Predictability Day Practical Sessions

Predictability practical sessions

To start practical sessions:

- Login to Cheyenne

- Start an interactive geyser session using "execdav -m 100G -t 3:00:00"

- Go to appropriate directory using "cd PWS2018/day2"

- If needed, load the idl module using "module load idl"

- Copy over tutorial directory using "cp –r /glade/u/home/mholland/predict_tutorial ."

- Load gv using "module load gv" (unless you use a different viewer for ps files)

Practical 1. Seasonal Predictors

- Purpose: To assess predictors of
  - Hemispheric sea ice extent
  - Alaskan Snow Covered Area
  - Greenland Ice Sheet Melt or
  - Surface air temperature

by computing correlations with prior environmental conditions.

- Produces: Correlation maps for twelve months preceding the predictand.

- Method: Uses monthly mean output from 10 years of the CESM Large Ensemble to compute correlations (usually 30 members for 10 years).
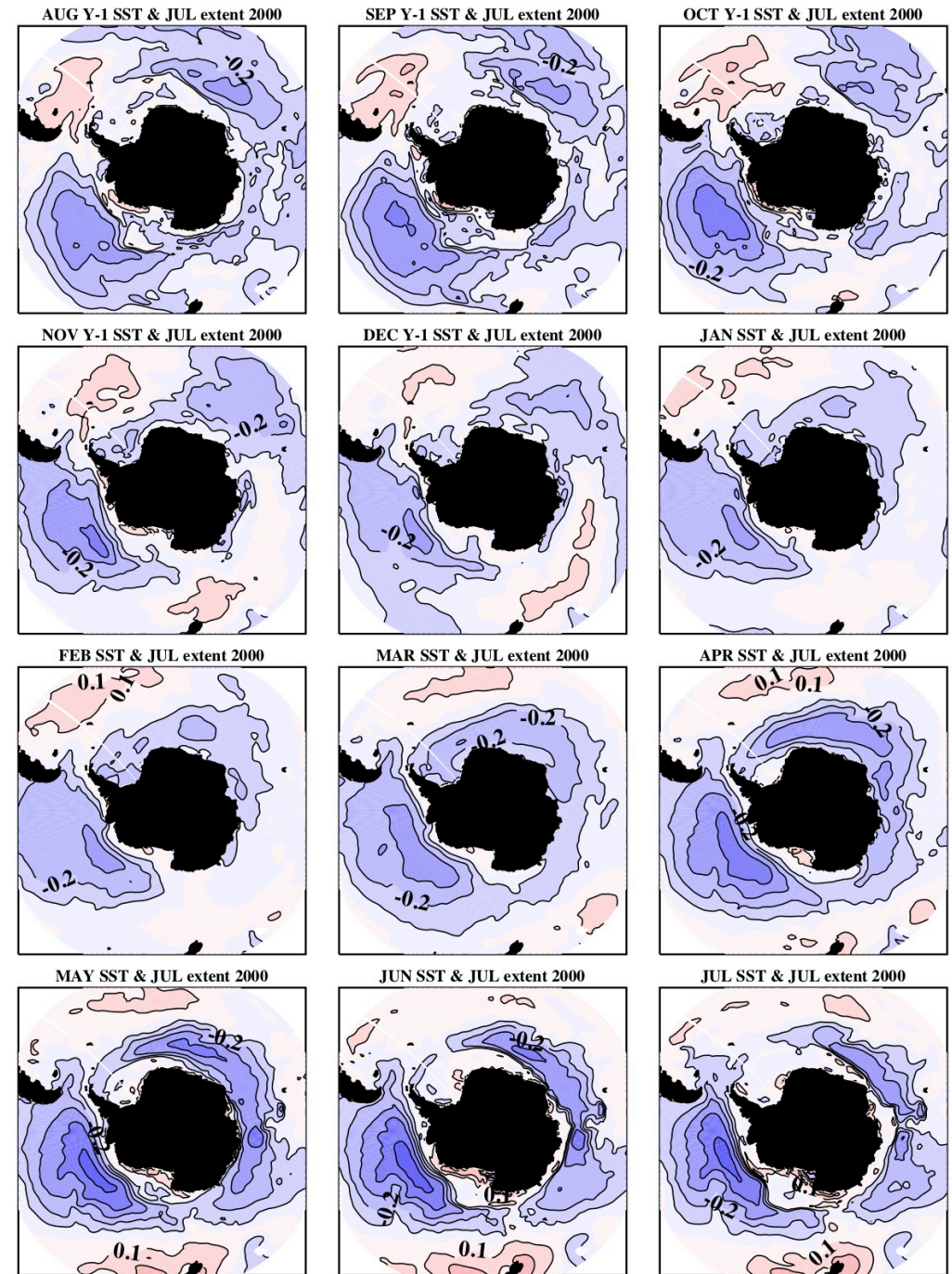
Practical 1. Seasonal Predictors - Instructions

