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# Space Science Education, Space Weather and CCMC in Istanbul Technical University

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Zerefşan Kaymaz  
Istanbul Technical University  
Faculty of Aeronautics and Astronautics  
Laboratory of Upper Atmosphere and Space Weather

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# Outline

- About ITU Space Science Facilities
  - Faculty
  - Courses
  - Lab
- Activities with CCMC
- Projects

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# ITU (Istanbul Technical University)

- Oldest university in Turkey
- Established in 1783 as the Royal School of Naval Engineering during the reign of Ottoman Sultan of Selim III
- 1928 University Status with three faculties
- 1944 named as Istanbul Technical University
  - An engineering university which built the country especially during the early years of establishment of republic
- 1971 A “four year education system” was adopted for BSc
- Currently 15 faculties with education
  - 4 year Bsc +
  - 2 years for M.Sc. +
  - PhD

# Faculty of Aeronautics and Astronautics

- Established in 1983
- 3 departments
  - Aeronautical Engineering (since 1948)
  - Atmospheric Sciences (since 1953)
  - Space Science and Technology (since 1983)
- All three departments passed successfully ABET evaluation in Dec 2010.
  - ABET: Accreditation Board in Engineering and Technology
- Advantage:
  - include Scientists and Engineers in their expertise area of Atmospheric and Space Science
- Accepts students within 500 to 1000 portion of the nationwide exam which is taken by more than 1,000,000 students each year

Space Science is a new discipline which is still at the very beginning of the research and education compared to the progress in the international space science and engineering community.

# Space Science Education

## Courses Offered

### ■ BSc level

- Space Environment
  - Compulsory
  - 60 students
- Physics of Upper Atmosphere
  - Selective
  - 15 students
- Planetary Atmospheres
  - Selective
  - 15 students
- Introduction to Space Weather (newly offered, effective as of 2013)

### ■ MSc + PhD level

- Magnetospheric Physics
  - Solar MHD
  - Solar Terrestrial Physics
  - Space Plasma Physics
- ### ■ Newly offered (effective as of 2013)
- Observational Techniques and Data Analysis in Space Physics
  - Ionospheric Physics and Electrodynamics

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UZH411e, Space Environment Class (undergraduate, 60 students)  
Final Exam,  
January 11, 2012, 15:00-17:00, D-Z08 and D-Z09



Classroom-Z08

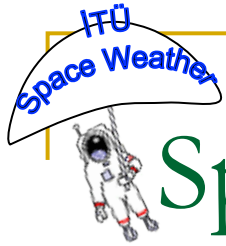


Classroom-Z09

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# Student Lab Work

- Lab work (Current + Future)
  - Applications via Xspace + Xsolar from UCLA currently running on lab computers (with permission from Chris Russell)
  - Ionosonde radar measurements (start as of 2013)
  - SID monitor measurements (currently available since June 2011)
  - Telescope measurements of sun spots (currently available)
  - Magnetometer measurements
  - Model runs
    - CCMC (in planning stage)
    - Running Local models (faculty computer resources)
  - ITU satellite Lab tests and design
    - in conjunction with Space Engineering Department



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# Space Weather Laboratory

- Established in July 2010
- To establish the necessary lab exercises integrated within especially BSc courses
- To initiate and help to advance the Space Science through observations and modelling studies
- To provide necessary theoretical and experimental environment for building space instruments
- To bring ITU-Space Weather Lab to the center of nation in space research
- To bring ITU to the international levels in Space Science Research and Education
- To create public awareness for Space Weather events



**YUKARI ATMOSFER  
ve UZAY HAVASI  
LABORATUVARI**  
UPPER ATMOSPHERE  
and SPACE WEATHER  
LABORATORY



# Instrumental Infrastructure

## ■ Currently Available

- ❑ Ionosonde HF Radar within Maslak Campus (in progress of installing)
- ❑ SID VLF monitors
- ❑ Telescope Sun Spot Observations
- ❑ Space Weather Activity TV Displays
- ❑ Computer Lab for running models

## ■ In planning stage/near future

- ❑ UCLA ground magnetometer
- ❑ Electrometer (Finland)

