



EPN2020-RI

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Deliverable 5.6 Second PSWS Annual Report

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Responsible WP Leader: CNRS, Nicolas André

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Dissemination level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Service)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (excluding the Commission Services)	

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Abstract: Under Horizon 2020, the Europlanet 2020 Research Infrastructure (EPN2020-RI) will include an entirely new Virtual Access Service, “Planetary Space Weather Services” (PSWS) that will extend the concepts of space weather and space situational awareness to other planets in our Solar System and in particular to spacecraft that voyage through it. PSWS will make twelve new services accessible to the research community, space agencies, and industrial partners planning for space missions. These services will in particular be dedicated to the following key planetary environments: Mars (in support of the NASA MAVEN and European Space Agency (ESA) Mars Express and ExoMars missions), comets (building on the outstanding success of the ESA Rosetta mission), and outer planets (in preparation for the ESA JUperiter ICy moon Explorer mission), and one of these services will aim at predicting and detecting planetary events like meteor showers and impacts in the Solar System. This will give the European planetary science community new methods, interfaces, functionalities and/or plugins dedicated to planetary space weather as well as to space situational awareness in the tools and models available within the partner institutes. The present report summarizes the status of the project after the second year.

Contents

1. Continuous reporting	4
1.1 Publications	4
1.2 Dissemination	4
1.3 Deliverables	5
1.4 Milestones	5
2. Explanation of the work carried out by the beneficiaries and Overview of the progress	6
2.1 Objectives	6
2.2 Explanation of the work carried per WP	7
2.3 Impact	8
2.4 Statistics	9
2.5 Access	9
3. Deviations from Annex 1	9
Annex 1. PSWS participants	11

1. Continuous reporting

The following sections will be also fed into the portal, under the continuous reporting, so that this document constitutes part of the second periodic report, for the second year of the project (PM12-PM24).

1.1 Publications

4 in total, including 3 for this period

1. N. André, M. Grande, N. Achilleos, M. Barthélémy, M. Bouchemit, K. Benson, P.-L. Blelly, E. Budnik, S. Caussarieu, B. Cecconi, T. Cook, V. Génot, P. Guio, A. Goutenoir, B. Grison, R. Hueso, M. Indurain, G.H. Jones, J. Liliensten, A. Marchaudon, D. Matthiä, *et al.*, Virtual Planetary Space Weather Services offered by the Europlanet H2020 Research Infrastructure, <https://doi.org/10.1016/j.pss.2017.04.020>, 2017

2. V. Génot, L. Beigbeder, D. Popescu, N. Dufourg, M. Gangloff, M. Bouchemit, S. Caussarieu, J.-P. Toniutti, J. Durand, R. Modolo, N. André, B. Cecconi, C. Jacquy, F. Pitout, A. Rouillard, R. Pinto, S. Erard, N. Jourdane, L. Leclercq, S. Hess, M. Khodachenko, *et al.*, Science data visualization in planetary and heliospheric contexts with 3DView, *Planetary and Space Science*, <https://doi.org/10.1016/j.pss.2017.07.007>, 2017

3. A.P. Rouillard, B. Lavraud, V. Génot, M. Bouchemit, N. Dufourg, I. Plotnikov, R.F. Pinto, E. Sanchez-Diaz, M. Lavarra, M. Penou, C. Jacquy, N. André, S. Caussarieu, J.-P. Toniutti, D. Popescu, E. Buchlin, S. Caminade, P. Alingery, J.A. Davies, D. Odstrcil, L. Mays, *et al.*, A propagation tool to connect remote-sensing observations with in-situ measurements of heliospheric structures, *Planetary and Space Science*, <https://doi.org/10.1016/j.pss.2017.07.001>, 2017

