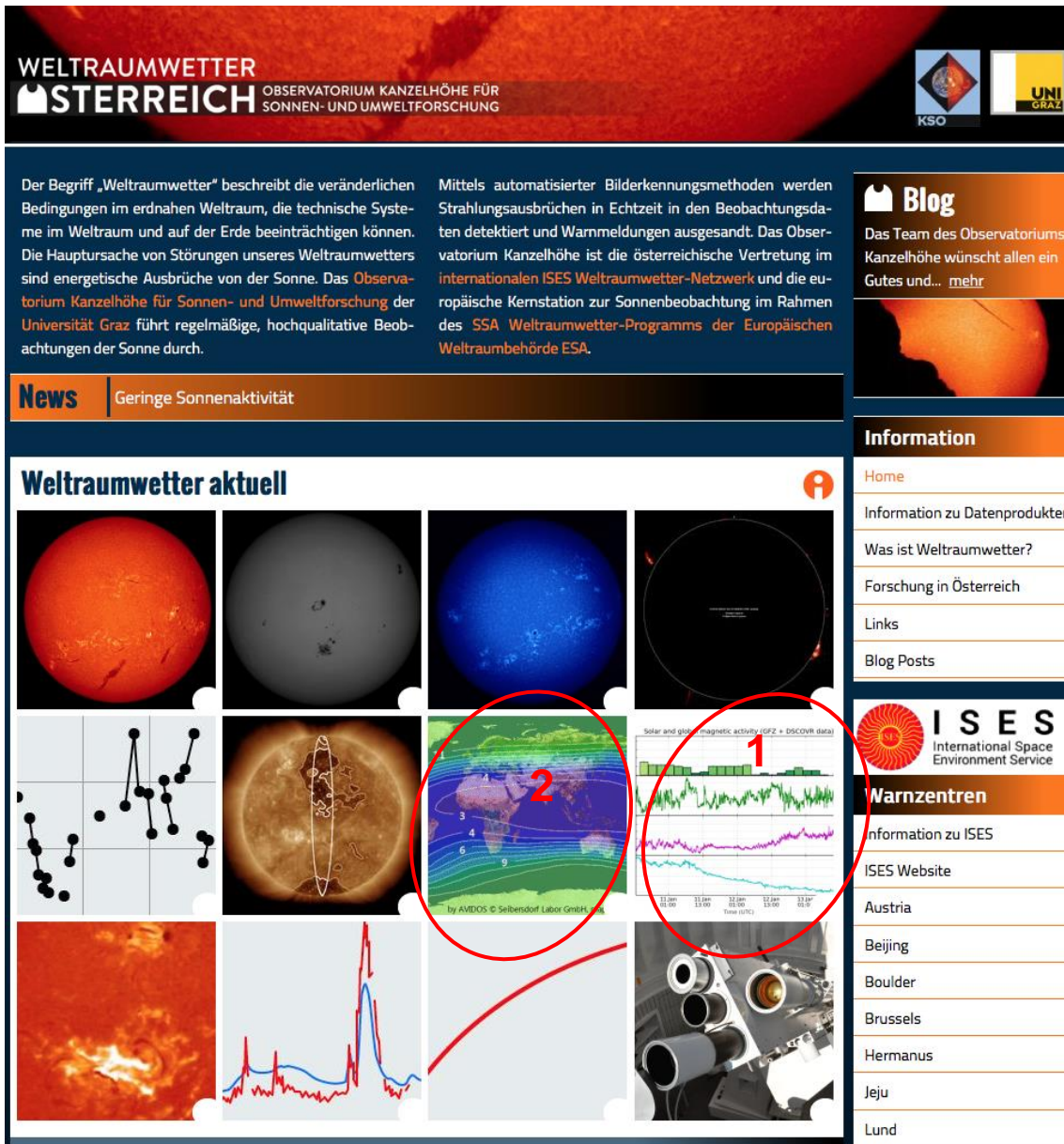# Recent and future actions about Space Weather in Austria

