Wigner contribution to PSWS

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Wigner RCP = KFKI/RMKI + MTA/SzFKI

KFKI/RMKI ⇨ Institute for Particle and Nuclear Physics → **Space Department**
MTA/SzFKI ⇨ Institute for Solid State Physics and Optics

Department of Space Physics and Space Technology

Team: ~10 physicists and ~15 engineers

Science: solar system exploration, heliospheric physics, planetary plasma environments...
Technology: onboard data processors, hardware and software, ground support equipments...

Space missions:

- Vega
- Ulysses
- SOHO
- Cluster
- STEREO A&B
- Cassini-Huygens
- Venus Express
- Rosetta-Philae
- ExoMars TGO
- BepiColombo
- Solar Orbiter
- JUICE

Photo: Bea Kallos (MTI)

Wigner contribution to Europlanet

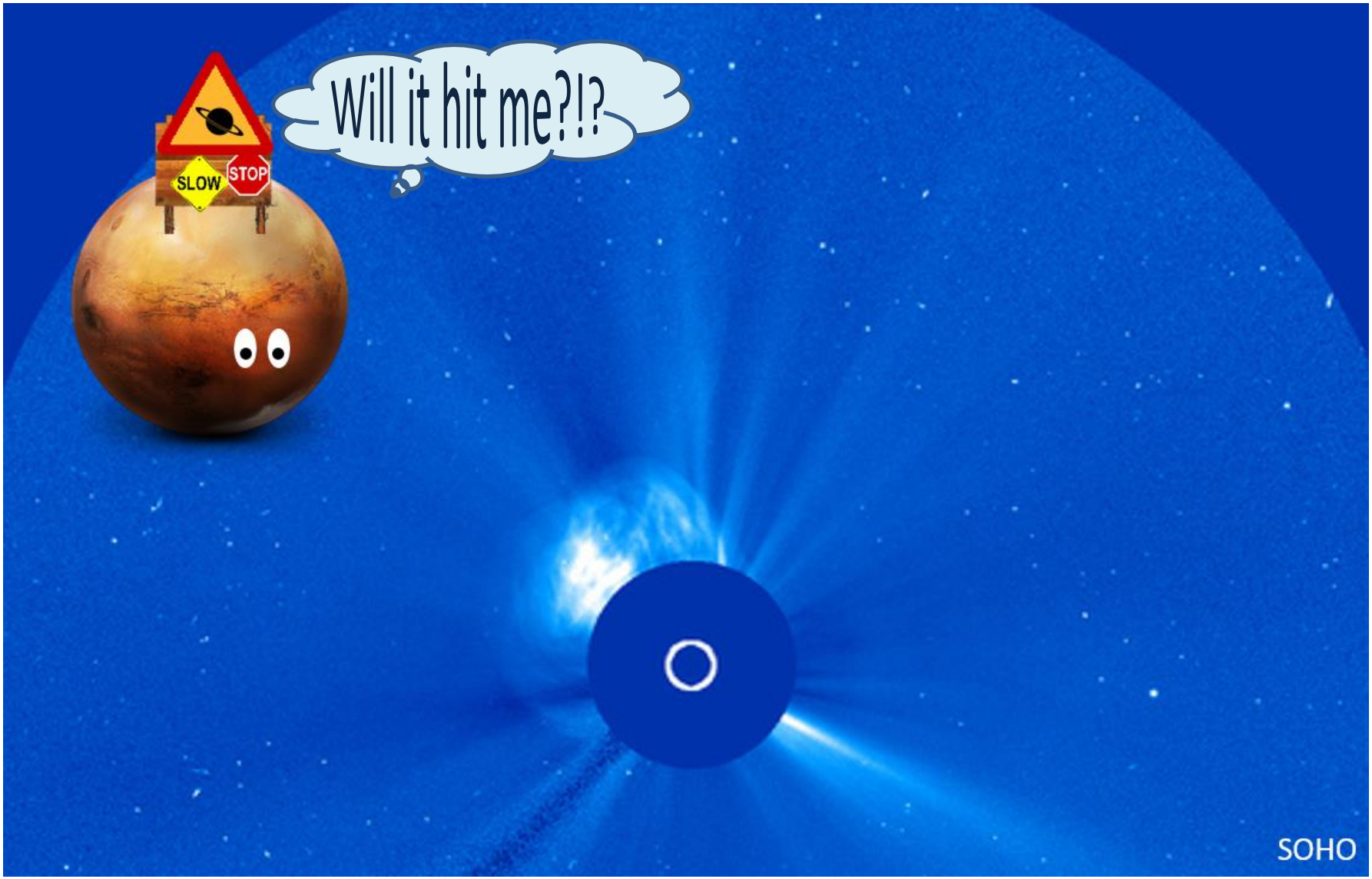
Prof. emer. Károly Szegő
Scientific Advisor
Europlanet: WP12 Inclusiveness Officer

