



# AFFECTS Trailer

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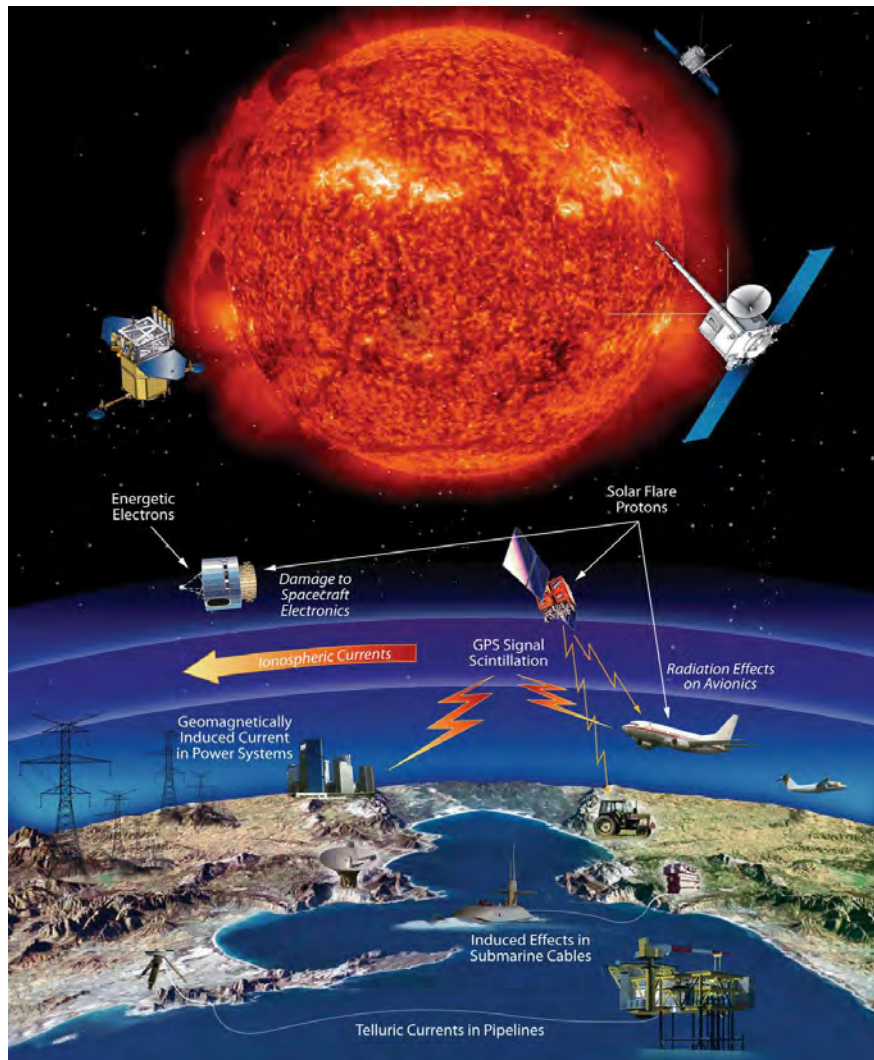
# **AFFECTS User Workshop**

28.02.2013, ROB, Brussels, Belgium





# Introduction to the project

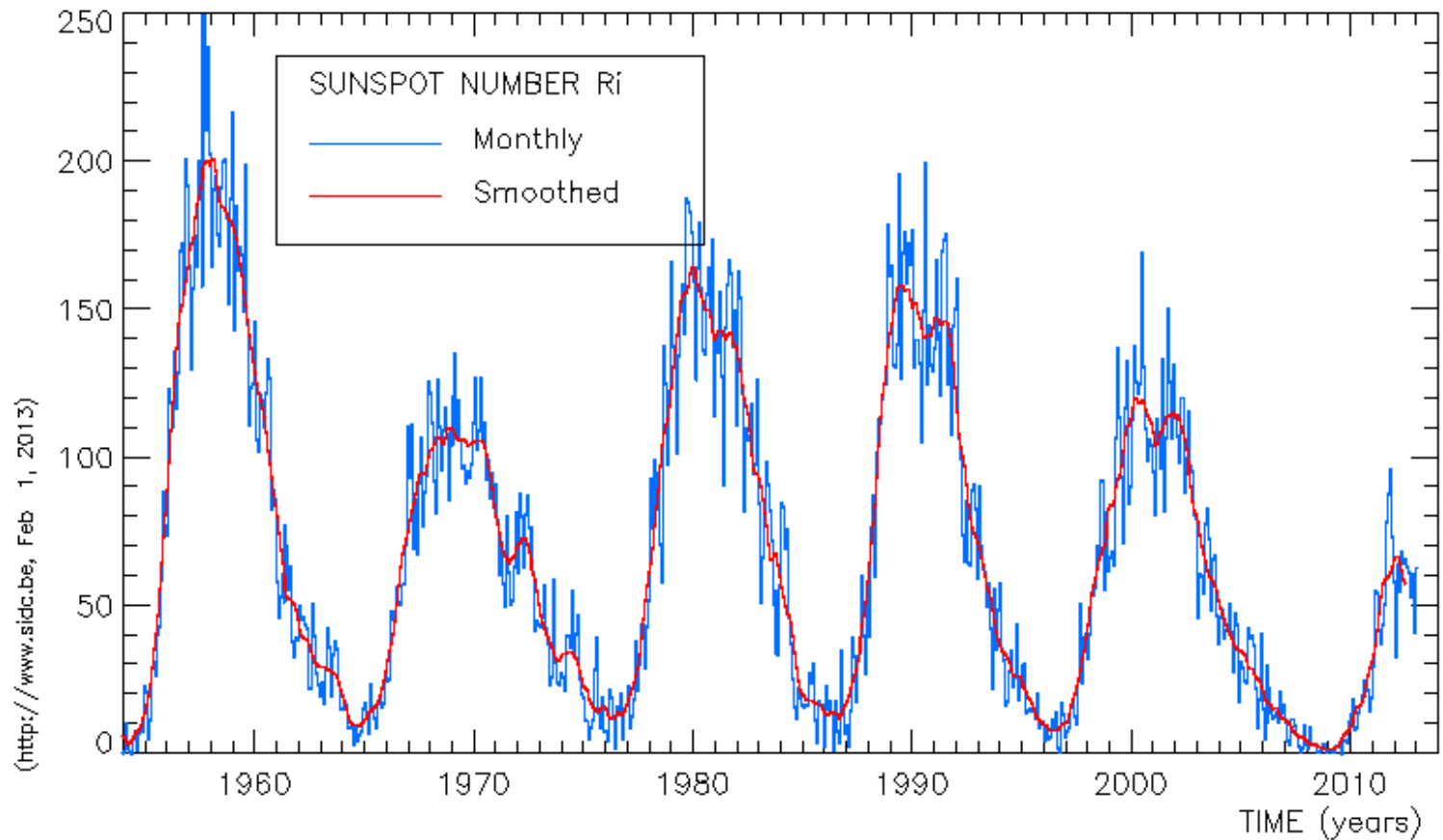


Summary of space weather effects on the terrestrial environment.  
Courtesy: NASA.



