GGOS and Virtual Observatory

Geodetic Webservices thanks to VO-table format developed by astronomers

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Keywords

Virtual Observatory, Metadata, Webservices, Space geodesy, Time series, Interoperability, Interface Astronomy-Geophysics.

Abstract

One of the objectives of GGOS is to develop a web portal in order to promote very important and valuable products of the IAG services.

All the relevant data and products for Earth sciences and applications have to be made accessible through a GGOS portal. The development of such a tool will certainly require to work on the notions of **interoperability, standardization, data access protocol, data model, web services**.

The focus of this paper is to present the International Virtual Observatory Alliance (IVOA), which develops all these concepts in the **field of astronomy/astrophysics** since a few years. We also present the geodetic and fundamental astronomy component of the French part of IVOA, group called OV-GAFF. This group works on the definition of standards for the geodetic community (in terms of data model and Unified Content Data for example) and on the development of webservices.

We briefly discuss the advantages for GGOS to develop its portal in the context of virtual observatory, and in particular thanks to **metadata described with a specific format, VO-table**, developed by IVOA: the user is allowed to search for data wrt time or space, and heterogeneous data can be compare and transformed in an easy way.

Time series within and around « geodesy »

Geodetic products on the basis of scientific studies concerned by geodesy:

- Links between terrestrial and celestial frames: precession-nutation parameters, universal time,
- Earth's rotation: Lenght of day, polar motion,
- Terrestrial frame: time series of station coordinates, transformation parameters, scale, gravitational constant,
- Gravity field: long, medium and short spatial wavelenghts, mass transfer mainly through fluid layers, temporal variations, data coming from the geophysics community (hydrology, oceanic circulation etc…)

VO-table format and Webservices

Use of data where they are stocked : VO-Table format (XML)

- To facilitate links between communities,
- Data need not to be duplicated
- Our database :
  - Contains solutions realized in an homogeneous reference frame over a given period of time (e.g. only one position and velocity per period for a station)
  - Is a PostGre SQL DB which gives access to:
    - **Time series per technic or analysis center**
    - **All solutions (per technic or analysis center) available for a given parameter**

Webservices

- Compatibility between different s/w is ensured by VO-Table format
- Many existing tools using VO-Table format: visualization, transformation, extraction of data…

Example:

ASCII file

date	soln	resph	sigph	reslb	siglb	resh	sigh
2001.847945205479 39	1	37.9	54.86	8	44.77	1	55.87
2002.395890411 0958 03	1	51.1	27.71	41.1	33.36	24.5	24.55

VO-Table file

Contains fields,

as well as information

describing the different fields

```
<FIELD unit="year" datatype="double" name="date"/>
<FIELD unit="ind" datatype="double" name="soln"/>
<FIELD unit="mm" datatype="double" name="resph"/>
<FIELD unit="mm" datatype="double" name="sigph"/>
<FIELD unit="mm" datatype="double" name="reslb"/>
<FIELD unit="mm" datatype="double" name="siglb"/>
<FIELD unit="mm" datatype="double" name="resh"/>
<FIELD unit="mm" datatype="double" name="sigh"/>
<DATA>
  <TABLEDATA>
  <TR>
    <TD>2001.847945205479 39</TD>
    <TD>1</TD>
    <TD>37.9</TD>
    <TD>54.86</TD>
    <TD>8</TD>
    <TD>44.77</TD>
    <TD>1</TD>
    <TD>55.87</TD>
  </TR>
```

Data and Webservices available

OCA-GEMINI Java Time Series Tool: OCA provides its time series of station coodinates and EOP, and of various groups linked to ILRS, IGS, IVS: **http://www.obs-azur.fr/gemini/equipes/gmc/systref/visu.html**

Range bias per laser station found by OCA-GEMINI, between station intrumental changes: http://maestro.obs-azur.fr/cgi-bin/query_mrb.pl

OP EOP-PC: time series of EOP coming frim IERS, at Paris Observatory: **http://hpiers.obspm.fr/eop-pc/**

OP ICRS-PC: page devoted to ICRF and radio sources, at Paris Observatory: **http://hpiers.obspm.fr/icrs-pc/**

French IVS Analysis Center (Paris Observatory):http://ivsopar.obspm.fr

Links gathered on the ov-gaff web-page:

http://www.obs-azur.fr/heberges/ov-gaff

A « new science » possible through VO-concept

We are convinced that the concept provided by International Virtual Observatory Alliance (***http://www.ivoa.net***) could help our wide scientific community (fundamental astronomy, geophysics, geodynamics) to solve some problems which absolutely require contributions from each component of this community.

The **scientific goals** are, among others:

- carrying out solutions of geodetic products be comparable in an homogeneous way,

-developing webservice to directly interact within scientific analysis s/w,

- developing an efficient interface between different scientific communities linked to geodesy (fundamental astronomy and geophysics, in particular).

