Report on the German ISWI activities 19 January 2018

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DLR Neustrelitz holds two projects that are part of the International Space Weather Initiative (ISWI): The world-spanning, near real-time network named GIFDS (Global Ionospheric Flare Detection System, see also Wenzel et al., 2016) and the educational project named SOFIE (SOlar Flares detected by Ionospheric Effects). Both projects deal with the monitoring of the lower ionosphere by means of VLF measurements in order to monitor, analyze and discuss solar flare effects and its relation to space weather.

Currently, the GIFDS network consists of five globally distributed receivers located in Neustrelitz (Germany), Krakow (Poland), Boston (MA, USA), Stanford (CA, USA) and Taoyuan City (Taiwan). Two further installations are in progress, one in Fortaleza (Brazil) and another one in Hermanus (South Africa). Each GIFDS station is capable of measuring amplitude and phase of several VLF transmitters in real-time. With GIFDS, we joined a live broadcast of the solar eclipse effects on the 21 August 2017 demonstrating its real-time capabilities (see SWACI news via http://swaciweb.dlr.de/news/solar-eclipse-21-aug-2017/?L=1). Besides the TEC products of the Ionosphere Monitoring and Prediction Center (IMPC, formerly SWACI), VLF amplitude measurements of the GIFDS stations in Boston and Stanford are presented.

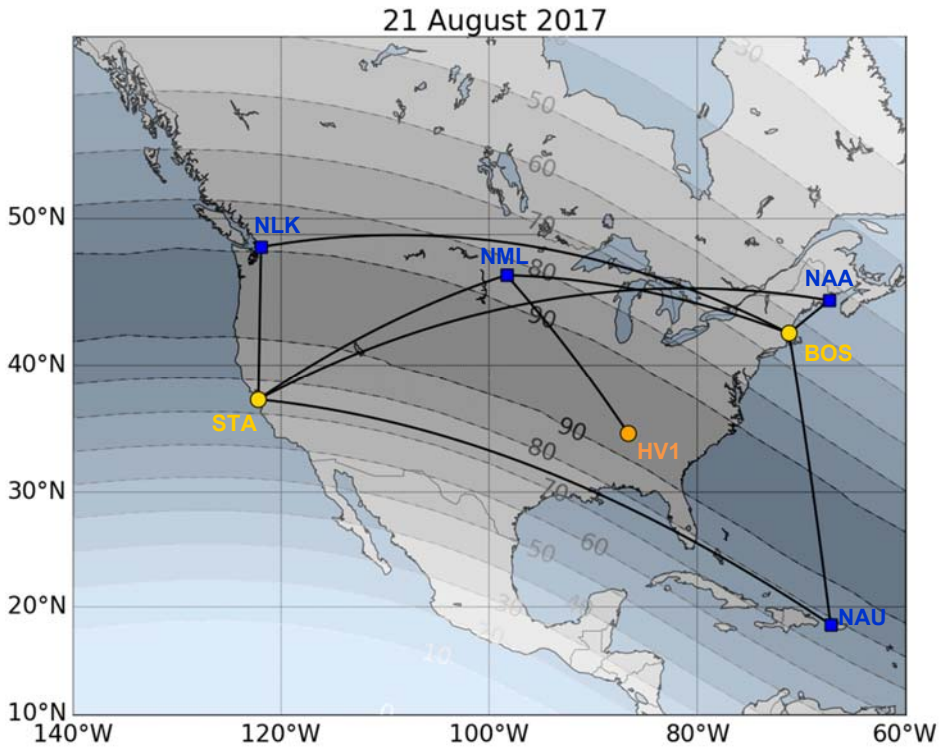

Figure 1: Spatial distribution of VLF receivers (circles) and transmitters (blue squares): The GIFDS stations at Stanford (STA) and Boston (BOS) are marked by yellow circles, and the SOFIE receiver (HV1) at Huntsville Alabama is marked in orange.

Figure 1~~Figure 1~~ illustrates the spatial distribution of VLF receivers and transmitters and their corresponding propagation paths which extend across and alongside the path of totality. Both GIFDS stations are situated within the area of obscuration. Each GIFDS receiver is able to record multiple VLF signals. The relevant propagation paths at the time of the eclipse are shown in Figure 1~~Figure 1~~. Figure 2~~Figure 2~~ shows the diurnal variation of different VLF amplitude measurements on the eclipse day as it was demonstrated during real-time transmission. The VLF observations successfully showed clear eclipse signatures. Here, in particular NML (dark blue) and NAU (light blue) should be mentioned (cp. Figure 2~~Figure 2~~). Some results shall be published soon (Kriegel et al. 2018, in review at GRL).