- Change into directory – cd PWS2018/day2/predict_tutorial/predictors
- Start an interactive IDL session by typing "idl" and run script using ".r predictor"
- You will be prompted for input on:
  - The predictand (extent, aksno, gismlt, TREFHT)
  - If extent or TREFHT is chosen, then the hemisphere of interest
  - The month to use for the predictand (0-11)
  - The predictor variable
  - The year to start decadal analysis
- The script will run and produce a postscript file of the format: R_predictorname_and_month_predictandname_year.ps
- Use ghostview to view file: "gv filename" (perhaps on a different laptop)

Possible predictors: TREFHT (atm temp), PBLH (Atm boundary layer height), PRECSL (snowfall), PSL (sea level pressure), hi (ice thickness), aice (ice concentration), hs (snow thickness on ice), apond002 (pond fraction), SST (sea surface temp), HBLT (ocean boundary layer depth), SNOWDP (snow depth on land), FSNO (land snow fraction), QSNOMELT (land snow melt)

# Practical 1. Seasonal Predictors

Some comments and questions to consider:

- The lined contour interval on the plots is at 0.1 and the zero line is omitted

- Carefully consider timing of predictand and the predictor to analyze (for example GIS melt in January is probably not very relevant).

- Is there evidence for skillful predictors and if so, what are they?

- Do important predictors change with the changing climate? If so, why might this be?

- Do important predictors change seasonally? If so, why might this be?

- Do important predictors change with the region? If so, why might this be?

Possible predictors: TREFHT (atm temp), PBLH (Atm boundary layer height), PRECSL (snowfall), PSL (sea level pressure), hi (ice thickness), aice (ice concentration), hs (snow thickness on ice), apond002 (pond fraction), SST (sea surface temp), HBLT (ocean boundary layer depth), SNOWDP (snow depth on land), FSNO (land snow fraction), QSNOMELT (land snow melt)

Practical 2. Boundary Forced Change

- Purpose: To assess changing climate conditions relative to the pre-industrial control.

- Produces: Plots of the seasonal histogram and timeseries of a specified variable relative to that from the pre-industrial control. The histogram is calculated for a user-specified decade.

