

German ISWI activities

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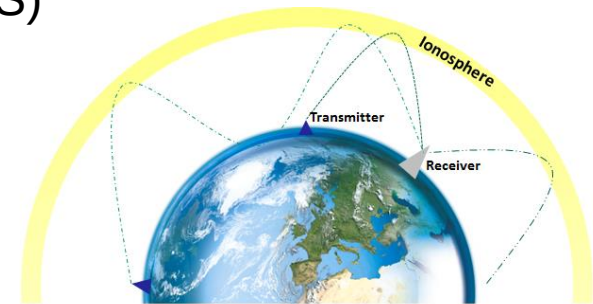
Knowledge for Tomorrow



German ISWI activities:

1. Global Ionospheric Flare Detection System (GIFDS)

- DLR project of the newly founded Institute of Solar-Terrestrial Physics (SO)
- Contact: Daniela Banyś (Daniela.Banys@dlr.de)



2. Solar Flares detected by Ionospheric Effects (SOFIE)

- Educational project led by DLR_Project_Lab Neustrelitz with scientific supervision from SO
- Contact: Alexander Kasten (Alexander.Kasten@dlr.de)



→ Scientific Advisor: Norbert Jakowski (Norbert.Jakowski@dlr.de)



ISWI: Global Ionospheric Flare Detection System (GIFDS)

GIFDS receiving sites:

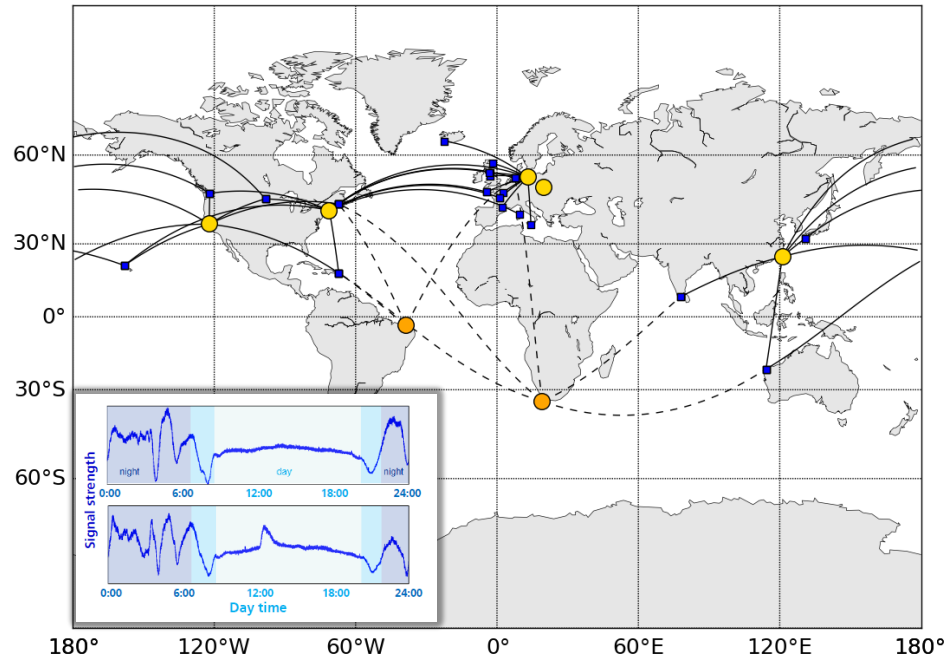
- DLR Neustrelitz
- Boston College
- PAN Krakow
- Stanford University
- NCU Taiwan

Under preparation:

- Hermanus, SANSA
- Fortaleza, Brazil

Objectives:

- Now cast detection of SIDs caused by solar flares using a ground-based VLF system
- 1Hz measurements of multiple VLF transmitters (Navy stations) in amplitude and phase
- Next step: Integration of VLF data and warnings into services of IMPC



