EPN2020-RI

EUROPLANET2020 Research Infrastructure

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Deliverable 5.5 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, WP5 VA1 "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. WP5 will make five entirely new 'toolkits' accessible to the research community and to industrial partners planning for space missions: a general planetary space weather toolkit, as well as three toolkits dedicated to the following key planetary environments: Mars (in support of ExoMars), comets (building on the success of the ESA Rosetta mission), and outer planets (in preparation for the ESA JUICE mission to be launched in 2022). This will give the European planetary science community new methods, interfaces, functionalities and/or plugins dedicated to planetary space weather in the tools and models available within the partner institutes. It will also create a novel event-diary toolkit aiming at predicting and detecting planetary events like meteor showers and impacts. The present report summarizes the status of the project after its first year.

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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 first periodic report, for the first 12 months of the project.

1.1 Publications

1. Christina Plainaki, Jean Lilensten, Aikaterini Radioti, Maria Andriopoulou, Anna Milillo, Tom A. Nordheim, Iannis Dandouras, Athena Coustenis, Davide Grassi, Valeria Mangano, Stefano Massetti, Stefano Orsini, Alice Lucchetti, Planetary space weather: scientific aspects and future perspectives, 2016, *J. Space Weather & Space Climate* **6**, A31. DOI: 10.1051/swsc/2016024.

Publications in preparation for the special issue of Planetary and Space Sciences on 'Open access, solar system sciences and interoperability', deadline for submission September 5, 2016

1.2 Dissemination

1. Planetary Space Weather Services for the Europlanet 2020 Research Infrastructure, oral presentation, session MT5 EPSC 2019, September 28, Nantes, France (Scientific Community)
2. Planetary Space Weather Services for the Europlanet 2020 Research Infrastructure, invited e-poster, session 8, European Space Weather Week, Ostend, November 23-27, 2015 (Scientific Community)
3. Planetary Space Weather Services for the Europlanet 2020 Research Infrastructure, invited e-poster, session 8, European Space Weather Week, Ostend, November 23-27, 2015 (Scientific Community)
4. Planetary Space Weather Services for the Europlanet 2020 Research Infrastructure, poster presentation, colloquium of the French Solar-Terrestrial Interactions Programme, March 14-16, Hendaye, France (Scientific Community)
5. Planetary Space Weather Services for the Europlanet 2020 Research Infrastructure, poster presentation, EGU General Assembly 2016, held 17-22 April, 2016, Vienna, Austria (Scientific Community)

1.3 Deliverables

D5.5 PSWS Annual Report (first year), M12

This document.

D10.1 PSWS Database Consolidation Report, M12

The Data Consolidation phase consisted in reviewing and defining the needs for improvements and adaptation in the already existing tools, as well as ingesting all required input data in those tools.

1.4 Milestones

- MS31 PSWS Kick-Off meeting, M6 instead of M3

Date: 21 & 22 March 2016

Place: IRAP, Toulouse, France

The agenda & presentations are available on line:

http://planetaryspaceweather-europlanet.irap.omp.eu/dist/presentations.html

Next PSWS coordination meeting: Oostende, 14-18 November 2016

-MS32 PSWS External Review Board, M6

See 2.5, this document

-MS33 PSWS Website, M6

http://planetaryspaceweather-europlanet.irap.omp.eu/

Next major update of the website: December 2016

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

2.1 Objectives

Under Horizon 2020, the Europlanet 2020 Research Infrastructure (EPN2020-RI) includes an entirely new Virtual Access Service, WP5 "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 spacecrafts that voyage through it. WP5 will make five entirely new 'toolkits' accessible to the research community and to industrial partners planning for space missions:

-a general planetary space weather toolkit

-three toolkits dedicated to the following key planetary environments: Mars (in support of ExoMars), comets (building on the success of the ESA Rosetta mission), and outer planets (in preparation for the ESA JUICE mission to be launched in 2022). This will give the European planetary science community new methods, interfaces, functionalities and/or plugins dedicated to planetary space weather in the tools and models available within the partner institutes.

-It will also create a novel event-diary toolkit aiming at predicting and detecting planetary events like meteor showers and impacts.

2.2 Explanation of the work carried per WP

WP10:

The deliverables of WP10 feed into WP5.

During the first year of the project the Data Consolidation phase of WP10 consisted in reviewing and defining the needs for improvements and adaptation in the already existing tools, as well as ingesting all required input data in those tools. D10.1 PSWS Database Consolidation Report summarizes these developments.