Melinda Dósa
PhD student
Problem-tailored SW predictions
Europlanet: Inclusiveness Assistant

Dr. Andrea Opitz
Senior Research Fellow
Europlanet: WP5&10 PSWS

Zsuzsanna Dálya
Scientific Assistant
ICME catalogues

Wigner contribution to PSWS



Wigner contribution to PSWS

Planetary Space Weather Services will make prototype planetary event and space weather services operational in Europe at the end of the programme. It will provide access to datasets and models that cover the inner planets (Mercury, Venus and Mars) and the outer gas giants (Jupiter and Saturn). The overall objectives of JRA4 is to review, test, improve and adapt methods and tools available within the partner institutes.

Task 3.Enabling planetary event prediction and ensuring reliability of services (Wigner RCP, OBSPARIS)

Wigner RCP will define planetary proxies and reliability factors for planetary space weather applications. They will link space weather models to predictable solar wind parameters and quantify the reliability of the prediction depending on the method used based on observational data.

Task 4.Testing space weather connections in the Solar System (IAP, DLR, Wigner RCP)

The objective is to validate, compare and enhance the capability of the existing models and tools in order to predict the impact of solar events in the vicinity of Solar System objects. Wigner RCP and IAP will validate the outputs of the PSWS models/tools against both observational/simulation data of planetary environments within the inner and outer heliosphere, respectively.

Wigner contribution to PSWS

ICME catalogues:

Dalya et al.: Dedicated ICME lists for ballistic propagation.

↳ WIND, ACE, SOHO, STEREO A&B, VEX and MEX.

Venus hitting ICME list by Vech et al. 2014 JGR.

Mars hitting ICME list by Sanchez-Diaz et al. 2012.

Comparison of observed and predicted events:

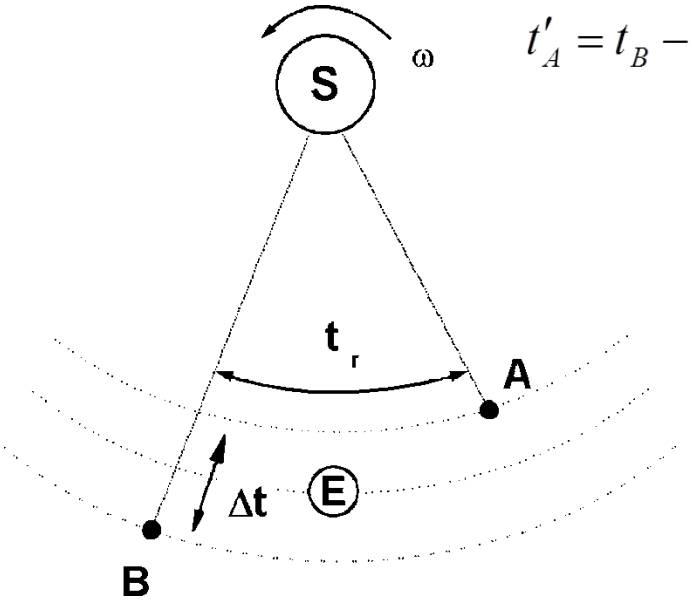
Prediction by CDPP propagation tool and observation at the planets.

Reliability analysis:

Opitz, Fedorov et al. 2010 Solar Physics: Goodness Index defined from heliocentric longitudinal separation of the solar spacecraft (input data) and the target planet.

