



# eur PLANET 2024

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1. **Nature:** R = Report, P = Prototype, D = Demonstrator, O = Other

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Public	Restricted to other programme participants (including the Commission Service)	Restricted to a group specified by the consortium (including the Commission Services)	Confidential, only for members of the consortium (excluding the Commission Services)

**Executive Summary / Abstract:**

An update for year 4 of the Virtual European Solar and Planetary Access (VESPA) Virtual Activity of the Europlanet 2024 Research Infrastructure is provided.

Strengthening and sustainability were the main focuses during the fourth year of the project, with major upgrades of several data servers, cleaning of the IVOA registry, and the storage of most existing services in a single GitLab repository. In addition, 3 new services were published, ~15 services drafted, and many existing services upgraded to provide more functions. Both SSHADE and PVOL enlarged their content significantly, with the addition of spectral bandlists to SSHADE and planetary maps to PVOL.

The fourth implementation workshop is being prepared to be held in Warsaw in April 2024. 3 papers have been published, and at least 17 presentations given in international conferences and workshops.

Intense collaborative activity has continued with international consortia, mainly IVOA, IPDA, and IHDEA.

## Table of Contents

<b>1. Explanation of VESPA WP6/VA2 Work &amp; Overview of Progress .....</b>	<b>4</b>
a) Objectives .....	4
b) Explanation of the work carried in WP .....	4
c) Impact to date .....	9
d) Summary of plans for the 6 months extension .....	13
<b>2. Update of data management plan .....</b>	<b>13</b>
<b>3. Follow-up of recommendations &amp; comments from previous review(s) .....</b>	<b>13</b>

## 1. Explanation of VESPA WP6/VA2 Work & Overview of Progress

### a) Objectives

#### Task 1.

- Coordination — ObsParis, JacobsUni + CBK-PAN

#### Task 2.

- Enlarging VO content (beneficiaries) – BIRA/IASB, ObsParis + All
- Design and implementation of services from beneficiaries

#### Task 3.

- Enlarging VO content – JacobsUni, OeAW/IWF + CBK-PAN, ObsParis, CNRS/IRAP
- Design and implementation of services from calls to the community (external AO) and collaborations

#### Task 4.

- Amateur community linking / services – UPV/EHU, OeAW/IWF + ObsParis
- Design and implementation of selected services from the amateur astronomy community

#### Task 5.

- Consolidation – INAF/OATs, Heidelberg Uni + ObsParis
- A system to preserve data service definition files, perform technical reviews, and deploy them on EOSC when relevant

#### Task 6.

- Standards & Sustainability – ObsParis, Heidelberg Uni + JacobsUni, Bristol Uni
- Publication of VESPA standards, contribution to other standards of interest, dissemination through consortia and conferences

### b) Explanation of the work carried in WP

The present report is one of the deliverables of WP6 VESPA VA (D6.15). The other deliverables due in year 4 are:

#	Title	Lead participant	Delivery date
D6.5	New radio services: MASER	ObsParis	13/2/2023
D6.6	Catalogue of exoplanetary disks and related tools	ObsParis	26/4/2023
D6.7	Exoplanet atmospheric composition from observations	UCL	20/5/2023
D6.8	ARTECS service interface	INAF / OATs	4/8/2023

(Other deliverables initially scheduled during year 4 were moved after month 48 with the extension of the VA and are being prepared).

The schematic VESPA infrastructure is summarized in Fig. 1 of the VESPA JRA 4<sup>th</sup> Year Annual Report (D7.9) to help follow this discussion.

Acronyms are explained here: <http://www.euoplanet-vespa.eu/glossaire.shtml>

Tools of interests are listed here: <http://www.euoplanet-vespa.eu/tools.shtml>

### Task 1.

Task 1 is responsible for the overall coordination and management of the VA and connection with the JRA and other WPs. Deliverables and milestones are linked from this page:

<https://voparis-wiki.obspm.fr/display/VES/Deliverables+and+milestones%2C+EPN2024>

The VESPA Confluence site also contains extensive material about the WP activity.

