

Space Weather activities in Austria

Manuela Temmer*

Institute of Physics, University of Graz, Austria

*ISWI national coordinator

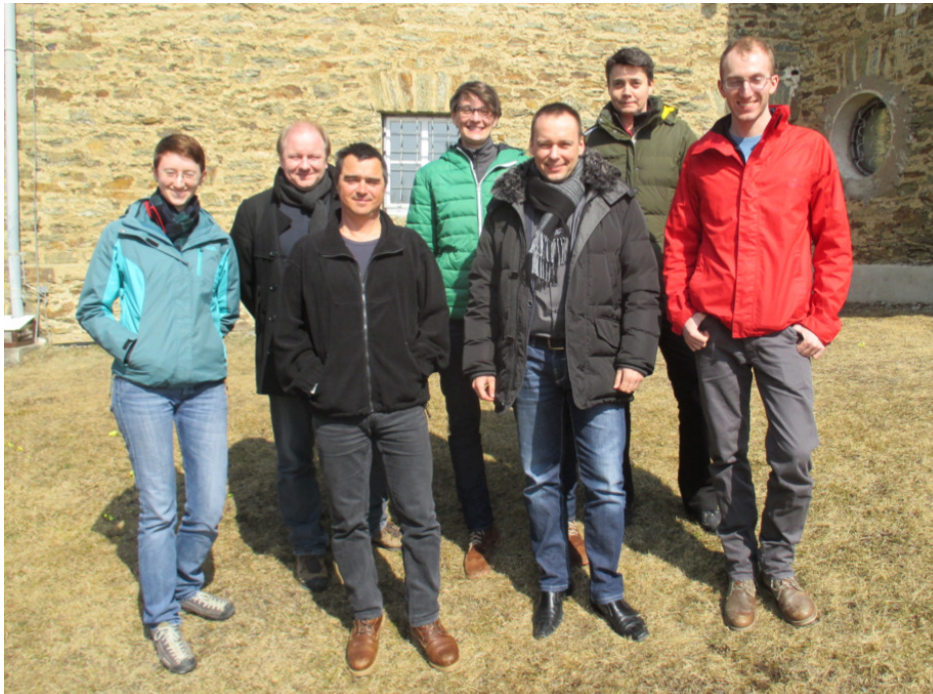


Space Weather services „made“ in Austria

Space Weather is an important issue of global matter and global efforts, but needs also coordinated collaboration on a national level. The University of Graz and its Kanzelhöhe Observatory for Solar and Environmental Research (KSO) is ISES member and regional Space Weather warning center of Austria (weltraumwetter.at/spaceweather.at).

Recent efforts in summer 2018, initiated by Conrad Observatory (ZAMG), led to the preparation of a coordinated project (possible FFG funding) covering stakeholders of Space Weather in Austria.

Picture shows the start of coordinated efforts in 2015 (meeting at KSO).



1. Österr. Weltraumwetter Workshop at KSO

Research institutions:

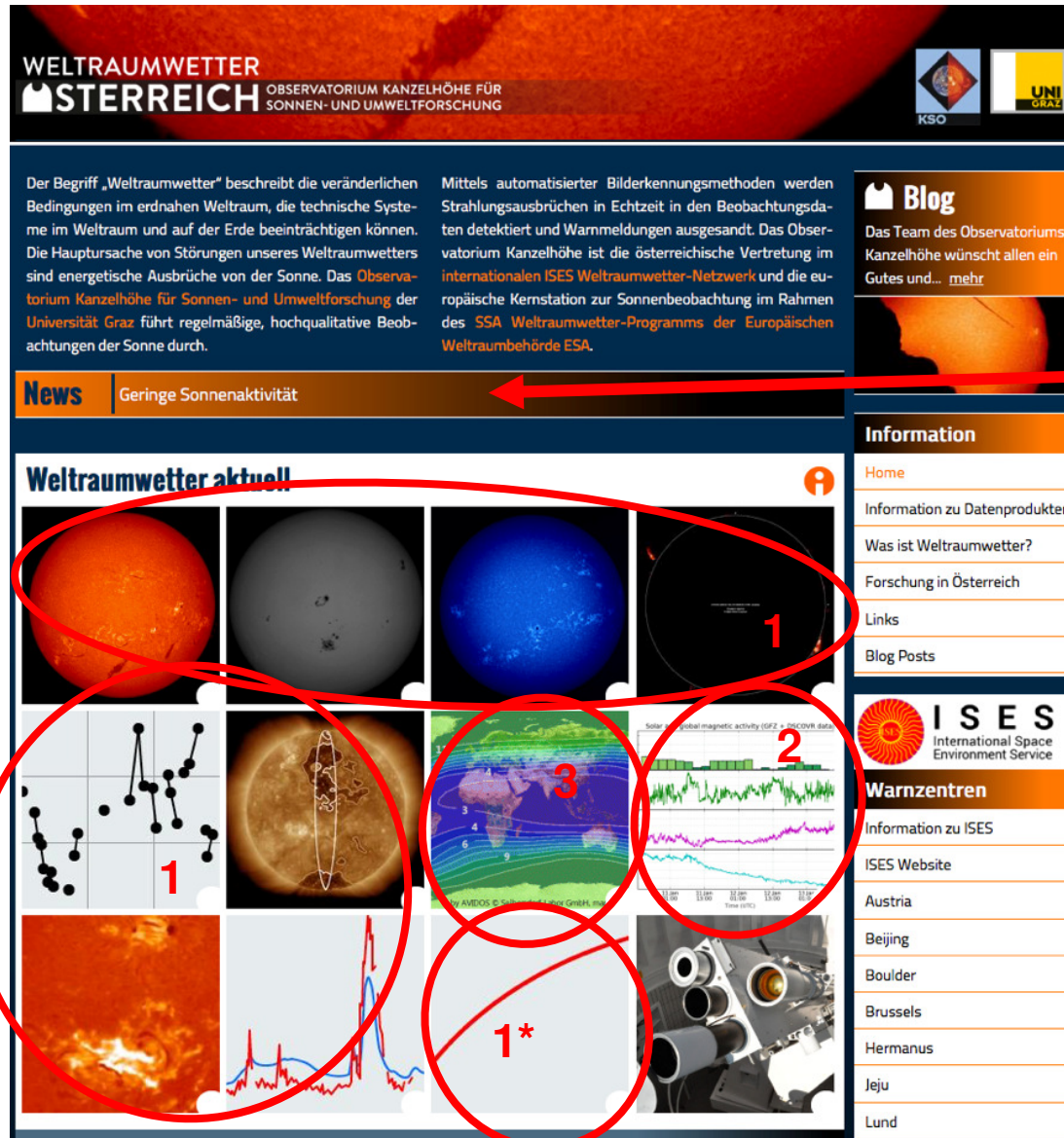
- University of Graz
- Conrad Observatory (ZAMG)
- Seibersdorf Laboratories
- Space Research Institute Graz (ÖAW)

Stakeholders (*new!*):

- Austrian Power Grid AG
- Austro Control (Aviation)
- Spacekeys GmbH



Weltraumwetter.at / Spaceweather.at will be updated in 2019 covering ALL key players!



The screenshot shows the website's layout with several red circles highlighting specific elements:

- Top Header:** "WELTRAUMWETTER ÖSTERREICH" logo and "OBSERVATORIUM KANZELHÖHE FÜR SONNEN- UND UMWELTFORSCHUNG" text.
- Blog Section:** A post titled "Blog" with the text "Das Team des Observatoriums Kanzelhöhe wünscht allen ein Gutes und... mehr".
- News Section:** A headline "News" with the sub-headline "Geringe Sonnenaktivität".
- Weltraumwetter aktuell:** A grid of images and charts. Red circles highlight:
 - A solar image (top left).
 - A graph of solar activity (middle left).
 - A world map with magnetic activity contours (middle right).
 - A line graph of global magnetic activity (bottom right).
 - A close-up of a solar flare (bottom left).
 - A technical diagram of a satellite or instrument (bottom right).
- Information Menu:** A sidebar menu with items like "Home", "Information zu Datenprodukten", "Was ist Weltraumwetter?", "Forschung in Österreich", "Links", and "Blog Posts".
- ISES Section:** "International Space Environment Service" logo and "Warnzentren" (Warning Centers) list.