Manuela Temmer

Institute of Physics, University of Graz, Austria

Kanzelhöhe (UNI Graz) – ISES Network Regional Warning Center Austria

spaceweather.at updated to cover activities

- University of Graz
- Conrad Observatory **1**
- Seibersdorf Laboratories **2**
- (IWF will follow soon)

(ESA requested to use the text from **spaceweather.at** describing „Was ist Weltraumwetter".)

spaceweather.at / weltraumwetter.at

Conrad Observatory – Space Weather Activities
Geomagnetically induced Currents in Austria

GICs are **result of solar wind interaction** with Earth's magnetosphere

Can **cause damage to power grids**, e.g. March 1989 power outage (9h) in Quebec
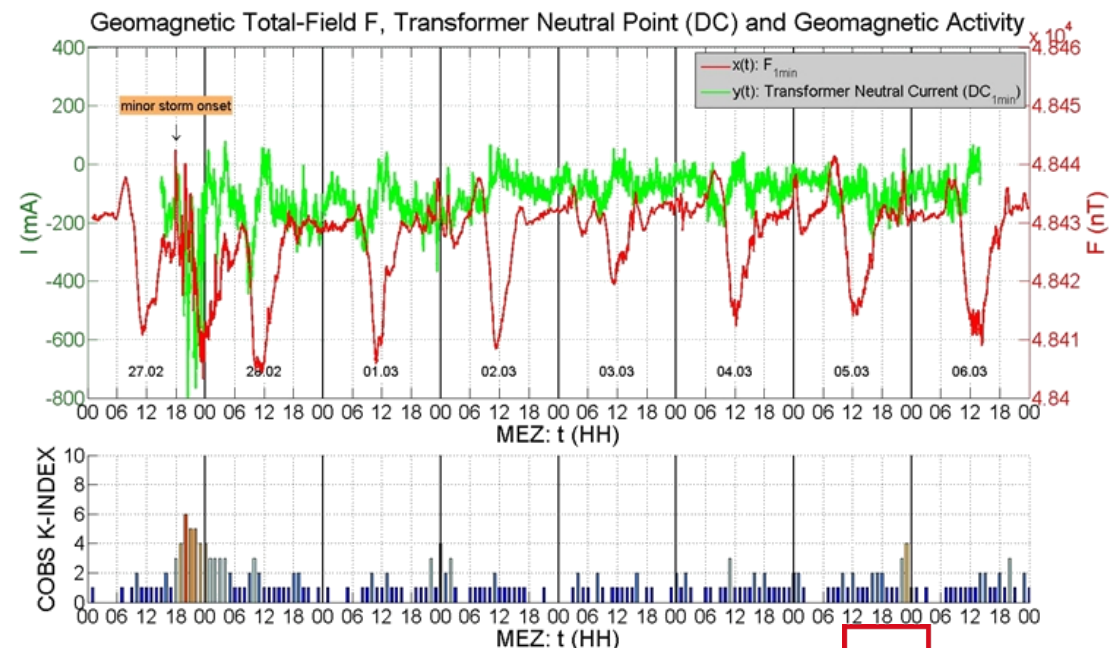
GIC in Austria could be larger than in nearby countries due to highly resistive alps

Credit: PSE&G

Measurements by Austrian Power Grid (APG) already show **considerable DC currents** in transformers