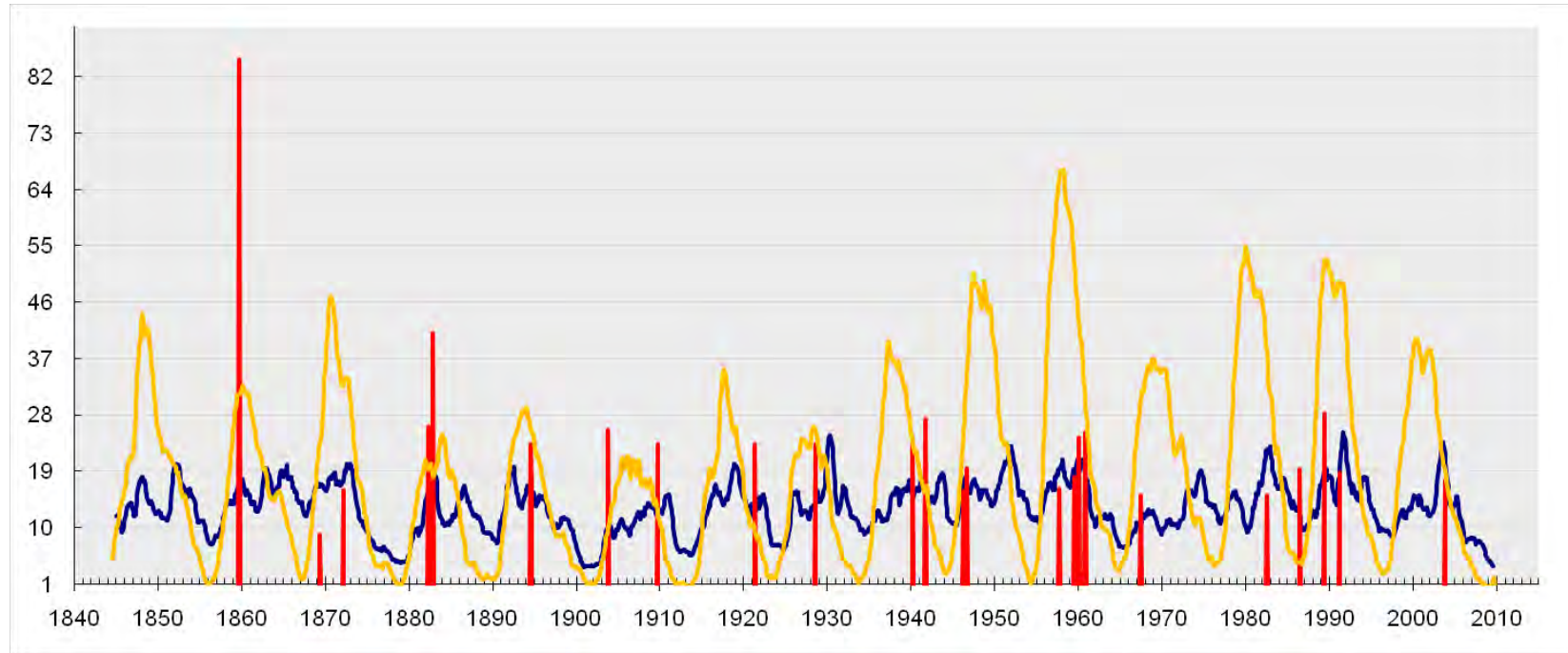


# Status of Solar Activity





# History of Solar Superstorms – Magnitude not dependent on Sunspot Number



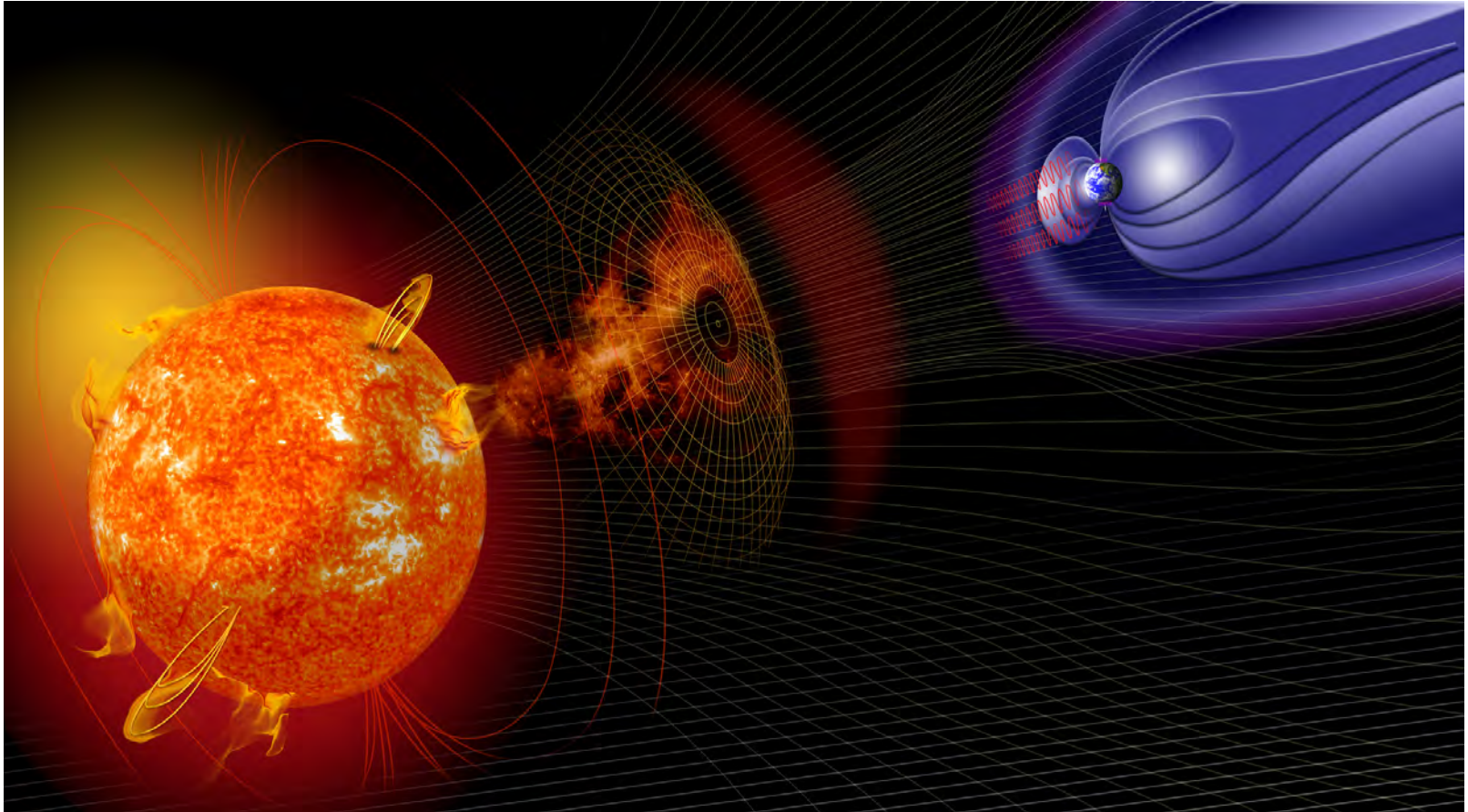
Storms with Kp (eq. aa, DSt amplitudes) g.e. 9 and extended time intervals of Kp g.e. 8-







