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EBVCube: Enhancing Biodiversity Data Sharing with Interoperable Geospatial Standards

EBV Data Team



iDiv



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EBV Data Portal Workshop
Session 1 / 07.10.2024 / On-line

Workshop

EBVCube: Enhancing Biodiversity Data Sharing with Interoperable Geospatial Standards

Session 1:

Overview of the EBVCube Concept and EBV Data Portal

Date and time: 07-Oct. 2024 from 11:00 to 12:00 am

Session 2:

Hands-on training on the `ebvcube` R package

Date and time: 14-Oct. 2024 from 11:00 to 12:00 am

Agenda

1. Overview of the EBV Cube Concept and EBV Data Portal (20 min + 10 min questions) by Henrique.
2. Poll to investigate technical needs and skills for the second session (5 min).
3. Recap slide on 'EBV Cube Format' (5 min) by Lina.
4. Navigating the EBV Data Portal (data sets, DOIs) and metadata creation on the Portal (10 min) by Lina.
5. Data visualisation in Panoply (5 min) by Emmanuel.



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Team



Henrique



Néstor



Lina



Christian



Emmanuel



Luise



Miguel

Session 1: Overview of the EBV Cube Concept and EBV Data Portal

By

Henrique Pereira
Lina Estupinan-Suarez
Emmanuel Oceguera

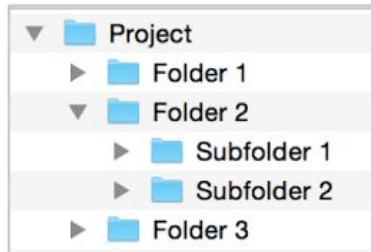
The problem

Many spatial biodiversity datasets from modelling analysis and other approaches (e.g. expert) maps exist only has inaccessible figures in papers and reports

When the datasets have been published, they are made available in a variety of formats, from ASCII to GeoTiff, often organized by ad-hoc organization in folders to convey the hierarchical nature of the data.

Existing repositories such as DRYAD and ZENODO do not enforce any standard data structure and act mostly as dumps for the data.

This contrasts with remote sensing, environmental and climate modelling community that have been sharing their datasets using NetCDF and Climate Forecast convention for many years.



DRYAD

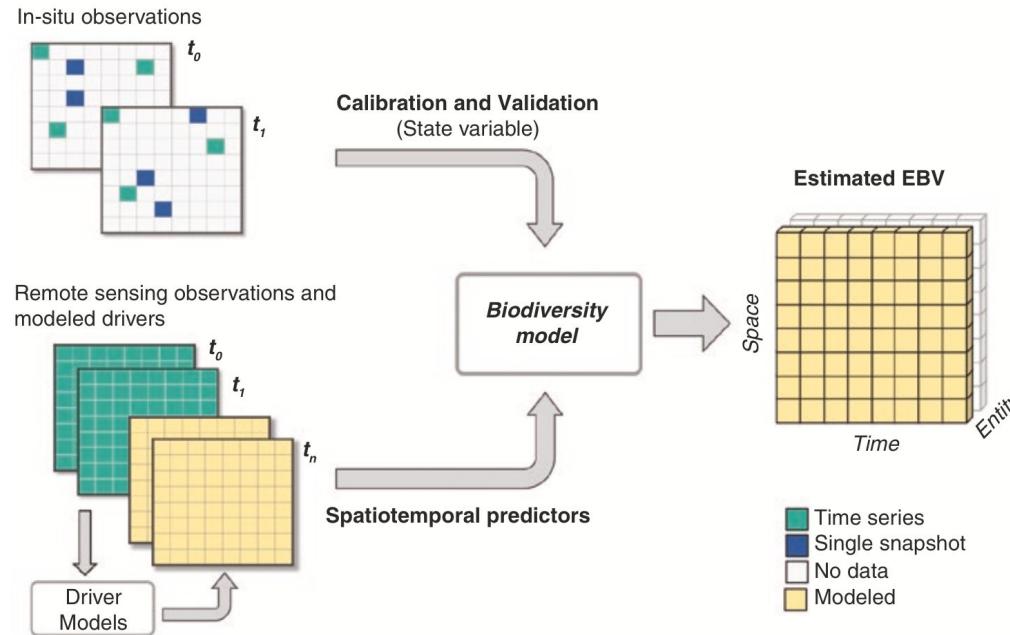


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Biodiversity Building Blocks for policy

