### NetCDF Zarr Viewer

### A Tool to Explore cloud data

Samuel Fooks - VLIZ
Making public NetCDF/Zarr Data Accessible to Everyone

#### **NCZarr Viewer**

- III Load and explore NetCDF and Zarr datasets
- Q Browse variables and dimensions through a simple interface
- **Y Subset data** by time, space, and other dimensions visually
- Visualize results with interactive plots
- Access cloud data directly from S3 buckets
- **Work with large datasets** efficiently
- **Example 2** Containerized for easy deployment and sharing

## **Architecture Overview**

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- Interactive UI \ Data Manager \ NetCDF/Zarr

# **\*\* Technology Stack**

- Frontend: Dash + Bootstrap Components
- **Data Processing**: Xarray + NumPy
- File Formats: NetCDF4, Zarr
- Visualization: Plotly, Matplotlib, Cartopy
- Cloud Access: S3FS, FSSpec (cloud storage access)
- Marine Data: Copernicus Marine Toolbox integration

# **Quick Start**

```
# Option 1: Use Docker
docker run -p 8050:8050 samfooks/nczarr-viewer:latest

# Option 2: Local development (if you have Python)
git clone [https://github.com/EDITO-Infra/nczarr-viewer)](https://github.com/EDITO-Infra/nczarr-viewer)
cd nczarr-viewer
pip install -r requirements.txt
python run.py
```

Access at: http://localhost:8050

**Tip**: Think of this as "R Shiny for NetCDF data" - but already built for you!

# **Supported Data Sources**

- ARCO data on EDITO: ARCO datasets from the EDITO STAC
- Personal Cloud Storage: Minio storage on EDITO
- Local Files: NetCDF, Zarr

## **Q** Core Features

### **Data Exploration**

- Variable Browser: See all variables, dimensions, and metadata
- **Dimension Handling**: Time, depth, latitude, longitude
- Data Subsetting: Interactive selection of regions and time periods

#### **Visualization**

- Interactive Maps: Cartopy-based geographic plots
- Time Series: Plotly charts for temporal data
- Statistical Analysis: Basic stats, and summaries

# **C** Marine Data Examples

### **EDITO Integration**

- **Biodiversity**: Species distribution data
- **Chemistry**: Water quality parameters
- **Geology**: Seafloor characteristics
- **STAC Access**: Browse collections and datasets

### **Copernicus Marine**

- **Direct Access**: CMEMS credentials integration (you will need an account)
- Multiple Formats: NetCDF, Zarr (and others in future)
- Real-time Data: Latest ocean observations

### **Performance Features**

- Chunked Processing: Handle datasets larger than memory
- Lazy Loading: Only load data when needed
- Cloud Optimization: Efficient S3 data access



## Configuration & Deployment

### Setup

To access CMEMS datasets you may need an account using Copernicus Marine Toolbox

```
# CMEMS credentials
CMEMS_USERNAME=your_username
CMEMS_PASSWORD=your_password
```

### **Docker Deployment**

```
docker build -t nczarr-viewer .
docker run -p 8050:8050 nczarr-viewer
```

# Subsetting ARCO Data: Core Concepts

#### **Multidimensional Data Structure**

```
Variables: temperature, salinity, oxygen, etc.

Dimensions: time, depth, latitude, longitude

Shape: (time: 365, depth: 50, lat: 1800, lon: 3600)
```

#### **Subsetting Operations**

- Variable: Pick specific parameters
- **Temporal**: Select specific dates
- **Spatial**: Choose latitude/longitude boundaries

# **©** Subsetting in Practice

### **Example: Extract Surface Temperature for North Sea**

```
import xarray as xr
# Load ARCO dataset
ds = xr.open_zarr("s3://arco-data/ocean-temp.zarr")
# Variable: surface temperature
temp_surface = ds['temperature'].sel(depth=0)
# Temporal: August 30
august30_data = temp_surface.sel(
    time='2025-08-30'
# Spatial bounds: North Sea region
north_sea = august30_data.sel(
    latitude=slice(51.0, 61.0), # 51°N to 61°N
    longitude=slice(-5.0, 15.0) # 5°W to 15°E
```