1.2 Dissemination

14 in total, including 9 for this period

1. Gangloff, Michel; Génot, Vincent; Cecconi, Baptiste; Andre, Nicolas; Budnik, Elena; Bouchemit, Myriam; Jourdane, Nathanaël; Dufourg, Nicolas; Beigbeider, Laurent; Toniutti, Jean-Philippe; Durand, Joelle, Planetary plasma data analysis and 3D visualisation at the French Plasma Physics Data Centre, DPS-EPSC conference, Pasadena, October 2016 (Scientific Community)
2. Grande, Manuel; Andre, Nicolas; COSPAR/ILWS Roadmap Team, Comparative Science and Space Weather Around the Heliosphere, DPS-EPSC conference, Pasadena, October 2016 (Scientific Community)
3. André, Nicolas, Manuel Grandé and the PSWS Team, Operational Planetary Space Weather Services for the Europlanet 2020 Research Infrastructure, EGU General Assembly, EGU General Assembly 2017, held 23-28 April, 2017, Vienna, Austria (Scientific Community)
4. Génot, Vincent; Dufourg, Nicolas; Bouchemit, Myriam; Budnik, Elena; André, Nicolas; Cecconi, Baptiste; Gangloff, Michel; Durand, Joelle; Pitout, Frédéric; Jacquy, Christian; and 4 co-authors, Recent advances of the French Plasma Physics Data Centre (CDPP) in the context of Europe funded projects, EGU General Assembly 2017, held 23-28 April, 2017, Vienna, Austria (Scientific Community)
5. A. Goutenoir, M. Indurain, M. Bouchemit, P.-L. Blelly, A. Marchaudon, N. André, V. Génot, System architecture enabling runs on request for a Transplanet model of magnetosphere-

ionosphere coupling at Earth, Mars, and Jupiter, Japan Geoscience Union Meeting, 20-25 May 2017, Chiba, Japan (Scientific Community)

6. Marchaudon, et al., Development of new ionospheric on-line tools in the frame of CDPD Superdarn workshop, San Quirico D'Orcia, 4 - 9 June 2017, Italy (Scientific Community)
7. M. Indurain, A. Goutenoir, M. Bouchemit, P.-L. Blelly, A. Marchaudon, N. André, V. Génot, A Transplanet model of ionosphere-magnetosphere coupling, CCMC-LWS Workshop 2017, 3-7 April 2017, Cape Canaveral, USA (Scientific Community)
8. André, Nicolas, Génot, Vincent, Manuel Grandé, Tao Chihiro, and the PSWS Team, Operational Planetary Space Weather Services for the Europlanet 2020 Research Infrastructure, Japan Geoscience Union Meeting, 20-25 Mayh 2017, Chiba, Japan (Scientific Community)
9. Pierre Le Sidaner, Baptiste Cecconi, Michel Gangloff et al., VoEvent for planetary sciences, IVOA Meeting, Shanghai, 2017

1.3 Deliverables

D5.6 PSWS Annual Report (second year), M24

This document.

D10.2, PSWS Software Development, Public, from M24 to M30

Available by PM30

In addition 3 deliverables internal to the project were also delivered:

- Report about Test results and space weather connections in the inner Solar System, IAP, 15 January 2017.
- Report about 'Test results and definition of reliability factors for solar wind propagation', WIGNER, 15 January 2017.
- Report about 'System architecture and functionalities for the Mars radiation environment', ABER, 15 January 2017.

1.4 Milestones

M5.4 PSWS Coordination Meeting

Date : 19 September 2017

Place : Riga, Lettony (during the EPSC 2017 conference, following our PSWS session

there <http://meetingorganizer.copernicus.org/EPSC2017/session/26067>)

M10.1 Prototype Diary Service

Meeting between CNRS and OBSPARIS

Date: 28 June 2017

Place: IRAP, Toulouse, France

Specifications frozen and first XML files produced

<https://voparis-confluence.obspm.fr/pages/viewpage.action?spaceKey=PSWS&title=VOEvent+Examples>