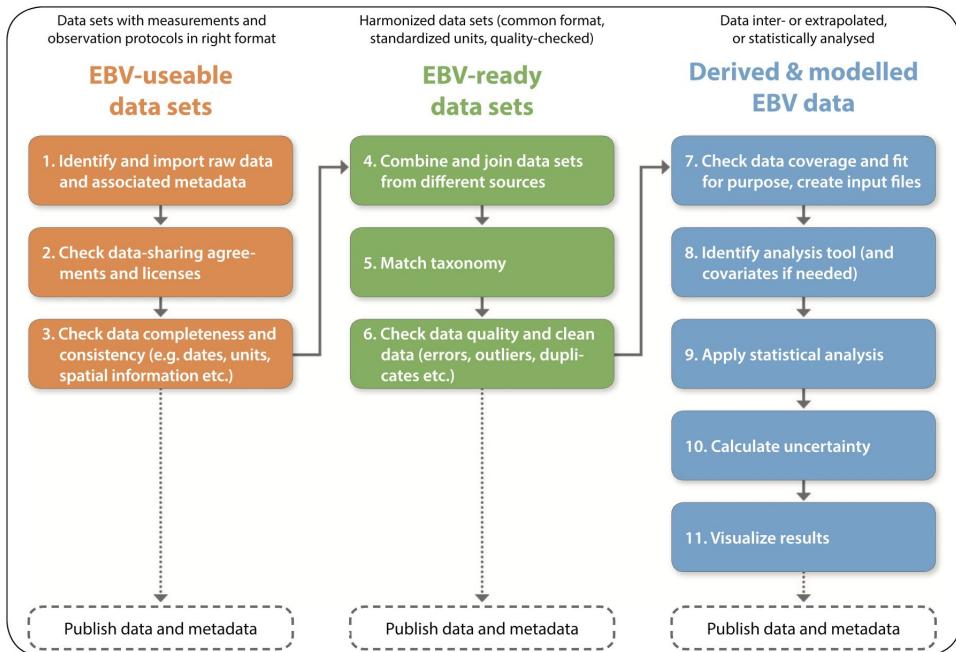
EBV workflows



EBV workflows

BIOLOGICAL REVIEWS
doi:10.1111/bev.12559

Cambridge Philosophical Society
600



Biodiversity Building Blocks for policy

Kissling et al. (2018a), Kissling et al. (2018b)

nature
ecology & evolution

PERSPECTIVE

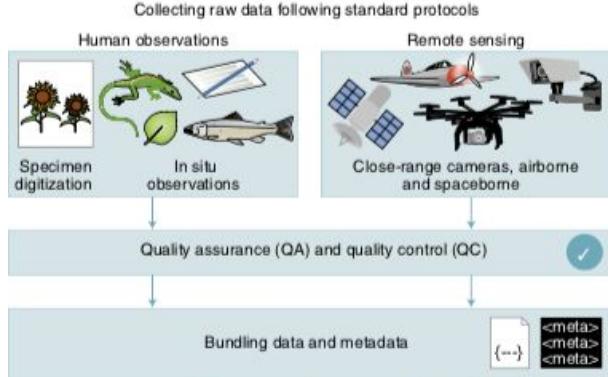
https://doi.org/10.1038/s41559-018-0667-3

OPEN

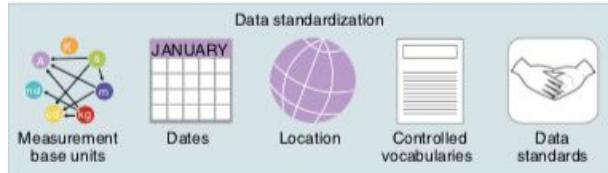
Towards global data products of Essential Biodiversity Variables on species traits

W. Daniel Kissling ^{1*}, Ramona Walls², Anne Bowser³, Matthew O. Jones⁴, Jens Kattge ^{5,6}, Donat Agosti⁷, Josep Amengual⁸, Alberto Bassetti⁹, Peter M. van Bodegom¹⁰, Johannes H. C. Cornelissen¹¹, Ellen G. Denny¹², Salud Deudero¹³, Willi Egloff¹⁴, Sarah C. Elmendorf^{14,15},

