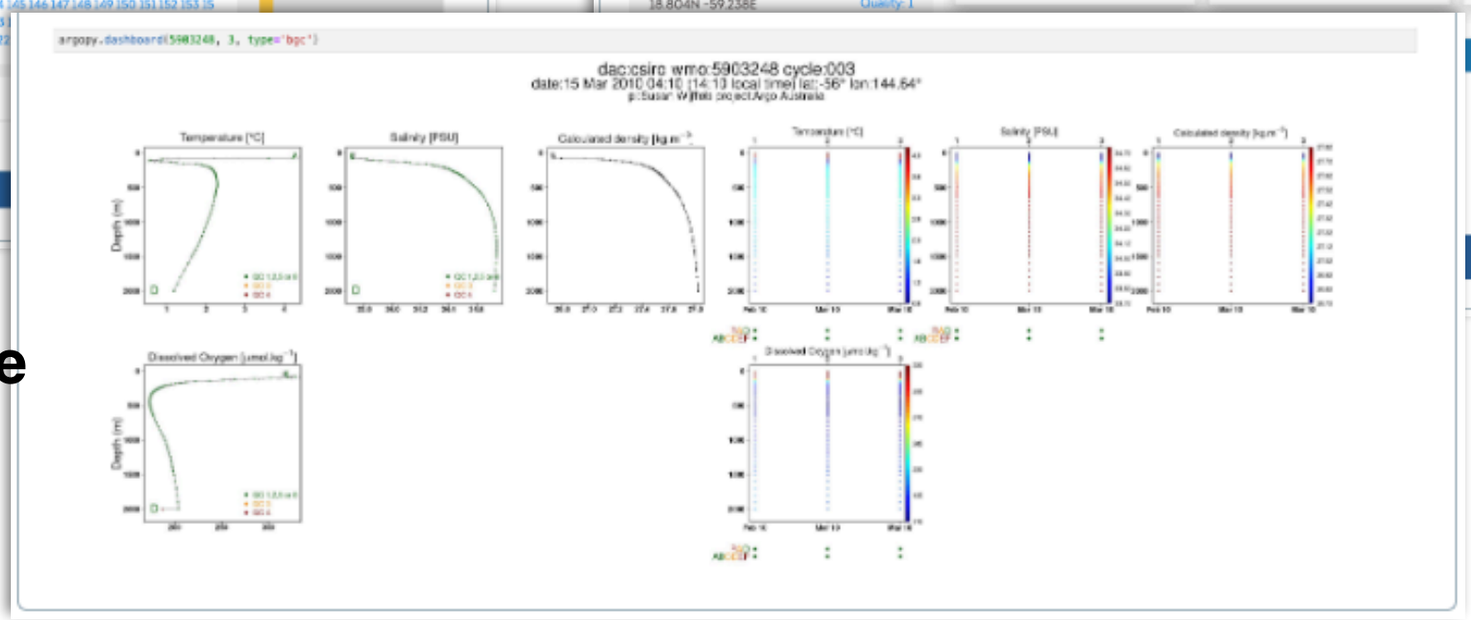
```
DataFetcher().float(6903091).dashboard()
DataFetcher().profile(6903091,12).dashboard()
```

For a float



For a profile

For a BGC float or profile

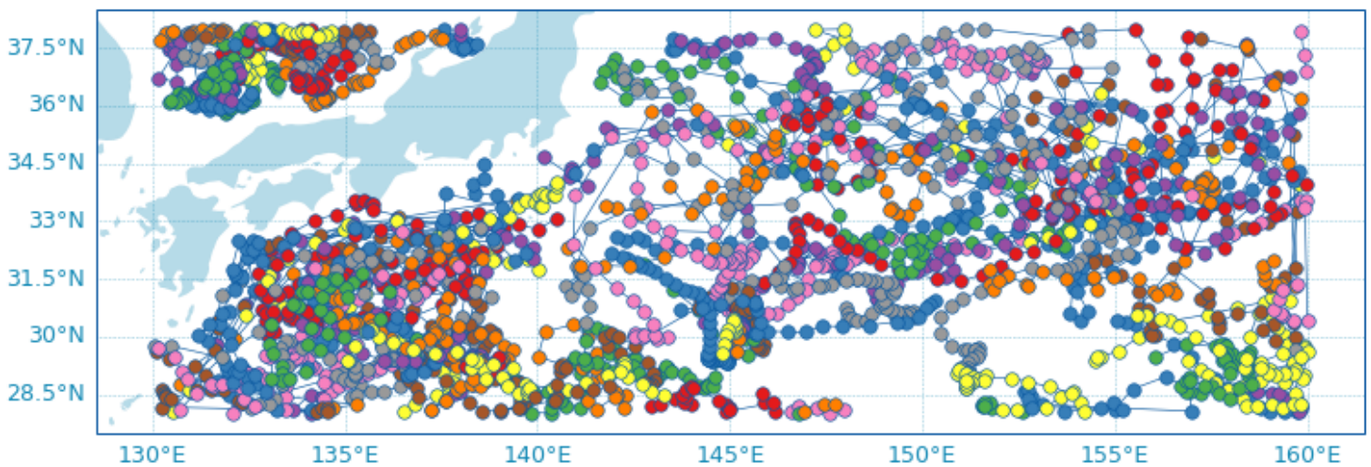


How to use argopy ?

Visualise data with `.plot` methods

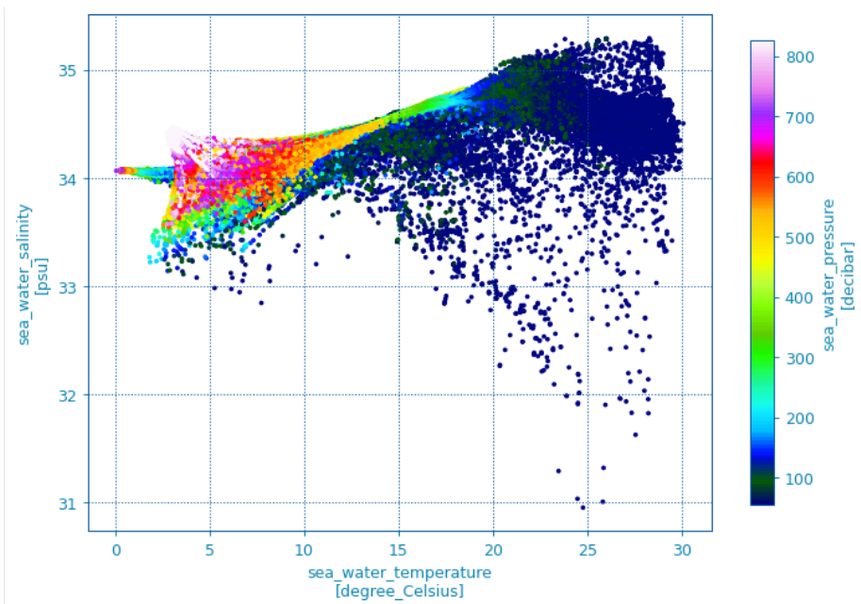
Look at trajectories:

