2458-9

Workshop on GNSS Data Application to Low Latitude Ionospheric Research

6 - 17 May 2013

Analysis of the latitudinal variations of vTEC during perturbed geomagnetic conditions

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WORKSHOP ON GNSS DATA APPLICATION TO LOW LATITUDE IONOSPHERIC RESEARCH

Analysis of the latitudinal variations of *v*TEC during perturbed geomagnetic conditions

Case study / November 9 to 15 , 2012

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SPACE WEATHER

Necessity of a systemic approach with large data sets

The classification of the data is essential

Analysis of the solar data
Analysis of the geomagnetic data
Analysis of the ionospheric data

GENERAL OVERVIEW

Analysis of the solar data

Sun

- Sunspot cycle
- Solar event (coronal mass ejection(CME), solar flares, coronal hole, …

Interplanetary medium - solar wind parameters

- solar wind speed
- Interplanetary magnetic field Bz

Analysis of the geomagnetic data

Magnetosphere - Magnetic indices

- Global geomagnetic activity -> Am and Km
- Dst -> [H sym and H asym] -> mid-latitude ring current
- AE-> AU and AL -> auroral electrojets

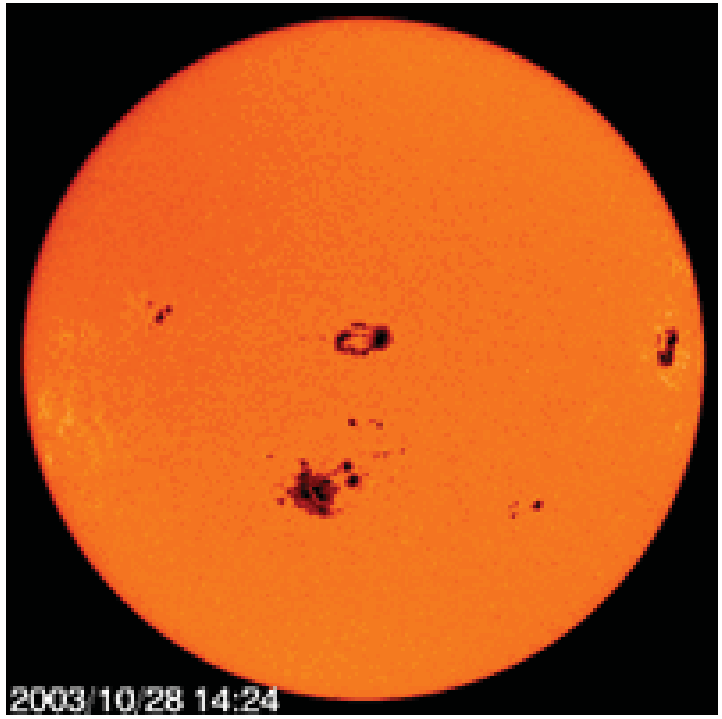
Analysis of the ionospheric data

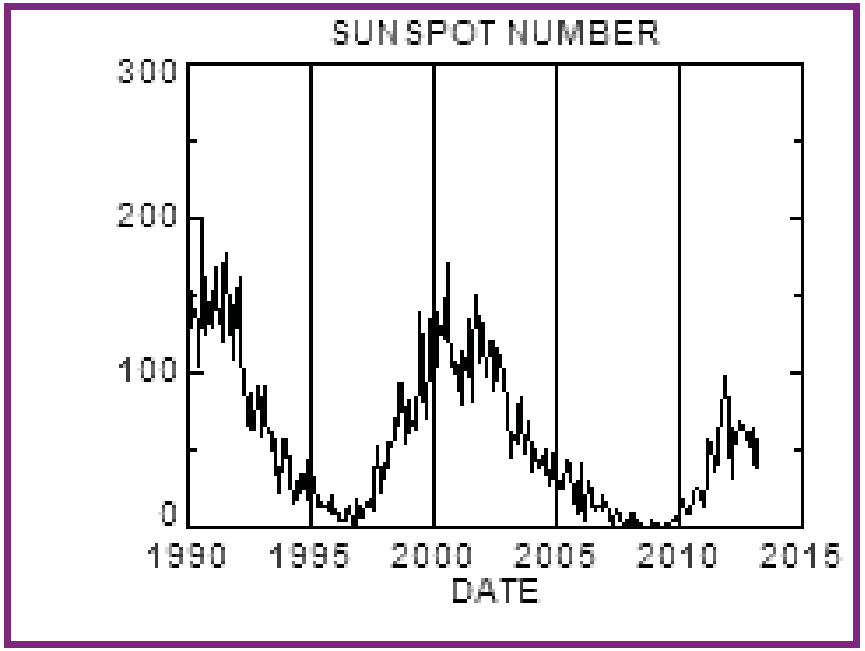
Ionosphere GPS network

- Ionospheric ionization - Analysis of the TEC

THE SOLAR DATA

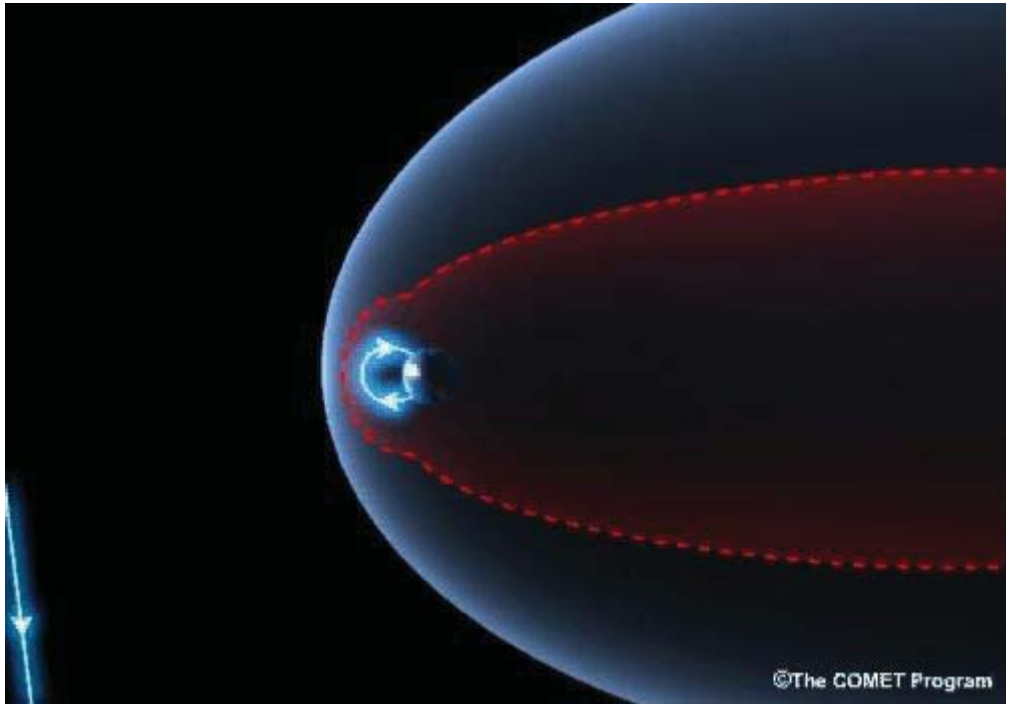
Sun -> increasing phase of the sunspot cycle 24
http://solarscience.msfc.nasa.gov/SunspotCycle.shtml





Mean solar wind conditions:
Solar wind speed **Vx** and Interplanetary magnetic field **Bz**

Vx ⟶



Bz ↓

Ey = - Vx x Bz

Websites

www.spaceweather.com

http://spidr.ngdc.noaa.gov/spidr/

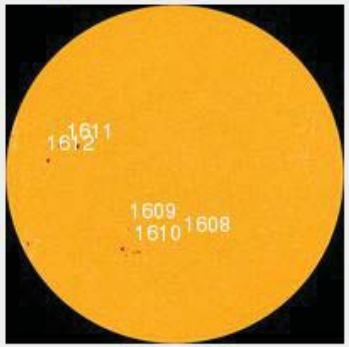
Website : www.spaceweather.com

Current Conditions

Solar wind
speed: **393.6** km/sec
density: **2.3** protons/cm^3
explanation | more data
Updated: Today at 2345 UT

X-ray Solar Flares
6-hr max: **C2** 2139 UT Nov12
24-hr: **C2** 1022 UT Nov12
explanation | more data
Updated: Today at: 2300 UT