M10.2 Prototype Alert Service

Meeting between CNRS and OBSPARIS

Date: 28 June 2017

Place: IRAP, Toulouse, France

Specifications and architecture frozen, first xml files produced

<https://voparis-confluence.obspm.fr/display/PSWS/VOEvent+for+PSWS+Specification>

3 additional meetings internal to PSWS were conducted during this period:

- PSWS CNRS/EHU-UPV/Amateur Meeting

Date: 12 & 13 January 2017

Place: IRAP, Toulouse, France

- PSWS CNRS/WIGNER Reliability Meeting

Date: 23 & 27 January 2017

Place: IRAP, Toulouse, France

- VESPA/PSWS Meeting between CNRS, OBSPARIS, IAP, UCL

Date: 23 & 24 February 2017

Place: IRAP, Toulouse, France

2. Explanation of the work carried out by the beneficiaries and Overview of the progress

2.1 Objectives

Space Weather – the monitoring and prediction of disturbances in our near-space environment and how they are controlled by the Sun - is now recognised as an important aspect of understanding our Earth and protecting vital assets such as orbiting satellites and power grids. The Europlanet 2020 Research Infrastructure (<http://www.europlanet-2020-ri.eu/>) aims to enhance the science of space weather, by extending its scope throughout the Solar System. An entirely new Virtual Access Service, “Planetary Space Weather Services” (PSWS, <http://planetaryspaceweather-europlanet.irap.omp.eu/>) has therefore been included in the Europlanet H2020 Research Infrastructure funded by the European Union Framework Programme for Research and Innovation.

The Planetary Space Weather Services will provide 12 services distributed over 4 different service domains – Prediction, Detection, Modelling, Alerts - having each its specific groups of end users. The PSWS portal (<http://planetaryspaceweather-europlanet.irap.omp.eu/>) gives access to an initial presentation of PSWS activities (WP5 and WP10, see below).

2.2 Explanation of the work carried per WP

WP10:

The deliverables of WP10 feed into WP5.

During the second year of the project the Software Development phase of WP10 consisted in adapting and developing software for solar wind propagation, modelling of planetary environments, detection of events, and building of VOEvents. D10.2 PSWS Software Development Report to be delivered in PM30 will summarize these developments.

WP5:

PSWS WP5 includes 12 services that will be partly accessible at the end of year 2 (September 2017).

Those services and their status are summarized below (in parenthesis the institute responsible for the service; in bold the services that relate to WP5 only, the others being also related to WP10):

A1. 1D MHD Solar Wind Prediction Tool (CNRS)

Status: prototyped, operational in September 2017 (PM25)

A2. Propagation Tool (GFI Informatique)

Status: fully operational

A3. Meteor showers (OBSPARIS)

Status: prototyped, operational in September 2017 (PM25)

A4. Cometary tail crossings (UCL)

Status: Software being updated by UCL, preliminary version to be delivered by PM27

B1. Lunar impacts (ABER)

Status: Preliminary software delivered to CNRS, to be put online by PM25

B2. Giant planet fireballs (EHU-UPV)

Status: Software updated, prototype available at http://pvol2.ehu.eus/psws/iovian_impacts/

B3. Cometary tails (UCL)

Status: not started

C1. Transplanet – Earth, Mars (Venus), Jupiter (CNRS)

Status: Fully operational (<http://transplanet.irap.omp.eu>)

C2. Mars radiation environment (ABER)

Status: Software currently developed, preliminary version to be delivered by PM30

C3. Giant planet magnetodiscs (UCL)

Status: Preliminary software delivered by UCL to CNRS

C4. Jupiter's thermosphere (UCL)

Status: Preliminary model outputs delivered by UCL to CNRS

D. Alerts (OBSPARIS)

Status: Specifications and architecture frozen first XML files produced, to be put online by the end of 2017 (PM27)

During the second year of the project the two following services were made operational:

A1. 1D MHD Solar Wind Prediction Tool (CNRS)

This service includes access to propagated solar wind parameters at various planetary bodies (Mercury, Venus, Mars, Jupiter, Saturn) and for different spacecraft (Rosetta, Juno, Maven) using a 1D MHD code developed by Chihiro Tao and used in the CDP/AMDA tool (<http://amda.cdpp.eu>). A dedicated website is currently being designed (<http://heliopropa.irap.omp.eu>).