Coordination of the two VESPA WPs has again focused on maintaining discussions in small groups during year 4, focussing on data services publication and updates, reports and documentation. Larger-scale activities were handled in the VA, as they mainly concerned consistency upgrades of the protocols and standards in use and sustainability.

### Task 2.

• Three new data services were published during year 4:

- MoonsProp (properties of all solar system satellites) at ObsParis/IMCCE (MS79)
- Ionosondes (ionogrammes showing solar events, from MZ152 probe in Poland) at CBK/PAN
- MP3C (global properties of asteroids) at OCA, Nice, from the 2021 implementation workshop.

• Other projects are implemented and under final review. These are expected to be published within the end of the programme:

- ARTECS in OATs (Trieste, It) designed during the 2023 Graz workshop (simulation of exoplanet atmospheres, D6.8)
- 3 solar observation services at KIS (Leibnitz, Ge), as an outcome of the H2020 ESCAPE programme
- 2 solar observation services at ROB (Brussels, Be) designed during the 2021 workshop, connected to the H2020 ESCAPE programme
- NRH & ORFEES radio solar databases at ObsParis
- 4 new LOFAR services with observations of Jupiter at CBK/PAN (MS70)
- Predictions of stellar occultations by natural satellites in the next ~ 10 years, with observability conditions (D6.9)
- GMAP service sharing products derived in the Europlanet GMAP WP (reusing the structure of the existing PlanMap service)
- SpecStar (Stellar spectra to support calibration of telescopic observations of planets) at ObsParis

Advanced drafts will be published in the coming months:

- The PARSEC service (AMU, Po) publishing observations collected by the Europlanet NA2 Telescope Network
- Output of the Solar burst AI pipeline, from NenuFAR observations (ObsParis)
- MESSENGER spectral data of Mercury at DLR (MS66)
- POLARBASE planetary data at CNRS/IRAP
- LuckyStar ERC: occultations by asteroids and their rings, ObsParis

In addition to services started during the 2023 workshop in Graz (see task 3):

- NEOCC for asteroid properties at ESA / ESRIN, Rome
- I-LOFAR radio data at DIAS, Dublin
- NEOROCKS, outcome of the H2020 programme at ASI, Rome
- DAMIT collection of asteroid shape models at Charles University, Prague

The NASA PDS Plasma node has made progress on the publication of its assets – this is a set of ~ 180 EPN-TAP services which are expected to be published in 2024 (started during the 2021 workshop).

Altogether, there are currently 64 EPN-TAP data services accessible through the VESPA portal. We expect to publish ~ 15 additional new services by the end of the programme (July 2024) – another 20 projects are pending, in addition to the ~ 180 NASA PDS PPI collections. The expected increase in the number of services impacts the structure of the portal, as described in the VESPA JRA report (D7.9).

- In the frame of the quality control activity, many services previously installed were deeply upgraded, with new functionalities added:
  - SOIR / Venus profiles: addition of new molecules (profiles or upper limits)
  - NOMAD: addition of CO profiles (follow-up of MS100)
  - Mars\_dust: addition of Martian year 36
  - AMDA: full upgrade of the service. API, das2 client and TFCat reader added to foster interoperability with MASER services at ObsParis
  - CLIMSO: being modified to make regular updates from a very large database
  - VizieR\_planets: content extended to Aug 2023 and completed (follow-up of MS99)
  - PVOL now computes automatic maps of Jupiter and Mars (MS97, distributed outside EPN-TAP in a first step; see task 4)
  - ESA/PSA: modernisation of EPN-TAP interface, validation and addition of more info in metadata (now including more than 30+ million files)
  - Exoplanet Encyclopedia: entire redesign of the infrastructure and data model; addition of exoplanetary disks (under review) and circumbinary planets.
  - Many services have been reorganised to benefit from modern datalink usage and coverages as MOC (lon/lat) or TFCat (time/frequency) – the functionalities have been implemented in DaCHS v2.8 (follow-up of MS96, see JRA report for details). Fixes were also made to ensure correct links to data files (secured with regression tests) or native databases. This activity results in added value for the users, but frequently involves upgrading the servers and sometimes a part of the IT installation in the home institutes.