Daily Sun: 12 Nov 12



Sunspot 1610 poses a growing threat for solar flares. Credit: SDO/HMI

Sunspot number: 106
What is the sunspot number?
Updated 12 Nov 2012

What's up in space

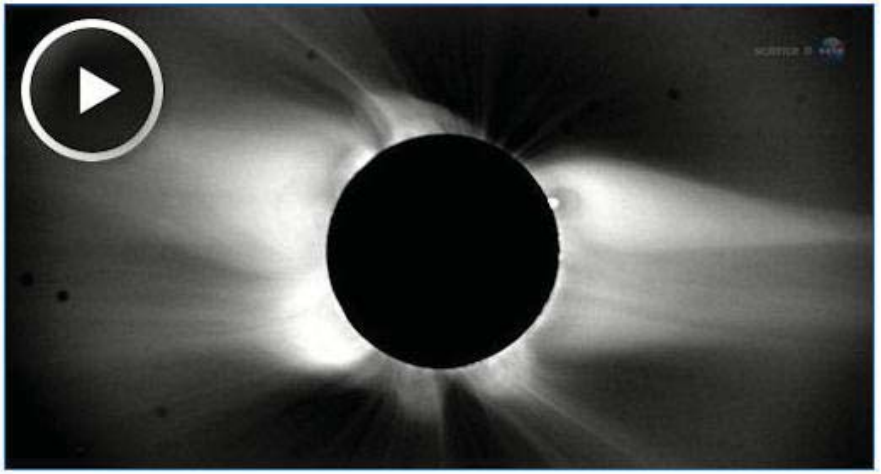
Monday, Nov. 12, 2012

Thirty-five new items have just been added to our Meteorite Jewelry collection. Browse the Space Weather Store for something out of this world.

Meteorite Jewelry

CME IMPACT: An interplanetary shock wave (probably the leading edge of a CME) hit Earth's magnetic field on Nov. 12th at approximately 2300 UT. NOAA forecasters estimate a 55% chance of polar geomagnetic storms. **Aurora alerts:** text, voice.

TOTAL ECLIPSE OF THE SUN: The staff of spaceweather.com are in Australia this week to witness a total eclipse of the sun on Nov. 13/14. The path of totality cuts right across Port Douglas and Cairns, Qld--a.k.a. the "Gateway to the Great Barrier Reef." People on cruise ships, divers in the reef, and thousands of people standing along beaches of the Coral Sea will witness the early morning sun disappear behind the Moon for more than two minutes. It's going to look something like this:



The only cloud on the horizon is ... well ... clouds. Residents are hoping that the gray skies they have been seeing in recent mornings will turn blue before the big moment arrives. Totality begins on Wednesday, Nov. 14th, at 06:38 am local time in northeast Australia (the afternoon of Nov. 13th in the USA) with the rising sun just 14 degrees above the horizon.

archives

November
12
2012
view

Solar Telescope
RECOMMENDED BY DR. TONY PHILLIPS

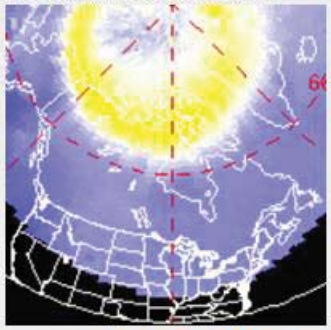
averted imagination

November 12, 2012

Current Stretch: 0 days
2012 total: 0 days (0%)
2011 total: 2 days (<1%)
2010 total: 51 days (14%)
2009 total: 260 days (71%)
Since 2004: 821 days
Typical Solar Min: 486 days
Update 12 Nov 2012

The Radio Sun
10.7 cm flux: **133** sfu
explanation | more data
Updated 12 Nov 2012

Current Auroral Oval:



Switch to: Europe, USA, New Zealand, Antarctica
Credit: NOAA/POES

Planetary K-index
Now: **Kp= 2** quiet
24-hr max: **Kp= 2** quiet
explanation | more data

Interplanetary Mag. Field
B_{total}: **17.6** nT
B_z: **9.9** nT **north**
explanation | more data
Updated: Today at 2346 UT

Coronal Holes: 11 Nov 12

Spaceweather.com author Dr. Tony Phillips will be running the Solar Eclipse Marathon, which begins at 3rd contact when the first ray of sunlight lances over the limb of the retreating Moon. Race organizers say its "the first marathon with an intergalactic starting gun." Actually, it's the first marathon with a rubber chicken. Phillips' running mate in the race will be the fowl Camilla, who is incorporating the 26 mile run into her astronaut training.

