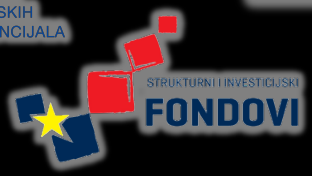


Europska Unija
Ulaganje u budućnost
Projekt je sufinancirala Europska Unija iz Europskog socijalnog fonda

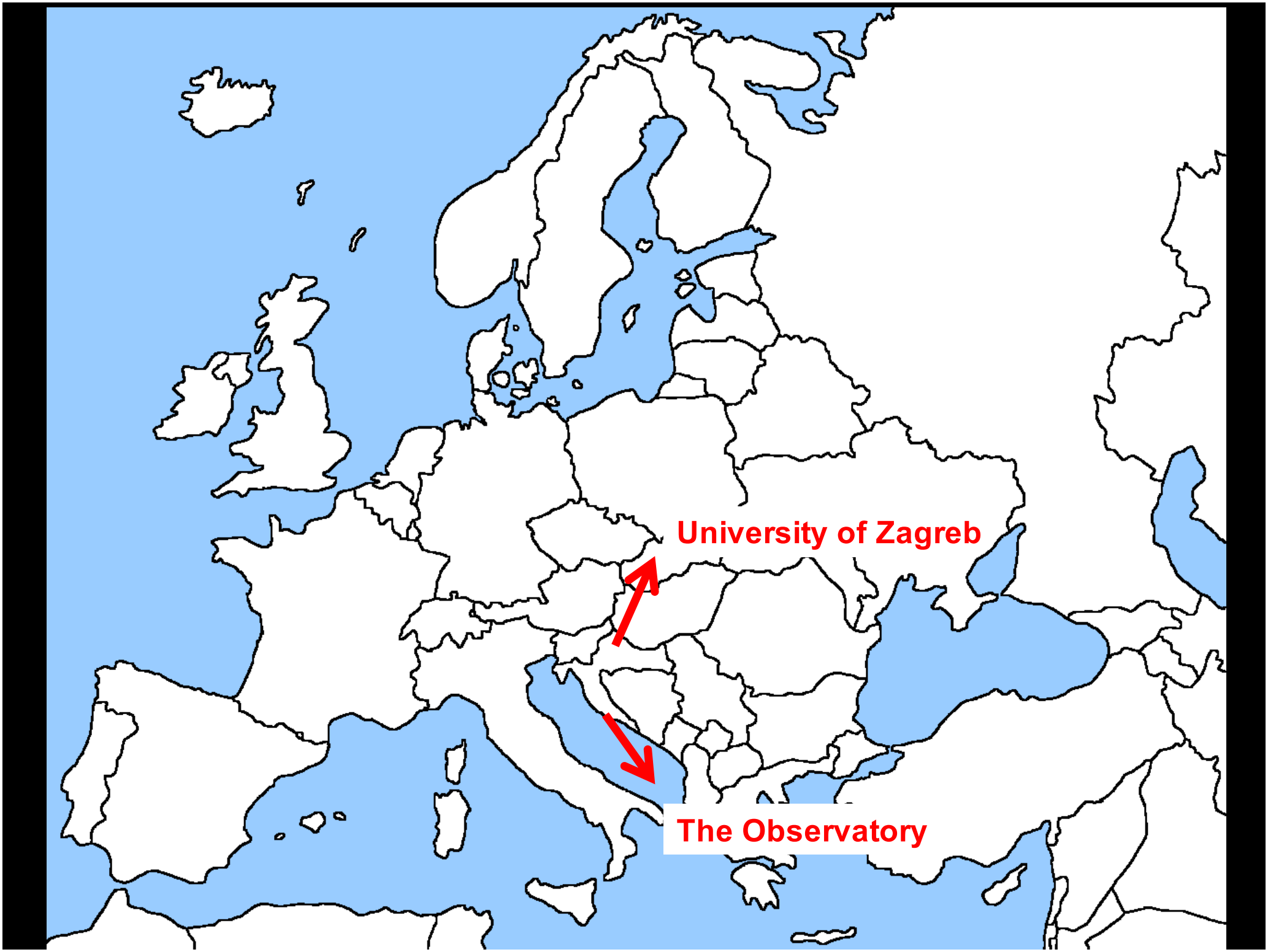
(SPACE WEATHER RESEARCH AT) THE HVAR OBSERVATORY

Mateja Dumbović

Hvar Observatory, Faculty of Geodesy,

University of Zagreb, Croatia


WORLD CROATIA MAP
Prime Meridian
Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn
Antarctic Circle
International Date Line
1:150,000,000
Miles
0 1,000 2,000 4,000


University of Zagreb
The Observatory

University of Zagreb

Situated on a hill above Hvar town in a historical fort originally built by the Napoleon army in early 19 century

The Observatory

Founded in 1972: Yugoslavian (Croatian) – Chechoslovakian (Chech) collaboration

Today managed by Faculty of Geodesy (University of Zagreb, Croatia)

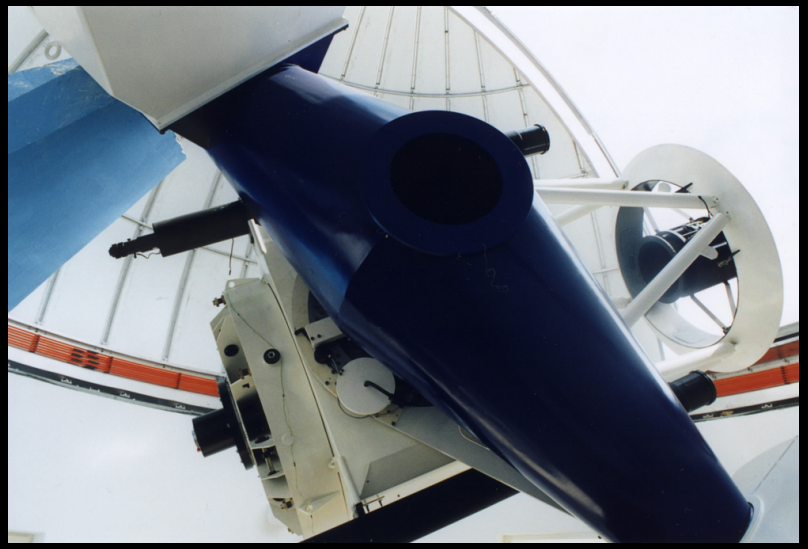
www.oh.geof.unizg.hr

About the Observatory, instruments, staff, projects, publications, space weather tools, news…

INSTRUMENTS:

