

# Where to click to get data from most of the instruments discussed at the school

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# How is the Sun doing?

All real time information about the Sun, such as sunspots, CME (whether it is coming to us or not and the time it takes to reach us, Co-rotating corona holes, some impacts that we observe on the ground because of the Sun misbehavior.

In general, all space weather related phenomenon is featured here on the real time base.

<http://www.spaceweather.com/>

# Where can we get more picture of the Sun?

The CME and CIR structures of Sun is continuously monitored by the sophisticated camera deployed onboard SOHO, STEREO A & B, and SDO space crafts and more pictures and movies can be found from

[SOHO Data-Base](#)

<http://sohowww.nascom.nasa.gov/data/>

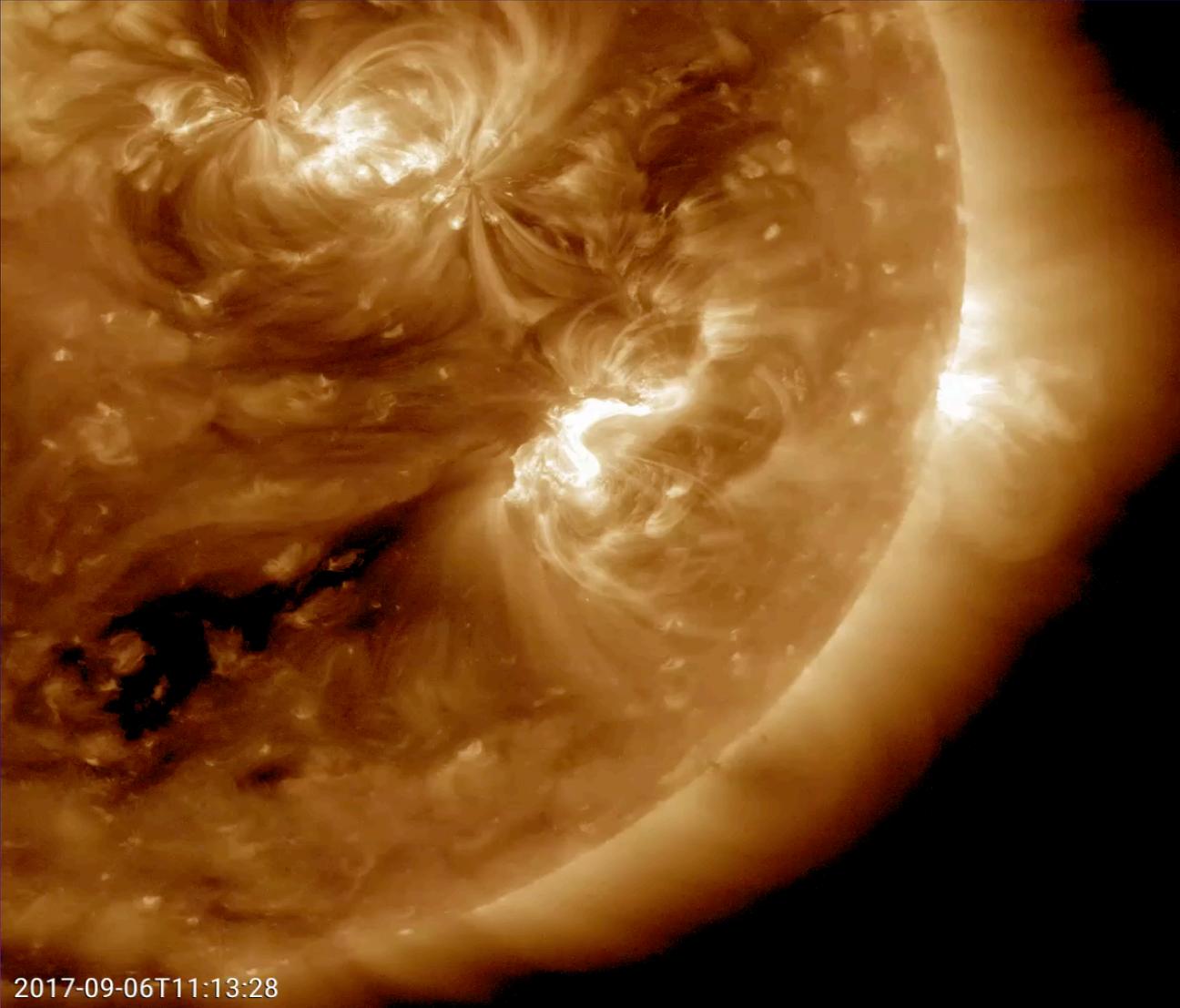
[STEREO Data-Base](#)

[http://www.nasa.gov/mission\\_pages/stereo/main/](http://www.nasa.gov/mission_pages/stereo/main/)

[Solar Dynamics Observatory \(SDO\)](#)

<http://sdo.gsfc.nasa.gov/>

# Where can we get more picture of the Sun?



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# Where can we get about solar wind data?

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Solar wind speed, density, temperature, magnetic field (IMF), ram and dynamic pressure, and more

ACE space craft (Real time ACE data)

<http://www.srl.caltech.edu/ACE/ASC/level2/>

<http://www.swpc.noaa.gov/products/ace-real-time-solar-wind> (Real time)

WIND space crafts

<http://wind.nasa.gov/data.php>

# Where can we get Geomagnetic indices

Dst, KP, AE, AL, and AU indices!

- [Kyoto University](#)

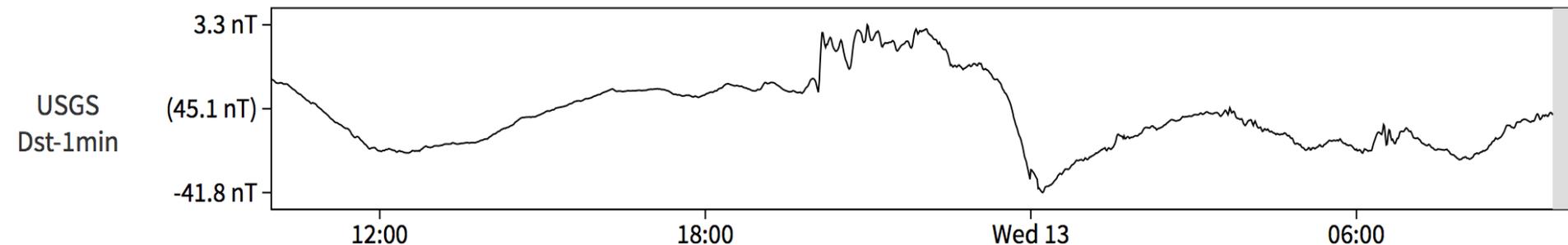
<http://wdc.kugi.kyoto-u.ac.jp/wdc/Sec3.html>