Planetary Space Weather prediction

Ballistic solar wind propagation



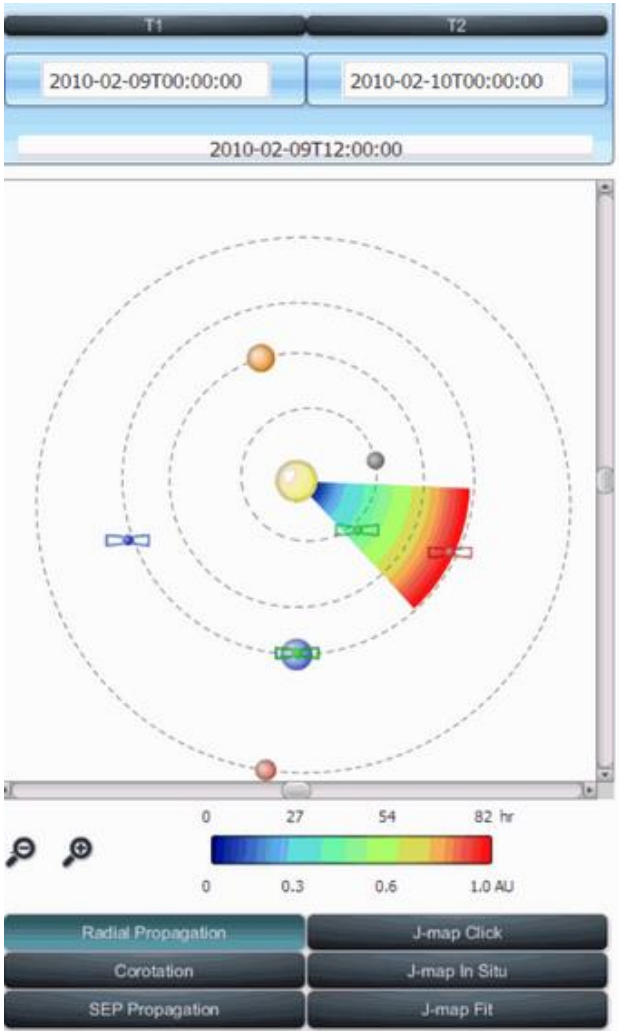
✍ Opitz, Karrer, Wurz et al. 2009 Solar Physics

Clean input data from ICME signatures:

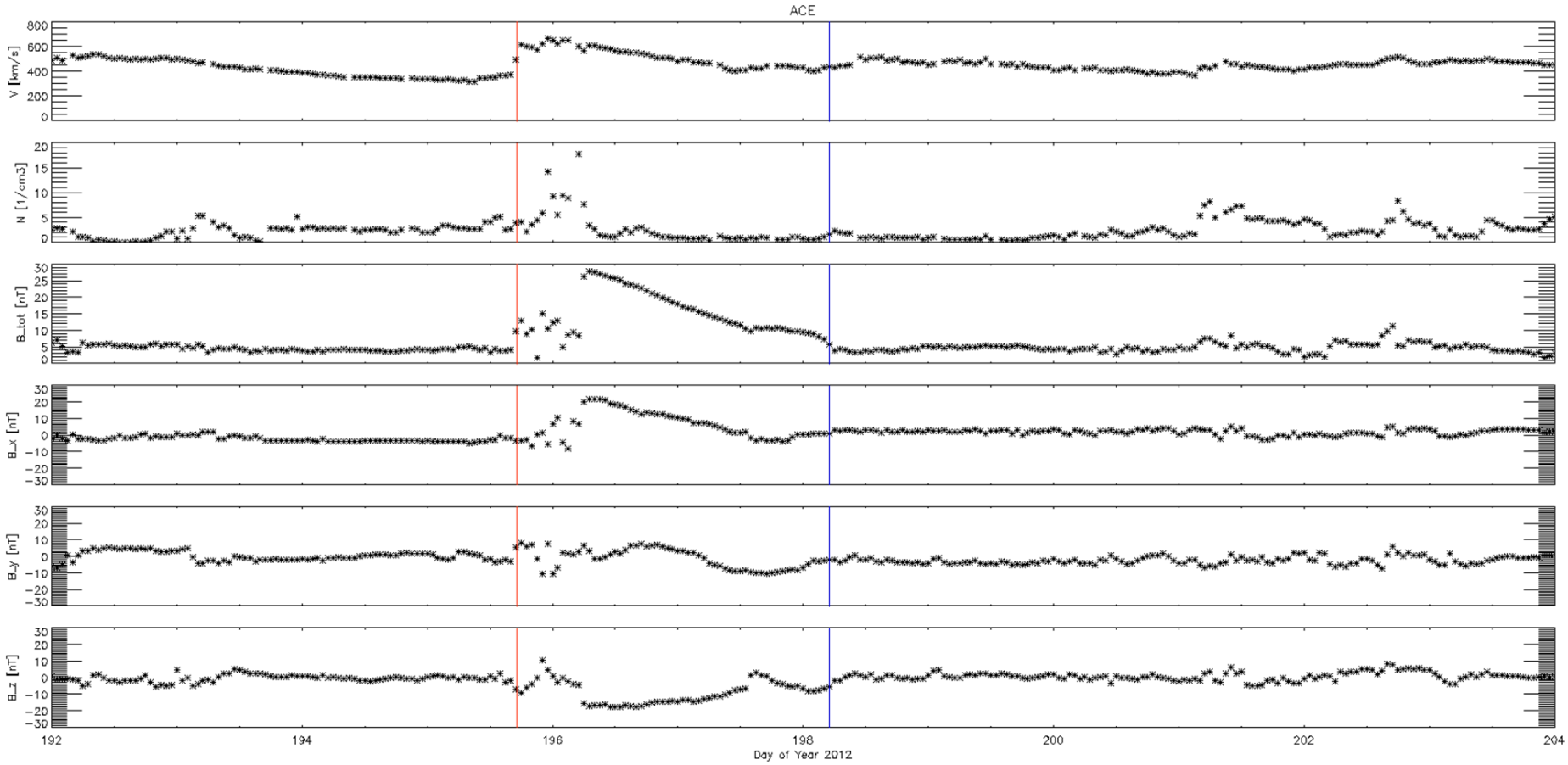
⇨ Dedicated ICME lists by Dalya et al.

