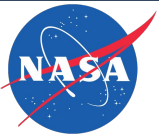


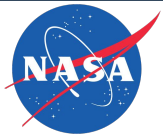
Proposed Knowledge Graph to Connect Data, Applications and People

Suggestion for joint work with Group on Earth Observations (GEO)
Expert Advisory Group (EAG)



GEOSS¹ Knowledge Hub Aspiration

- Curated and Linked Documents to...
- ...make reproducible results available
 - Methods
 - Data (esp. ARD)
 - Software
- Technologies
 - Cloud Computing
 - JSON-LD
 - schema.org



GEOSS Knowledge Hub Aspiration

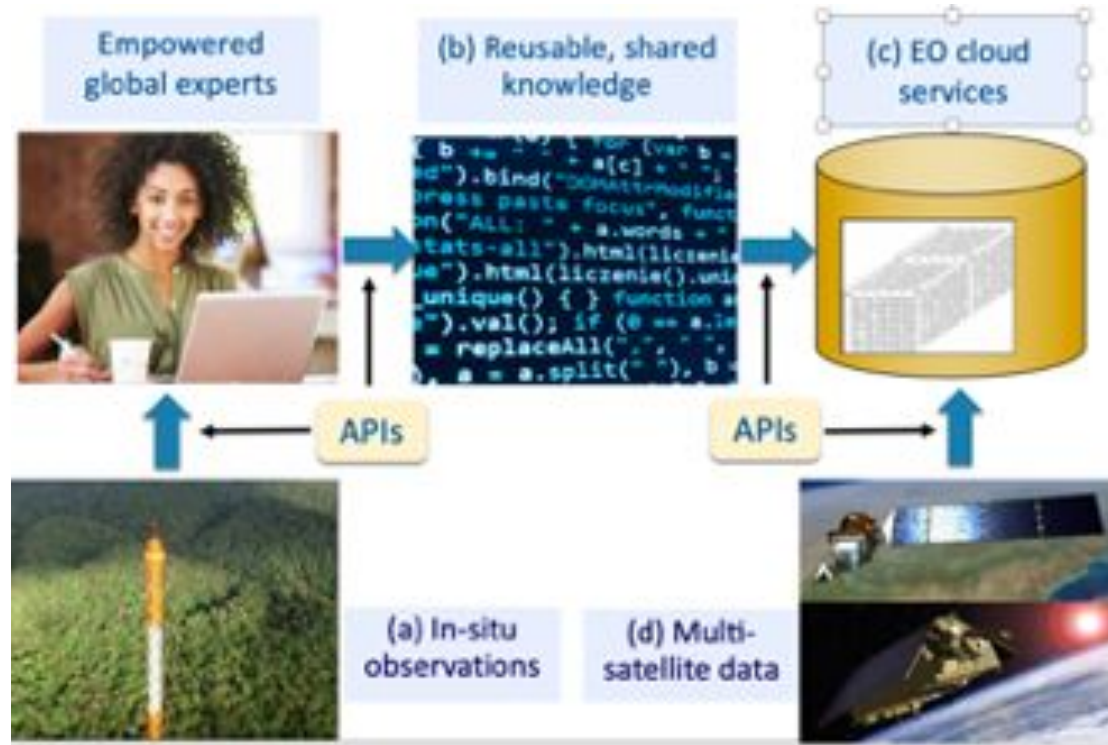


Fig. 1 in GEO EAG Discussion Paper “Building the infrastructure for a results-oriented GEOSS”



Useful Artifacts in the Knowledge Hub

(a) Journal paper

ISPRS Journal of Photogrammetry and Remote Sensing

Big earth observation time series analysis for monitoring Brazilian agriculture

Michelle Cristina Araújo Pires^{1*}, Gilberto Camara¹, João Sanchez², Rolf Snelke³, Alexandre Carvalho², Adeline Marché², Alexandre Coutinho², João Esperança², João Amorim², Rodrigo Raulino Begatti², Damiano Arvor², Claudia Almeida²

Received: 01 June 2016; Accepted: 01 July 2016; Published: 15 July 2016

*Correspondence: mpires@ita.br

Keywords: satellite remote sensing; time series; Brazil; vegetation; agriculture

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(b) In-situ data

PANGAEA

Geographic Information Systems (GIS) and Environmental Modeling

Camara, Gilberto; Pires, Michelle; Simoes, Rolf; Snelke, Adeline; Carvalho, Alexandre X Y; Coutinho, Alexandre; Esperança, João; Amorim, João; Begatti, Rodrigo; Arvor, Damiano (2016): Land cover change maps for Mato Grosso State in Brazil, 2001-2016, links to files. PANGAEA, <https://doi.org/10.1594/PANGAEA.811291>.

