6.2.2024
PAP301 Seminar in Particle Physics and Astrophysical Sciences
Abstract
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Creating a new Ultra-low frequency wave index

Solar wind is a constant stream of plasma and magnetic field from the Sun. There can be larger structures in the solar wind, such as interplanetary coronal mass ejections (ICMEs) and high speed streams (HSSs). These larger structures can cause geomagnetic storms and substorms at Earth. They also drive ultra-low frequency (ULF) waves, which are pulsations of the geomagnetic field. In this thesis we study pc5 ULF waves in the frequency range of 2-7 mHz, since they can accelerate energetic electrons in Earth's radiation belts and they can transfer particles and energy from the magnetosphere into the ionosphere.

Magnetic local time (MLT) can be thought of as a longitude. It is like a 24-hour clock around the Earth: MLT=12, known as noon, corresponds to the magnetic meridian facing the Sun, while MLT=24, or midnight, is facing the other way. MLT can be divided into four sectors: dawn (3-9 MLT), day (9-15 MLT), dusk (15-21 MLT) and night (21-3 MLT). This is a helpful parameter since noon always faces the Sun, the source of the solar wind, and we can study from which direction disturbances and fluctuations are coming from.

There is a pre-existing groundbased ULF wave index but it lacks MLT dependence and it has 1-hour resolution. The main issue with this index is that the wavepower value for each hour is only derived from the station with the peak ULF wavepower

For this thesis, a new MLT-dependent groundbased ULF wave index was created. The groundbased magnetometer data was collected from SuperMAG with 1-minute resolution. SuperMAG is a worldwide collaboration with data from nearly 600 magnetometers, but for this index, magnetometers between specific magnetic latitudes were picked. The ULF wavepower is obtained by using Wavelet transform, a method used to unfold a signal into both time and frequency space enabling the study of variation in a time series. Then the wavepower is averaged across stations and divided into the four MLT sectors.

Using this new ULF wave index we can study the wavepower during geomagnetic storms. We studied the wavepower during an intense geomagnetic storm caused by an HSS and an ICME by correlating the ULF index with different solar wind parameters. The results indicate a MLT dependence.