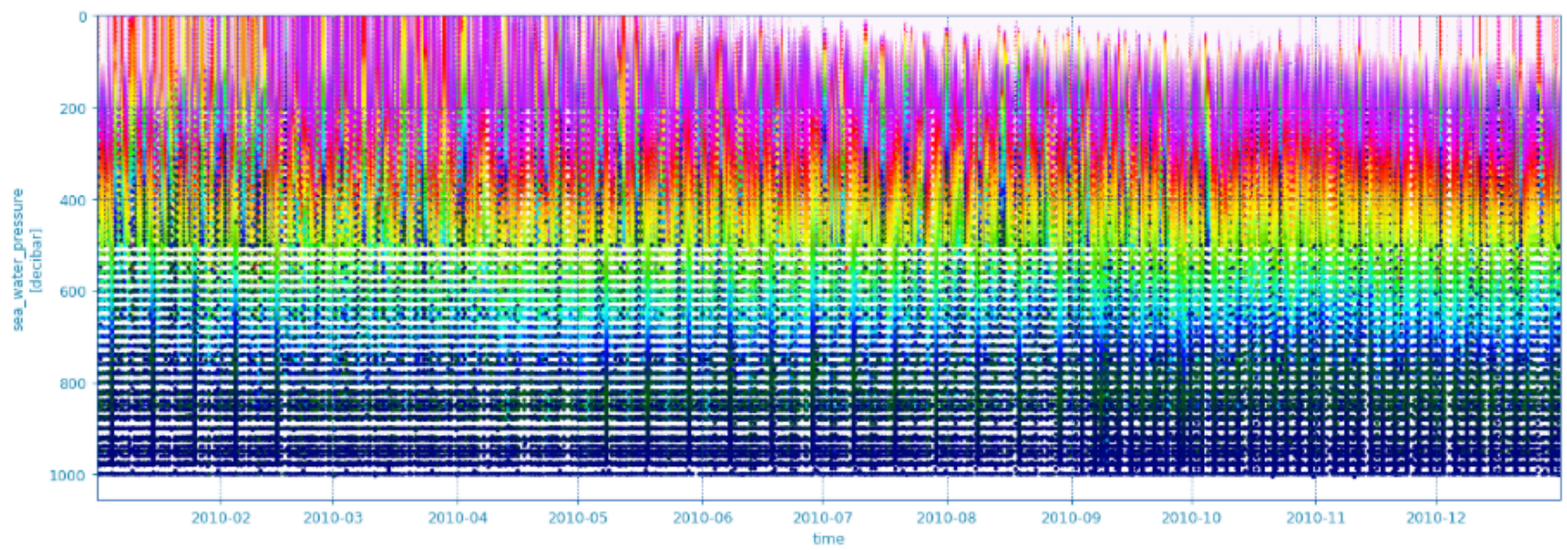
```
fetcher = DataFetcher(src='erddap').region([130, 160, 28, 38, 0, 10, '2010', '2011'])
fetcher.plot('trajectory', legend=False)
```



Or variables in scatter plots:

```
fetcher.plot('PRES', cbar=True, this_x='TEMP', this_y='PSAL', figsize=(9,6));
fetcher.plot('TEMP')
```





Outline

The project, the team
Why argopy ?

Getting started

For those more familiar with Argo

For experts

ArgoIndex → Argo sampling analysis
Listing files

ArgoFloat → Per float analysis

ArgoColors
Plotters → Viz Quick-starters

How to use ArgoIndex ?

Work with index files

```
idx = ArgoIndex() # Point to local or remote GDAC source using `host`
idx = ArgoIndex(host='/home/ref-argo/gdac') # Point to local GDAC

idx = ArgoIndex(index_file='bgc-s') # Select which file index to use

idx.load()  # Load full index (2-3 seconds for core profiles index)
```

```
>>> idx
<argoindex.pyarrow>
Host: https://data-argo.ifremer.fr
Index: argo_synthetic-profile_index.txt.gz
Convention: argo_synthetic-profile_index (Synthetic-Profile directory file of the Argo GDAC)
In memory: True (348531 records)
Searched: False
```

Table 4 **argopy** GDAC index file support status

	Index file	Supported
Profile	ar_index_global_prof.txt	✅
Synthetic-Profile	argo_synthetic-profile_index.txt	✅
Bio-Profile	argo_bio-profile_index.txt	✅
Metadata	ar_index_global_meta.txt	✅
Auxiliary	etc/argo-index/argo_aux-profile_index.txt	✅
Trajectory	ar_index_global_traj.txt	❌
Bio-Trajectory	argo_bio-traj_index.txt	❌
Technical	ar_index_global_tech.txt	❌
Greylist	ar_greylist.txt	❌

https://argopy.readthedocs.io/en/latest/advanced-tools/stores/argoindex.html

How to use ArgoIndex ?

Search the index

```
idx.query.wmo(1901393)  # or list eg: [6903091, 6903092]
idx.query.cyc(1)
idx.query.wmo_cyc(1901393, [1,12])

idx.query.lon([-60, -55, 40., 45., '2007-08-01', '2007-09-01'])
idx.query.lat([-60, -55, 40., 45., '2007-08-01', '2007-09-01'])
idx.query.date([-60, -55, 40., 45., '2007-08-01', '2007-09-01'])
idx.query.lon_lat([-60, -55, 40., 45., '2007-08-01', '2007-09-01'])
idx.query.box([-60, -55, 40., 45., '2007-08-01', '2007-09-01'])

idx.query.params(['C1PHASE_DOXY', 'DOWNWELLING_PAR'])  # Only for BGC profile index
idx.query.parameter_data_mode({'BBP700': 'D'})  # Only for BGC profile index
idx.query.profiler_type(845)
idx.query.profiler_label('NINJA')

idx.query.compose({'box': BOX, 'wmo': WMOs})
idx.query.compose({'box': BOX, 'params': 'DOXY'})
idx.query.compose({'box': BOX, 'params': (['DOXY', 'DOXY2'], {'logical': 'and'})})
idx.query.compose({'params': 'DOXY', 'profiler_label': 'ARVOR'})
```

Methods and Attributes

```
idx.to_indexfile('myindex.csv')
idx.N_RECORDS
idx.N_MATCH

idx.read_wmo(); idx.read_dac_wmo(); idx.records_per_wmo()
idx.read_params() ; idx.read_domain()
idx.read_files()
```

https://argopy.readthedocs.io/en/latest/advanced-tools/stores/argoindex.html

How to use ArgoIndex ?

```
>>> idx

<argoindex.pyarrow>
Host: https://data-argo.ifremer.fr
Index: argo_synthetic-profile_index.txt.gz
Convention: argo_synthetic-profile_index (Synthetic-Profile directory file of the Argo GDAC)
In memory: True (348531 records)
Searched: False
```

```
# Export to a fully documented list of files (WMO, CYC, DAC, etc…):
>>> idx.to_dataframe()
```