- [World data center \(Russia\)](#)

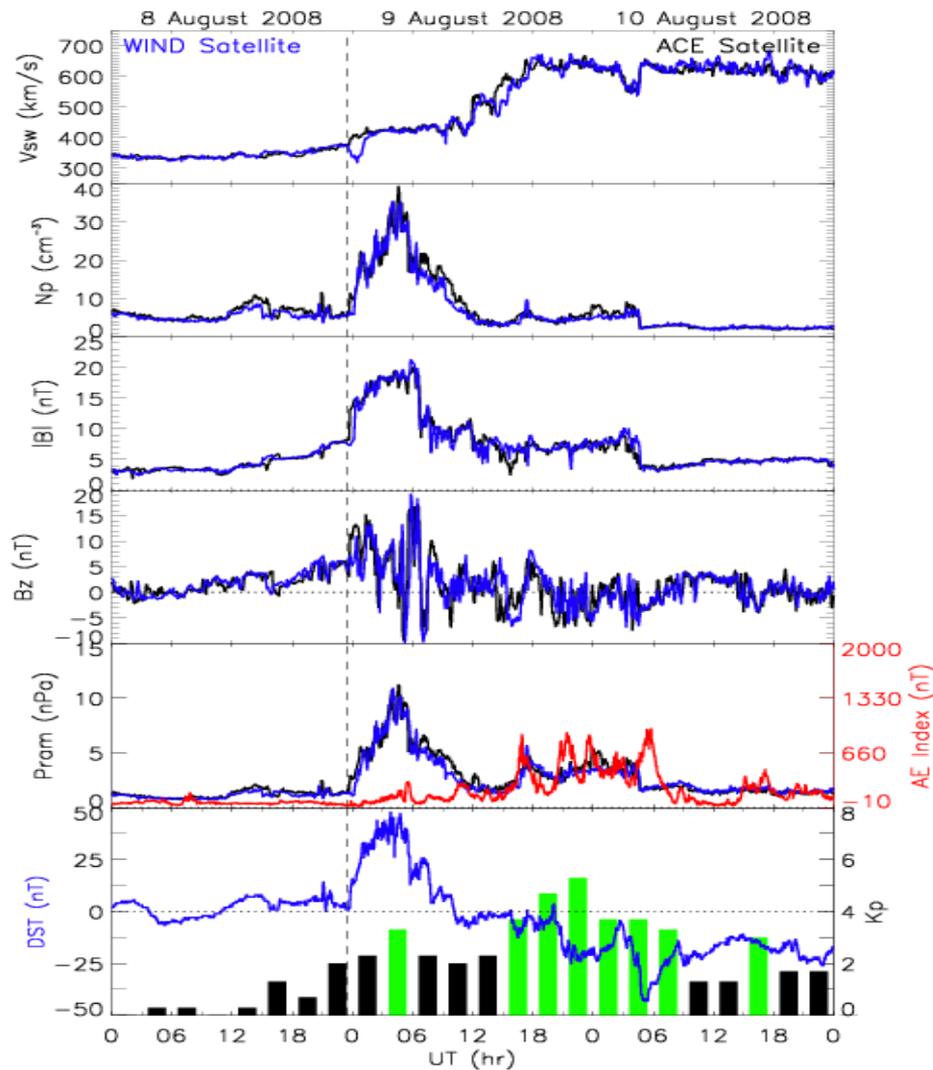
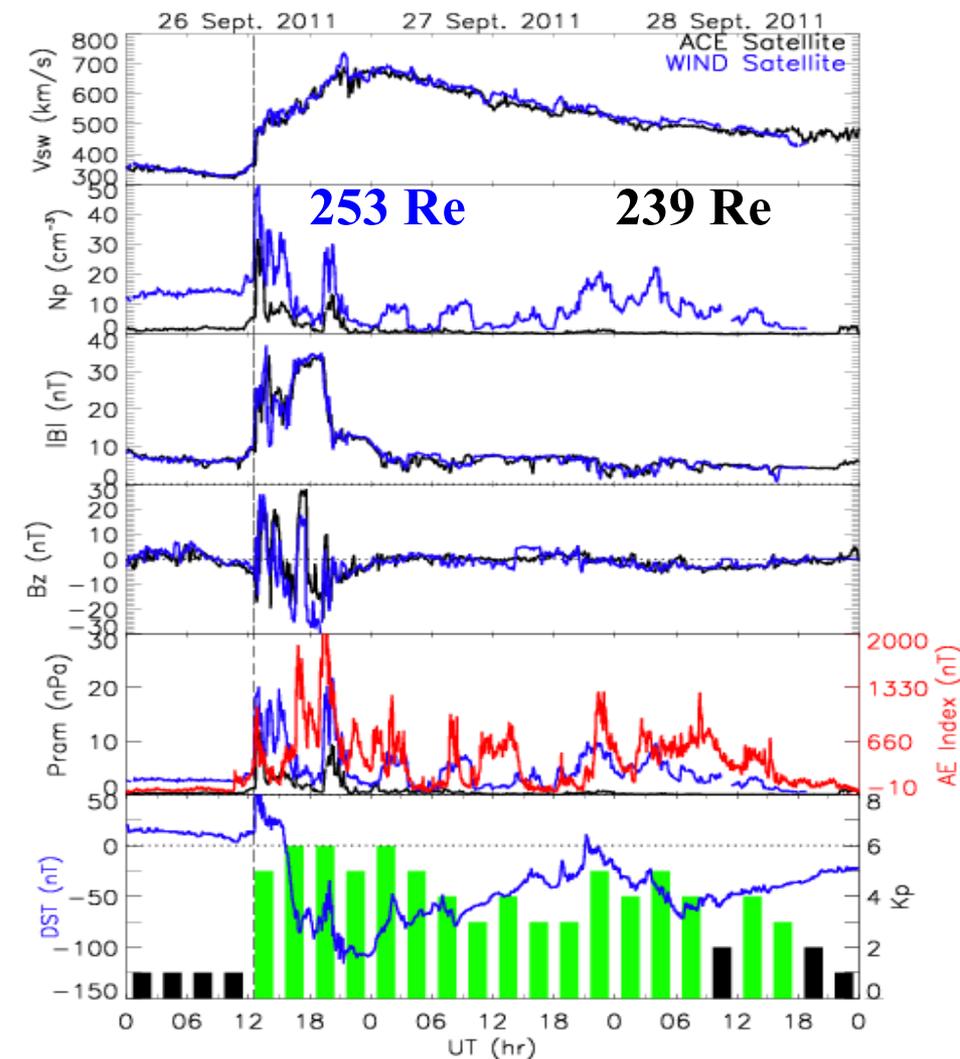
<http://www.wdcb.ru/stp/data/geomagni.ind/>

