ANALYZING LUNAR DTMS THROUGH WEB SERVICES WITH EARTHSERVER/PLANETSERVER-2

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ABSTRACT:

In this abstract we present an approach to analyze a Digital Terrain Model (DTM) located at the Lunar south pole using a web client. The aim of this paper is to describe the structure of the project which involves a server (database) and a client (web interface) side. A case study is proposed where the tool will be evaluated to calculate illumination conditions. The analyzed area is located on the south pole of the Moon where illumination has been exhaustively studied. The results will be cross-validated with previous studies in order determine their robustness.

1. INTRODUCTION

Earth Server 2 is a H2020 EC-funded project, follow-up from Earth Server (Baumann et al., 2015) aiming at access and exploitation of Big Earth Science data. The project comprises various services related to specific domains. The planetary section of the project is developed at Jacobs University Bremen and it focuses on the visualization and analysis of space mission data on solid planets and moons, using Open Geospatial Consortium (OGC) standards on a web client based on the JavaScript version of NASA's World Wind (Hogan and Gaskins, 2009). The service development has two components: the server and the client side. In the server side data are stored using the Array DataBase Management System (DBMS) Raster Data Manager (Rasdaman), capable of storage and retrieval of multidimensional data (Baumann et al., 1998). In the client side, the data is visualized using NASA's Web World Wind allowing the user to access the data through a web interface.

2. DATA

ESA's Planetary Science Archive (PSA)(Heather et al., 2013) and NASA's Planetary Data System (PDS)(McMahon, 1996) data are publicly available, after limited embargo periods. Therefore the retrieval of planetary data from different missions and instruments is an easy task. Its reduction and processing historically relies largely on users, although recently initiatives provide server-side pre-processing (Hare et al., 2014). Nevertheless, remote, interactive data analysis using on-line service (Oosthoek et al., 2014) is an approach that can benefit users while larger and more heterogeneous datasets are produced.

In the present study, we use data from the Lunar Reconnaissance Orbiter (LRO) hosted in NASA's PDS. The DTM selected for this study covers an area of the Lunar south pole centered in the the region known as Connecting Ridge (CR1) – a potential landing site for ESA's Lunar Lander mission (Carpenter et al., 2012). Previous studies in illumination conditions at CR1 (Gläser et al., 2014a), (Gläser et al., 2014b), (De Rosa et al., 2012) will allow us to cross validate our results.

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3. CASE STUDY

Due to the low inclination of the Moon's rotational axis (1.54^o) and the topography of its south pole, illumination conditions at the Lunar south pole are very extreme. While Permanently Shadowed Areas (PSA) occur, thus the possibility of harboring water-ice, some areas rest in almost continuous illumination (Bussey et al., 2010), (Mazarico et al., 2011). Regardless its heavy computational process (Marco Figuera et al., 2014), the visualization and access to illumination data is also not straightforward, since users need to rely often on own developed tools. A case study is presented to analyze illumination conditions at the lunar south pole using a web interface. The process is divided in two parts: server and client side. On the server side, all the pre-processing and heavy computation will take place. The client side will retrieve the data from the server and display illumination maps and graphic data.

4. SERVICE ARCHITECTURE

In general terms, the Planetary Service (PlanetServer) of EarthServer comprises two sides: the server side (Rasdaman) and the client side (based on NASA Web World Wind). Rasdaman is an Array DBMS (Baumann et al., 1998) offering features such as query languages, query optimization and parallelization on n-D arrays. The Rasdaman data model consists of n-D arrays with individually fixed or variable boundaries. The query language, "rasql", is an ISO SQL extended language allowing declarative array selection and processing with multidimensional operators. The array is partitioned (tiling) and stored along with the processing engine, thus reducing the query response time. OGC standards such as the Web Coverage Processing Service (WCPS) (Baumann, 2009), are implemented in the PetaScope component (**?**), a set of geospatial and geometry libraries, data access libraries and relational database access components.

NASA Web World Wind is a general-purpose 3D/4D client used as a virtual globe to interactively analyze and visualize data. As Web World Wind is completely open-source, one can easily extend its functionality and API to fit in the project purposes. In our study, we use Web World Wind to enable the visualization of

the DTM in a virtual Moon environment and to retrieve illumination information and wrapped it into the virtual globe. Graphical information such as horizon profiles or illumination patterns (amount of illumination over the analyzed period) is also displayed. The communication between client and server side is done by using WCPS to retrieve the data from the database. A general overview of the process and data interaction is shown in Figure 1.

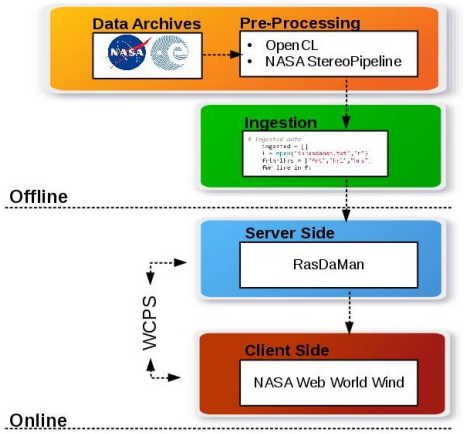

Figure 1: Overview of the project structure's

5. PLANNED DEVELOPMENTS

An early version of the PlanetServer-2 web client applied to the present use case will be provided, as well as the generalized client concept which will increase its capabilities, including additional use cases, throughout the EarthServer-2 project timeline.

Future developments within the present use case will include options for the calculation of illumination conditions over larger areas. We will also evaluate WebGeocalc (Semenov, 2015), a web based SPICE routines repository, together with WCPS in order to calculate the shadowing from the client side.

During the project, PlanetServer-2 Client code and server-side components are going to be publicly released.

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