**Ionosphere Monitoring and
Prediction Center**

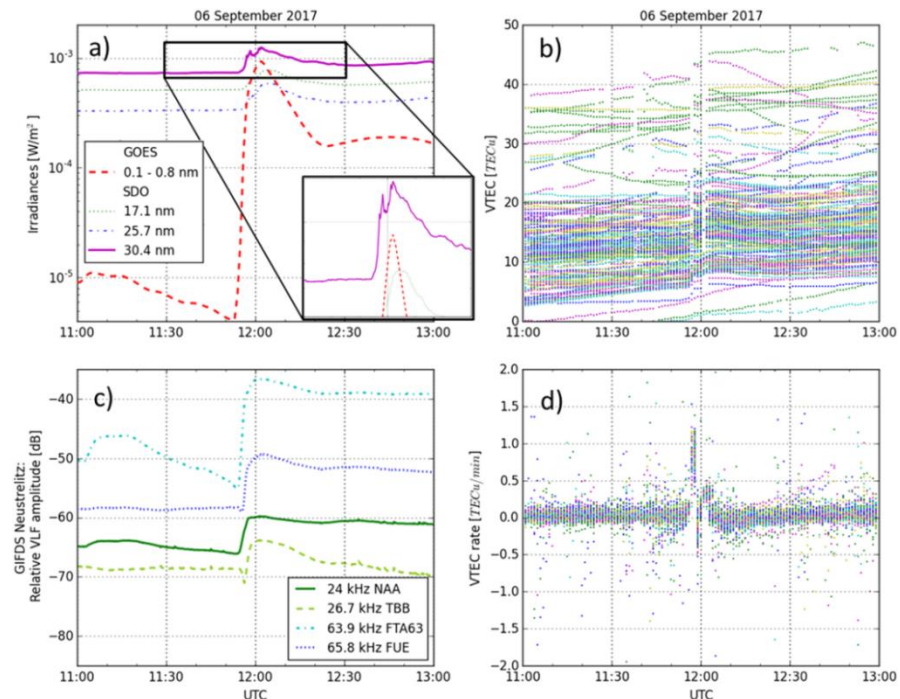
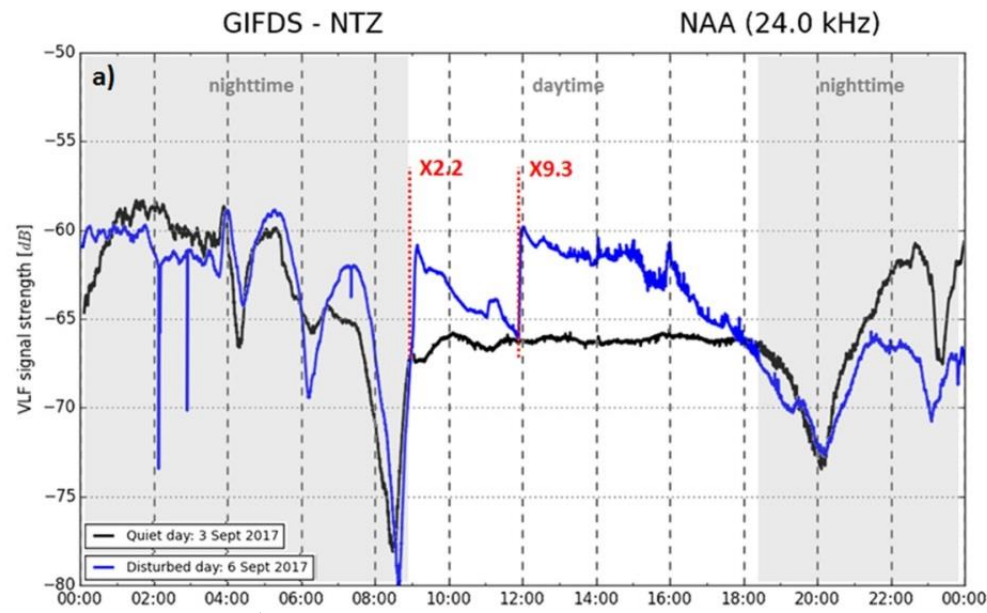
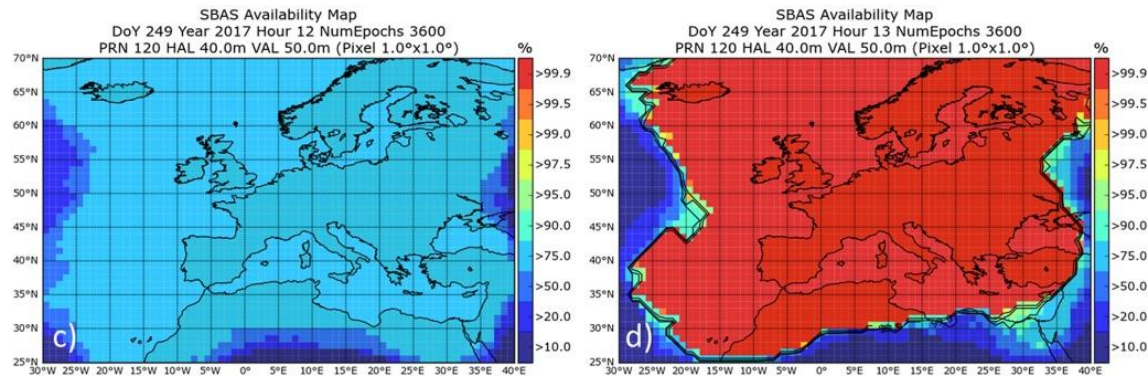
impc.dlr.de



