Enhancing ARGO Floats Data Re-usability

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Context

Argo data (www.argo.ucsd.edu) record environmental parameters (e.g. Ph, salinity, pressure, chlorophyll) since Jan. 1999, through a large network of floats. Data are assembled by Global Data Assembly Centers. They are largely used in environmental monitoring systems.

Issues:

- Argo data are in **NetCDF-Point** and **CSV** formats; detailed metadata are described externally to the files;
- Parsing and usage is **hardware demanding** and **requires specific coding**;
- **Not directly usable** in common processing and visualization tools;
- Repositories **not always** easily **accessible**;
- **Poor compliance with Open Science** requirements of re-usability, repeatability, reproducibility.

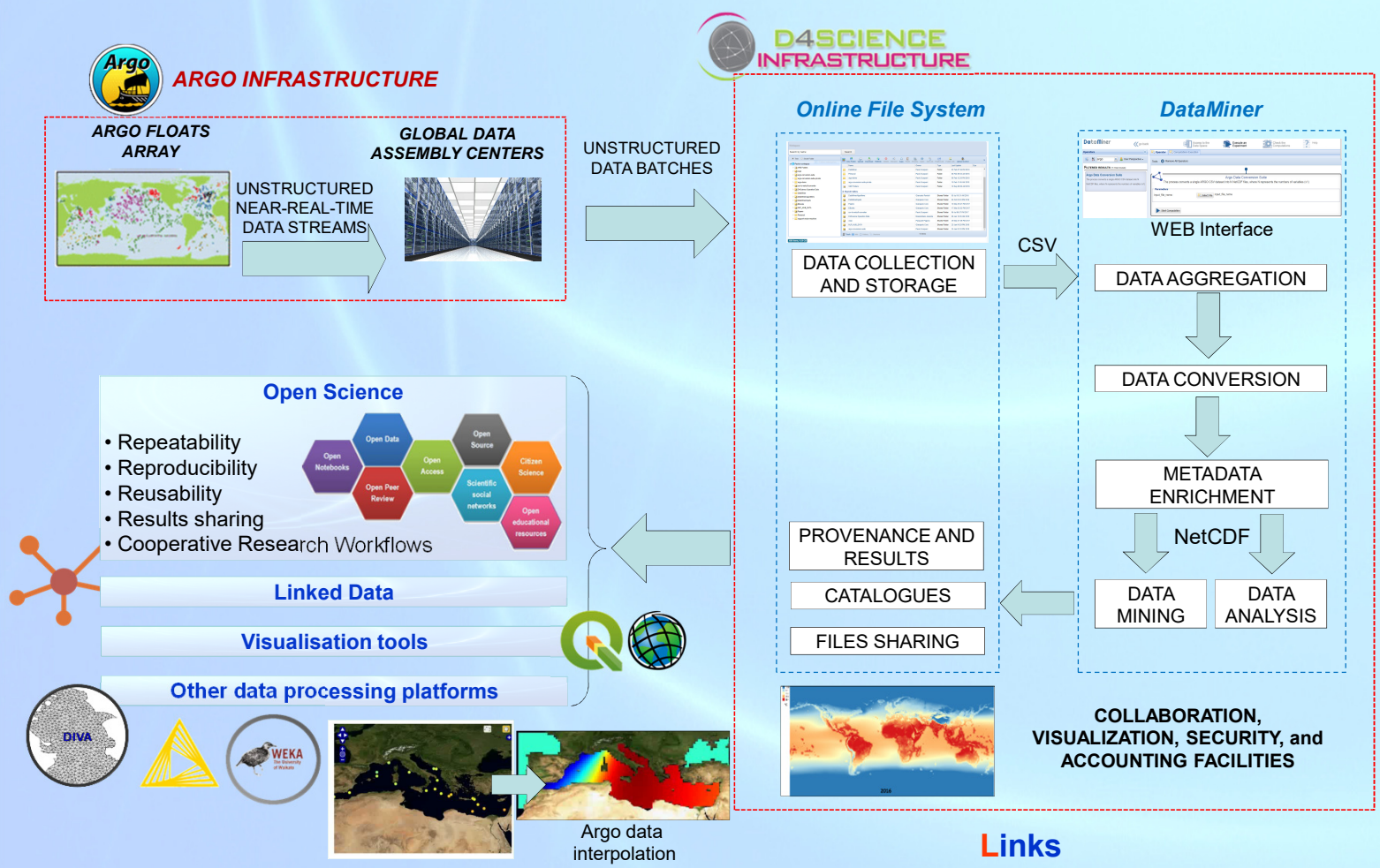
Solution

We implemented an **Open Science oriented workflow** to convert (**5584) Argo datasets** into standardized **NetCDF-CF Grid** files. We used the **DataMiner** cloud computing system of the **D4Science e-Infrastructure** (www.d4science.org):

Workflow:
1.Retrieve monthly-observation datasets from Argo;
2.Represent metadata (i.e. variable names and descriptions, units of measure, etc.), in compliance with the Climate and Forecast (CF) standard vocabulary;
3.Uniform Z dimension by porting all depths to meters;
4.Generate 3D grids with 10 logarithmic-divided depth intervals and 0.5° longitude-latitude resolution;
5.Clamp observation values to this 3D grid and associate average-aggregated values to each cell;
6.Create NetCDF-CF files for every monthly ARGO dataset and variable.

Advantages:

- Argo files are processed by **20 machines** in DataMiner (Ubuntu, 32GB RAM, 16 vCores);
- The transformation process is **reusable** – published under the OGC **Web Processing Service** standard;
- **Provenance** (link to the original input, processing metadata, etc.) is attached to each produced dataset;
- **NetCDF-CF Grid** files are directly **usable** by many modelling and visualization tools;
- Access via **OPeNDAP** protocol is enabled and metadata are described in **ISO-19139** format;
- Availability within a free-to-use **Virtual Research Environment** and via **high availability services** in D4Science.



Conclusions

- Our approach is **compliant with Open Science advices** and allows **adding specific terms** as variables and global attributes in order to **connect Argo data to domain-specific ontologies**.
- Metadata in ISO-19139 and NetCDF-CF Grid files allow for
  - **Easy retrieval** of ARGO data;
  - **Connecting** data **to other catalogues;**
  - **Using** data **in other processes**, e.g. the SeaDataNet DIVA service, ecological niche models, etc.;
  - **Visualising data** in common tools (e.g. ArcGIS and QGIS).
- Publication in a free-to-use Virtual Research Environment enables **security, access monitoring,** and **files/information sharing**.

Links

D4Science **BiodiversityLab Virtual Research Environment**:
https://services.d4science.org/group/biodiversitylab/

VRE Data Catalogue:
https://services.d4science.org/group/biodiversitylab/data-catalogue

VRE Integrated Visualization Tool:
https://services.d4science.org/group/biodiversitylab/geo-visualisation

Argo Data Conversion WPS Process:
https://services.d4science.org/group/scalabledatamining/data-miner?OperatorId=org.gcube.dataanalysis.wps.statisticalmanager.synchserver.mappedclasses.transducerers.ARGO_DATA_CONVERSION_SUITE