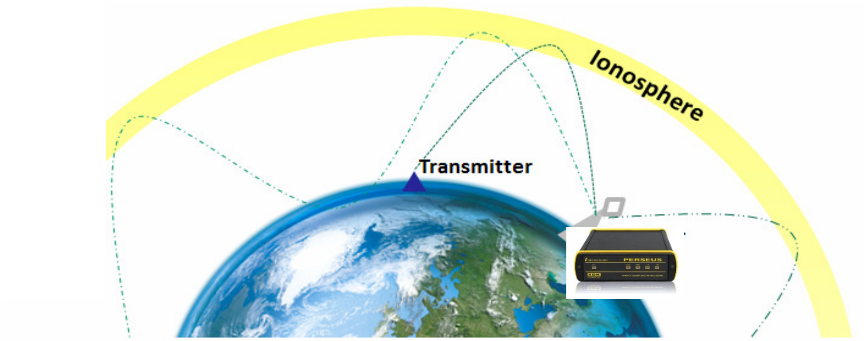
ISWI Instrument Updates
February 14, 2019

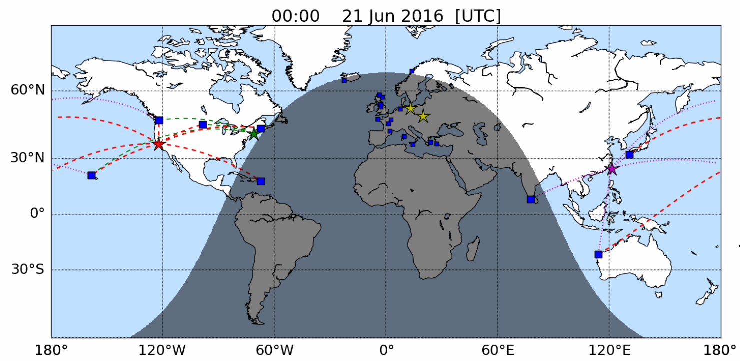
1. AWESOME (from Morris Cohen)
   - 10 “new design” receivers operating across from Puerto Rico to Alaska.
   - Several “original” receivers are still actively being run by colleagues in other countries.
   - Recently secured a significant grant part of which will be used to further expand AWESOME network.
   - Another grant opportunity being pursued to allow sending of a larger number if AWESOME receivers to international partners.
   - PDMP will be updated with minor changes

2. CALLISTO (from Christian Monstein)
   - PI lost original affiliation due to retirement.
   - CALLISTO is no more an ETH activity
   - PI has a new affiliation from a related institute.
   - PDMP will be updated with new address and affiliation

3. Global Ionospheric Flare Detection System (GIFDS; see longer report from N. Jakowski)
   - **GIFDS** solar flare records may have impact on GNSS positioning http://swaciweb.dlr.de/news/solar-eclipse-21-aug-2017/?L=1), Berdermann et al., 2018).
   - GIFDS network consists of 5 globally distributed receivers: 1 in Germany, 1 in Poland, 2 in USA, 1 in Taiwan, 1 in Brazil and 1 in South Africa.
   - Each GIFDS station measures VLF amplitude & phase from different transmitters in near real-time. To get permanent information on solar flare activity all records from globally distributed stations are merged into one continuous 24 hours' time series as described by Wenzel et al. (2016).

