



Tools

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netCDF data

- **Advantages of using netCDF?**

- Platform-independent (*big_endian* / *little_endian*)
- A lot of software already exist which can be used to process netCDF data

- **netCDF operators**

- <http://nco.sourceforge.net/>
- <http://www.gfdl.noaa.gov/products/vis/data/netcdf/>
- Stand alone programs to, which can be used to manipulate data (*performing grid point averaging / file differencing / file 'appending'*)

ncdump

- reads a netCDF dataset and prints information from the dataset

ncdump -h *file*

print header (inc. list of variables in the file)

```
netcdf wrfinput_d01 {  
dimensions:  
    Time = UNLIMITED ; // (1 currently)
```

```
    DateStrLen = 19 ;  
    west_east = 73 ;  
    south_north = 60 ;  
    west_east_stag = 74 ;  
    bottom_top = 27 ;  
    south_north_stag = 61 ;  
    bottom_top_stag = 28 ;  
    DIM0008 = 5 ;  
    soil_layers_stag = 5 ;
```

```
variables:
```

```
    char Times(Time, DateStrLen) ;  
    float LU_INDEX(Time, south_north, west_east) ;  
        LU_INDEX:FieldType = 104 ;  
        LU_INDEX:MemoryOrder = "XY " ;  
        LU_INDEX:description = "LAND USE CATEGORY" ;  
        LU_INDEX:units = "" ;  
        LU_INDEX:stagger = "" ;  
    float U(Time, bottom_top, south_north, west_east_stag) ;  
        U:FieldType = 104 ;  
        U:MemoryOrder = "XYZ" ;  
        U:description = "x-wind component" ;  
        U:units = "m s-1" ;  
        U:stagger = "X" ;
```

// global attributes:

```
:TITLE = " OUTPUT FROM REAL_EM V2.1.2 PREPROCESSOR";  
:START_DATE = "2000-01-24_12:00:00" ;  
:SIMULATION_START_DATE = "2000-01-24_12:00:00" ;  
:WEST-EAST_GRID_DIMENSION = 74 ;  
:SOUTH-NORTH_GRID_DIMENSION = 61 ;  
:BOTTOM-TOP_GRID_DIMENSION = 28 ;  
:DX = 30000.f ;  
:DY = 30000.f ;  
:GRIDTYPE = "C" ;  
:DYN_OPT = 2 ;  
:DIFF_OPT = 0 ;  
:KM_OPT = 1 ;  
:DAMP_OPT = 0 ;  
:KHDIF = 0.f ;  
:KVDIF = 0.f ;  
:MP_PHYSICS = 3 ;  
:RA_LW_PHYSICS = 1 ;  
:RA_SW_PHYSICS = 1 ;  
:SF_SFCLAY_PHYSICS = 1 ;  
:SF_SURFACE_PHYSICS = 1 ;  
:BL_PBL_PHYSICS = 1 ;  
:CU_PHYSICS = 1 ;  
:WEST-EAST_PATCH_START_UNSTAG = 1 ;  
:WEST-EAST_PATCH_END_UNSTAG = 73 ;  
:WEST-EAST_PATCH_START_STAG = 1 ;  
:WEST-EAST_PATCH_END_STAG = 74 ;
```

ncdump

- reads a netCDF dataset and prints information from the dataset

ncdump -v *VAR file*

print data of the variable VAR

ncdump -v Times *file*

.....

.....

.....