WP5:

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

Those services are detailed below:

1. Planetary meteor shower prediction tool (OBSPARIS)
2. Lunar impact detection software (ABER)

3. Giant planet fireball detection software (UPV/EHU)
4. Space weather prediction tool (CNRS)
5. Coupled solar wind/magnetosphere/ionosphere model at Mars (IRAP)
6. Comet tail analysis and crossing detection (UCL)
7. Coupled solar wind/magnetosphere/ionosphere model at giant planets (IRAP)
8. Coupled solar wind/magnetosphere/ionosphere model at Jupiter (UCL)
9. Coupled solar wind/atmosphere/surface model at Mars (ABER/DLR)
10. VO event services for alert systems (OBSPARIS)
11. 'Reliability factors' for prediction (IAP, Wigner)
12. Propagation Tool with planetary plugins (GFI Informatique)

During the first year of the project the two following services were opened as prototypes:

4. Space weather 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 CDPP/AMDA tool (http://amda.cdpp.eu). See D10.1 PSWS Database Consolidation Report for more details including illustrations.

12. Propagation Tool with planetary plugins (GFI Informatique)

New plug-ins have bee defined, developed, and made available for comets in the tool including selection of comet as targets, visualization of their trajectories, projection onto solar maps, projection onto J-maps, and estimates of solar wind disturbance arrival times. See D10.1 PSWS Database Consolidation Report for more details including illustrations.

2.3 Impact

Contact with ESA SSA contributors as well as with the winners of the COMPET Space Weather call not yet initiated, to be initiated during the forthcomoing European Space Weather Week in Ostende, 14-18 November 2016.

Participation to the first Europlanet Impact and Innovation board meeting in 2015.

Press Release on Jupiter fireball, 18 May 2016: http://www.europlanet-eu.org/jupiter-blasted-by-6-5-fireball-impacts-per-year-on-average/.

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

Preparation of the NA1 workshop on the Sun's influence on planets, Toulouse, November 28 – December 02.

Submission of a working session on planetary space weather at European Space Weather Week in Oostende, November 14-18 2016.

2.4 Statistics

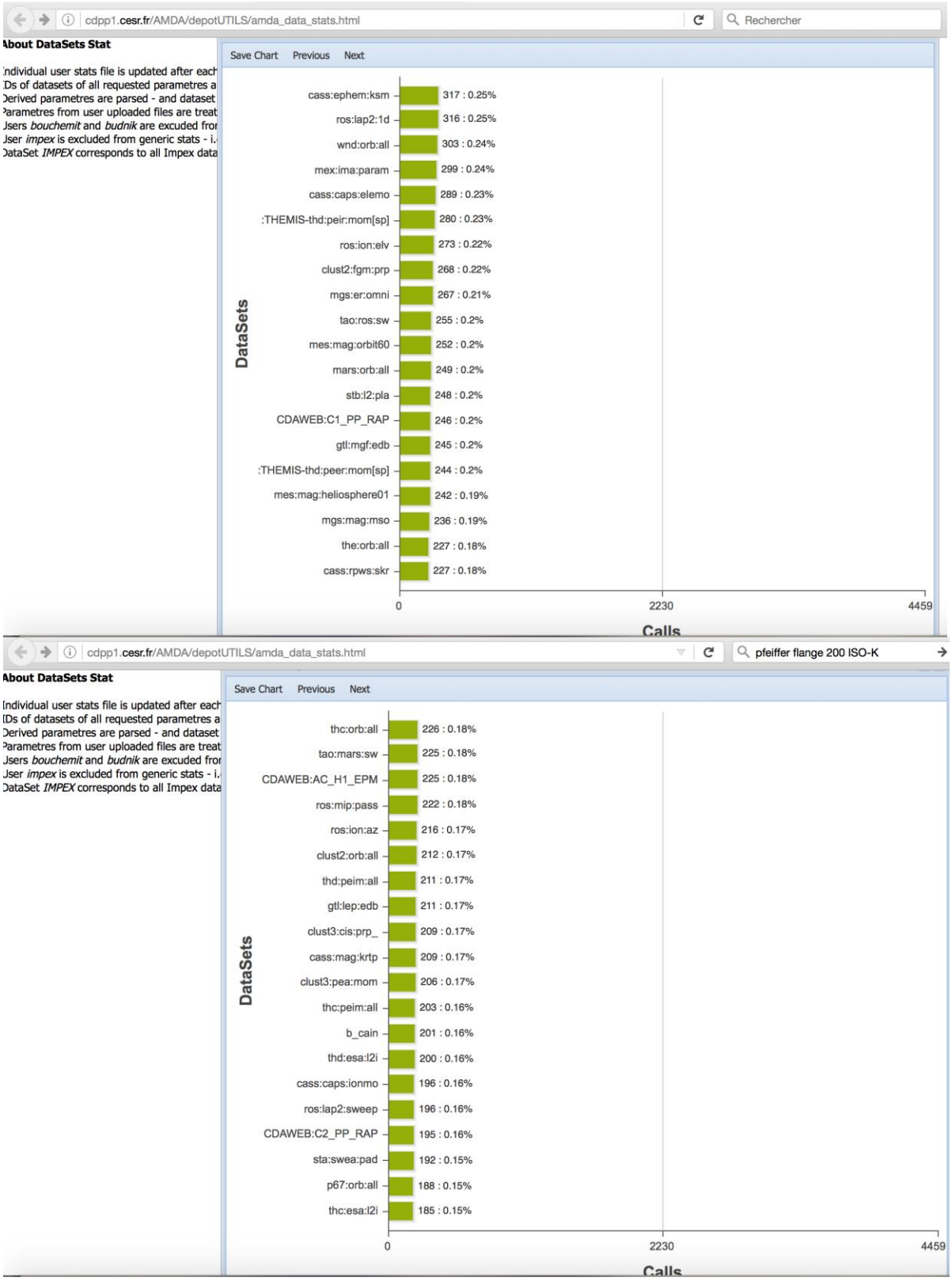
Statistics for the PSWS portal (website) that has been developed during the first year of the project can be found at:
http://planetaryspaceweather-europlanet.irap.omp.eu/ **1469 visitors since 01/09/2015 to 27/07/2016**