USGS Dst index

<https://geomag.usgs.gov/plots/dst.php>



# Examples of solar wind and magnetic indices



# Where to find magnetometer data?

## Magnetometer Data Sets

### Intermagnet magnetometer Network

[http://www.intermagnet.org/Welcom\\_e.php](http://www.intermagnet.org/Welcom_e.php)

## AMBER Magnetometer Data

### AMBER magnetometer Network

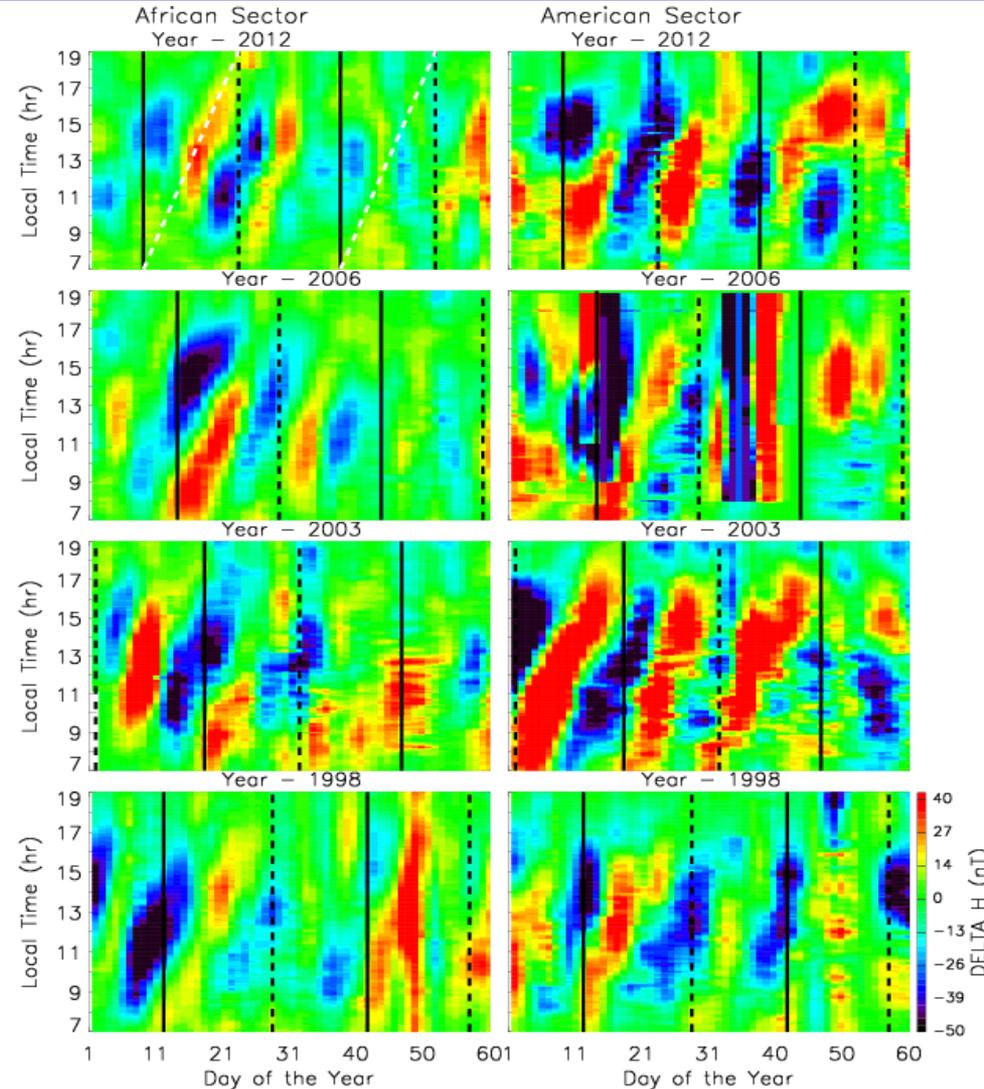
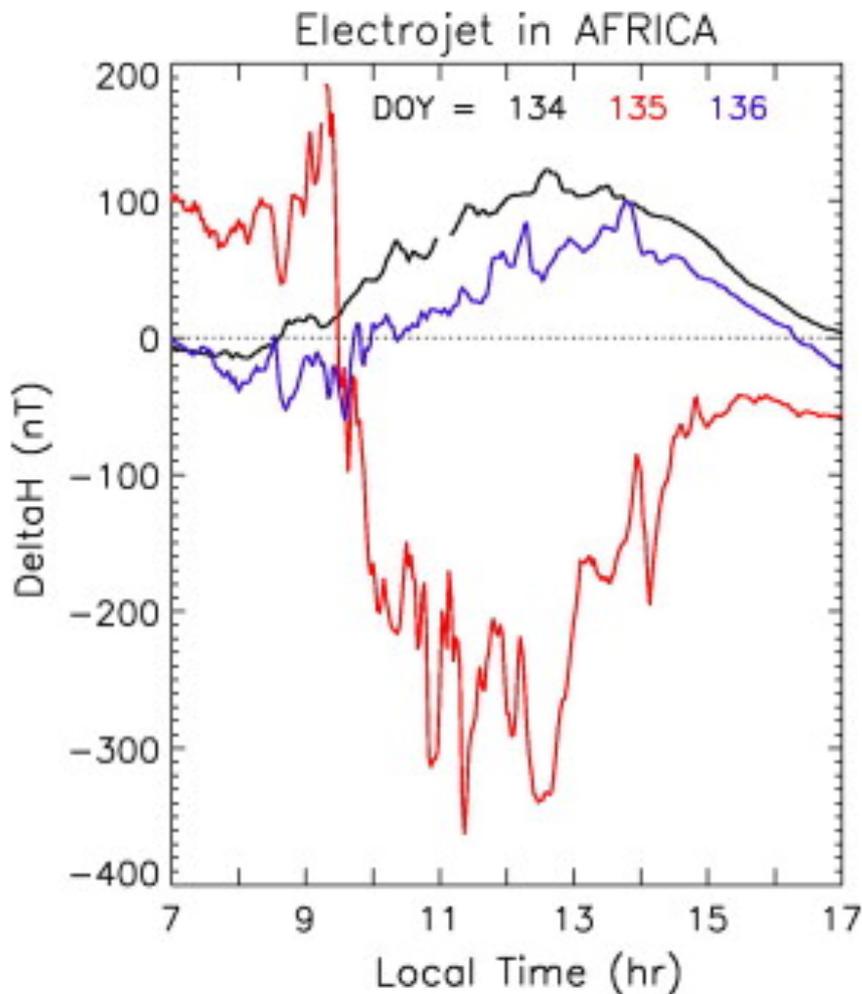
<http://magnetometers.bc.edu/index.php/amber>