Kanzelhöhe Solar Observatory (UNI Graz) – ISES RWC for Austria

Public outreach

Alerts (based on automatic flare detection at KSO)

Space Weather (research, services, satellites) in Austria:

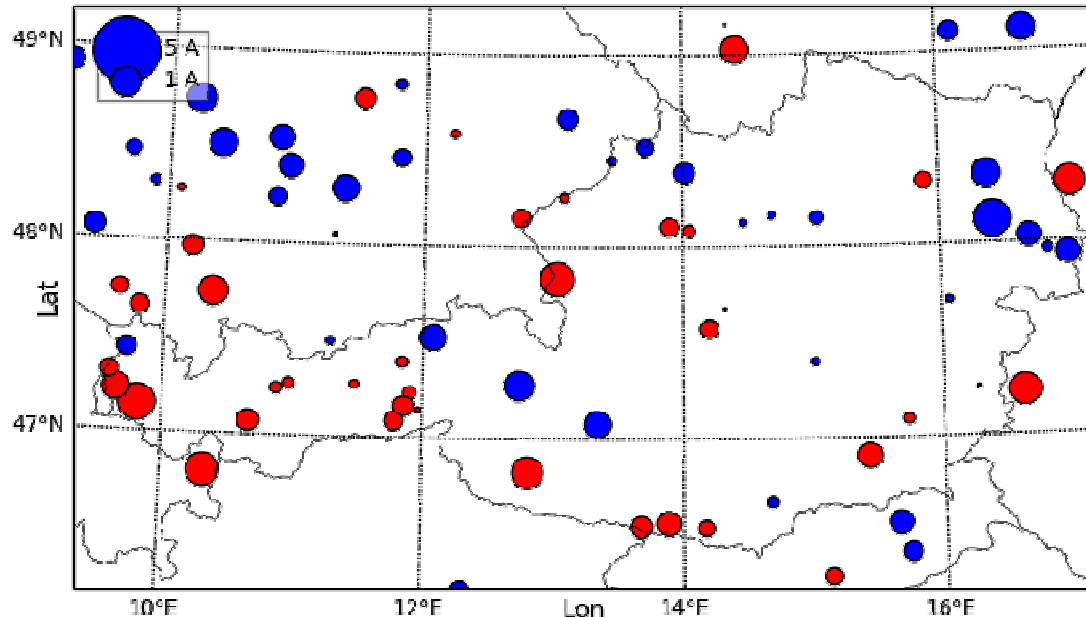
- University of Graz **1**
- Conrad Observatory **2**
- Seibersdorf Laboratories **3**
- IWF Graz / Space Research Institute
- [University of Zagreb] **1***

Conrad Observatory/ZAMG

Geomagnetically induced Currents in Austria



GIC in Austria on 2014-10-15

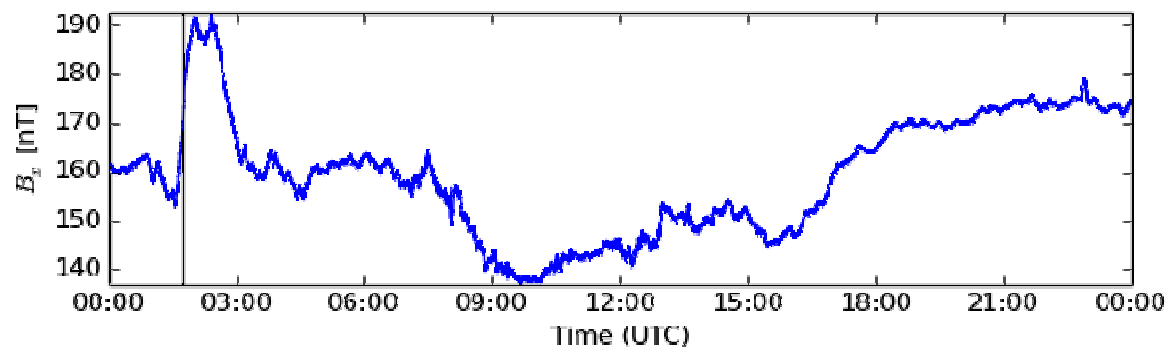


Geomagnetic Observatory part of the „Zentralanstalt für Meteorologie und Geodynamik“

Real-time H measurements

Research on GICs in Austria, which could be larger than in nearby countries due to highly resistive alps.