- SSHADE hosted 45 new datasets with about 2100 additional spectra during year 4, provided by some of the 23 SSHADE partners — more than twice the annual increase during years 2 and 3. The SSHADE database now provides public access to 7500+ spectra of ices, minerals, rocks, organic matters and cosmomaterials (will be D6.13). Extension in the SSDM data-model and improvements in the user interface, in particular the search tools and dynamic plotting tool, have been implemented. Links to other services (TOPCAT, CASSIS, SPLAT-VO) have been added and the SSHADE-spectra EPN-TAP service is updated automatically from the SSHADE database.

The new SSHADE bandlist database currently includes more than 60 absorption and Raman bandlists and 1250 bands (from VUV to far-IR) of ices, organics and minerals. Its data model has been expanded with new properties and its tools and interface to search and display band lists and bands have been improved. The DOI for bandlists has been implemented and the preparation of the interoperable bandlist service for VESPA has also started. Training sessions for database managers have been conducted for one new SSHADE partner, to allow them to create and fill their SSHADE database.

- 69 planetary multiresolution maps (HiPS) are now available for use with tools such as Aladin, with the addition of NewHorizon observations of Pluto this year. A web service converting HiPS to/from WMS has been provided by CNES and installed at ObsParis (<http://voparis-vespa-hips-wms.obspm.fr:8080>). WMS is an OGC/Earth Observation format widely used for planetary surfaces in a GIS context. Although planetary HiPS traditionally provide contextual basemaps to overplot other data, they can now be used to extract regions of interest from a range of values — this is particularly

relevant for maps of mineralogical or chemical abundance. This functionality is used in the new VESPA geoportal described in D7.9 (JRA report).

### Task 3.

• The third implementation workshop was held in person at IWF/Graz from May 30 to June 02. The workshop page is located here:

<https://voparis-wiki.obspm.fr/display/VES/2023-vespa-implementation-workshop>

Five projects were selected from the public call, others were invited:

Project	Institute	Status
I-LOFAR	DIAS Ireland, Dublin	External, selected
DAMIT	Charles University, Prague, Czech Republic	External, selected
NEOCC	ESA / ESRIN	External, selected
CIGAR	Institute of Geophysics PAS, Po	External, selected
AMMy	Faculty of Physics, University of Warsaw, Po	External, selected
PARSEC	Adam Mickiewicz University, Poznan, Po	From Europlanet NA2
NEOROCKS	ASI (Italian Space Agency)	Invited
ARTECS	INAF / OATs, Trieste, It	From Europlanet

Relying on previous experience, this workshop was carefully prepared in advance to be as efficient as possible. In particular, draft services were developed on DaCHS servers installed on Docker and deployed on the EOSC infrastructure. All service files were stored on the VESPA Gitlab installed at ObsParis during year 1, with external access (AAI) provided by GÉANT – this greatly facilitated interactions with the teams in post-workshop phases.

This workshop was particularly successful. AMMy and CIGAR are Earth-related geophysics projects driven by students. The other projects are approaching completion and will be published in the coming year.

- In parallel, the follow-up of the previous workshop (held online in Dec 2021) continued:
  - The NASA/PDS Planetary Plasma Interaction Node (PPI), represented by UCLA, plan to make their complete data holdings available as EPN-TAP services. This encompasses ~ 200 datasets, 168 of which are currently installed in draft versions.
  - The two solar projects from the Royal Observatory of Brussels (sunspot and coronal holes catalogues) are under final review.
  - MP3C (properties of asteroids) is published

• The fourth implementation workshop will be held in Warsaw during spring 2024.