65 cm stellar telescope

1m stellar Austro-Croatian telescope

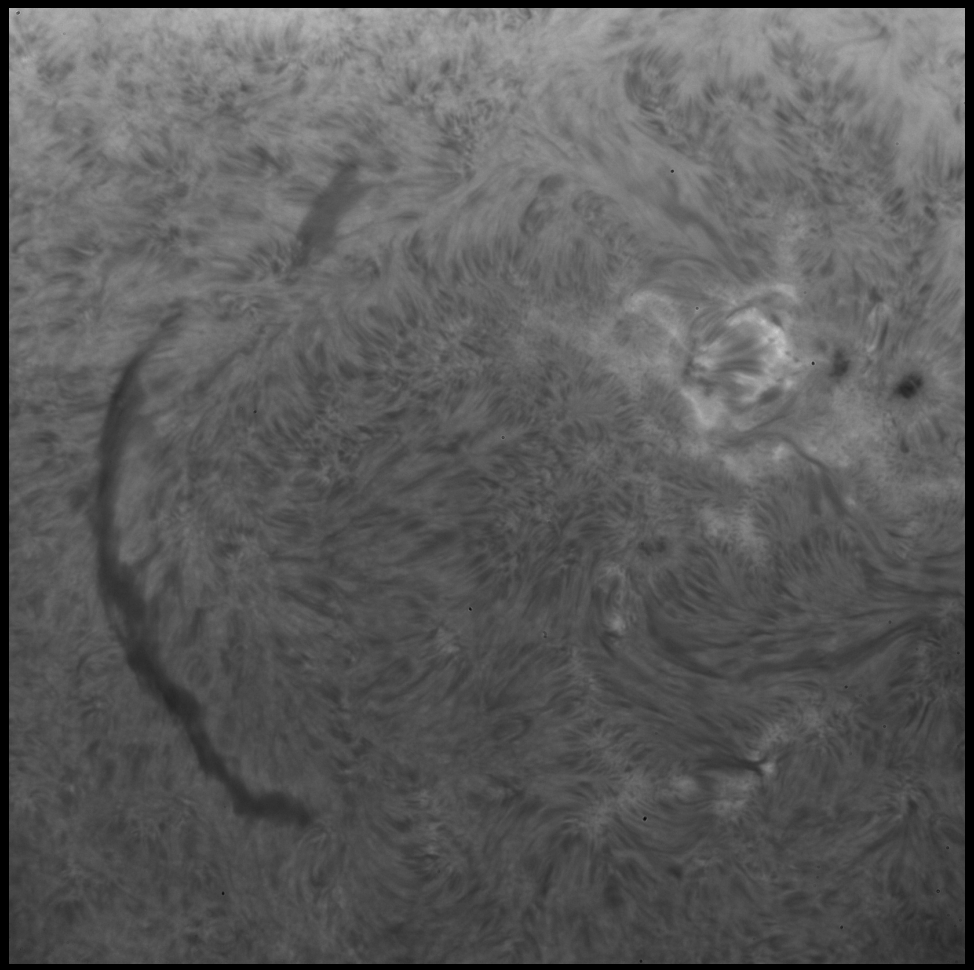


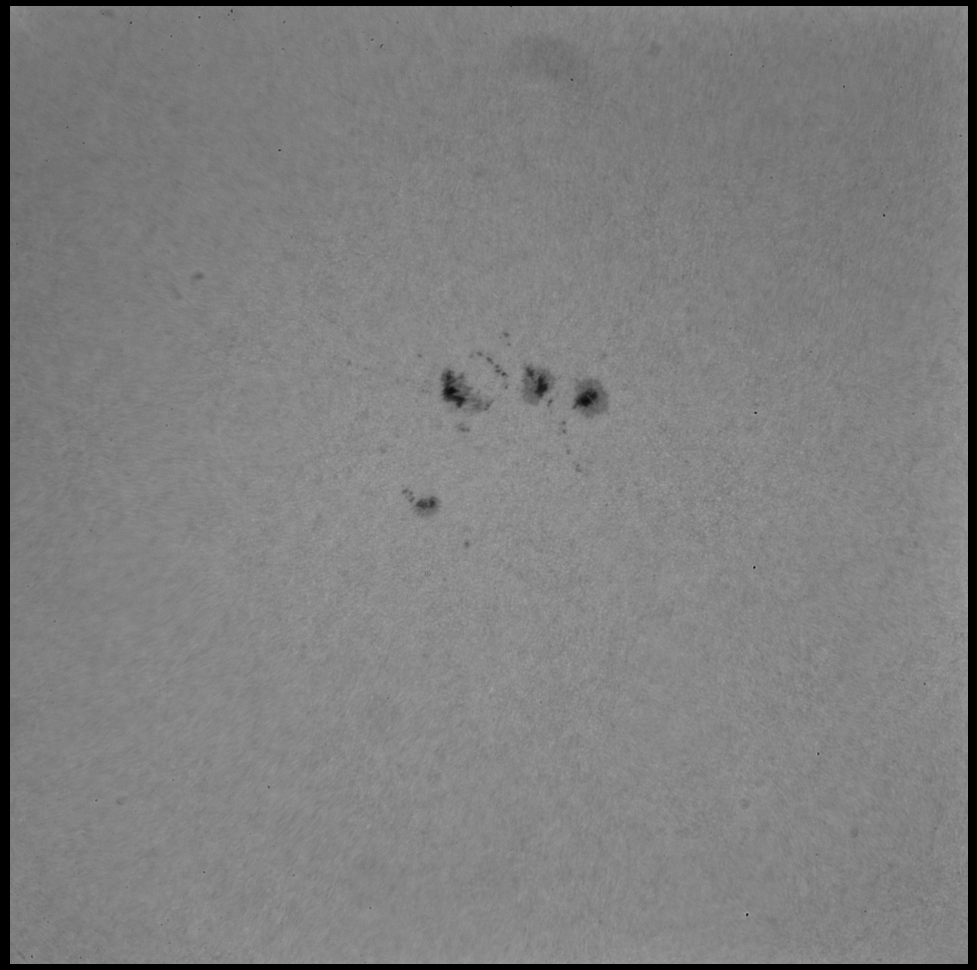
Double solar telescope

1 mounting, 2 refractors:

white light for photosphere (d=217mm, FOV 11 arcmin)

H alpha for chromosphere (d=130mm, FOV 7 arcmin)





H-alpha (left) and corresponding white-light (right) observation of the active region AR1271 and a nearby filament with a double solar telescope of Hvar Observatory (22 August 2011).

Data available upon request (J. Čalogović – contact at the website)

XIVth Hvar Astrophysical Colloquium

Last Updated on Monday, 07 December 2015 10:14

26 - 30 September 2016, Hvar, Croatia

TOPICS / SESSIONS:

- Activity of the Sun and Solar-Like Stars
- Eruptive Processes in the Solar Atmosphere
- Solar Terestrial Connection and the Heliosphere
- Space Weather and Space Climate Forecasting
- Observing techniques, Campaigns and Databases

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Arnold Hanslmeier (co-chair)
Edward Cliver
Nat Gopalswamy
Bernd Heber
Aleš Kučera
Manuela Temmer
Bojan Vršnak
Andrei Zhukov

LOCAL ORGANIZING COMMITTEE

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Domagoj Ruždjak (co-chair)
Joško Domančić
Mateja Dumbović
Davor Sudar
Katica Vučetić
Tomislav Žic

Contact (Domagoj Ruždjak)


www.ilijaveselica.com

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Publications

- Central European Astrophysical Bulletin (ISSN 1845-8319)
  - 2006 - present (Volume 30 - ...)
- Hvar Observatory Bulletin (ISSN 0351-2657)
  - 1997 - 2006 (Volume 1 - Volume 29)

Peer reviewed international scientific journal
ISSN 0351-2657
papers on theoretical, observational and instrumental astrophysics

Editorial board:

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Languages

 

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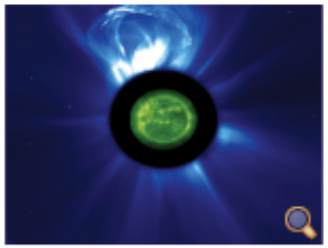
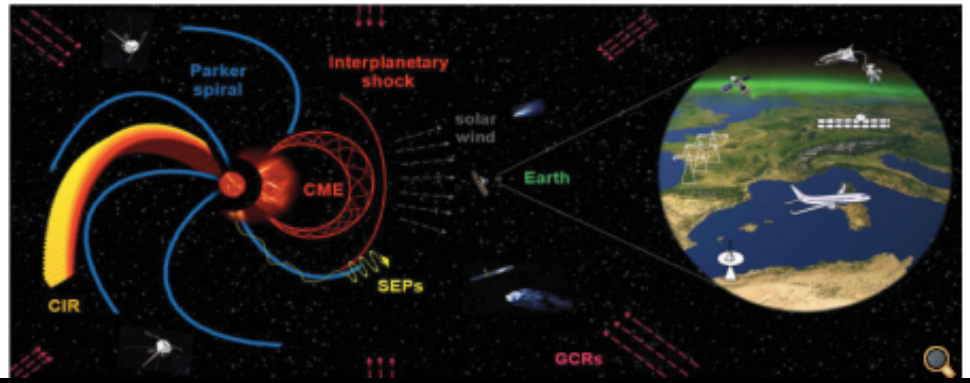
Today	1
Month	1
All	119

Currently are 2 guests and no members online



This project is a continuation of the research conducted under the EU FP7 projects SOTERIA and COMESEP. The aim is to improve the space weather tools developed under these projects and to consolidate them into a single SolarSoft package for broad solar physics and space weather related applications.

The research is related to the propagation and space weather effects of coronal mass ejections. Coronal mass ejections are expulsions of magetoplasma from the solar corona that propagate trough the heliosphere. If they arrive to Earth they can cause the geomagnetic storms and a number of harmful effects to the human technologies. They can cause spacecraft disruptions and shutdown, problems in the electric network grid, degradation of pipelines, increased radiation dosage for astronauts and transpolar flight crews…



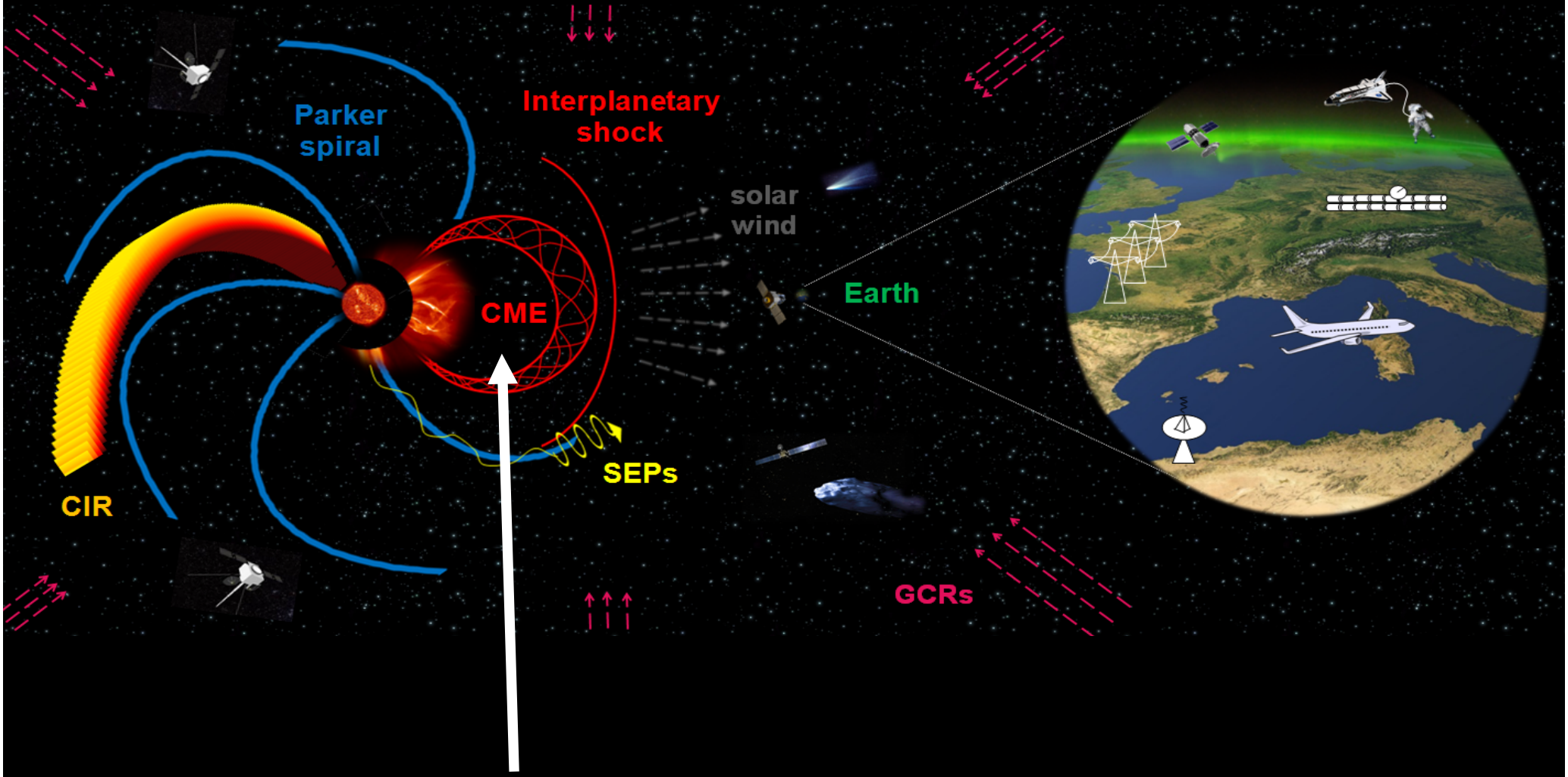
SCIENTIFIC RESEARCH:

Stellar astrophysics (observations and modelling of Be stars and eclipsing binary systems with accretion disks

Solar physics (solar differential rotation, solar cycle, solar radio astronomy, radiation processes in the solar atmosphere, eruptive phenomena in the solar atmosphere, coronal shocks - theoretical and observational aspects)

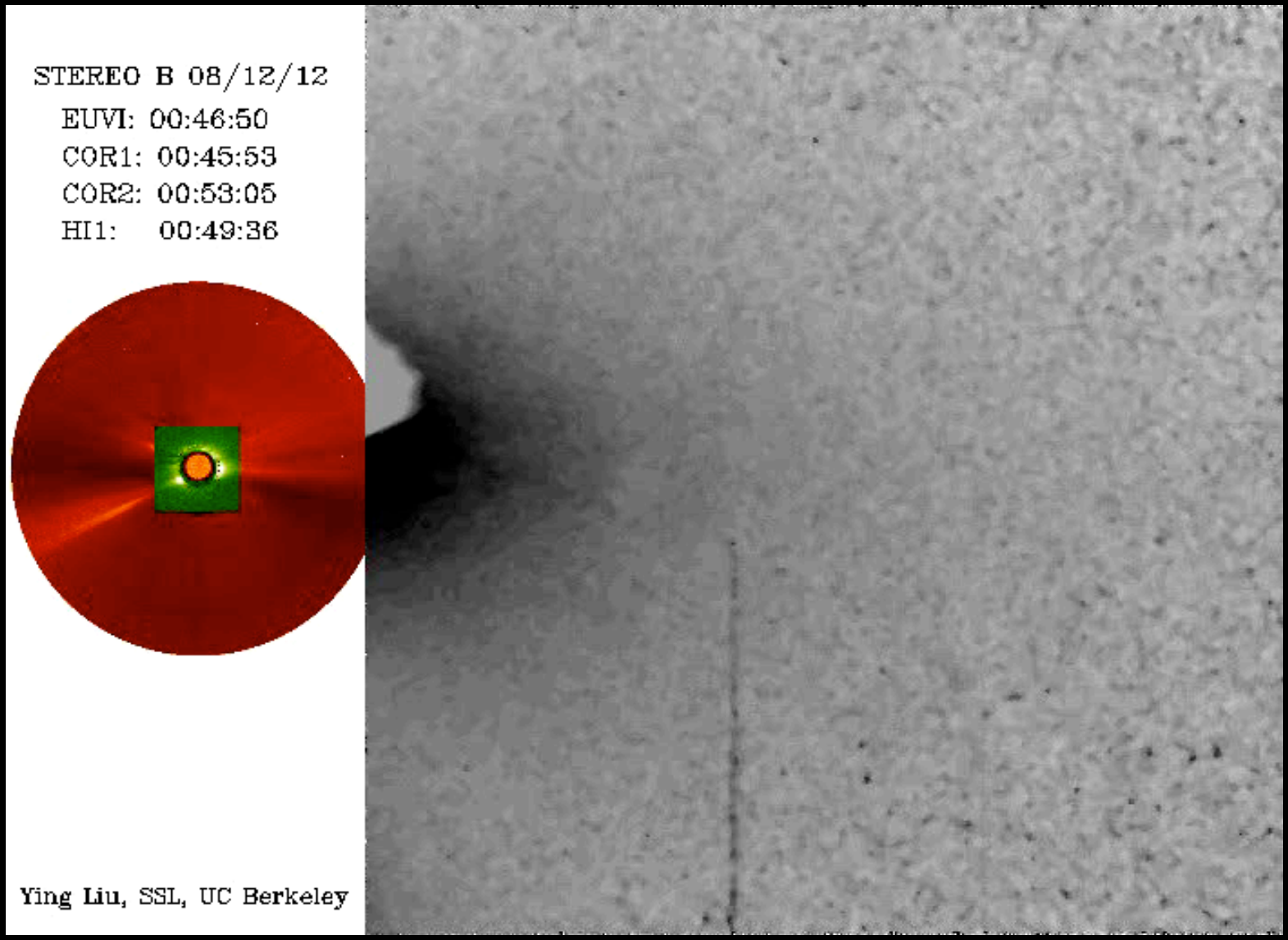
Solar-terrestrial physics, heliophysics and space weather (heliospheric propagation of coronal mass ejections, interplanetary coronal mass ejections, interplanetary shocks, corotating interaction regions, geomagnetic storms, cosmic ray modulation, influence of the solar activity on Earth weather and climate)

SPACE WEATHER



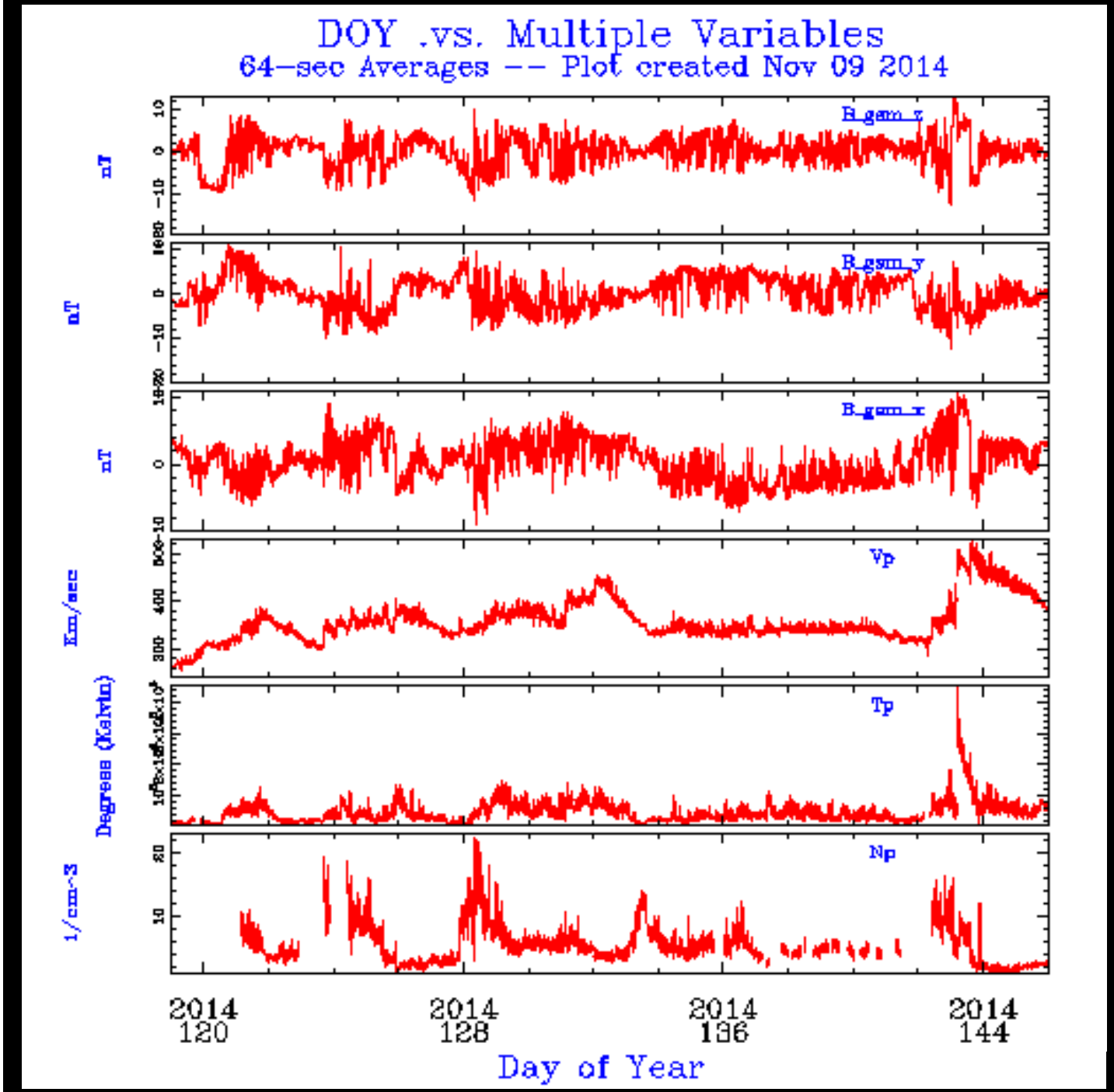
Main drivers of space weather

Coronal mass ejection (CME)