GIFDS – global network



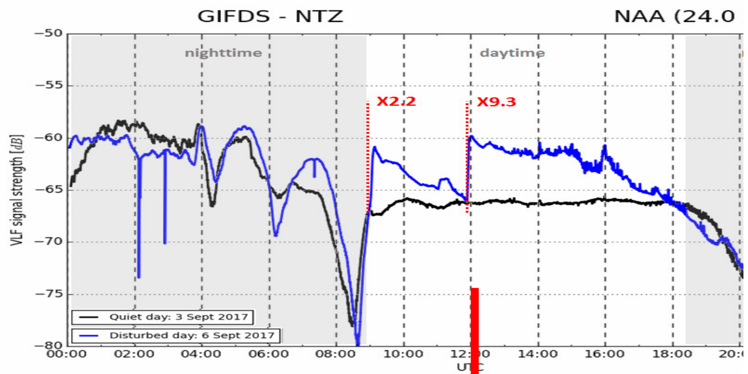


Receiver locations

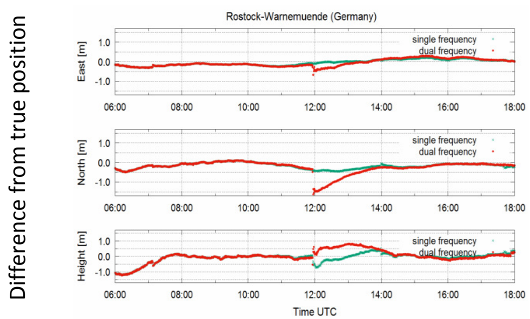
Germany 1
Poland 1
Taiwan 1
USA 2

Permanent Monitoring of solar flare activity
Wenzel et al., (2016) JASTP, Vol. 138–139, 233-242

Solar flare impact on GNSS



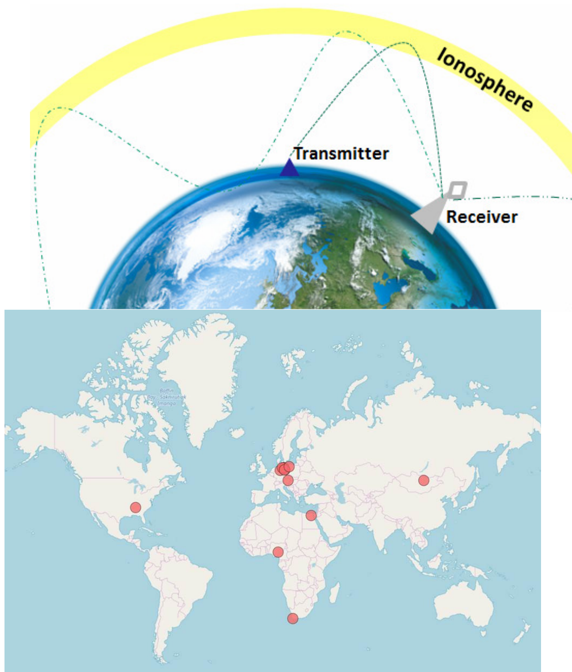
Solar flare impact on positioning
Berdermann et al.. (2018)
Space Weather, 16(10)



4. SOlar Flares detected by Ionospheric Effects (SOPHIE; see longer report from N. Jakowski)

- Though started as a German educational project, SOFIE has been expanded in 2018 to serve education and research under the guidance from the DLR_Project_Lab in Neustrelitz and in cooperation with many partners (see http://www.projectlab-neustrelitz.de/sofie/eng/sofie.php).
- Currently, 7 SOFIE-Receivers are located at different schools in (mostly northern) Germany.
- 2 receivers are in Austria & Poland, operated by astronomy & space weather enthusiasts.
- 5 stations are operated outside of Europe: in the USA, South Africa, Egypt, Nigeria and Mongolia. From these we are currently setting up the SOFIE receivers in Nigeria and Mongolia to obtain near-real time data in a similar way as from other international stations.
- Additional SOFIE-receivers in Taiwan and Ethiopia are being considered/planned.

SOFIE global network

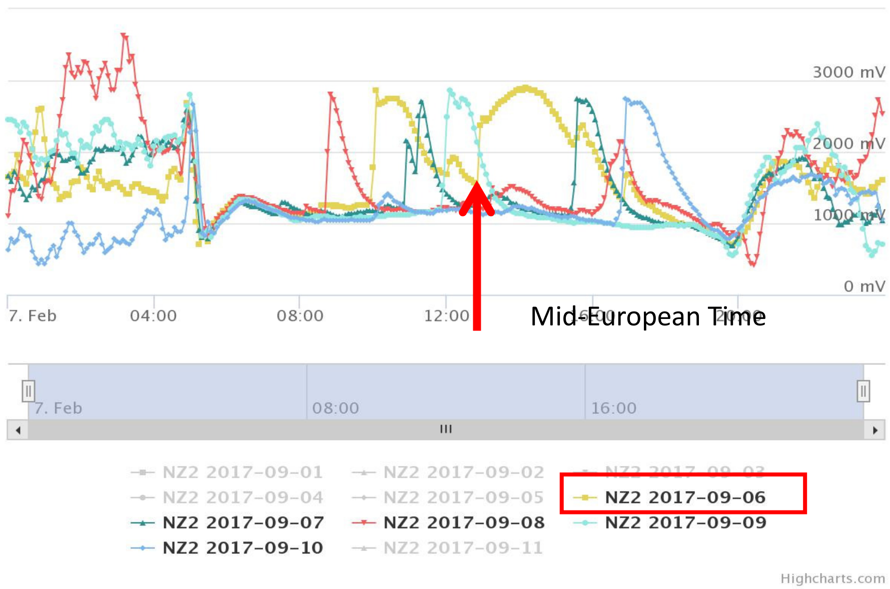


Receiver locations
Austria 1
Egypt 1
Germany 7
Nigeria 1
Poland 1
South Africa 1
USA 1