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://cdpp1.cesr.fr/AMDA/depotUTILS/stats.html **4472 connections since 01/09/2015 to** 27/07/2016
- Details on geographical distribution etc. can be found at CDPP/AMDA awstats: http://amda.cesr.fr/awstats/awstats.pl

- Access to CDPP/PROPTOOL (http://propagationtool.cdpp.eu/) http://storms-st.irap.omp.eu/awstats/awstats.pl

- Access to CDPP/AMDA datasets:
http://cdpp1.cesr.fr/AMDA/depotUTILS/amda_data_stats.html including access to solar wind parameters propagated using Chihiro Tao's 1D MHD code put in service for PSWS:



255 access for propagated solar wind parameters at Rosetta (tao:ros:sw)
225 access for propagated solar wind parameters at Mars (tao:mars:sw)

N.B.: Similar tools for statistics will be implemented in all PSWS services.

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 connecting with ESA/SSA and space weather-related FP7 projects. mle@leicester.ac.uk

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

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

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

The PSWS External review board will be invited to participate to the PSWS coordination meeting organized during the European Space Weather Week in Oostende on November 14-16. Deliverable D5.1 will therefore be delivered in December 2016 as approved by the Project Officer.

3. Deviations from Annex 1

3.1 Tasks

PSWS WP5 includes 12 services that will be fully accessible at the end of year 2 (September 2017). Listed below are some of the issues the PSWS Team had to deal with during the first year:

- Travel budget to meet face to face is limited in the programme but the impact is limited since most of the foreseen services are independently developed.
- Some of the PSWS partners (UCL and UPV/EHU) are also involved in WP6 VA VESPA and WP11 JRA VESPA and have focused so far on VESPA-related activities but the risk of PSWS developments being delayed is minor since the related VESPA developments will serve the PSWS developments.
- Service 9. Coupled solar wind/atmosphere/surface model at Mars involves several contributors and had difficulty to start. The recent hiring of a PDRA at ABER will guarantee the future success of this service.
- Service 11. 'Reliability factors' for prediction have been slightly delayed compared to the initial plan. This is however a critical development that will strongly benefit from the release of Service 4. Space weather prediction tool and Service 12. Propagation Tool with planetary plugins. These services should fully be operating

in December 2016 and this will enable their intensive exploitation by IAP and Wigner to fulfil the objectives of Task 3 and Task 4 of JRA10 (see Annex 2).

– Task 1 Coordination of WP5 has slowed down since May 2016 since the key person hired to develop PSWS website had resigned. A new person has been hired at CNRS to achieve this task and will begin in this position on 01 October 2016.

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 From 18 July, part time)
18. Wigner	Karoly Szego	Andrea Opitz, F (01/09/2015-31/08/2019, 1/3 time) Zsuzsanna Dálya, F (02/2016-04/2016, 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 2

- Before mid-term

Full access to the following services (prototypes):

1. Planetary meteor shower prediction tool (OBSPARIS)
2. Lunar impact detection software (ABER)
3. Giant planet fireball detection software (UPV/EHU)
4. Space weather prediction tool (CNRS)
5. Coupled solar wind/magnetosphere/ionosphere model at Mars (IRAP)
7. Coupled solar wind/magnetosphere/ionosphere model at giant planets (IRAP)
12. Propagation Tool with planetary plugins (GFI Informatique)

- Before end of year 2

Full access to the following services (prototypes):

6. Comet tail analysis and crossing detection (UCL)
8. Coupled solar wind/magnetosphere/ionosphere model at Jupiter (UCL)
9. Coupled solar wind/atmosphere/surface model at Mars (ABER/DLR)
10. VOevent services for alert systems (OBSPARIS)
11. 'Reliability factors' for prediction (IAP, Wigner)