1. Collecting and provisioning species trait datasets

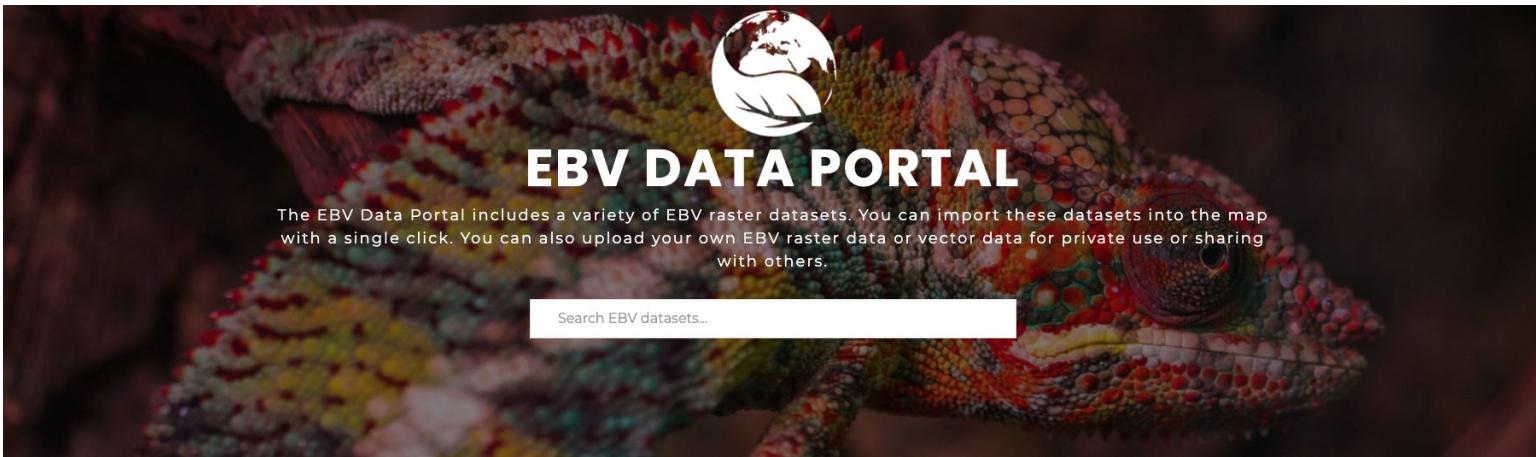


2. Standardizing and integrating trait data and metadata



ion

A platform for discovering Essential Biodiversity Variables



Datasets distributed using the new **EBV-cube** standards

- *Interoperable data across thematic, spatial and temporal dimensions*
- *Consistently documented in a way that maximizes usability*
- *Traceable (both resources and production pipelines)*



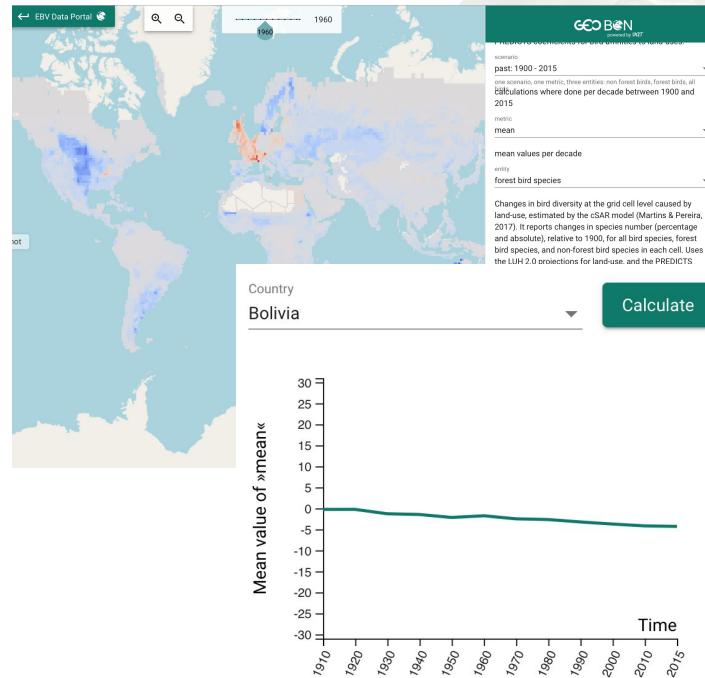
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EBV Portal

Catalog

The screenshot shows the GEO BON Beta EBV Data Portal Catalog. At the top, there are links for Home, Map, Datasets, Upload, and SIGN IN. Below this is a section titled "DATASETS" with a sub-section "Filter By Year". A slider allows filtering by publication year from 2010 to 2020. A search bar contains the placeholder "Filter EBV datasets..." and a dropdown menu for "Default sorting". To the right of the search bar is a circular icon with the number "4" and the text "EBV datasets filtered". Below the filter section are three preview images: "RELATIVE MAGNITUDE OF FRAGMENTATION (RMF)" showing a globe with green and blue patterns; "PREDICTED SUITABILITY FOR EUNIS HABITAT TYPES" showing a map of Europe with green and yellow areas; and "CHANGES IN LOCAL BIRD DIVERSITY (CSAR)" showing a map of the world with green and orange areas.

