

Space Weather activities in Austria

ISWI steering committee meeting @UN, Vienna :: February 10, 2023

presenter: Manuela Temmer
University of Graz (on behalf of the Austrian Space Weather Community)



SWAP - Space Weather: The Austrian Platform

- Developing a national platform for space weather
- Currently at <https://cobs.zamg.ac.at/swap>
- Cooperative project running 2021 — 2024

The screenshot shows the SWAP website interface. At the top, there is a navigation bar with links for Home, SW-Live, Media-Center, Glossar, Über uns, and Kontakt. The main content area is divided into several sections:

- SW-Live:** A dashboard displaying real-time space weather data. It includes a large circular image of the Sun on the left, several smaller circular gauges in the center, and a map of Europe on the right. The date and time shown are "Do., 12. Jan. 2023 10:28:36".
- Weltraumwetter Glossar:** A glossary section titled "Weltraumwetter Glossar" with a sub-header "Hier werden Begriffe aus der Weltraumwetterforschung aufgelistet und kurz beschrieben. Die englische Übersetzung wird auch gleich angeführt." It lists terms under the letter "A" (Aktive Regionen (active regions) - Siehe: Sonnenflecken), "C" (Chromosphäre), and "D" (Direct Current Compensation (DC) - Eine Methode zur Reduktion von DC (oder DIC) Einflüssen auf Leistungstransformatoren. Über eine zusätzliche Windung wird ein Gleichstrom eingepreigt, welcher dem störenden Strom entgegenwirkt.).
- Call to Action:** A section titled "Interessieren Sie sich für Weltraumwetter?" with the text "Weltraumwetter informieren oder nach möglichen" and "Hier sind Sie richtig!". It features a prominent "Live-Daten" button.

Below the screenshot, there are two green callout boxes:

- Left Callout Box:**
 - Shows current space weather activity
 - Provides Austria-specific metrics
 - “Atlas” of national space weather competence
- Right Callout Box:**
 - German-language space weather glossary and list of press releases

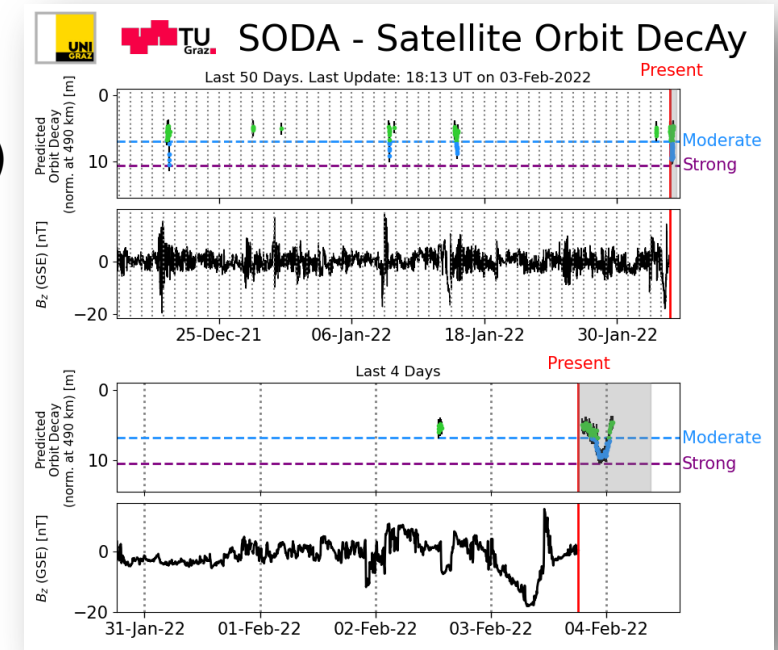
This block contains the logos of the partner institutions involved in the SWAP project:

- GeoSphere Austria
- SEIBERSDORF LABORATORIES
- TU Graz
- UNIVERSITÄT GRAZ
- UNI GRAZ
- APC
- ÖAW (Österreichische Akademie der Wissenschaften)
- IWF (Institut für Weltraumforschung)
- JOANNEUM RESEARCH

Institute of Geodesy (Working Group „Theoretical Geodesy and Satellite Geodesy“)