argopy

	file	date	latitude	longitude	ocean	profiler_code	institution_code	parameters	parameter_data_mode	date_update	wmo	cyc	institution	dac	profiler
0	aoml/1900722/profiles/SD1900722_001.nc	2006-10-22 02:16:24	-40.316	73.389	I	846	AO	PRES TEMP PSAL DOXY	DDDD	2022-06-28 08:08:01	1900722	1	AOML, USA	aoml	Teledyne Webb Research float with SBE conducti...
1	aoml/1900722/profiles/SD1900722_002.nc	2006-11-01 06:44:23	-40.390	73.528	I	846	AO	PRES TEMP PSAL DOXY	DDDD	2022-06-28 08:08:13	1900722	2	AOML, USA	aoml	Teledyne Webb Research float with SBE conducti...
2	aoml/1900722/profiles/SD1900722_003.nc	2006-11-11 10:12:22	-40.455	73.335	I	846	AO	PRES TEMP PSAL DOXY	DDDD	2022-06-28 08:08:26	1900722	3	AOML, USA	aoml	Teledyne Webb Research float with SBE conducti...
3	aoml/1900722/profiles/SD1900722_004.nc	2006-11-21 07:50:21	-40.134	73.080	I	846	AO	PRES TEMP PSAL DOXY	DDDD	2022-06-28 08:08:39	1900722	4	AOML, USA	aoml	Teledyne Webb Research float with SBE conducti...
4	aoml/1900722/profiles/SD1900722_005.nc	2006-12-01 18:33:00	-39.641	73.158	I	846	AO	PRES TEMP PSAL DOXY	DDDD	2022-06-28 08:08:52	1900722	5	AOML, USA	aoml	Teledyne Webb Research float with SBE conducti...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
348526	meds/4902688/profiles/SR4902688_085.nc	2025-05-10 15:31:00	57.664	-52.164	A	834	ME	PRES TEMP PSAL DOXY DOWN_IRRADIANCE380 DOWN_IR...	RRRRRRRRAR	2025-05-22 19:08:43	4902688	85	MEDS, Canada	meds	PROVOR V SBE
348527	meds/4902688/profiles/SR4902688_086.nc	2025-05-16 15:31:00	57.459	-53.125	A	834	ME	PRES TEMP PSAL DOXY DOWN_IRRADIANCE380 DOWN_IR...	RRRRRRRRAR	2025-05-22 19:08:53	4902688	86	MEDS, Canada	meds	PROVOR V SBE
348528	meds/4902688/profiles/SR4902688_087.nc	2025-05-22 15:29:00	57.289	-54.123	A	834	ME	PRES TEMP PSAL DOXY DOWN_IRRADIANCE380 DOWN_IR...	RRRRRRRRAR	2025-06-02 17:41:06	4902688	87	MEDS, Canada	meds	PROVOR V SBE
348529	meds/4902688/profiles/SR4902688_088.nc	2025-05-28 15:35:00	57.294	-54.127	A	834	ME	PRES TEMP PSAL DOXY DOWN_IRRADIANCE380 DOWN_IR...	RRRRRRRRAR	2025-06-02 17:41:16	4902688	88	MEDS, Canada	meds	PROVOR V SBE
348530	meds/4902688/profiles/SR4902688_089.nc	2025-06-03 15:33:00	57.440	-54.106	A	834	ME	PRES TEMP PSAL DOXY DOWN_IRRADIANCE380 DOWN_IR...	RRRRRRRRAR	2025-06-04 00:07:11	4902688	89	MEDS, Canada	meds	PROVOR V SBE

https://argopy.readthedocs.io/en/latest/advanced-tools/stores/argoindex.html

How to use ArgoFloat ?

Direct access to float datasets

whatever their location

```
from argopy import ArgoFloat

af = ArgoFloat(6902746) # Can point to local or remote data source using `host` argument

af = ArgoFloat(WMO, host='/home/ref-argo/gdac')  # Use your local GDAC copy
af = ArgoFloat(WMO, host='https')  # Shortcut for https://data-argo.ifremer.fr
af = ArgoFloat(WMO, host='ftp')    # shortcut for ftp://ftp.ifremer.fr/ifremer/argo
af = ArgoFloat(WMO, host='s3')     # Shortcut for s3://argo-gdac-sandbox/pub
```

```
>>> af

<argofloat.6902746.http.online>
GDAC host: https://data-argo.ifremer.fr
DAC name: coriolis
Network(s): ['CORE']
Deployment date: 2017-07-06 11:15 [2891 days ago]
Float type and manufacturer: ARVOR [NKE]
Number of cycles: 138
Dashboard: https://fleetmonitoring.euro-argo.eu/float/6902746
Netcdf dataset available: ['Rtraj', 'meta', 'prof', 'tech']
```

https://argopy.readthedocs.io/en/latest/advanced-tools/stores/argofloat.html

How to use ArgoFloat ?

Direct access to float datasets

whatever their location

```
from argopy import ArgoFloat

af = ArgoFloat(6902746) # Can point to local or remote data source using `host` argument

af = ArgoFloat(WMO, host='/home/ref-argo/gdac')  # Use your local GDAC copy
af = ArgoFloat(WMO, host='https')  # Shortcut for https://data-argo.ifremer.fr
af = ArgoFloat(WMO, host='ftp')    # shortcut for ftp://ftp.ifremer.fr/ifremer/argo
af = ArgoFloat(WMO, host='s3')     # Shortcut for s3://argo-gdac-sandbox/pub
```

List and open netcdf files for this float:

```
>>> af.ls_dataset()

{'Rtraj': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_Rtraj.nc',
 'Sprof': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_Sprof.nc',
 'meta': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_meta.nc',
 'prof': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_prof.nc',
 'tech': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_tech.nc'}
```

```
af.open_dataset('prof') # Return a Xarray dataset (argopy data model)
af.open_dataset('prof', netCDF4=True) # Return a legacy netCDF4 dataset
af.open_dataset('prof', lazy=True) # If supported by server
```

and more…

https://argopy.readthedocs.io/en/latest/advanced-tools/stores/argofloat.html

Plotters and ArgoColors

Visualise expert data

Use standard colormaps:

```
from argopy.plot import ArgoColors
ArgoColors('data_mode')
ArgoColors('qc_flag')
ArgoColors('deployment_status')
```

Months

Names: month, months, month, season, seasonal

1	Jan
2	Feb
3	Mar
4	Apr
5	May
6	Jun
7	Jul
8	Aug
9	Sep
10	Oct
11	Nov
12	Dec

Argo Data-Mode

Names: data_mode, datamode, dm

R	Real-time
A	Adjusted
D	Delayed

Deployment status

Names: deployment_status, deployment_code, deployment_id, ptfstatus.id, ptfstatus, status_code

