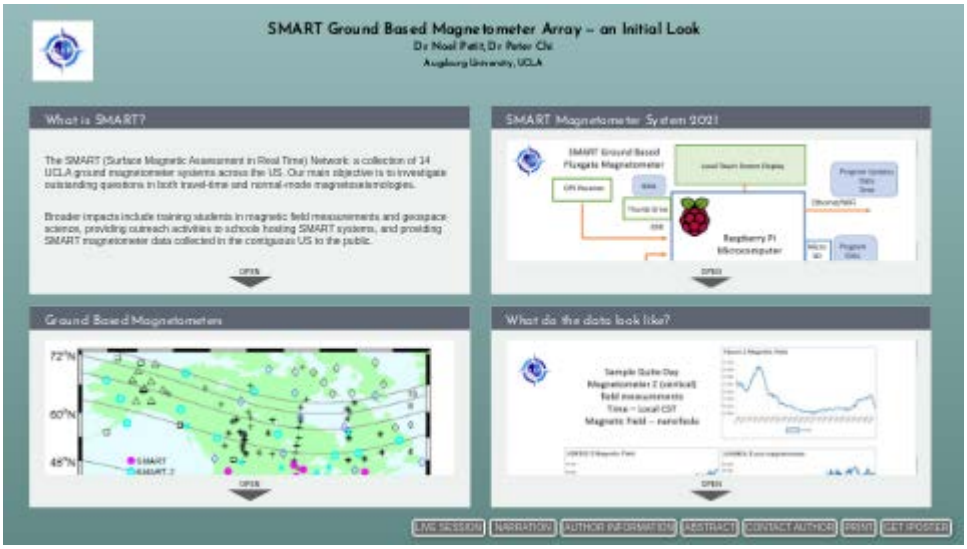
SMART Ground Based Magnetometer Array -- an Initial Look



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PRESENTED AT:

WHAT IS SMART?

The SMART (Surface Magnetic Assessment in Real Time) Network: a collection of 14 UCLA ground magnetometer systems across the US. Our main objective is to investigate outstanding questions in both travel-time and normal-mode magnetoseismologies.

Broader impacts include training students in magnetic field measurements and geospace science, providing outreach activities to schools hosting SMART systems, and providing SMART magnetometer data collected in the contiguous US to the public.

Scientific Goals of SMART:

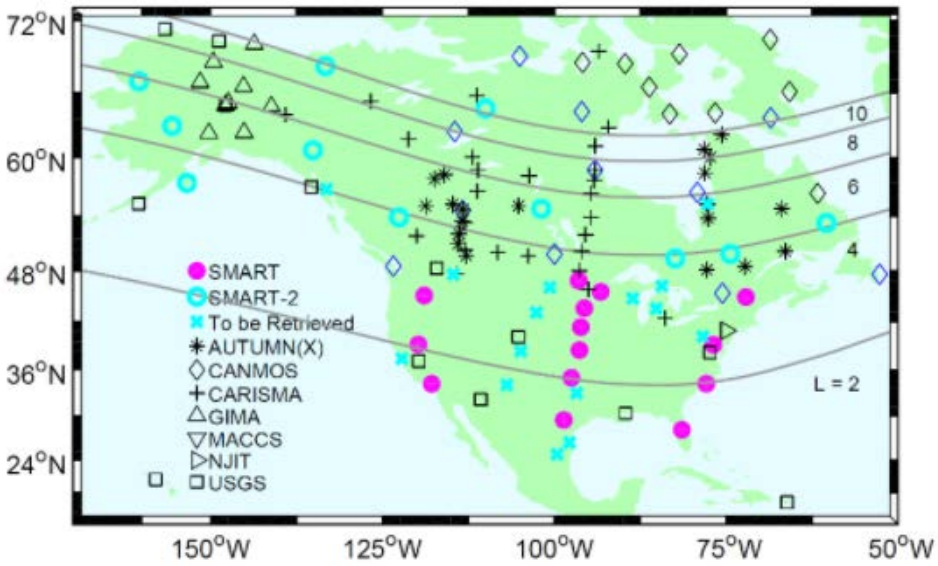
1.How does the annual variation of equatorial plasma mass density depend on the L-value? How does the result compare with the annual variation in the ionosphere?

2.Does the plasmaspheric density truly have a clear local time dependence over a short time scale? If so, is it controlled by the ionospheric density?

