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,:,:)

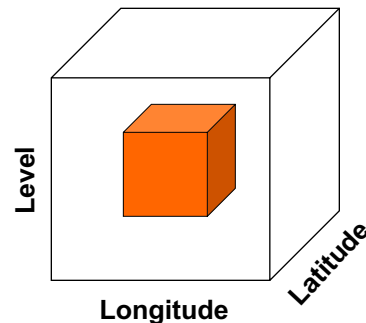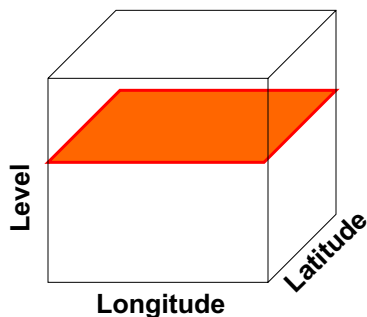 - file 2 = T(13:24,:,:)

  - concatenated file = T(0-24,:,:)

3

Hyperslabs

A hyperslab is a subset of data.

4

2

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**

5

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**

7

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**

8

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**

9

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**

12

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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**

13

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**

14

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**

15

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**

16

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**

17

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)

18

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.

19

Options: "-R" and "r"

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

- Prints current version of the operator

20

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**

21