0	PROBABLE
1	CONFIRMED
2	REGISTERED
6	OPERATIONAL
4	INACTIVE
5	CLOSED

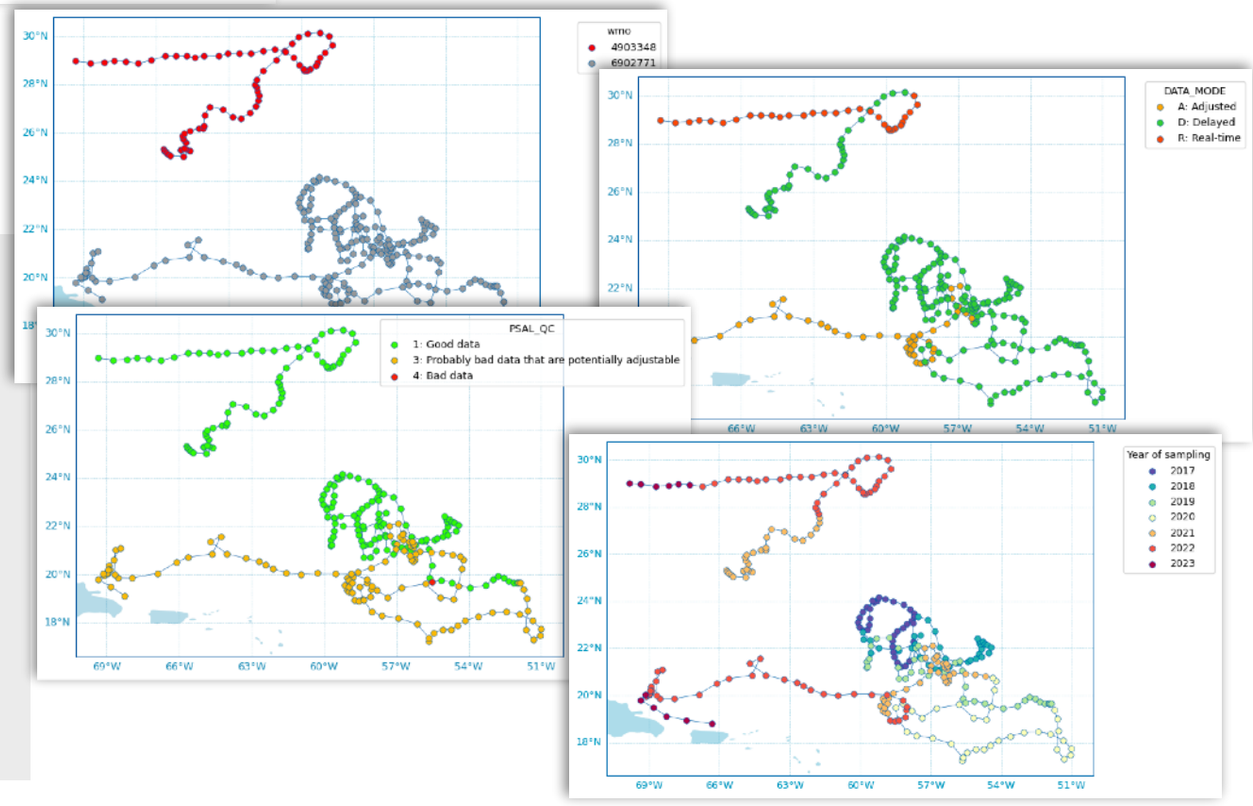
Quality control flag scale

Names: qc, qc_flag, quality_control, quality_control_flag, quality_control_flag_scale

0	No QC performed
1	Good data
2	Probably good data
3	Probably bad data that are potentially adjustable
4	Bad data
5	Value changed
6	Not used
7	Not used
8	Estimated value
9	Missing value

Plot your own scatter maps:

```
from argopy.plot import scatter_map

scatter_map(ds)
scatter_map(ds, hue='DATA_MODE')
scatter_map(ds.isel(N_LEVELS=0), hue='PSAL_QC')

ds['year'] = ds['TIME.year']  # Add a variable
scatter_map(ds.isel(N_LEVELS=0),
            hue='year',
            cmap='Spectral_r',
            legend_title='Year of sampling')
```



https://argopy.readthedocs.io/en/latest/user-guide/working-with-argo-data/visualisation.html

Argopy in a nutshell

Use the **`DataFetcher`** to load data

Select profiles with **`.region`**, **`.float`** and **`.profile`** methods
Choose dataset, data source and user mode with **`ds`**, **`src`** and **`mode`** options

Use **`Dataset.argo`** xarray accessor to manipulate data

Use **`ArgoFloat`** to work with one float data

Use **`ArgoIndex`** to work with index of files

Tutorials

https://github.com/euroargodev/argopy-training

Theme	Notebooks
📊 Argo data fetching	Select and fetch data
	Source and user mode
	BGC data specifics
	Direct access to one float dataset
	How to handle large data selection
🛠️ Argo data manipulation	Filtering (QC flags, data mode)
	Vertical interpolation & binning
	Compute (TEOS, Optic,Nutrients/Carbonates)
	Compute your own per-profile diagnostic
🗃️ Argo index and meta-data	Working with Argo index files
	Argo Reference tables lookup
🎯 Low-level tools	Generic GDAC file system
	web-API requests

Outline

The project, the team
Why argopy ?

Getting started
For those more familiar with Argo

For experts

For experts

Data filtering (QC flags, data mode): **ds.argo**

GDAC file store: **gdacfs**

Argo vocabulary: **ArgoNVSReferenceTables**

DOIs and GDAC snapshots: **ArgoDOI**

ADMT documentation: **ArgoDocs**

Deployment plan: **OceanOPSDeployments**

Coming up in next versions:

- **ArgoReferenceTable** & **ArgoReferenceValue** (full vocabulary support)
- **ArgoSensor** (meta-data, calibration parameters, manufacturer data, etc...)

Data filters and transformers

Filter points according to QC flags with **`argo.filter_qc`**:

```
ds.argo.filter_qc(QC_list=[1, 2], QC_fields='all', drop=True, mode='all')
ds.argo.filter_qc(QC_list=[1, 2], QC_fields=['PSAL_QC'], drop=True)
```

Filter points according to data mode with **`argo.datamode.filter`**:

```
ds.argo.datamode.filter(dm='D', params='all')
```

Merge PARAM and PARAM_ADJUSTED with **`argo.datamode.merge`**:

```
ds.argo.datamode.merge(params='all')
```

Merging is done as follows:

- For measurements with data mode R: keep <PARAM>
- For measurements with data mode D or A: keep <PARAM>_ADJUSTED

GDAC file store

Easy access to GDAC files with **gdacfs**

- **argopy** provides a convenient store for all GDAC files, a generic file system, for all possible GDAC hosts, which makes all paths relative to the GDAC root level
- the **gdacfs** class will help you separate the logic in your code between data loading and access with specific host protocol handling

```
In [1]: from argopy import gdacfs

In [2]: fs = gdacfs("https://data-argo.ifremer.fr")

# or:
# fs = gdacfs("https://usgodae.org/pub/outgoing/argo")
# fs = gdacfs("ftp://ftp.ifremer.fr/ifremer/argo")
# fs = gdacfs("s3://argo-gdac-sandbox/pub")
# fs = gdacfs("/home/ref-argo/gdac")
In [3]: fs
Out[3]: <argopy.stores.implementations.http.httpstore at 0x7f8d8d6f8820>
```

- You can also use shortcut for all remote GDACs:

Full host	Shortcut
`https://data-argo.ifremer.fr`	`http` or `https`
`https://usgodae.org/pub/outgoing/argo`	`us-http` or `us-https`
`ftp://ftp.ifremer.fr/ifremer/argo`	`ftp`
`s3://argo-gdac-sandbox/pub/idx`	`s3` or `aws`

https://argopy.readthedocs.io/en/latest/advanced-tools/stores/gdac_filesystem.html

GDAC file store

Easy access to GDAC files with `gdacfs`

- A **gdacfs** instance will provide most of the required methods to work with any file on a GDAC, **without the burden of handling access protocols and paths construction**
- paths are relative to the GDAC root folder (which is natively the case in Argo files index)

```
In [5]: fs.glob("dac/aoml/13857/*_meta.nc")
Out[5]: ['dac/aoml/13857/13857_meta.nc']

In [6]: fs.info("dac/aoml/13857/13857_meta.nc")
Out[6]:
{'name': 'dac/aoml/13857/13857_meta.nc',
 'size': 25352,
 'mimetype': 'application/x-netcdf',
 'partial': False,
 'url': 'https://data-argo.ifremer.fr/dac/aoml/13857/13857_meta.nc',
 'ETag': '"41c2167c-6308-577f9e9106041"',
 'type': 'file'}

In [7]: ds = fs.open_dataset("dac/coriolis/6903091/profiles/R6903091_001.nc")

In [8]: with fs.open("ar_index_this_week_meta.txt", "r") as f:
   ...:     data = f.readlines()
   ...:
```

https://argopy.readthedocs.io/en/latest/advanced-tools/stores/gdac_filesystem.html

