NASA GCMD Keywords

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What Are The GCMD Keywords?

- Hierarchical set of controlled vocabulary covering Earth science disciplines that have been evolving for over 25 years.
- Contains
  - 12 published keyword types
  - Over 11,000 unique keywords
  - More than 100 defined keyword relationships

https://gcmd.nasa.gov/
Implementing Keywords and Relationships

1. Add Keyword
2. Add Alternate Label
3. Add Resource
4. Add Definition
5. Add Reference
6. Add Related Keyword

Each keyword created has a universally unique identifier (UUID) that does not change.
A Look Behind The Scenes

Request for a list of platforms and their relationship to an instrument (AQUA has several related instruments):
https://gcmdservices.gsfc.nasa.gov/kms/concept_relation/?scheme=platforms&relation_type=has_instrument

{"prefLabel": "AQUA",
 "scheme": "platforms",
 "uuid": "ea7fd15d-190d-43f3-bdd3-75f5d88dc3f8",
 "relatedConcepts": [
 {"prefLabel": "AMSR-E",
  "relationType": "has_instrument",
  "uuid": "736038ef-c1ae-47c7-a50e-729474eeb3b1",
  "scheme": "instruments"},
 {"prefLabel": "AMSU-A",
  "relationType": "has_instrument",
  "uuid": "2a393a42-ecf9-4137-b1ea-1c25692384b4",
  "scheme": "instruments"},
]
Visualizing Keyword Relationships

The example below shows a relationship between Platforms and Instruments. These instruments fly on the Aqua satellite.
The Global Change Information System (GCIS) wanted to implement GCMD science keywords and associated relationships to describe figures, tables, chapters, etc. in the Fourth National Climate Assessment (NCA4).


• Background:
  – The GCIS is working with NASA’s Inter Agency Implementation and Advanced Concepts (IMPACT) team to improve the discovery of global change resources.
  – The MSFC IMPACT team is collaborating with the GCMD/IDN team to identify gaps in keywords based on the NCA4 review.
  – The GCMD is implementing keyword changes and defined relationships based on the gap analysis.
GCIS Implementation Process

1. Reviewed KMS API Documentation
2. Wrote GCMD Keyword Update Script
3. Ran Script To Pull In New and Updated Keywords
4. Ran Script To Update GCIS HTML Pages
5. Reviewed HTML Pages With Data Manager
6. Published HTML Pages
GCMD Implementation Process

(1) Reviewed Proposed Keyword Changes With IMPACT Team

(2) Added Keyword and Definition To KMS

(3) Added Keyword Relationships to KMS

(4) Peer Reviewed Changes With IMPACT Team

(5) Published Keyword Changes In KMS

(6) Informed IMPACT Team of Published Keywords
Drying Effect of Warmer Air on Plants and Soils

Figure 21.3
North Carolina State University
Kenneth E. Banks
This figure appears in chapter 21 of the Impacts, Risks, and Adaptation in the United States: The Fourth National Climate Assessment, Volume 1 report.

As air temperatures increase in a warming climate, vapor pressure deficit (VPD) is projected to increase. VPD is the difference between how much moisture is in the air and the amount of moisture in the air at saturation (100% relative humidity). Increased VPD has a drying effect on plants and soils, as convective transpiration (from plants) and evaporation (from soil) into the air. (a) Current air (2006) shows less water as vapor, putting less demand for moisture in plants, while warmer air can maintain more water as vapor, putting more demand for moisture on plants. (b, c) The maps show the greatest change in the moisture deficit of the air based on the projected maximum 6-day VPD by the late 21st century (2070–2099) for (b) lower and (c) higher scenarios (RCP4.5 and RCP8.5; not shown; U.S. Forest Service, NOAA NCEI, and CICS NC).

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This figure was created on May 30, 2017.
This figure was submitted on December 30, 2018.

This figure is composed of these images:

Result: GCIS Keyword Reference

https://data.globalchange.gov/gcmd_keyword/427e5121-a142-41cb-a8e9-a70b7f98eb6a
The Midwest is a major producer of a wide range of food and animal feed for national consumption and international trade. Increases in warm-season absolute humidity and precipitation have eroded soils, created favorable conditions for pests and pathogens, and degraded the quality of stored grain (very likely; very high confidence). Projected changes in precipitation, coupled with rising extreme temperatures before mid-century, will reduce Midwest agricultural productivity to levels of the 1960s without major technological advances (likely; medium confidence).

This finding is from chapter 21 of Impacts, Risks, and Adaptation in the United States: The Fourth National Climate Assessment, Volume II.

