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g.cite: A new GRASS GIS functionality for scientific citation of individual GRASS modules

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We report on the development of the new GRASS GIS add-on module g.cite. The module implements a workflow to create on demand citations for individual GRASS GIS modules, supporting various citation styles. This functionality is a crucial step to enable citation of research code based on or extending GRASS GIS as part of Open Science.

GRASS GIS is the oldest existing and actively developed open source community project in the geospatial domain. Being initiated in 1982 it has been a founding member and strong driver of the OSGeo foundation of geospatial software projects, which was established in 2006. In the meantime, the paradigm of Open Science is affecting both scientists in and beyond the geospatial domain, but also the volunteers themselves, which enable community-driven software projects. Open Science requires the citation of scientific articles, the underlying data and the research code used to compute the results. GRASS GIS is very actively used in science. Due to its open source nature, new and innovative functionalities can easily be implemented in GRASS GIS. Once such code meets the requirements to become part of the GRASS GIS code repository (either the core system or the GRASS GIS Addons repository), it will be maintained by the force of volunteers and updated to meet technology changes, as long as it is considered useful for the GRASS GIS user communities.

However, the options for citing GRASS GIS software in scientific writing are currently limited. The latest stable version, GRASS GIS 7.4, provides a built-in functionality for a BibTEX citation link for the whole GRASS GIS software suite. While the volunteer community provides a repository of best-practices and static examples for citations (https://grasswiki.osgeo.org/wiki/GRASS_Citation_Repository), there is still a lack of software functionality for scientific citation of selected GRASS GIS modules in multiples citation styles, as it is provided in research data repositories like Zenodo.

This functionality is now provided by the new GRASS GIS Addon module g.cite. As a positive side-effect, the implementation of g.cite has led to recommendations for the GRASS GIS developer community to improve the structuring of GRASS GIS manual pages and to embed machine-actionable metadata in them. While the structure of GRASS GIS manual pages already meets the requirements of DOI landing pages, the GRASS and OSGeo communities yet have to embrace DOI-based citation mechanisms.

The g.cite add-on module is a first step towards persistent scientific citation of individual GRASS GIS functionalities: While the structure of these manual pages already meets the requirements of landing pages for persistent identifiers, such as Digital Object Identifiers (DOI), the GRASS and OSGeo communities yet have to embrace DOI-based citation mechanisms. Once this is accomplished, the g.cite functionality can be used to provide permanent scientific citation, resulting in due scientific credit for the authors of GRASS GIS modules being cited. Also, the project has provided recommendations on how to embed machine-actionable metadata of the content provided to a human audience by GRASS GIS manual pages.