FFG project **GEOMAGICA** looks at GIC in **Austria** / Central Europe

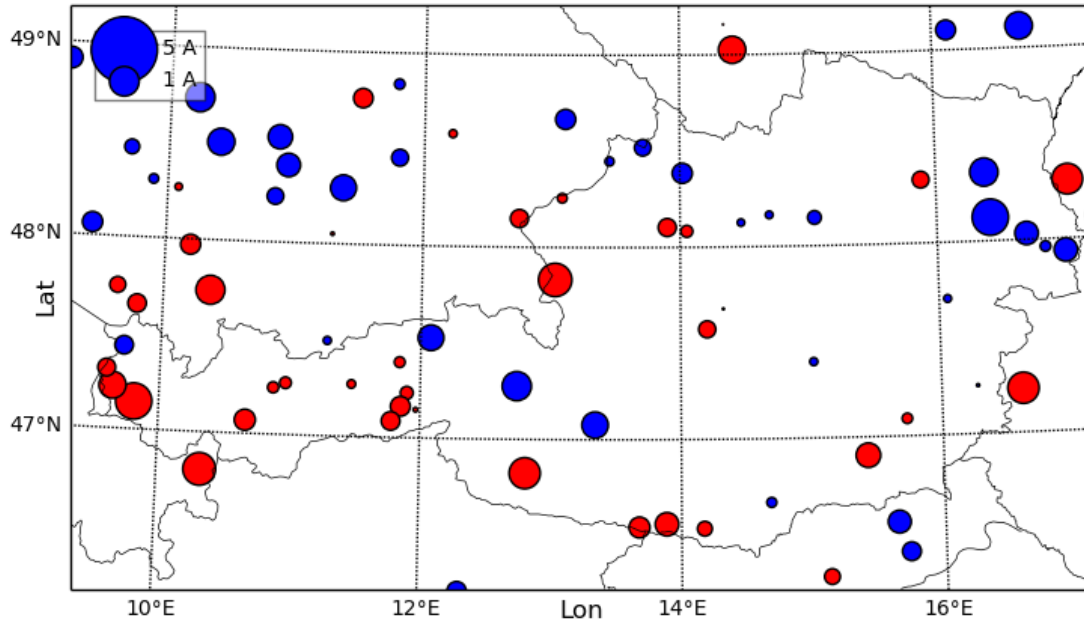Geomagnetic Total-Field F, Transformer Neutral Point (DC) and Geomagnetic Activity

Credit: APG

ZAMG

Conrad Observatory – Space Weather Activities
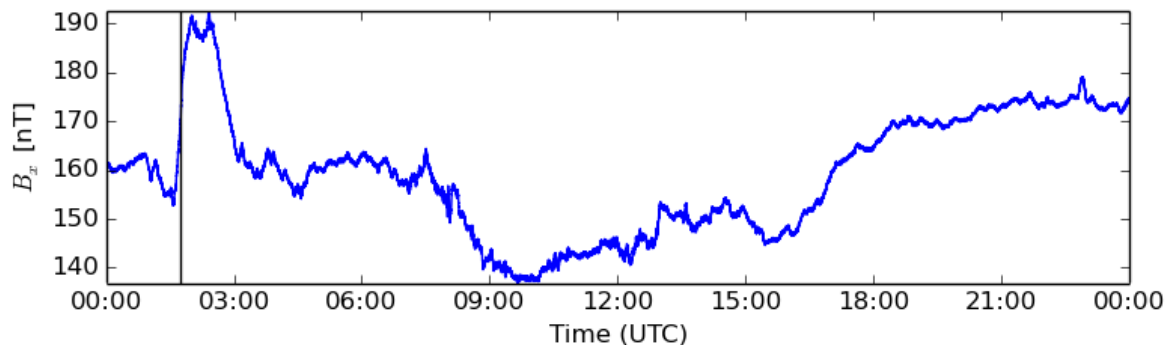# Geomagnetically induced Currents in Austria

GIC in Austria on 2014-10-15

FWF project partners: Austrian Power Grid, British Geological Survey, TU Graz, ...