Magnetized plasma ejection from the solar corona (seen in coronagraphs and heliospheric imagers by white light emitted by scattered electrons as it moves through)

In situ measurements of solar wind and IMF

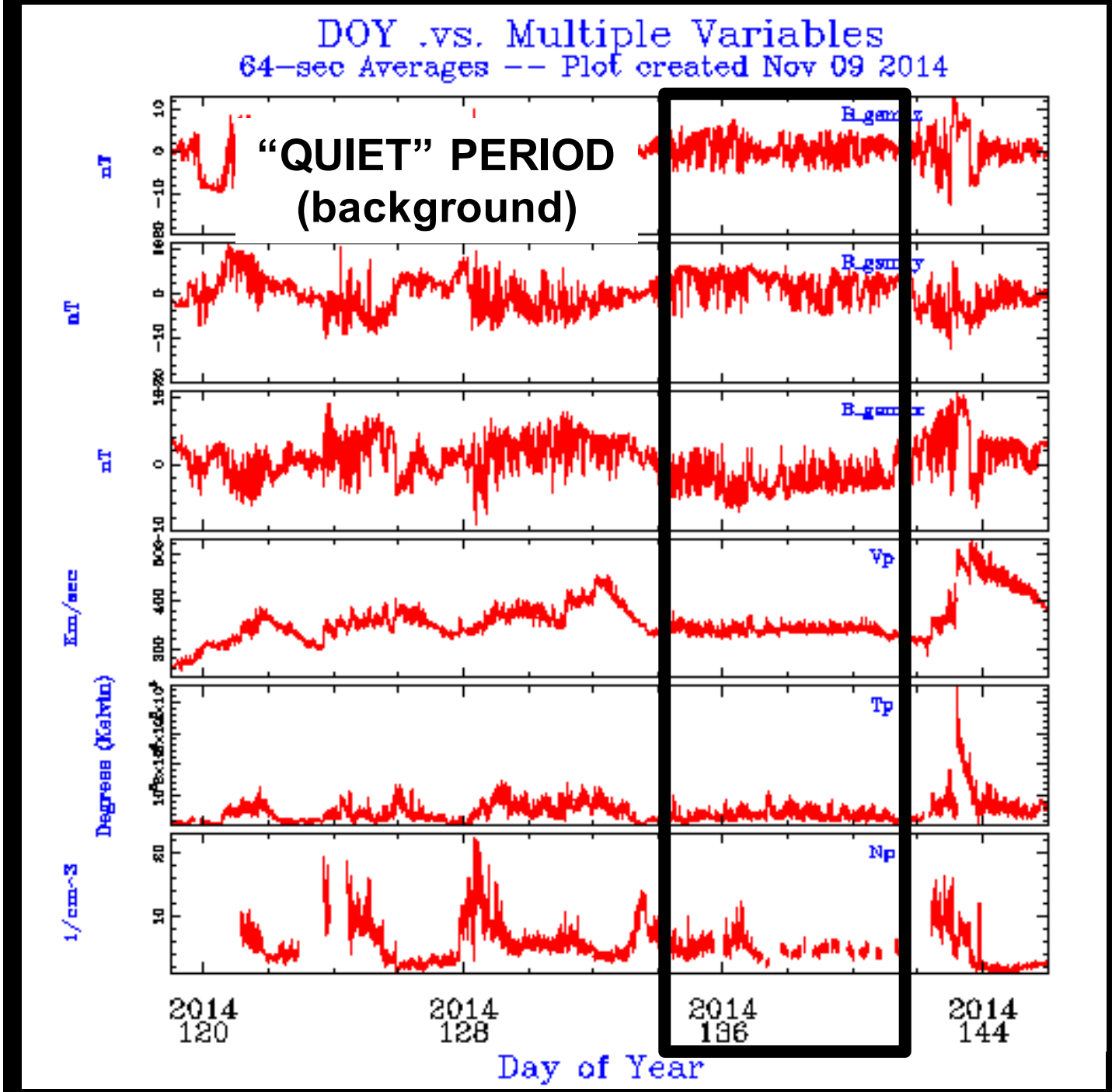


IMF components

Solar wind parameters

Advanced Composition Explorer (ACE)

In situ measurements of solar wind and IMF

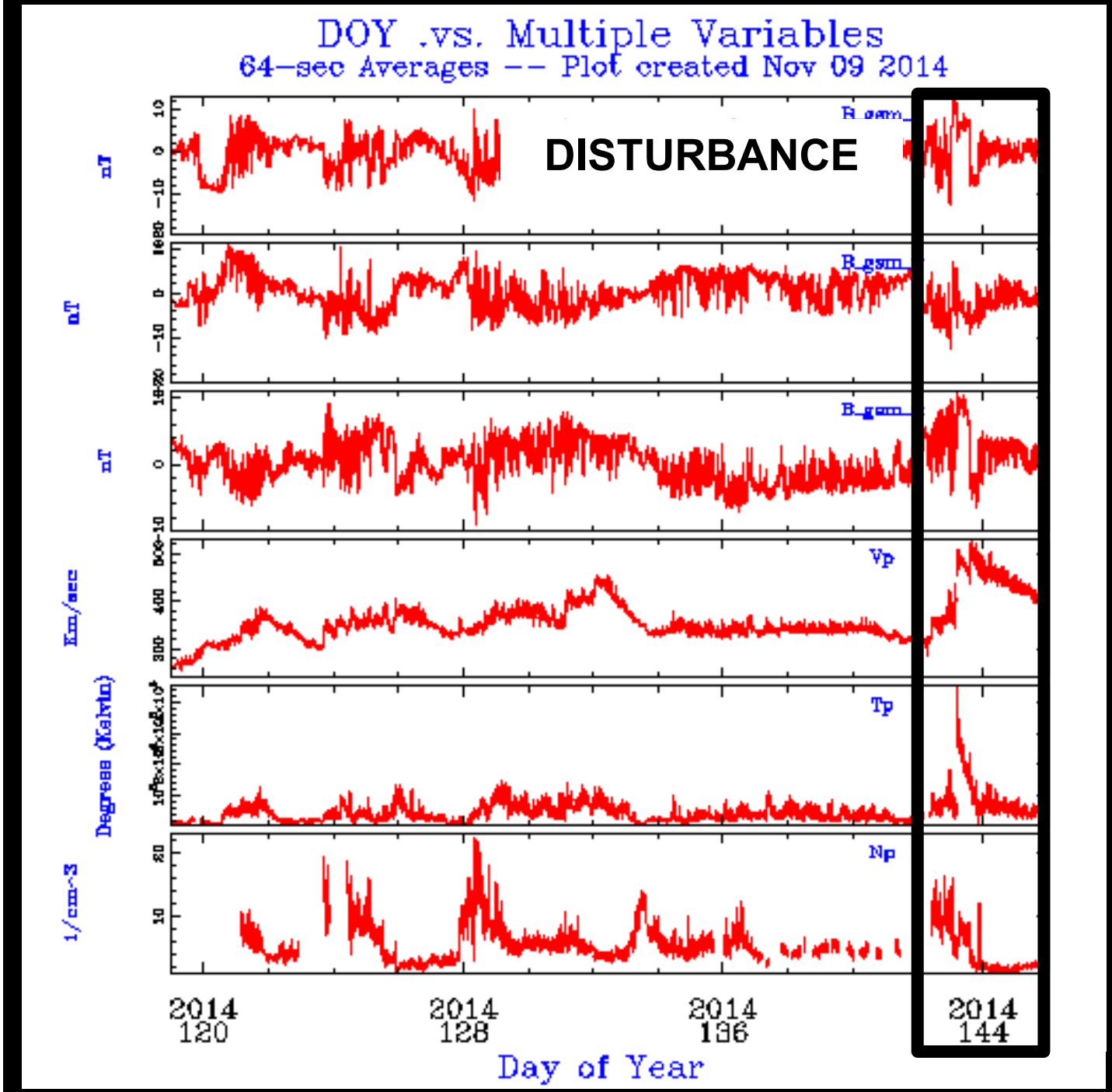


IMF components

Solar wind parameters

Advanced Composition Explorer (ACE)

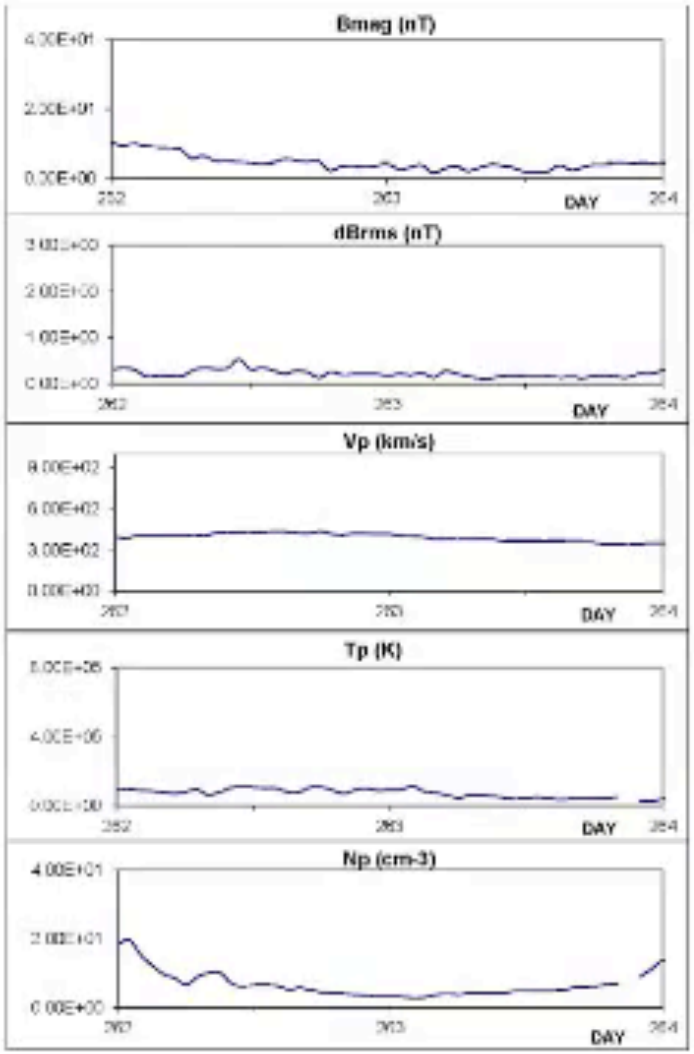
In situ measurements of Solar wind and IMF