PSWS contribution

ICME propagation tool

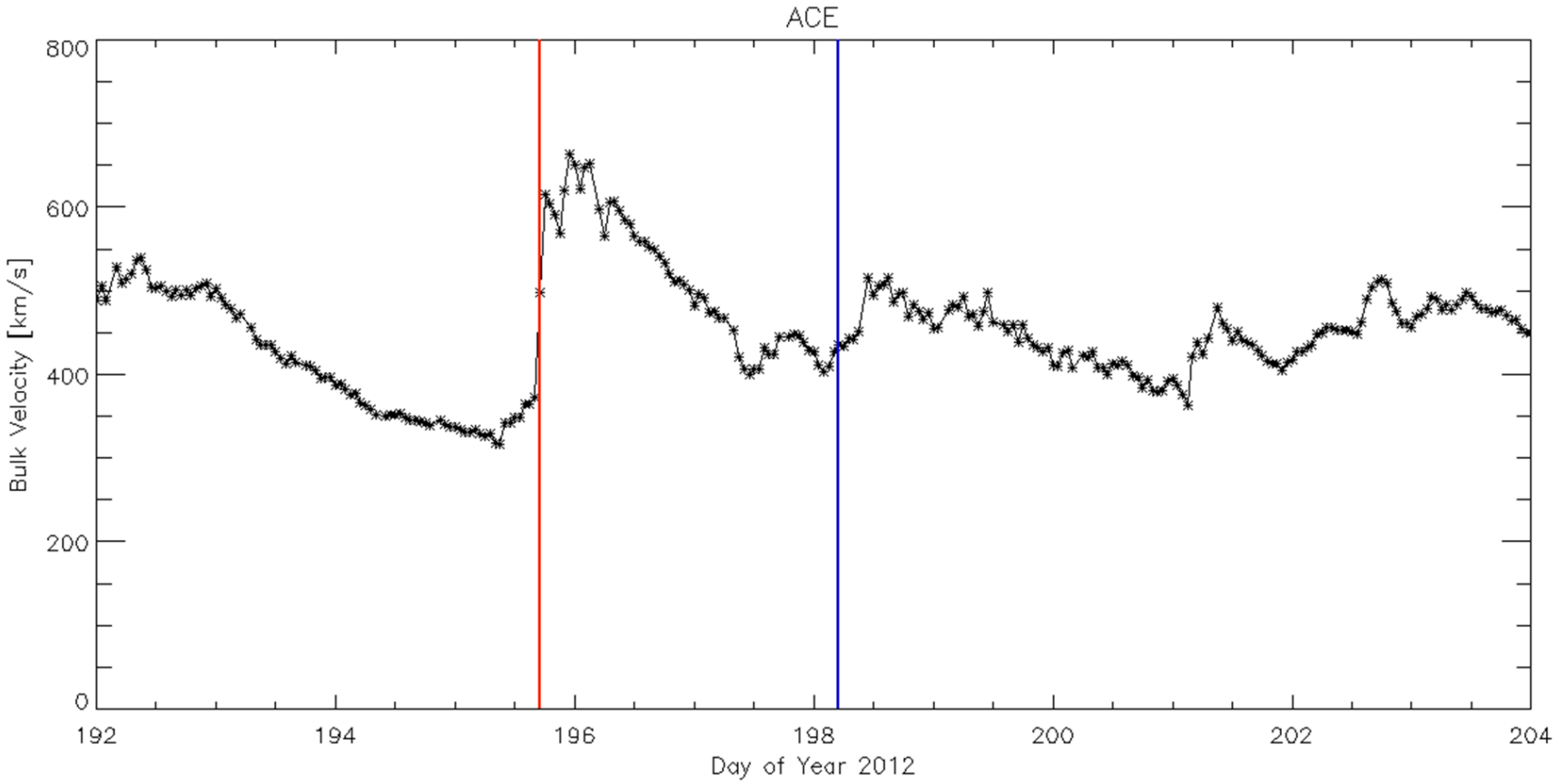


ICME catalogues



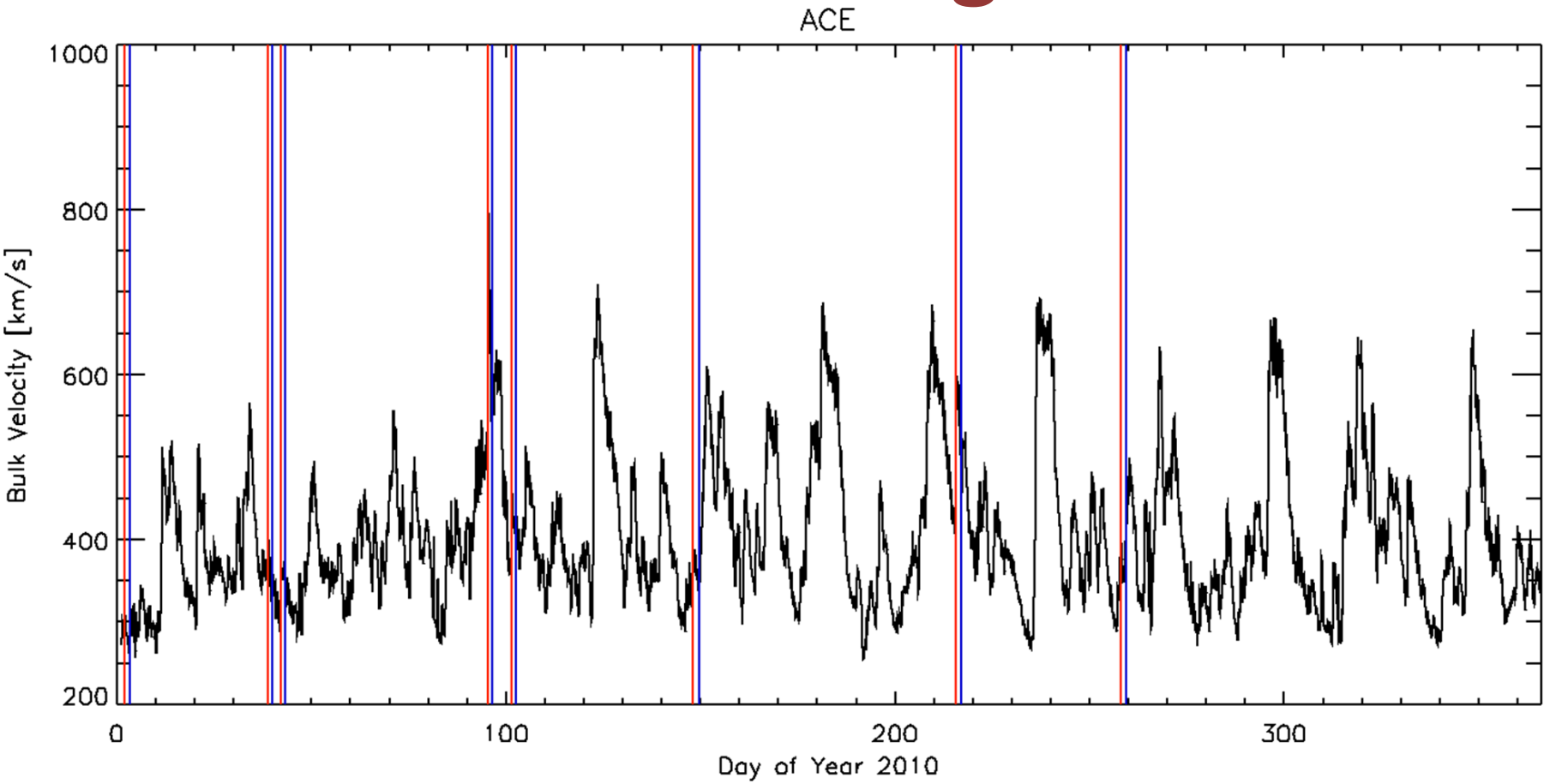
Velocity (V), proton number density (N) and magnetic field (B_tot) and its components (B_x, B_y, B_z) from ACE data during an ICME in 2012 (Dálya and Opitz 2016).

