

## Planetary Space Weather Services for the Europlanet 2020 Research Infrastructure

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## 1. Europlanet H2020 RI and PSWS

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

The Europlanet 2020 Research Infrastructure (RI) is funded under the European Commission's Horizon 2020 programme under grant agreement No 654208; it was launched on 1st September 2015 and will run until 31 August 2019.

The Research Infrastructure includes a new and unique Joint Research Activity (JRA) and a Virtual Access (VA) dedicated to **Planetary Space Weather Services** (PSWS).

The overall objectives of PSWS/JRA will be to review, test, improve and adapt methods and tools available within the partner institutes in order to **make prototype planetary event and space weather services operational** in Europe at the end of the programme.

## 2. PSWS Toolkits

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PSWS/VA will make five entirely new 'toolkits' accessible to the research community and to industrial partners e.g. planning for space missions:

### 1. General planetary space weather toolkit

2. Novel "event-diary" toolkit aiming at predicting and detecting planetary events like meteor showers and impacts

as well as three toolkits dedicated to the following key planetary environments:

3. Mars (in support of ESA ExoMars missions to be launched in 2016 and 2018)

4. Comets (building on the expected success of the ESA Rosetta mission)

5. Outer planets (in preparation for ESA JUICE mission to be launched in 2022)

## 3. PSWS Deliverables and Users

### PSWS deliverables (before september 2017)

1. Planetary meteor shower prediction tool (J. Vaubaillon)
2. Lunar impact detection software (T. Cook)
3. Giant planet fireball detection software (R. Hueso)
4. Generic space weather 1D MHD propagation tool (CDPP, France)
5. Coupled solar wind/magnetosphere/ionosphere models at Mars (P.-L. Bély)
6. Comet tail analysis and crossing detection (G. Jones)
7. Coupled solar wind/magnetosphere/ionosphere models at Mars (P.-L. Bély)
8. Coupled solar wind/magnetosphere/ionosphere models at Jupiter (N. Achilleos)
9. Coupled solar wind/atmosphere/surface model at Mars (M. Grande)

### PSWS users

User #1. Scientific community

User #2. Amateur community and General Public

User #3. Space Agencies and Industrial Partners

## 4. PSWS Impact

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[www.europlanet-eu.org](http://www.europlanet-eu.org)

### Siding spring comet at Mars / Lunar flashes

MAVEN, MEX, MSL observations in 2014  
All PSWS users impacted (e.g. MAVEN Instruments turned-off for safety)



### Comet Encke causes seasonal showers of meteor at Mercury

MESSENGER observations in 2013  
All PSWS users impacted (e.g. BepiColombo operation scenario)

### Shoemaker-Levy 9 at Jupiter / Giant planet fireballs at Saturn

Dedicated campaign in 1994 / Detection by amateur astronomer A. Wesley  
All PSWS users impacted (e.g. Jupiter Watch network)

### HST observation of shock-driven auroral emissions at Uranus

HST observations by Lamy et al. in 2012  
All PSWS users impacted (e.g. Ice Giant mission design)

