NetCDF Zarr Viewer

A Tool to Explore cloud data

Samuel Fooks - VLIZ

Making public NetCDF/Zarr Data Accessible to Everyone

NCZarr Viewer

- 📊 **Load and explore** NetCDF and Zarr datasets
- 🔍 **Browse variables** and dimensions through a simple interface
- ✂️ **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
- 🐋 **Containerized** for easy deployment and sharing

🏗️ Architecture Overview

👤 User Interface → 🚀 Dash App → 🗄️ Data Engine

↓ ↓ ↓

🖥️ Web Browser 🐍 Python Core 📊 Xarray

↓ ↓ ↓

🎨 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

🔍 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

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

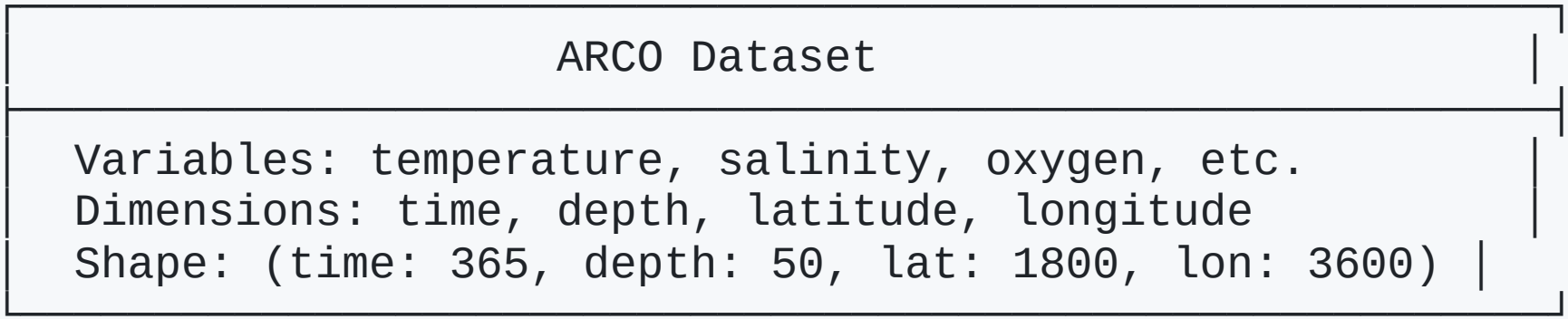
```
# CMEMS credentials
CMEMS_USERNAME=your_username
CMEMS_PASSWORD=your_password
```

Docker Deployment

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

🔍 Subsetting ARCO Data: Core Concepts

Multidimensional Data Structure



Subsetting Operations

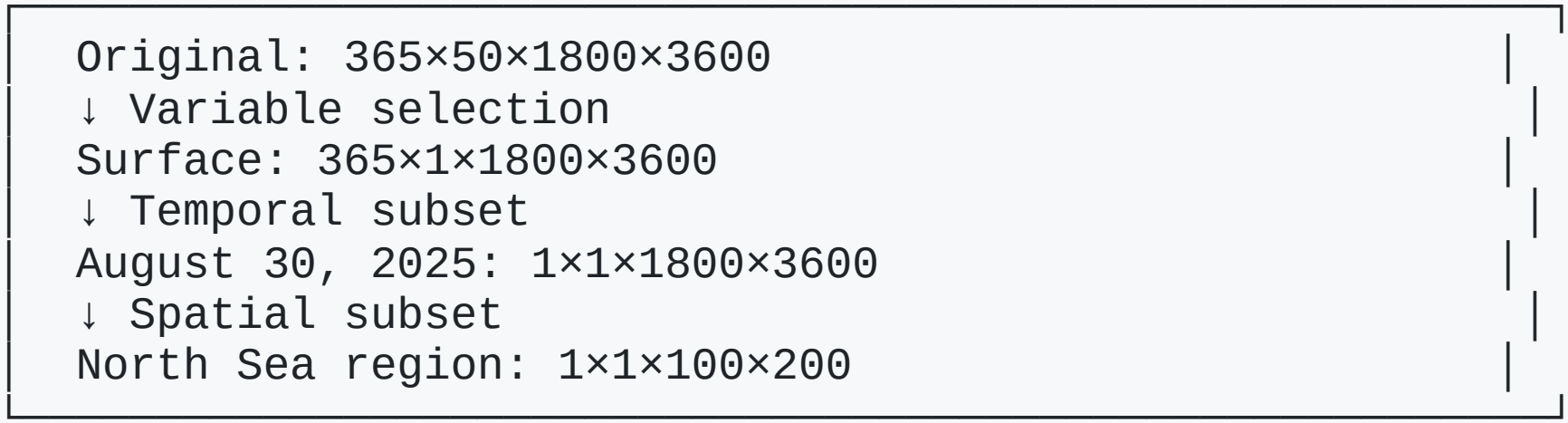
- **Variable**: Pick specific parameters
- **Temporal**: Select specific dates
- **Spatial**: Choose latitude/longitude boundaries