ICME catalogues

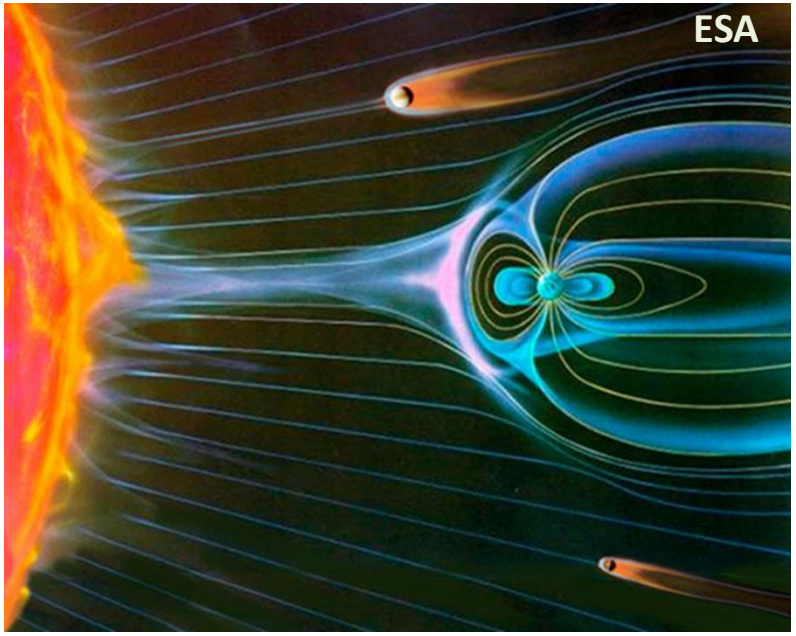


One identified ICME overplotted to the velocity time series of ACE spacecraft in 2012, red line is the beginning and blue line is the end of the event (Dálya and Opitz 2016).

ICME catalogues



Plasma bulk velocity measured by ACE in 2010 and overplotted with the beginning (red) and end (blue) times of the ICME (Dálya and Opitz 2016).



Wigner contribution to Planetary Space Weather Services

Clean input solar wind data for background solar wind prediction:
Dalya et al.: Dedicated ICME lists for ballistic propagation.

Comparison of observed and predicted ICME events:
Venus hitting ICME list by Vech et al. 2014 JGR and beyond.
Mars hitting ICME list by Sanchez-Diaz et al. 2012 and beyond.

Theoretical and empirical reliability indices:
Goodness Index (Opitz et al. 2010) and beyond.
Predicted-observed comparison over good statistics.