Web GIS with Indicator tool



<https://portal.geobon.org>



Biodiversity Building Blocks for policy

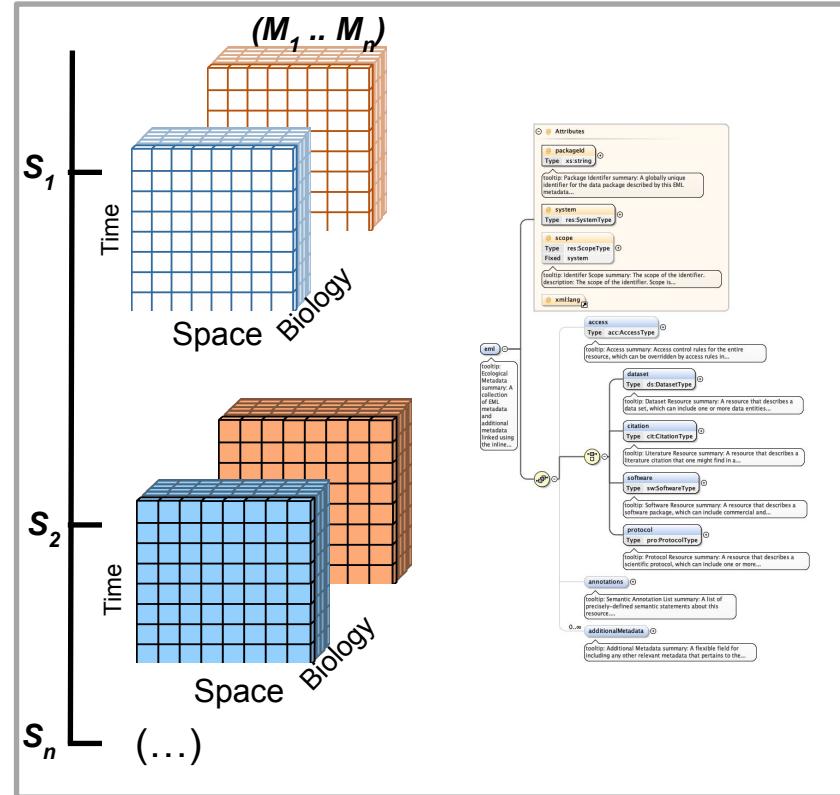
e
e-shape

GEO BON
Group on Earth Observations
Biodiversity Observation Network

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Open EBV Datasets with the EBV Cube Standard

- NetCDF specification with a **unified hierarchical structure** for organizing EBV data
- A **minimum information** specification using **ACDD** terms (with translation into **EML**)
 - *Self-described*
 - *Compliant with FAIR and GEOSS-DMP*



