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 7th 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 worldwide leading research and academic institutions and industrial enterprises from Germany, Belgium, Ukraine, Norway and the United States.

www.affects-fp7.eu

Funded by the European Union

infoNetwork

Official Media Partner

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

Advanced Forecast For Ensuring Communications Through Space (AFFECTS)

Volker Bothmer, Project Coordinator

Cis Verbeeck, presenter

& AFFECTS Team

10th European Space Weather Week, November 18-22, 2013, Antwerp

Outline

1. Objectives
2. Alerts
3. Other products and services
4. Dissemination

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AFFECTS Project Objectives

- State-of-the-art analysis and modelling of the Sun-Earth chain of effects on the Earth's ionosphere and their subsequent impacts on communication systems based on multipoint space observations and complementary ground-based data.

- Development of a prototype space weather early warning system and reliable space weather forecasts, with specific emphasis on ionospheric applications.

- Dissemination of new space weather products and services to end users, the scientific community and general public.

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CME/Flare Alerts – Subscription Services

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UCMEO 93001 30723 1850/
30722 60624 81254 3062/ 305// 333// 41032
30722 60535 80705 ///// ///// 1112/
99999

PLAIN

SOHO/LASCO observed an asymmetric HALO CME on July 22, 2013.  Event is
first seen in C2 beginning 06:24 UT with a bright loop over the Northwest.
The event expands with extensions to a full HALO with cavity and core by
07:12 UT.  The event continues into the C3 field beginning 06:24-12:54 UT
leaving the C3 field at 30Rsun in the Northwest.