• Besides, Europlanet/VESPA communities have been declared on [EUDAT](#) and [Zenodo](#), with a minimal set of metadata. These areas may be helpful to provide access to data collections which are difficult to describe in EPN-TAP, in particular experimental data from Europlanet

TAs, and still maintain a link with Europlanet and VESPA: an EPN-TAP service may gather such collections in the future, although collections on Zenodo are not searchable at granule level. Such a service may also link to GitHub repositories, e.g. the Exoplanet atmospheric composition data at UCL (D6.7).

#### Task 4.

- PVOL now includes more than 65,500 amateur images (amounting to 24 GBs of data), with ~ 3900 new images in 2023. Although this represents another increase of 6% this year, it reflects a slow-down in user contributions related to a policy incorporated in 2023 against uploading images processed with Artificial Intelligence (AI) noise reduction software. AI tools became very popular over 2023 in amateur astronomy. However, the current tools produce important artefacts such as unrealistic cloud structures, which are easily spotted. PVOL now has a warning against the upload of such images (see [http://pvol2.ehu.eus/pvolfiles/AI\\_note.html](http://pvol2.ehu.eus/pvolfiles/AI_note.html)). This new policy resulted in the rejection of many submitted contributions and triggered the departure of some contributors.

PVOL hosts navigated images of Jupiter obtained by the JunoCam instrument on the Juno mission. During year 4 data from Perijove 39-44 was uploaded into the system, which currently hosts 23 GBs of Junocam images. Data from PJ45-48 is calculated and will be uploaded over January 2024.

The PlanetMap side of the project was installed and validated during year 4. It consists of an automated pipeline producing maps from amateur images of Jupiter, Venus and Mars. The images are available in a first step at <http://pvol2.ehu.eus/planetmap/>. It currently consists of 15,000 maps of Jupiter from 5,000 amateur images of the planet obtained in 2022 and 2023 and will be updated over January 2024. The current data volume of this service is 2.2 GBs.

- The VESPA contribution to Fireball networks in NA2 focused on the FRIPON service – this has been delayed by the activity plan in Marseille, where the main repository of images is located (outside Europlanet). A pipeline to combine observations of the same event from several sites on Earth and retrieve the trajectories has been drafted as a Jupyter notebook.

#### Task 5.

- The “VESPA hubs” activity installed during year 2 relies on a Gitlab server at ObsParis. Service definition files and server configuration files are stored and maintained through Gitlab issues and Pull Requests – this is handled by ObsParis, Constructor Univ and Heidelberg Univ, and has proven an essential part of VESPA sustainability:

- More services and institutes have been accommodated during year 4, and this has proven to be a big help for implementation workshops.

- Continuous Integration is now used to automatically deploy services from the GitLab upon updates, including on EOSC. It may be enlarged in the future to trigger automatic taplint validation.

- An associated mirroring system has been designed to replicate this repository in several places.

- More DMPs have been produced for existing services, see section 2.

- The EPN-TAP service validator installed at ObsParis during year 3 has been upgraded (<https://voparis-validation-reports.obspm.fr/validators/epntap>). This functionality relies on new versions of taplint/TOPCAT (D7.5). It has been used to track and correct issues in services and their declaration in the IVOA registry, and compliance with the evolution of IVOA standards.