Supplement to: Pires, Michelle; Camara, Gilberto; Sanchez, João; Simoes, Rolf; Carvalho, Alexandre X Y; Snelke, Adeline; Coutinho, Alexandre; Esperança, João; Amorim, João; Begatti, Rodrigo; Arvor, Damiano; Almeida, Claudia (2016): Big earth observation time series analysis for monitoring Brazilian Agriculture. ISPRS Journal of Photogrammetry and Remote Sensing, 146, 328-338, <https://doi.org/10.1016/j.isprs.2016.08.007>

(c) R code in github

Source available in https://github.com/mcpires/landcover_brazil

landcover_brazil [Data-File] (<https://doi.org/10.5281/zenodo.53464>)

1 Contribution

All Files (0) (2016) | 3.88 MB

- landcover_brazil
- landcover_brazil
- R (2016)_landcover
- Manual: Processing of a tiled Landsat 8 - RGB data set
- Manual: Manual checks that you have enough memory and RAM

(d) Cloud data in AWS

AWS Management Console

Amazon S3 | Buckets (3)

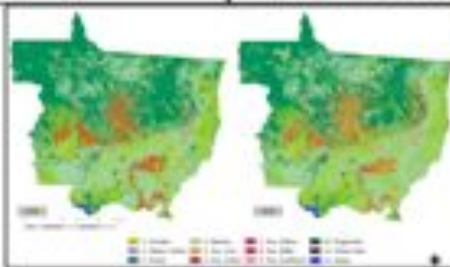
Search

Type: Buckets and objects that you search. Press ESC to close.

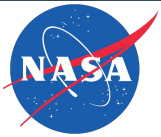
3 Objects | 2 Buckets (3)

None (1) | Sort modified (1) | None (1)

<input type="checkbox"/>	landcover_brazil	2016-08-05-00-00-00	Apr 5, 2016 1:08 AM UTC+02:00	0.4 KB
<input type="checkbox"/>	landcover_brazil	2016-08-05-00-00-00	Apr 5, 2016 1:08 AM UTC+02:00	0.4 KB
<input type="checkbox"/>	landcover_brazil	2016-08-05-00-00-00	Apr 5, 2016 1:08 AM UTC+02:00	0.4 KB



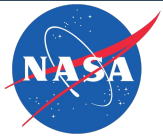
(e) Results



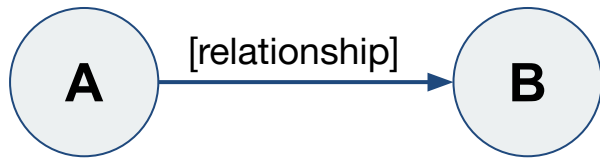
Earth Observation Knowledge Graph

Connect together the main elements of EO knowledge AND context in a way that is:

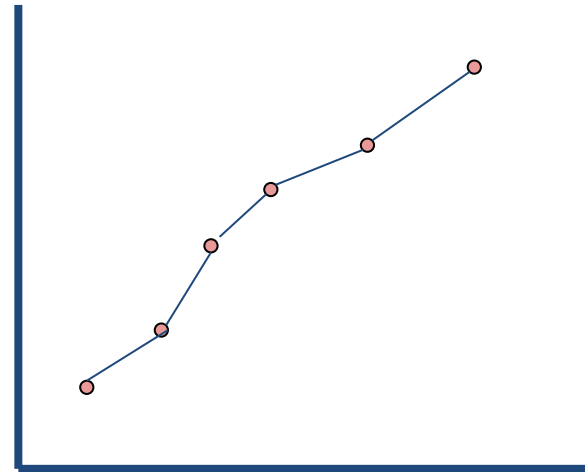
- Machine-readable
- Human-usable
- Curatable