.....

data:

Times =

"2000-01-24_12:00:00",

"2000-01-24_18:00:00",

"2000-01-25_00:00:00",

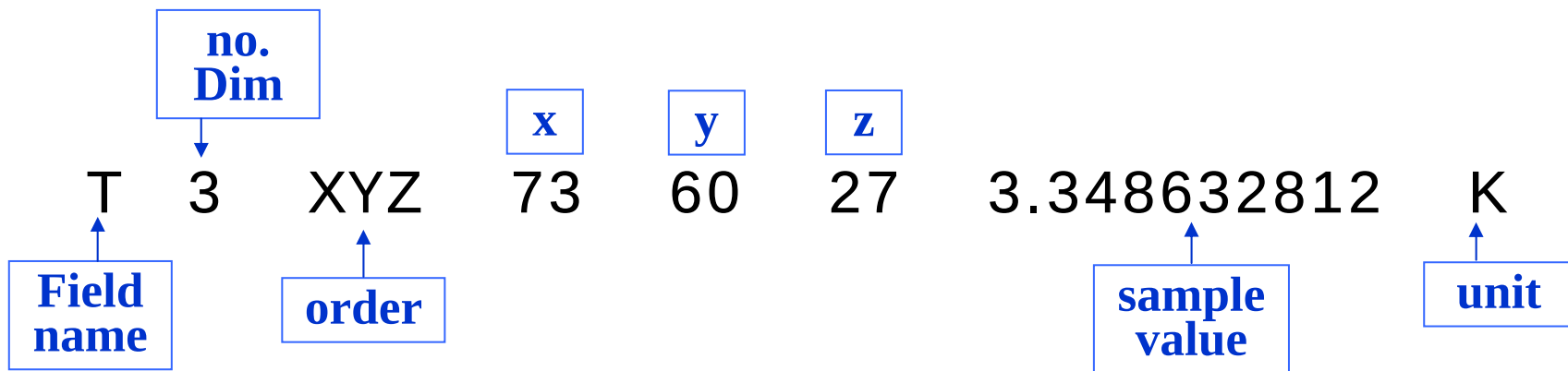
"2000-01-25_06:00:00" ;

}

read_wrf_nc

- Developed / Supported by NCAR
- FORTRAN program
 - Easy to use*
 - Easy to add your own code*

- Sample output



read_wrf_nc : Options

- att* Global Attributes
- m Min/Max values for each field
- M z Min/Max values for each field
(values for 3D fields @ z level)
- s List of available fields + a sample value
- S x y z List of available fields + value at point x y z
- times List of times in file
- t t1 t2* Act only on t1 to t2 (t2 optional)
- v VAR Basic information about field VAR
- V VAR Basic information about field VAR,
and dump the full field out to the screen
- w VAR Write the full field out to a file VAR.out
- diag* Add diagnostics tk, pressure, height
to any output option

read_wrf_nc : Options

- ts Time Series (*output TIMESERIES.out*)
xy X Y VAR VAR ...
xy lat lon VAR VAR ...
- lev z For a single vertical level (*time series*)
- rot Rotate winds (*time series*)

SPECIAL option : **-EditData VAR**

**User is responsible for adding the code
to the subroutine USER_CODE
(inside read_wrf_nc.f)**

iowrf

- **Read and Create netCDF files**

- **FORTRAN program**

Easy to use

Easy to add your own code

- **Options**

[-thina X]

Upscaling by averaging X grid points

[-thin X]

Upscaling with a X:1 ratio

[-box {}]

Extract a box from the data file.

