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Abstract

Citations for software and services/tools are important as they provide a way to improve reproducibility of science, better provenance and easier to attribute credit to the developers. Software citations are trickier than papers or data as software can be very dynamic so it is a bit of a moving target. It is even more difficult for services/tools as they usually have data as inputs so now a relation between the tool and data is needed. There are suggested citation formats, but they do not always contain enough information that can easily be gleaned or obtained from a metrics crawler. At the Summer 2017 Earth Science Information Partners (ESIP) meeting a workshop was held to evaluate the effectiveness of a citation. This presentation will summarize those results and put forth adjustments to the format. These adjustments will make it easier to verify that the citation is for a service or software and for information harvesting.

Motivation

There is an increasing **need to cite** software and services as they provide information and clarity on

- Research integrity
- Transparency
- Improves reproducibility
- Support the scientific record
- Provenance
- Authorship

There are multiple organizations that are trying to come up with recommendations for software citations (Force 11, TOP, DataCite, NASA ESDSWG) but do they provide enough information to resolve the dynamic nature of software and services? The information was presented at a session during the summer ESIP 2017 meeting.

Attendants were then given a service citation and asked how they would change it to be more accommodating.

Software vs. Service

Software - the user has access to the code and can alter it, i.e. models

Service - typically tools or protocols that manipulate data, but the user interacts with the software through an interface, i.e. web based tools (Giovanni, fig. 1) or processing on demand

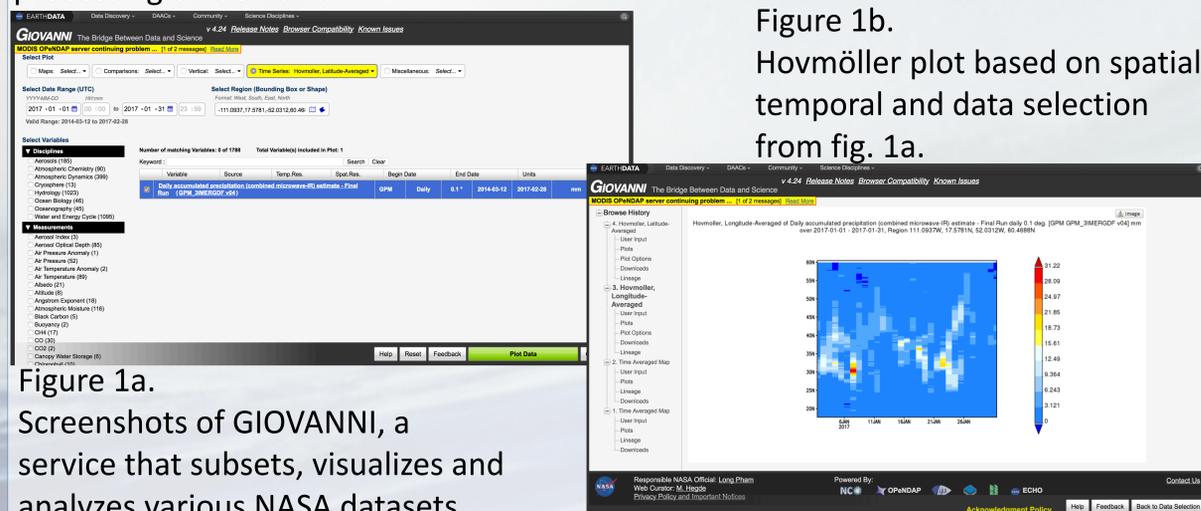


Figure 1b. Hovmöller plot based on spatial, temporal and data selection from fig. 1a.

What Next?

- Work with DataCite and Force11 Software Citation Implementation group
- Starting an ESIP Software and Services Citation group (kick off is at the winter meeting)
- Need to relate data to software/service
- When registering DOIs a resource type can be added to denote software, but is a more human readable component needed?
- See if Zenodo or Dpsy can be integrated into the citation or added to the registered information of the PID.

What Should the Citation Be?

A citation was given to the attendees and they were asked how would they approve upon it. They worked in 9 groups. The original citation format was based on a similar format for datasets. It is for the service GIOVANNI by NASA. Please note that it currently does not have a DOI. The DOI provided is for one of the datasets accessible within the tool.

Original Citation

GIOVANNI Team. 2017. **GIOVANNI.** Ver. 4.22. GSFC, MD, USA. DOI: 10.5067/GPM/IMERGDF/DAY/04

- Author
- Year service/software was released
- Title
- Version
- Publisher/host
- DOI

Suggested new citations

NASA, David.J.Meyer. June 25, 2017. GIOVANNI. Ver. 4.22. Service. Google Chrome. Ver. 59.0.3071.115. Browser. <https://giovanni.gsfc.nasa.gov/giovanni/> GSFC, MD, USA. DOI: [10.5067/GPM/IMERGDF/DAY/04](https://doi.org/10.5067/GPM/IMERGDF/DAY/04)

GIOVANNI 2017. GES DISC GIOVANNI Subsetting and Visualization Tool. GES DISC, Greenbelt, Maryland, USA. Accessed Month dd, yyyy. Subset obtained for [Product name] product at [Lat],[Lon], time period: [Start date] to [End date], and subset size: [Width] x [Height] km <http://dx.doi.org/10.5067/GIOVANNI>

GIOVANNI Team. 2017. Goddard Online Interactive Visualization AND aNalysis Infrastructure (GIOVANNI). Ver. 4.22. Goddard Space Flight Center (GSFC), MD, USA. DOI: 10.5067/GPM/IMERGDF/DAY/04. Accessed: date/time

Recommendations from the groups (9 in total)

Recommendation	# of Teams Recommending
Needs to state citation is for software, service or data	9
Needs to have access date	9
Subsetting/user inputs should be part of the citation	2
Subsetting/user inputs should only be in the methods	1
Include access method (web browser, wget, etc.)	2
Tie data to service/software	9