





How is the Earth coupled to space?

The Birkeland Centre for Space Science (BCSS) is a Norwegian Centre of Excellence (SFF) whose primary objective is to try to understand the Earth's relationship to space. To this end, BCSS has identified four areas of research:





DEOCHT DUDU IOATIONS

What is the impact of energetic particles from thunderstorms on

geospace





• Goal of the project is to understand how the same population of TGFs is detected in different ways by different spacecrafts.

Why



- Goal of the project is to understand how the same population of TGFs is detected in different ways by different spacecrafts.
- The best way to get familiar with TGF measurements is to work handson with real data
- Comparing measurements of the same phenomenon detected by different missions will help to understand the performace of the different missions, what they can and what they cannot do
- Time alignment between gamma-ray and lightning data is nowadays mandatory to get the physics out of TGF measurements





- The student should determine the distribution of TGFs detected by AGILE, RHESSI and Fermi in
 - Longitude
 - Latitude
 - Local times
 - Ocean, coast and land occurrence
 - Duration
 - Number of counts
- And discuss how and why they are different (different instruments, different orbits etc.).
- What is the information provided in the different catalogs? How do I relate similar information in different catalogs? Ex.: duration and intensity





- The student will also have available the Lightning location data by the World Wide Lightning Location Network (WWLLN) for a time window centered around the TGF times.
- The student should find the closest WWLLN match to each AGILE and Fermi TGF, taking into account light travel time from source to the satellite, then he/she should find the list of AGILE and Fermi TGFs with a WWLLN association closer than +/- 500 µs.
- You can use the Fermi TGF catalog with WWLLN associations as a benchmark to check your findings.
- For each satellite, how do the above distributions differ from the sample with WWLLN association with respect to the sample without association? Provide an explanation for the observed differences.





- The project requires programming by the student. The students can choose the preferred tools for data analysis.
- The students should produce a report of about 10 pages
- The report should include an introduction, results with relevant figures/plots and a discussion.
- The report should also include as appendix or attached table the list of AGILE TGFs with WWLLN association closer than +/- 500 µs, with all the relevant information associated to the lightning (location, time, distance from footprint, time separation).
- We assume the students have access to the relevant literature databases.





- Submit the project report by email to <u>martino.marisaldi@uib.no</u>
- Deadline: 5 July 2019
- You will received a feedback, maybe with requests for clarifications / improvements
- The project report must be approved by us to get the credits





- All the students who need the 10 ECTS credits from UiB need to submit the project
- All students who obtained financial support from UiB need to submit the project
- Students working at the same institution can work together and submit a single report
- All the others are welcome to do that :)