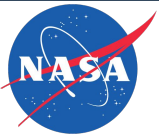


This kind of Graph



Not this kind of Graph





Important Entities

Publication

Result

Exploitation
System

Instrument

Satellite

Person

Workflow

Dataset

Application

Discipline

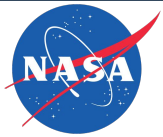
Software

Model

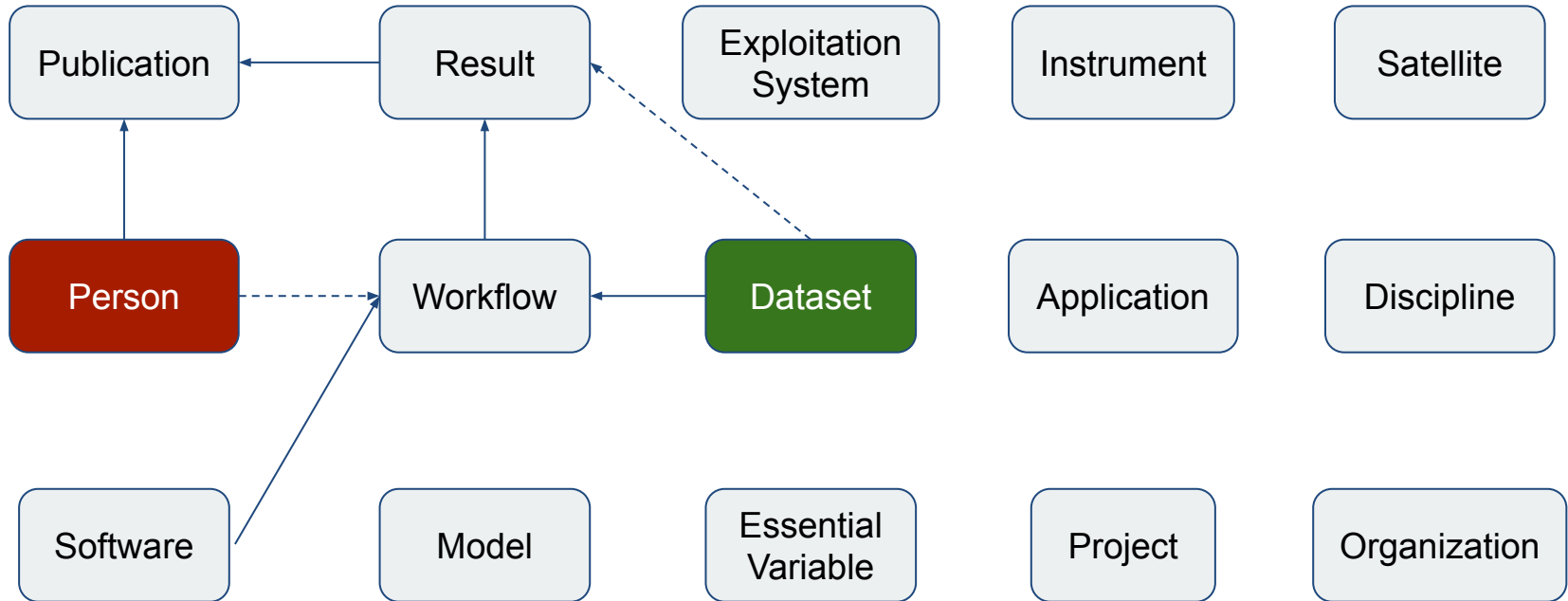
Essential
Variable

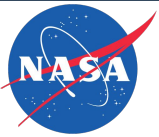
Project

Organization

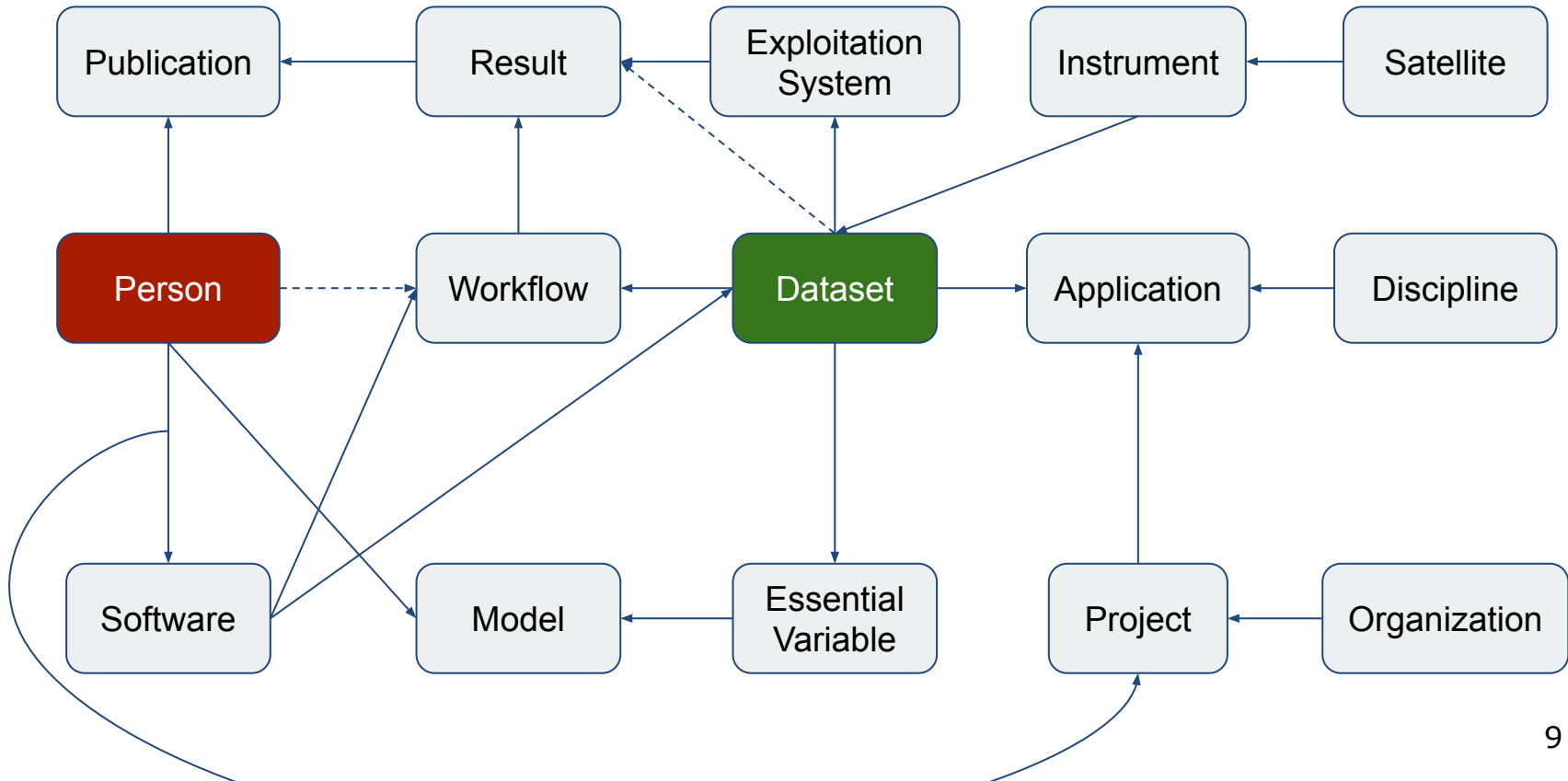


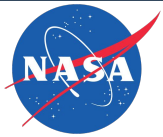
GEOSS Connections