IMF components

Solar wind parameters

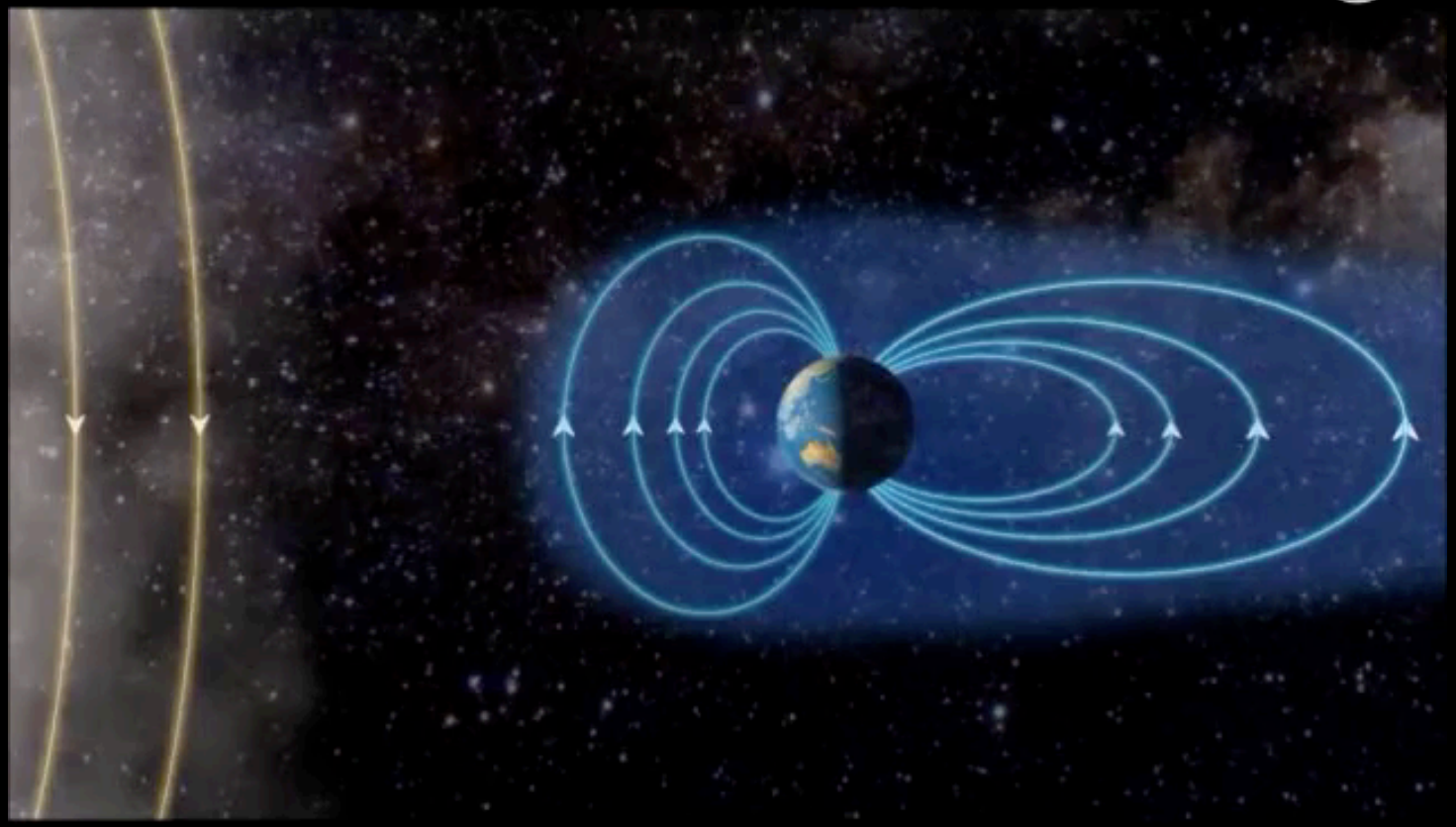
Advanced Composition Explorer (ACE)


Bmag (nT)
DAY
dBrms (nT)
DAY
Vp (km/s)
DAY
Tp (K)
DAY
Np (cm-3)
DAY

GEOMAGNETIC STORMS

Geomagnetic disturbances (detected by magnetometers at Earth)

Currents induced by charged particles injected due to magnetic reconnection between ICME & geomagnetic field

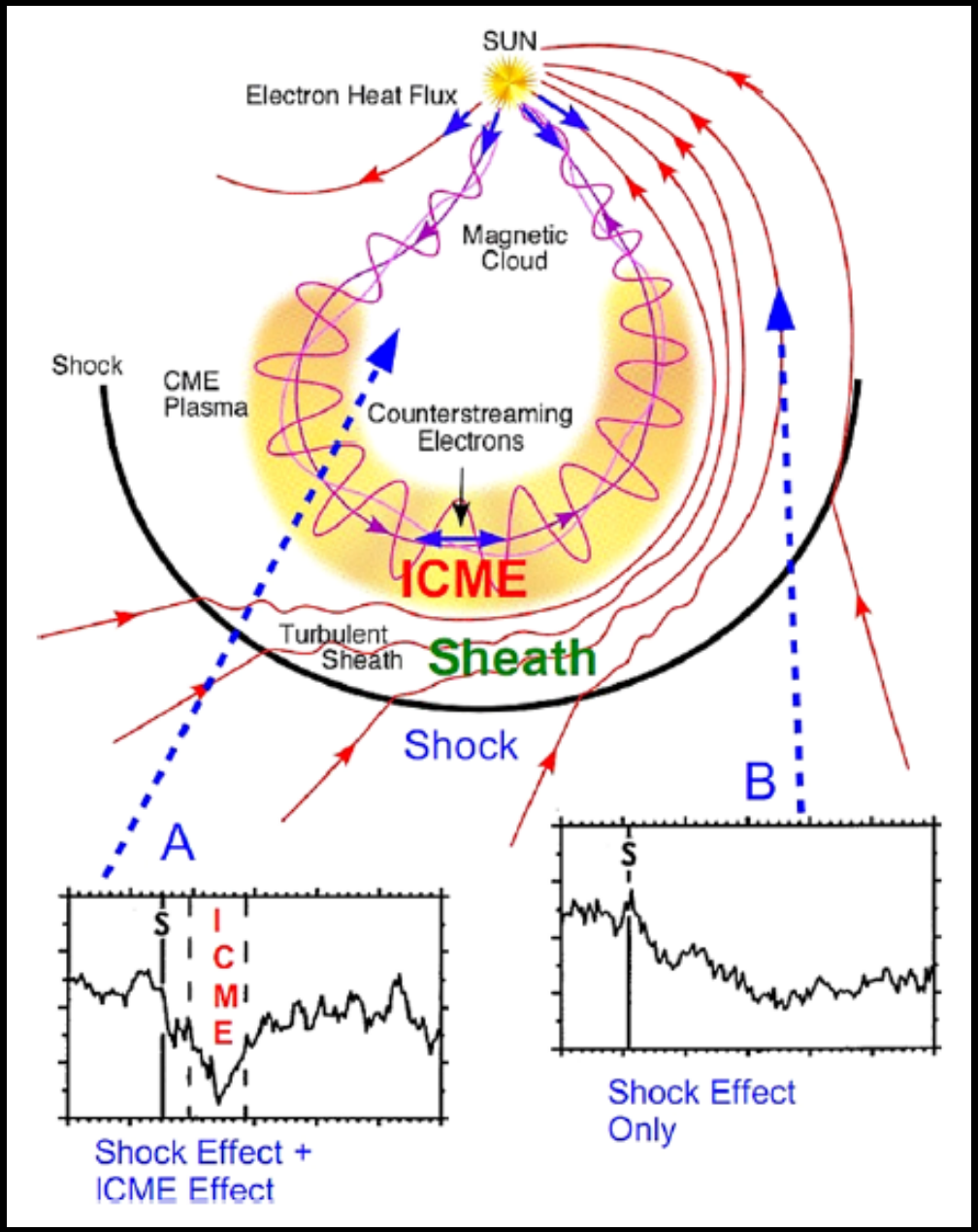


Animation: www.forskning.no (University of Oslo)