Contact: Roman Leonhardt and **Rachel Bailey**

IWF/OEAW SPACE WEATHER ACTIVITIES

➢ Hardware & data analysis & theory contribution to ongoing and future space missions for studying effects and causes of space weather

➢ Reserach topics:

Contact: Rumi Nakamura

- CME propagation

- Solar wind- Earth's/planets' magnetosphere interaction

- CME/flare induced atmospheric density disturbances

➢ Hardware contributions to future missions for space-weather sciences

- SOSMAG (Service Oriented Spacecraft Magnetometer):
  a ready-to-use space weather monitoring system

  → ESA's Space Situational Awareness program finished in 2016

  → onboard Korean *GEO-KOMPSAT-2A* mission (Launch 2018)

- DPU for Soft-X ray Imager onboard ESA/CAS Mission SMILE (Solar wind Magnetosphere Ionosphere Link Explorer)   (Launch 2018)

UniGraz – ESA Expert Service Center
for Heliospheric Weather
(operational since October 2016)

See also **swe.uni-graz.at**

Critical SW speed
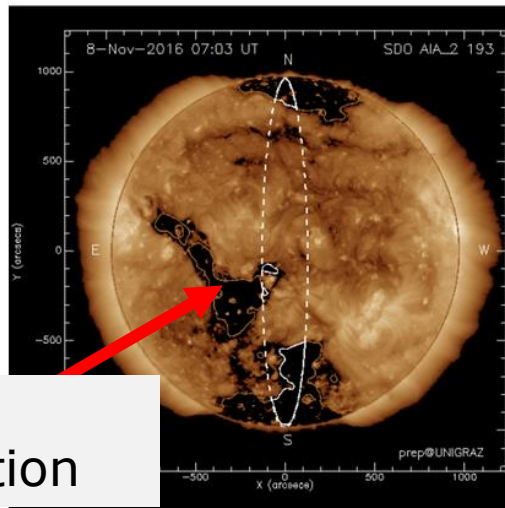
Comparison to measurements (ACE, DSCOVR)

CH detection

ESWF

swe.ssa.esa.int – Heliospheric Weather

See also **swe.uni-graz.at**

Federated products from the **University of Graz (UNIGRAZ)**

Drag-Based Model: Arrival-Forecasting of ICMEs

| Results | Kinematic plot | CME geometry plot | Documentation |

Output:

CME arrival at target (date & UTC time): **10.11.2016 at 13h:57min**
Transit time: **52.42 h**
Impact speed at target (at 0.99 AU): **580 km/s**

Results

Input parameters:

CME take-off date & UTC time: **08.11.2016 at 09h:32min**
$\gamma = 0.20\times10^{-7}$ km^{-1}, $w = 396$ km/s,
$R_0 = 20$ r_{Sun}, $v_0 = 1000$ km/s, $\lambda = 30°$, $\varphi_{CME} = 0°$
$R_{target} = 0.99$ AU, $\varphi_{target} = 0°$

Calculated in 2.45 seconds.

Download all results

Download the output files!

Real-time Custom

2 options

Select drag parameter γ based on event: normal: 0.2 ⌄ ×10^{-7} km^{-1} Select

Select also the constant solar wind speed w: mean: 396 ⌄ km/s Select

Starting radial distance of CME, R_0 = 20 r_{Sun}

Speed of CME at R_0, v_0 = 1000 km/s

CME's angular half-width, λ = 30 deg

Longitude of source region, φ_{CME} = 0 deg

The real-time forecasting is only valid for **Earth!**

Calculate   Reset!

User input

© Tomislav Žic, Hvar Observatory, 2015 | Number of visits: **2015**

Geomagnetic Conditions
Heliospheric Weather
Other Resources
Documents
SWWT
SWEN NewsLetter
Upcoming Events
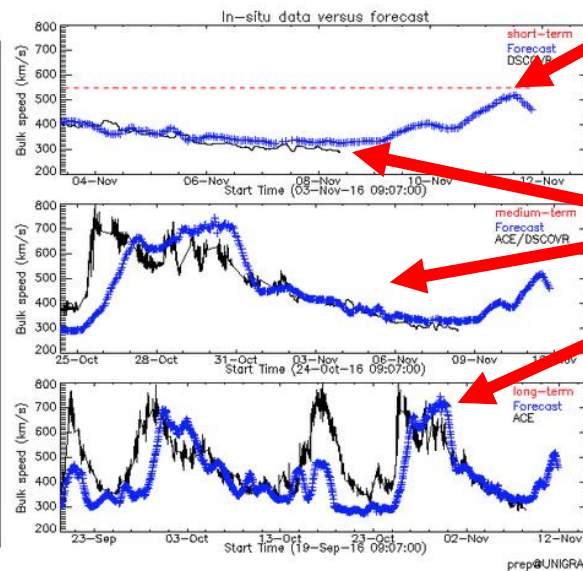**Sign-In**
Roland Maderbacher is signed in
Sign Out

