HAO Colloquium Series
(Refreshments served)

Speaker:  Ingrid Cnossen, British Antarctic Survey
Time:    1:30–2:30 pm
Date:  Wednesday, January 29, 2014
Location:  CG1 – 1210 South Auditorium (also webcast at http://www.fin.ucar.edu/it/mms/cg-live.htm)
Title:  Causes of long-term change in the upper atmosphere and a possible downward connection

Abstract:

Several different processes are likely to contribute to long-term (multi-decadal) changes (“trends”) in the thermosphere and ionosphere. The increase in atmospheric CO2 concentration is generally seen as the main contributor, causing cooling and contraction of the upper atmosphere. However, I will show that long-term changes in the Earth’s magnetic field are also important, especially for the ionosphere. In addition, effects of magnetic field changes may extend further downward than we expected.

I will start with an overview of the key mechanisms by which changes in the Earth’s magnetic field affect the upper atmosphere, based on investigations with the Coupled Magnetosphere-Ionosphere-Thermosphere (CMIT) model. I will then use simulations with the Thermosphere-Ionosphere-Electrodynamics General Circulation Model (TIE-GCM) to directly compare the effects of changes in the magnetic field over the past century to the effects of the increase in CO2 concentration over the same time span. The ultimate aim is to compare these simulated effects to actually observed trends to determine to what extent each of these processes is responsible for those trends. There are however also problems associated with detecting long-term trends in observational records, in part due to the strong influence of the approximately 11-year solar cycle on the upper atmosphere. I will illustrate this with a trend analysis example on foF2 data. This also demonstrates that any long-term (> 11-year) variation in solar activity would likely contribute to long-term change in the upper atmosphere.

To finish, I will briefly show some initial results produced during my current visit to NCAR. I have been using the Whole Atmosphere Community Climate Model (WACCM) to explore whether the changes in the upper atmosphere that are produced by magnetic field changes can influence the atmosphere below. It appears that effects of magnetic field changes extend well into the middle atmosphere, and occasionally even into the troposphere, for certain regions and times of year. Work is ongoing to try and explain this surprising result.