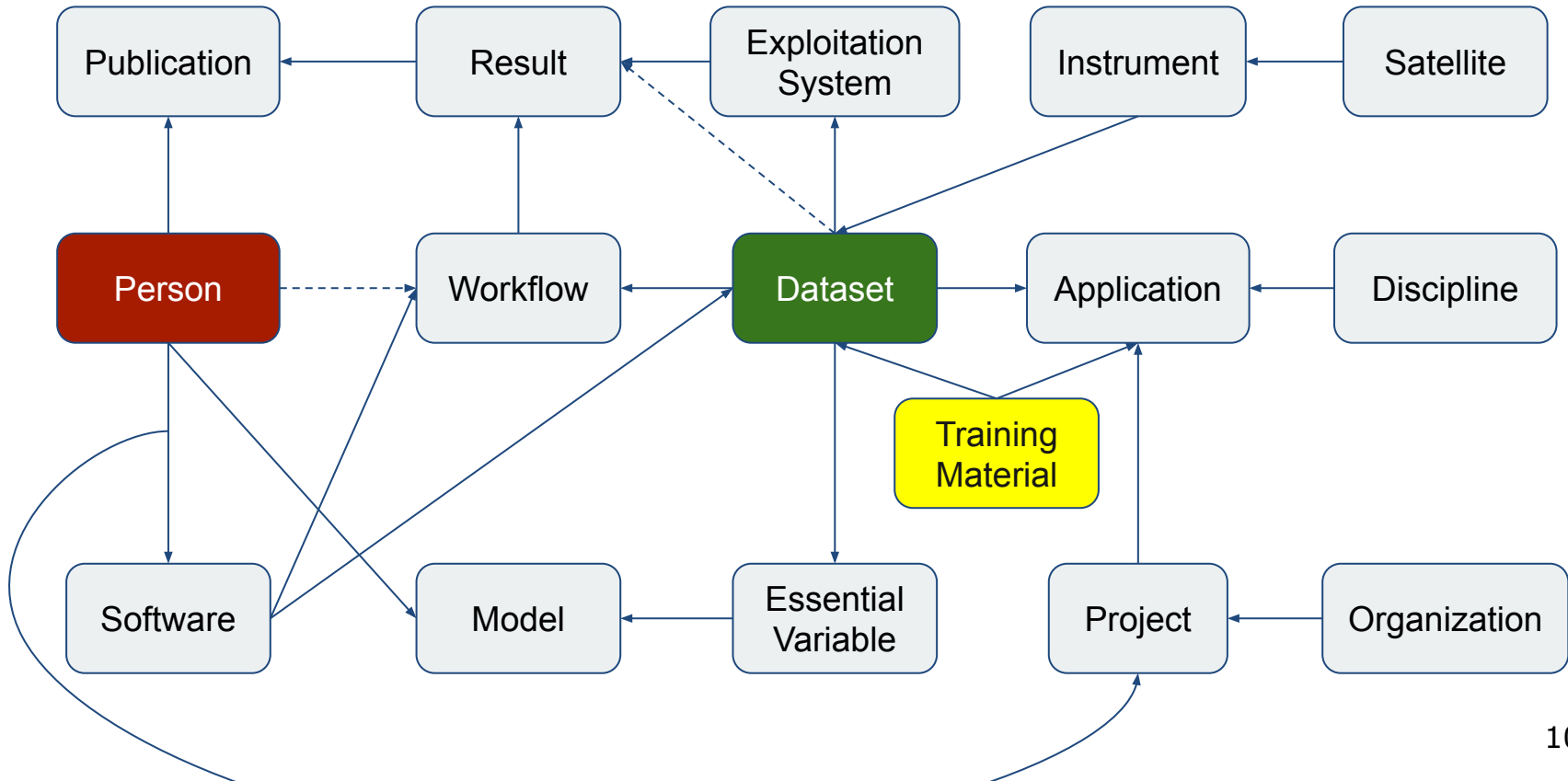


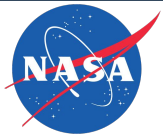
Other Important Connections



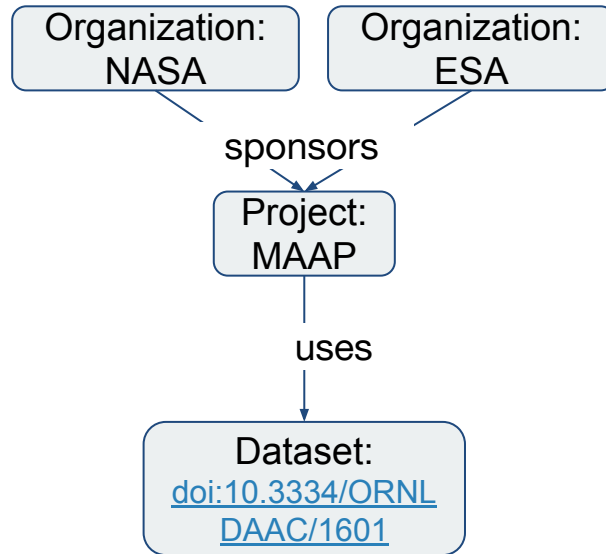


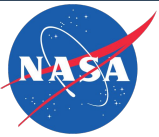
Other Important Connections



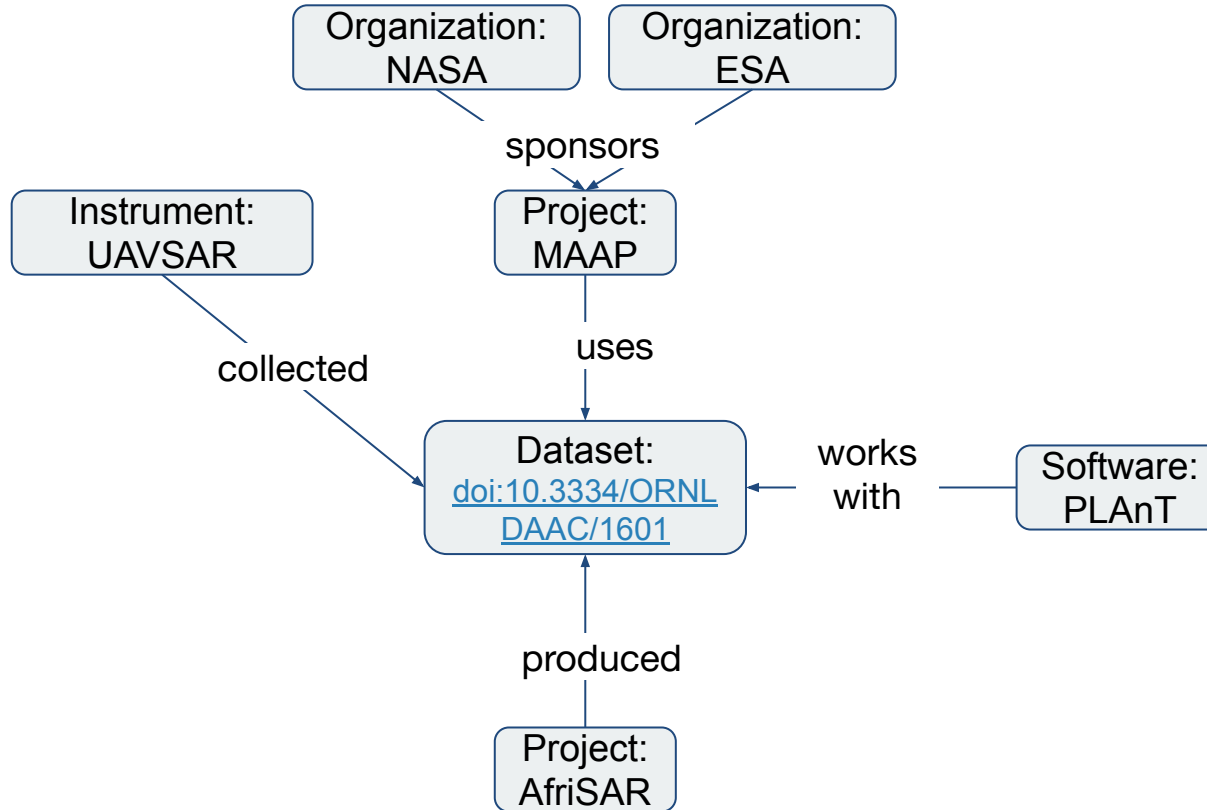


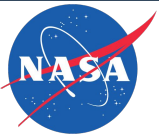
Example



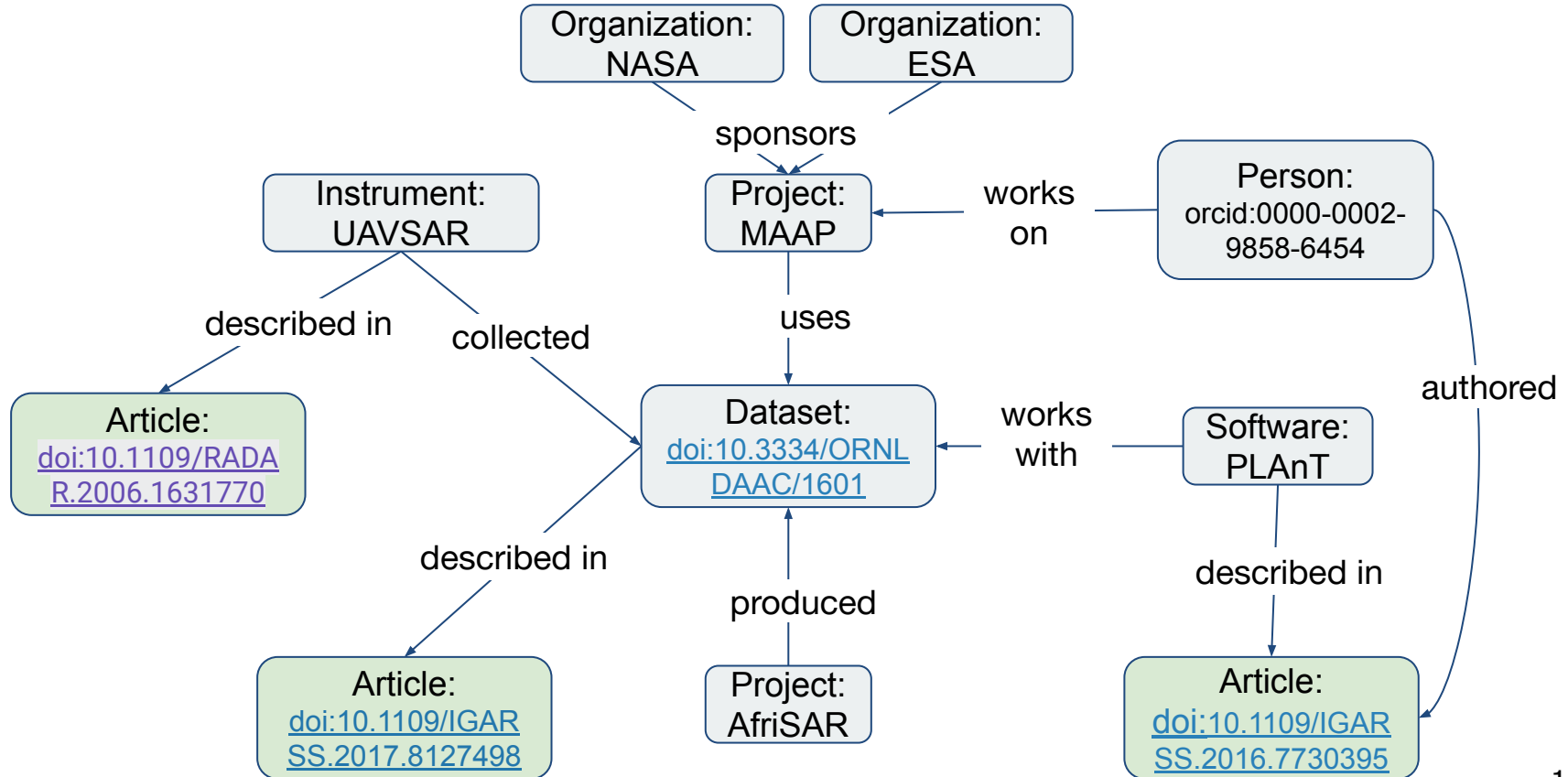


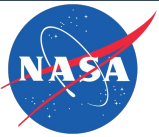
Example





Example



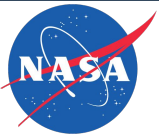


Potential Use Cases

