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Using GRASS GIS as a planning tool for VIR instrument onboard Dawn mission

S. Fonte, A. Frigeri, M.C. De Sanctis, E. Ammannito, E. Palomba, G. Magni, M. T. Capria, F. Capaccioni, F. Carraro, F. Tosi, F. Zambon, D. Turrini, C. Federico, M. Farina and the Dawn Team; Istituto di Astrofisica e Planetologia Spaziali, Istituto Nazionale di Astrofisica, Rome, Italy (sergio.fonte@ifsi-roma.inaf.it)

1. Introduction

Planning observations during an ongoing planetary scientific mission represents an important and delicate task, as every byte of data from these projects embodies huge personnell efforts and investments.

While specific tools are usually provided within almost every instrument or mission, we propose a more generic approach that enables to plan future observation using the experience and skills acquired during the scientific observations up to the moment of planning. The use of Geographic Information Systems (GIS) is spreading among planetary sciences [1] as they offer unique capabilities for geospatial analysis of a wide range of data products.

Within the VIR/Dawn team, we have worked on methods to use GRASS GIS [2] as a planning tool for future observations.

1.1. GRASS GIS

Initially developed by the U.S. Army Construction Engineering Research Laboratory (USA-CERL), since 1991 the Geographic Analysis Support System (GRASS) is maintained by an international team of developers and researchers, and is distributed under the term of the General Public License, the same license of the GNU/Linux operative system [3].

GRASS is written in C and the library functions are accessible, beside C and C++, also from popular scripting languages as Perl or Python. Among others GIS, GRASS is characterized by a modular architecture with specialized software modules (more than 300 in the official distribution) that require a very small memory footprint. The developments of the last 10 years introduced a Graphical User Interface (GUI) and the possibility to use the popular Free Open Source desktop GIS QuantumGIS as an integrated graphical user interface within a GRASS session [3]. GRASS has been ported to almost any existing hardware platform and operative systems, from clusters to palmtop computers.

The availability of both the command line interface and the graphical user interface maximize the range of applications of GRASS GIS.

2. Planning VIR Observations

We have used the vector support available in GRASS to ingest the future observation geometries generated using the C-SPICE Toolkit. This way the footprints of the VIR instrument are being made available into the GIS stack of GRASS, and instrument's coverage of specific targets can be explored and analyzed using data already acquired, as mosaics or single data frames.

The vector analysis functionalities of GRASS allow to use spatial and statistical procedures to study the connectivity of the footprints and to control, for example, how many times a target zone will observed by the instrument.

The database connectivity of GRASS allow to store the planned observations in a remote Spatial Relational Database Management System (S-RDBMS) so that the coverage maps of future observations can be accessed by the scientific team directly through a network using other installations of GRASS or other GIS clients via interoperable protocols.

Figure 1 shows the coverage map of Vesta during the simulation of a real acquisition of VIR instrument in Dawn mission.

3. Conclusions and Future Work

Using the scripting capabilities of GRASS we have developed a system to optimize the observation planning within a GIS environment. Once data is available in GRASS, we take advantage of spatial analysis and visualization capabilities of GIS to study and improve observations strategies, also using already acquired data. Being a Free Open Source Software, the license of GRASS allows access to source code and the pos-

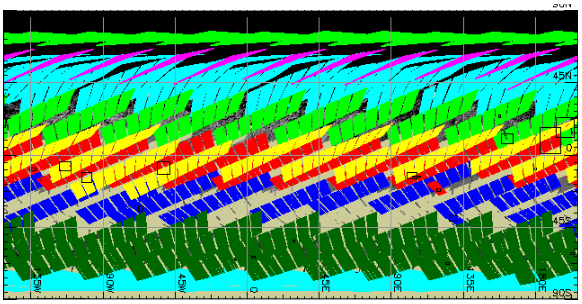

Figure 1: The planned coverage of VIR on Vesta, visualized in GRASS. Footprints' colors indicate the different Dawn cycles around Vesta. Black frames represent selected scientific targets.

sibility to improve the software introducing new functionalities. We plan to develop specific C routines and scripts to enable coverage planning functionalities directly into GRASS GIS.

References

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