



Osservatorio Astronomico di Trieste
Astronomical Observatory of Trieste



Study of the correlation between the solar activity and the geomagnetically induced currents in gas pipelines systems

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Project aim, deliverables and milestones

The main **scientific goal** of the project will be the identification and characterization of the properties of the solar conditions which can produce Space Weather events potentially harmful for a gas pipeline system at our latitude. Then a detailed description of the suitable conditions for the occurrence of the geomagnetic disturbances which may affect the pipelines systems will be reported in a published paper.

On the basis of these properties we will develop a **prototype of a smartphone application** to send alerts in case of potentially dangerous events for gas pipeline systems at different latitudes on Earth due to the solar activity. This application will be dedicated to potential users who work in the sector of the management and monitoring of gas pipelines.

Deliverables and Milestones:

Done

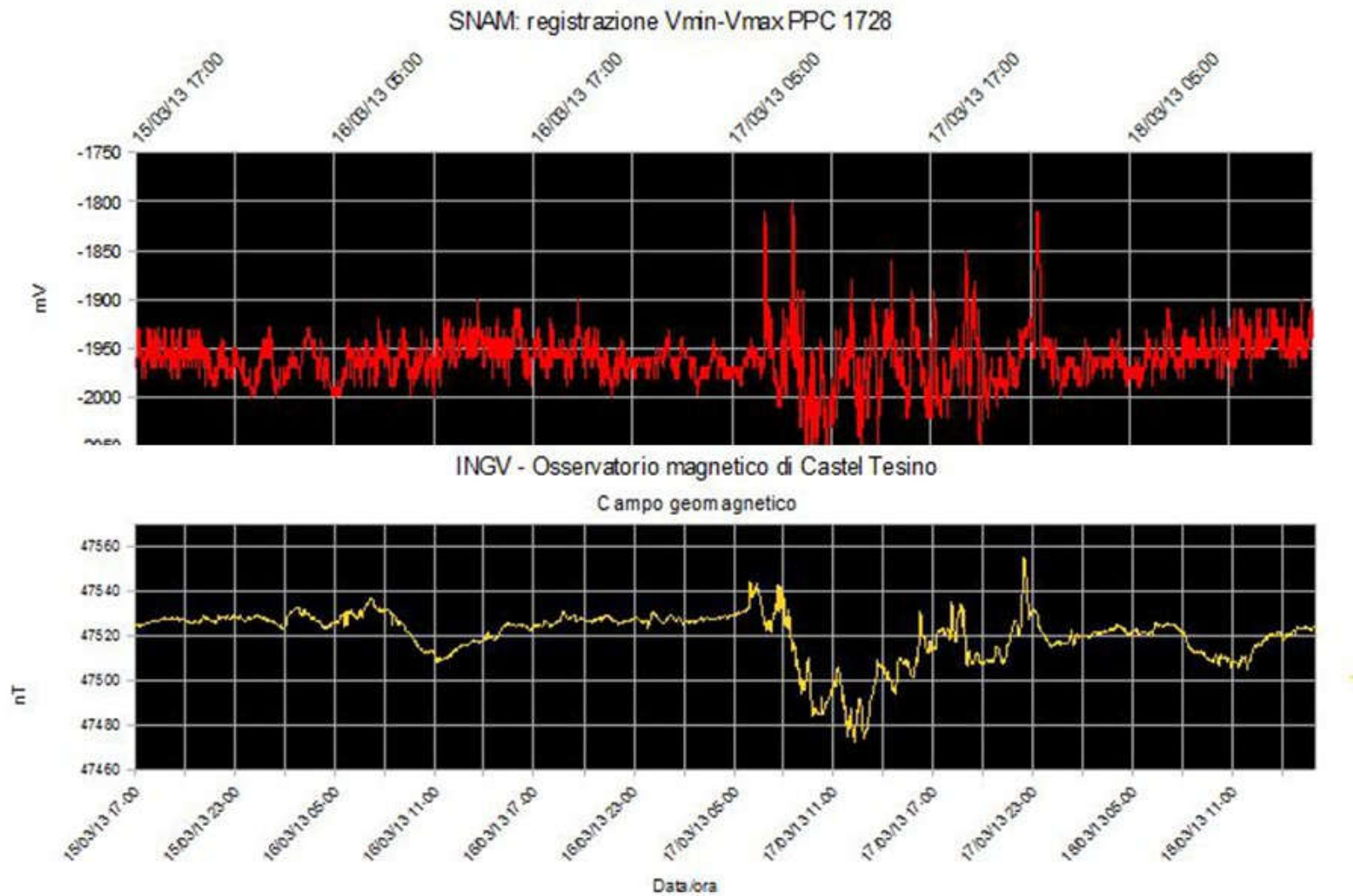
InProgress

- Identification of a list of significant potential variations registered along the SNAM pipeline and the corresponding geomagnetic events (T0+6M)
- Report containing the results reached during the first year of activity (T0+12M)
- Publication of a case study in a peer review journal (T0+12M)
- Identification of the properties of Space Weather events potentially harmful for a gas pipeline system at our latitude (T0+12M)
- Publication of a paper in a peer review journal describing the method for the identification of the solar conditions suitable for the occurrence of the geomagnetic disturbances which may affect the pipeline systems at different latitudes (T0+22M)
- Prototype of an Application for smartphone useful for alert in case of potentially dangerous events for a pipeline system located at a selected latitude (T0+24M).
- Final report containing the results reached during the whole project (T0+24M)