FORBUSH DECREASES

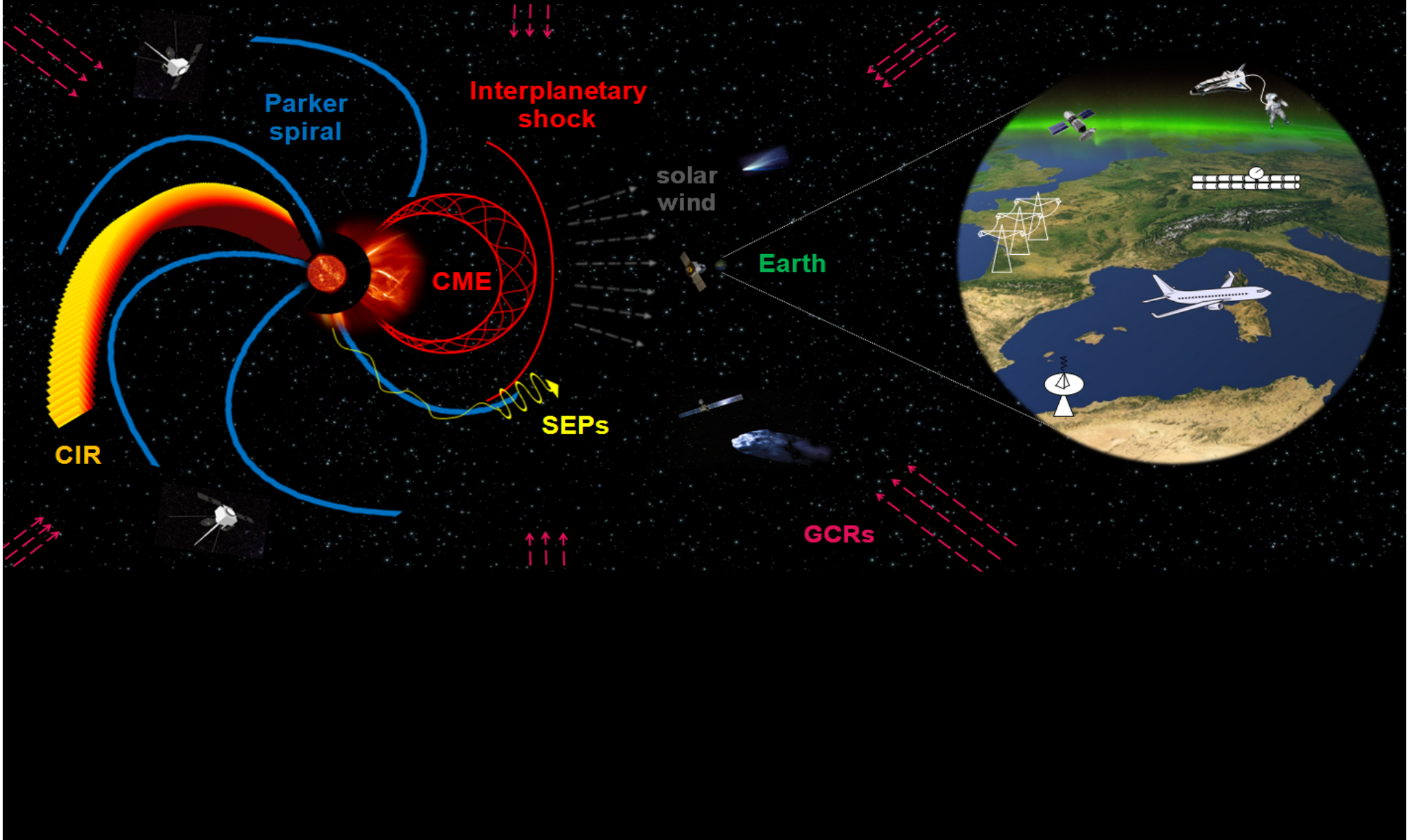
Short term decreases in galactic cosmic ray (GCR) flux (typical duration several days, typical magnitude several %)

Due to interaction of GCRs with shock/sheath region and CME/ejecta region (different mechanisms)

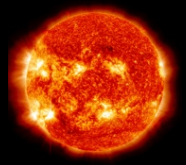


Richardson & Cane (2011)

Why should we care?

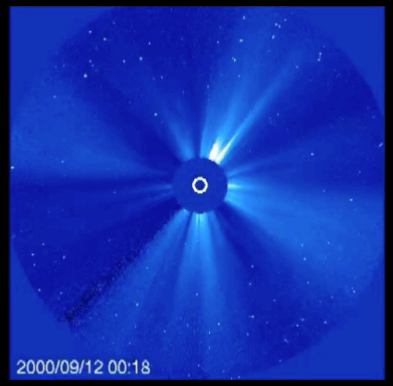


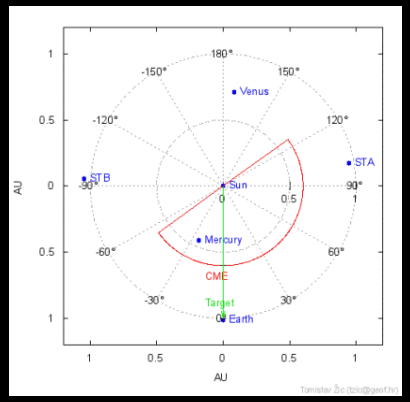
How to predict CME space weather effects?

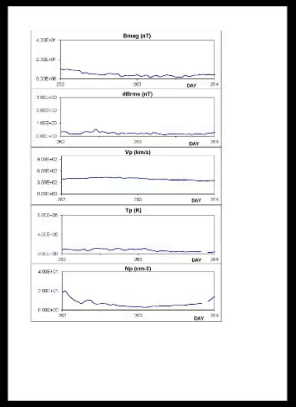


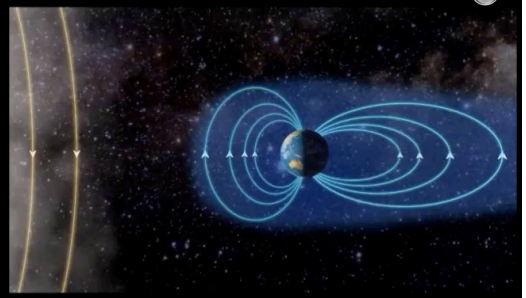
1500 000 km

150 000 000 km









CME detection: Initial conditions → Modeling of CME propagation & evolution → Prediction of ICME arrival and near-Earth properties → Modeling of geomagnetic storms and Forbush decreases

~ 1 day

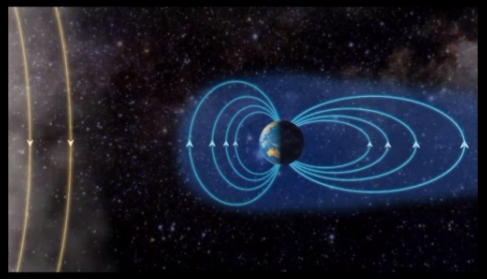
~ 1 h

Models for CME space weather effects

Statistical relations

↓

Empirical probabilistic model



CME detection:
Initial conditions

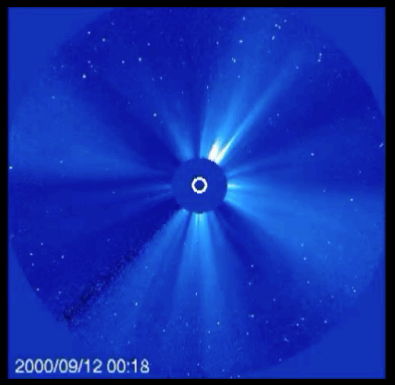
→

Modeling of geomagnetic storms and Forbush decreases

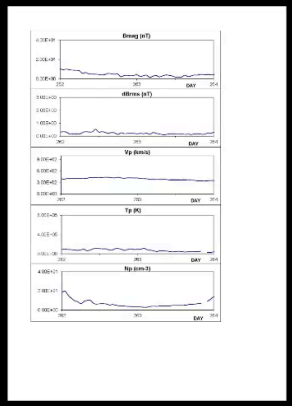
~ 1 day

CME Geo-effectiveness Forecast Tool (CGeFT)
Forbush Decrease Forecast Tool (FDFT)

Model for heliospheric propagation of CMEs



Physical model based on magnetohydrodynamical drag



CME detection: Initial conditions

Prediction of ICME arrival

Drag based odel (DBM)

Space weather tools

Propagation models

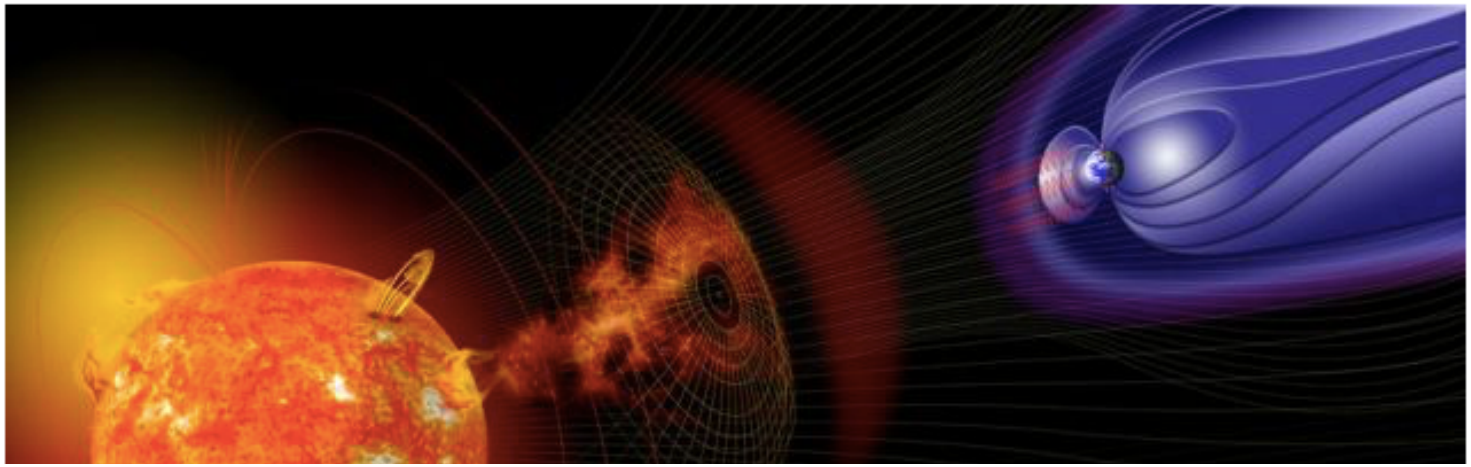
- Forecasting the Arrival of ICMEs at 1 AU: The Drag-Based Model
- Solar wind forecast