# Introduction to the project

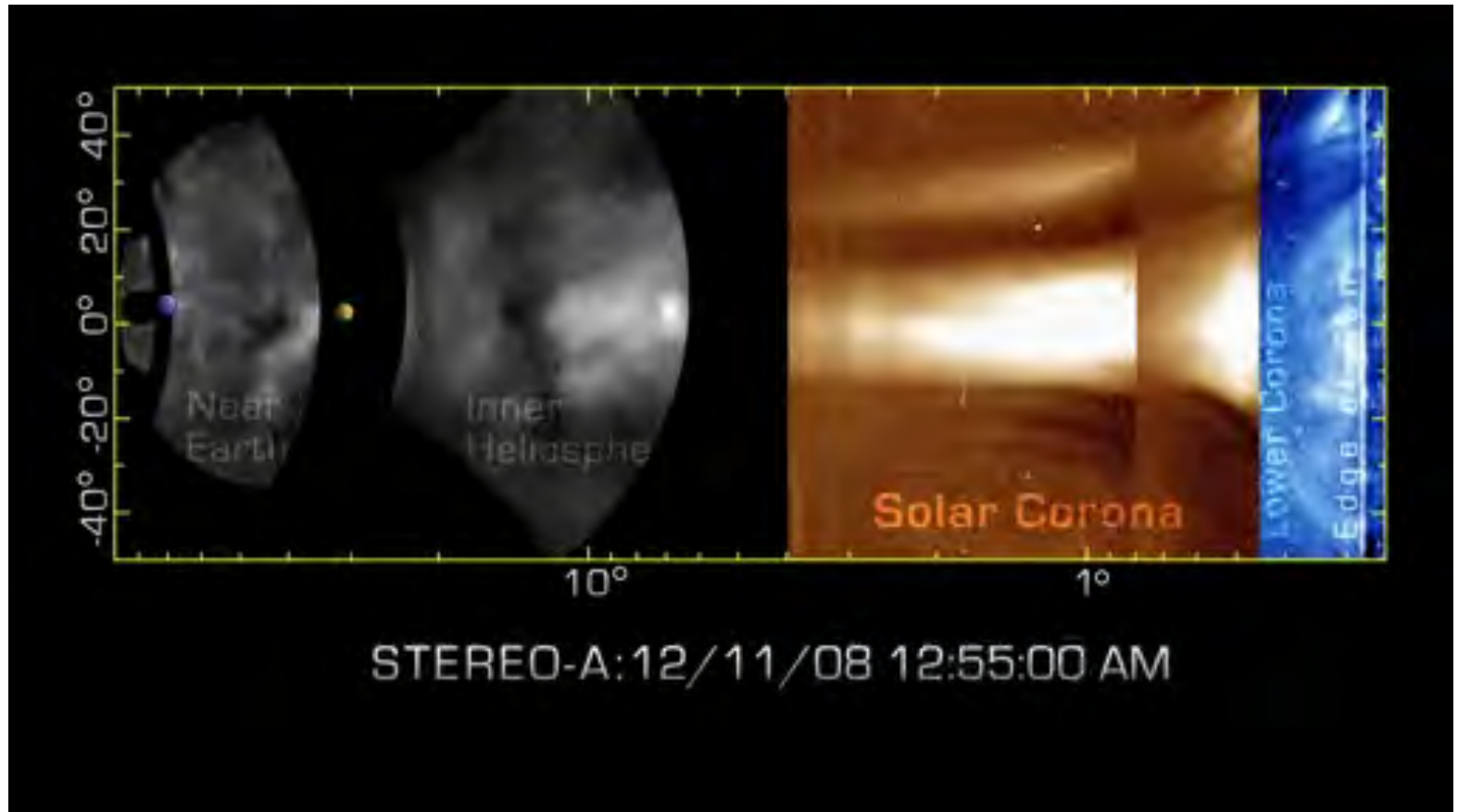


Sketch of a coronal mass ejection propagating towards Earth. Courtesy: NASA.