The effect of the solar eclipse was also measured by the SOFIE receiver HV1 in Huntsville /Alabama (cp. Figure 1~~Figure 1~~). Figure 3~~Figure 3~~ shows the amplitude measurements of NML in Eastern Standard Time (EST). All presented measurements showed a clear increase in amplitude during the time of eclipse.

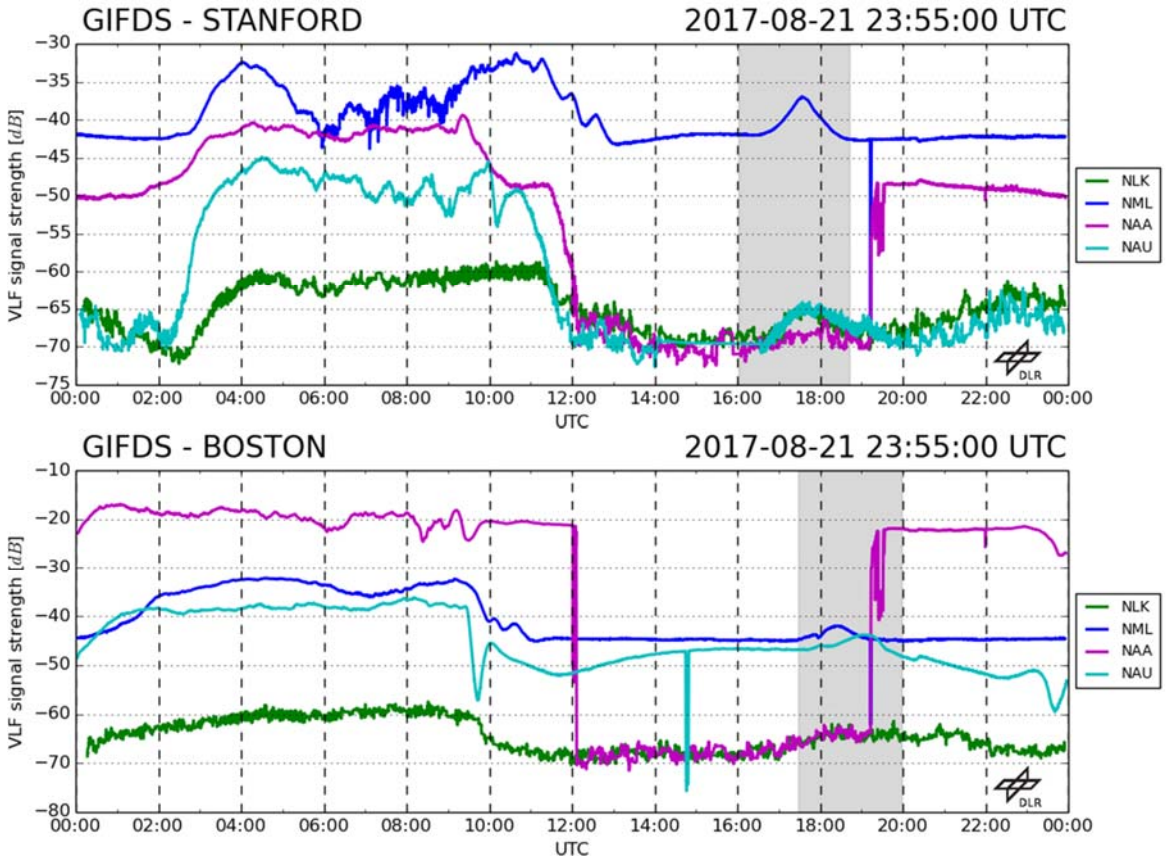

Figure 2: VLF amplitude measurements of 21 August 2017 recorded in Stanford (top panel) and Boston (bottom panel): The gray-shaded areas mark the times of obscuration for Stanford and Boston respectively. Due to long VLF propagation paths crossing other parts of obscuration, the actual impact on VLF signals may vary in time.