Geomagnetic storms

- CME Geo-effectiveness Forecast Tool

Forbush decreases

- Forbush Decrease Forecast Tool



Forecasting the Arrival of ICMEs: The Drag-Based Model

Basic DBM | Advanced DBM | Documentation

CME take-off **date**:	Feb 1 2016
CME take-off **time** (UTC):	18 h 01 min
$\mathbf{R_0}$ - starting radial distance of CME (R_S)	20
$\mathbf{v_0}$ - speed of CME at R_0 (km/s)	1000
Γ - drag parameter (10^{-7} km^{-1})	0.2
w - asymptotic solar wind speed (km/s)	450
$\mathbf{R_{target}}$ - target heliocentric distance (AU)	1

Calculate Reset!

Drag-Based Model has performed **3015** successful calculations (since 26.12.2012).

Forecasting the Arrival of ICMEs: The Drag-Based Model

Results | v-R-t plots | CME geometry plot | Documentation

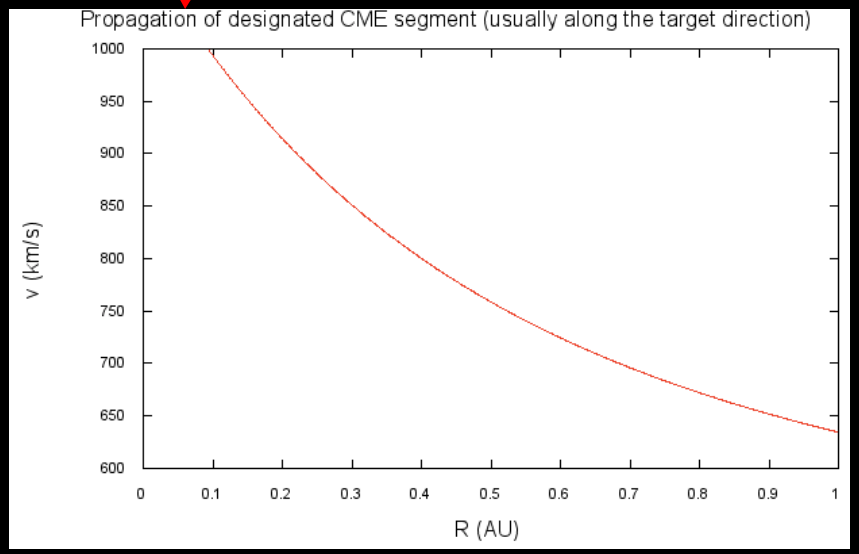
Output:

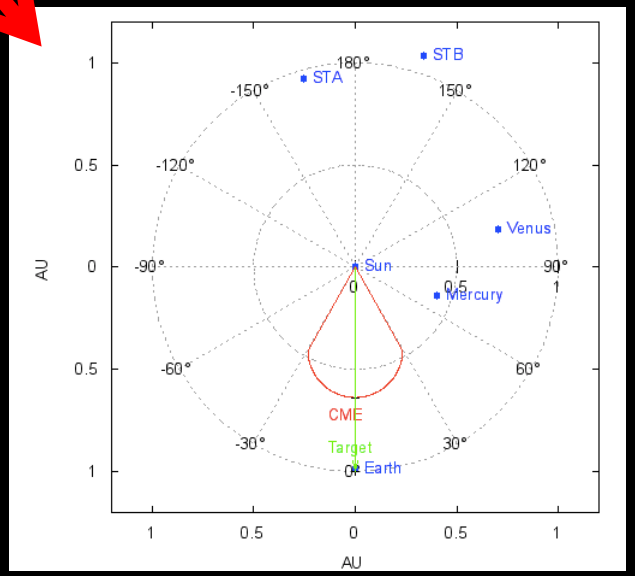
CME arrival at target (date & time): **03.02.2016 at 20h:02min**
Transit time: **49.99 h**
Impact speed at target (at 1 AU): **635 km/s**

Input parameters:

CME take-off date & time: **01.02.2016 at 18h:03min**

R_0=20 R_S, v_0=1000 km/s, Γ=0.2×10^{-7} km^{-1}, w=450 km/s, R_t=1 AU, θ=30 deg, ϕ_{target}=0 deg, ϕ_{CME}=0 deg.





CME Geo-effectiveness Forecast Tool (CGeFT)

Model input | Documentation

CME speed, *v* (in km/s): [ ] not available

CME/flare source position radius, R_S (in solar radii): [ ] not available

CME apparent width, *w*: not available

Solar flare x-ray class, *f*: not available

CME-CME interaction level, *i*: not available

Calculate Reset!

CME geo-effectiveness forecast tool has performed **265** successful calculations (since 10.3.2014).

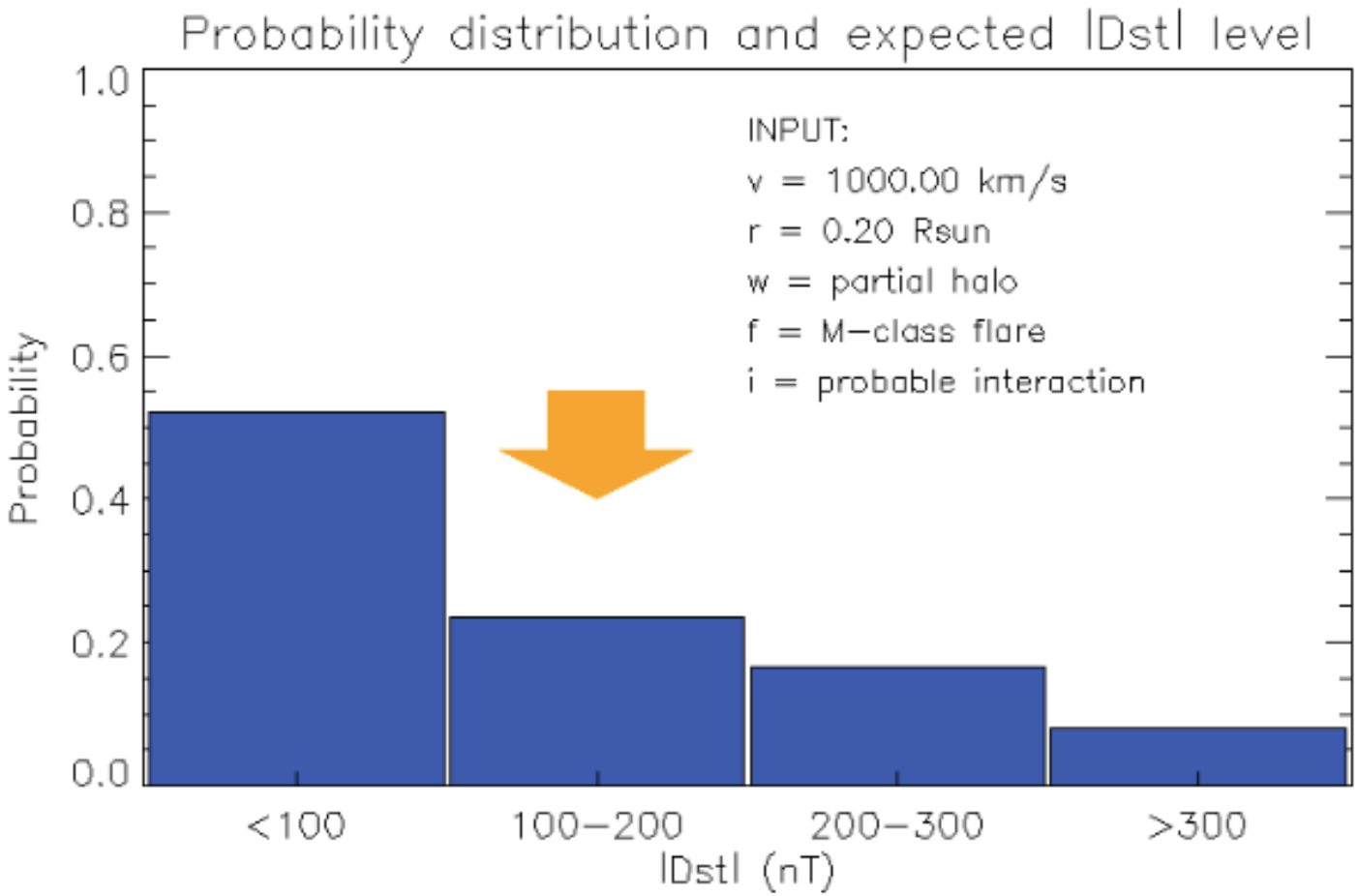
CME Geo-effectiveness Forecast Tool (CGeFT)

Results | Documentation

Output:

Based on the probability distribution for a given CME (blue histogram), the expected |Dst| level calculated by the model is 100 nT < |Dst| < 200 nT (marked by arrow).
Combined probability distribution calculated based on P_v, P_r, P_w, P_f, P_i (see table and table description).

