Adaptable Information Models in the Global Change Information System

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```
http://data.globalchange.gov
http://github.com/USGCRP/gcis
```

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Outline

Overview

The US Global Change Research Program (USGCRP) has established the Global Change Information System (GCIS) to better coordinate and integrate the use of Federal information products on changes in the global environment and the implications of those changes for society.

Overview

The GCIS provides a RESTful API for retrieving global change information. The GCIS also provides a triple store. URLs in the triple store are resolvable using the API. URIs in the triple store are described by the GCIS ontology.

Producing the Third National Climate Assessment

In May, 2014, the US Global Change Research Program released the 2014 National Climate Assessment.

Production of this 829 page report and its web site involved collaboration between over 300 authors, numerous editors, graphics producers, scientists, data scientists, software developers, and web teams.

The content included 161 findings, 284 figures, 3,395 bibliographic references (journal articles, books, reports).

The GCIS facilitated the assembly of the report by providing common **identifiers** for resources and concepts, providing a common web interface for entering and viewing information, as well as an API for adding and removing information using a variety of formats.

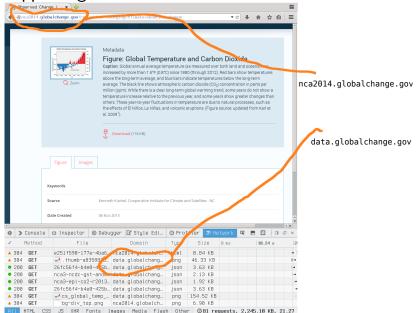# Producing the Third National Climate Assessment

data.globalchange.gov
/report/nca3
.html

Supporting the NCA3 website

A website, `http://nca2014.globalchange.gov`, was released concurrently with the report. The site received over 200,000 visits in the first two days after launch and continues to receive frequent main stream media attention.

GCIS serves as the backend : the website sends client side requests to `http://data.globalchange.gov` and receives JSON responses which it uses to populate elements of some pages dynamically.

Supporting the NCA3 website

nca2014.globalchange.gov

data.globalchange.gov

Provenance

The identifiers within GCIS can be used to trace the provenance of figures, findings, and other resources.

A figure may be derived from a journal article which is derived from a dataset which is derived from a NASA standard product which is derived from an instrument which is on a platform.

Provenance

Queries

Structured information allows for querying.

- Find reports with figures derived from a dataset generated by an instrument on a specific platform.
- Show figures associated with data generated by instruments on platforms flown by NOAA.

Queries are based on the information model.

Outline

Relational

Canonical representation : PostgreSQL database.

- One-many, many-one, many-many relationships.
- Referential integrity.
- String type checking.
- Column constraints.
- Cascading updates and deletes.
- Well known optimization techniques.
- Wide spread adoption.

PostgreSQL hstores allow key-value storage.

Closed world assumption.

Semantic

- Relationships are first class objects.

The semantic representation has benefits such as
The ability to describe how two entities are related.
A figure **was influenced by** a report.
An article **was cited by** a report.
A dataset **was derived from** another dataset.
A GCIS ontology defines semantic relationships between entities.
The semantic representation allows GCIS data to be used with external data.
Open world assumption : a figure may be related to a dataset, but this is not in GCIS.

Example

http://bit.ly/gcis-dbpedia

```
PREFIX bibo: <http://purl.org/ontology/bibo/>
PREFIX gcis: <http://data.globalchange.gov/gcis.owl#>
PREFIX cito: <http://purl.org/spar/cito/>
PREFIX dcterms: <http://purl.org/dc/terms/>
PREFIX dbprop: <http://dbpedia.org/property/>
PREFIX dbpo: <http://dbpedia.org/ontology/>

SELECT  DISTINCT ?dbpjournal ?gcisjournal ?issn
FROM <http://data.globalchange.gov>
WHERE {
    SERVICE <http://data.globalchange.gov/sparql> {
        ?gcisjournal a bibo:Journal .
        ?gcisjournal bibo:issn ?issn .
        ?gcisjournal dcterms:hasPart ?gcisarticle .
        ?gcisarticle a bibo:Article .
        ?gcisarticle dcterms:isPartOf ?gcisjournal .
        ?gcisarticle cito:isCitedBy <http://data.globalchange.gov/report/nca3> .
    }
    SERVICE <http://dbpedia.org/sparql> 1
     ?dbpjournal dbprop:frequency "Monthly" @en .
     ?dbpjournal dbpo:issn ?issnd .
    }
    FILTER(?issnd = ?issn)
}
```

Outline

Diagram

todo

Content Changes

When identifiers exist in other APIs, we can match them with GCIS identifiers, to perform updates.

For journal articles, use DOIs and crossref.org.

When identifiers are unique to specific organizations, maintain a table which maps organization identifiers to GCIS identifiers.

We call these tables lexicons.

Example :

PO.DAAC has identifiers for satellites. So does CEOS. Map both to GCIS identifiers.

PODAAC : AQUA -> /platform/aqua

CEOS : 206 -> /platform/aqua

Allows PODAAC identifiers to be mapped to CEOS identifiers.

Schema Changes

Changes to the schema propagate to the JSON API. JSON key names match the column names, and nested JSON objects correspond to relationships.

1. Write a test for new REST functionality.
2. Run the tests. Do they test pass?
3. Yes? Done.
4. No? Write a schema patch.
5. Goto step 2.

The tests remain part of the test suite, which is run continuously.

Ontology Changes

Change to the triple are handled by turtle templates.

1. Write a test with a SPARQL query that should succeed.
2. Run the tests. Do they pass?
3. Yes? Done.
4. No? Modify the turtle templates.
5. Go to step 2.

The tests remain part of the test suite, which is run continuously.

Ontology Changes

Sample turtle template :

```
<%= article->uri %> a gcis:Article;
<%= article->uri %> dcterms:isPartOf
    <%= article->journal->uri %>;
```

Outline

4. Conclusion, Ongoing Work, Future Plans

Current work involves extending the data model to include models, in situ observations, datasets from more DAACs, and identifying lexicons and APIs for GCIS resources.

Thank you

http://github.com/usgcrp/gcis
http://data.globalchange.gov
http://www.globalchange.gov