Metadata and Geodetic Webservices at Observatoire de la Côte d'Azur

Available data:

• Time series generated by OCA SLR analysis center (EOP + station coordinates)

• Time series provided by other groups

• Biases per SLR stations, adjusted between two technological events.

Work done:

• Definition of the database's structure, for reference frame analysis purposes.

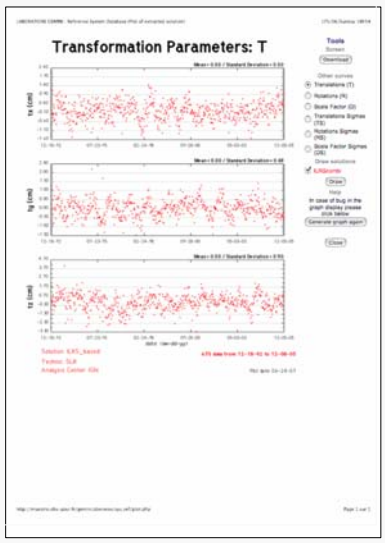
• Automatization of various steps of SLR data analyses (inside s/w GINS, DYNAMO, MATLO, CATREF).

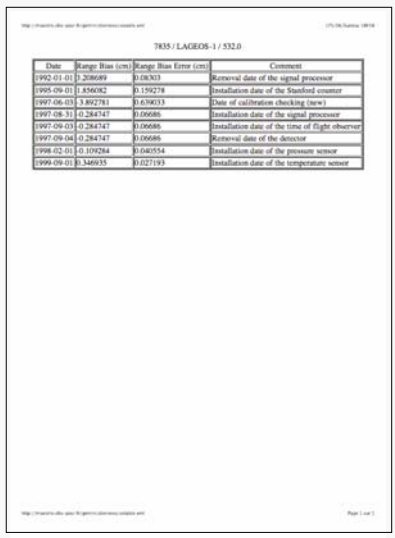
Work in progress

• **Time series of station coordinates** (SLR, LLR), **following user's requests** to account (or not) for different models of variations (tides, loading, …)

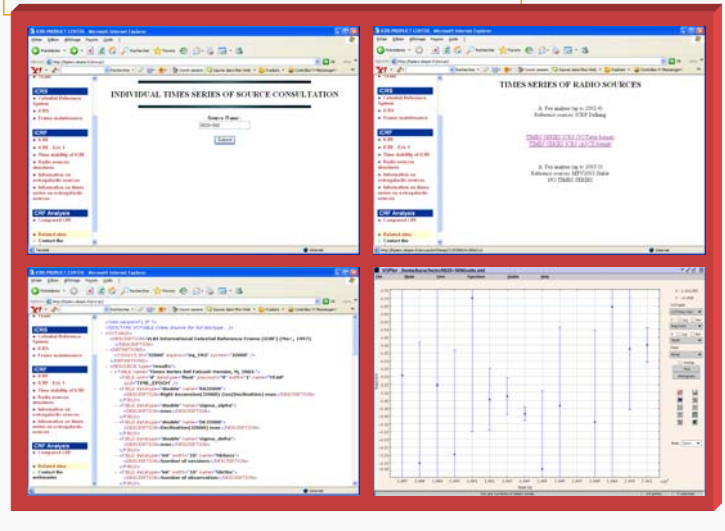
• Adding a « VO-layer » (VO-Table format) within the available data

• Requests for the databse directly through the Web, and visualization of results through a dedicated graphic s/w.





Date	Range Bias (cm)	Range Bias Error (cm)	Comment
1992-01-01	3.208689	0.08303	Removal date of the signal processor
1995-09-01	1.856082	0.159278	Installation date of the Stanford counter
1997-06-03	3.892781	0.639033	Date of calibration checking (new)
1997-08-31	-0.284747	0.06686	Installation date of the signal processor
1997-09-03	-0.284747	0.06686	Installation date of the time of flight observer
1997-09-04	-0.284747	0.06686	Removal date of the detector
1998-02-01	-0.109284	0.040554	Installation date of the pressure sensor
1999-09-01	0.346935	0.027193	Installation date of the temperature sensor



Metadata and Geodetic Webservices at Paris Observatory

Goals:

• Interoperability of **International Celestial Reference System – Product Center** (ICRS-PC),: connected with CDS Web site.

• Interoperability of **IVS Analysis Center/Data Center** (IVS-OPAR) : availability of VLBII observations and analyses for reference frames.

• Availability of VLBI series, through **time series of radio-source positions**, following the format recommended by IVOA (VO-table).

• Availability of Earth Orientation Parameters, as well as other geodetic products generated by EOP-PC, following a format recommended by IVOA (VO-table).

Next steps:

• Transformation of these time series in VO-Table format, format recommended by IVOA, as well as results of analyses in terms of stability.

•Taking benefit from the VO-table format to analyse dynamical and physical properties of radio sources, thanks to VO dedicated toolboxes.