# Project for FYS3610, Space Physics, Autumn 2014

## Objective

Study ionospheric and auroral dynamics in response to changes in solar wind conditions. Reconnection is the dominant mechanism, giving rise to enhancements in the region 1/2 current system and large-scale ionospheric flows, changes in the polar cap size, and auroral activity.

## Data sources

•ACE

◦ ACE data are available at http://cdaweb.gsfc.nasa.gov/cdaweb/istp_public/. Choose ACE, then highest resolution Level 2 data from the MAG and SWEPAM instruments, and then the date of interest.

•Ground-based magnetometer

◦ Magnetometer data are available at http://www.ava.fmi.fi/image/. Click “Data”, then “user-defined jpg plots and PostScript files (more flexible)”. Choose stations, time period and scaling for the components.

•SuperDARN

◦ SuperDARN data are available at http://superdarn.jhuapl.edu/. Click “Plot data”, then “Global convection plots”, and click on date of interest. You need to register in order to download the data.

•AMPERE

◦ AMPERE data are available at http://ampere.jhuapl.edu/. Click “Data Browser” and select the date of interest. You need to register in order to download the data.

•All-Sky Camera

◦ ASI keogram data are available at http://tid.uio.no/plasma/aurora/.

## Approach

Select one of the following dates:

•04 December 2010, 0900-1500 UT

•01 January 2011, 0900-1500 UT

•04 January 2011, 1800-2400 UT

•06 January 2011, 1800-2400 UT

Inspect the quick look database of keograms, i.e., auroral intensity along the north-south magnetic meridian versus time at http://tid.uio.no/plasma/aurora/. Note that not all auroral data are good data due to poor weather conditions (clouds). Look for large-scale movement of the auroral features in the latitudinal direction or sudden brightenings. Familiarize yourself with ACE data and create plots of key parameters during corresponding time intervals, taking into account the travel time of the solar wind from the ACE position to Earth. Widen the scope by adding ionospheric current (magnetometer), large-scale flow (SuperDARN) and current density (AMPERE) data. Describe what large-scale dynamics you would expect and what is observed. Do you see signatures of dayside/nightside reconnection in the auroral data? What are the corresponding signatures in the other datasets? Discuss!

## Requirements of the report

The report should tell the story of how a change in the solar wind conditions (as observed by the ACE satellite), propagated to Earth and there affected the large-scale configuration of the magnetosphere (as observed by SuperDARN, ground-based magnetometers, AMPERE, and an ASI). Demonstrate that you understood the underlying physics by describing what dynamics you would expect from such a

change and support your expectations by data. The report must include

•a front page with title and author(s)

•an introduction including a brief description of the used instruments.

•a main part subdivided into sections (like introduction, observations, discussion, conclusion), numbered figures with captions, numbered equations, list of references, numbered pages.

The report should be written in English (Norwegian is also acceptable). It should amount to 10-15 pages, contain around 2500 words, and be written by a team of two. You will receive comments and questions regarding your report and your contribution during the oral examination.

## Submission

Submission deadline is 21 November 2014, 1600 CET. The report has to submitted electronically (pdf or word format) to lasse.clausen@fys.uio.no.

## Supporting literature

Kievelson and Russel, Introduction to Space Physics, Chapters 9, 13, and 14, available in the UiO library

Sandholt, P.E., C.J. Farrugia, J. Moen, Ø. Noraberg, B. Lybekk, T. Sten, and T.L. Hansen, A classification of dayside auroral forms and activities as a function of IMF orientation, J. Geophys. Res.,103, 23,325-23,345, 1998.

Ruohoniemi, J. M., R. A. Greenwald, Dependencies of high-latitude plasma convection: Consideration of interplanetary magnetic field, seasonal and universal time factors in statistical patterns, J. Geophys. Res., 110, A09204, doi:10.1029/2004JA010815, 2005.

Newell, P. T., J. M. Ruohoniemi, and C.–I. Meng, Maps of precipitation by source region, binned by IMF, with inertial convection streamlines, J. Geophys. Res., 109, A10206, doi:10.1029/2004JA010499, 2004.