EPSC Abstracts
Vol. 9, EPSC2014-586-3, 2014
European Planetary Science Congress 2014

Planetary GIS interfaces and links with the Planetary Virtual Observatory

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1. Introduction

Planetary data with a strong geographic component constitute a large portion of all those collected over planets and moons [e.g. 1]. The variety of Solar System bodies imaged and their geometry is large and cartographic standards have been set [e.g. 2]. Linking and making broadly accessible the growing amount of data in planetary archives of the NASA Planetary Data System (PDS) [3, 4] and ESA Planetary Science Archive (PSA) [5], derived datasets from experiment teams, group and individual scientists is a tremendous challenge. In order to tackle this, Virtual Observatory (VO) techniques and tools applied to Planetary Science data have been developed [6, 7].

2. GIS and VO

Various Planetary GIS efforts exist [e.g. 8, 9], with particular emphasis on remote sensing data (e.g. raster, multidimensional cubes, time series) and they are largely based on the extensive experience and heritage of terrestrial (mainly Earth Observation-based) work. In fact, terrestrial communities dealing with geographic data make extensive use of standards [e.g. 10]. Those data standards that allow efficient access to datasets include those approved by the Open Geospatial Consortium (OGC).

Among them there are few particularly suited for raster data and customized analytics. Access to raster data can be provided with the Web Coverage Service (WCS), offering functionalities such as subsetting directly on the server. We have used an open source implementation on planetary data. Further advances in standards for data access allow complex queries to be sent and executed directly on the server offering the dataset; this is the case with the Web Coverage Processing Service (WCPS) standard [8, 10]. With WCPS it is possible to build analytics queries that provide to the calling entity just the results of a server-side executed process, as demonstrated in applications to atmosphere data services [e.g. 11]. In addition, and, as a strongly complementary option, map streaming with protocols and interfaces such as Web Map Service (WMS) [e.g. 12] allow for easy rendering of large amounts of data remotely.

The link between GIS/OGC interfaces and Planetary Virtual Observatory ones, in terms – among others - of metadata and query capabilities are being explored. The growing set of multi-mission, multi-experiment data on a variety of solar system bodies calls for such integration.

In this respect, the use of existing protocols, their improvement and eventually new ones to allow spatial interoperability in GIS/VO realms are going to be explored, using as targets planetary bodies with the required data coverage and complexity. Particularly, the inclusion of geographic and cartographic elements in Flexible Image Transport System (FITS) labels, in addition to the already existing ones in PDS data is going to be developed.

3. Future developments

Integration and lower overhead on individual scientists (and their workstations/personal computing systems) for processing and accessing data is a trend that will most likely continue, in particular since data volumes are increasing rapidly and so the analytical needs to answer scientific questions over large-scale geographic areas and processes (at regional to global level). The match between VO and GIS approaches is a way forward not only to maximize the scientific exploitation of geographic data for all Solar System bodies, but also to cross-fertilize neighboring disciplines.

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