B2. Giant planet fireballs (EHU-UPV)

Two different packages of software ([JID](#) and [DeTeCt](#)) for inspection of video observations of Jupiter with the aim of recovering impacts of small objects producing bright and short fireballs in the atmosphere of the planets have been prototyped and delivered (http://pv02.ehu.es/psws/jovian_impacts/). Five of such bolides have been identified on video observations of Jupiter obtained by amateur astronomers in June and August 2010, in September 2012, in May 2016 and in June 2017. This project aims to build a fast open source software program released to the large community of amateur astronomers who obtain video observations of Jupiter. The DeTeCt program can be used with [scripting options](#) to analyze several videos or hundreds of observations from different observers. Both softwares currently support the automatic analysis of long sequences of videos.

2.3 Impact

Contact with CCMC established during the CCMC-LSW 2017 workshop (https://ccmc.gsfc.nasa.gov/CCMC-LWS_Meeting/).

Participation to the second Europlanet Impact and Innovation board meeting, 7 September 2016.

Submission of a science session on planetary space weather and climate – science and services at the European Planetary Science Congress 2017 in Riga, September 17-September 22 (<http://meetingorganizer.copernicus.org/EPSC2017/session/26067>).

Preparation of the NA1 workshop on the Sun's influence on planets, Toulouse, October 09 – 11 2017 (<http://planetaryspaceweather-europlanet.irap.omp.eu/workshops.html>).

Submission of a science session on planetary space weather at European Space Weather Week in Oostende, November 27-December 01 2017 (http://www.stce.be/esww14/program/session_details.php?nr=1).

Inclusion of the 1D MHD Solar Wind Prediction Tool service in the ESA SSA programme (Period-E extension, Heliospheric European Science Center) proposed in July 2017.

Preparation of the topical issue on planetary space weather for Journal of Planetary Space Weather and Space Climate – Editor: Jean Lilensten (CNRS).

2.4 Statistics

Statistics for the PSWS portal (website) that has been developed during the first year of the project can be found at:

<http://planetaryspaceweather-europlanet.irap.omp.eu/> **9792 visitors since 01/09/2015 to 27/07/2017**

Statistics for the PSWS tools that have been developed during the first year of the project can be found at the following webpages:

- CDPP/AMDA tool (total number of connections, <http://amda.cdpp.eu/>):

<http://cdpp.eu/AMDA/depotUTILS/stats.html> **6063 connections since 01/09/2015 to 24/07/2017**

- Details on geographical distribution etc. can be found at CDPP/AMDA awstats: <http://amda.cdpp.eu/awstats/awstats.pl>
- Access to CDPP/PROPTOOL (<http://propagationtool.cdpp.eu/>)

Similar tools for statistics will be implemented in all PSWS services by PM30.

2.5 Access

The PSWS External review board is composed of the following independent persons:

Chair : Mark Lester (Male / Univ. Leicester, UK). He will help us to connect with ESA/SSA and space weather-related FP7 projects. mle@leicester.ac.uk

Apostolos Christou (Male, Armagh Observatory, Ireland). He will help us to liaise with the amateur community. aac@arm.ac.uk

Angelica Sicard (Female, ONERA, France). She will help us to connect with industries / space agencies. angelica.sicard@onera.fr

Kirsti Kauristie (Female / FMI, Finland). She will help us to connect with COSPAR and their space weather roadmap. kirsti.kauristie@fmi.fi

The PSWS External review board will be invited to participate in the PSWS coordination meeting organized during the European Space Weather Week in Oostende on November 27, 2017 following our PSWS session there (http://www.stce.be/esww14/program/session_details.php?nr=1).