## ■ Future

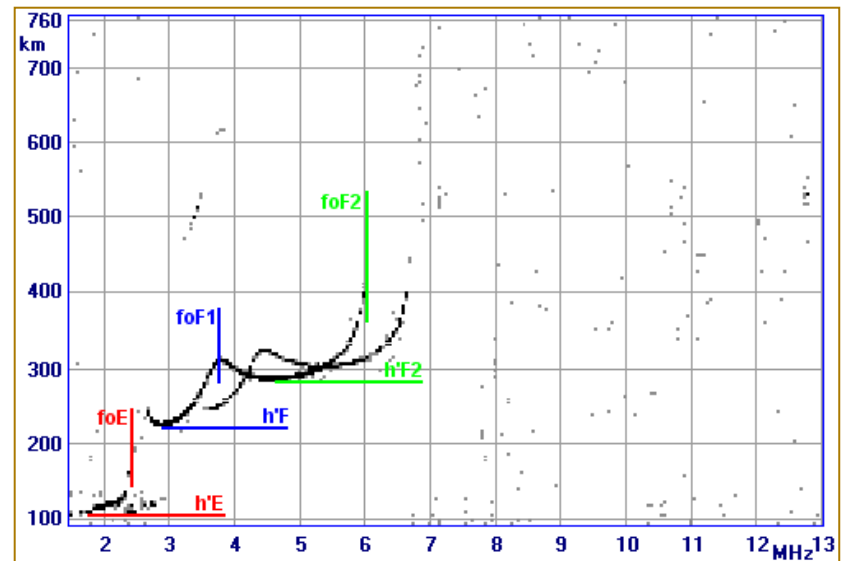
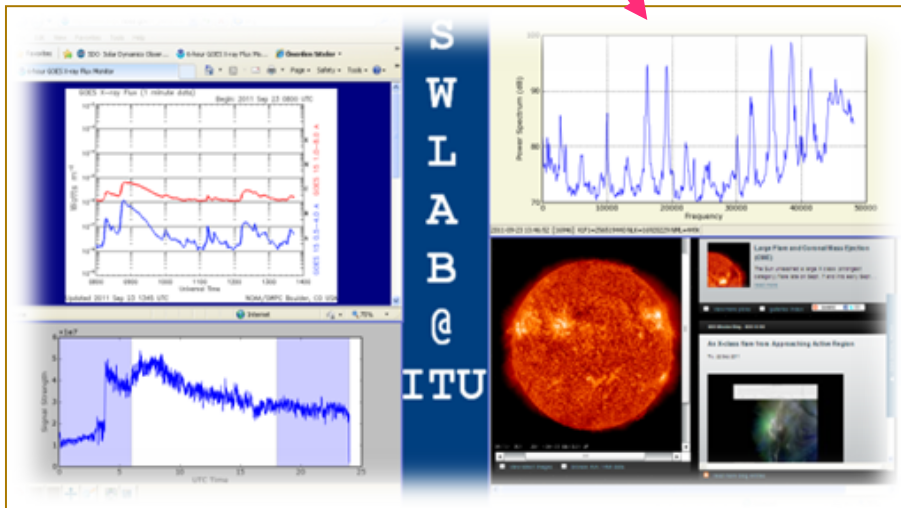
- ❑ Incoherent scatter radar
- ❑ UV Airglow imager
- ❑ Other ionospheric and magnetospheric ground measurements



SID Antenna



Ionosonde Transmitter on Site



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# Team and Collaborations

Currently, we are a small group lead by Z. Kaymaz

- 1 Post Doc
- 1 PhD Student
- 1 MSc Student
- Several BSc students from Space and Atmospheric Sciences at the level of BSc projects, who are very anxious to get involved in space science projects
  
- Nationally, in collaboration with Electric-Electronic Eng. Dept. in ITU and Hacettepe University for ionospheric studies
  
- Established and expected future collaborations within the international community, including
  - NASA Space Weather Lab
  - APL
  - UCLA
  - Max Planck Institute for Solar Sytem Research, Lindau
  - and others at different levels ...



