Adaptable Information Models in the Global Change Information System

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

Outline

1. Introduction and Functionality
    - Overview
    - Producing the Third National Climate Assessment
    - Supporting the NCA3 website
    - Provenance
    - Queries
2. Information Model
    - Relational
    - Semantic
    - Example
3. System Architecture
    - Diagram
    - Content Changes
    - Schema Changes
    - Ontology Changes
4. Conclusion, Ongoing Work, Future Plans

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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

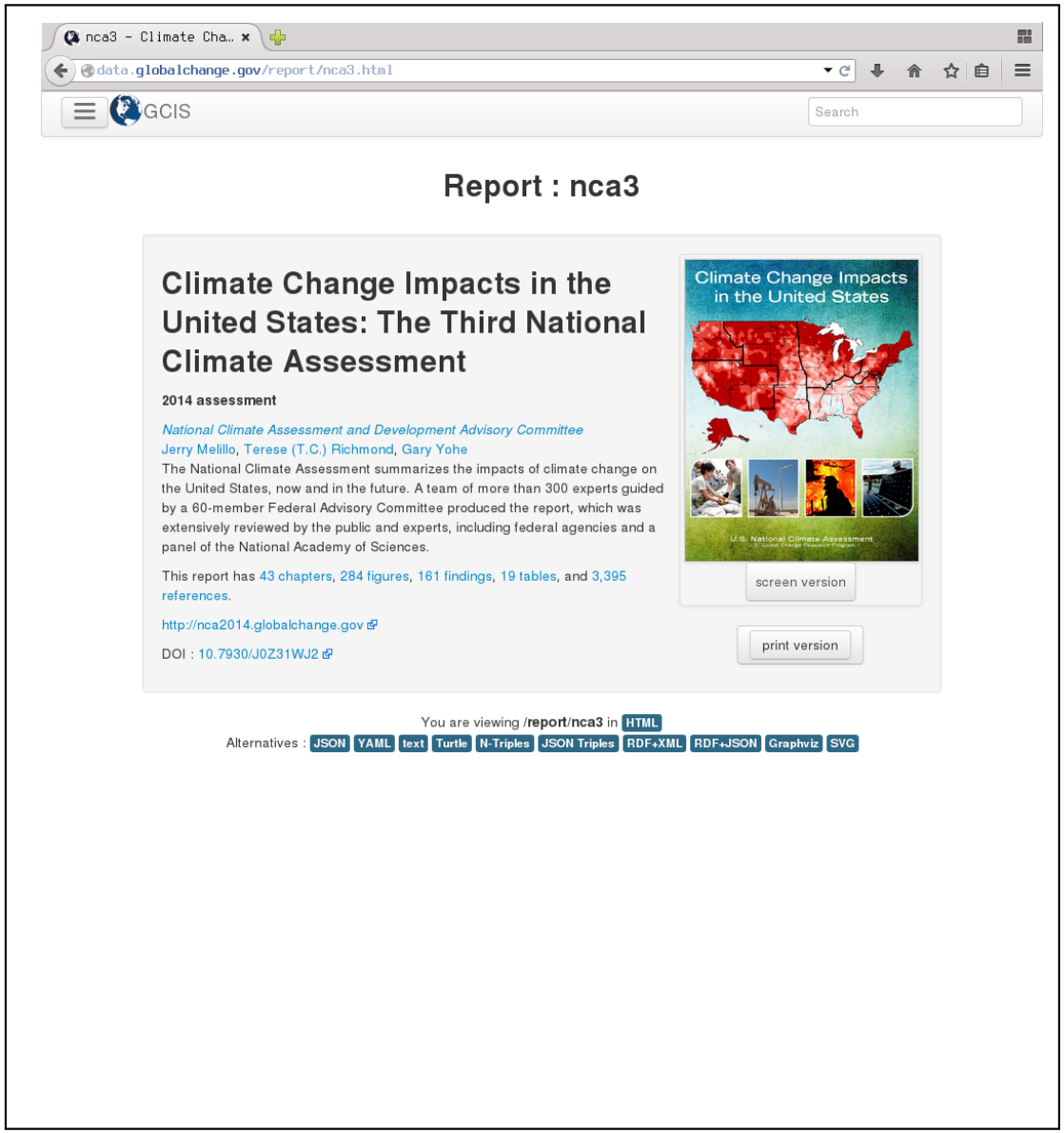
In May, 2014, the US Global Change Research Program released the 2014 National Climate Assessment.