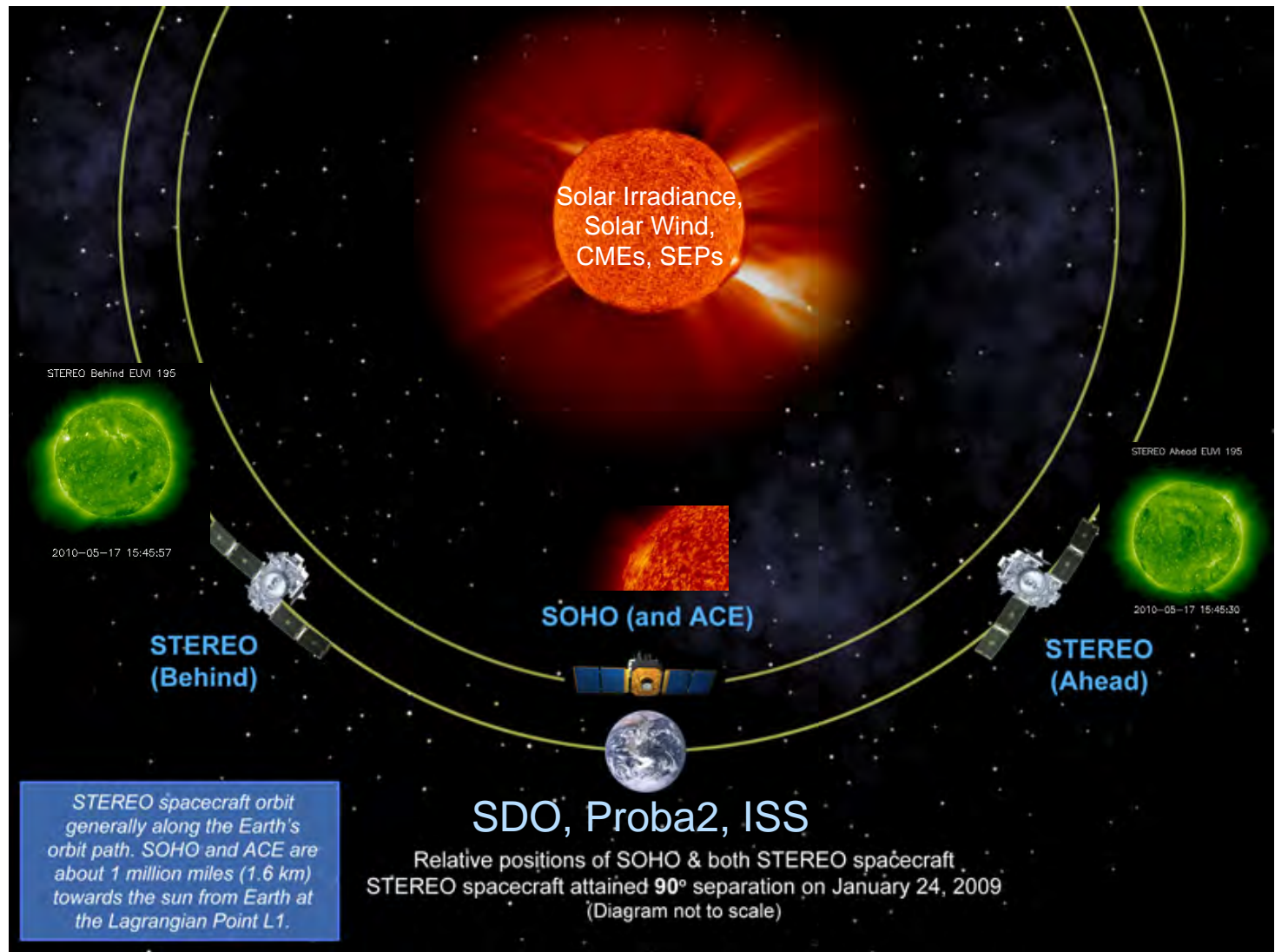




# Storms tracked to Earth



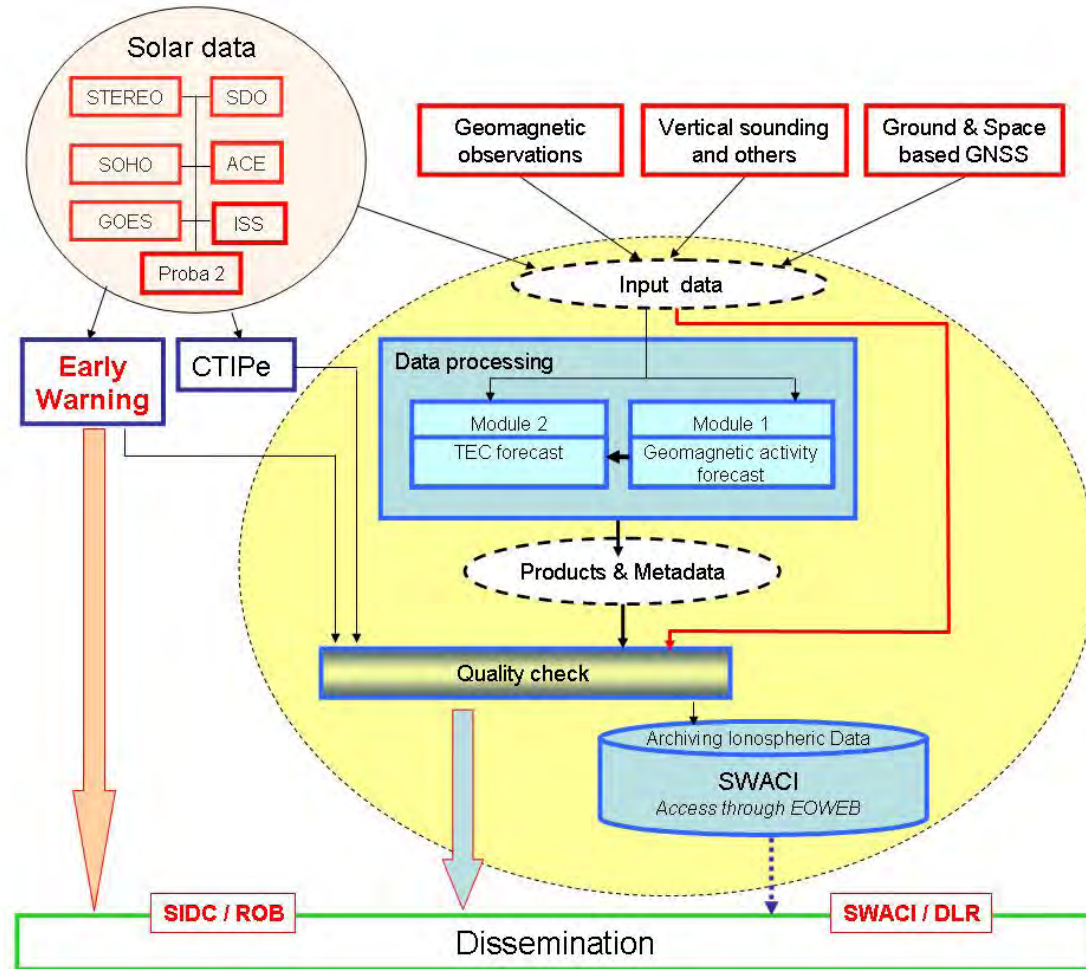
# Multipoint observations





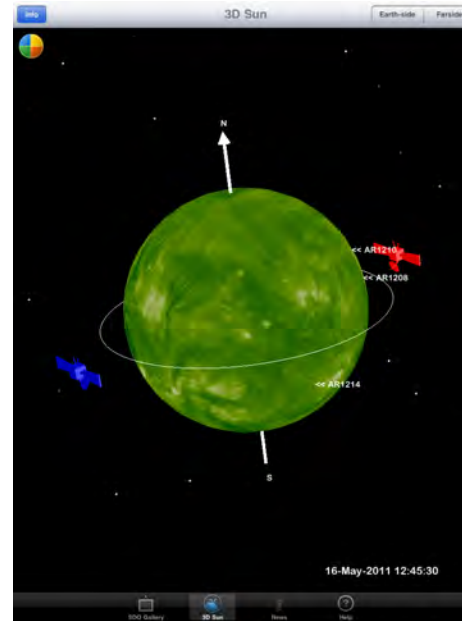
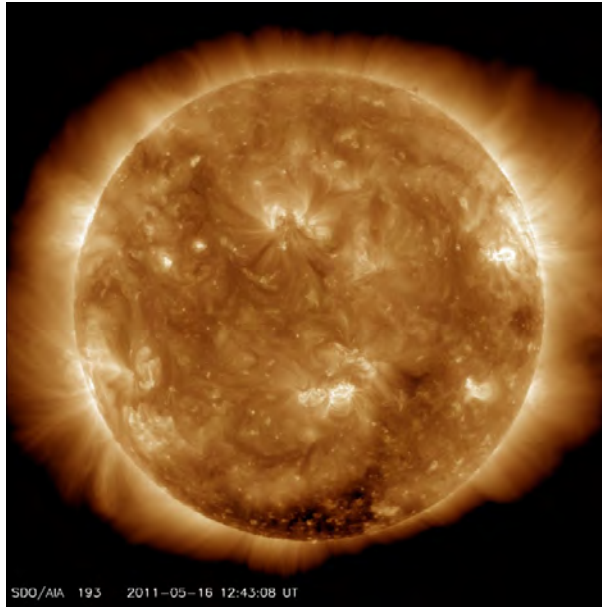


# AFFECTS Workflow





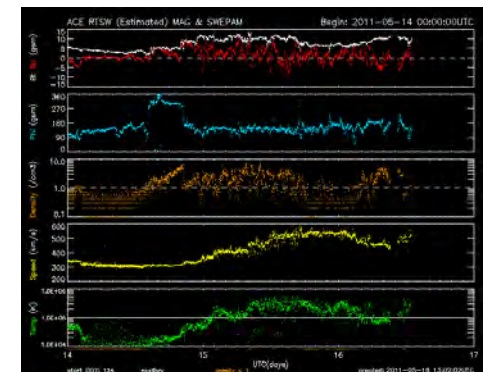
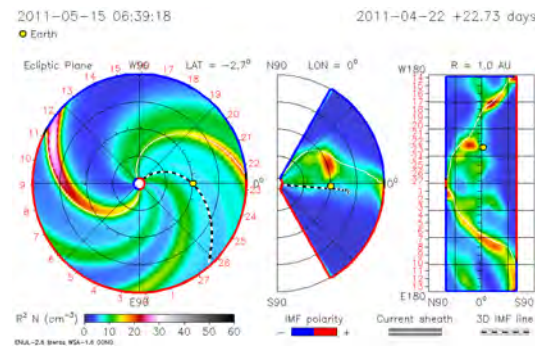
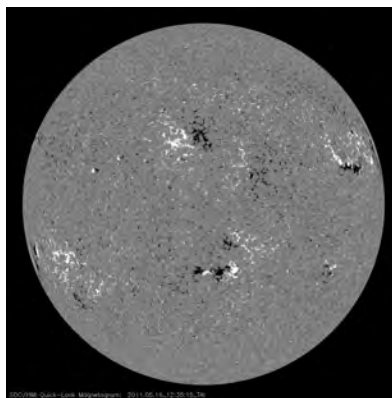
# Selected Dissemination Activities in PY2 4/5



iphone/ipad  
Apps:

The 3D Sun; The Sun  
Viewer; ACE-Daten

SWACI is part of NASA  
Space Weather Apps





# Welcome to the AFFECTS 2nd General Meeting and associated User Workshop



# AFFECTS

## Advanced Forecast For Ensuring Communications Through Space

Solar storms are a consequence of sudden eruptions of magnetised gas in the Sun's outer atmosphere. Commonly such storms start with a sudden release of electromagnetic radiation – a solar flare, and by an eruption of a giant cloud of magnetised plasma – a coronal mass ejection (CME). A fast CME also accelerates solar particles to high energies – a solar energetic particle event.

Solar storms affect the Earth environment from the magnetosphere down to the ionosphere, and even to the lower atmosphere climate system. The natural hazards of severe space weather have the potential to catastrophically disrupt the operations of technological systems, such as communication systems and power grids on Earth. Through the AFFECTS project funded by the European Union's 7<sup>th</sup> Framework Programme, European and US scientists develop an advanced prototype space weather warning system to safeguard the operation of telecommunication and navigation systems on Earth to the threat of solar storms. The project is led by the University of Göttingen's Institute for Astrophysics and comprises world-wide leading research and academic institutions and industrial enterprises from Germany, Belgium, Ukraine, Norway and the United States.







[www.affects-fp7.eu](http://www.affects-fp7.eu)

Funded by the European Union

infoNetwork  
Official Media Partner

Image Credits: University of Göttingen, NASA, ESA, Planetarium Hamburg



# AFFECTS Project Goals

- Timeline: 1<sup>st</sup> March 2011 until 28<sup>th</sup> February 2014

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- State of the art analysis and modeling of the Sun-Earth chain of effects on the Earth's ionosphere and their subsequent impacts on communication systems
- Quantitative and timely (advanced) forecast - based on multi-point space observations complemented by ground-based measurements of auroral electrojet and ionospheric activity - of the relevant space weather effects on the ionosphere
- Provision of Europe's first advanced early warning and space weather prototype forecast system to help European citizens mitigate space weather impacts on telecommunication and -navigation systems





# AFFECTS Trailer

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# AFFECTS Website - [www.affects-fp7.eu](http://www.affects-fp7.eu)

**AFFECTS - ADVANCED FORECAST FOR ENSURING COMMUNICATIONS THROUGH SPACE -**

is a space research project under the 7th Framework Programme of the European Union

AFFECTS will provide advanced early space weather warning to protect communication systems.

This website is set up by the AFFECTS consortium and informs you about the project's details and progress. We hope you enjoy your stroll through the pages...

**THE FOLLOWING INSTITUTIONS ARE INVOLVED IN AFFECTS:**

Beneficiary No.	Country	Institution	Short Name	Scientific Contact	Link to 'Institution' website
1	Germany	Georg-August-University Göttingen	UCOE	Dr. Volker Bothmer, project coordinator	<a href="http://www.uni-goettingen.de/en/1.html">www.uni-goettingen.de/en/1.html</a>
2	Belgium	Royal Observatory of Belgium	ROB	Dr. Ronald Van der Linden, Dr. Francis Verbereck	<a href="http://www.astro.oma.be/EN/fornews/index.php">www.astro.oma.be/EN/fornews/index.php</a>
3	Ukraine	Space Research Institute	SRI NASU-NSAU	Dr. Aleksei Ponomarev	<a href="http://www.sri.kiev.ua">www.sri.kiev.ua</a>
4	Germany	Fraunhofer IPT	FHG	Dr. Raimund Bräuer	<a href="http://www.ipn.fraunhofer.de/en.html">www.ipn.fraunhofer.de/en.html</a>
5	Norway	University of Tromsø	UoT	Prof. Chris Hall	<a href="http://www2.ut.no/kb/Views/page/Inenglish">www2.ut.no/kb/Views/page/Inenglish</a>
6	Germany	German Aerospace Center	DLR	Dr. Norbert Jakowski, Dr. Claudia Bortol	<a href="http://www.dlr.de/ln/en/desktopdefault.aspx">www.dlr.de/ln/en/desktopdefault.aspx</a>
7	Germany	Astrium GmbH	ASTRIUM ST	Mr. Wilfried Pfeiffer	<a href="http://www.astrium.eads.net/en/">www.astrium.eads.net/en/</a>
8	U.S.A.	Space Weather Prediction Center of NOAA	NOAA-SWPC	Dr. Rodney Vieux	<a href="http://www.swpc.noaa.gov">www.swpc.noaa.gov</a>
9	Germany	Planetarium Hamburg		Mr. Thomas Krause	<a href="http://www.planetarium-hamburg.de/service/information-for-our-english-speaking-visitors/">www.planetarium-hamburg.de/service/information-for-our-english-speaking-visitors/</a>