3.What is the profile of SI arrival time across the two-dimensional magnetometer array based on event statistics? Is this arrival time profile consistent with the predictions by the Tamao travel time in the 3D magnetosphere?

4.What is the statistical profile of nightside transient arrival time on the ground? How does this profile vary with the solar wind input or geomagnetic activity?

GROUND BASED MAGNETOMETERS



Some of the ground based magnetometers in the North American Continent. Purple dots make up the initial SMART array. Other magnetometers perform similar functions with different instruments:

1) Search Coils -- coils of wire around a magnetic core to measure the change in mangetneic field

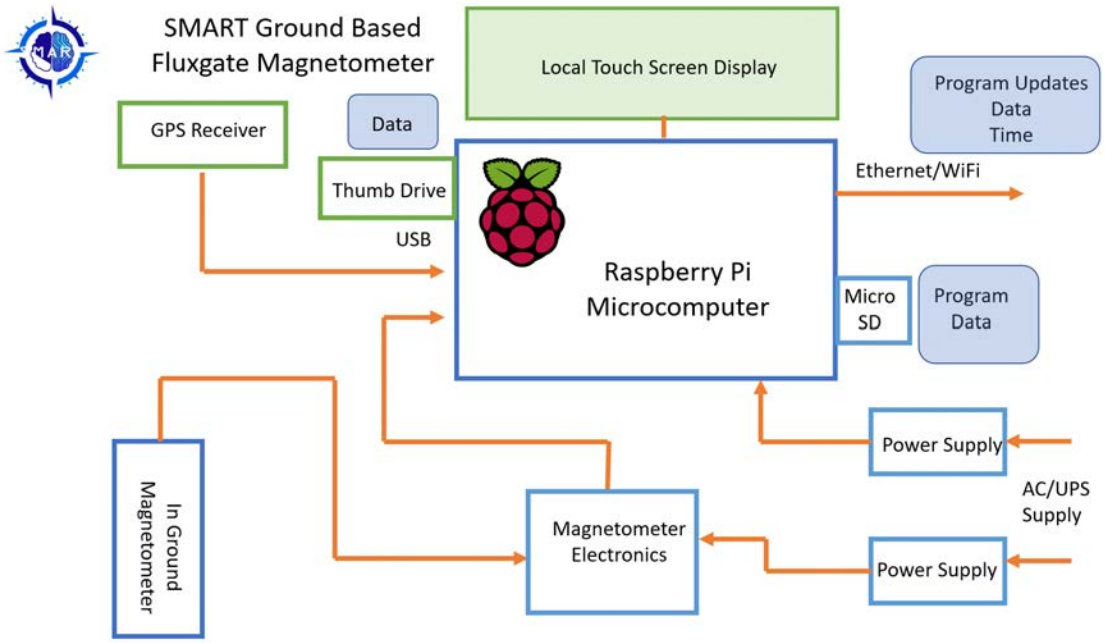
2) Magnetoresistive Circuits -- measure the change in resistance as the magnetic field changes

3) Flux Gates -- offset the earth's magnetic field with magnetic coils to null the field through material

4) Micro Coils -- measure the change in inductance through sub millimeter coils and convert the inductance into field strength

5) Hall Effect -- directly messure the change in resistance of a semiconductor as the field changes

SMART MAGNETOMETER SYSTEM 2021



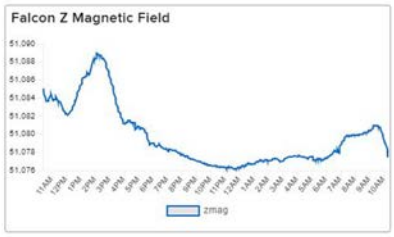
Blue boxes are mandatory

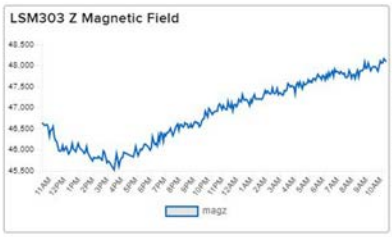
Green boxes are optional

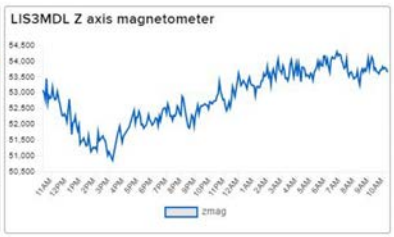
Some source of time must be used (eithter GPS or Internet NTP)

WHAT DO THE DATA LOOK LIKE?