## 5. PSWS Hosted Models at a Glance

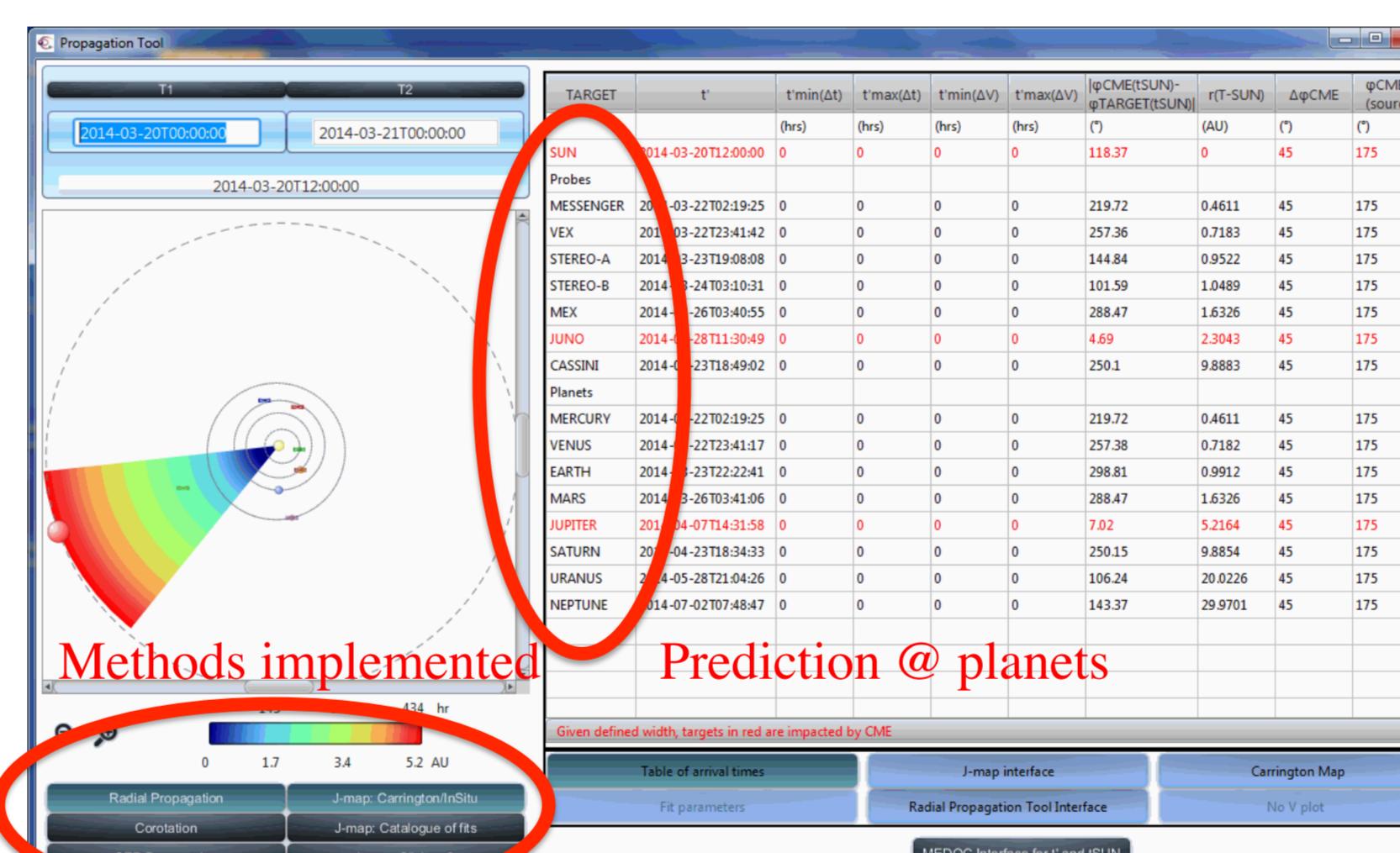
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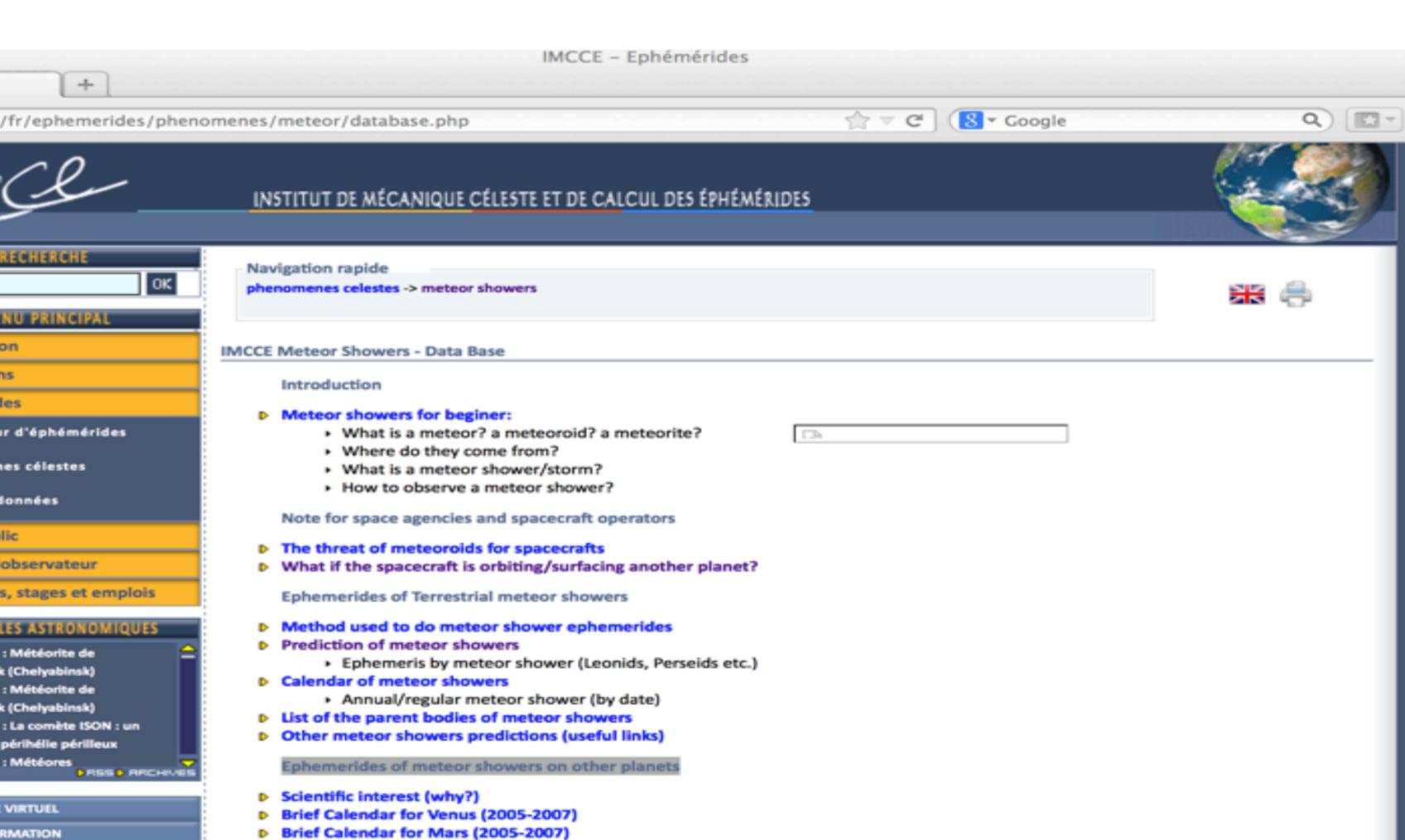
Domain	Model Name	Developer	Institution	Pre-project	Project-funded		End of project
					Development	Early life cycle	
1D-MHD propagation software	C. Tao et al.	CDPP, France	Publicly available	Example outputs available		Under development	Publicly available
Space Weather Tool	A. Rouillard et al.	CDPP, France	Under development				Publicly available
TRANSCAR-Earth	P.L. Bély et al.	IRAP, France	On request			Online service	Publicly available
HelgeSSA	I. Stanisławska et al.	SERC PAS, Poland	Publicly available			Development of alerts	Alert Service operational
Lunar impact detection software	T. Cook et al.	ABER, UK	On request			Upgrades and conversion	Publicly available
TRANSCAR-Mars	P.L. Bély et al.	IRAP, France	On request			Online service	Publicly available
Mars surface environment	M. Grande et al.	ABER, UK				Under development	Alert Service operational
Jupiter magnetodisc model outputs	N. Achilleos et al.	UCL, UK	On request			Online service	Publicly available
Jupiter thermospheric model outputs	N. Achilleos et al.	UCL, UK	On request			Online service	Publicly available
TRANSCAR-Jupiter	P.L. Bély et al.	IRAP, France	Under development			Online service	Publicly available
TRANSCAR-Saturn	P.L. Bély et al.	IRAP, France	Under development			Online service	Publicly available
Fireball detection software	R. Hueso et al.	UPV/EHU, Spain	Publicly available			Upgrades and conversion	Publicly available
Cometary tail detection software	G. Jones et al.	UCL, UK	On request			Upgrades and conversion	Publicly available
Meteor showers Calendar	J. Vaubaillon et al.	OBSParis, France	Publicly available			Development of alerts	Alert Service operational
Planetary Diary							