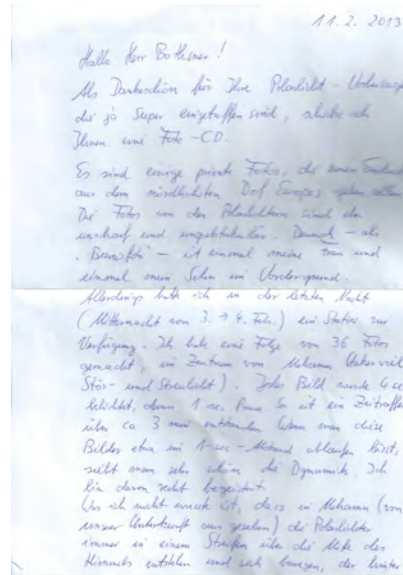
- Website includes Wiki engine

## Provides

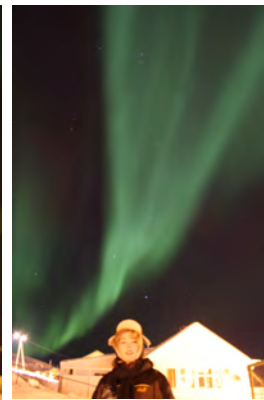
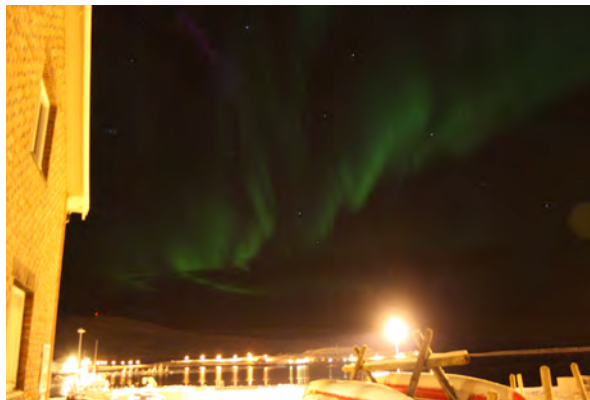
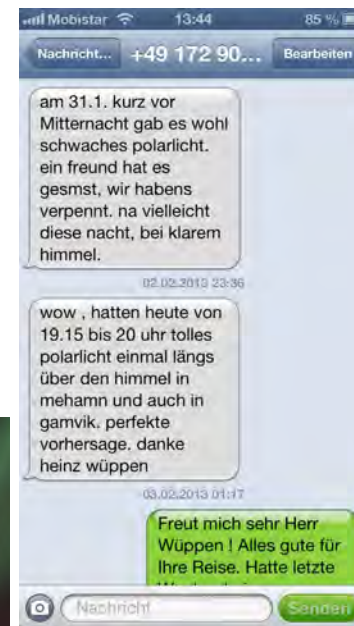
- 3 monthly AFFECTS Newsletter
- PR Material (Trailer, press releases, meeting reports)
- Weather reports and alerts based on solar activity analysis
- Links to partner sites and other useful resources



# Selected Dissemination Activities in PY2 5/5 – Forecast for Media and Individuals



RSS Feeds available at AFFECTS homepage





# AFFECTS provides space weather warnings to infoNetwork Media Group – Official collaboration





# Solar Storm on June 7, 2011





# Forecast Schematics

Onset

Event  
Awareness

Geometrical  
Real Time  
Modelling

GCS  
Thernisien, NRL

CAT  
Millward, NOAA

Extrapolation  
to L1

L1 prediction  
Drag models or  
statistics

Extrapolation  
to Earth  
*M. Venzmer*

Geomagnetic  
indices forecast

Auroral  
forecast







# Forecast Schematics

Onset

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Extrapolation  
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Geomagnetic  
indices forecast

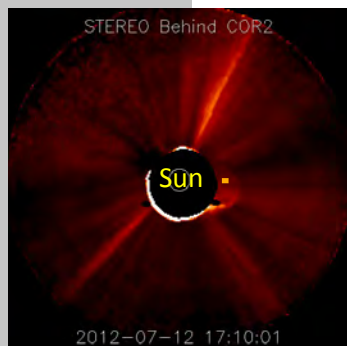
Auroral  
forecast



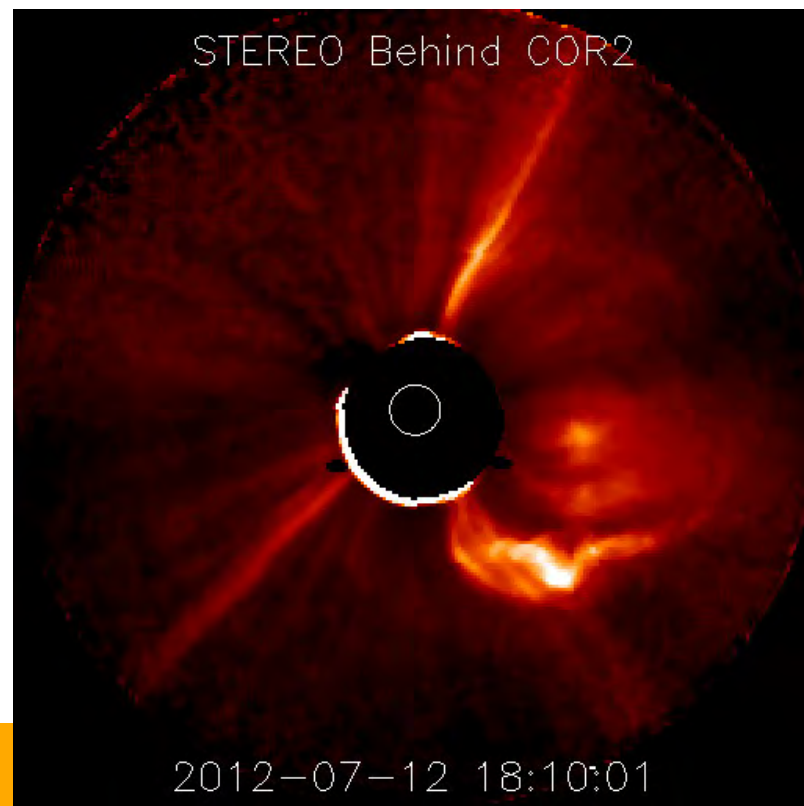
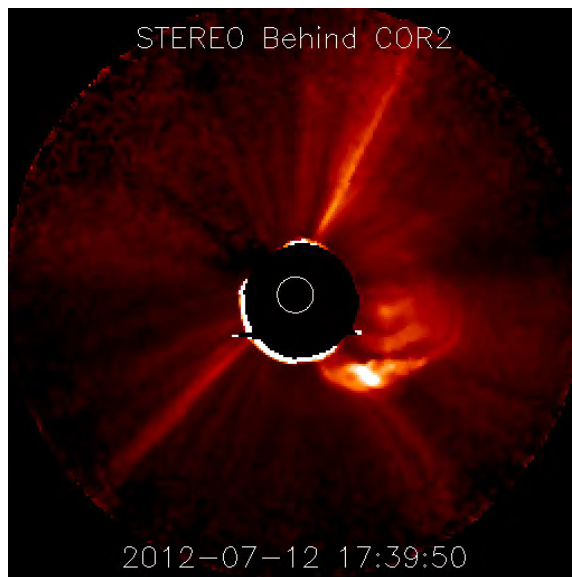