For model calculation details see documentation.



Forbush Decrease Forecast Tool (FDFT)

Model input | Documentation

Initial CME speed, ***v*** (in km/s): ☐ not available

CME/flare source position radius, R_S (in solar radii): ☐ not available

CME apparent width, ***w*** (in degrees): ☐ not available

Flare strenght, ***f*** (in 10^{-7} Wm^{-2}): or select flare x-ray class ☐ not available

CME-CME interaction level, ***i***: not available

Calculate Reset!

Forbush Decrease Forecast Tool has performed **20** successful calculations (since 10.3.2015).

Opservatorij Hvar Hvar Observatory

SOLSTEL

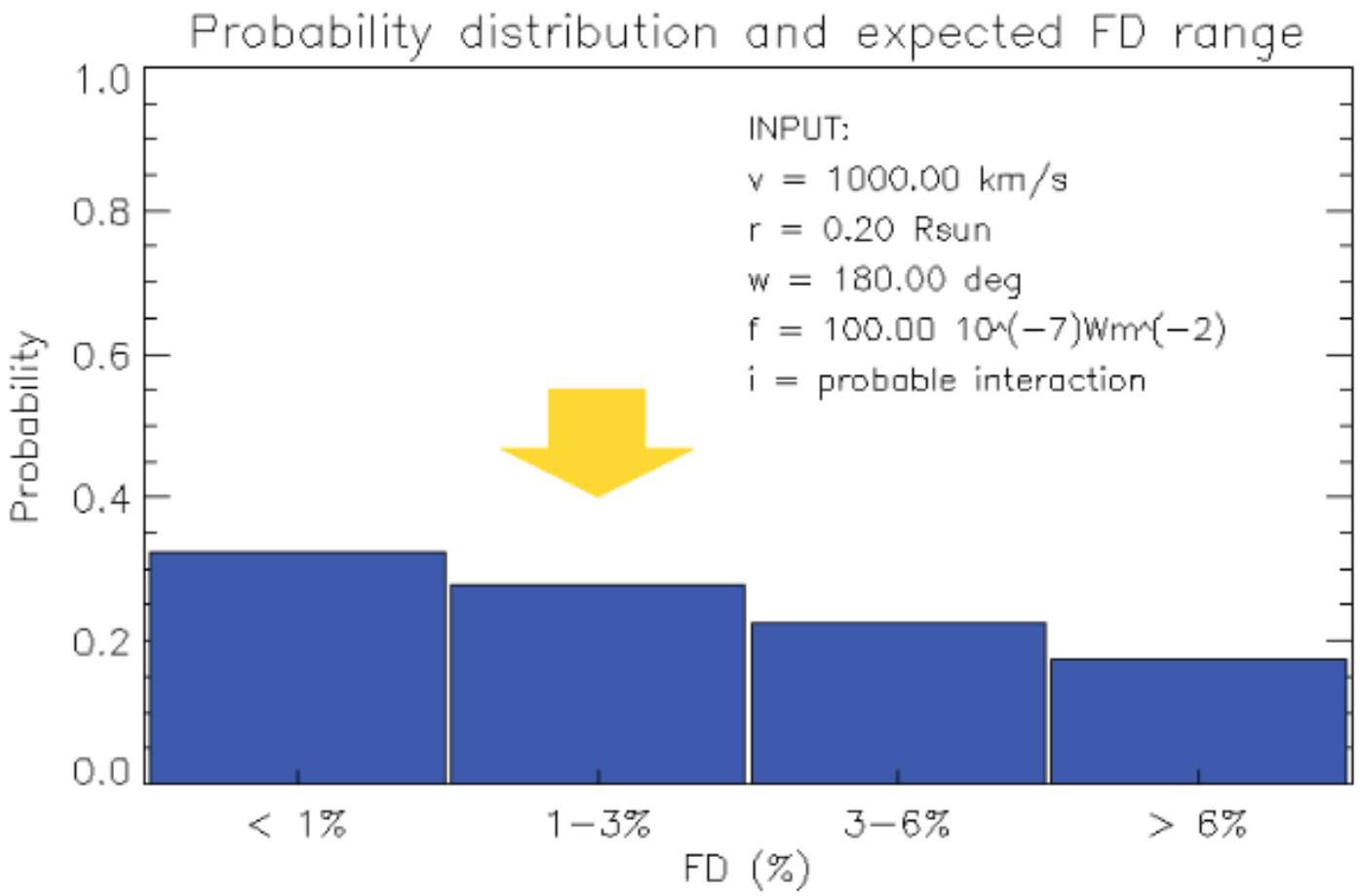
Forbush Decrease Forecast Tool (FDFT)

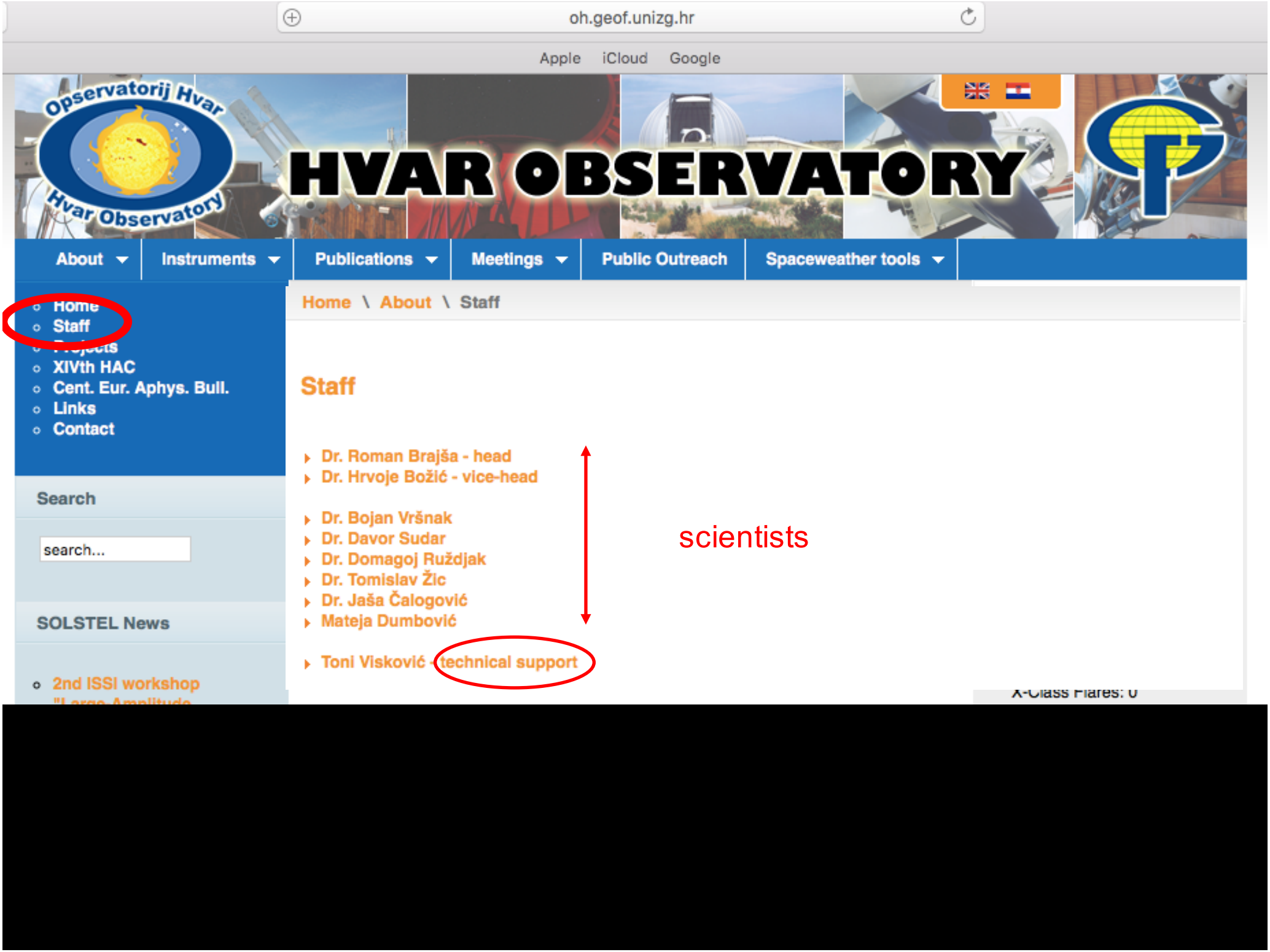
Results | Documentation

Output:

Based on the probability distribution for a given CME (blue histogram), the expected FD range calculated by the model is 1% < FD < 3% (marked by arrow).
Combined probability distribution calculated based on P_v,P_r,P_w,P_f,P_i (see table and table description).

For model calculation details see documentation.

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scientists
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Dr. Mateja Dumbović, dipl. ing.

mdumbovic@geof.hr

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Profession: Dr. sc. of Physics

Room: 505

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Citizenship: Croatia

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Tel: +385 1 4639 279; fax: +385 1 4828 081

E-mail: mdumbovic@geof.hr

Professional Preparation

PhD in Physics (Astrophysics), Department of Physics, Faculty of Science, University of Zagreb, 2015
dipl.ing.phys (Mag.Phys), Department of Physics, Faculty of Science, University of Zagreb, 2010

Employment: Hvar Observatory, Faculty of Geodesy, Uni. Zagreb, since 2010

Position: Post Doc

Europska Unija
Ulaganje u budućnost
Projekt je sufinancirala Europska Unija iz Europskog socijalnog fonda

Thank you for your attention!