Main project activities

- Comparison between the **reported anomalies** in the SNAM pipeline **potential variations** and the **geomagnetic variations** measured along the pipeline by a magnetometer
- Correlation of the highlighted **potential variations** registered along the SNAM pipeline with some global **geomagnetic indices**
- Check the correspondence of the **reported anomalies** with major solar events, like **CMEs** and the associated **flares**.
- Investigation over some properties of those **CMEs**, such as **speed, acceleration, polar angle, angular width, and mass**, using data acquired by the LASCO onboard the Solar and Heliospheric Observatory (SOHO), measured SEPs (ACE and STEREO measurements) and type-II radio bursts (publicly available radio data NOAA, e-Callisto)
- Comparison of the recorded anomalies of the **potential variations** with several parameters describing the solar activity in order to search for quantifiable correlations with the conditions of the solar atmosphere suitable for the occurrence of Space Weather events using data taken by space and ground-based telescopes dedicated to solar monitoring (such as **sunspot number and their areas** measured by the Catania Solar Telescope , **HMI data, emissions at several wavelengths**, radio, EUV and X ranges)
- Development of a **prototype of a smartphone application** to send alerts in case of potentially dangerous events for gas pipeline systems at different latitudes on Earth due to the solar activity

March 15, 2013 solar event (class M1 flare + CME)



INAF – OATs Magnetometer

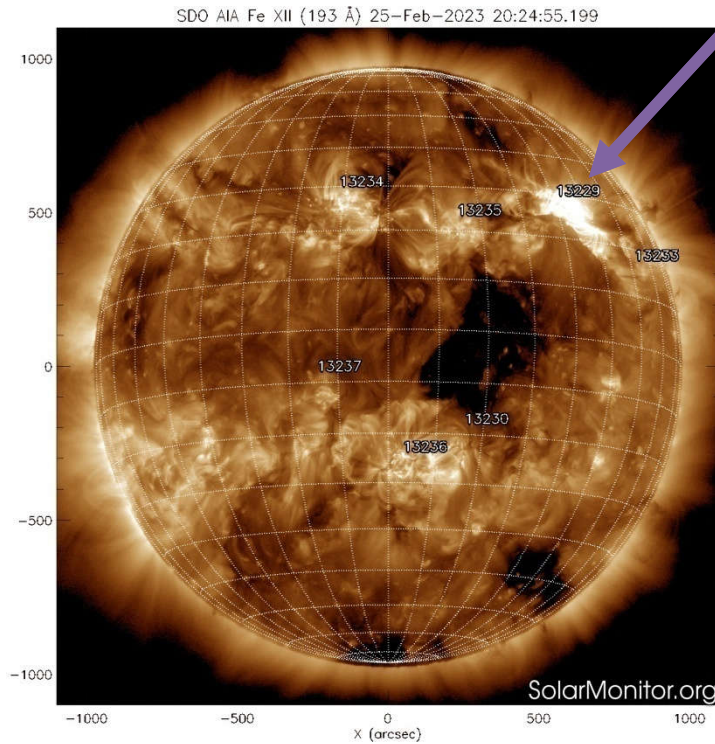


INAF - OATs Magnetometer



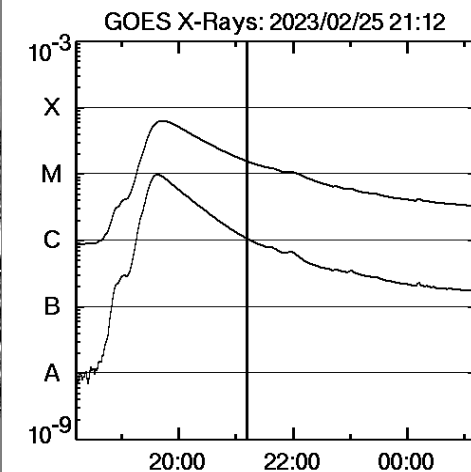
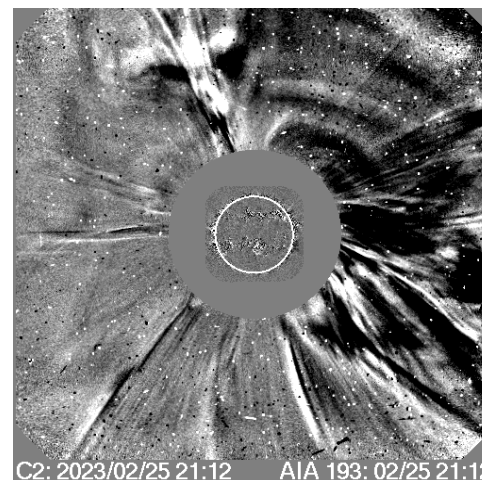
February 27, 2023 Geomagnetic Storm

AR 13229



Central coronal hole

GOES Class	Date	Peak (UT)	AR	Location
M6.4	25-2-2023	18:40	13229	N24 W45
M3.7	24-2-2023	20:03	13229	N29 W24
M1.1	24-2-2023	17:11	13235	N20 E01



Halo CME started on Feb 25, 2023, at 19:24 UT and characterized by an average velocity of about 1200 km/s