DBM

2 1.5 1 0.5 ... STB STA Venus Sun Mercury CME Earth Target Mars AU

Tomislav Žic (tzic@geof.hr), Hvar Observatory

Fast and easy download for Kanzelhöhe Observatory image data
(new! 01/2017)

kanzelhohe.uni-graz.at

VarSITI: scientific program of SCOSTEP (2014-2018)

UNI Graz provides daily email service (ISEST/MiniMax24 campaign), giving forecasts of solar wind high speed streams and filament eruptions.

Automated filament detection at Kanzelhöhe (developed during ESA/SSA) is active since summer 2015.

Mouse sensitive map: get additional info of each detected filament

http://cesar.kso.ac.at/sniv/filaments.php
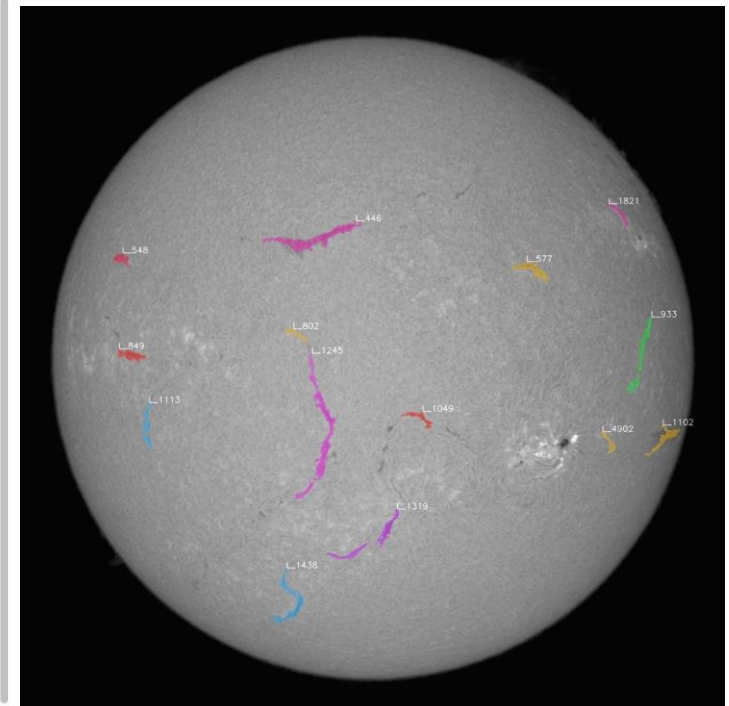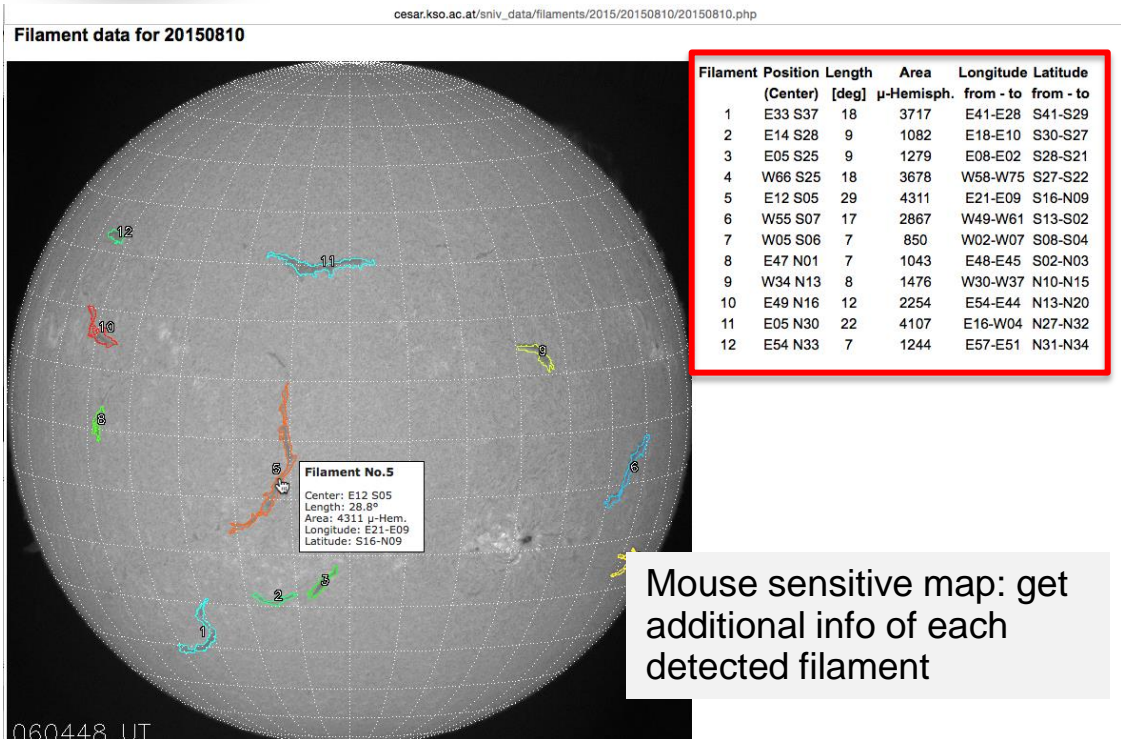
Uni Graz – recent scientific results