🎯 Subsetting in Practice

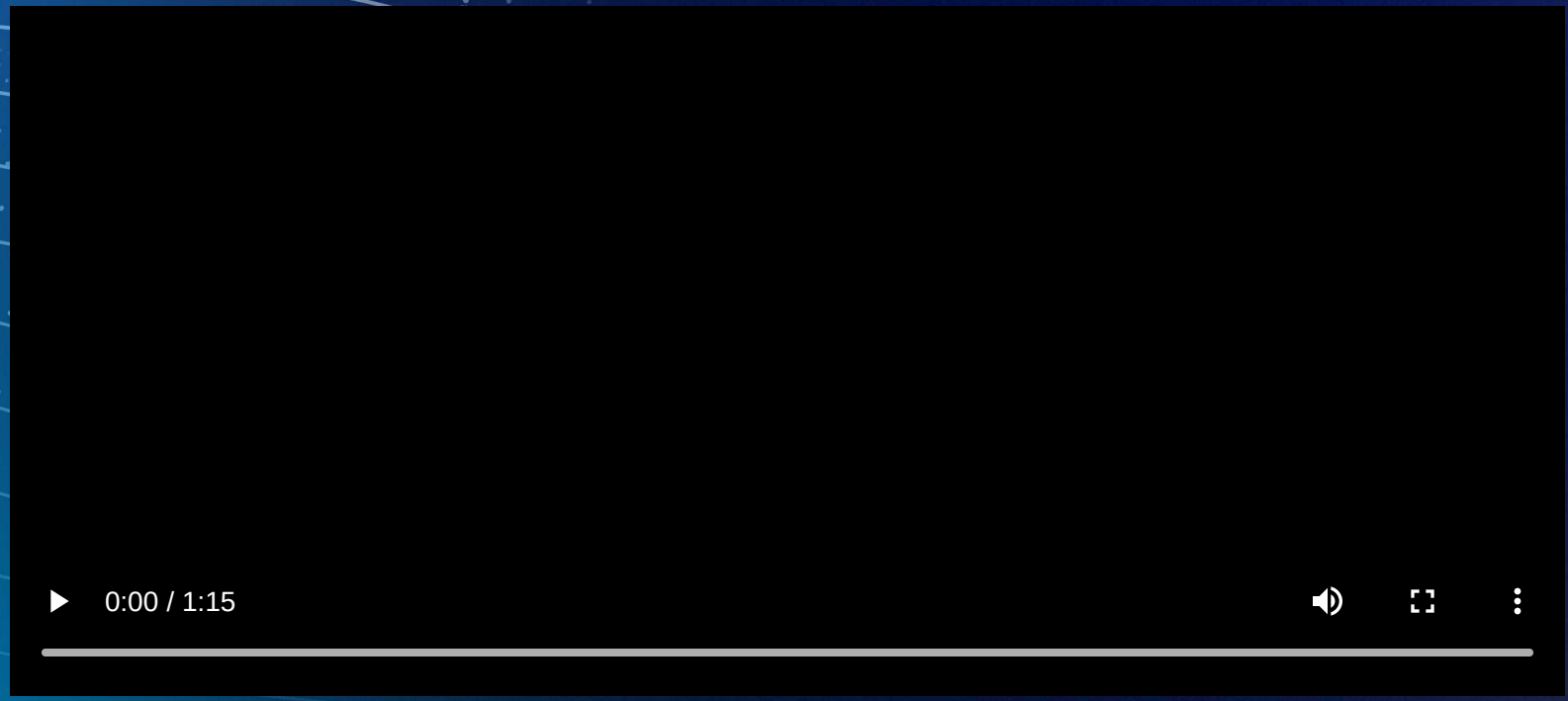
Example: Extract Surface Temperature for North Sea

```
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