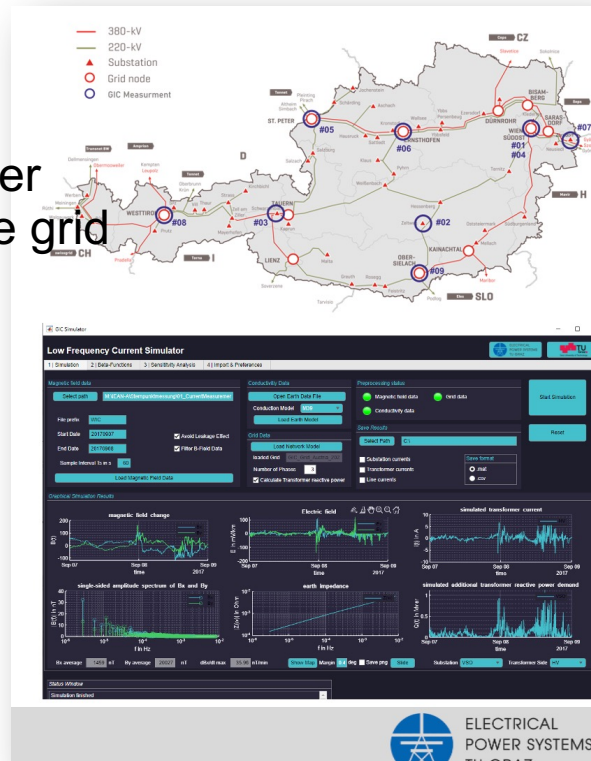
- Forecast of thermospheric densities and satellite orbit decays based on interplanetary observations at the L1 point (FFG Project).
- Investigation of atmospheric pre-conditioning and cooling effects in the Earth’s atmosphere (FWF Project).
- ESA I-ESC Expert Service Group
- Cooperation with:
 - University of Graz, Institute of Physics
 - Austrian Academy of Sciences, Space Research Institute

<https://www.tugraz.at/institute/ifg/projects/theoretical-geodesy-and-satellite-geodesy/>



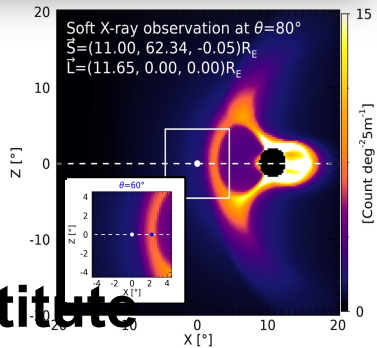
Institute of Electrical Power Systems

- GIC measurement
- Continuous measurement of 9 transformer neutral points in the Austrian high voltage grid
- GIC calculation
- Analysis of GIC impact on power grids
- Detailed modelling of power grid assets
- Development of mitigation methods
- Simulation software available under <https://github.com/IEAN-TUGraz/LFC-Simulator>



Space Research Institute

- Magnetometers in SWx missions
- GEO-KOMPSAT-2A, SOSMAG, SWFO, future: Vigil, FORESAIL2
- Data Analysis/Modeling on M-I coupling
- SoLo, BepiC, MMS, THEMIS, SMILE
 - Cluster, THEMIS, MMS, Arase, Geotail
- Aurora & global boundaries: SMILE (2025)
- Data Analysis in collaboration with TUGRAZ, UNIGRAZ



Kanzelhöhe Solar Observatory

- ESA Expert Service Group for Solar Weather alerting for real-time flare emission and filament eruption detection (kso.ac.at)
- Regional Warning Center Austria (ISES network)

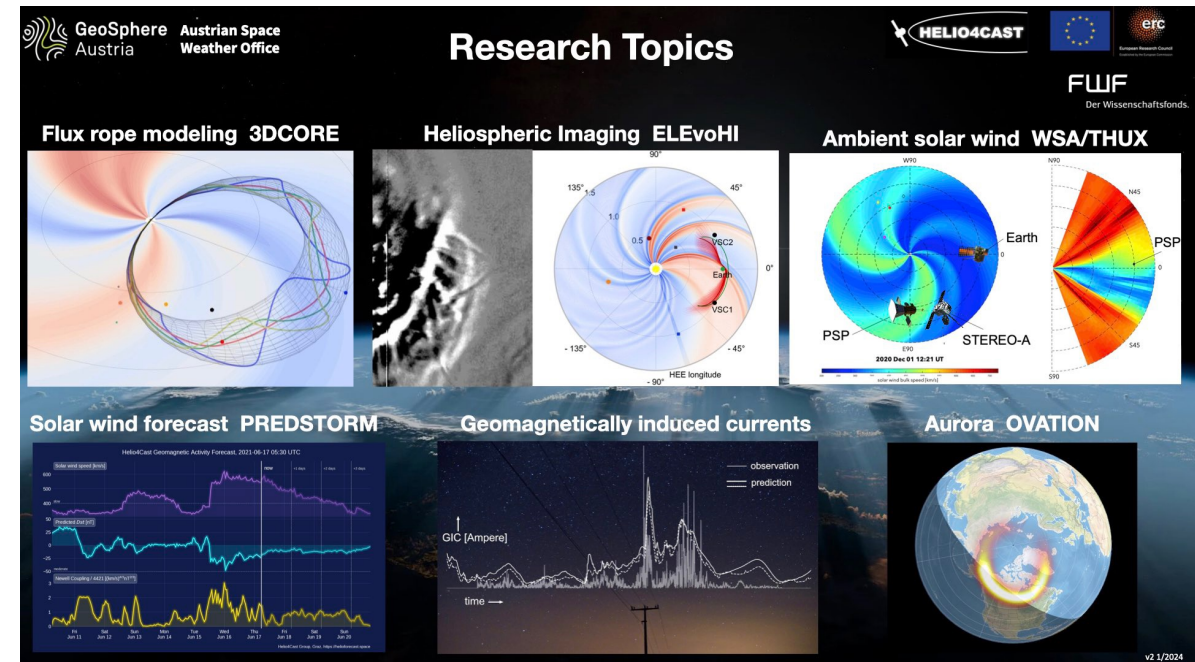
Institute of Physics

- ESA Expert Service Group for Heliospheric and Ionospheric Weather (swe.uni-graz.at): CME propagation tool, solar wind forecast, satellite orbit decay (cooperation with TUGRAZ)
- iSWAT-COSPAR international team member
- e-CALLISTO network station AUSTRIA-UNIGRAZ
- ESA L5 project for Vigil mission preparation in collaboration with Geosphere