- Method: Reads in the timeseries of pre-processed variable for the CESM LENS and its pre-industrial control run. Computes the histogram of the variable for the decade of interest.
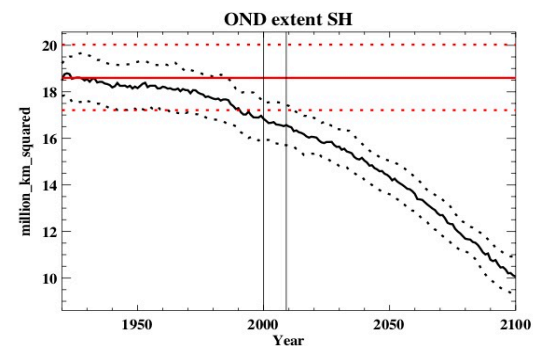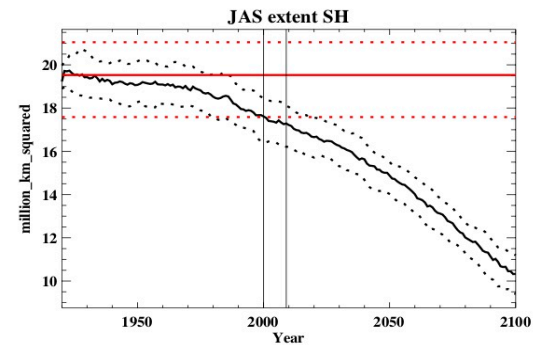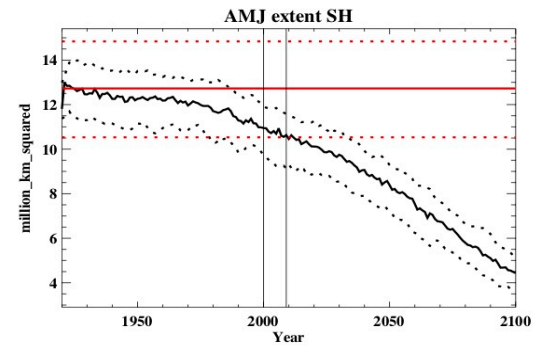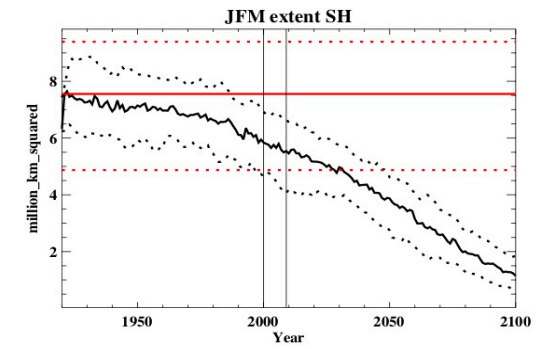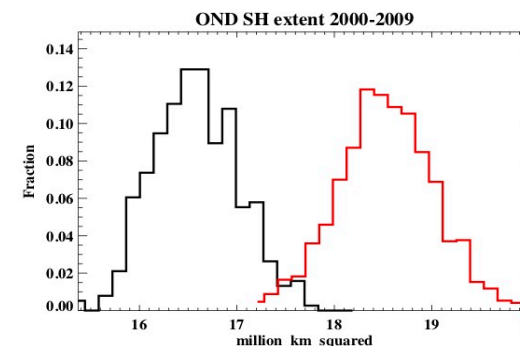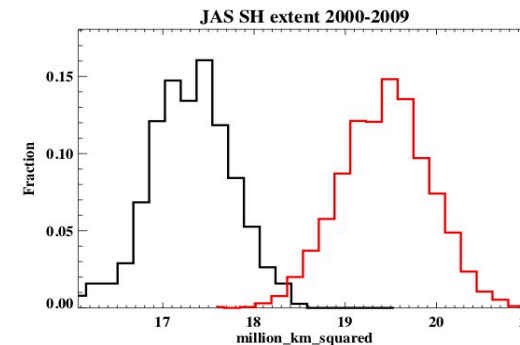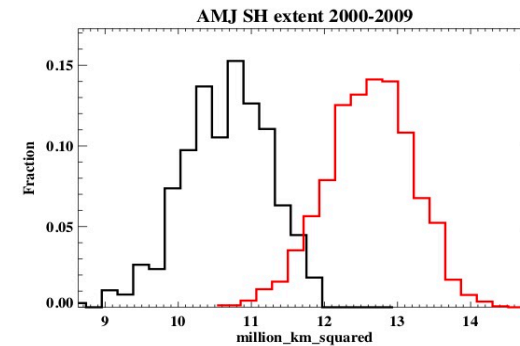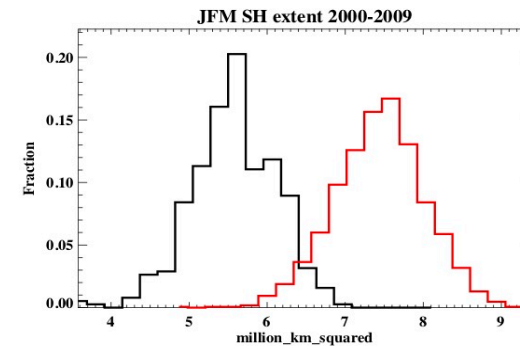
Practical 2. Boundary Forced Change - Instructions

- Change into the appropriate directory using "cd predict_tutorial/histogram"

- Start interactive IDL session by typing "idl" and run script using ".r histogram_var"