Argo Reference Tables

Accessing the **NVS** - NERC Vocabulary Server - for Argo

```
from argopy import ArgoNVSReferenceTables

NVS = ArgoNVSReferenceTables()
```

If you don't know the ID of a reference table,
you can search in all tables name/definition:

```
NVS.search('quality')
```

```
[('R11',
  ('RTQC_TESTID',
   'List of real-time quality-control tests and corresponding binary identifiers, used as
reference to populate the Argo netCDF HISTORY_QCTEST variable.',
   'http://vocab.nerc.ac.uk/collection/R11/current/')),

 ('RD2',
  ('DM_QC_FLAG',
   "Quality flag scale for delayed-mode measurements. Argo netCDF variables
<PARAMETER>_ADJUSTED_QC in 'D' mode are populated by RD2 altLabel.",
   'http://vocab.nerc.ac.uk/collection/RD2/current/')),

 ('RP2',
  ('PROF_QC_FLAG',
   'Quality control flag scale for whole profiles. Argo netCDF variables PROFILE_<PARAMETER>_QC
are populated by RP2 altLabel.',
   'http://vocab.nerc.ac.uk/collection/RP2/current/')),

 ('RR2',
  ('RT_QC_FLAG',
   "Quality flag scale for real-time measurements. Argo netCDF variables <PARAMETER>_QC in 'R'
mode and <PARAMETER>_ADJUSTED_QC in 'A' mode are populated by RR2 altLabel.",
   'http://vocab.nerc.ac.uk/collection/RR2/current/'))]
```

Many more features coming up in version v1.4.0 !

Argo Reference Tables

Accessing the **NVS** - NERC Vocabulary Server - for Argo

Or/and directly load the reference table name or content:

```
NVS.tbl_name('R11')

('RTQC_TESTID',
 'List of real-time quality-control tests and corresponding binary identifiers, used as
reference to populate the Argo netCDF HISTORY_QCTEST variable.',
 'http://vocab.nerc.ac.uk/collection/R11/current/')
```

```
NVS.tbl('R11')  # Return a dataframe:
```

	altLabel	prefLabel	definition	deprecated	id
0	Test 13	Stuck Value test	Stuck Value test. Test binary ID = 8192	false	http://vocab.nerc.ac.uk/collection/R11/current...
1	Test 23	Interim rtqc flag scheme for data deeper than ...	Interim rtqc flag scheme for data deeper than ...	false	http://vocab.nerc.ac.uk/collection/R11/current...
2	Test 25	MEDD test	MEDian with a Distance (MEDD) test. Test binar...	false	http://vocab.nerc.ac.uk/collection/R11/current...
3	Test 9	Spike test	Spike test. Test binary ID = 512	false	http://vocab.nerc.ac.uk/collection/R11/current/9/
4	Test 11	Gradient test	Gradient test. Test binary ID = 2048	true	http://vocab.nerc.ac.uk/collection/R11/current...
5	Test 7	Regional Global Parameter test	Regional Global Parameter test. Test binary ID...	false	http://vocab.nerc.ac.uk/collection/R11/current/7/
6	Test 2	Impossible Date test	Impossible Date test. Test binary ID = 4	false	http://vocab.nerc.ac.uk/collection/R11/current/2/
7	Test 18	Frozen profile test	Frozen profile test. Test binary ID = 261144	false	http://vocab.nerc.ac.uk/collection/R11/current...
8	Test 16	Gross Salinity or Temperature Sensor Drift test	Gross Salinity or Temperature Sensor Drift tes...	false	http://vocab.nerc.ac.uk/collection/R11/current...
9	Test 17	Visual QC test	Visual QC test. Test binary ID = 131072	false	http://vocab.nerc.ac.uk/collection/R11/current...
10	Test 26	TEMP_CNDC test applied to RBRargo3 2K	TEMP_CNDC test applied to RBRargo3|2K, test ad...	false	http://vocab.nerc.ac.uk/collection/R11/current...
11	Test 3	Impossible Location test	Impossible Location test. Test binary ID = 8	false	http://vocab.nerc.ac.uk/collection/R11/current/3/
12	Test 14	Density Inversion test	Density Inversion test. Test binary ID = 16384	false	http://vocab.nerc.ac.uk/collection/R11/current

Argo DOIs

ID and reference the most appropriate dataset with **`ArgoDOI`**

Promote analysis reproducibility …

```
from argopy import ArgoDOI
ArgoDOI()
```

```
<argopy.DOIrecord>
DOI: 10.17882/42182
Title: Argo float data and metadata from Global Data Assembly Centre (Argo GDAC)
Date: 2023-10-09
Network: core+BGC+deep
File: 138 files in total
Files for core+BGC+deep:
     - #105302 Global GDAC Argo data files (2023-10-09 snapshot) https://www.seanoe.org/data/00311/42182/data/105302.tar.gz (56.6GiB, openAccess=True)
     - #104707 Global GDAC Argo data files (2023-09-09 snapshot) https://www.seanoe.org/data/00311/42182/data/104707.tar.gz (55.9GiB, openAccess=True)
     - #104145 Global GDAC Argo data files (2023-08-09 snapshot) https://www.seanoe.org/data/00311/42182/data/104145.tar.gz (54.8GiB, openAccess=True)
     - #103614 Global GDAC Argo data files (2023-07-09 snapshot) https://www.seanoe.org/data/00311/42182/data/103614.tar.gz (54.1GiB, openAccess=True)
     - #103075 Global GDAC Argo data files (2023-06-09 snapshot) https://www.seanoe.org/data/00311/42182/data/103075.tar.gz (53.8GiB, openAccess=True)
     - #102270 Global GDAC Argo data files (2023-05-09 snapshot) https://www.seanoe.org/data/00311/42182/data/102270.tar.gz (53.2GiB, openAccess=True)
     - #101760 Global GDAC Argo data files (2023-04-10 snapshot) https://www.seanoe.org/data/00311/42182/data/101760.tar.gz (52.7GiB, openAccess=True)
     - #100487 Global GDAC Argo data files (2023-03-10 snapshot) https://www.seanoe.org/data/00311/42182/data/100487.tar.gz (52.1GiB, openAccess=True)
     - #99784 Global GDAC Argo data files (2023-02-10 snapshot) https://www.seanoe.org/data/00311/42182/data/99784.tar.gz (51.5GiB, openAccess=True)
     - #98916 Global GDAC Argo data files (2023-01-10 snapshot) https://www.seanoe.org/data/00311/42182/data/98916.tar.gz (50.8GiB, openAccess=True)
Files for BGC only:
     - #105307 BGC Sprof data files (2023-09-09 snapshot) https://www.seanoe.org/data/00311/42182/data/105307.tar.gz (3.7GiB, openAccess=True)
     - #104705 BGC Sprof data files (2023-09-09 snapshot) https://www.seanoe.org/data/00311/42182/data/104705.tar.gz (3.6GiB, openAccess=True)
     - #104148 BGC Sprof data files (2023-08-09 snapshot) https://www.seanoe.org/data/00311/42182/data/104148.tar.gz (3.4GiB, openAccess=True)
     - #103643 BGC Sprof data files (2023-07-09 snapshot) https://www.seanoe.org/data/00311/42182/data/103643.tar.gz (844.2MiB, openAccess=True)
     - #103088 BGC Sprof data files (2023-06-09 snapshot) https://www.seanoe.org/data/00311/42182/data/103088.tar.gz (3.3GiB, openAccess=True)
     - #102271 BGC Sprof data files (2023-05-09 snapshot) https://www.seanoe.org/data/00311/42182/data/102271.tar.gz (3.3GiB, openAccess=True)
     - #101753 BGC Sprof data files (2023-04-08 snapshot) 101753.tar.gz (2.6GiB, openAccess=False)
     - #100490 BGC Sprof data files (2023-03-08 snapshot) 100490.tar.gz (3.0GiB, openAccess=False)
     - #99793 BGC Sprof data files (2023-02-08 snapshot) 99793.tar.gz (1.4GiB, openAccess=False)
     - #98921 BGC Sprof data files (2023-01-08 snapshot) 98921.tar.gz (2.6GiB, openAccess=False)
```