Overall dimming

Dissauer et al., (2016)
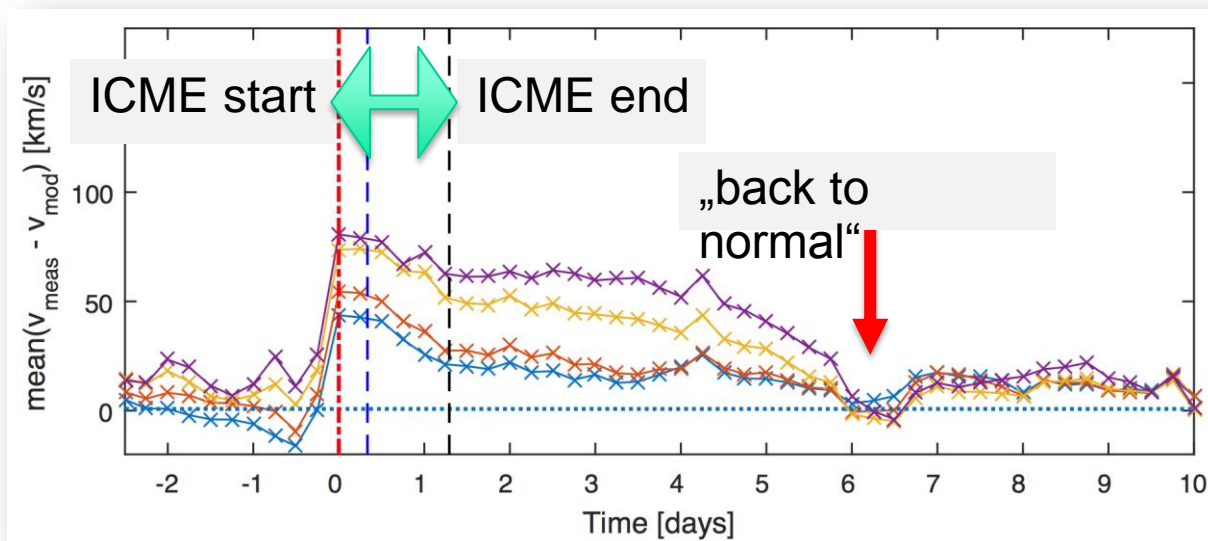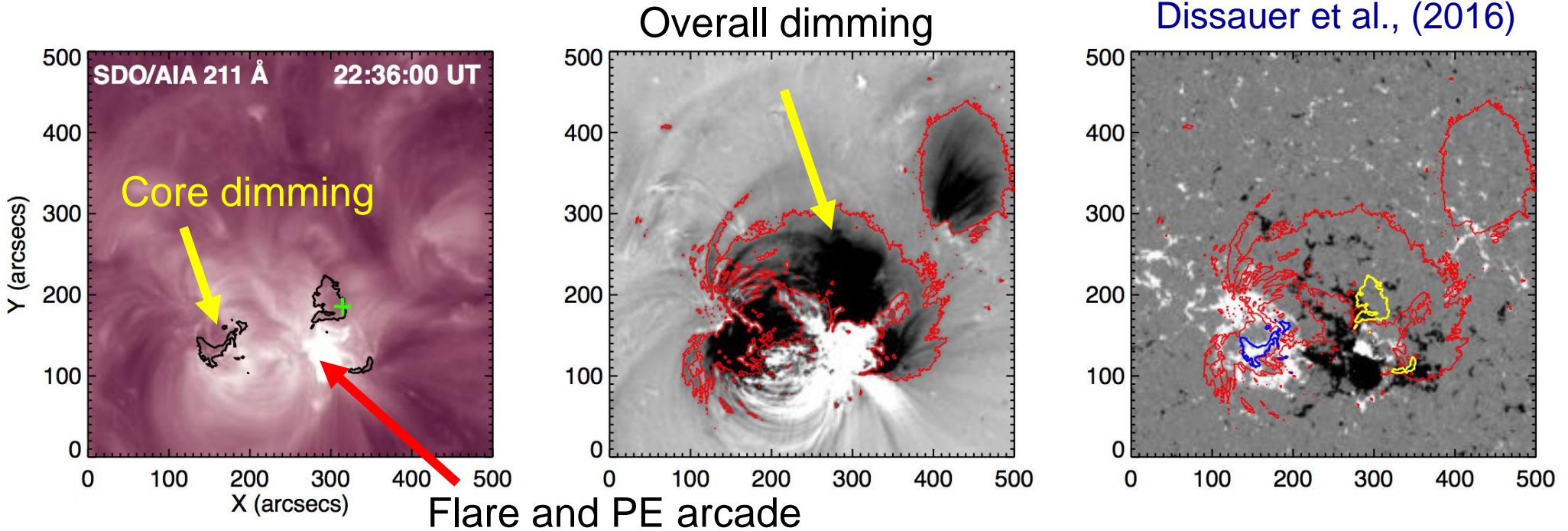
IP space needs 4.25–6 days to recover from an ICME disturbance. Preconditioning :: input for Space Weather models and forecasts. Temmer et al., (2017; in press for ApJ)

SWE products „made in Austria"

- *Seibersdorf Laboratories*: AVIDOS – real-time aviation dose rates

- *Conrad Observatory*: GEOMAGICA – development of automated GIC warning system

- *Space Research Institute*: SWE satellite mission participation and research in planetary space weather as well as CME propagation

- *UNI Graz / Kanzelhöhe Observatory*:

  - Automatic near-real-time detection of flares and filaments (Pötzi et al., 2015; Veronig and Pötzi, 2016)

  - Automated verification of solar wind forceasting – swe.uni-graz.at (Reiss et al., 2016)

  - In collaboration with University of Zagreb (Croatia), the drag-based model (DBM) will be enhanced for ensemble modelling (M. Dumbovic, B. Vrsnak, M. Temmer)

  - Research in preconditioning of IP space, CME propagation and relation to solar surface activities (flares, coronal waves, magnetic field models, ...) Temmer et al., 2017

ESA/SSA, VarSITI, ISES, ...