Using meteorological, satellite, and ground-based data to study the Arctic

V. Lynn Harvey, Laboratory for Atmospheric and Space Physics

- What is the phenomena that you want to explore? What scientific question are you posing?
  - What temporal and spatial resolution and coverage is needed?
  - What variables are needed?
  - What if the data that you need is not available?
    - Repose question, model it, or propose a mission.
- Meteorological assimilated data (ECMWF, MetO, NCEP, MERRA)
- Satellite data sources (MLS, SABER, MIPAS, ACE, CIPS, OMI)
- Ground based data sources (Lidar, Radar, imagers, aircraft, buoys, ice cores, radiosondes, rockets)

Ask questions!

CREATE summer school, Alliston, Ontario, July 2012
NASA successfully launched five suborbital sounding rockets early March 27, 2012 from its Wallops Flight Facility in Virginia as part of a study of the upper level jet stream. The first rocket was launched at 4:58 a.m. EDT and each subsequent rocket was launched 80 seconds apart. Each rocket released a chemical tracer that created milky, white clouds at the edge of space. Credit: NASA/Goddard Space Flight Center

http://www.youtube.com/watch?v=XUztdqdf_2G8&feature=related
How to find data?

- Distributed Active Archive Centers DAACs
- Colleagues
- Papers
- Google!

List of data centers and data specialization

**Alaska Satellite Facility (ASF):** Synthetic Aperture Radar (SAR) data, sea ice, polar processes, geophysics.

**Crustal Dynamics Data Information System (CDDIS):** Space geodesy.

**Global Hydrology Resource Center (GHRC):** hydrologic cycle, severe weather interactions, lightning, atmospheric convection.

**Goddard Earth Sciences Data and Information Services Center (GES DISC):** global precipitation, solar irradiance, atmospheric composition, atmospheric dynamics.

**Land Processes DAAC (LP DAAC):** surface reflectance, land cover, vegetation indices.

**Level 1 Atmosphere Archive and Distribution System (MODAPS LAADS):** radiance, atmosphere.

**NASA Langley Research Center Atmospheric Science Data Center (LaRC ASDC):** radiation budget, clouds, aerosols, tropospheric chemistry.

**National Snow and Ice Data Center (NSIDC):** snow, ice, cryosphere, climate.

**Oak Ridge National Laboratory DAAC (ORNL DAAC):** biogeochemical dynamics, ecological data, environmental processes.

**Ocean Biology Processing Group:** ocean biology, ocean color, ocean biogeochemistry, sea surface temperature.

**Physical Oceanography DAAC (PO DAAC):** sea surface temperature, ocean winds, circulation and currents, topography and gravity.

**Socioeconomic Data and Applications Data Center (SEDAC):** human interactions, land use, environmental sustainability, geospatial data.
What to do with the data?

• “Slice and Dice” it.
  – 3D? yz, xy, yz, yt, zt, xt
  – Swaths? Time series? Point measurements?
    Compute means and variances. Explore mechanisms for fluctuations. Find correlative data to support results.
To explore vertical motions during SSWs and MCs.
Demark the vortex in the mesosphere using chemical data.
Use ACE NO$_x$ and CO mixing ratios poleward of 50° N to explore descent of NOx during 2004, 2006, 2009 when the stratopause reformed ~80 km.
CIPS imagery from the AIM satellite. Very dim clouds in week before 19th. Did SSW have a global impact?
Inter-hemispheric coupling
SSW’s and PMC’s

Combine MLS Temp with CIPS cloud freq

SSW→ peak in PMCs several days later. SSW’s are associated with variations over the globe

Next: Interhemispheric teleconnections
On the onset of polar mesospheric cloud seasons as observed by SBUV

Susanne Benze,¹,² Cora E. Randall,¹,² Bodil Karlsson,³ V. Lynn Harvey,¹
Matthew T. DeLand,⁴ Gary E. Thomas,¹ and Eric P. Shettle⁴

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Figure 2. Time series of average SH PMC season onset dates as observed by SBUV (black) and date of SH stratospheric zonal mean zonal wind (ERA40 and MetO combined) reversal from winter to summer conditions at 50 hPa and 65°S latitude (red). Dotted lines indicate PMC onsets before 1984. Error bars show the range of values from multiple SBUV instruments.

SH PMC onset date depends on zonal winds below and gravity wave filtering.
Interactive Discussion

• Atmosphere, Ocean, Ice, Land, Biosphere, Solar, Planetary…

• Pick a phenomenon.
  – What is the science question?
  – Determine resolution, coverage, time span.
  – Now find appropriate data to study it.
  – What plot(s) will you make?

Let’s do an example together!
In-class Reflection

Now do it on your own.
Thanks!