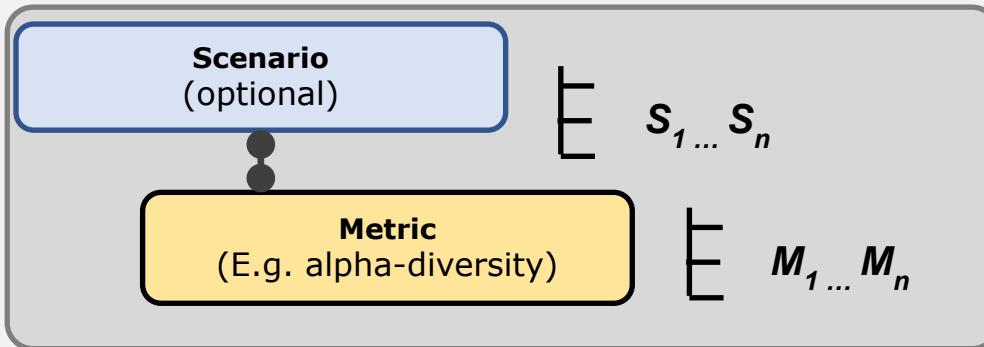
© Henrique M. Pereira, Néstor Fernández



EBV Cube: a standard for spatiotemporal biodiversity data

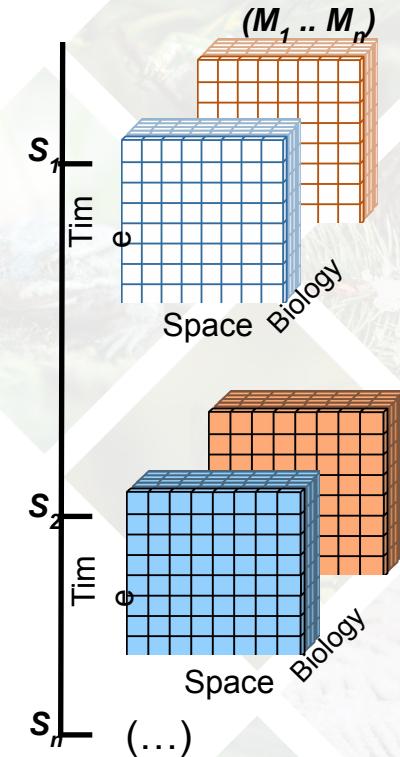
NetCDF file structure

Groups



Dimensions

Entity x Space x Time



© Henrique M. Pereira, Néstor Fernández



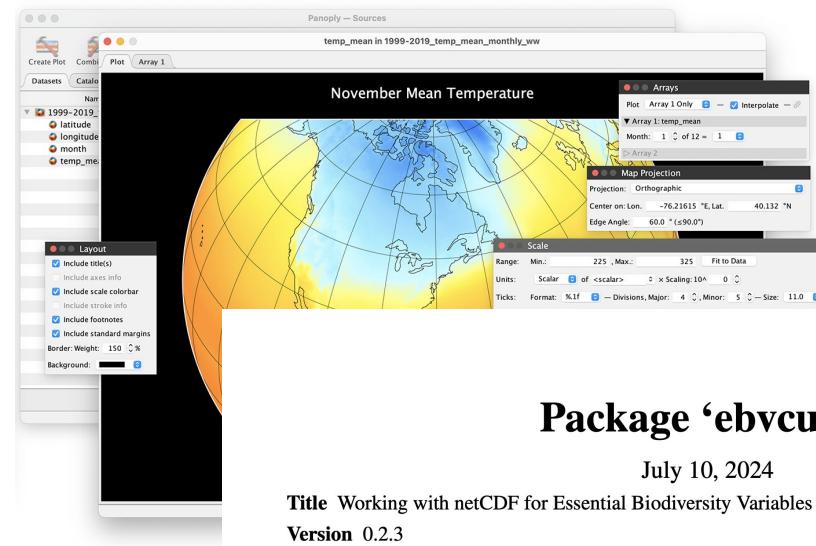
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The EBVCube ecosystem

- EBVcube R package
- Panoply
- GIS EBVcube Plug-in
- Jupiter notebook
- In general, anything compatible with CF netcdf



Package ‘ebvcube’

July 10, 2024

Title Working with netCDF for Essential Biodiversity Variables

Version 0.2.3

Date 2024-07-10

Author Luise Quoss [aut, cre] (<<https://orcid.org/0000-0002-9910-1252>>),
Nestor Fernandez [aut] (<<https://orcid.org/0000-0002-9645-8571>>),
Christian Langer [aut] (<<https://orcid.org/0000-0003-1446-3527>>),
Jose Valdez [aut] (<<https://orcid.org/0000-0003-2690-9952>>),
Henrique Miguel Pereira [aut] (<<https://orcid.org/0000-0003-1043-1675>>)



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Biodiversity Building Blocks for policy

EBV Portal: Take home messages

- An open platform
- A platform for all: different scales, different approaches, different systems
- Seamless exploration of many types of biodiversity spatial data
 - The power of the EBV metadata and datacube structure



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Training Needs Assessment

- Which operating system are you using on your computer?
- Do you have administrative rights to install new software?
- Do you have R and RStudio installed on your computer?
- What is your proficiency level in R?
- Have you worked with netCDF before?
- Are you familiar with the concept of Essential Biodiversity Variables (EBV)?
- What is your experience with data cubes?
- What is your level of experience with spatial data analysis?

EBV Cube Format

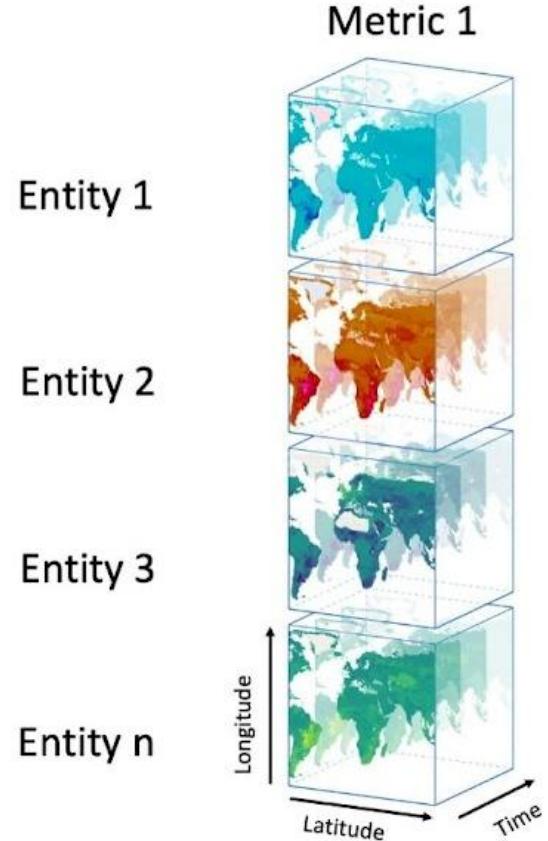
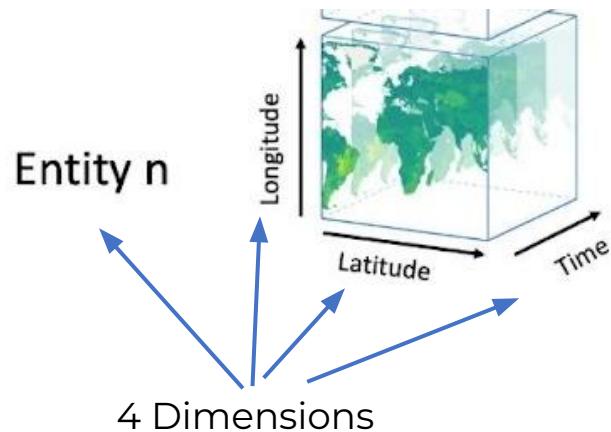
A data format for multidimensional geospatial data of biodiversity