Under consideration
Taiwan, Ethiopia

http://www.projectlab-neustrelitz.de/sofie/eng/sofie.php)

Recording solar flares



VLF signal strength measurements via SOFIE receivers in Neustrelitz revealed numerous solar flares from September 6 -10, 2017.
The X 9.3 solar flare on 6 September 2017 causing an impact on GNSS positioning (see previous slide) is indicated by an arrow.

GIFDS & SOPHIE Report
N. Jakowski

Report on German ISWI activities in 2018

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*German Aerospace Center (DLR), Institute of Communications and Navigation
**German Aerospace Center (DLR), DLR Campus Neustrelitz

The German Aerospace Center (DLR) participates with two projects in the International Space Weather Initiative ISWI:

- The solar flare monitoring system "Global Ionospheric Flare Detection System" (GIFDS)
- The educational students project "SOlar Flares detected by Ionospheric Effects" (SOFIE)

Both projects have been continued successfully since the last SB meeting.

GIFDS has shown its capability to record solar flares which may have strong impact on GNSS positioning (see http://swaciweb.dlr.de/news/solar-eclipse-21-aug-2017/?L=1), Berdermann et al., 2018). Currently, the GIFDS network consists of five globally distributed receivers located in Neustrelitz (Germany), Krakow (Poland), Boston (MA, USA), Stanford (CA, USA), Taoyuan City (Taiwan), Fortaleza (Brazil) and Hermanus (South Africa). Each GIFDS station measures amplitude and phase of VLF signals from different transmitters in near real-time. To get permanent information on solar flare activity all records from globally distributed stations are merged into one continuous 24 hours' time series as described by Wenzel et al. (2016).

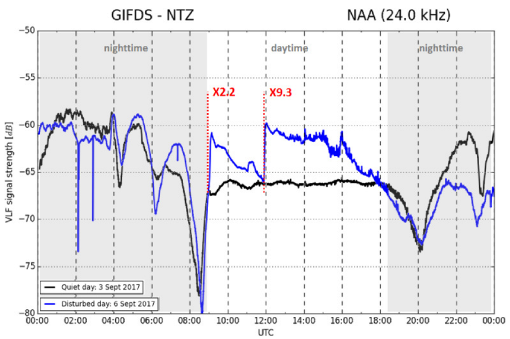


Figure 1: GIFDS measurements at the Neustrelitz station on September 3 and 6, 2017 showing severe Flare activity on 6 September 2017 (for further details see Berdermann et al., 2018).

SOFIE started as a German educational project but, under the guidance of the DLR_Project_Lab in Neustrelitz and in cooperation with many other partners from Germany and abroad, SOFIE could expand its activities to educational and research institutions in other countries. Thus, SOFIE has been further enlarged in 2018 (see http://www.projectlab-neustrelitz.de/sofie/eng/sofie.php). Currently, seven SOFIE-Receivers are located at different schools in Germany preferably in the northern part of Germany. Two more receivers are reliably operating in Austria and in Poland maintained by astronomy and space weather enthusiasts. Outside of Europe, we operate five stations: in the USA, South Africa, Egypt, Nigeria and Mongolia. From these we are currently setting up the SOFIE receivers in Nigeria and Mongolia to obtain near-real time data in a similar way as from other international stations. Additionally we check options to install SOFIE-receivers in Taiwan and Ethiopia.

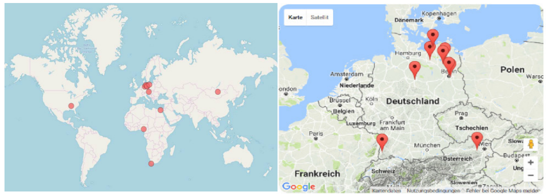


Figure 2: Network of SOFIE receivers on global (left) and local scale (right)

Besides solar flares also the ionospheric response of solar eclipses like those on 21 August 2017 over North America can be recorded. The SOFIE receiver HV1 in Huntsville /Alabama (Figure 1) shows clearly an amplitude increase around 12:00 Eastern Standard Time (EST) indicating changed propagation conditions for VLF signals during the eclipse.