# CME Detection

STEREO B,  $v_{\text{CME}}$  at PA  $270^\circ \sim 1.500 \text{ km/s}$



150 Million km towards Earth

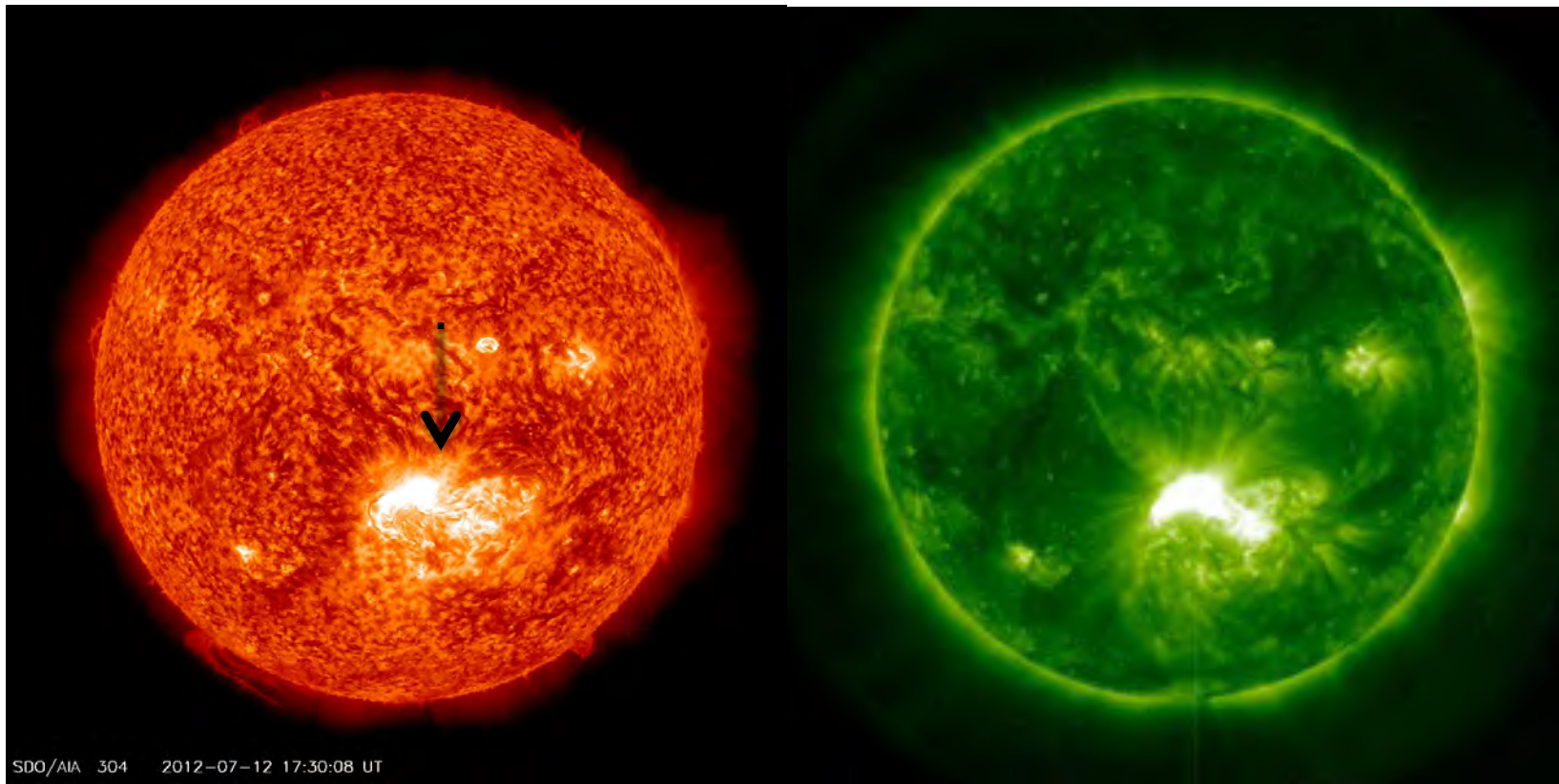




# Identification of solar Source Region

(near „Post“ Flareloops at S15 W01, 17:30 UT)

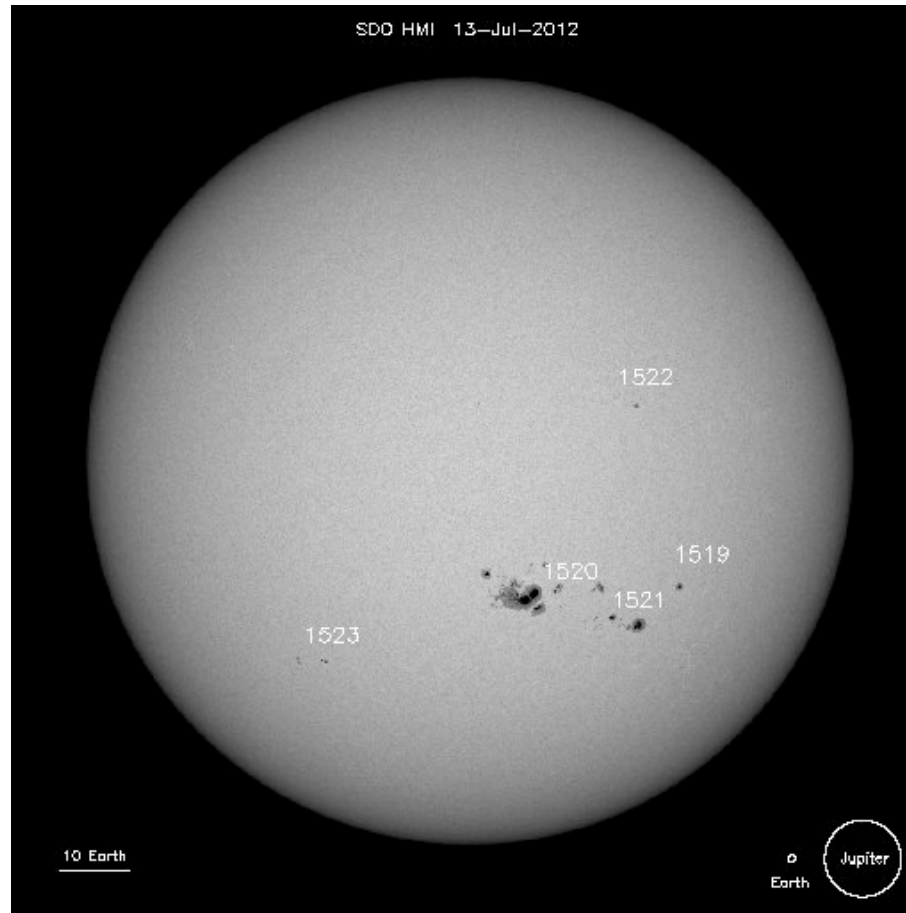
SDO/AIA (left 30.4 nm, right 19.3 nm)