ISWI: Global Ionospheric Flare Detection System (GIFDS)

Latest publication:

- Ionospheric Response to the X9.3 Flare on 6 September 2017 and Its Implication for Navigation Services Over Europe (Berdermann et al. 2018)





ISWI: Solar Flares detected by Ionospheric Effects (SOFIE)

Educational project:

- Directed by the DLR_Project_Lab Neustrelitz developing an own VLF receiver
- Long history:
 - 10th anniversary of DLR_Project_Lab in November 2019
 - Almost 13 years of the VLF project
- SOFIE offers a professional insight into space weather and their influences on technological systems
- Started as a German educational project, a collaboration with schools in other countries is intended and has recently started



ISWI workshop 2019 in Trieste:

- We received a very positive feedback!
- DLR got several enquiries for further installations (e.g. Chile, Azerbaijan, India)



ISWI: Solar Flares detected by Ionospheric Effects (SOFIE)

Used transmitters:

- Cutler NAA (USA)
- NRK (Iceland)
- Rauderfehn DHO38 (Germany)
- Skelton GQD (UK)
- NSY (Italy)



	Location	ID	Transmitter	Status
National	DLR_Project_Lab Neustrelitz	NZ1	24,0 kHz (NAA / US)	active
	DLR_Project_Lab Neustrelitz	NZ2	22,1 kHz (GQD / GB)	active
	DLR_Project_Lab Neustrelitz	NZ3	37,5 kHz (NRK / IS)	active
	DLR_Project_Lab Neustrelitz	NZ4	24,0 kHz (NAA / US)	active
	Canow	CA1	22,1 kHz (GQD / GB)	active
	Gymnasium Parchim	PA1	22,1 kHz (GQD / GB)	active
	FEZ(orbital) Berlin	BL1	37,5 kHz (NRK / IT)	active
	Käthe-Kollwitz-Gymnasium Berlin	BL2	22,1 kHz (GQD / GB)	inactive
	DLR_School_Lab Braunschweig	BS1	22,1 kHz (GQD / GB)	active
	Freiburg im Breisgau	FB1	24,0 kHz (NAA / US)	under construction
International	Kiel	Ki1	37,5 kHz (NRK / IS)	under construction
	Leonardo da Vinci Campus Nauen	VCN	37,5 kHz (NRK / IS)	active
	Antares NÖ Volkssternwarte	NOE	45,9 kHz (NSY / IT)	active
	University Kairo (Egypt)	EY1	24,0 kHz (NAA / US)	inactive
	Huntsville (USA)	HV1	23,4 kHz (DHO38 / DE)	active
	Huntsville (USA)	HV2	22,1 kHz (GQD / GB)	inactive
	SANSA (Hermanus, South Africa)	SA1	24,0 kHz (NAA / US)	active
	SANSA (Hermanus, South Africa)	SA2	22,1 kHz (GQD / GB)	active
	Szczecinek (Poland)	PL1	45,9 kHz (NSY / IT)	active
	Mongol Od Kontor (Mongolia)	MG1	19,8 kHz (NWC / AU)	under construction
	OSC Nigeria	NG1	24,0 kHz (NAA / US)	under construction