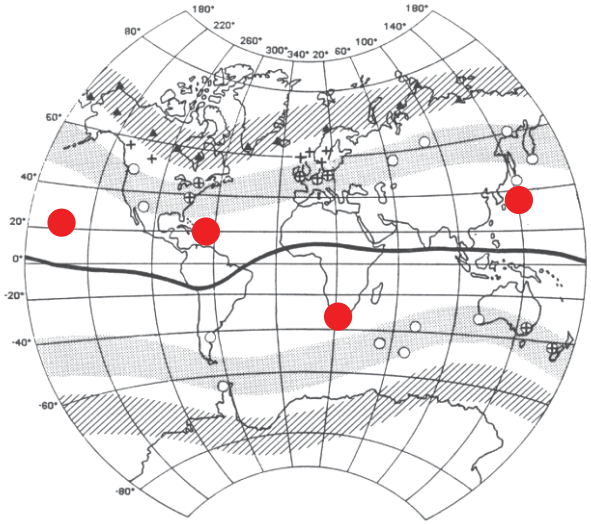
Stay tuned for photos and updates from the path of totality.

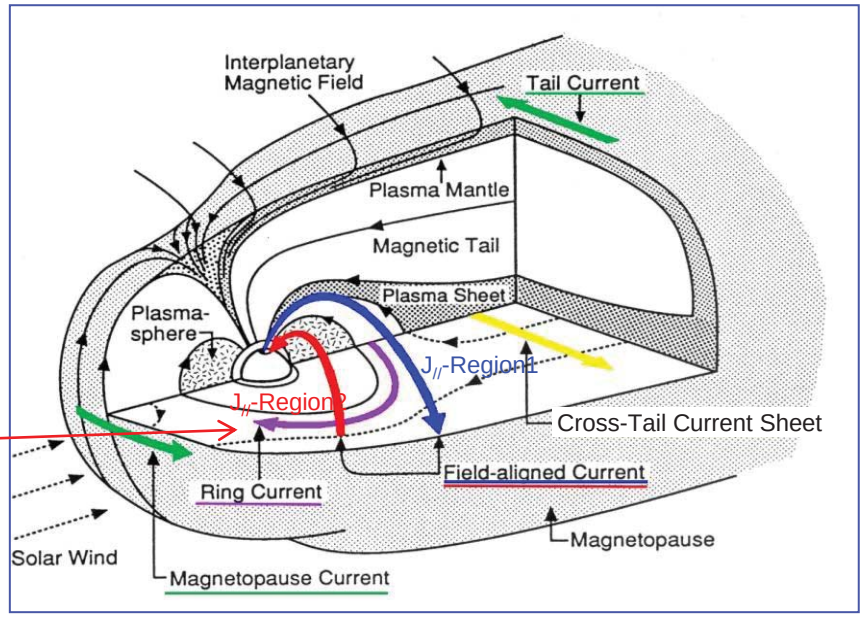
INCOMING CMES: A pair of minor CMEs is heading for Earth. They were launched on Nov. 9th and 10th, respectively, and are expected to merge into a single cloud before they reach our planet on Nov. 12th. NOAA forecasters estimate a 55% chance of polar geomagnetic storms in the next 24 hours. **Aurora alerts:** text, voice.

Consider this a preview of the coming display. On Nov. 7th, a minor solar wind stream hit Earth's magnetic field, sparking Northern Lights over Muonio, Finland:

THE GEOMAGNETIC DATA

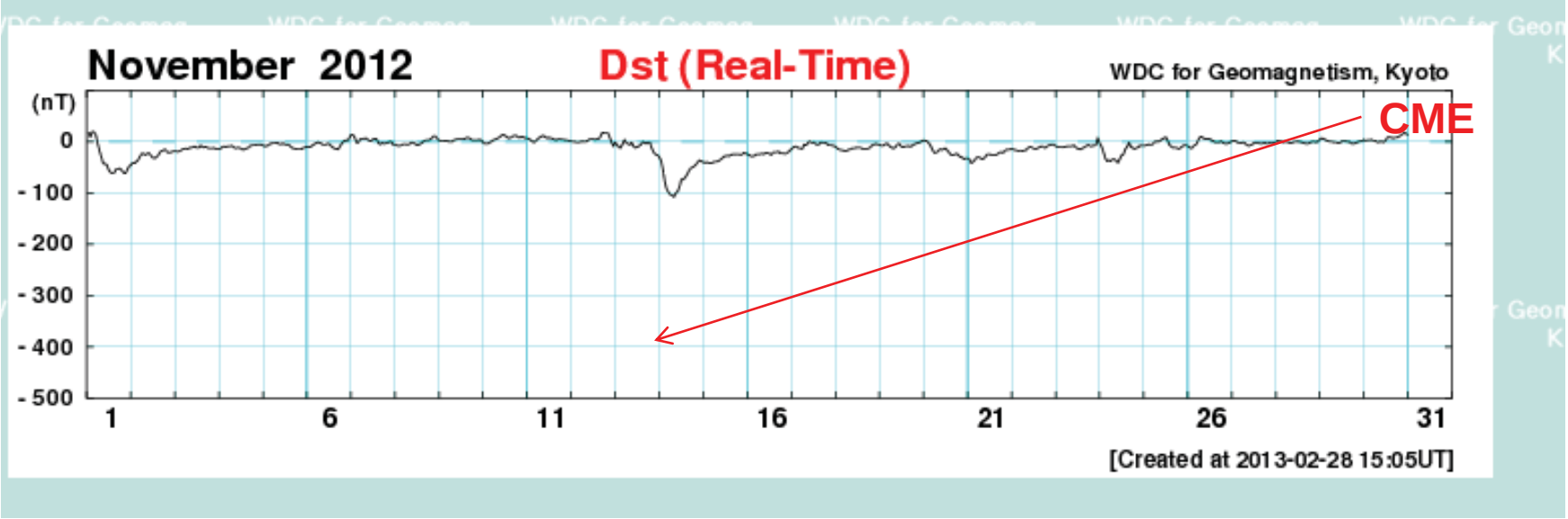
Dst gives an estimation of the ring current