Argo DOIs

ID and reference the most appropriate dataset with **ArgoDOI**

Promote analysis reproducibility …

```
ArgoDOI().search('2022-10', network='BGC')  # Return doi closest to a given date for a specific network
```

```
<argopy.DOIrecord>
DOI: 10.17882/42182#96562
Title: Argo float data and metadata from Global Data Assembly Centre (Argo GDAC) - Snapshot of BGC Sprof data fil
Date: 2022-10-08
Network: BGC
File: https://www.seanoe.org/data/00311/42182/data/96562.tar.gz (3.0GiB, openAccess=True)
```

```
ArgoDOI(hashtag='96562')
```

```
<argopy.DOIrecord>
DOI: 10.17882/42182#96562
Title: Argo float data and metadata from Global Data Assembly Centre (Argo GDAC) - Snapshot of BGC Sprof data fil
Date: 2022-10-08
Network: BGC
File: https://www.seanoe.org/data/00311/42182/data/96562.tar.gz (3.0GiB, openAccess=True)
```

```
ArgoDOI(hashtag='96562').dx
```

```
'https://dx.doi.org/10.17882/42182#96562'
```

ADMT official documentation

Ever get lost with all Argo manuals ?

```
from argopy import ArgoDocs
ArgoDocs().list
```

	category	title	doi	id
0	Argo data formats	Argo user's manual	10.13155/29825	29825
1	Quality control	Argo Quality Control Manual for CTD and Trajec...	10.13155/33951	33951
2	Quality control	Argo quality control manual for dissolved oxyg...	10.13155/46542	46542
3	Quality control	Argo quality control manual for biogeochemical...	10.13155/40879	40879
4	Quality control	BGC-Argo quality control manual for the Chloro...	10.13155/35385	35385
5	Quality control	BGC-Argo quality control manual for nitrate co...	10.13155/84370	84370
6	Quality control	Quality control for BGC-Argo radiometry	10.13155/62466	62466
7	Cookbooks	Argo DAC profile cookbook	10.13155/41151	41151
8	Cookbooks	Argo DAC trajectory cookbook	10.13155/29824	29824
9	Cookbooks	DMQC Cookbook for Core Argo parameters	10.13155/78994	78994
10	Cookbooks	Processing Argo oxygen data at the DAC level	10.13155/39795	39795
11	Cookbooks	Processing Bio-Argo particle backscattering at...	10.13155/39459	39459
12	Cookbooks	Processing BGC-Argo chlorophyll-A concentratio...	10.13155/39468	39468
13	Cookbooks	Processing Argo measurement timing i		
14	Cookbooks	Processing BGC-Argo CDOM concentra		
15	Cookbooks	Processing Bio-Argo nitrate concen		
16	Cookbooks	Processing BGC-Argo Radiometric data		
17	Cookbooks	Processing BGC-Argo pH data at t		
18	Cookbooks	Description of the Argo GDAC File Ch		
19	Cookbooks	Description of the Argo GDAC File Me		
20	Cookbooks	BGC-Argo synthetic profile file proc		
21	Cookbooks	Argo GDA		
22	Cookbooks	Processing BGC-Argo pH data at t		
23	Cookbooks	Processing BGC-Argo nitrate concen		

List and search all ADMT documents with **`ArgoDocs`**

```
id_list = ArgoDocs().search('user')
for id in id_list:
    print("-", id, ArgoDocs(id))
```

```
- 29825 <argopy.ArgoDocs>
Title: Argo user's manual
DOI: 10.13155/29825
url: https://dx.doi.org/10.13155/29825
last pdf: https://archimer.ifremer.fr/doc/00187/29825/94819.pdf
Abstract: This document is the Argo data user's manual. It contains
the description of the formats and files produced by the Argo Data
Assembly Centres (DACs).
```

```
ArgoDocs(29825).open_pdf()
# ArgoDocs(29825).open_pdf(page=12)
```

Argo deployment plan

Connect to the OceanOPS database to get the global or regional deployment plan

```
from argopy import OceanOPSDeployments

deployment = OceanOPSDeployments()

<argo.deployment_plan>
API: https://www.ocean-ops.org/api/1/data/platform
Domain: [lon=-/-; lat=-/-; t=2025-06-06/-]
Deployed only: False
Nb of floats in the deployment plan: - [Data not retrieved yet]
```

```
deployment.to_dataframe()  # Trigger download of the full plan
```

	date	lat	lon	wmo	status_name	status_code	program	country	model
0	2025-06-10 00:00:00	-5.200	-81.650	7901039	CONFIRMED	1	Coriolis	FRANCE	ARVOR
1	2025-06-10 00:00:00	-6.500	-81.350	1902608	CONFIRMED	1	Coriolis	FRANCE	ARVOR
2	2025-06-10 00:00:00	-17.000	-74.000	5907068	CONFIRMED	1	Coriolis	FRANCE	ARVOR
3	2025-06-10 00:00:00	-18.000	-72.000	4903788	CONFIRMED	1	Coriolis	FRANCE	ARVOR
4	2025-06-10 00:00:00	-13.000	-77.500	2903900	CONFIRMED	1	Coriolis	FRANCE	ARVOR
...	...	...	...	...	...	...	...	...	...
526	2028-05-20 12:00:00	35.000	19.500	TMP-736322952	PROBABLE	0	Argo ITALY	ITALY	ARVOR
527	2028-06-14 08:56:58	36.710	17.402	TMP1190108211	PROBABLE	0	Argo ITALY	ITALY	ARVOR_D
528	2028-07-14 09:02:22	36.202	17.700	TMP2027352587	PROBABLE	0	Argo ITALY	ITALY	PROVOR_V - J
529	2028-10-14 08:58:10	39.690	11.917	TMP633847789	PROBABLE	0	Argo ITALY	ITALY	ARVOR_D
530	2028-10-14 09:04:07	42.830	8.180	TMP226293750	PROBABLE	0	Argo ITALY	ITALY	PROVOR_V - J