ISWI: Data Access

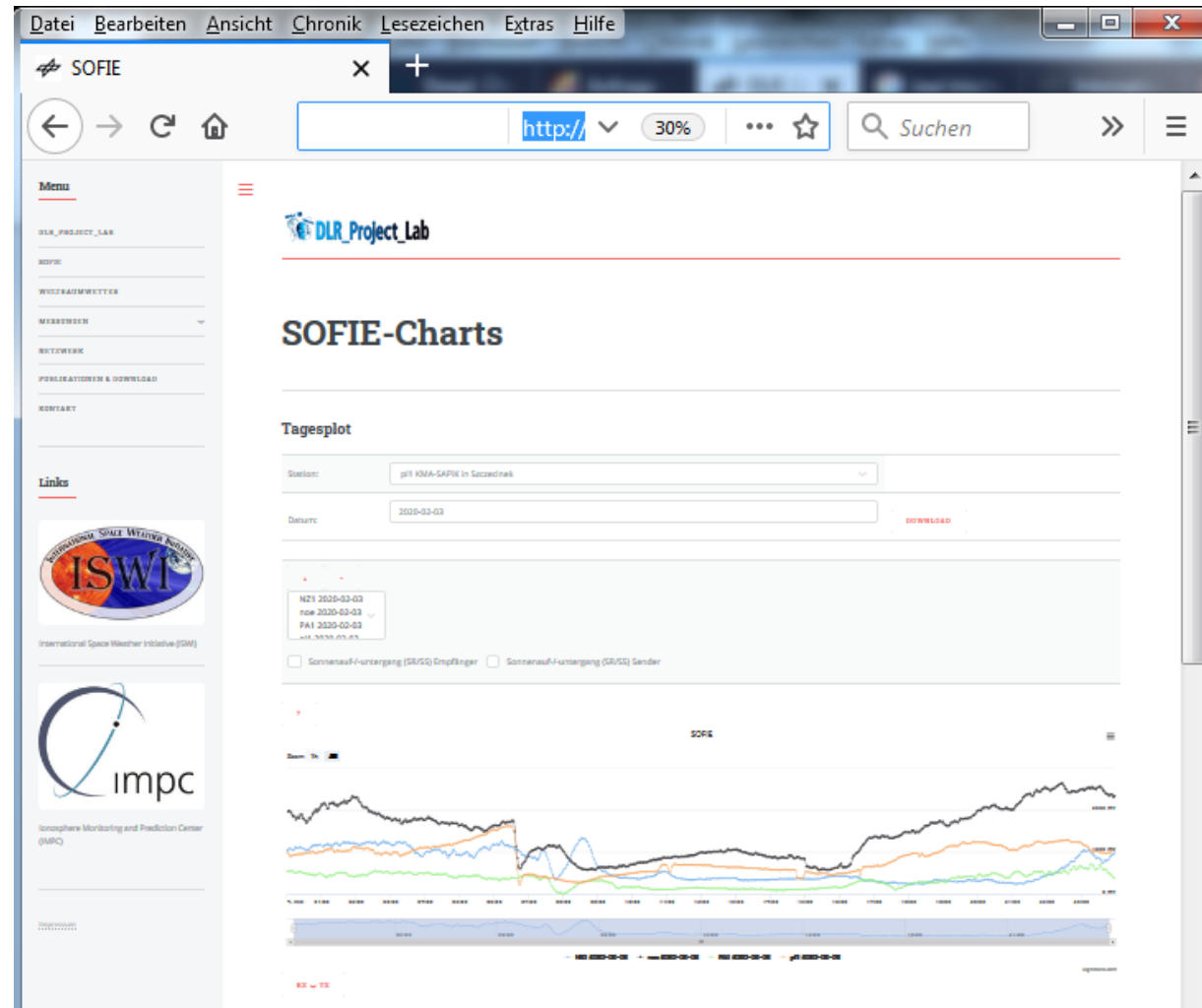
<http://www.projectlab-neustrelitz.de/sofie/eng/daten.php>

SOFIE:

- Interactive web-application for data visualisation
- Real-time visualisation of SOFIE data (gradual change into real-time operation)
- Open data access via Website and FTP

GIFDS:

- Real-time data visible on the website of the DLR_Project_Lab
- Data access via IMPC in the near future