## SuperMag Magnetometer Data

### Supermag magnetometer Network

<http://supermag.jhuapl.edu/mag/>

# What can you do with magnetometer data?



*Ngwira et al., ASR, 2012*

# **GNSS RINEX databases**

## **SOPAC GPS RINEX Database**

**<http://sopac.ucsd.edu/cgi-bin/dbDataBySite.cgi>**

## **NASA GPS RINEX Database**

**<ftp://cddis.gsfc.nasa.gov/pub/>**

## **South Africa GPS RINEX Database**

**<http://geodesy.hartrao.ac.za/site/en/data-and-products.html>**

## **UNAVCO GPS RINEX Database**

**[http://facility.unavco.org/data/gnss/perm\\_sta.php](http://facility.unavco.org/data/gnss/perm_sta.php)**

## **Position of GPS satellites in X,Y,Z Cord.**

**[http://igs.cb.jpl.nasa.gov/components/prods\\_cb.html](http://igs.cb.jpl.nasa.gov/components/prods_cb.html)**

## **NASA's GNSS satellite biases**

**<ftp://cddis.gsfc.nasa.gov/pub/gps/products/ionex/>**

# TOPEX and JASON altimeter TEC can be used to augment GPS TEC

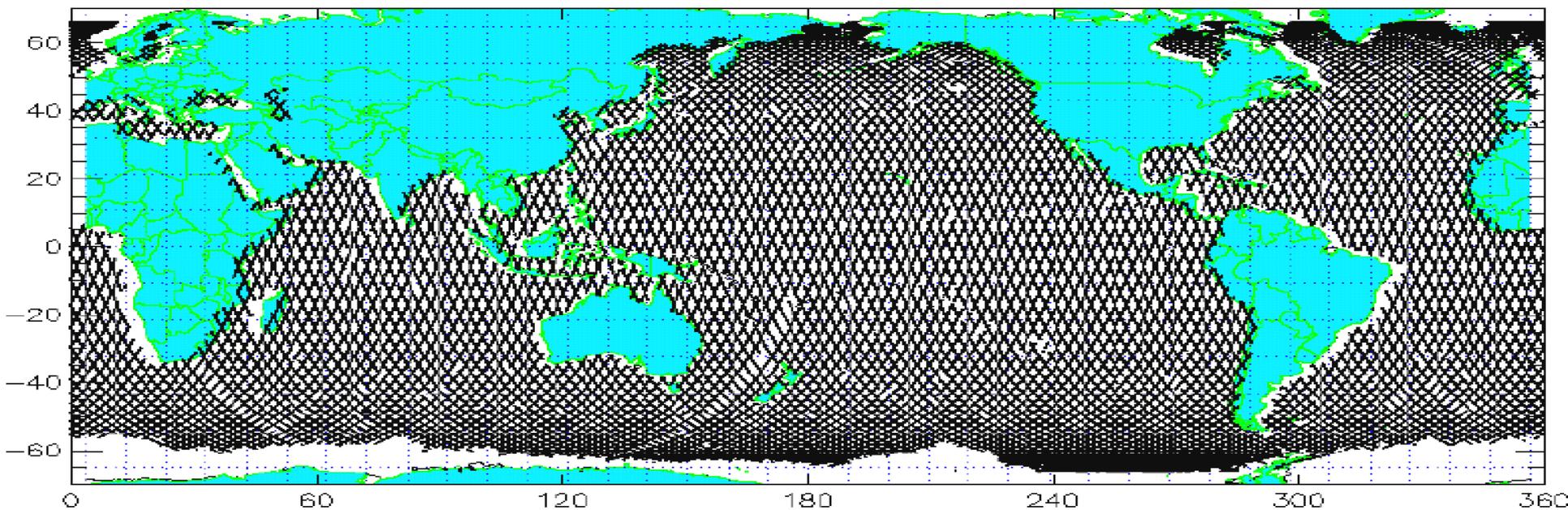
TOPEX and JASON provide altimeter TEC (i.e, vertical TEC below 1335 km altitude) over the ocean.

## TOPEX Altimeter TEC

[ftp://podaac.jpl.nasa.gov/SeaSurfaceTopography/topex/L2/tp\\_ssha/](ftp://podaac.jpl.nasa.gov/SeaSurfaceTopography/topex/L2/tp_ssha/)

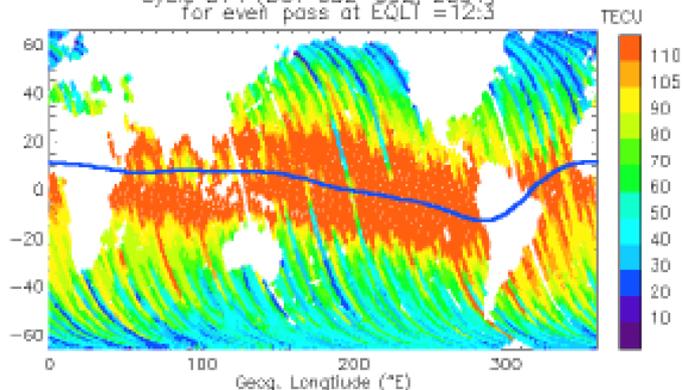
## JASON Altimeter TEC

[ftp://podaac.jpl.nasa.gov/SeaSurfaceTopography/jason1/L2/j1\\_ssha/](ftp://podaac.jpl.nasa.gov/SeaSurfaceTopography/jason1/L2/j1_ssha/)

