OBSERVATION OF LARGE AMPLITUDE ULF WAVES IN SPACE AND ON EARTH

Beket Tulegenov, Thomas Guido, Anatoly Streltsov
ULF WAVES IN SPACE

Source – Sun

- **Coronal Mass Ejections** - ejection of solar matter from the atmosphere of the Sun

- **Solar Wind** – continuous flow of plasma originated from the Sun
On March 13, 1989, at 2:44 am, a transformer failure on one of the main power transmission lines in the HydroQuebec system precipitated a catastrophic collapse of the entire power grid. The string of events that produced the collapse took only 90 seconds from start to finish. The transformer failure was a direct consequence of ground induced currents from a large geomagnetic storm. 6 million people lost electrical power for more than 9 hours.
GEOMAGNETIC SUBSTORM

Substorm disrupts auroral arcs
GEOMAGNETIC SUBSTORM

Geomagnetic substorm is a large-amplitude disturbance of magnetic fields and auroral arcs observed in the ionosphere.
DATA ANALYSIS

- Raw data from ground magnetometer is in blue.
- Low-frequency part of the signal is in red.

This is the signal that we analyze.
The signal that was received is being analyzed using spectral analysis based on the Fast Fourier Transform.

Substorm has particular frequencies that are specific to it.

Question is: *Where do they come from?*
ACE SATELLITE
The time it takes for a solar wind reach the Earth on average is an hour. The average speed of the solar wind is 350-400 km/s
Data from ground magnetometer in Gakona, Alaska is compared with the ACE satellite's data analysis.

From Gakona, AK

From ACE

February 12, 2012
We discovered a strong correlation between ULF waves measured on the satellite and on the ground in a frequency range of 0.75-1.00 mHz.

These results bring new understanding of the fundamental physics of the Sun-Earth interactions and make the basis for the quantitative predictions of Space Weather at high latitudes.
THANK YOU...