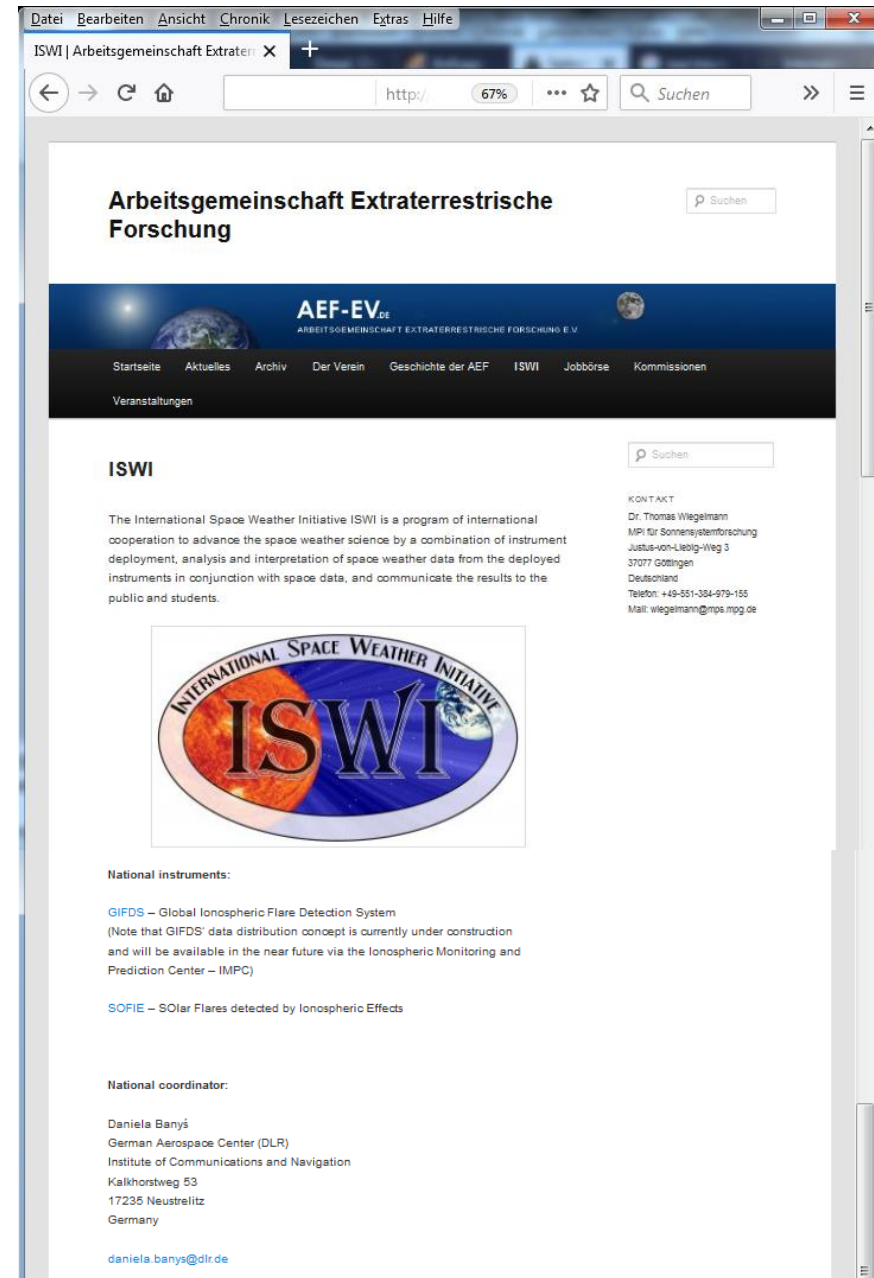


ISWI: National Integration

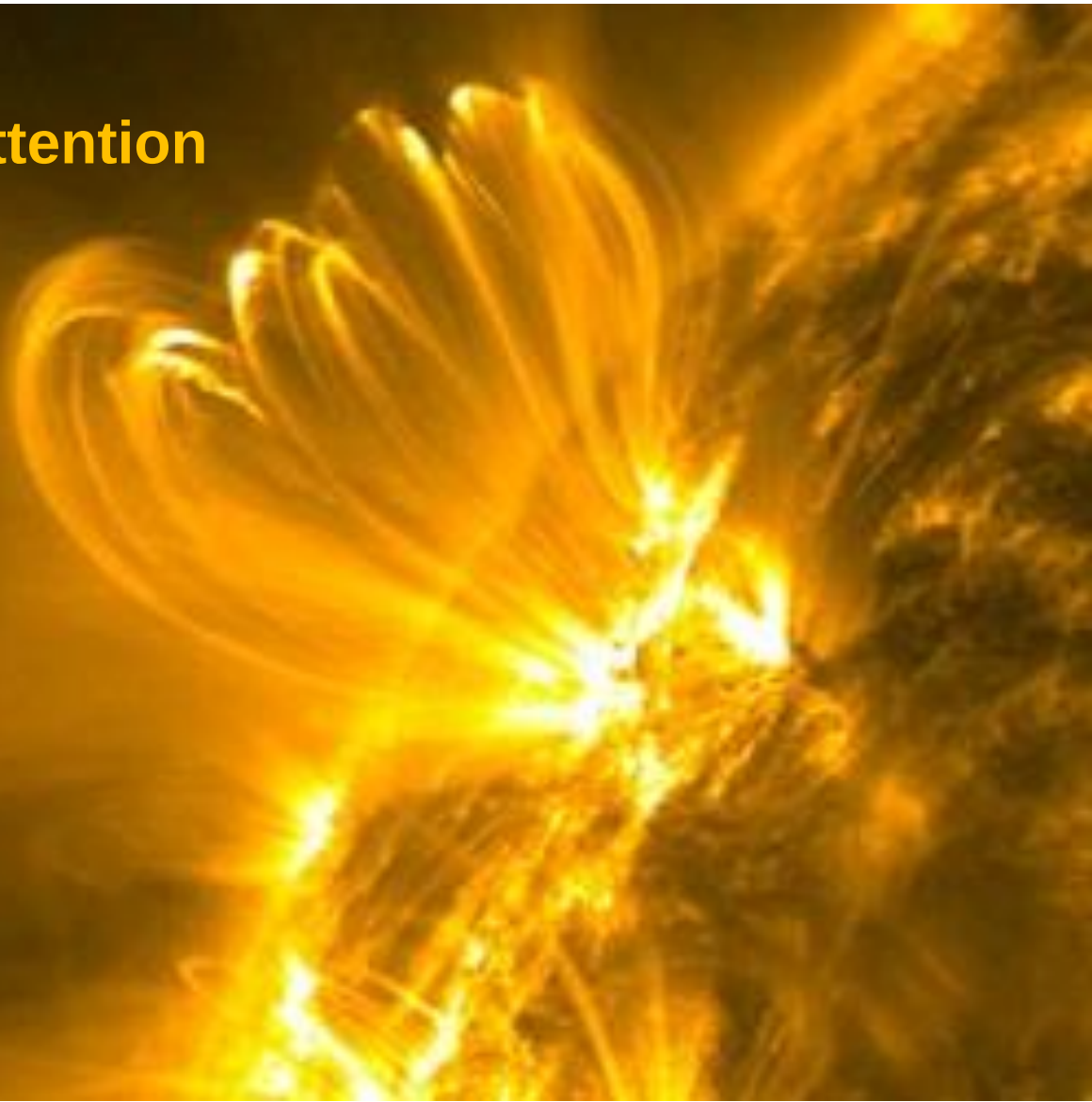
AEF - Arbeitsgemeinschaft Extraterrestrische Forschung:

<http://www.aef-ev.de>

- Presentation of ISWI on the AEF homepage
- ISWI integrated nationally through the AEF and represented by Daniela Banyś as national coordinator



Thank you for your attention



References

Berdermann, J., Kriegel, M., Banyś, D., Heymann, F., Hoque, M. M., Wilken, V., Borries, C., Heßelbarth, A., Jakowski, N. (2018), Ionospheric Response to the X9.3 Flare on 6 September 2017 and Its Implication for Navigation Services Over Europe. *Space Weather*, 16, 1604– 1615. <https://doi.org/10.1029/2018SW001933>

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Global Ionospheric Flare Detection System (GIFDS)

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Introduction

Solar radiation bursts or flares may lead to significant changes of Earth's ionosphere. Additional photoionization causes enhanced ionization which modifies propagation of radio waves traveling through the ionospheric plasma. Solar flares impact