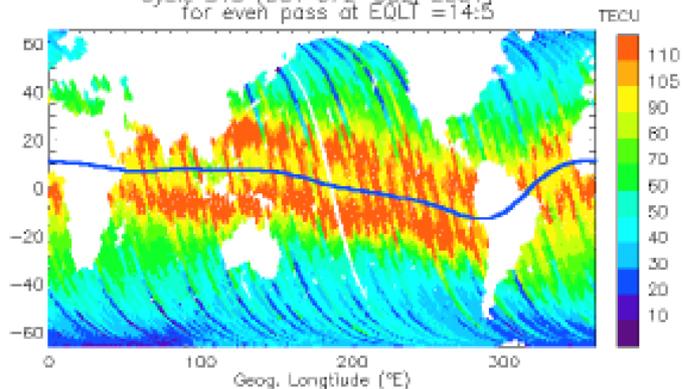


# TOPEX altimeter TEC plot

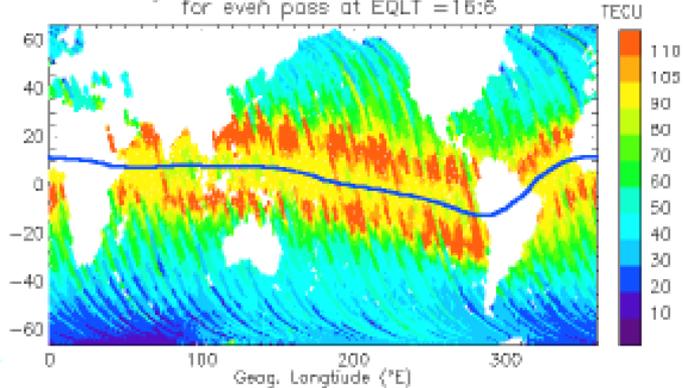
Cycle 314 (DOY 082-092, 2001)  
for even pass at EQLT =12:3



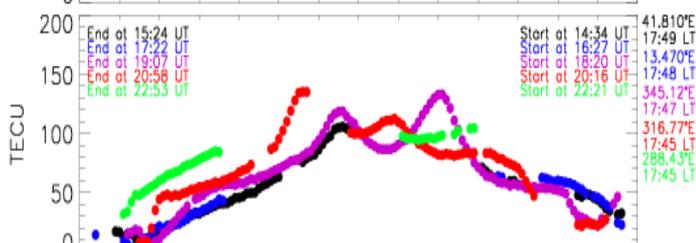
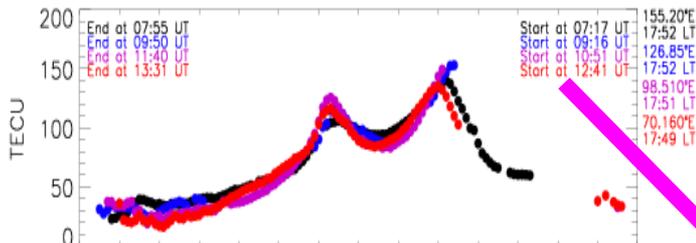
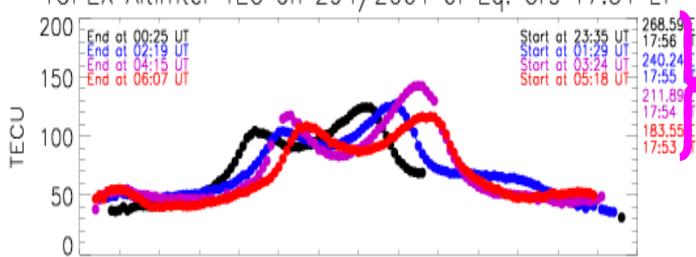
Cycle 313 (DOY 072-082, 2001)  
for even pass at EQLT =14:5



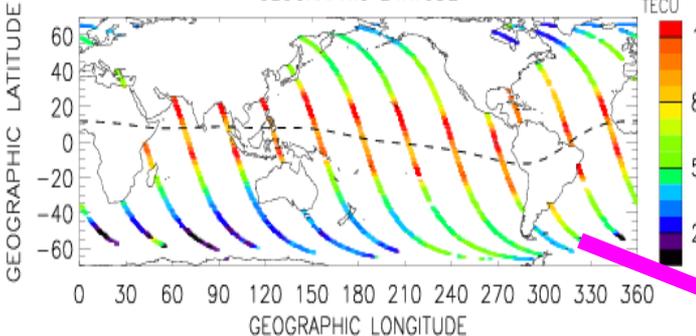
Cycle 312 (DOY 062-072, 2001)  
for even pass at EQLT =16:6



TOPEX Altimiter TEC on 294/2001 of Eq. Crs 17:51 LT



GEOGRAPHIC LATITUDE



Equatorial crossing longitudes

Topex passes start and end times

Topex TEC contour plots along its ground tracks

# Where can we get calculated GPS TEC?

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Madrigal data base (developed by MIT group) provide global calculated GPS TEC, interpolated 1 x 1 degree latitude and longitudes. The calculated TEC is averaged every 5 minutes.

Madrigal calculated TEC data base

<http://madrigal.haystack.mit.edu/cgi-bin/madrigal/madInvent.cgi>

# How about data from other LEO satellites?

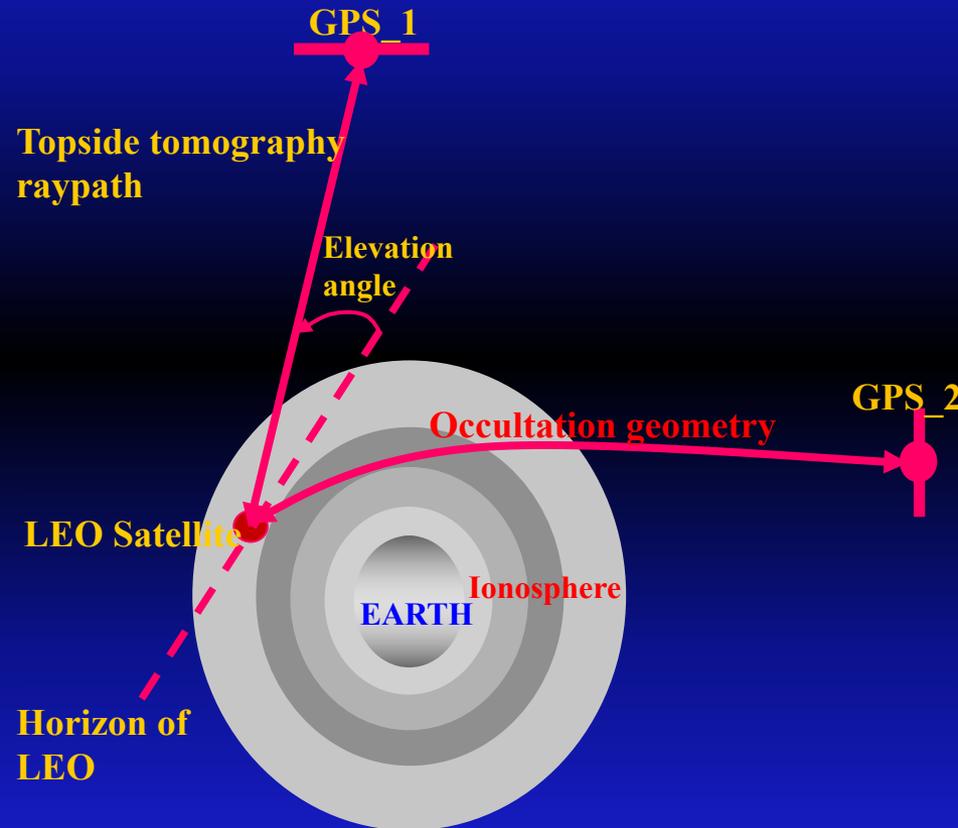
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The COSMIC (six LEO satellites) and other LEO satellites provide two sets of very important data. (1) topside ionospheric and plasmaspheric GPS TEC (2) Occultation ionospheric density profiles (from about 70 km upto the altitude of the spacecraft).