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



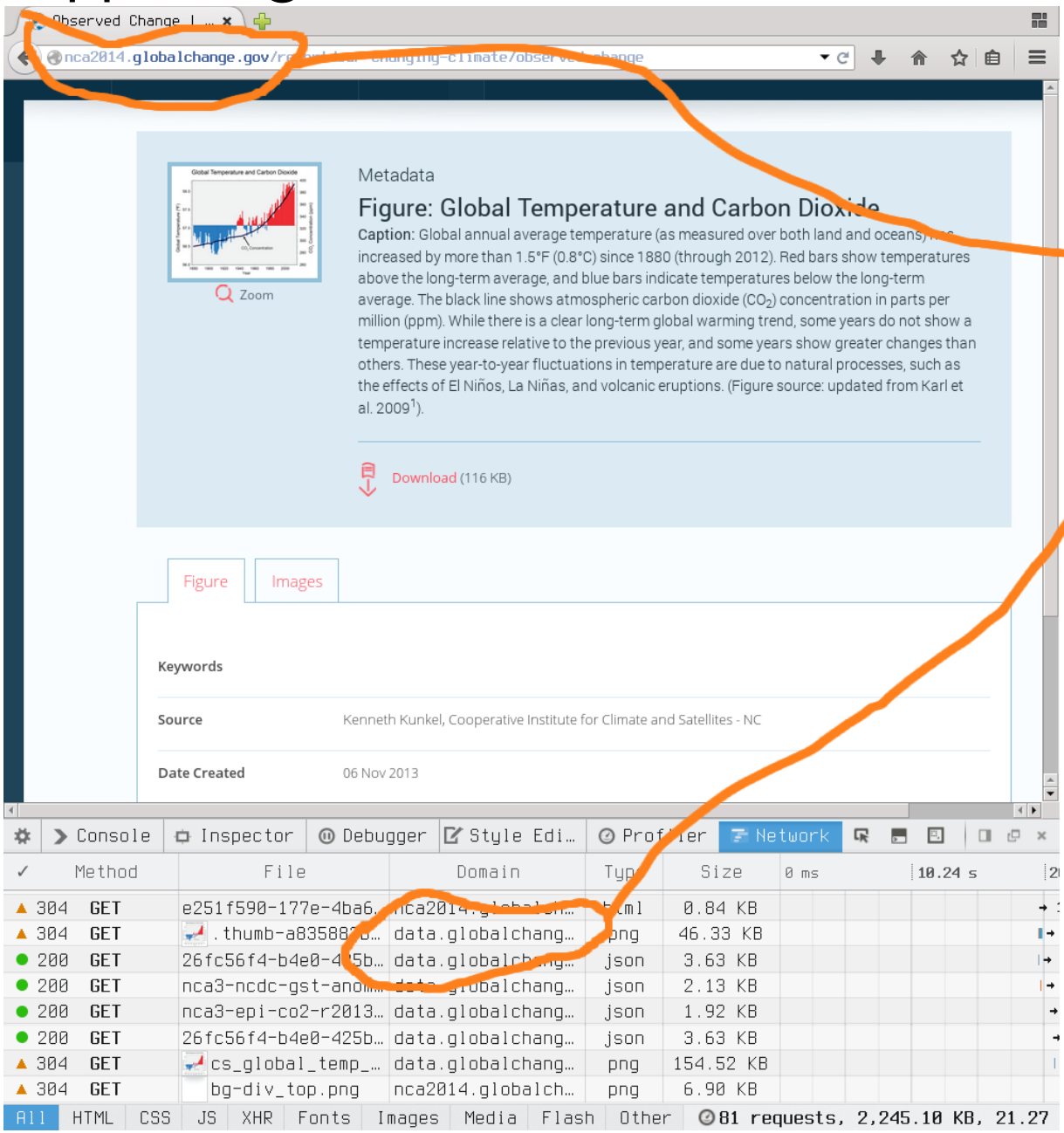
data.globalchange.gov
/report/nca3
.html

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


Platform : jason-1
Instrument : poseidon-2
Advanced Microwave Radiometer
dataset : nasa-podaac-merged_tp_j1_ostm_ost_cycles_v2
dataset : nasa-podaac-integrated-multi-mission-ocean-altimeter-data-for-climate-research
article : 10.1080/01490419.2010.491031
Estimating Mean Sea Level Change from the TOPEX and Jason Altimeter Missions
Figure : past-and-projected-changes-in-global-sea-level-rise
Past and Projected Changes in Global Sea Level Rise
Figure 2.26

Queries

The inverse of provenance.

Sample questions :

Given a dataset, find reports with figures generated from the dataset.

Show figures associated with data generated by instruments funded by NASA.

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Relational

A relational model provides one/many to one/many relationships.
One report has many chapters.
One journal has many articles.
Many datasets support many articles.

Critical features : referential integrity, type checking, check constraints, cascading updates of primary keys (identifiers), high performance, well established scalable tools. Postgres also offers some useful features like hstores for looser information.

Closed world assumption for some contexts. A figure is related to a chapter if and only if it is in the chapter.

The canonical representation of GCIS data is in the Postgres database.

Semantic

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)
}
```

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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 %>;
```

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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

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http://data.globalchange.gov
http://www.globalchange.gov