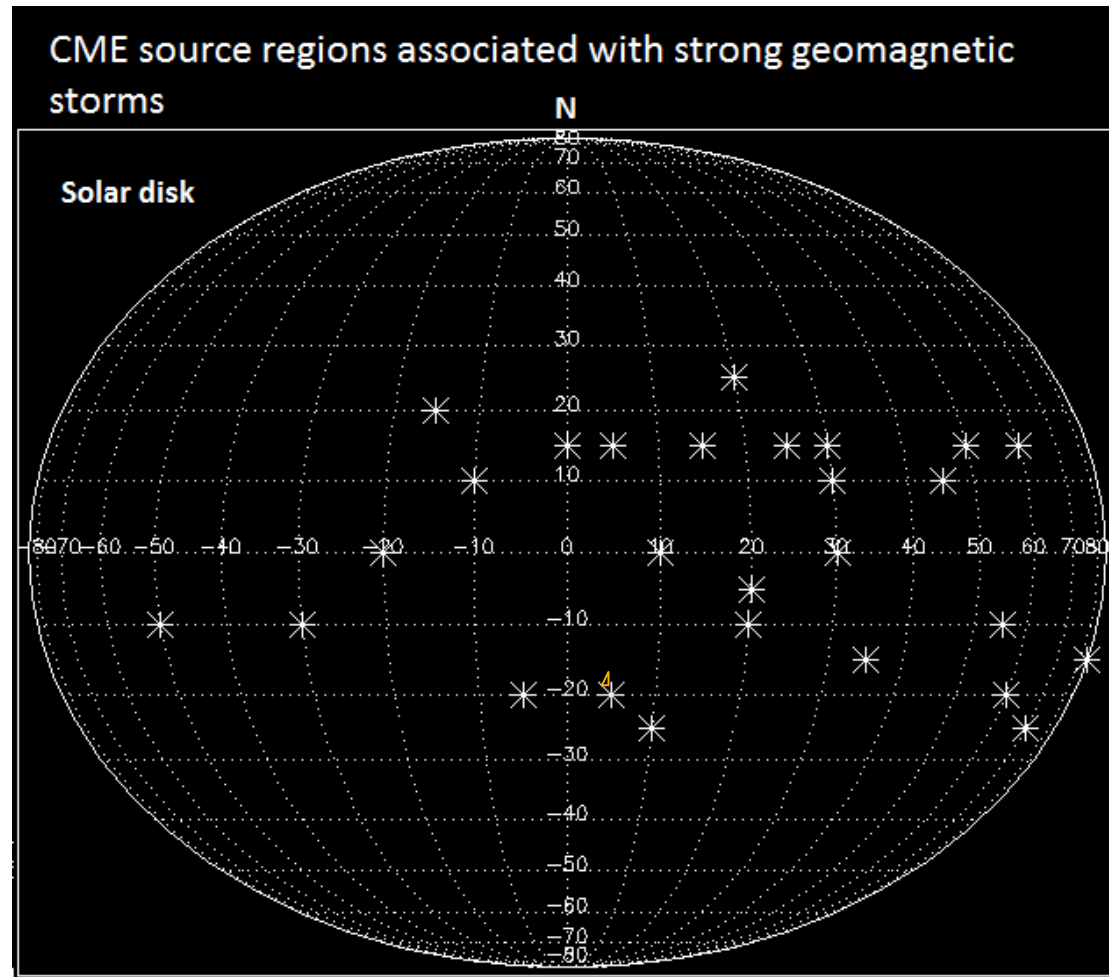
# Visible disk and sunspots

## SDO/HMI Observations: active region 1520





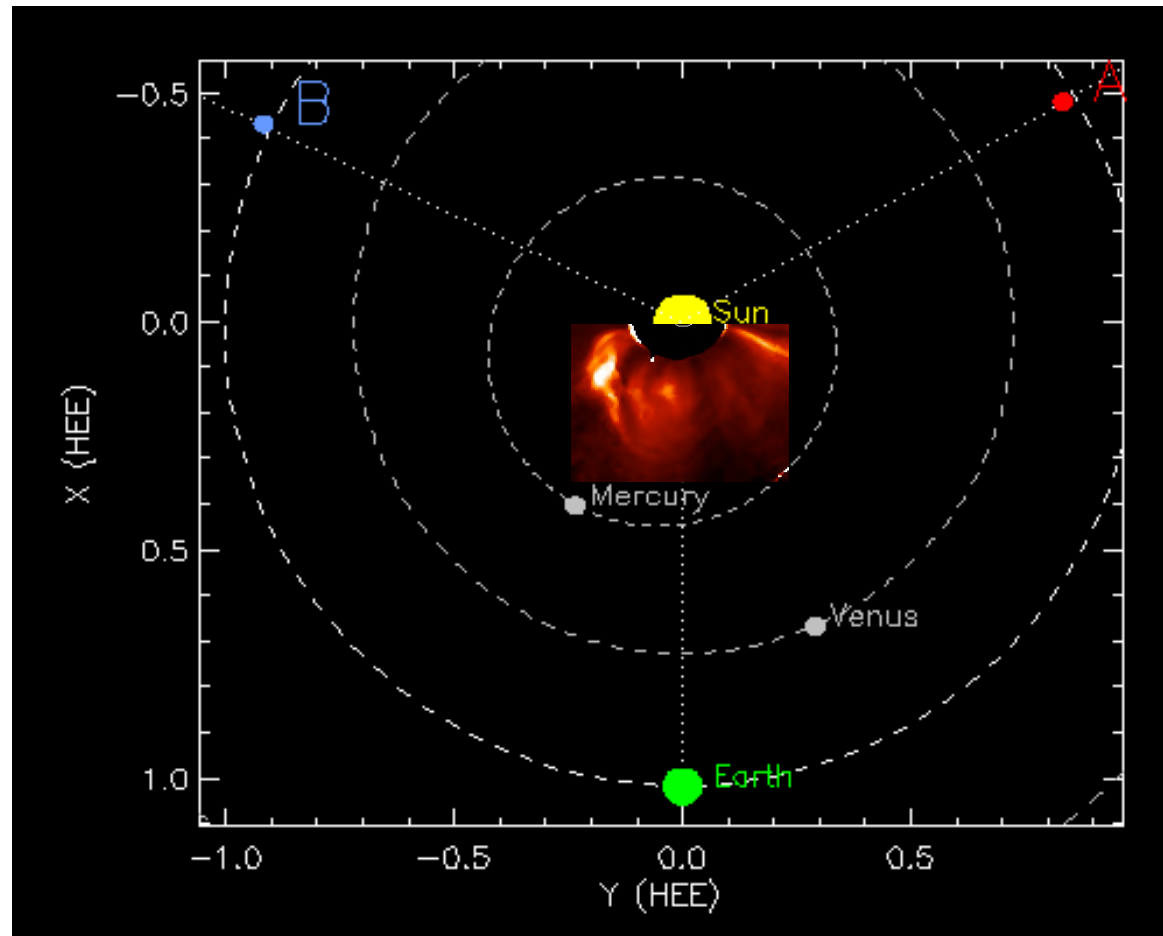
# Strong ( $K_p \geq 8$ -) geomagnetic Storms and SR Locations (1998-2006)- W preference