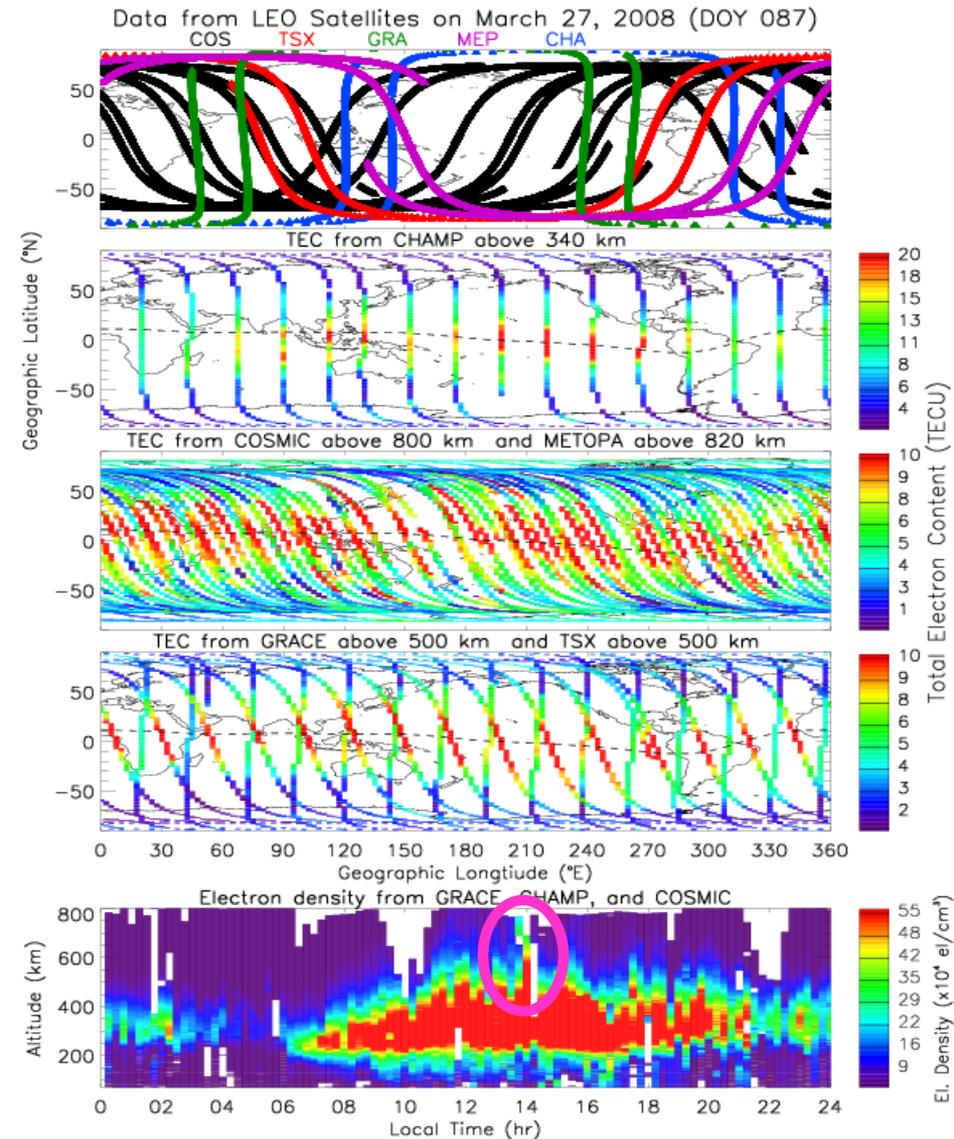
LEO satellites' data base

<http://cosmic-io.cosmic.ucar.edu/cdaac/>

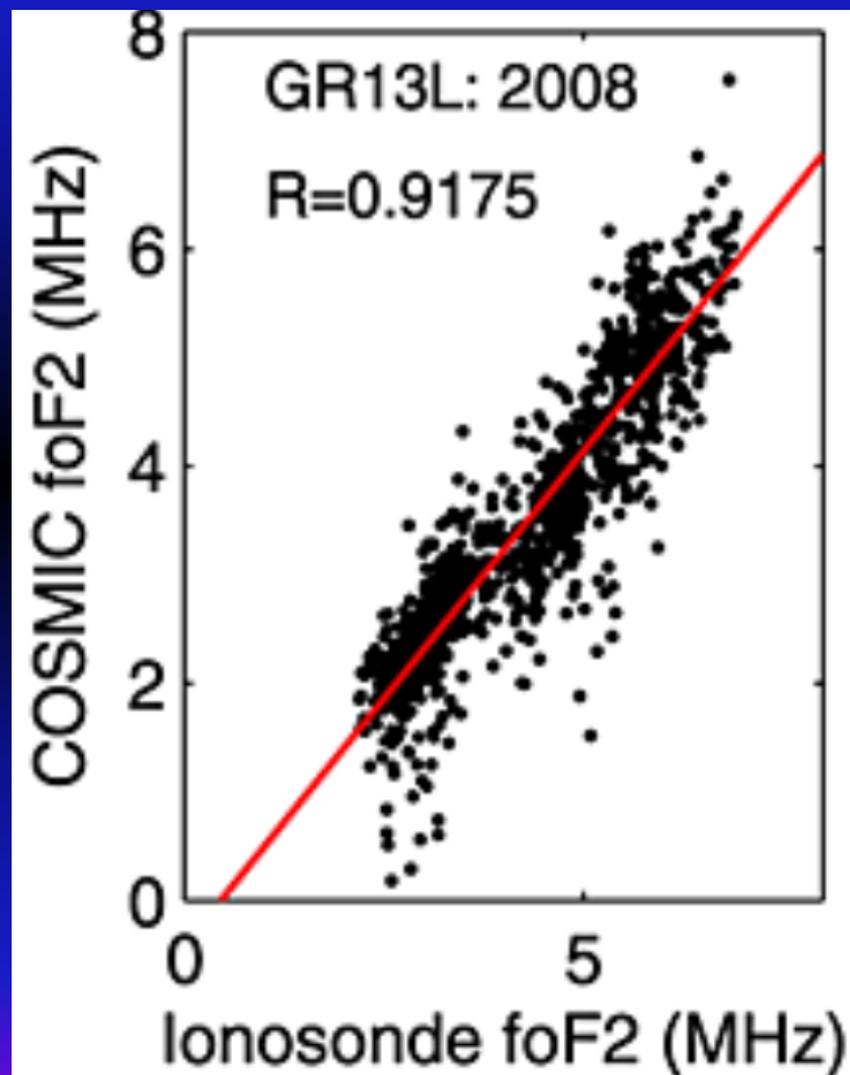
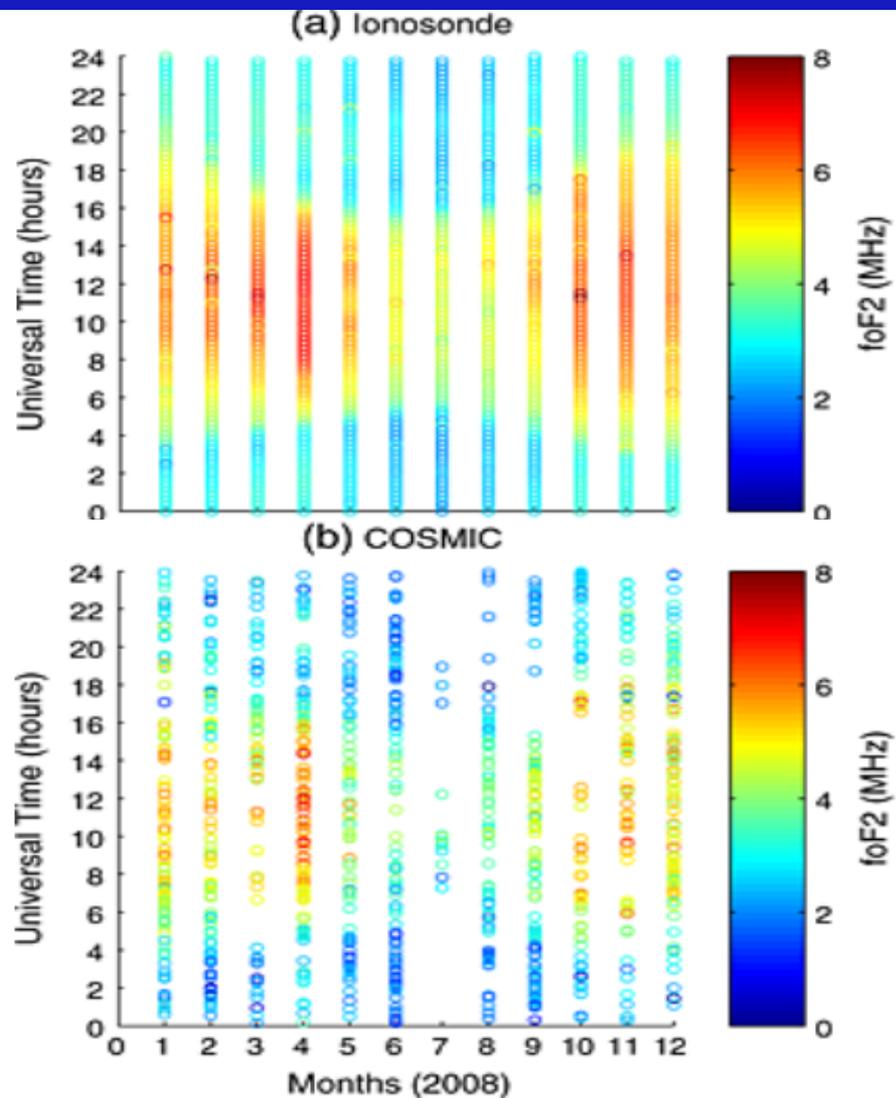