Time/height measurements were marked at 5 points in C2 with speeds of
972.3 Km/sec at pa 306 degrees. The event is marked to 8 points in C3.
Speeds average through both fields to 1031.6 Km/sec at PA 306 degrees.
Acceleration 39.81 m/sec².
```

- **ROB Presto - Flare and Cactus CME alerts**
- **NOAA-SWPC - PSS**
- **SOHO/LASCO halo CME alerts**
- **NRT generated messages**

Von SWPC Product Subscription Service <SWPC.Products@noaa.gov>
Betreff SUMMARY: X-Ray Event exceeded M5 (R2)
An Volker Bothmer

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Space Weather Message Code: SUMXM5
Serial Number: 104
Issue Time: 2013 Jun 07 2326 UTC

SUMMARY: X-ray Event exceeded M5
Begin Time: 2013 Jun 07 2211 UTC
Maximum Time: 2013 Jun 07 2249 UTC
End Time: 2013 Jun 07 2304 UTC
X-ray Class: M5.9
Location: S28W73
NOAA Scale: R2 - Moderate

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/NOAAscales

Potential Impacts: Area of impact centered primarily on sub-solar point on the sunlit side of Earth.
Radio - Limited blackout of HF (high frequency) radio communication for tens of minutes.
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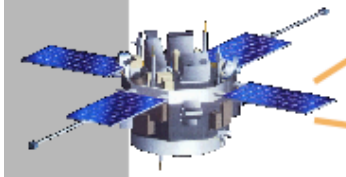
Early Warning for GNSS Users

Ionospheric disturbance scale	Expected Hazards	Arrival Time	Influenced Area	Condition Ionosphere
I 0	None	none	-	Ionosphere nominal
I 1	Impacts on high frequency (HF) radio propagation expected. Influence on positioning and navigation possible.	Arrival within a rough time period expected.	Rough information on influenced region (polar, mid-latitudes).	Ionosphere disturbed.
I 2	Strong impact on high frequency communication. Satellite navigation errors expected.	Detailed with reliable error estimation .	More detailed information on influenced regions (latitude dependent).	Ionosphere strongly disturbed with forecast information due to correlation analysis (Bz - dTEC).