- You will be prompted for input on:
  - The variable to analyze (see description below)
  - The region for analysis
  - Which year to start decadal analysis

- The script will produce a postscript file of the form: variable_decade_region.ps

- Use ghostview to view file: "gv filename"

Possible Variables to assess:

Atmospheric variables: TREFHT - Atmospheric temperature, PRECL – Large-scale precipitation rate, PSL– Sea level pressure, PBLH– Atmospheric Planetary Boundary layer height, PRECSL– Large-scale snowfall rate, CLDTOT – total cloud fraction

Ice variables: extent – sea ice extent, hi – sea ice volume

Land variables: Snow_Area – Snow covered area, H2OSNO – Snow water equivalent

Practical 2. Boundary Forced Change

Some comments and questions to address:
- In the plots, values in red show the pre-industrial control. On right panels, the solid line is the ensemble (or PI) mean, the dotted lines are the range.
- When is a boundary forced signal apparent in the variable of interest?
- How does the emergence of this signal differ across variables? Why might this be?
- Is there a different between atmospheric, terrestrial, and marine variables?
- How might you define a metric for the emergence of a boundary forced signal?

Possible Variables to assess:

Atmospheric variables: TREFHT - Atmospheric temperature, PRECL – Large-scale precipitation rate, PSL– Sea level pressure, PBLH– Atmospheric Planetary Boundary layer height, PRECSL– Large-scale snowfall rate, CLDTOT – total cloud fraction

Ice variables: extent – sea ice extent, hi – sea ice volume

Land variables: Snow_Area – Snow covered area, H2OSNO – Snow water equivalent

Practical 3. Initial value predictability

extent SH From 1920

- Purpose: To assess how simulations diverge from an initialized state.

- Produces: Plots of the daily timeseries of an initialized variable of interest relative to the internal daily variability from the pre-industrial control simulation.

- Method: Reads in daily timeseries of pre-processed variable for the CESM LENS from the 1920 initialized state and its pre-industrial control run. Computes potential prognostic predictability (PPP) metric and plots the PPP timeseries for one year. PPP is the reduction in the prediction ensemble variance relative to internal variability from the control run, where

PPP=1.-variance(prediction_ensemble)/variance(control)