# Research

- experimental studies using International spacecraft measurements
- modelling studies using publicly available models at international institutes/centres/universities

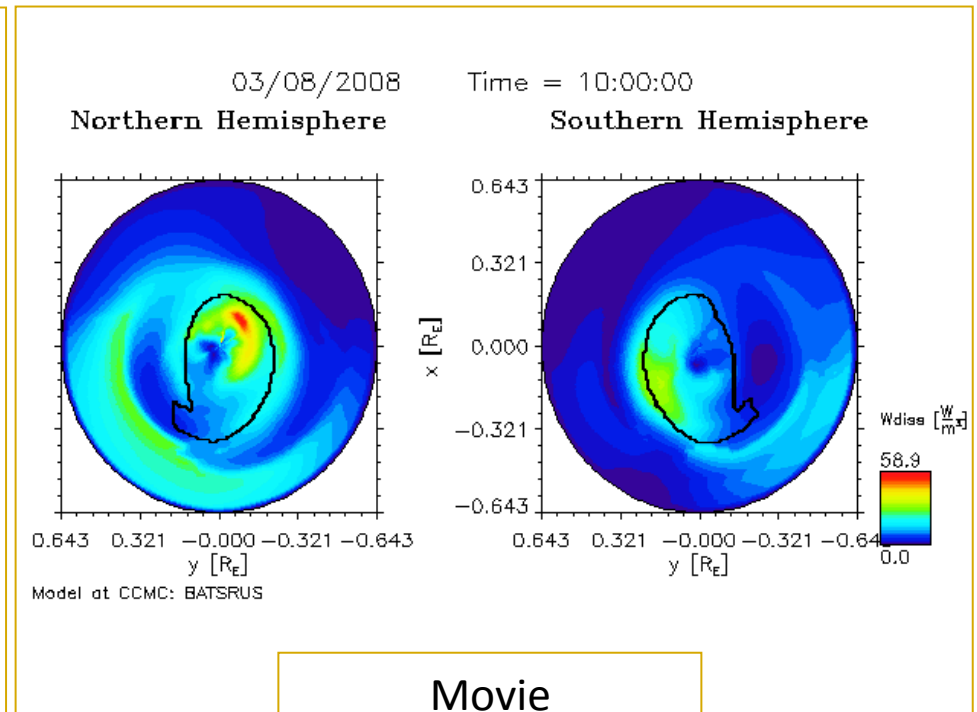
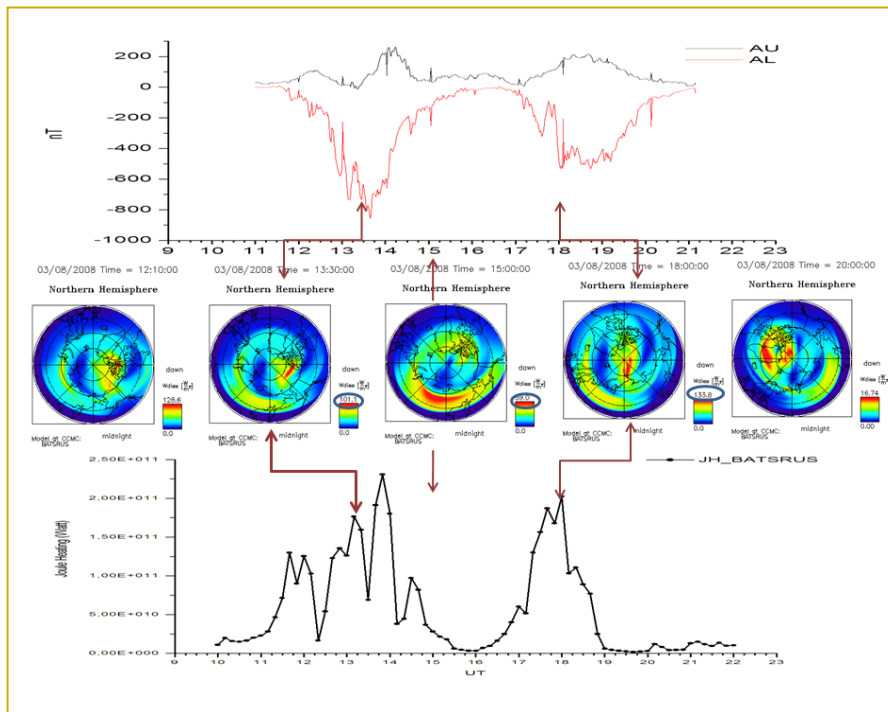
Some of the work we currently carry out:

- Solar wind-magnetosphere-ionosphere coupling
- Magnetosheath studies
- Upper Atmospheric consequences of Magnetic storms and substorms
- Ionospheric joule heating
- Recently, propagation of interplanetary disturbances

- Currently we run OPEN GCM and BATSRUS models to study
  - PDL investigation
  - Joule Heating
- ENLIL cone model
  - For CME propagation

# Joule Heating from Batsrus

## Joule Heating of Magnetospheric Substorm of March 2008

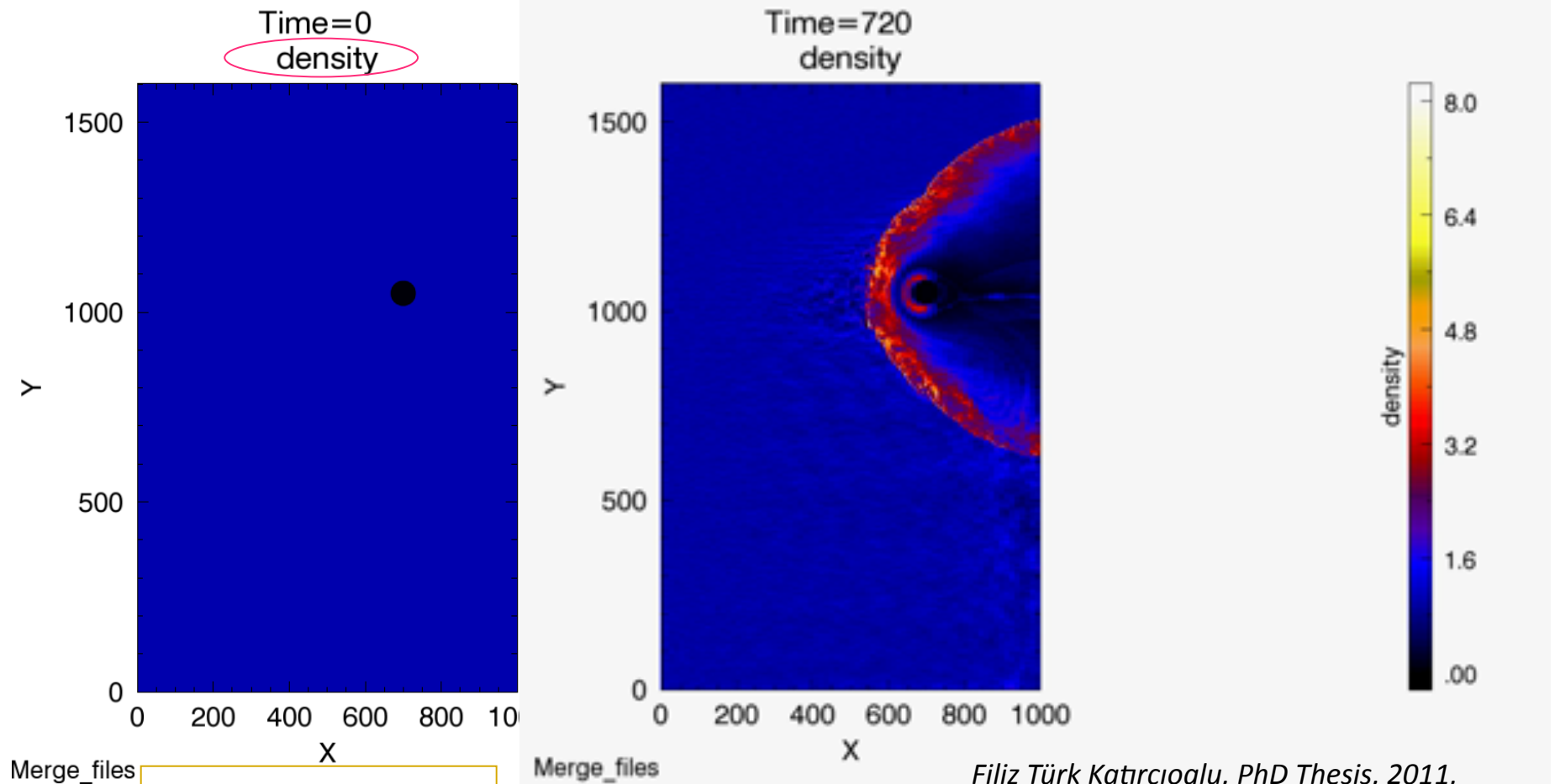


Movie  
Click on the Figure

*E. Ceren Kalafatoglu, MSc. Thesis, 2010*  
*Kalafatoglu, et al., EGU 2009 and 2010*  
*GRL paper in review, 2011*

# Magnetosheath for different radial IMFs

## Kinetic-Hybrid model



Movie  
Click on the Figure

Filiz Türk Katırcıoğlu, PhD Thesis, 2011,  
Collaborative work, D. Sibeck and N. Omidi

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# NASA/CCMC and ITU

We are interested to

- Collaborative works on Space Weather
- Run CCMC models remotely
  - for scientific research
  - for practical applications of space weather
- To create space weather user groups and public awareness
- Create a display set up in our lab as in NASA Space Weather
- Use educational products and means from CCMC in our classroom activities (upon permission)
- Anxious to help developing educational programs with CCMC



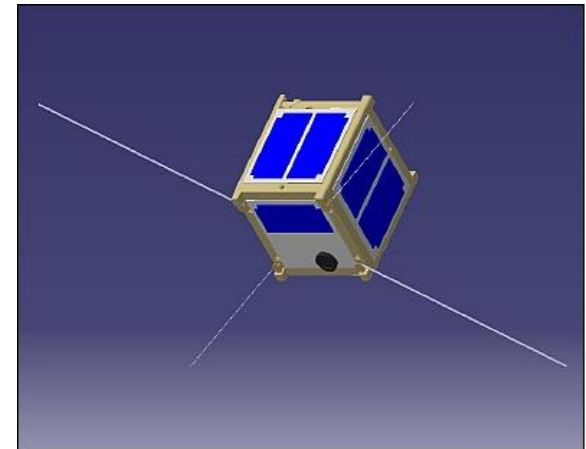
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# NASA/CCMC at ITU

- In the framework of creating user groups and public awareness within ITU community (first)
  - Space Weather TV displays as in NASA/CCMC center
  - Regular Space Weather prediction e-mails to ITU academic staff and students
    - either from NASA/Space Weather Lab
    - or create using international spaceweather web sites