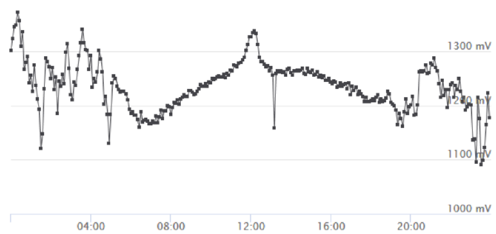


Figure 1: VLF amplitude variation during the solar eclipse on the 21 August 2017 (EST) recorded by the SOFIE receiver HV1 in Huntsville Alabama: HV1 measures the VLF signal transmitted by NML (LaMoure / North Dakota).

Next time we plan to organize a seminar for teachers who guide the SOFIE project at different schools in Germany to discuss space weather topics and project issues in particular focusing on ideas how SOFIE can support the educational program at schools.

References:

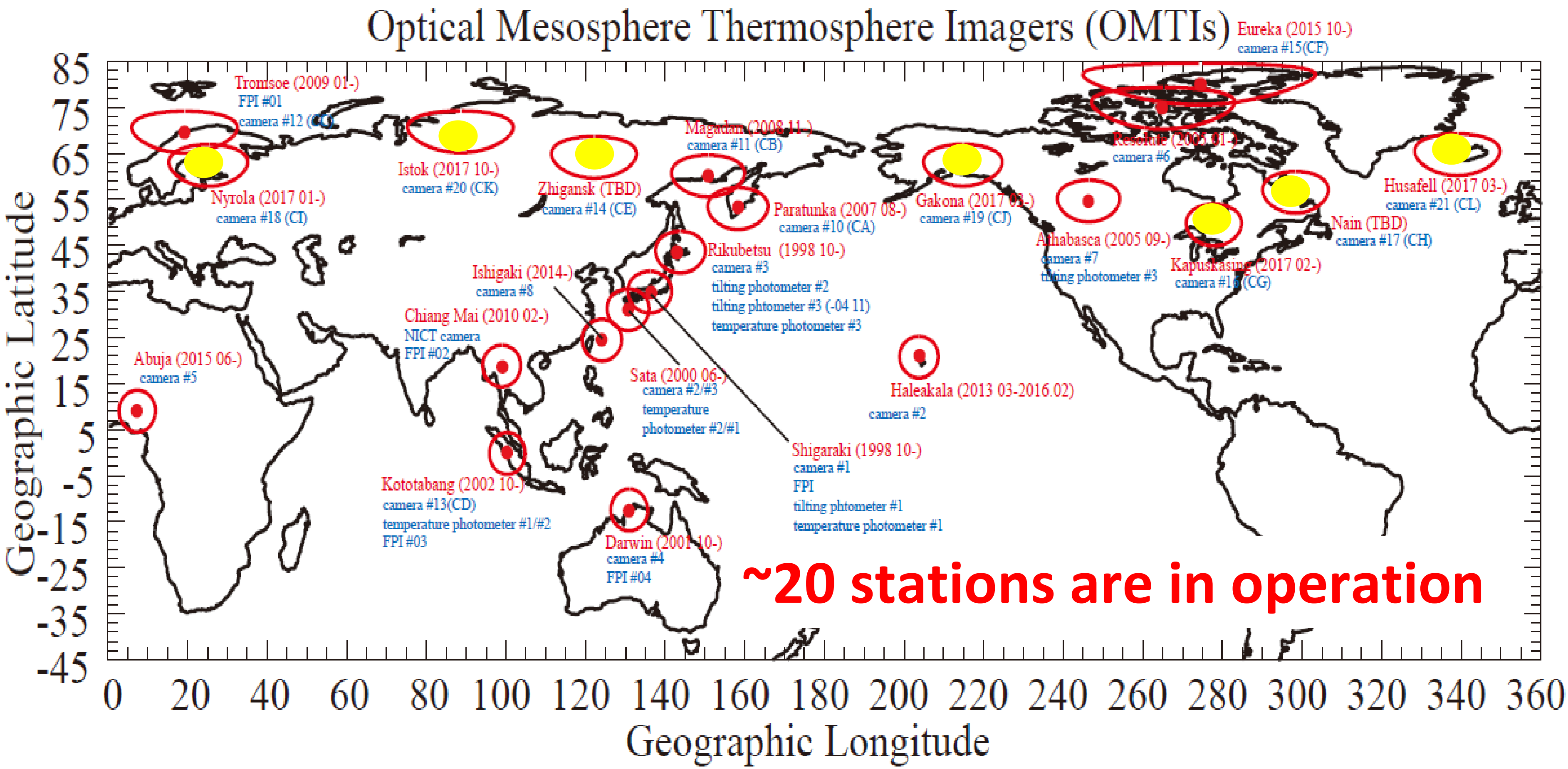
Berdermann, J., M. Kriegel, D. Banyś, F. Heymann, M. M. Hoque, V. Wilken, C. Borries, A. Heßelbarth, and N. Jakowski (2018), Ionospheric response to the X9.3 Flare on 6 September 2017 and its implication for navigation services over Europe, Space Weather, 16(10), https://doi.org/10.1029/2018SW001933

