**Introduction and objective**

Substorm are usually associated with large ground geomagnetic disturbances at high magnetic latitudes and at the night as a consequence of changes in the ionospheric currents. During a substorm part of the energy in the magnetotail is transported towards the near-Earth by transient high-speed plasma flows, known as Bursty Bulk Flows (BBFs) that are coupled with the ionosphere via Field-Aligned Currents (FACs). The F-BURST project aims to study MI coupling using multi-spacecraft observations.

We plan to combine long-term ionospheric and magnetospheric data such as Swarm, Cluster, and MMS observations:
- Database of 2394 BBF in the magnetotail from MMS data performed by L. Richard et al (2022) https://zenodo.org/records/7528071
- We use Tsyganenko models to find the BBFs’ footprint into the ionosphere
- Swarm is used to study the behaviour of FAC during BBFs

**BBF Statistics**

The BBF were detected during the magnetotail season of MMS (Jun-Sep)

- BBFs have a orbital coverage bias
  - Gaussian distribution centered at $X_{GSM} = 5.80 \text{ Re}$ and $Y_{GSM} = 2.55 \text{ Re}$
  - Positive mean dipole tilt angle 18.1°
- The mean duration of the BBF is 3.49 minutes
- 89% of the events are Earthward directed
- ~75% of BBF occurs during calm geomagnetic conditions ($Kp < 3$ and -25 nT < Sym-h < 5 nT)

To reduce the orbital bias we plan to extend our database with BBFs detected by THEMIS and Cluster.

**BBF footprint**

Histogram of the BBFs footprint for all Tsyganenko models shows similar characteristics:
- Footprints are mainly clustered between
  - MLT 21-03
  - AACGM latitude 65-75°
- Maximum at pre-midnight

The footprint at pre-midnight is directly related with the BBF position at $T_{GSM} > 0$

**SWARM Field-aligned currents**

We use Swarm FAC from single spacecraft at the moment of the BBF observation plus 15 minutes.
- The signed mean value shows the usual pattern of R1 and R2 currents.
- Due to the orbital bias in summer season we observe:
  - Mean absolute value larger in north hemisphere than in the south hemisphere
  - Larger magnitudes in the midday sector due to higher conductivity of the ionosphere in the illuminated side.

- The seasonal and diurnal effect should be taken into account. We will focus in the region defined by the footprint

**Future plans**

- Include a set of BBF detected by Cluster and/or THEMIS
- Estimate the difference in the footprint location from different Tsyganenko models
- Use SwarmFAC package https://zenodo.org/records/7361439 to study the behaviour of FAC during BBFs

**References:**