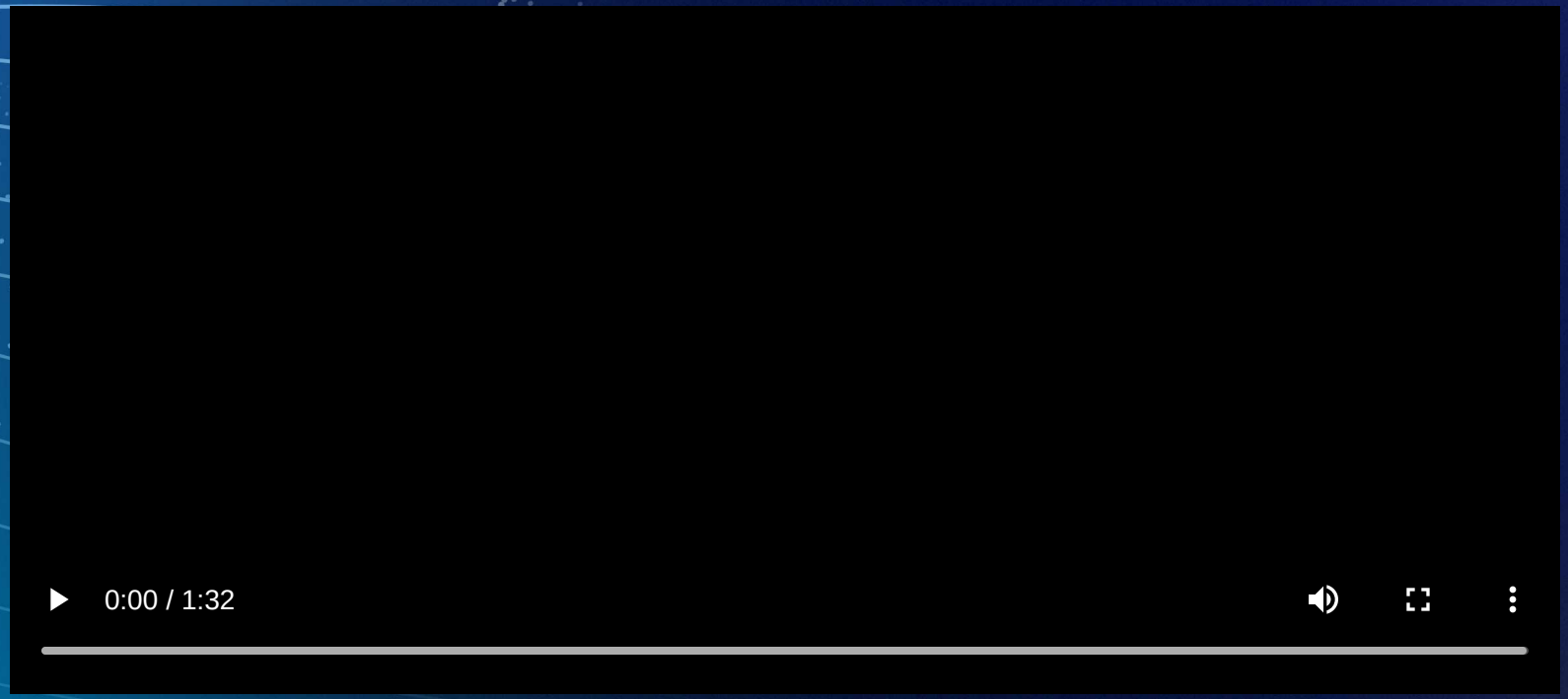


Use the NCZarr Viewer locally or on EDITO



Click to play

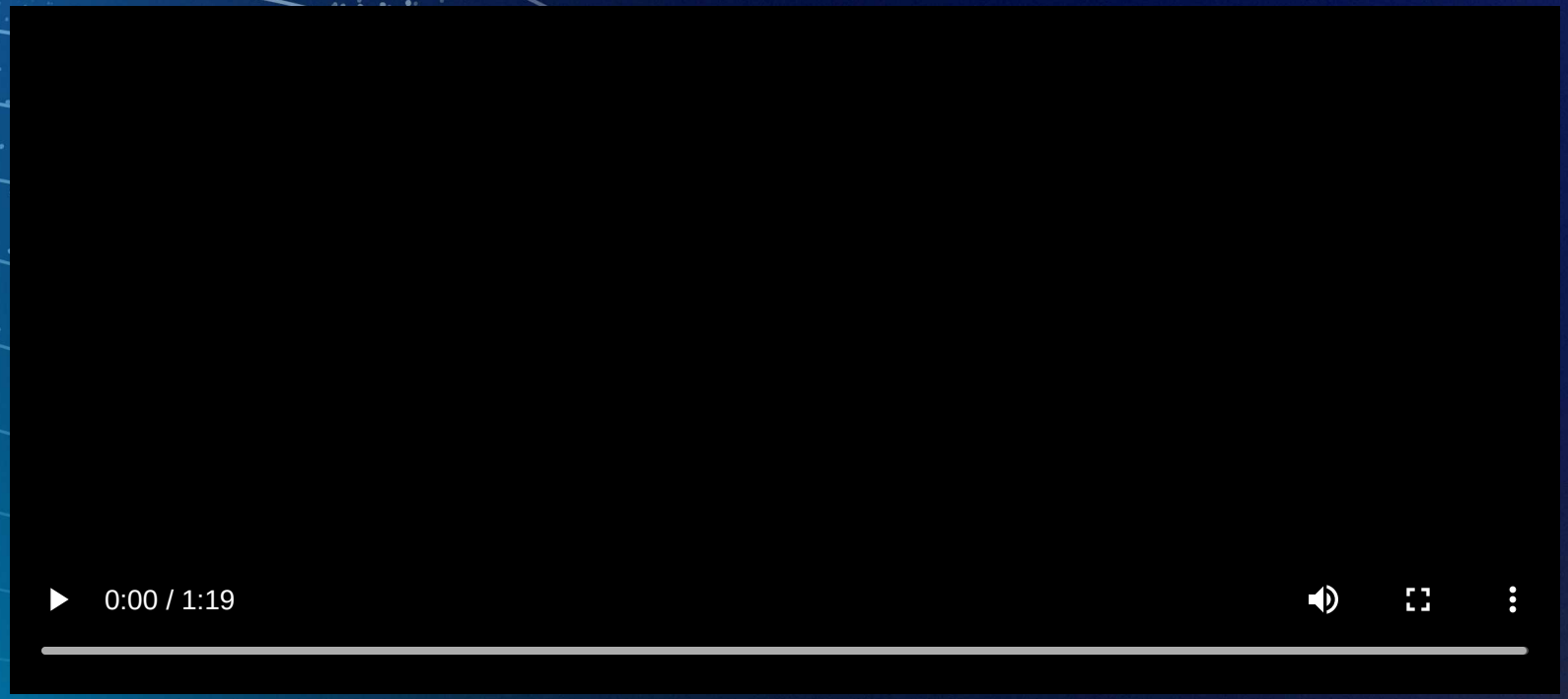
Explore a NetCDF from your Minio bucket on EDITO



Click to play

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

Thank You!

Samuel Fooks - samuel.fooks@vliz.be

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

Docker Hub: samfooks/nczarr-viewer

Questions?