Wenzel, D., Jakowski, N., Berdermann, J., Mayer, Chr., Valladares, C., Heber, B. (2016). Global Ionospheric Flare Detection System (GIFDS), Journal of Atmospheric and Solar-Terrestrial Physics, Vol. 138–139, 233-242, https://doi.org/10.1016/j.jastp.2015.12.011

5. The Optical Mesosphere Thermosphere Imagers (OMTIs) consist of ~20 all-sky cooled-CCD imagers, 5 Fabry-Perot interferometers, 3 airglow temperature photometers, and 3 meridian-scanning photometers. They measure two-dimensional airglow images in the mesopause region and in the thermosphere, wind and temperatures in the lower thermosphere, and airglow rotational temperatures in the mesopause region.

: new sites after Feb.1, 2017

- OMTIs: http://stdb2.isee.nagoya-u.ac.jp/omti/
- Meta-data of OMTI (IUGONET): http://www.iugonet.org/
- CDF data (ERG Science Center): https://ergsc.isee.nagoya-u.ac.jp/index.shtml.en

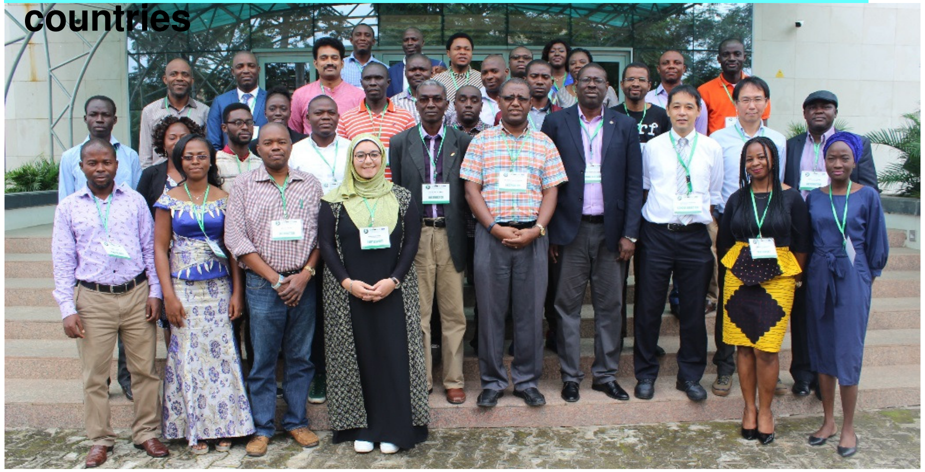


OMTI-related Capacity Building Activities in 2017-2018

Plasma School at the 2nd VarSITI 2017 Symposium, July 9, 2017: Irkutsk, Russia, 35 students from 5 countries

International School on Equatorial and Low Latitude Ionosphere (ISELION)–2018, March 5-9, 2018 Bandung, Indonesia, 40 students from 7

2nd International School on Equatorial and low-latitude ionosphere (ISELLI-2), Sept 11-15, 2017 Ota, Nigeria, 38 students from 7 African countries



International School on Equatorial Atmosphere (ISQUAR), March 18-22, 2019 Bandung, Indonesia, ~100 students (TBD)

6. SEVAN (from Ashot Chilingarian)
   - 1 new node will be installed in February in Czech Republic
   - 2 nodes in DESY Berlin and Hamburg will be delivered in April to be installed in July