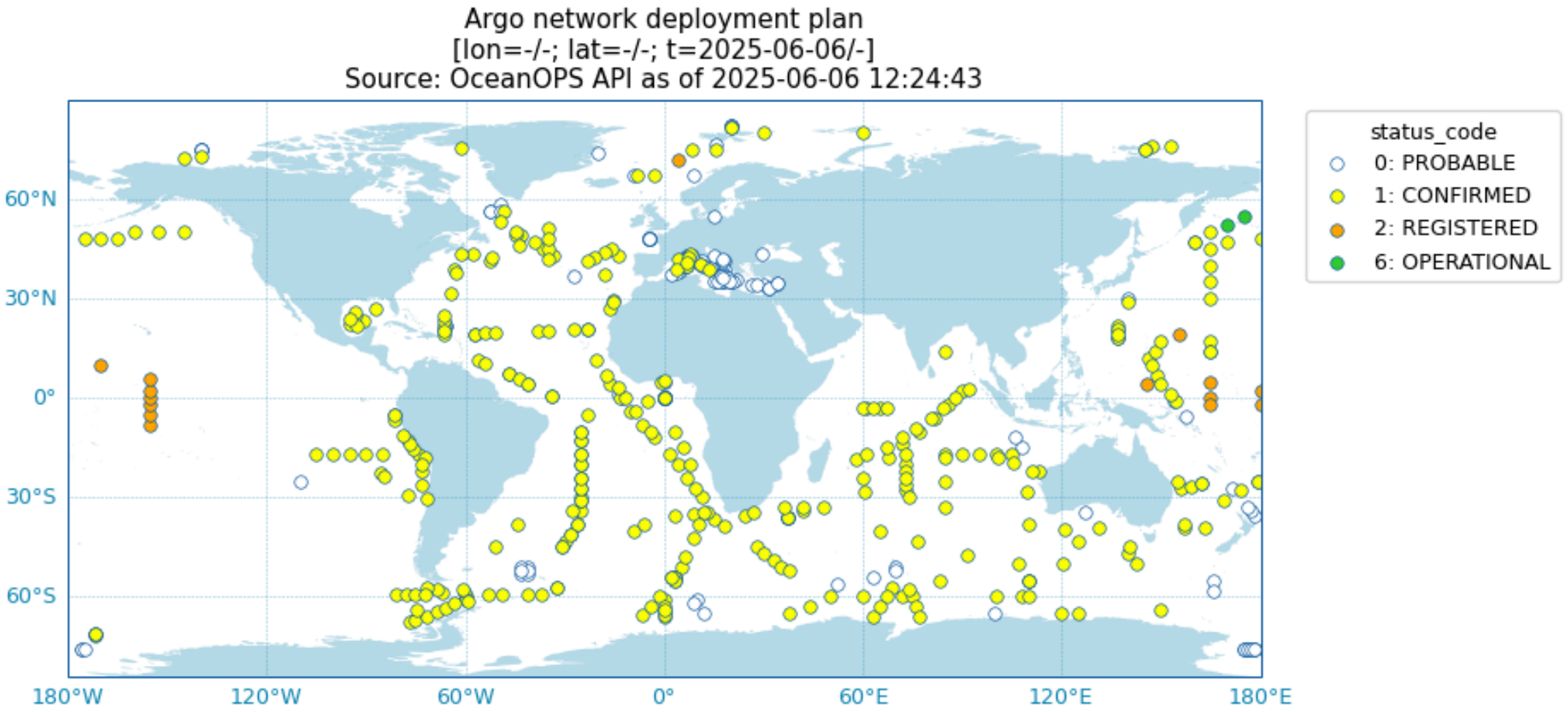
531 rows × 9 columns

```
deployment = OceanOPSDeployments([-60, 0, 0, 90])
deployment = OceanOPSDeployments([-20, 0, 42, 51, '2020-01', '2021-01'])
deployment = OceanOPSDeployments([-180, 180, -90, 90, '2020-01', None])
```

Argo deployment plan

Connect to the OceanOPS database to get the global or regional deployment plan

```
deployment.plot_status()
```



Advanced examples

How to use the DataFetcher ?

Use the **parallel** option to improve performances on large selection

```
from argopy import DataFetcher

box = [-60, -30, 40.0, 60.0, 0.0, 100.0, "2007-01-01", "2007-04-01"]

ds = DataFetcher(parallel='thread', progress=True).region(box).to_xarray()
```

3 methods are available to set-up your data fetching requests in parallel:

- **`thread`**: multi-threading with a **`concurrent.futures.ThreadPoolExecutor`**
- **`process`**: multi-processing with a **`concurrent.futures.ProcessPoolExecutor`**
- **`client`**: a Dask Cluster

You can further control the parallel requests with **`chunks`** or **`chunks_maxsize`**

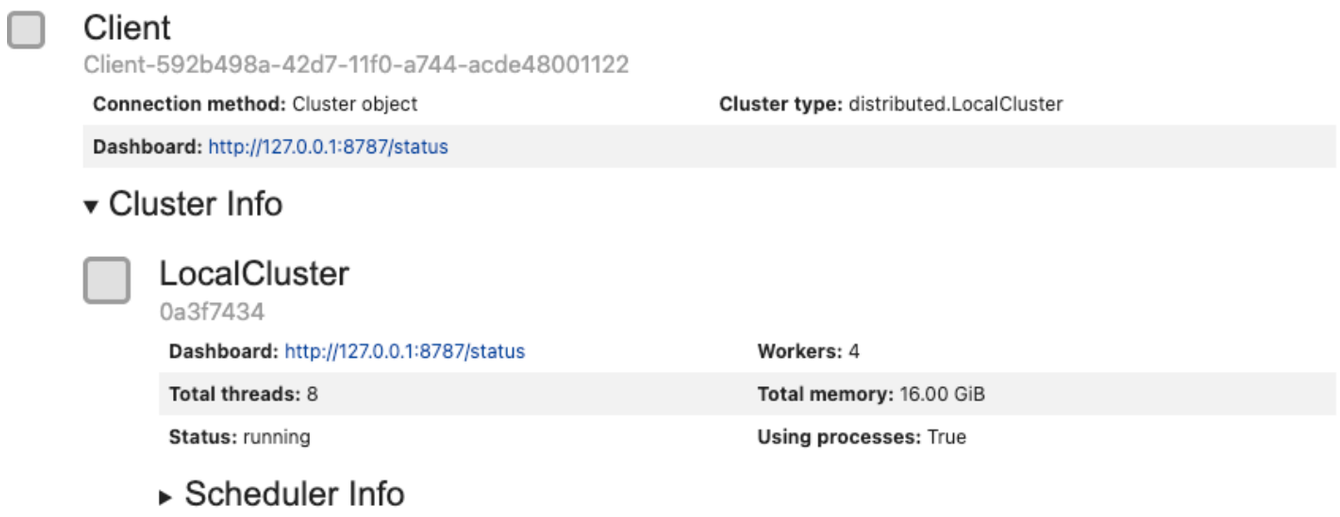
```
fetcher = DataFetcher(parallel=True,
                      chunks={'lon': 5, 'lat':1, 'dpt':1, 'time':1}).region(box)
```

Access point dimension	Maximum chunk size
🗺 region / **lon**	20 deg
🗺 region / **lat**	20 deg
🗺 region / **dpt**	500 m or db
🗺 region / **time**	90 days
🤖 float / **wmo**	5
⚓ profile / **wmo**	5

How to use the DataFetcher ?

or use a Dask client:

```
from dask.distributed import Client

client = Client(processes=True)
print(client)
```




```
from argopy import DataFetcher

box = [-60, -30, 40.0, 60.0, 0.0, 100.0, "2007-01-01", "2007-04-01"]

ds = DataFetcher(parallel=client).region(box).to_xarray()
```

Argopy data processing chain

argopy 1.0.0

Join the community at github.com/euroargodev/argopy

User formulates request

User receives analysis-ready data in memory

Argo data sources

argopy Facade

Options

Post-processing

User data models

xarray

pandas

argopy file systems *file,https, s3, ftp*

argopy Fetchers (data, meta, related)

List of resources to load and process (URIs)

Interface argopy / users :

- *Data transforms*
- *Data filters*
- *Data conversion*

Pre-processing

Interface data source / argopy:

- *Load and decode data*
- *Apply data & meta data conventions*

argopy internal data models

xarray

pandas

ARROW

Concat all chunks of data to create a single dataset in memory

Can be executed in parallel (multi-threading & processing + Dask)

Data type casting

argopy provides Argo dataset with variables appropriately casted !

```
from argopy import DataFetcher
fetcher = DataFetcher(src='gdac', gdac='http', mode='expert').float(6903091)
ds = fetcher.to_xarray()
```

```
from argopy import ArgoFloat
af = ArgoFloat(6903091)
ds = af.open_dataset('prof')
```

```
from argopy import gdacfs
fs = gdacfs('http')
ds = fs.open_dataset('dac/coriolis/6903091/6903091_prof.nc', xr_opts={'engine':'argo'})
```

You can also use the 'argo' xarray engine coming with argopy on any Argo netcdf file

```
import xarray as xr
ds = xr.open_dataset('6903091_prof.nc', engine='argo')
```

ArgoFloat support auxiliary data

```
from argopy import ArgoFloat
```

```
In [4]: af = ArgoFloat(WMO)

# or:
# af = ArgoFloat(WMO, host='/home/ref-argo/gdac')  # Use your local GDAC copy
# af = ArgoFloat(WMO, host='https')  # Shortcut for https://data-argo.ifremer.fr
# af = ArgoFloat(WMO, host='ftp')    # shortcut for ftp://ftp.ifremer.fr/ifremer/argo
# af = ArgoFloat(WMO, host='s3')     # Shortcut for s3://argo-gdac-sandbox/pub
```

Ifremer https GDAC is the default choice

```
In [5]: af = ArgoFloat(WMO, aux=True)

In [6]: af
Out[6]:
<argofloat.6903091.http.online>
GDAC host: https://data-argo.ifremer.fr
DAC name: coriolis
Network(s): ['BGC']
Deployment date: 2021-03-05 22:55 [1469 days ago]
Float type and manufacturer: PROVOR_III [NKE]
Number of cycles: 330
Dashboard: https://fleetmonitoring.euro-argo.eu/float/6903091
Netcdf dataset available: ['Rtraj', 'Sprof', 'meta', 'meta_aux', 'prof', 'tech', 'tech_aux
```

```
In [7]: af.ls_dataset()
Out[7]:
{'Rtraj': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_Rtraj.nc',
 'Sprof': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_Sprof.nc',
 'meta': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_meta.nc',
 'meta_aux': 'https://data-argo.ifremer.fr/aux/coriolis/6903091/6903091_meta_aux.nc',
 'prof': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_prof.nc',
 'tech': 'https://data-argo.ifremer.fr/dac/coriolis/6903091/6903091_tech.nc',
 'tech_aux': 'https://data-argo.ifremer.fr/aux/coriolis/6903091/6903091_tech_aux.nc'}
```

ArgoIndex and ArgoFloat

Iterate over **ArgoFloat** objects with an **ArgoIndex**

```
In [10]: from argopy import ArgoIndex

# Make a search on Argo index of profiles:
In [11]: idx = ArgoIndex().query.lon_lat([-70, -55, 20, 30], nrows=100)

# Then iterate over ArgoFloat matching the results:
In [12]: for a_float in idx.iterfloats():
   ....:     ds = a_float.open_dataset('meta')
   ....:     print(a_float.WMO, ds['LAUNCH_DATE'].data)
   ....:
1900022 2002-03-03T13:27:00.000000000
1900242 2003-06-03T17:10:00.000000000
1900639 2006-01-28T16:08:00.000000000
1900707 2006-06-02T22:19:00.000000000
```

Misc info

User mode for BGC

- 🏄 expert mode return all the Argo data, without any post-processing,
- 🏊 standard mode simplifies the dataset, remove most of its jargon and return a priori good data,
- 🚣 research mode simplifies the dataset to its heart, preserving only data of the highest quality for research studies, including studies sensitive to small pressure and salinity bias

🏊 Standard mode (default)

Table 2 Table of **argopy** data processing details in `standard` user mode 🏊

Parameters	Dataset	Level of assessment (data mode)	Level of quality (QC flags)	Pressure error	Return variables
Pressure, temperature, salinity	🟡+🔵 + 🟢	real time, adjusted and delayed mode data: [R,A,D] modes	good or probably good values (QC= [1,2])	*not used*	all without jargon [a]
Radiometry parameters [b] and BBP700 [c]	🟢	real time, adjusted and delayed mode data: [R,A,D] modes	good or probably good values, estimated or changed values (QC=[1,2,5,8])	*not used*	all without jargon [a]
CDOM [d]	🟢	None allowed	None allowed	*not used*	all without jargon [a]
All other BGC parameters [e]	🟢	real time data with adjusted values, delayed mode data: [A,D] modes	good or probably good data, estimated or changed values (QC=[1,2,5,8])	*not used*	all without jargon [a]

🚣 Research mode

Table 3 Table of **argopy** data processing details in `research` user mode 🚣

Parameters	Dataset	Level of assessment (data mode)	Level of quality (QC flags)	Pressure error	Return variables
Pressure, temperature, salinity	🟡+🔵 + 🟢	delayed mode data only: [D] mode	good values (QC= [1])	smaller than 20db	comprehensive minimum [a]
CDOM [d]	🟢	None allowed	None allowed	*not used*	comprehensive minimum [a]
All other BGC parameters [e]	🟢	delayed mode data only: [D] mode	good data, estimated or changed values (QC=[1,5,8])	*not used*	comprehensive minimum [a]

Argo index supported

Table 4 **argopy** GDAC index file support status

	Index file	Supported
Profile	ar_index_global_prof.txt	✅
Synthetic-Profile	argo_synthetic-profile_index.txt	✅
Bio-Profile	argo_bio-profile_index.txt	✅
Metadata	ar_index_global_meta.txt	✅
Auxiliary	etc/argo-index/argo_aux-profile_index.txt	✅
Trajectory	ar_index_global_traj.txt	❌
Bio-Trajectory	argo_bio-traj_index.txt	❌
Technical	ar_index_global_tech.txt	❌
Greylist	ar_greylist.txt	❌

shortcuts

Index file	Shortcut
`ar_index_global_prof.txt`	`core`
`argo_bio-profile_index.txt`	`bgc-b`
`argo_synthetic-profile_index.txt`	`bgc-s`
`ar_index_global_meta.txt`	`meta`
`etc/argo-index/argo_aux-profile_index.txt`	`aux`

Argo index

More **index** features for experts

- Support search for profiler type or label:

```
from argopy import ArgoIndex

idx = ArgoIndex(host='https', index_file='bgc-b', cache=1)

idx.search_profiler_type(834)  #  PROVOR V SBE

idx.search_profiler_type([890, 891])  #  PROVOR III (SBE and RBR)

idx.search_profiler_label('PROVOR V')
```

- Valid types are given by integers with values from the R8 Argo Reference table

```
from argopy import ArgoNVSReferenceTables

rt8 = argopy.ArgoNVSReferenceTables().tbl(8)
rt8.sample(5)
```

	altLabel	prefLabel	definition	deprecated
26	844	ARVOR float with SBE conductivity sensor	ARVOR profiling float with Sea-Bird Scientific...	false
50	882	XUANWU	XUANWU float (Code marked as 'Reserved' in WMO...	false
15	859	NEMO float with no conductivity	NEMO profiling float with no conductivity	false
2	841	PROVOR float with SBE conductivity sensor	PROVOR profiling float with Sea-Bird Scientifi...	false