Recap slides

Hierarchical structure of the EBV Cube Format

A data format for multidimensional
geospatial data of biodiversity

4D Data cube



How to: https://portal.geobon.org/downloads/pdf/how_to_ebv-portal.pdf

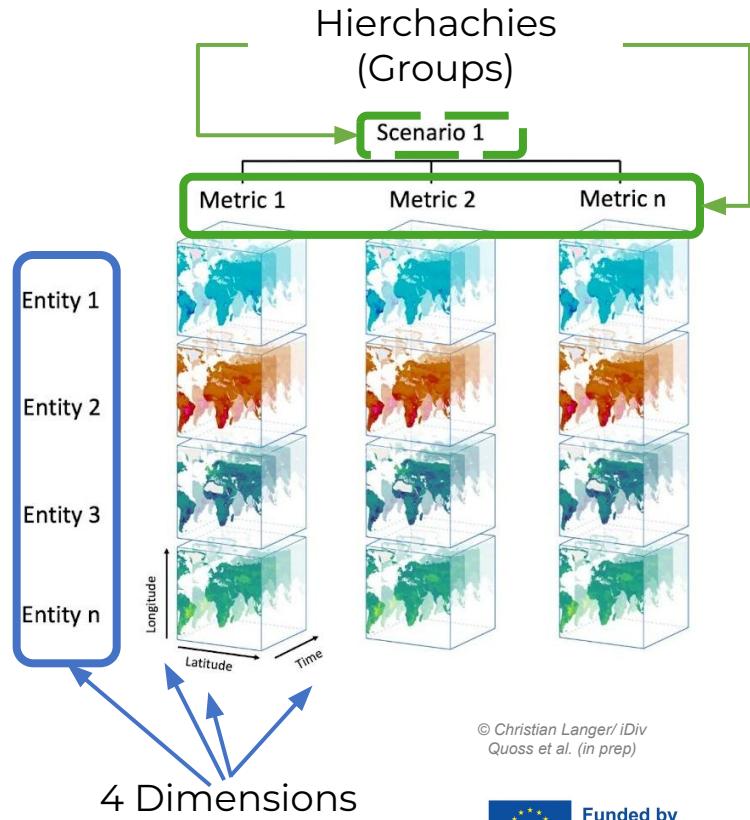


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Hierarchical structure of the EBV Cube Format

A data format for multidimensional geospatial data of biodiversity

NetCDF specification with a **unified hierarchical structure** for organizing geospatial data for EBV



How to: https://portal.geobon.org/downloads/pdf/how_to_ebv-portal.pdf

Metadata

Are Metadata incantations written in some strange, secret language only understood by a small band of metadata geeks?



lovetoknowpets (2024)

Cans of mystery



canit (2024)