Magnetic index Dst

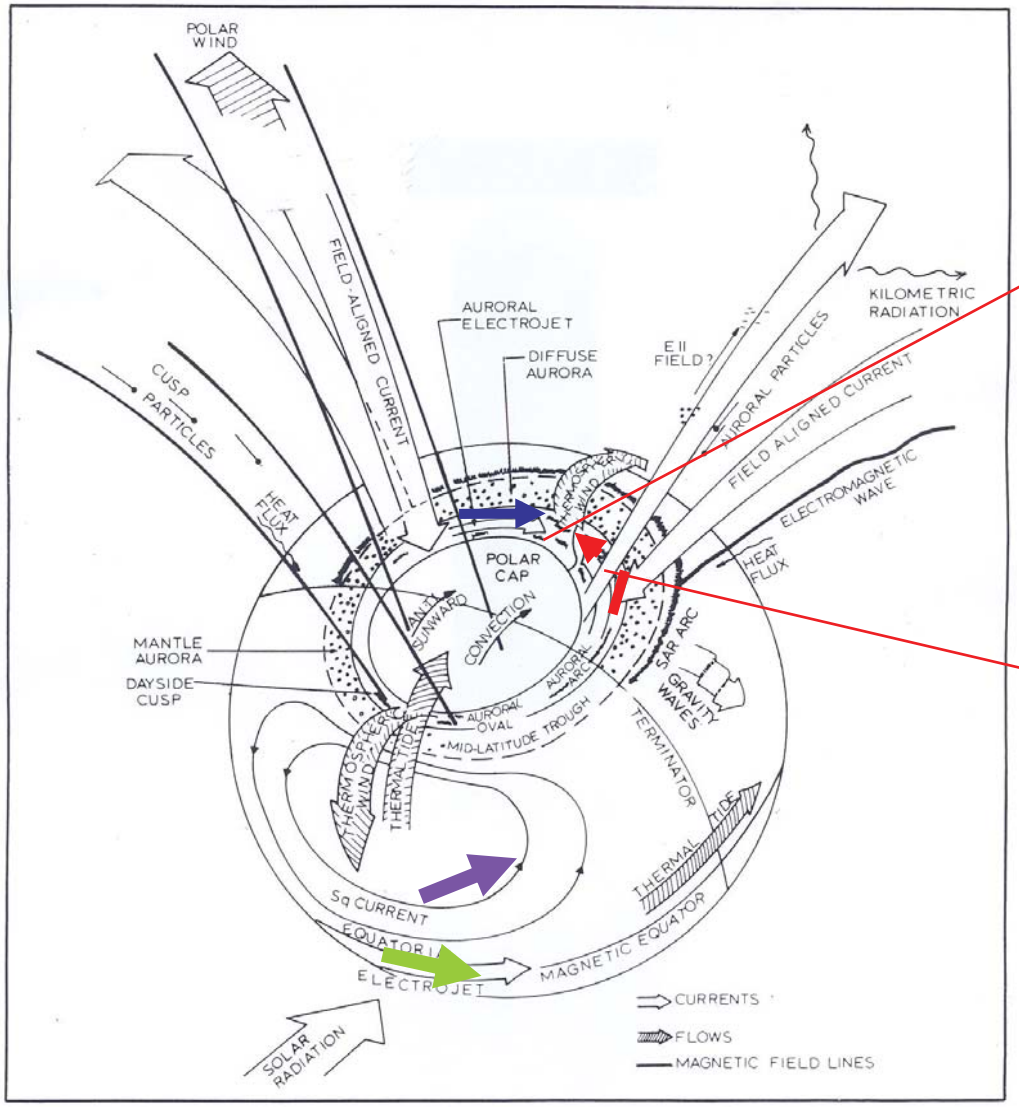
Website: http://isgi.cetp.ipsl.fr

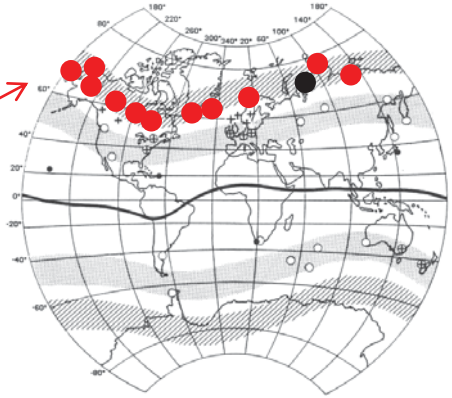


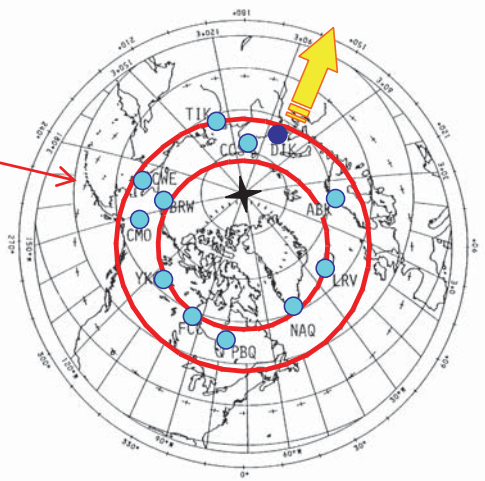
"… a geomagnetic storm as an interval of time when a sufficiently intense and long-lasting interplanetary convection electric field leads, through a substantial energization in the magnetosphere-ionosphere system, to an intensified ring current sufficiently strong to exceed some key threshold of the quantifying storm time Dst index".