# The two most important type of LEO GPS observations



*Yizengaw and Carter, 2016*

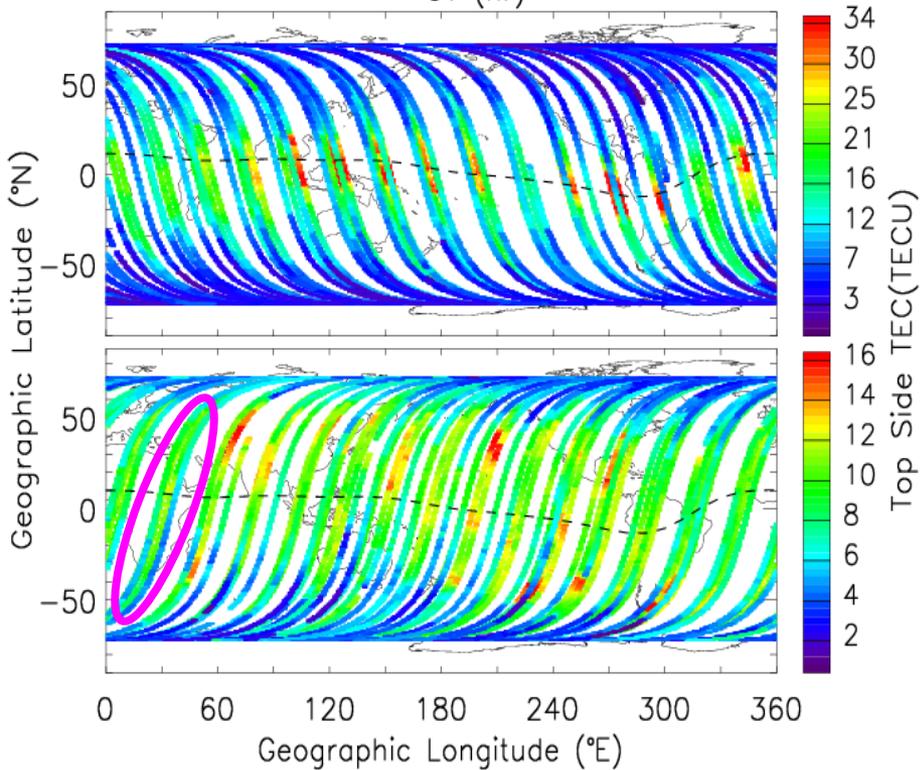
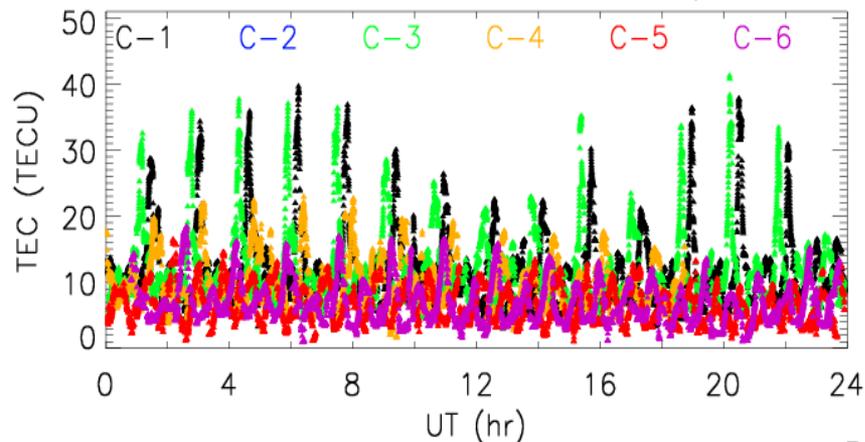