L1 Alerts – Provided as RSS-Feeds



ACE spacecraft.
Credit: NASA

Data stream:

e.g. DLR

NOAA
web server

L1 Solar Wind Alert

L1 Kp Alert

L1 Aurora Alert

L1 GNSS error Alert

ACE data from MAG and SWEPAM instruments:

- NOAA/SWPC/RTSW (ACE Real Time Solar Wind, preliminary data)
  - http://www.swpc.noaa.gov/ace/index.html
- CALTECH/ASC (ACE Science Center, level 2 data)
  - http://www.srl.caltech.edu/ACE/ASC/level2/index.html
- NASA/GSFC/SPDF (OMNIWeb interface, level 2 data)
  - http://omniweb.gsfc.nasa.gov

Warning through AFFECTS Website and Mailing List

AFFECTS Space Weather Reports

Contents [hide]

May 15, 2013

Active region 1748 appeared at the Sun's East limb on May 13, 2013 when it caused on this, the following day and today three X-ray flares with peak intensities in the M to X-range. Three fast CMEs with speeds in the range 1400-2000 km/s were associated with these events. The first two ones are not expected to cause any impacts at Earth whilst a shock wave is expected to arrive between 06:30 and 12:30 local time (DST) tomorrow on May 16, 2013. The estimated speed at Earth is 1000 km/s. There are no indications that the CME main body will pass the Earth and there are no indicators for a major geomagnetic storm to be happening. The delayed and slow intensity increase in the >10 MeV proton flux is a typical signature for shock wave propagation East of central meridian. It is likely that the next days will be stormy too since besides AR 1748, AR 1745 closer to CM also has potential for causing major solar storms.

April 12, 2013

On April 11 around 07 UT SOHO and STEREO detected the onset of a CME near CM. The estimated speed of it is 603 km/s in the STEREO/COR2-B field of view. Using the BHV prediction method yields an arrival time of April 14, 03 UT with an in-situ speed of 500 