Answering Questions for Developers and Users

- What **Organizations** are producing **Datasets** used by **Exploitation System X**?
- **Who** knows a lot about **Science Application X**?
- Which **Organizations** are using **Dataset X** and for what purpose?
- How was **Result X** obtained: which **data** and **tools/services**?

Connecting Systems



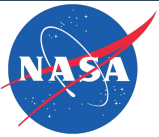
Suggested Pilots

- Knowledge Graph for NASA-ESA MAAP
- Knowledge Graph for GeoGLAM Crop Monitor
- Demonstration queries

ESA = European Space Agency

MAAP = Multi-mission Algorithm and Analysis Platform

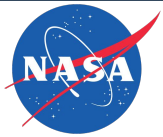
GeoGLAM = Group on Earth Observations Global Agricultural Monitoring Initiative



Suggested Division of Labor

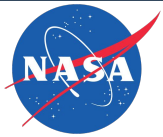
Task	GEO	WGISS / CEOS
Requirements and Design	✓	✓
Knowledge Hub Implementation	✓	
Knowledge Graph Collection Mechanisms		✓
Knowledge Graph Population		✓
Naming Authority Engineering*		✓
Knowledge Hub Operations	✓	

*Eliminating duplication is the key to curation;
Unique identifiers is the key to preventing eliminating



Leveraging and Learning from Current Efforts

- Global Change Information System (GCIS)
- Global Change Master Directory (GCMD)
- Committee on Earth Observing Satellites (CEOS)
Tool Inventory
- Unified Metadata Model (Services ↔ Collections)
- Javascript Object Notation-Linked Data (JSON-LD)
- OGC Testbed 15 EOPAD thread (JSON + Services)



Global Change Information System

Connecting global change resources.



JSON YAML