GeoSphere Austria

- Austrian Space Weather Office for research to operations to research (R2O2R) in solar wind forecasting, informing the public on current aurora events: <https://helioforecast.space>
- Conrad Observatory (COBS) for geomagnetic measurements
- Bz problem in heliospheric weather forecasting HELIO4CAST(ERC funded)
- Solar storm modeling with ML (FWF funded)
- Ambient Solar Wind Modeling and Prediction (FWF funded)
- GIC now- and forecasting
- COBS is coordinating the SWAP project





Seibersdorf Laboratories

Radiation exposure at aviation altitudes

- Galactic Cosmic Rays (GCR), Solar Energetic Particles (SEP)
- **AVIDOS** (aviation dosimetry) service for:
 - International Civil Aviation Organization (**ICAO**) via **PECASUS** - Partnership of Excellence for Civil Aviation Space weather User Services
 - European Space Agency - **ESA** Space Weather Service Network
 - Airlines

Radiation detectors

- Tissue Equivalent Proportional Counter (**TEPC**) for
 - International Space Station (**ISS**)
 - On-board aircraft and terrestrial measurements

Space radiation dose modeling

- Monte Carlo simulation techniques (**FLUKA, Geant4**)

Radiation Hardness Assurance for space applications

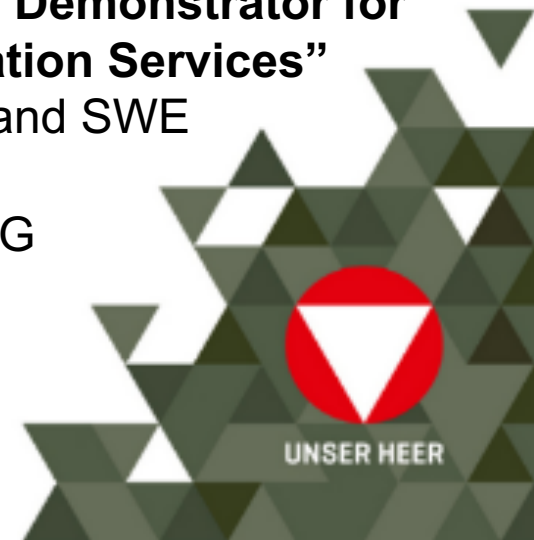
- **Accredited testing** services of space electronics

<https://avidos.seibersdorf-laboratories.at/avidos.html>



Ministry of Defense (MoD) Austria

- **Capability Development in SSA (Space Situational Awareness) initiated:** Space Weather (SWE), Near-Earth Objects (NEO) and Space Surveillance and Tracking (SST), as well as special “military” SSA components (Space Domain Awareness)
- **Increase the awareness for SSA and SWE** (e.g. communication and PNT-services, IT, critical infrastructure) within the MoD and for national security participant in several **EDIDP** (European Defence Industrial Development Programme) and **EDF** (European Defence Fund) projects in SSA
- Development of an MoD-internal **Demonstrator for “SWE Information and Predication Services”**
- **Research cooperation** in SSA and SWE at national level
- POC: Bgdr Dr. TEICHMANN, IMG



Summary

Space Weather is an important issue of global matter and global efforts but needs also coordinated collaboration on a national level.

- ESA Space Weather Service Network <https://swe.ssa.esa.int/>: Austria with its capabilities from Seibersdorf Laboratories, University of Graz, and Graz University of Technology currently contributes to 4 out of 5 Expert Service Centers (ESCs). With GeoSphere, soon it will contribute to all 5 ESCs on Solar Weather, Heliospheric Weather, Space Radiation, Ionospheric Weather, and Geomagnetic Conditions.
- SWAP will further deepen and strengthen our national collaboration on Space Weather with industrial partners and “end-users” like MoD, APG, Aviation, etc. (**FFG project led by Geosphere Austria**)
- Space Weather – the Austrian Portal <https://swap.zamg.ac.at/>
- ISES Regional Warning Center Austria (Kanzelhöhe Observatory) <https://spaceweather.at/weltraumwetter.at>
- Austria fully supports the UN COPUOS Expert Group Recommendations.



Joanneum Research

- Vulnerability of satellite services and counter-measures
 - Expansion of satellite channels to higher frequencies
 - More robust satellite navigation or alternative solutions
 - Crisis management preparation
 - EMC - electromagnetic compatibility
 - EM wave propagation
- Projects on GNSS (ESA, FFG)