Biodiversity Building Blocks for policy

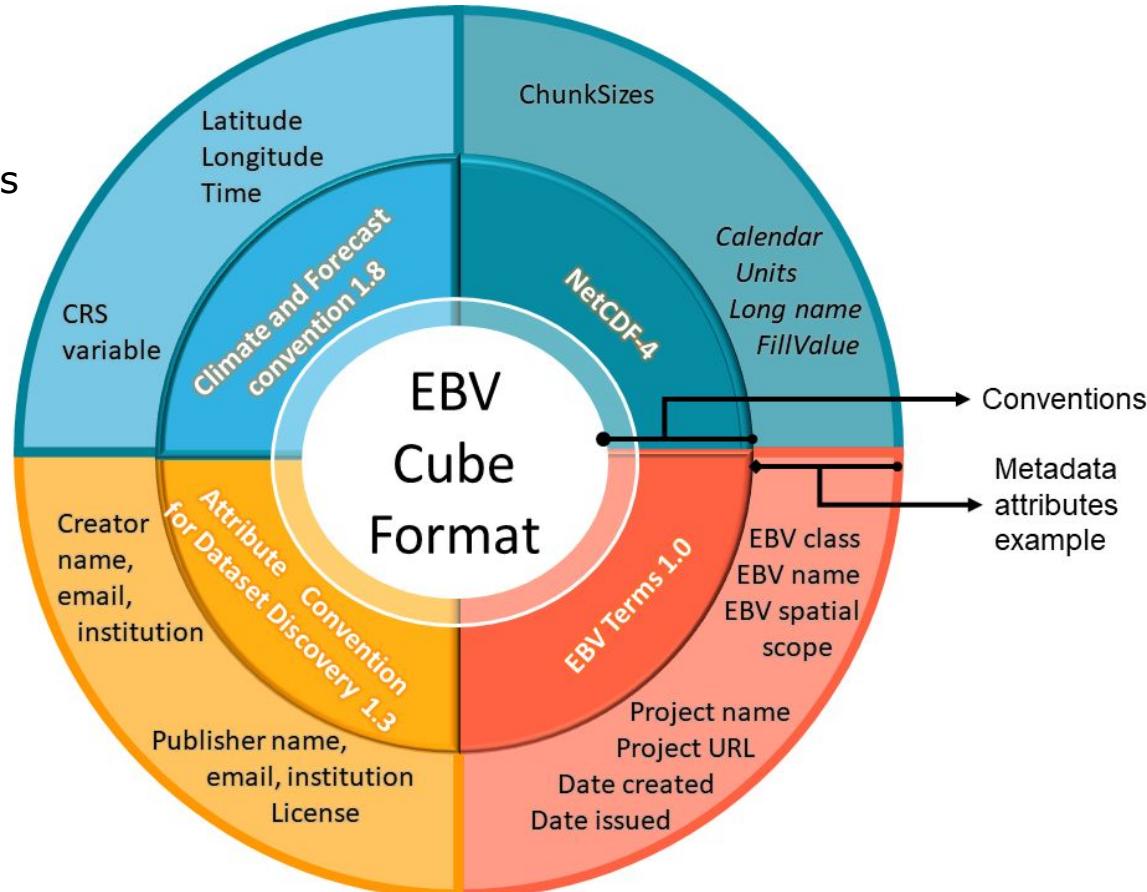


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Metadata conventions implemented in the EBV Cube Format

A **minimum information** specification using **ACDD[1]** terms (with translation into **EML[2]**)

- *Self-described*
- *Compliant with FAIR and GEOSS-DMP [3]*



[1] ACDD: The Attribute Convention for Dataset Discovery

[2] EML: Ecological Metadata Language

[3] GEOSS - DMP: The Global Earth Observation System of Systems Data Management Principles

Metadata conventions implemented in the EBV Cube Format

A **minimum information** specification using **ACDD[1]** terms (with translation into **EML[2]**)

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[1] ACDD: The Attribute Convention for Dataset Discovery

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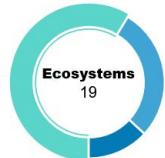
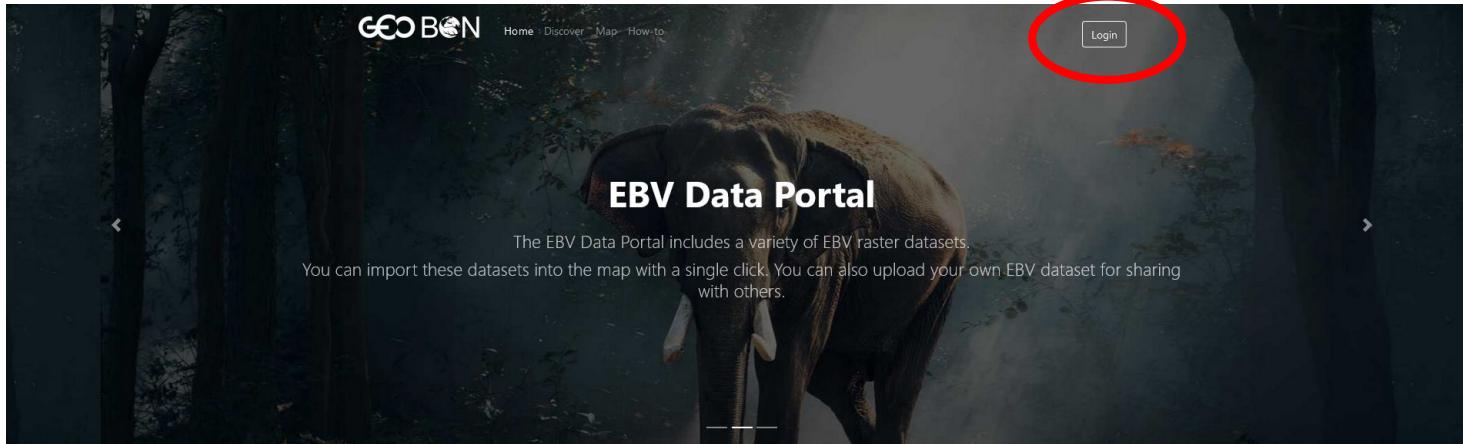
Attributes	NetCDF component	Convention /Source
	Root level Group 4D Cubes	ACDD 1.3 CF 1.8 EBV Terms 1.0 netCDF-4
long_name	x x	
standard_name	x x	
units	x x	
name	x	
email	x	
institution of the creator	x	
co-creator(s)	x	
publisher	x	
geospatial_bounds	x	
time coverage resolution	x	
title	x	
summary	x	
source	x	
references	x	
id	x	
naming_authority	x	
Conventions	x	
ebv_class	x	
ebv_name	x	
ebv_entity_type		x