## 6. Illustrations

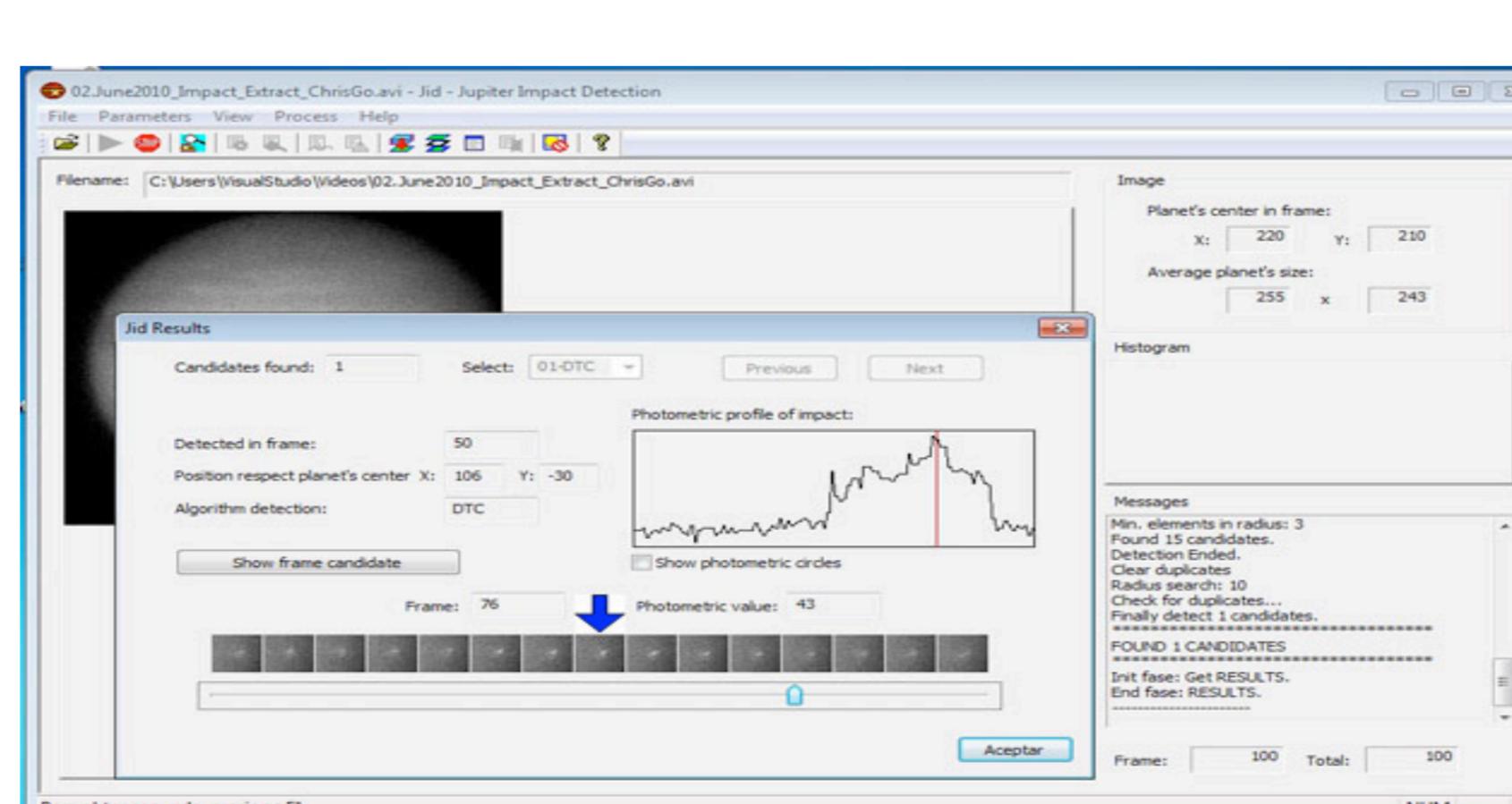
### A CDPP/Propagation Tool (<http://propagationtool.cdpp.eu>)



### B) Predict, e.g. meteor showers at planets (Jérémie Vaubaillon)



### C. Detect, e.g. Jovian Impacts Detection Software (Ricardo Hueso)



### D. Towards an operational planetary space weather alert system: use of VOEvent / the Skyalert experience



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