TEMPORAL AND SPATIAL FOOTPRINT COVERAGES OF EARTH OBSERVATION DATA

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ABSTRACT:

This paper describes the Web Mapping Service (WMS) developed for the Committee on Earth Observation Satellites (CEOS) that portrays Earth Observation (EO) footprint coverages by sensor. The CEOS Working Group on Information Systems and Services (WGISS) Data Services Task Team serves as a forum for the exchange of technical information about Web-and Internet-related software technologies of interest to the EO community. This includes Web services in general and Web mapping services in particular. In order to facilitate the construction of interoperable service infrastructures, the Data Services Task Team closely observes and interacts with international standardization activities and test beds and makes the results available to CEOS parties and the EO community at large. This particular WMS allows EO researchers to determine if sufficient coverage of their area of interest is available from a specific sensor. The service supports regional or global spatial querying and provides extensive complementary information such as land cover, elevation, transportation networks, and feature names to assist in the investigation of study areas. This capability also allows spatial data gaps to be recognized immediately, which is a primary objective of the service. A temporal element is provided to permit researchers to compare their area of interest coverage by calendar year or season, which is especially useful in studies involving biologic features. The WMS service contains more than 1,000 footprint coverage files and allows for other organizations to link to and provide their own footprint coverage files, thus extending the value of the service to CEOS and the larger EO research community.

1. INTRODUCTION

The CEOS[1] WGISS Data Services Task Team sponsors a Web Map Service as part of its mission to learn about and share information related to Web technologies. The service portrays the ground coverage, or footprints, from Earth observing satellites. While the motivation for the service was initially to go beyond statistics in characterizing satellite holdings, the original concept grew out of work that described CEOS satellite holdings in a tabular fashion[2].

Representing those holdings in a spatial and temporal context was perceived to be more useful than tabular means or monthly reports detailing the number of images (Fig. 1). A follow-on strategic goal was to graphically describe data-rich areas as well as locate gaps in coverages. The data gap concept is somewhat related to earlier efforts in gap analysis[3]. A final goal was to allow other organizations involved in Earth observation to link to the service and pull the coverages for their particular uses.

USGS Digitial Holdings		Tapes	Granules
Shuttle Radar Topography Mission (SRTM)			
SRTM DTED© Level 1		13	14,277
SRTM DTED© Level 2		7	1,095
	Total SRTM	**20**	**15,372**
Landsat			
Landsat MSS		20,191	659,530
Landsat TM		49,821	662,237
Landsat ETM+		TBD	515,860
	Total Landsat	**70,012**	**1,837,747**

Figure 1. Excerpt from a typical USGS monthly report.

2. MAIN BODY

In order to accomplish the stated goals, metadata from a relational database management system were used to build Environmental Systems Research Institute[*] (ESRI) shapefiles. These shapefiles were loaded into an Oracle ArcSDE Database and displayed in the interactive viewer using an Open Geospatial Consortium (OGC) Web Map Service (WMS) map service. For many of the coverages, the temporal elements of both years and seasons were added, allowing researchers to analyze the available satellite coverages over time.

The Earth observation satellite coverages used include the following collections:

- Landsat Multispectral Scanner (MSS)
- Landsat Thematic Mapper (TM)
- Landsat Enhanced Thematic Mapper Plus (ETM+)
- Landsat Ground Station Operators Working Group MSS
- Landsat Ground Station Operators Working Group TM
- Landsat Orthorectified Panchromatic
- Landsat Orthorectified Multispectral
- Landsat Orthorectified Thematic Mapper
- Satellite Pour l'Observation de la Terre (SPOT) (North America)
- Declassified Satellite
- Shuttle Radar Topography Mission 90 Meters (SRTM)
- Shuttle Radar Topography Mission 30 Meters
- Earth Observing-1 Advanced Land Imager (ALI)
- Earth Observing-1 Hyperion
- Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Digital Elevation Models (DEM)