### Task 6.

Considerable efforts have continued to address sustainability and to finalize the VESPA standards with international consortia:

- The EPN-TAP protocol and the EPNCore metadata vocabulary from VESPA were validated by the IVOA during year 3 and have become the international standard to publish Planetary Science data in the Virtual Observatory (Erard et al 2022, <https://ivoa.net/documents/EPNTAP/>).
- Work has started recently in the frame of the IVOA Solar System Interest Group to clarify the current document, formalize lists of values as IVOA vocabularies, and to finalize and integrate some thematic extensions. This will eventually lead to version 2.1 of the standard.
- Reference to Coordinate Reference Systems (CRS) is a long-standing issue in EPN-TAP, especially for planetary surfaces. CNES & USGS have provided a registry of body-fixed CRS for the planets, implemented at ObsParis during year 3: <http://voparis-vespa-crs.obspm.fr:8080/web/>. The registry provides the main parameters with an ID and encoding (WKT format) for each CRS defined by the IAU. This ID scheme is being discussed in the new Planetary DWG of the OGC consortium, so that planetary frames are supported in Earth Observation tools. The final version will be used in EPN-TAP to document body-fixed projected data.
- The "Observation facility nomenclature", also of interest to the astronomy community, has progressed:
  - The SPASE registry from heliophysics has been included as an additional source of information.
  - Wikidata, already identified as a major on-line resource, has been used as an additional source. Experience however showed the risk to interface directly with a resource maintained by Internet users. New valuable content from Wikidata is now identified and stored in an intermediate, IVOA-curated database, then ingested in the ObsFacility list. The latter is protected from uncontrolled or undesirable updates of Wikidata content.
  - Meetings have been held with CDS (Strasbourg, France) for coordination of work between institutes. An IVOA Note has been issued (Cecconi et al 2023): <https://ivoa.net/documents/Notes/ObsFacilityWikidata/>
- Simplified tutorials to install services and use tools and libraries have been produced.

### **c) Impact to date**

Interactions with international consortia and projects continued during year 4:

- Involvement in international consortia such as IVOA in astronomy, IPDA for space missions, IHDEA for heliophysics, Research Data Alliance, and EOSC-related bodies is developing further. Most notably, 2 VESPA participants have been appointed chairs of IVOA WG (semantics and applications), and the VESPA deputy leader at ObsParis (B. Cecconi) has been appointed co-chair of the IPDA.
- The adoption of the EPN-TAP protocol by the IVOA and the representation of the Europlanet Society in the IPDA have enforced interest in the context of space agencies: NASA PDS/PPI (converting all their data holdings to EPN-TAP), ESA PSA Guest storage facility (supplementary, non-PDS datasets) and ESAsky (planetary data in an astronomy archive interface). JAXA and ISRO are also studying the use of EPN-TAP on their archives.
- The project of the EPN-TAP data dictionary for PDS4 has also been revived. The IPDA should retire the older and limited PDAP protocol in the coming months, which would leave EPN-TAP as the basic standard to exchange planetary data between space agencies.

- Convergence between metadata vocabularies is progressing between solar system science, heliophysics and astronomy. This activity is handled by consortia and supported by other EC-funded programmes, e.g. OSTrails.
- The two data hub projects supported by CNES and CNRS in France (planetary surfaces and small bodies) are progressing. VESPA will provide VO interoperability to both projects, and SSHADE is included separately. Nearly all CNRS/INSU-certified data services in Planetary Science and Heliophysics are now connected through EPN-TAP and the VESPA portal (FRIPON at draft level).

#### Conferences and meetings:

- Events:
  - VESPA contributed to the organisation of the IHDEA meeting organised at ObsParis on 10-13 July 2023, where convergence of standards from heliophysics, astronomy and planetary science were discussed.
  - VESPA contributed to the ERIM meeting in Bratislava (19-23 June) with a topical workshop and participated in other activities.
- Conferences:
  - A dedicated data session (MITM open science and data tools) was organized at the joint DPS-EPSC meeting 2023 (San Antonio, Tx, USA, 2-6 Oct 2023) with 2 presentations and 1 poster related to VESPA.
  - The VESPA team attended the AGU meeting (San Francisco, 4-8 Dec) and contributed to the IPDA booth. Presentations were also given at the PV2023 conference (CERN, Geneva, 2-4 May; 2 presentations and 1 poster) and the ADASS conference just before the IVOA fall Interop (Tucson, Az, USA 6-9 Nov; 1 presentation and 5 posters).
- Workshops:
  - VESPA activities were presented at IVOA spring and fall Interop meetings (Bologna, It, 8-12 May and Tucson, Az, 10-11 Nov; 6 presentations each time), the IPDA Steering Committee meeting (29-30 June, Flagstaff, Co/US), and the DASH meeting (Data, Analysis, and Software in Heliophysics) in APL, Laurel, USA (9-11 Oct).
  - At national level, VESPA and SSHADE gave extended presentations at the French meetings of the CNES planetary surfaces data node (17 May) and SF2A (French professional astronomy society) annual meeting (Strasbourg, June 2023). Several more technical presentations were given at ASOV (French VO) annual meeting (ObsParis, 28-30 Apr)