How to: https://portal.geobon.org/downloads/pdf/how_to_ebv-portal.pdf



EBV Data Portal

<https://portal.geobon.org/>



Portal statistics

Spatial Domain



Environmental Domain

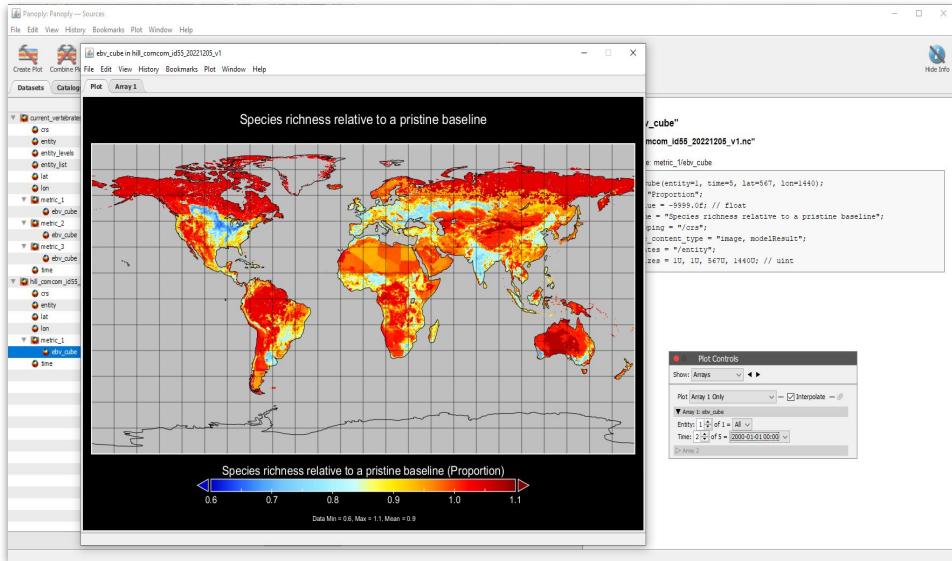


The EBV Cube in Panoply

Visualisation of EBV Cubes

An Overview of Panoply for Exploring EBVs

- A **cross-platform tool** for visualizing geo-gridded data in **netCDF**, HDF and GRIB formats
- It provides a **graphical interface** for **inspecting** and **visualizing** netCDF data.
- Ideal for **visualizing EBVs** across **spatial**, **temporal** and **biodiversity** (e.g. taxonomy) **dimensions**.
- Panoply shows the **full structure** including **technical components** (e.g. coordinate variables)



Download link: <https://www.giss.nasa.gov/tools/panoply/>
Panoply developed by NASA (Dr. Robert Schmunk).



Recap of Panoply Demonstration

- ❖ **Exploring Data with Panoply**
 - Opened and loaded EBV in netCDF format
 - Navigate spatial, temporal, biodiversity components
 - Visualized data using various plot types
- ❖ **Technical set up**
 - Java Runtime Environment(JRE)
 - Memory consideration
- ❖ **Key Features Highlighted**
 - Visualization primarily
 - User-friendly interface
- ❖ **Alternatives for Analysis**
 - R, Python and QGIS

Thank you!



Home Discover Map How-to

Login

EBV Data Portal

The EBV Data Portal includes a variety of EBV raster datasets.

You can import these datasets into the map with a single click. You can also upload your own EBV dataset for sharing with others.



@BCubedProject



B-Cubed Project

This project receives funding from the European Union's Horizon Europe Research and Innovation Programme (ID No 101059592). Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the EU nor the EC can be held responsible for them.

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<https://commons.wikimedia.org/w/index.php?curid=4956453>

Image Sources

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- Kissling, W.D., Ahumada, J.A., Bowser, A., Fernandez, M., Fernández, N., García, E.A., Guralnick, R.P., Isaac, N.J.B., Kelling, S., Los, W., McRae, L., Mihoub, J.-B., Obst, M., Santamaría, M., Skidmore, A.K., Williams, K.J., Agosti, D., Amariles, D., Arvanitidis, C., Bastin, L., De Leo, F., Egloff, W., Elith, J., Hobern, D., Martin, D., Pereira, H.M., Pesole, G., Peterseil, J., Saarenmaa, H., Schigel, D., Schmeller, D.S., Segata, N., Turak, E., Uhlir, P.F., Wee, B. and Hardisty, A.R. (2018), Building essential biodiversity variables (EBVs) of species distribution and abundance at a global scale. *Biol Rev*, 93: 600-625.
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