Future additions may include satellite coverages from U.S. commercial firms operating high-resolution satellites. These companies currently include Space Imaging Inc., DigitalGlobe Inc. and ORBIMAGE Inc[*].
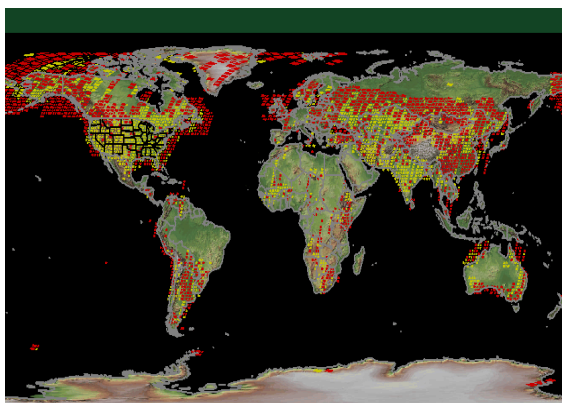
Figure 2. WMS depicting March–May 1975 Landsat Multispectral Scanner Footprints
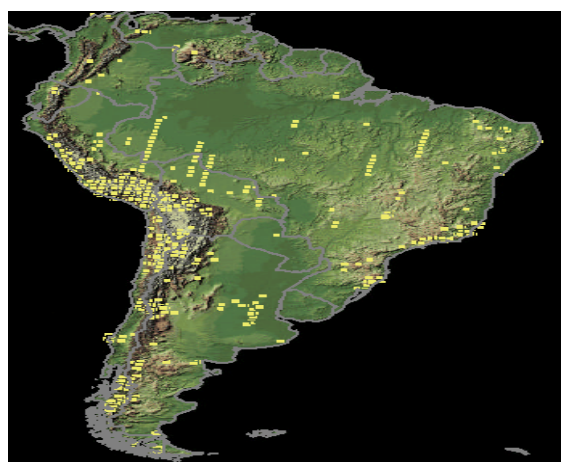

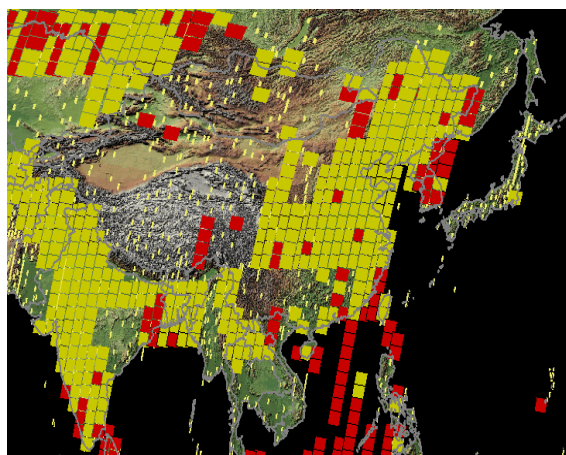Figure 3. South American coverage for all years of ASTER DEM

Figure 4. Asian coverage from summer 1975 Landsat Multispectral Scanner (large yellow and red footprints) and all Earth Observing-1 Advanced Land Imager (small yellow footprints)

Examples of the results are portrayed in the following figures. Red footprints indicate all Landsat coverages, while yellow footprints represent Landsat coverages having less than 30% cloud cover and good to best qualities. Figure 2 illustrates

capabilities used to examine the global records for particular satellite collections. The specific view represents Landsat Multispectral Scanner footprints for March-May 1975. All of the Landsat coverages allow seasonal and annual depictions. Figure 3 frames a continental view of ASTER DEM coverages. Figure 4 combines full-year Landsat Multispectral Scanner and Earth Observing-1 Advanced Land Imager coverages over an area in Asia.

- Any use of trade, product, or firm names is for descriptive purposes and does not imply endorsement by the U.S. Government.

3. CONCLUSIONS

The Web Map Service developed for the CEOS WGISS Data Services Task Team meets the goals of going beyond static reports, providing a means to view spatially and temporally (data-rich and data-gap) areas, and allowing other interested groups access to the coverages. The last goal has been accomplished as a collaboration of the University College London, the British National Space Centre, and the United Nations through a WMS established as part of their own efforts supporting CEOS. This group created the Integrated CEOS European Data Server, or ICEDS[3]. That work obtains the ASTER DEMs from the service described in this paper.

The spatial and temporal footprint coverage server contains more than 2,000 layers from multiple Earth observation satellite platforms. The ability to examine where areas have an abundance or lack of satellite coverage can assist researchers as they determine their data needs. The existing service has great potential for growth both in terms of adding more satellites and allowing other WMS access to the satellite coverages contained within it. Long-range plans may include providing scene-level metadata for each footprint, browse imagery, and ordering.

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Integrated CEOS European Data Server (ICEDS)", http://iceds.ge.ucl.ac.uk:8080/viewer/iceds/index.html.