#### Publications

7 peer-reviewed papers using or discussing VESPA have been published during year 4 – 5 were published during year 3 (revised number).  
At least 17 abstracts were accepted in international conferences.

#### **VESPA Access provisions to Research Infrastructures**

Data access is difficult to monitor with a system of distributed servers.

- As in the previous years, access to [VESPA EPN-TAP services](#) is extrapolated from statistics of the main planetary science server in ObsParis, which hosts 25% of VESPA services, then checked for consistency with analysis of connections on the heliophysics and radio servers

(another ~10% together). Bots and spiders' access are filtered, and the figures appear stable relative to year 3 with **an estimate of 2000 monthly visits from 500-800 unique visitors** for all EPN-TAP services, see Fig. 1 (the download volume is not actually monitored). The major users are the National Astronomical Observatory of Japan (as it has been for several years), French institutes (including the VESPA portal which collects queries from many places), ESA (mostly ESTEC this year), and various academic institutes in Europe and the US, including NASA centres. Occasional peaks from unexpected countries observed in 2023 have disappeared, confirming their suspicious origin (from Norway, Russia and China).

To estimate the evolution during the programme is equally difficult. For instance, the pages access on the servers have almost doubled from last year – this partly results from increasing monitoring from IVOA tools, and such housekeeping accesses are difficult to filter. In 2023, the **VESPA portal** alone (<http://vespa.obspm.fr>) has received **~ 200 monthly visits for 8,000 page views** (with the usual peak during the EPSC conference). Access statistics on the servers are more comprehensive than the portal, as they also include connections via tools, command line, and other APIs; conversely, many queries can be issued during a single visit of the portal.

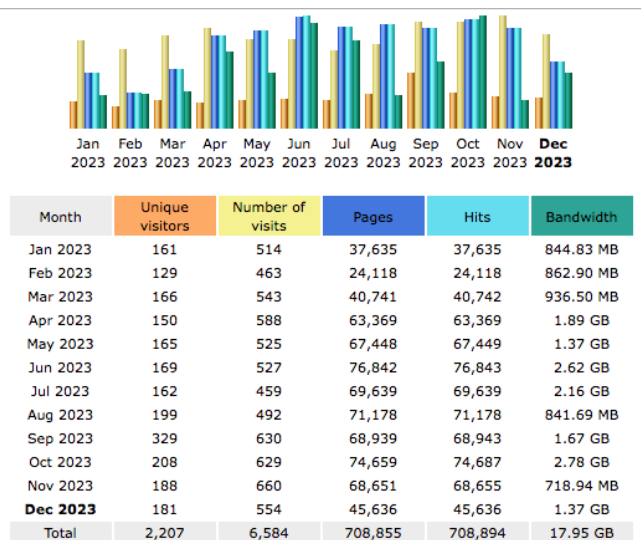


Fig. 1: 2023 statistics for the main server at ObsParis, providing 25% of VESPA content. Bandwidth only refers to metadata, and Dec 2023 is incomplete.