Potential Prognostic Predictability extent
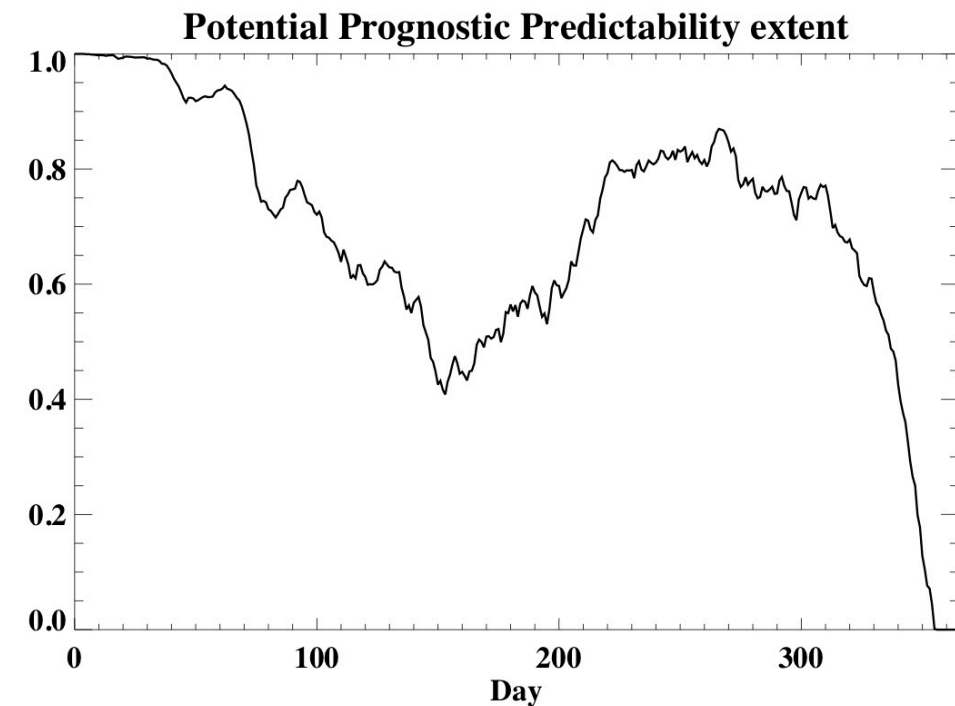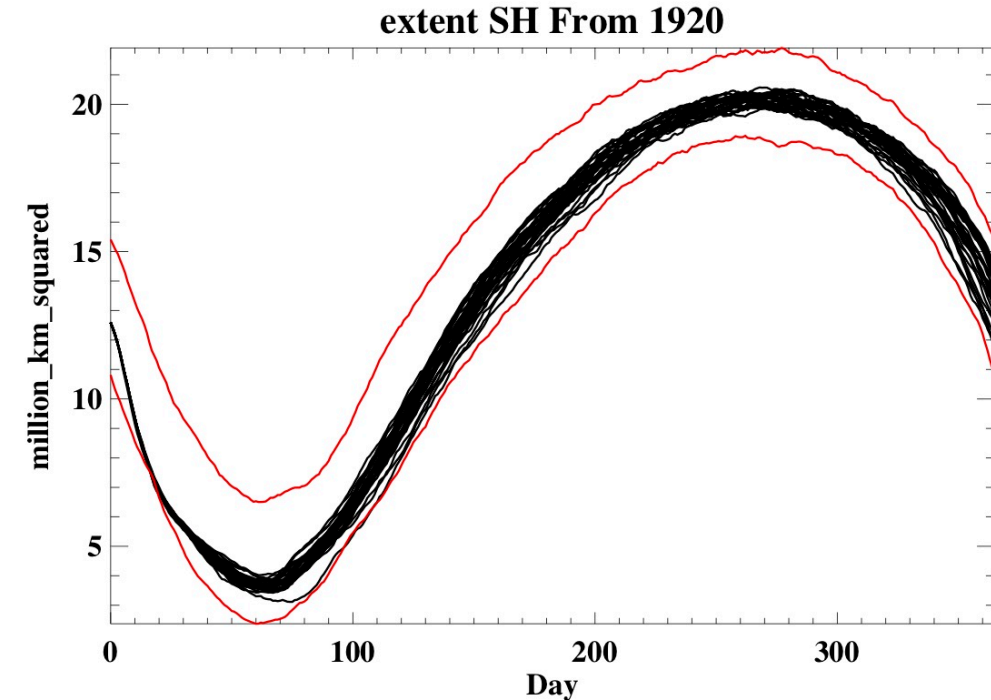
Practical 3. Initial value predictability - Instructions

- Change into the appropriate directory using "cd predict_tutorial/init_val"

- Start interactive IDL session by typing "idl" and run script using ".r init_val"

- You will be prompted for input on:
  - The variable to analyze (see description below)
  - The region for analysis

- The script will produce a postscript file of form: variable_1920_region_daily.ps

- Use ghostview to view file: "gv filename"

Possible Variables to assess:

Atmospheric variables: TREFHT - Atmospheric reference height temperature, PRECT – Total precipitation rate, PSL – Sea level pressure, PRECSL – Large-scale snowfall rate, Z500 – 500mb geopotential height

Ice variables: extent – sea ice extent, hi – sea ice volume

Land variables: FSNO – Snow covered fraction, H2OSNO – Snow water equivalent, SOILWATER_10CM – liquid water+ice in top 10cm of soil

Practical 3. Initial value predictability

Some questions to address:

- For how long does there appear to be initial value predictability for the variable of interest?

- How does this differ across variables? Are there differences across the atmosphere, land, marine system?

- Are there any common things that emerge across the different practical session exercises?

Possible Variables to assess:

Atmospheric variables: TREFHT - Atmospheric reference height temperature, PRECT – Total precipitation rate, PSL – Sea level pressure, PRECSL – Large-scale snowfall rate, Z500 – 500mb geopotential height

Ice variables: extent – sea ice extent, hi – sea ice volume

Land variables: FSNO – Snow covered fraction, H2OSNO – Snow water equivalent, SOILWATER_10CM – liquid water+ice in top 10cm of soil