### **Visual Representation**

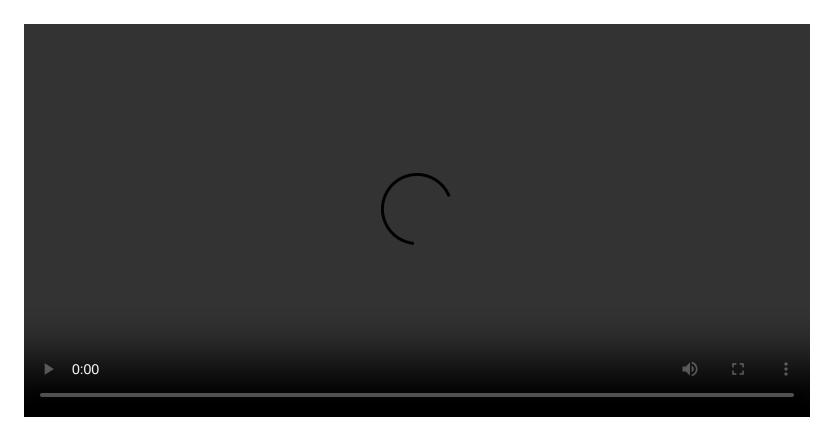
```
Original: 365×50×1800×3600

↓ Variable selection
Surface: 365×1×1800×3600

↓ Temporal subset
August 30, 2025: 1×1×1800×3600

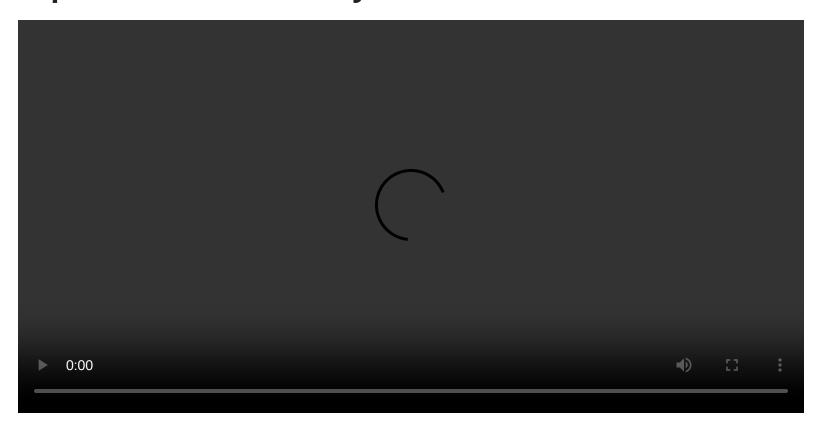
↓ Spatial subset
North Sea region: 1×1×100×200
```

# **C** Use the NCZarr Viewer locally or on EDITO



Click to play

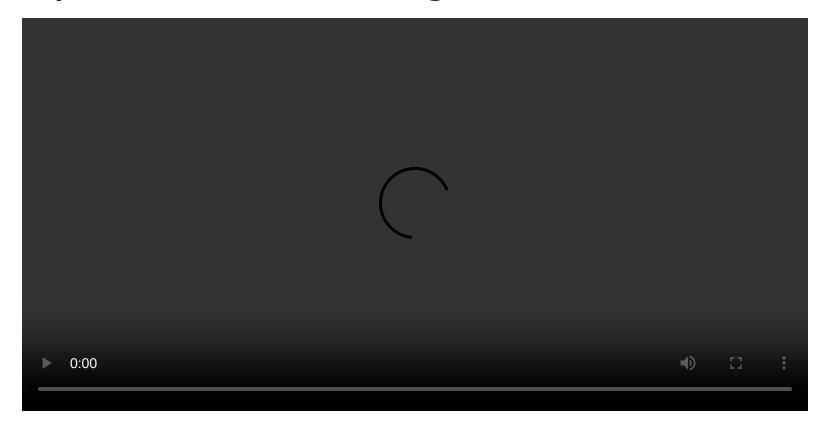
#### **Explore a NetCDF from your Minio bucket on EDITO**



Click to play

### **C** Live Demo Time!

**Explore CMEMs dataset using zarr link from EDITO STAC** 



Click to play



### Future Developments

- More Interactive Visualization: More interactive global maps and plots
- Advanced Analytics: Statistical modeling tools/plugins
- New ARCO Data types: Parquet, Geoparquet
- Collaboration: Multi-user editing and sharing

## **C** Thank You!

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**GitHub**: https://github.com/EDITO-Infra/nczarr-viewer

**Docker Hub**: samfooks/nczarr-viewer

**Questions?**