Altogether, the most robust estimate of the usage of the VESPA data services seems to compile statistics of the main 3 EPN-TAP servers in ObsParis *through the portal only* (Fig. 2). This is free from bot access but still includes a fraction of technical access (portal maintenance) and excludes direct requests to ObsParis servers and all requests to the other servers; an unknown scaling factor therefore applies to retrieve the actual figures. However, the evolution is assumed representative of the growing audience of VESPA data services — **an increase of 50% over the last 3 years** (or by a factor of 5 to 8 over a 4-year period if we include the year 2020). SSHADE and PVOL, the main access of which is independent, are reported below.

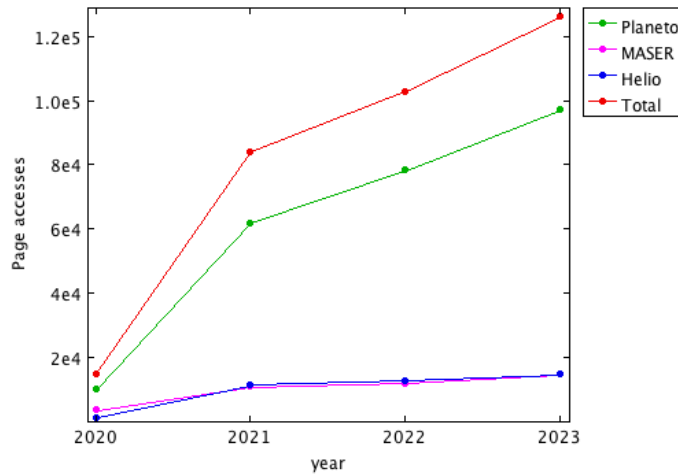


Fig. 2: Evolution of annual access to the main 3 servers in ObsParis through the portal only. This provides the evolutionary trend of the usage of EPN-TAP data services.

- **SSHADÉ** is simpler to monitor, as regular users are registered: currently 550 (increasing by more than 20% since last year). The main access is through a single dedicated interface, not the VESPA portal; SSHADÉ access statistics must therefore be added to the VESPA servers above. **Raw aggregate statistics for SSHADÉ indicate 2800 visitors and 6600 visits per month** (most are not registered), with ~8 GB downloaded each month (with stable repartition: Europe 44%, N America 31%, Asia 22%, Other 3%).

- **PVOL** now has 496 registered contributors, which reflects another 10% increase during year 4. The number of files registered in the system is now 65,510 – see Fig 3 and task 4 above for comments.

PVOL has accumulated 979,000 image views since the start of the service. Most of these originate from China (64%) and the US (17%). In the past 2 years, accesses from China have been unrealistically high and probably reflect activity from internet bot systems. A large part of accesses from the USA also seems affected by bot activities. The next countries with the most access are: Spain (5%, or 49,000 views; this is considered reasonable because the service is hosted in Spain and is popular there), Ukraine (4.5%, with its peak activity in 2020, therefore possibly affected by bot activity), Canada (1.6%), Australia (1.5%), France (1.0%), UK (1.0%), Greece (0.6%) and Italy (0.5%). An analysis of the overall activity suggests that the **total number of true accesses to PVOL is in the order of 200,000 since 2016, with 30% of true accesses produced during year 4 of the programme**. These accesses are counted on the PVOL native web interface and must be added to VESPA server statistics.