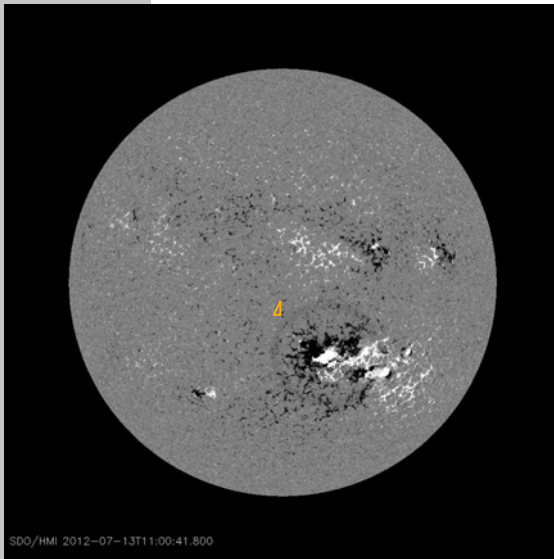


# Parametrization of CME Direction of Propagation and Speed

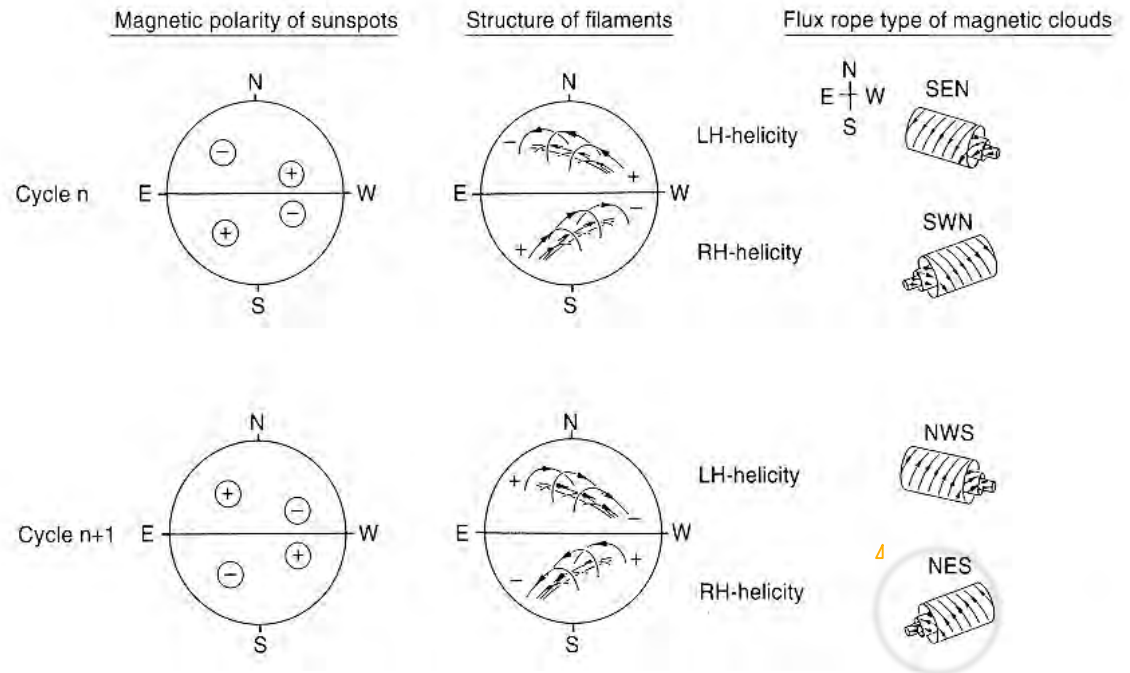




# Magnetic Field Configurations of CMEs

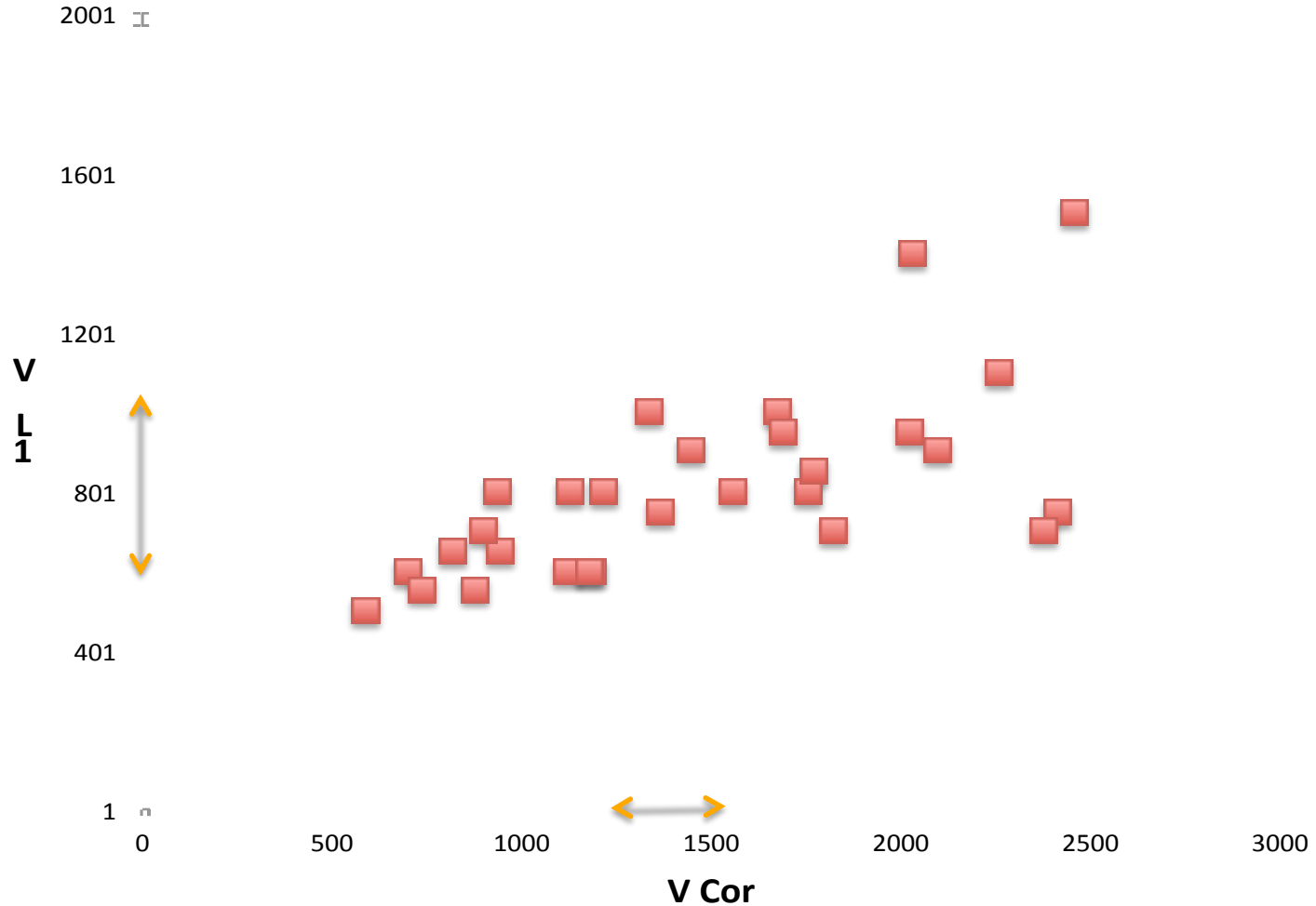


Complex cycle n+1 of Bothmer & Schwenn scheme due to proximity of two bipolar regions



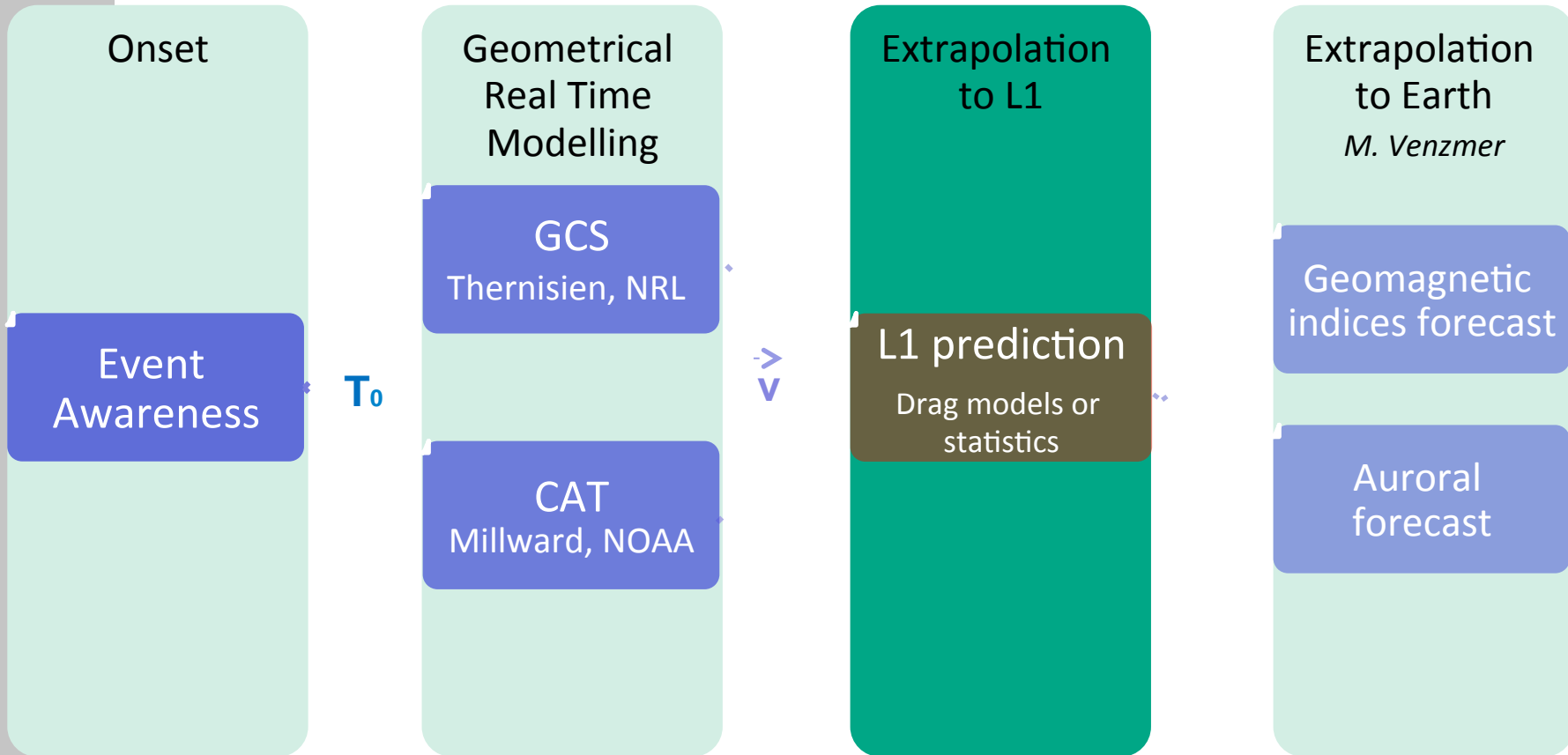


# COR 1 to L1 CME Speed Relationship





# Extrapolation to L1



# DON'T LET THE SUN GO DOWN ON YOU WATCH OUT FOR SOLAR STORMS

## AFFECTS

### Advanced Forecast For Ensuring Communications Through Space

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STEREO A

ACE

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SDO

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