3. Deviations from Annex 1

PSWS WP5 includes 12 services that will be fully accessible by PM30. Listed below are some of the issues the PSWS Team had to deal with during the second year:

- Travel budget to meet face to face is limited in the programme with face to face meetings restricted each year to the European Planetary Science Congress in September and to the European Space Weather Week in November (N.B.: when we meet our external review board).
- A 6-month extension has been requested by ABER and UCL for the C2: Mars radiation environment and B3: cometary tails services due to some delays in hiring personnel with appropriate skills. This request has been included in the amendment submitted by the coordination on August 2017. CNRS is proposing to provide assistance to ABER and UCL for integrating their models by PM30 and PM42, respectively, into the architecture developed for the C1 Transplanet – Earth, Mars (Venus), Jupiter (Saturn) service operational at <http://transplanet.cdpp.eu>. CNRS is however currently focusing on its own services before starting to develop the required interfaces for other services. The objective is to present prototypes for all PSWS services by EPSC 2017 in Riga end of September 2017 and by ESWW in Oostende in November 2017 for the most delayed ones. From September to November CNRS will be able to focus on the implementation of partner's services.

Annex 1. PSWS participants

PSWS participants are listed below.

Participant	Permanent personnel	Personnel hired by the project
2. OBSPARIS	Baptiste Cecconi Pierre Le Sidaner Jérémie Vaubaillon	Maxime Paillassa, M (09/2016-12/2016)
3. UCL	Nicholas Achilleos Geraint Jones	Patrick Guio, M
4. CNRS	Nicolas André Vincent Génot Alexis Rouillard Pierre-Louis Blelly Aurélie Marchaudon Frédéric Pitout Myriam Bouchemit Jean Lilensten Mathieu Barthélémy	Mikel Indurain, M (01/2015-12/2015) Arnaud Biegun, M (04/2016-06/2016) Antoine Gouvenoir, M (10/2016-08/2017)
11. DLR	Daniel Matthiae	
12. ABER	Manuel Grande Tony Cook	Patrick Dixon, M (18 July 2016-12/2016, part time) Nathalia Alzate, F (04/2017-, 50%)
18. Wigner	Karoly Szego	Andrea Opitz, F (01/09/2015-31/08/2019, 1/3 time) Zsuzsanna Dálya, F (02/2016-04/2016, 50%) Kludia Szabó, F (07/2017-, 50%)
19. IAP	Jan Soucek Benjamin Grison	
23. GFI Informatique	Stéphane Caussarieu Laurent Beigbeder Jean-Philippe Toniutti	
28. UPV/EHU	Ricardo Hueso	Jon Juaristi, M (02/2016-01/2017)
33. SRC PAS	Lukasz Tomasik Mariusz Pożoga Maria Miłodrowska	Piotr Koperski, M (12/2015-05/2016)

Annex 2. PSWS Structure

PSWS activities consist of two work packages with Joint Research activities feeding Virtual Access activities. These activities consist of the following tasks:

- JRA (WP10)
 - *Task 1.Coordination (CNRS, ABER)*
 - *Task 2.Adapting available tools and methods for planetary space weather (UCL, CNRS)*

- *Task 3. Enabling planetary event prediction/ensuring reliability of services (Wigner, OBSPARIS)*
- *Task 4. Testing space weather connections in the Solar System (IAP, DLR, Wigner RCP)*
- *Task 5. Alert Service (OBSPARIS, UCL, CNRS, SRC PAS)*
- VA (WP5)
 - *Task 1. Coordination (CNRS, ABER)*
 - *Task 2. Implementation (UCL, ABER, CNRS, SRC PAS)*
 - *Task 3. Detection (UPV/EHU, UCL, ABER)*
 - *Task 4. Liaison (CNRS, SRC PAS)*

Annex 3. Targeted objectives for year 3

- By PM30

Full access to all services (prototypes)