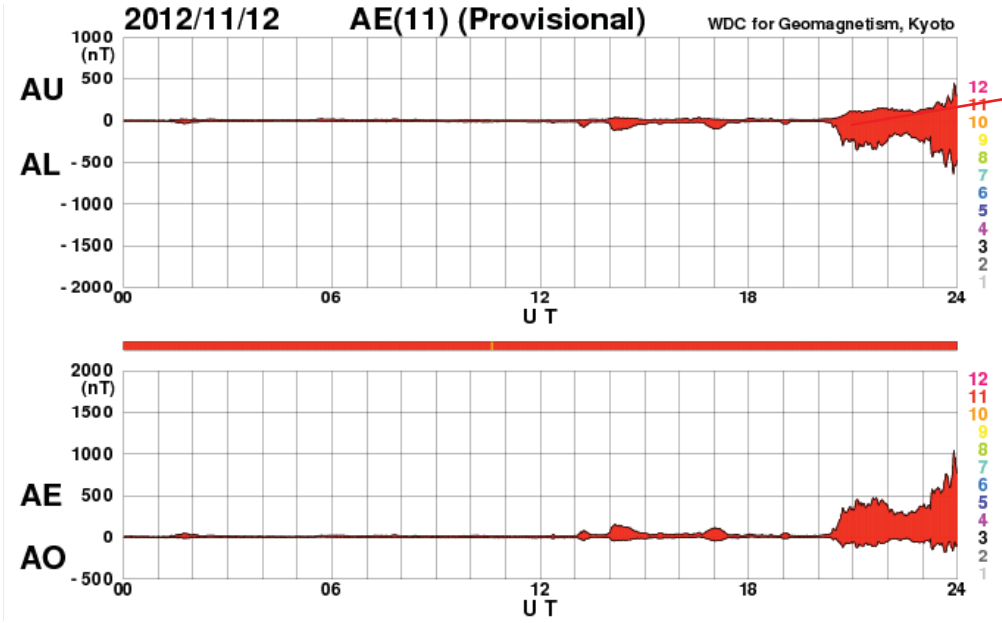
W.D. Gonzalez et al. (1994) What is a geomagnetic storm? *J. Geophys. Res.*, VOL. 99, NO. A4, pp 5771-5792

Auroral Electrojets estimated by AU and AL indices





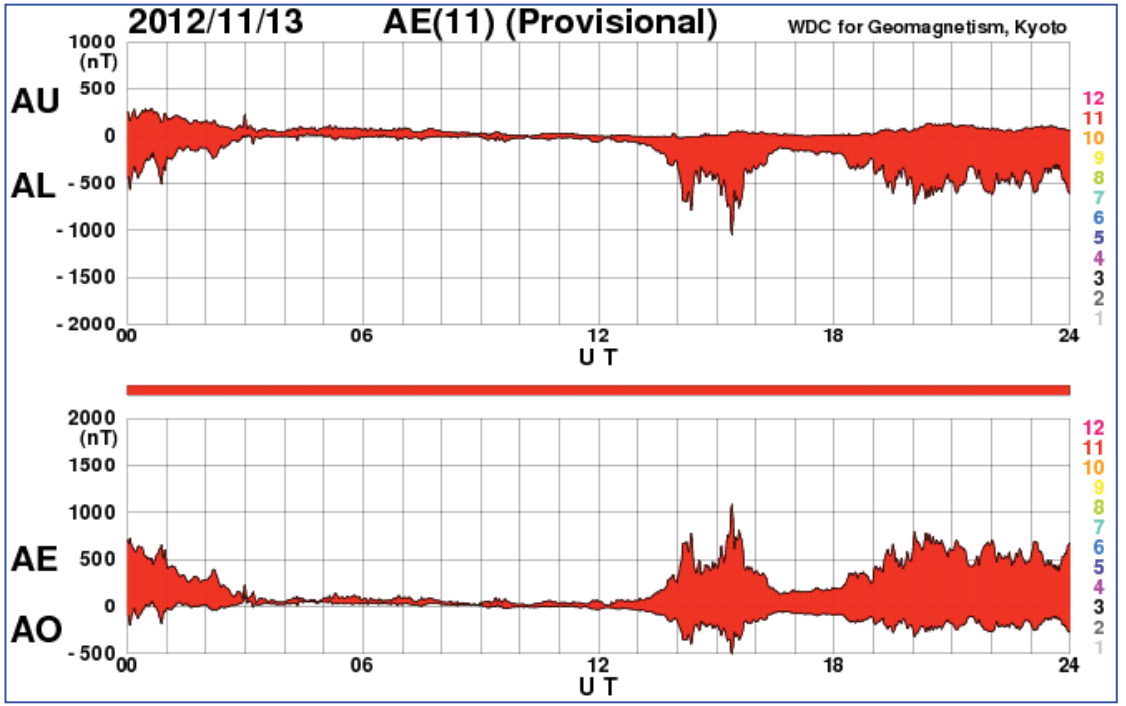




CME

Magnetic quiet day
No auroral electrojets

Magnetic disturbed day
Auroral electrojets



THE IONOSPHERIC DATA

http://t-ict4d.ictp.it/nequick2/gnss-tec-calibration

Processing &

Interpretation of Data

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