

SPACE WEATHER STUDIES IN TURKEY

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1. Flare Index values have been regularly calculated by the Kandilli Observatory Astronomy Laboratory since 1976, and these data are available to national and international scientific institutions and researchers.

<https://astronomi.boun.edu.tr/flare-index>

Also, sunspot observations have been performed since 1946 and regularly sent to the sunspot number data centers such as SIDAC

<https://astronomi.boun.edu.tr/aylik-leke-sayilari>

2. There is one small group at Akdeniz University. Currently two master and one PhD thesis, which are focused on SEP events, solar and geomagnetic activity predictions and upper atmosphere (Ionosphere-magnetosphere Interaction) respectively, are under preparation.

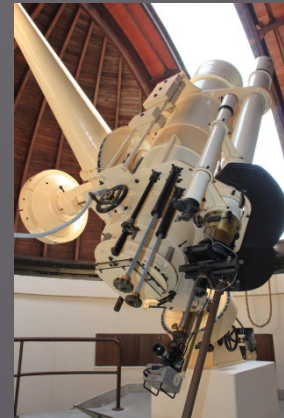
We have two proceedings related to space weather during this year: “Tirnakci M., Asenovski S., Kilcik A. “Investigation of Solar Energetic Particles (SEPs) Associated with X-Ray Solar Flares”, Proceedings of the Fifteenth Workshop “Solar Influences on the Magnetosphere, Ionosphere and Atmosphere” June, 2023.

Özgüç A., Kilcik A. “Temporal Offsets between Solar Flare Index and Cosmic, Geomagnetic, and Interplanetary Indicators during Solar Cycle 24”, Proceedings of the Fifteenth Workshop “Solar Influences on the Magnetosphere, Ionosphere and Atmosphere” June, 2023 (<https://www.spaceclimate.bas.bg/ws-sozopol/pdf/Proceedings2023.pdf>).

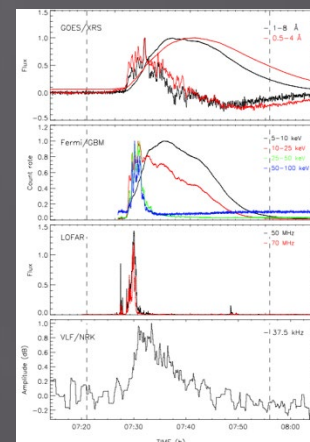
3. There is a one group at the Istanbul Technical university and they have space weather laboratory (<https://www.spaceweatherlab.itu.edu.tr/>)

The teams currently include five members and they are giving some lectures and courses related to space weather.

4. In 2023, a cosmic ray and space weather group was established at Istanbul University <http://ist60.istanbul.edu.tr/sun> Main activities of this group are sunspot observations which have been performed almost continuously since 1951, H α chromosphere observations (Archival data can be found at : <https://astronomi.istanbul.edu.tr/gunesgozlemaylik.php> Currently their sunspot observation results are also sent to SILSO)



Temporal and Spectral analysis of the solar flares in Solar Cycles 25 are being performed using observations from GOES (0.5-4 A, 1-8 A), Fermi - GBM (8-900 keV), LOFAR (20-80 MHz) and VLF (15-30 kHz).



In collaboration with the muon impact tracer and observer (MITO) team (see Ayuso et al. 2021) at Universidad de Alcala, they established a muon detector equipped with two 1x1m scintillators and 8 PMTs at the site of Eastern Anatolia Observatory (around Erzurum at 3200m altitude).

The goal is to monitor especially **Forbush decreases** and maybe **Ground Layer Events**. The new detector is working at the moment and its raw data is being streamed in real time at <http://ist60.istanbul.edu.tr/mirya>



5. Eastern Anatolia Observatory (Doğu Anadolu Gözlemevi, DAG) has the biggest telescope in Turkey (four meters). The observatory site, "Karakaya Tepeleri", has a ~3170 m summit on a mountain range of 2500-3170 m altitude.

In this observatory, Cosmic muon measurement studies were initiated as of January 2022 within the scope of the DAG Project. For muon detection, detectors designed by DAG team, mainly consisting of a plastic scintillator, photomultiplier tube and DRS4 reading system. Currently, they are focuses on establishing a station that receives and analyzes data 24/7 and on new detector designs. A second muon detector installed by the Istanbul University space weather team with a collaboration in 2023 and currently producing living data (<http://ist60.istanbul.edu.tr/mirya/>)

Also, DAG team introduced a new study subject or field called "Astrometeorology" (shortly Astrometeo), which brings together astronomy and space sciences such as Astronomical atmosphere, meteorology, satellite meteorology, remote sensing, atmospheric and meteorological information – products, space atmosphere and data analysis, etc.,).