# Validation of LEO Occultation Profiles with Ionosonde Measurements

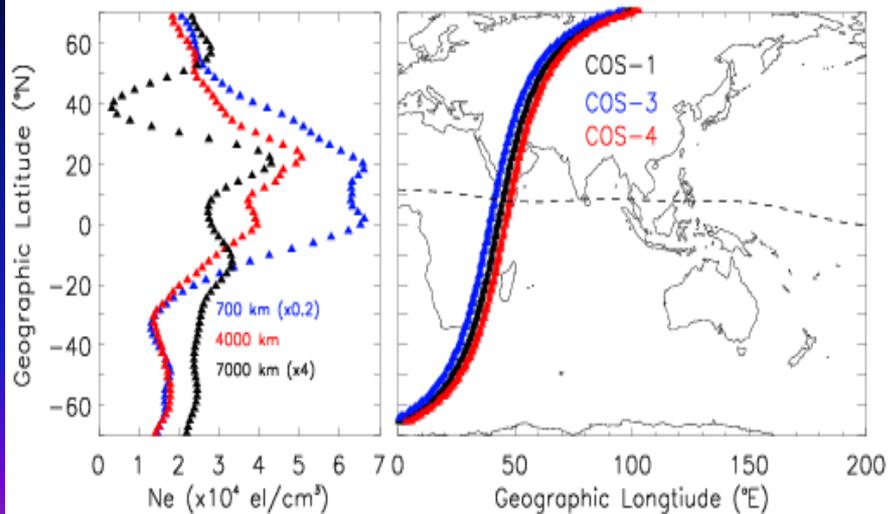
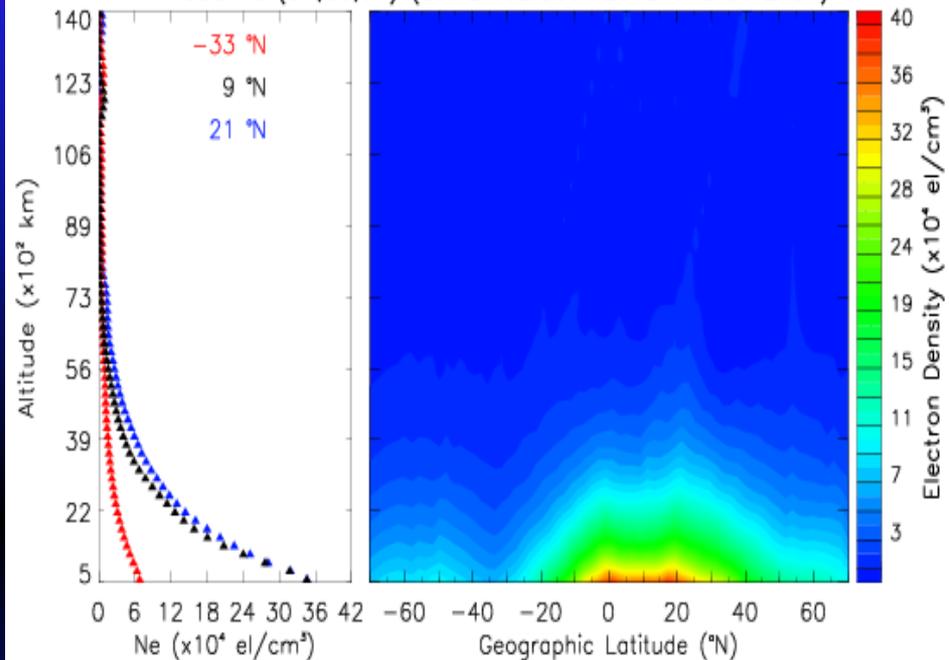


# Tomographic Application on Topside LEO TEC

COSMIC TEC data on March 24, 2007



Reconstructed Electron Density ( $\times 10^4$  el/cm<sup>3</sup>)  
COSMIC (C1,C3,C4) (04:15-05:55UT on 24 March 2007)



**More In situ density and drift  
observation also available from  
various space crafts, such as DMSP  
C/NOFS, and SWARM**

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**NASA's all public Satellite database**

**[http://cdaweb.gsfc.nasa.gov/cdaweb/istp\\_public/](http://cdaweb.gsfc.nasa.gov/cdaweb/istp_public/)**

**SWARM triplet Satellite**

**<ftp://swarm-diss.eo.esa.int/> (need to register at ESA website and  
get US & PW first)**

# More space weather data can also be available

Here are some of the publicly available data bases.

Coordinated Data Analysis Web (CDAWeb)

[http://cdaweb.gsfc.nasa.gov/cdaweb/istp\\_public/](http://cdaweb.gsfc.nasa.gov/cdaweb/istp_public/)

OMNI data base

[http://spdf.gsfc.nasa.gov/data\\_orbits.html](http://spdf.gsfc.nasa.gov/data_orbits.html)

# Where to find model run outputs?

Here are some of the publicly available model run data bases.

*Community Coordinated Modeling Center (CCMC)*

<http://ccmc.gsfc.nasa.gov/>

International Forum for Space Weather

Capabilities

<https://ccmc.gsfc.nasa.gov/assessment/forum-topics.php>

**Thank you!**

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**URL: <http://www2.bc.edu/endawoke-kassie>**