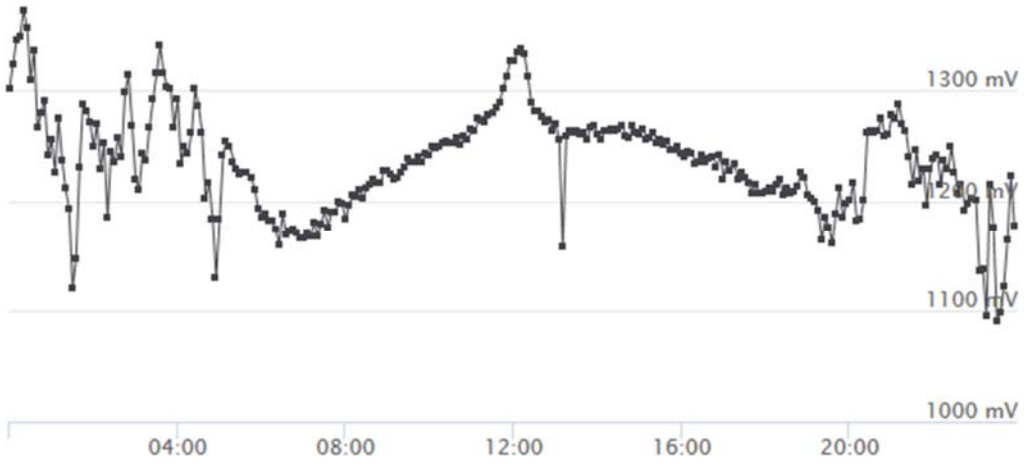

Figure 3: VLF amplitude measurement of the 21 August 2017 (EST) recorded by the SOFIE receiver HV1 in Huntsville Alabama: HV1 measures the VLF signal transmitted by NML (LaMoure / North Dakota).

The SOFIE project now contains a network of 14 receivers (see Figure 4~~Figure 4~~) installed at collaborating school, universities and scientific institutions. SOFIE started as German educational project but expanded its activities to educational and research institutions in other countries. At this time, four further stations are in preparation: Poland, Egypt, South Africa, and Taiwan. Furthermore, the SOFIE project is a prominent part of the annual Joint Space Weather Summer Camp. In collaboration with the University of Alabama in Huntsville (UAH), the South African National Space Agency (SANSA) and the DLR, the Summer Camp has become a trilateral workshop in which always two of the partners take over the role of the hosts. This year the summer camp will take place at DLR Neustrelitz and at the University of Alabama (2 - 29 July 2018). As part of the last summer camp in 2017, the stations in Neustrelitz (NZ2, NZ3, NZ4), Huntsville (HV1, HV2) and Hermanus (SA2) received a major update. These stations have been switched to real-time monitoring. The change of further stations to real-time monitoring is intended. All data is freely available and can be accessed via http://www.projectlab-neustrelitz.de/sofie/eng/daten.php or http://www.projectlab-neustrelitz.de/sofie/eng/messserver.php .

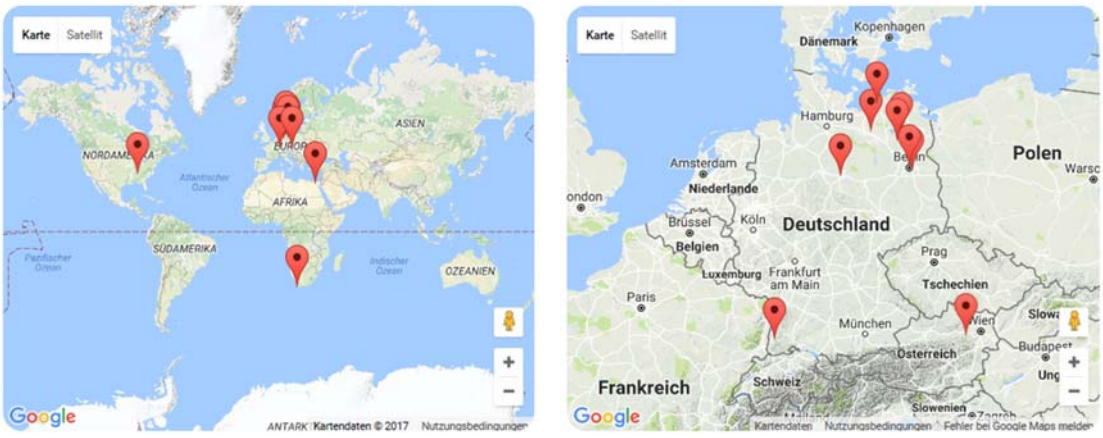

Figure 4: Network of SOFIE receivers on global (left) and local scale (right).

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