netCDF Operators [NCO]

http://nco.sourceforge.net/

Introduction and History

- Suite of Command Line Operators
- Designed to operate on netCDF/HDF files
- Each is a stand alone executable
- Very efficient for specific tasks
- Available for various computer architectures:
  - Solaris, Irix, AIX, Linux, Windows

Appending vs. Concatenation

- Appending is the merging of files:

  file1 = T,U,V

  file2 = PSI,CHI

  file3 = T,U,V,PSI,CHI

- Concatenation is the combination of variables along a record dimension:
  - file 1 = T(0:12,:,:)
  - file 2 = T(13:24,:,:)
  - concatenated file = T (0-24,:,:)

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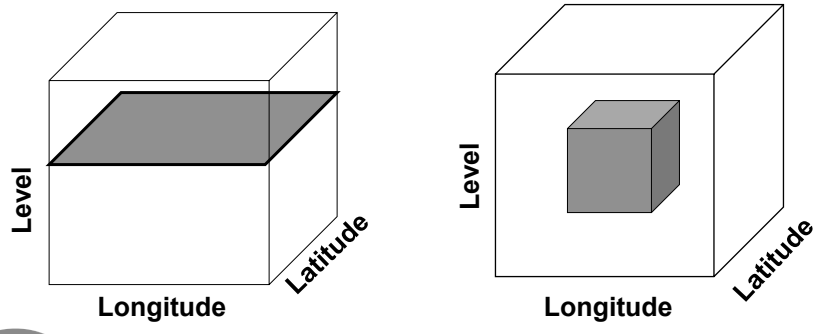
Hyperslabs

A hyperslab is a subset of data.



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Missing Values

- NCO identifies missing data by the **_FillValue** attribute. [v 3.9.2 8/2007]
- No arithmetic operations on these values.
- No longer recognizes **missing_value**
- Best to create netCDF with both **_FillValue** and **missing_value**

ncra: record averaging

- Averages record variables across an arbitrary number of input files
- The record dimension is retained as a degenerate (size 1) dimension.
- Weights each record in the input files equally
- **ncra 12.nc 01.nc 02.nc DJF.nc**

ncecat: ensemble concatenator

- Concatenates an arbitrary number of input files into a single output file. Wild characters allowed.
- Each input file is stored consecutively as a single record in the output file.
- Input files are glued together by the creation of a record dimension.
- **ncecat case-1.nc case-2.nc total.nc**
- **ncecat case*nc TOTAL.nc**

ncrcat: record concatenator

- Concatenates record variables across an arbitrary number of input files. Unix wild characters allowed
- Final record dimension is the sum of the lengths of the input files.
- Input files may vary in length, but **EACH** must have an **UNLIMITED** record dimension.
  - file1.nc ({time:1:12},:,:)
  - file2.nc ({time:13:24},:,:)
  - **ncrcat -h -O file1.nc file2.nc concat.nc**
  - concat.nc ({time:1:24},:,:)
  - **ncrcat -h -O file*.nc CONCAT.nc**

ncdiff: differencer

- File1 - File2 = File3
- Common dimensions must be the same size.
- For anomalies, the time dimension of the mean file must be removed.
- File2 should be a subset of File1 if they are not identical
  - ncwa -0 -a time in.nc out.nc
- **ncdiff 001.nc 002.nc diff.nc**

ncwa: weighted average

- Averages variables in a single file over arbitrary dimensions
  - options for weights, masks and normalizations

ncatted: attribute editor

- **ncatted -a att-dsc in.nc** (works on only one file at a time)

  att-dsc = att-nm, var-nm, mode, att-type, attval(order dependent)

  att-nm: The name of the attribute to edit

  var-nm: The name of the variable to edit

  mode: d=delete, a=append, c=create, m=mod, o=overwrite

  att-type: f=float, d=double, l = long, s=short, c=char

  att-val: The new value

- **ncatted -a history,global,a,c,"Add text here" in.nc**

ncks: kitchen sink

- Extracts a subset of data from an input file
- Global attributes for that output file are overwritten.
- Variable will be overwritten if it already exists in output file
- If record dimension is different, then **ncks** will create a new record dimension.
- **ncks -O -v TS,V in.nc out.nc**

ncrename

- Renames variables (-v), dimensions (-d), attributes (-a)
- **ncrename -v p,pres –v t,T in.nc out.nc**
- **ncrename –a missing_value,_FillValue –a Zaire,Congo in.nc out.nc**
- **ncrename –d longitude,lon –v longitude,lon –v rh,rhum in.nc out.nc**

ncap, ncap2

- Arithmetic processors
- **ncap2 –s ‘x@valid_range=(min(x),max(x))’ in.nc out.nc**
- **ncap2 -s ‘lon=lon+180.0’ in.nc out.nc**

Options: “-A” and “-O”

- Append variables to output file if it exists
- **ncks -A -v T,U,V in.nc out.nc**

- Will overwrite output file if it exists
- **ncks -O -v T,U,V in.nc out.nc**

Options: “-v” and “-x –v”

- Operates on only those variables listed
- **ncks -v T,U,V in.nc out.nc**

- Operates on all variables EXCEPT those listed.
- **ncks -x -v CHI,PSI in.nc out.nc**

Options: “-d” and “-h”

- Operates on a hyperslab of data
- **ncks -d lon,340.,50. -d lat,10.,35. in.nc out.nc**
- Real numbers indicate actual coordinate values
- Integer numbers indicate array indexes

- Override automatic appending of the global history attribute with the NCO command issued (which can be very long)

Options: “-p” and “n”

- Indicates a non-local path to data
- **ncra -p /data/usr/ jan_84.nc jan_85.nc**
- **ncks –v T /SHEA/data/ -l ./ 95.nc T.nc**
- **ncks MSSPATH –l directory infile outfile**

- **ncra -n 5,2,1 jan_84.nc outname.nc**
- Construct 5 filenames identical to jan_84 except that the final two digits are suffix to be incremented by 1.

Options: “-R” and “r”

- Delete files retrieved from remote locations after they have been processed

- Prints current version of the operator

Options: “-c” and “-C”

- Ensures that coordinate variables are copied to any new files.
- This is the default.
- **ncks -c -v T,U,V in.nc out.nc**

- No coordinate variables are copied.
- Use this with caution, coordinate variables are very useful.
- **ncks -C -v T,U,V in.nc out.nc**