concerns both transionospheric as well as reflected radio waves. Whereas the transionospheric impact on radio waves can be measured even in the GHz frequency range on GNSS signals reflected waves are most sensitive in the Very Low Frequency (VLF) range. It has been shown that VLF signals are suitable for a high-quality detection of solar flares. Currently, DLR is preparing the installation of a Global Ionospheric Flare Detection System (GIFDS) in order to issue warnings for mitigating space weather impact on sensitive technologies.

Beginning in April 2007, during the educational project SIMONE (Sun & Ionosphere - MOnitoring NEtwork) under supervision of the DLR_Project_Lab Neustrelitz, numerous sun eruptions have been observed by teachers and pupils from several schools in Germany as illustrated in Fig. 1 (see also ISWI Newsletter Vol.3 No.66, by K.-H. Eckelt).

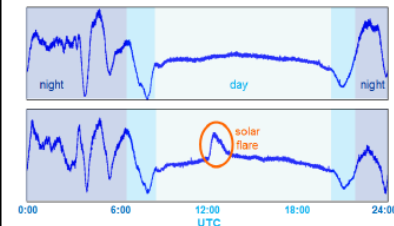


Fig. 1: Typical record of an undisturbed VLF signal (top) in comparison with a VLF signal modified by a solar flare event on the 11th of August 2012.



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