km/s. Based on the B&S flux rope scheme the CME is predicted to be of ENW (SEN) type. A geomagnetic storm is forecasted for April 14, 03 - 15 UT, with a magnitude of about Kp 7+.

Expected Final Result

- Europe's first prototype space weather warning system with specific focus on telecommunication and navigation systems

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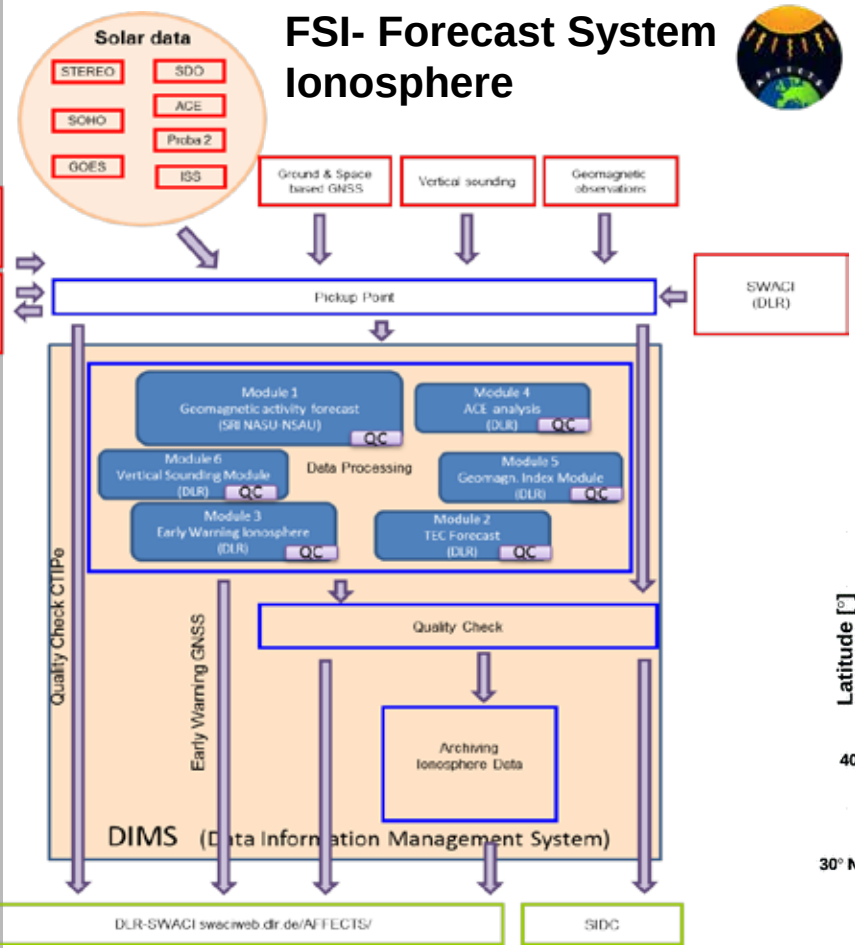
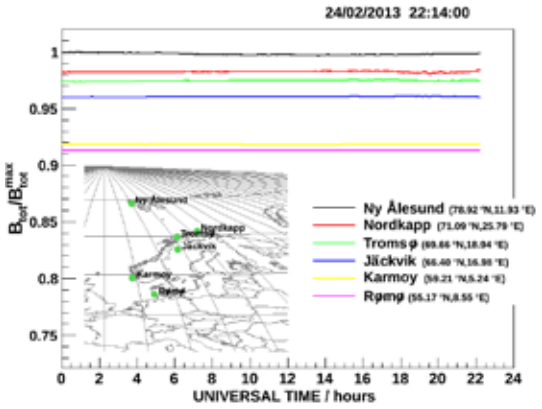
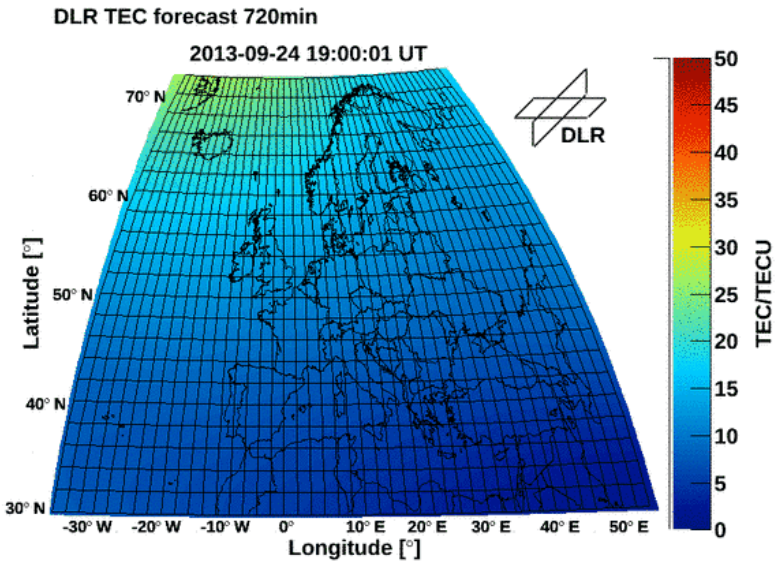
Forecast of „Ionospheric Storms“ and prediction of Total Electron Content (TEC) / „GPS error“



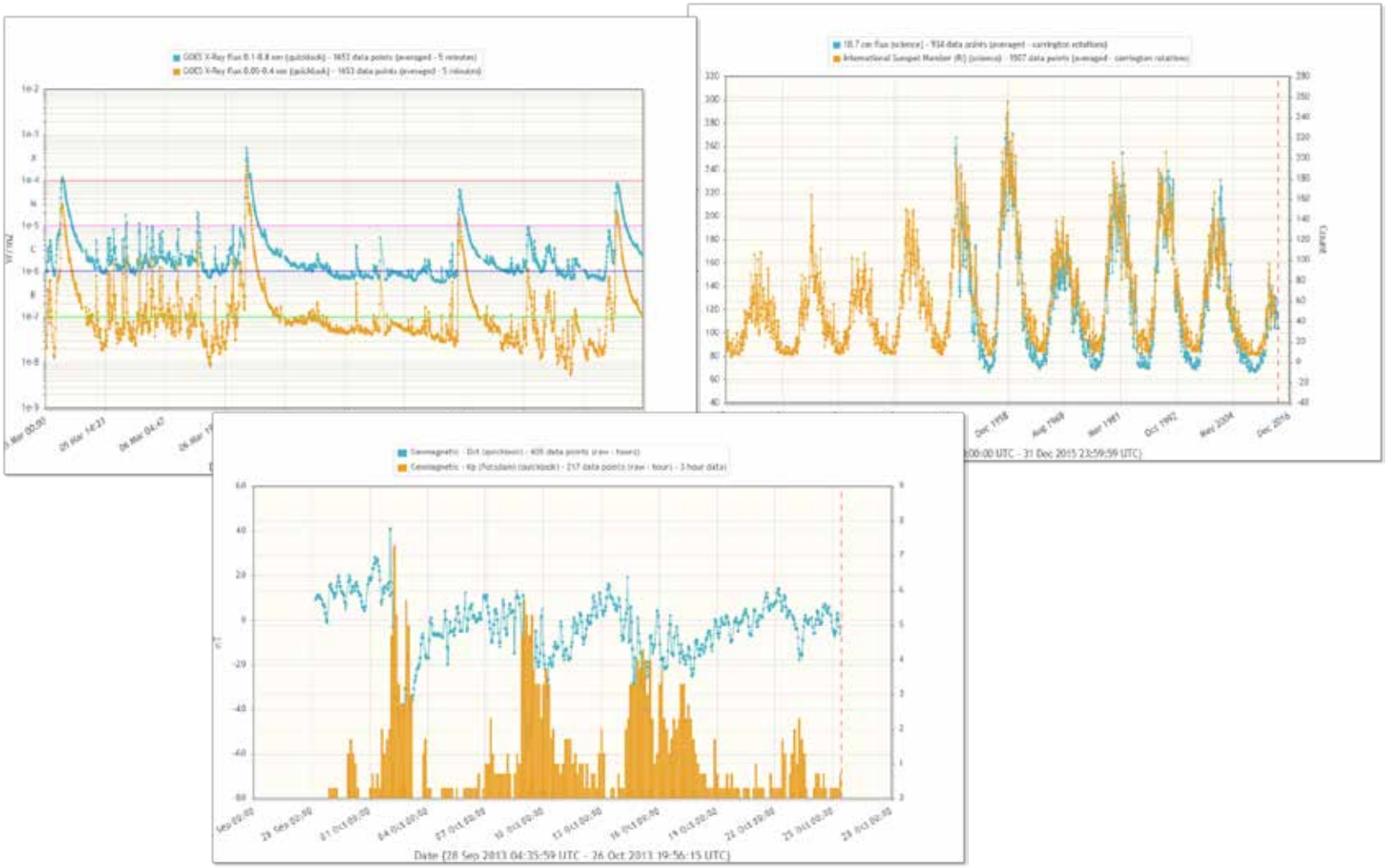




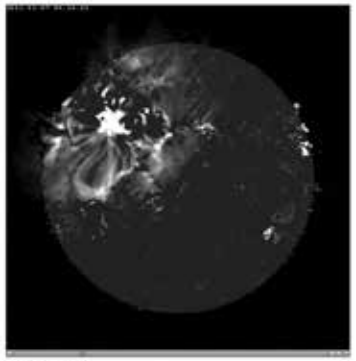
TEC 24 hrs forecast, taking space weather events into account in NRT.

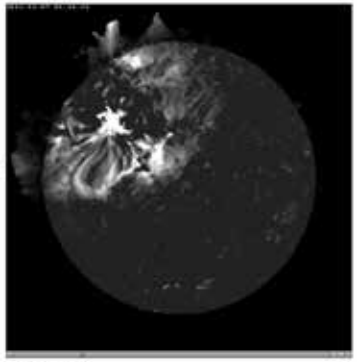
Solar Timelines viewer for AFFECTS (STAFF)

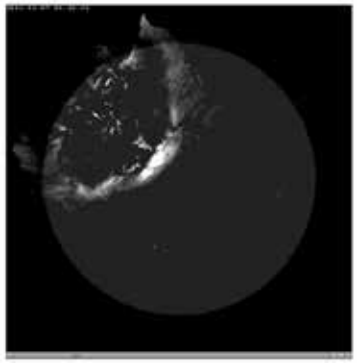
http://www.staff.oma.be

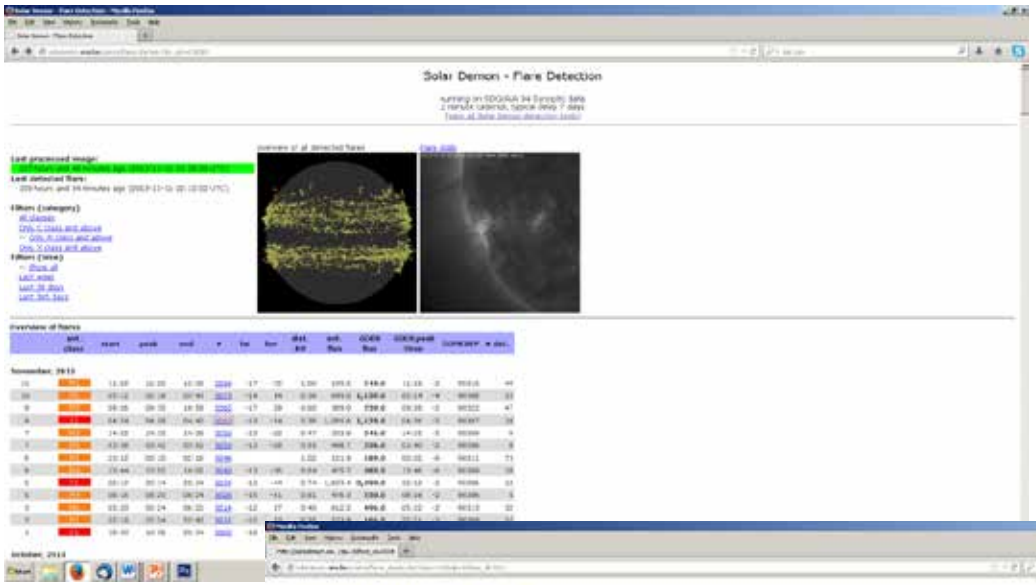


