STAC as FDO: From Standard to Future Data Infrastructure

Ivonne Anders, Beate Krüss, Marco Kulüke, ***Karsten Peters-von Gehlen****, Hannes Thiemann, and Heinrich Widmann*

DKRZ, Data Management, Hamburg, Germany (anders@dkrz.de)

Context & Challenge

Discoverable but fragmented



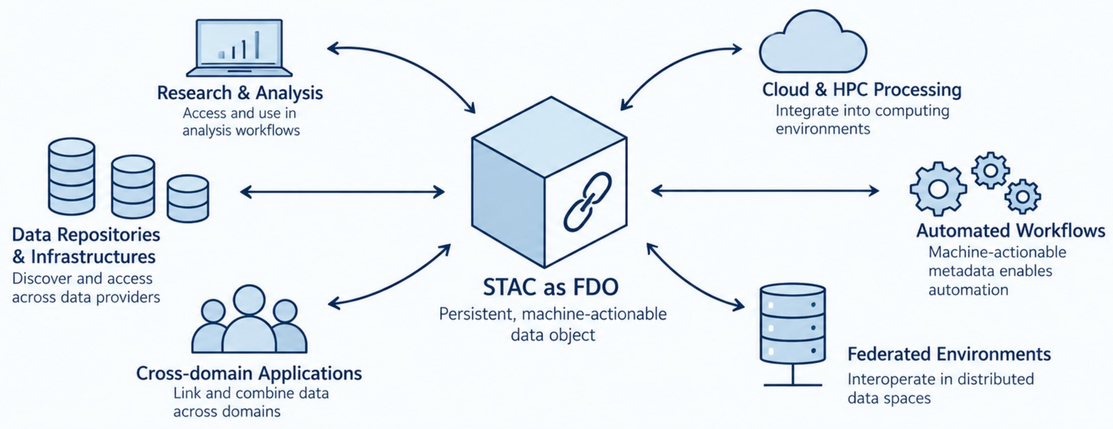
Climate research produces petabytes of heterogeneous data that must remain usable for decades.

Data are continuously migrated between HPC file systems, tape archives, and federated platforms – challenging long-term availability and referability.

Actionable FAIR Digital Objects

Enable integration and use across environments

FDOs combine a digital entity with its critical metadata into a persistent, machine-actionable, and technology-independent object. They provide a framework and tools indipendentfor scalable interdisciplinary workflows, improved trust, efficient management of scientific outputs, and stronger interoperability.
Combined with e.g. IPFS content addressing and replication, this enables resilient and interoperable data infrastructures.



A projects STAC Catalog as a FAIR Digital Object - Implementation at DKRZ

From STAC metadata to a persistent, typed, machine-actionable data object

The Research Project

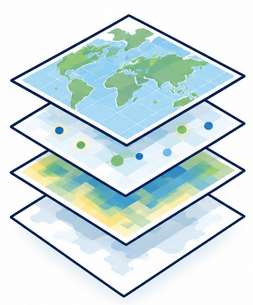
ORCESTRA

- **different institutions and countries**
- **multi-platform observations** (aircraft, ships, ground sites, EarthCARE satellite) Oduring a joint field campaign in Summer 2024



STAC - as a Starting Point

STAC (Spatio-Temporal Asset Catalog) is a widely adopted standard for organizing and discovering spatio-temporal data.



Catalog	Organizes collections
Collection	Defines a dataset
Item	Describes a spatio-temporal entity
Asset	Links to data files

metadata

- Standardised description of the STAC object itself
- description of the datasets

includes (limited)

data are organized in STAC objects





STAC specs registered in

Definitions in data type registry



DTR
EOSC Data Type Registry

- STAC Specs + FDO-Profile registered in DTR

refers to STAC API

rreferes to

Assign PID *(EPIC handle)*

```
21.T14995/1554ed15-
276a-4ddf-b35d-
bd3625c6bb86
```

has profile
has record

Example PID Record

URL	https://orcestra.cloud.dkrz.de/api/
id	21.T14995/1554ed15-276a-4ddf-b35d-bd3625c6bb86
name	STAC catalog
FDO_Profile_Ref	21.T11969/2b3dbd8491ca0edc4dc1
FDO_Type_Ref	21.T11969/68398d5511a138742b47
FDO_Genre_Ref	21.1/climate_model_data
FDO_Rights_Ref	2.1/CC0
FDO_Data_MD_Locs	https://orcestra.cloud.dkrz.de/api/
FDO_Status	created
HS_ADMIN	handle=0.NA/21.T14995; index=200; [create hdl,delete hdl,read val,modify val,del val,add val,modify admin,del admin,add admin]

Result: A FAIR persistent STAC Catalog as FDO

- persistent identifier and rich metadata
- machine readable and typed
- based on open standards and registries
- usable accross environments

FAIR DIGITAL OBJECTS FORUM

NFDI4Earth eosc FAIRCORE4EOSC GWDG esiwace