FFG funded GEOMAGICA project partners: Austrian Power Grid, British Geological Survey, TU Graz, ...



For more details see: <http://www.conrad-observatory.at/zamg/index.php/data-en/daily-magnetogram>

IWF/OEAW SPACE WEATHER ACTIVITIES

- Hardware & data analysis & theory contribution to ongoing and future space missions for studying effects and causes of space weather
- Research topics:
 - CME Modelling
 - Solar wind- Earth's/planets' magnetosphere interaction
- Hardware contributions to future missions for space-weather sciences
 - SOSMAG (Service Oriented Spacecraft Magnetometer):
a ready-to-use space weather monitoring system (ESA SSA program)
 - SOSMAG onboard Korean *GEO-KOMPSAT-2A* mission (Launch: 4 Dec. 2018) was successfully commissioned in space in early Jan. 2019;
Science phase will start in the second half of 2019
 - DPU for Soft-X ray Imager onboard ESA/CAS Mission SMILE (Solar wind Magnetosphere Ionosphere Link Explorer) (Launch 2022)

Space Weather Research & Services



Radiation exposure at aviation altitudes

- Galactic Cosmic Rays (**GCR**)
- Solar Energetic Particle (**SEP**) Events
- Ground Level Enhancements (**GLE**)
- Forbush Decrease (**FD**)

Radiation dose measurements

- Tissue Equivalent Proportional Counter (**TEPC**)

Radiation dose modelling

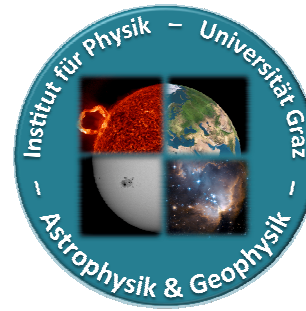
- Monte Carlo techniques



AVIDOS: Galactic and solar cosmic radiation at aviation altitudes (**aviation dosimetry**)

- for **International Civil Aviation Organization (ICAO)** as part of **PECASUS** consortium (Pan-European Consortium for Aviation Space weather User Services);
- **ESA-SSA service**
- Service for **individual airlines**





- Kanzelhöhe Observatory is ESA Expert Service Group for Solar Weather (real-time flare alerts and filament detection)
- ISES member and regional Space Weather warning center of Austria
- Institute of Physics is ESA Expert Service Group for Heliospheric Weather (CME propagation, solar wind forecast)
- Together with the Technical University of Graz (TU Graz) the ESA Expert Service Group for Ionospheric Weather is pursued (short-term forecast and nowcast of satellite orbit decays due to thermospheric density enhancement; funding needed – FFG-ASAP project just submitted)
- VarSITI member and daily MiniMax alert service for international group of Space Weather researchers (SCOSTEP programme 2015-2018 – we applied for continuation, expected result summer 2019)

Summary

spaceweather.at

- Kanzelhöhe Observatory of UNI Graz gives real-time warnings of solar flares and filament detection (**ESA-SSA Solar Weather**)
- Institute of Physics at UNI Graz gives real-time solar wind forecasting and provides, in collaboration with University of Zagreb, CME forecasting tools (**ESA-SSA Heliospheric Weather**)
- Collaboration between UNI Graz and TU Graz to become **ESA-SSA Ionospheric Weather** Expert Group (satellite orbit decay forecast/nowcast)
- Seibersdorf Laboratories provide radiation doses for aircraft passengers (**ESA-SSA Space Radiation**)
- The Conrad Observatory is specialized on ground-induced currents and local magnetic field variations as consequences of solar activity and part of the national weather service ZAMG
- The Space Research Institute in Graz is involved in satellite missions dedicated to Space Weather
- We deepen our collaboration with Space Weather industrial partners and “end-users”
→ ASAP-15 Exploratory Project for a complete *Austrian Space Weather Portal*