  - With a target making our own space weather predictions using available models

# ITUcube Sat and Future Nanosat

- ITU-pico satellite:
  - Prototype is ready / currently financial support is sought for at the governmental level
  - Plan to make it a “first” science satellite of Turkey, as a start, by putting a
    - Magnetometer
    - Plasma instrument
    - Faculty has already launched a ITUcube sat in Sept 2009 at an altitude of 700 km
    - did not have a science objective but measure of performance
- Ionosonde Radar and GNSS
  - Air traffic controllers company has contacted us on the ionospheric applications
- Airforce Academy contacted us to develop a Space Science and Environment program at the MSc+PhD level in their graduate school.



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[www.spaceweatherlab.itu.edu.tr](http://www.spaceweatherlab.itu.edu.tr)

- We are very anxious and open to any kind of collaboration educationally or researchwise
- Welcome any suggestions to improve our lab
- Contact:
  - [www.spaceweatherlab.itu.edu.tr](http://www.spaceweatherlab.itu.edu.tr)

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# Thanks

- Thank you for your attention!
- Thanks also to NASA Space Weather Lab CCMC personel for their support, encouragement, and help while visiting NASA in summer of 2011 (invitation by D. Sibeck), including
  - Michael Hesse
  - Masha Kuznetsova
  - Anti Pulkinen
  - Alexandro Taktakishvili
  - Anna Chulaki
- Special thanks to go to Masha Kuznetsova for her invitation to the workshop and presenting this work
- Z. Kaymaz would like to thank to her students, Filiz Turk Katircioglu and E. Ceren Kalafatoglu; without their support and enthusiasm nothing would have been easier in our activities.