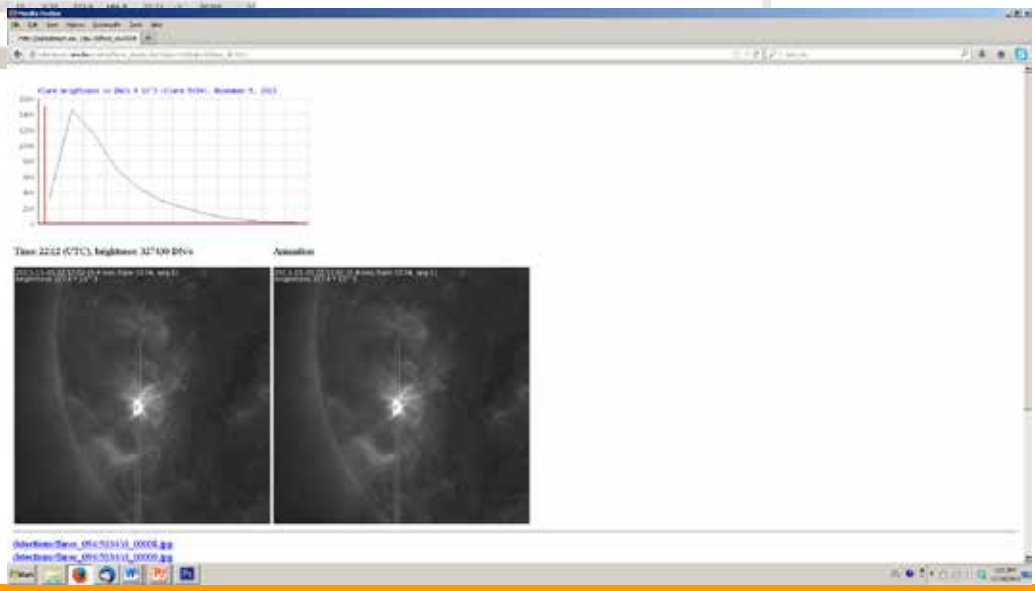
Solar Demon: near real time flare, dimming and EUV wave detection – http://solardemon.oma.be



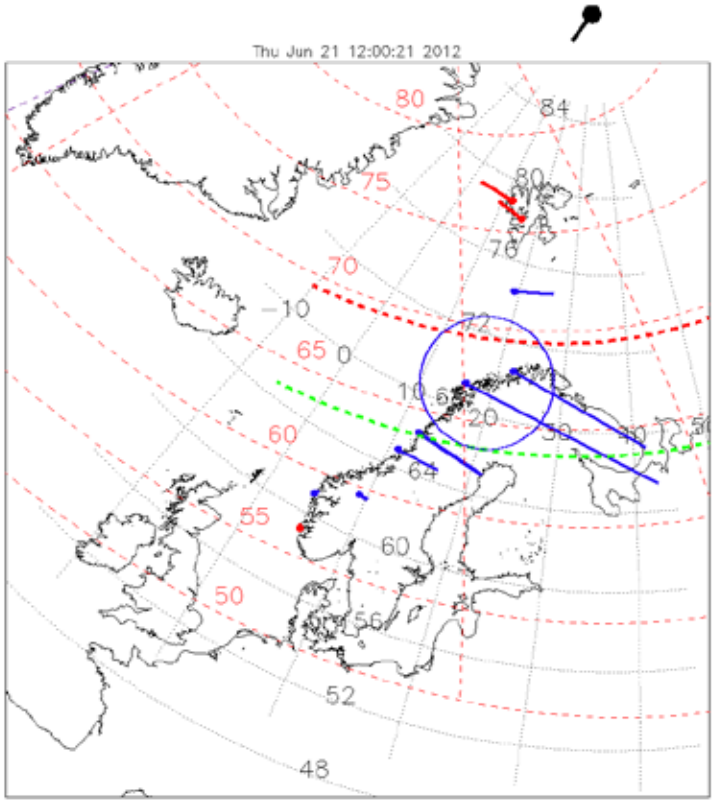


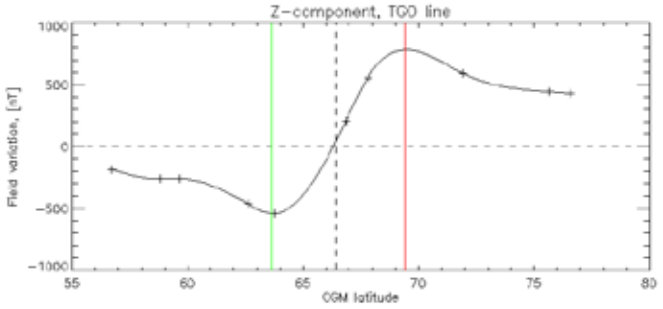


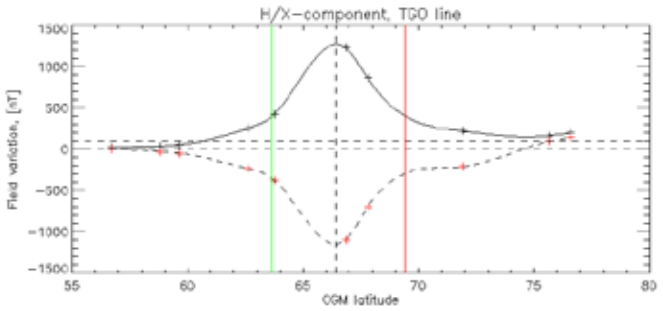




Auroral electrojet tracker







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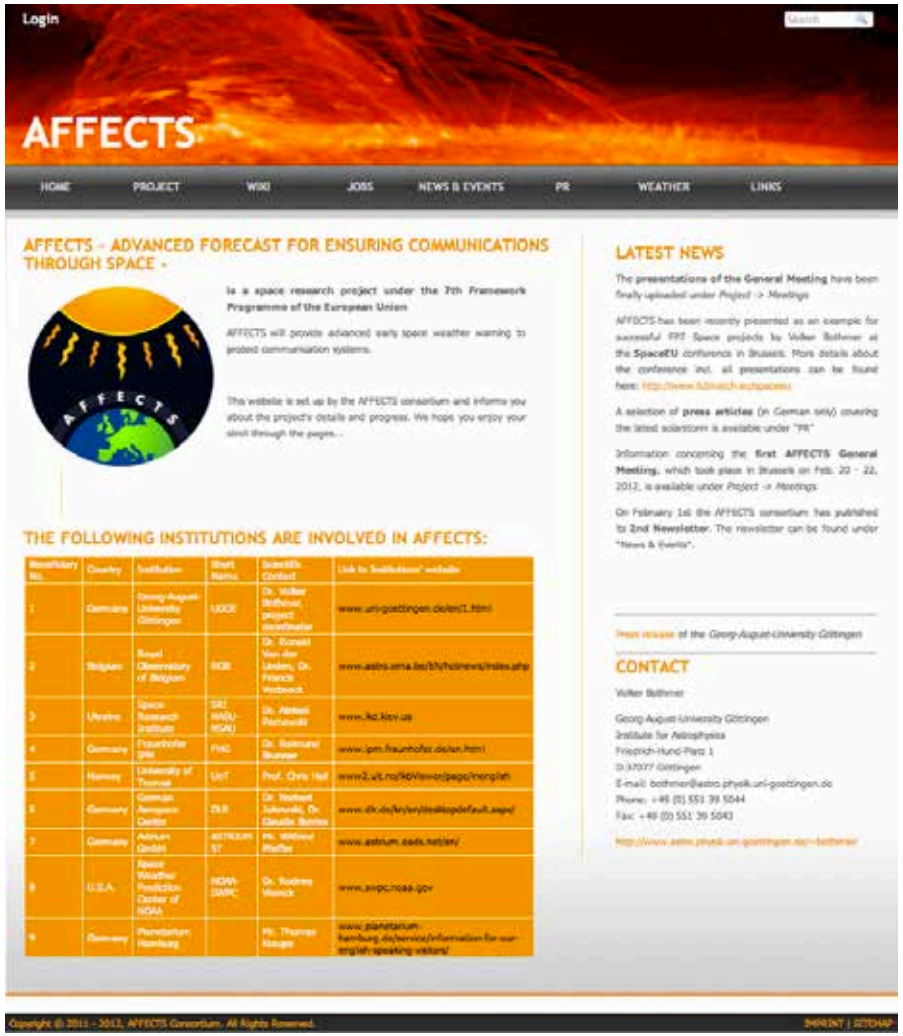
AFFECTS Website - www.affects-fp7.eu

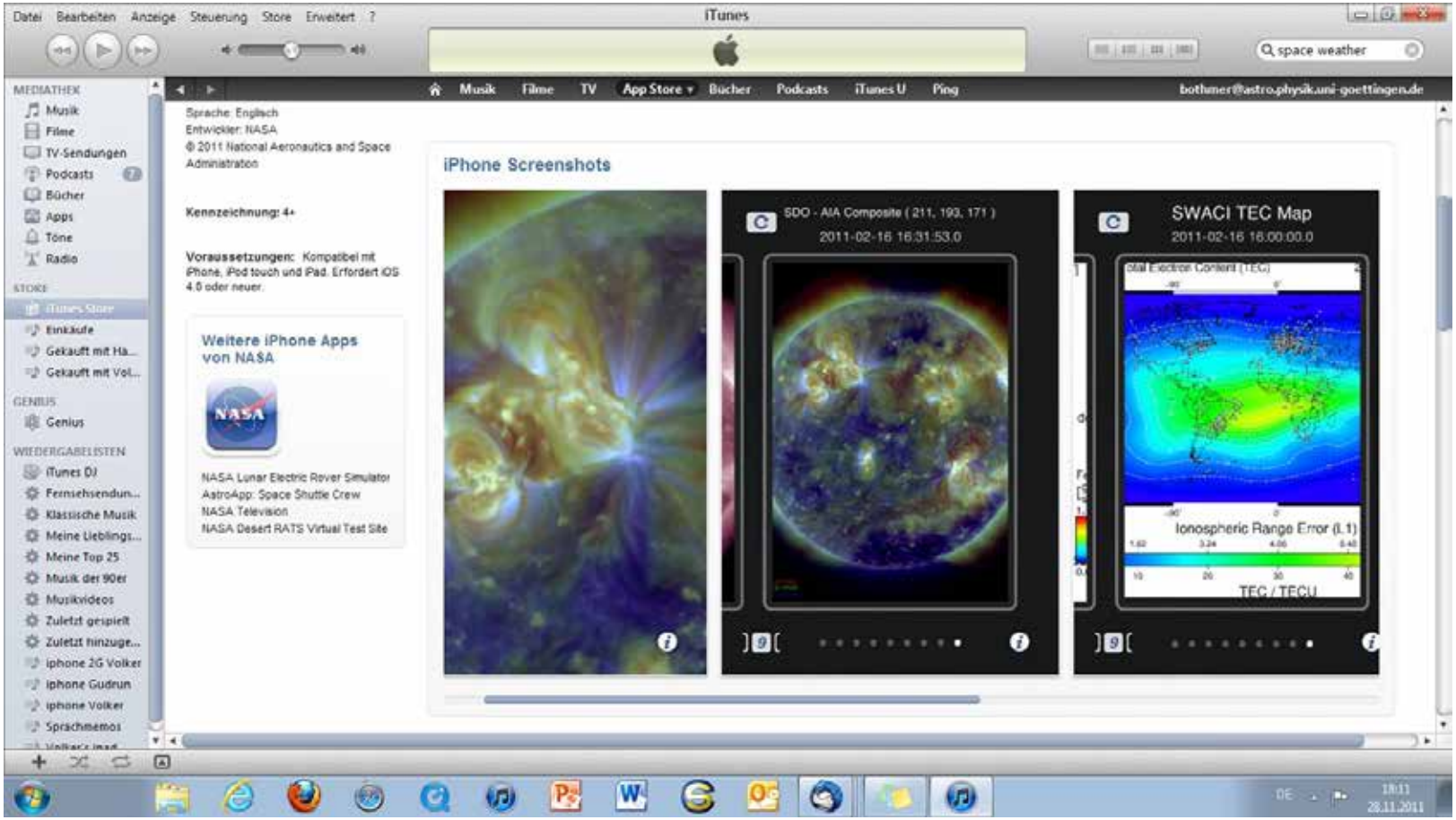


- Website includes Wiki engine

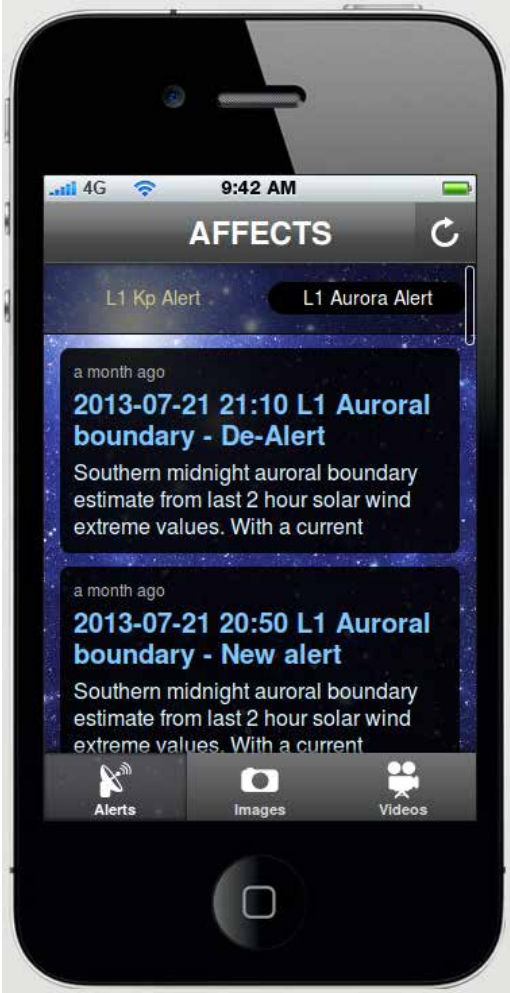
Provides

- 3 monthly AFFECTS Newsletter
- PR Material (Trailer, press releases, meeting reports)
- Weather reports and alerts
- Space Weather services
- Links to partner sites and other useful resources

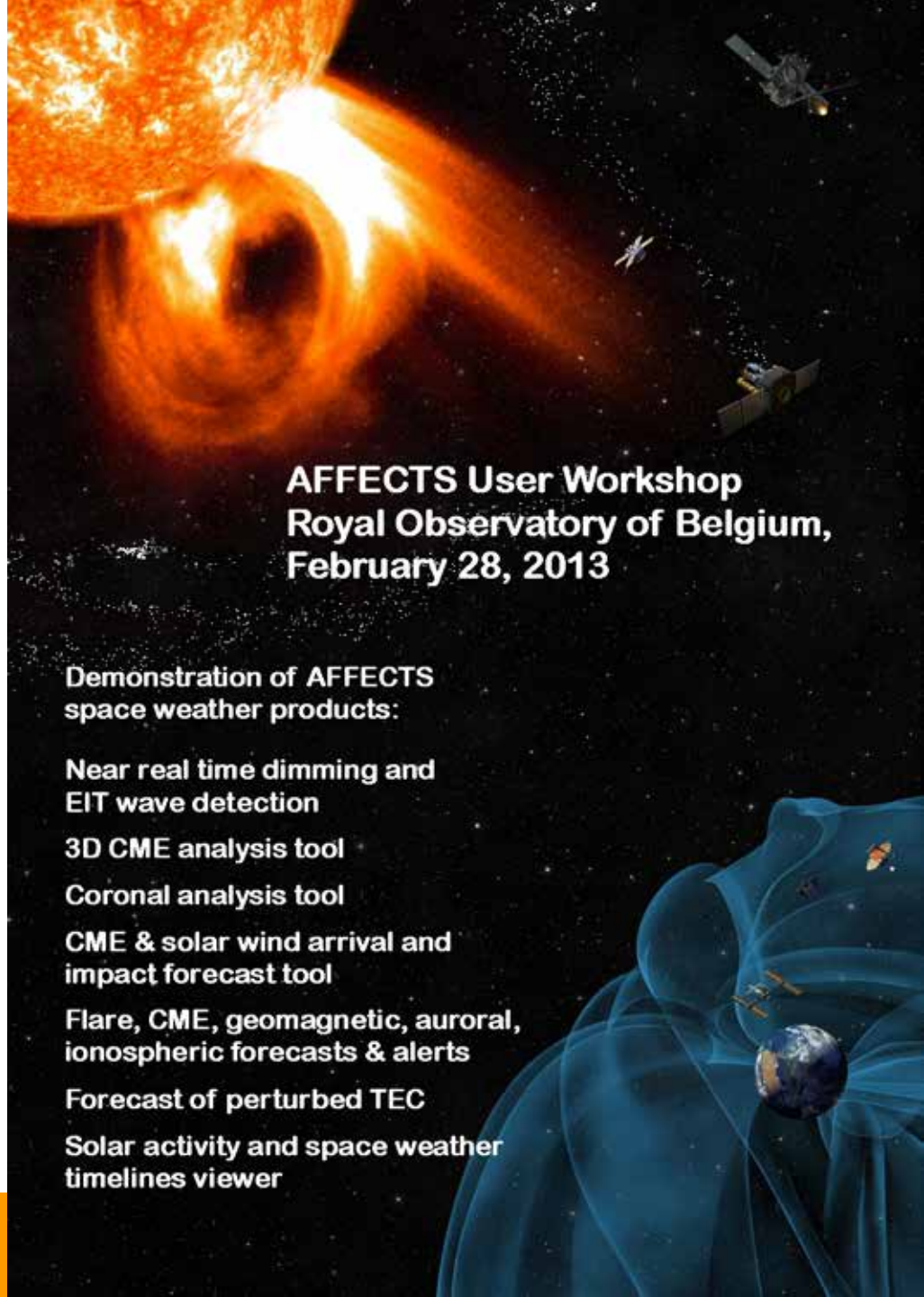
NASA Space Weather Apps



Space Weather App - Demo



AFFECTS International User Workshop



AFFECTS Dissemination activities

- Logo, available as sticker
- Trailer (2 min. HD Video)
- Flyer
- YouTube Video (EU)
- Planetarium Hamburg Show “Flammender Himmel” featuring AFFECTS
- Widespread Media coverage (TV, GEO, Radio, WWW, newspaper)
- Collaboration with infoNetwork
- International User Workshop at ROB (28 February 2013)
- Poster (2 versions)
- Website services incl. RSS-feeds
- Dedicated E/PO events (e.g., “Nacht des Wissens” @ UGOE)
- Space Weather Apps (e.g., 3D Sun, Sun Viewer,
- DVD, bluray, memory sticks
- Presentations at major meetings (EGU, ESWWT, national meetings)
- Joint publication (e.g. for JSWSC, AGU Space Journal)

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

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GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN · Fraunhofer IPM · UNIVERSITY OF TROMSØ UiT · ASTRIUM · DLR · IKI · PLANETARIUM

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