Sample Quite Day
Magnetometer Z (vertical)
field measurements
Time – Local CST
Magnetic Field -- nanoTesla





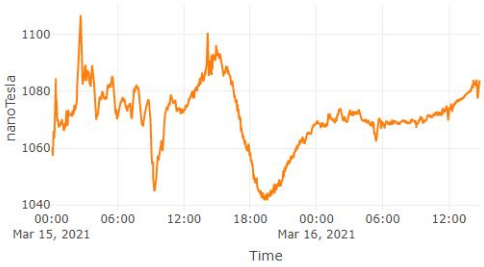


This displays the limits of the solid state LSM303 (micro coil detector) and LIS3MDL (magnetoresistive) detectors.

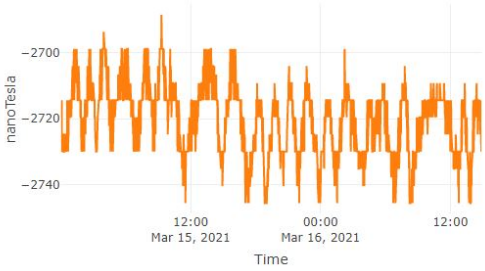
The Falcon Magnetometer clearly shows changes in the range of -/- 30 nanoTesla.

The noise on the LSM303 and LIS3MDL is on the range of +/- 50 nanoTesla and changes observed on this quiet day are not visilbe in the loswer plots. Most of the change in the lower two graphs is the change in temperature as the day warms and cools.

Plots of Moderate activity (K-5 peak)

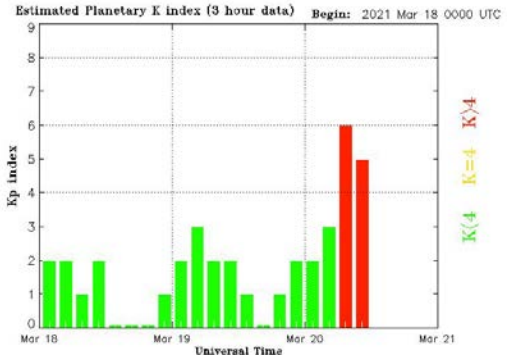


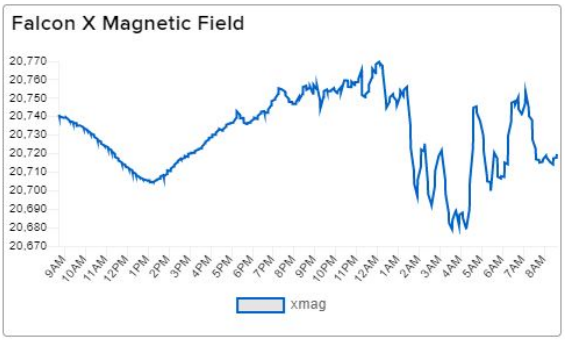
Falcon Fluxgate

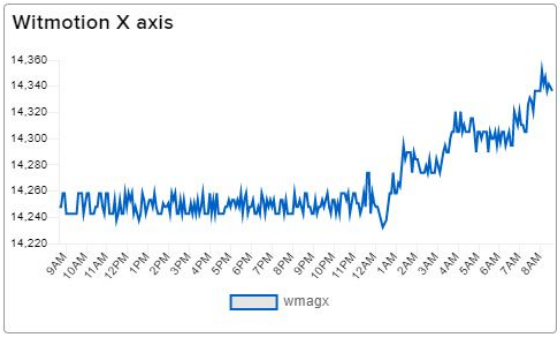


RM9100 Witmotion

20 March 2021 (Today) is active\







Live Data on Adafruit.com Cloud Server
(https://io.adafruit.com/petitnoel/dashboards)

More Information at
http://smartmagnet.org (http://smartmagnet.org)

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ABSTRACT

SMART is the renewal of an existing ground based magnetometer array. This array stretches from Hudson Bay to the Gulf of Mexico. The sites will all be upgraded with new computing and data storage.Additonally data will be available locally for students to monitor the mangetic enfironment and use the data for studies.