Process for developing key messages:

The chapter lead authors were identified in October 2016, and the author team was recruited in October and November 2016. Authors were selected for their interest and expertise in areas critical to the Midwest with an eye on diversity, level of experience, and gender. The writing team engaged in conference calls starting in December 2016, and calls continued on a regular basis to discuss technical and logistical issues related to the chapter. The Midwest chapter hosted an engagement workshop on March 1, 2017, with the hub in Chicago and satellite meetings in Iowa, Indiana, Michigan, and Wisconsin. The authors also considered other outreach with stakeholders, inputs provided in the public call for technical material, and incorporated the available recent scientific literature to write the chapter. Additional technical authors were added as needed to fill in the gaps in knowledge.

Discussion amongst the team members, along with reference to the Third National Climate Assessment and communications with stakeholders, led to the development of six Key Messages based on key economic activities, ecology, human health, and the vulnerability of communities. In addition, care was taken to consider the concerns of tribal nations in the northern states of the Midwest. The Great Lakes were singled out as a special case study based on the feedback of the engagement workshop and the interests of other regional and sector chapters.

Note on regional modeling uncertainties

Interaction between the lakes and the atmosphere in the Great Lakes region (e.g., through ice cover, evaporation rates, moisture transport, and modified pressure gradients) is crucial to simulating the region’s future climate (i.e., changes in lake levels or regional precipitation patterns). Globally recognized modeling efforts (e.g., the Coupled Model Intercomparison Project, or CMIP) do not include a realistic representation of the Great Lakes, simulating the influence of the lakes poorly or not at all. Ongoing work to provide evaluation, analysis, and guidance for the Great Lakes region includes comparing this regional model data to commonly used global climate model data (CMIP) that are the basis of many products practitioners currently use (e.g., NCA, IPCC, NOAA State Climate Summaries). To address these challenges, a community of regional modeling experts is working to configure and utilize more sophisticated climate models that more accurately represent the Great Lakes’ lake–land–atmosphere system to enhance the understanding of uncertainty to inform better regional decision-making capacity (see http://giss.rice.edu/projects/great-lakes-ensemble for more information).

Description of evidence base:

Humidity is increasing. Feng et al. (2016) show plots of trends in surface and 850 hPa specific humidity of 0.4 and 0.2 g/kg/decade, respectively, from 1979–2014 for the April–May–June period across the Midwest. These represent increases of approximately 5% and 3% per decade, respectively. Automated Surface Observing Stations in Iowa having dew point records of this length and season show dew point temperature increases of about 1°F per decade. Brown and DeGaetano (2013) show increasing dew points in all seasons throughout the Midwest. Observed changes in annual average maximum temperature for the Midwest over the 20th century (Vose et al. 2017) Table 6.1 have been less than 1°F. However, future projected changes in annual average temperature (Vose et al. 2017) Table 6.4, as well as in both extreme days of the year and extreme 5-day events, Vose et al. 2013 Table 6.5, are higher for the Midwest than in any other region of the United States.

https://data.globalchange.gov/report/nca4/chapter/midwest/finding/key-message-21-1
GCIS Script Details

https://github.com/USGCRP/gcis-scripts/tree/master/qa_scripts/update_gcmd_keywords
Conclusions

• GCMD keywords continue to evolve based on feedback from U.S. and international agencies, research universities, and scientific institutions.

• Implementing keyword relationships can be used to improve search and discovery of Earth science data and information.

• The process defined here could be reusable for other providers who want to implement the GCMD keywords and see associated relationships.

• You can contribute keywords by contacting the GCMD staff or sending an email to support@earthdata.nasa.gov.
Questions

Please provide questions/comments to:

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Background Information
Keyword Landing Page

- Learn More about the Keywords
- Access the GCMD Keywords
- Submit a Keyword Request
- See Keyword Release Announcements
- Review the Keyword Governance Document

https://earthdata.nasa.gov/about/gcmd/global-change-master-directory-gcmd-keywords
The Keyword Management Service (KMS) is a RESTful web service for maintaining and accessing the keywords.

- Retrieve the keywords as SKOS Concepts (RDF, JSON, OWL), XML, and CSV
- Retrieve defined keyword relationships
- Retrieve previous versions
- Retrieve in different case (Native, Title Case, Upper Case, Lower Case)
- Search by keyword pattern (i.e. Search by ‘Terra’)

Help Documentation
- [https://wiki.earthdata.nasa.gov/x/gwxNBQ](https://wiki.earthdata.nasa.gov/x/gwxNBQ)