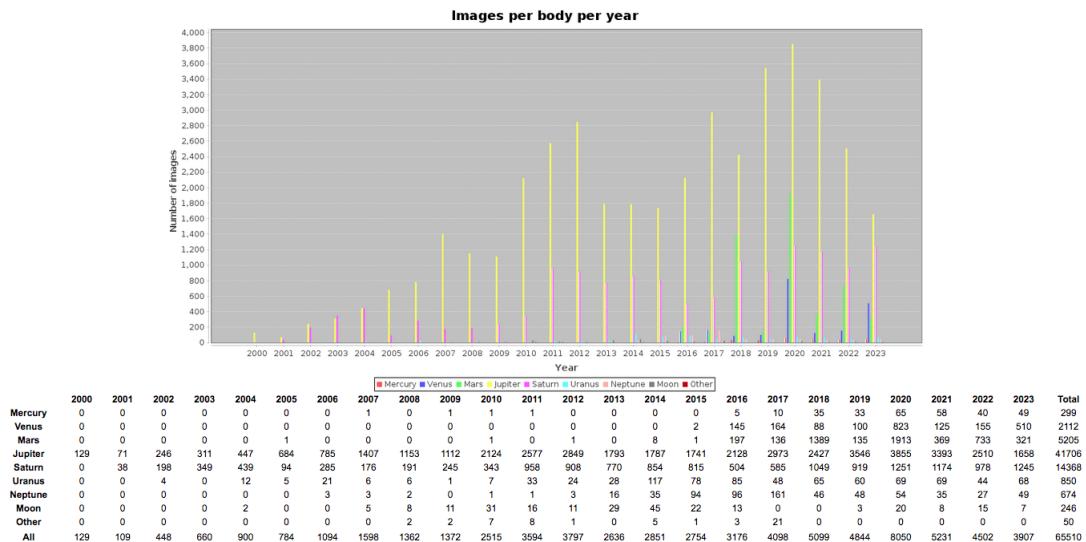


Fig. 3: PVOL content statistics, 21 Dec 2023.

#### d) Summary of plans for the 6 months extension

Objectives for the remaining of the programme include:

- Organizing the 4th VESPA implementation workshop in Warsaw, and finalizing projects started during the 2021 and 2023 workshops.
- Finalizing the milestones and deliverables according to schedule and providing more data services from beneficiaries and collaborations. Our roadmap is visible here: <https://voparis-wiki.obspm.fr/display/VES/EPN-TAP+Services>
- Publication of a data service for the NA2 telescope network
- Consolidation of the PlanetMap service in PVOL, where only a fraction of the final data is now available.
- Progress on DOI for data collections, which is related to local policies – e. g., in ObsParis this depends on choices at PSL University, which are progressing slowly.
- Finalizing the modernization of the registry, in compliance with new IVOA standards.
- Progress in the Observation facility list and using it with EPNCore.
- Progress with the EPN-TAP v2.1 document by integrating mature extensions, and possibly a scheme for coordinates frames.
- Continuation of interactions with consortia: attendance to the IVOA spring Interop meeting, at least remotely.

#### 2. Update of data management plan

The VESPA contribution to the Europlanet DMP was updated in February 2022 (and praised by the review board).

Detailed DMPs have been implemented since year 3 for several individual EPN-TAP services in various institutes:

<https://voparis-wiki.obspm.fr/display/VES/Individual+DMP+of+EPN2024RI+collections>

#### 3. Follow-up of recommendations & comments from previous review(s)

- The RP2 report review letter mentions

“A rather significant number of milestones remain not reached, without explanation, notably MS 48, ..., 66, 68, 70.” (MS50 and 60 are not from VESPA)

This has been answered in real time:

- MS66 (Mercury maps) has been reached (shortly published in December 2022, then removed). This was an assessment study of the coming D6.12.
- MS68 (SPICAM and SPICAV data) - the Mars part has been published in Nov 202 (SPICAM service); the Venus part is covered by updates of the SOIR service in 2023.
- MS70 (New data services at CBK-PAN) – CBK-PAN servers were updated during year 3 and suffered from an undetected publication issue. The Ionosphere service is now available in the VESPA portal, 3 other services are published in the IVOA registry but not yet linked from the portal (being fixed).
  
- MS48: see VESPA JRA report
- Other MS have been reached in the meantime
  
- The extensive review document also mentions  
“Ways to give stronger incentives for users to acknowledge VESPA and, especially, SPIDER need to be devised.”

This is a classical issue with data access systems: they are considered useful if they do not interfere with the user workflow.

We’ve added on most web sites a request to mention the usage of the VESPA infrastructure if found useful, which is the usual practice.