X/Y/Z can be controlled

independently. e.g.,

-box x 10 30 y 10 30 z 5 15

-box x 10 30 z 5 15

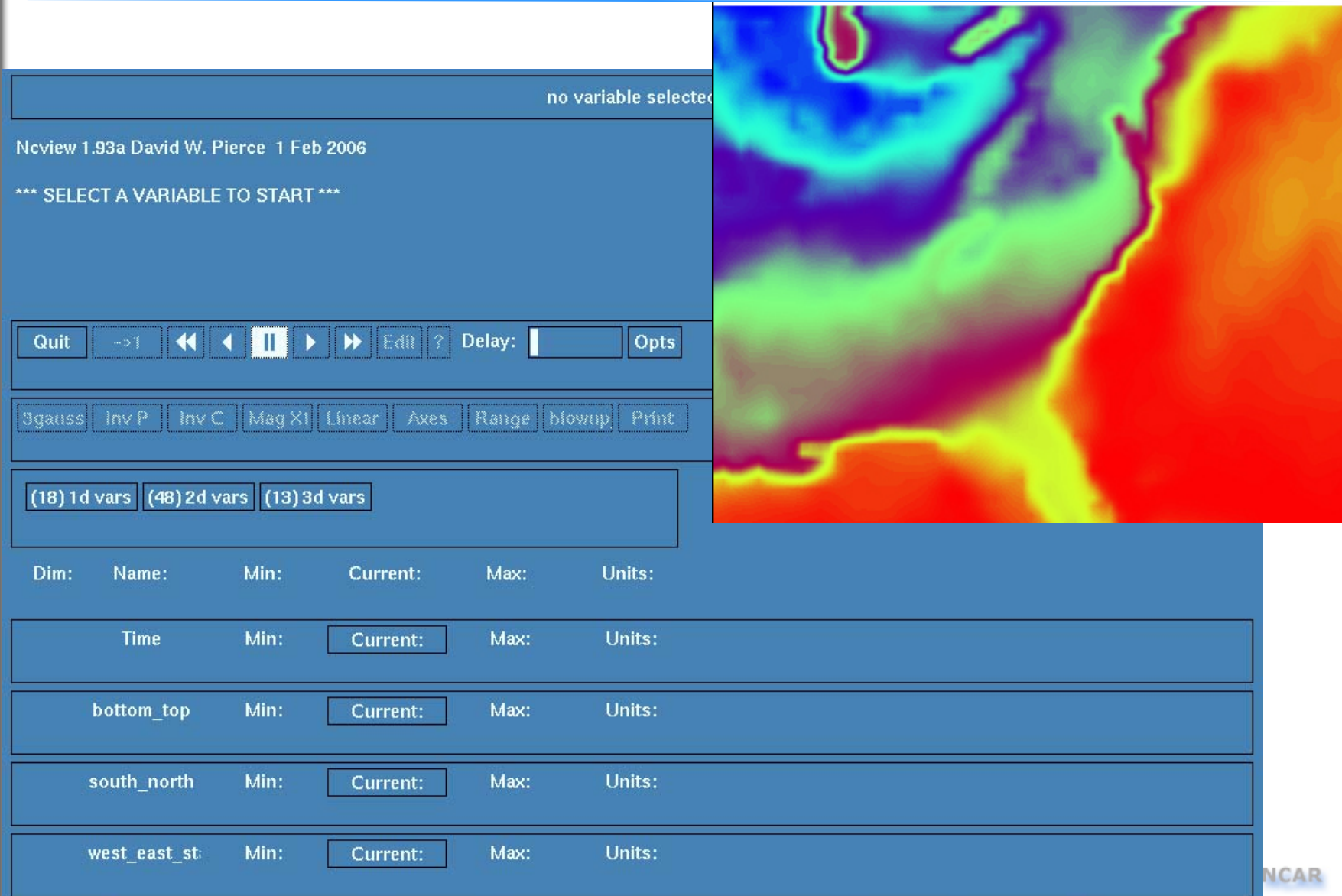
-box y 10 30

-box z 5 15

[-64bit]

If large (>2GB) will be created

ncview



other tools

- **ncdiff**

- **ncrcat**

- Write specified variables / times to a new file

```
ncrcat -v RAINNC wrfout* RAINNC.nc
```

```
ncrcat -d Time,0,231 -v RAINNC wrfout*  
RAINNC.nc
```

- **ncra**

- Average variables and write to a new file

```
ncra -v OLR wrfout* OLR.nc
```

GRIB data

- **g1print.exe & g2print.exe**
 - Show data available in GRIB1 & GRIB2 files
 - Available from util/ directory in WPS
- **grib2ctl.pl**
 - Create .ctl and .idx files, so one can plot GRIB files with GrADS (*available on web*)
- **wgrib**
 - wgrib -v file
 - wgrib -V file
 - <http://dss.ucar.edu/docs/formats/grib/gribdoc/>

GRIB data : wgrib

-s/-v	<i>short/verbose inventory</i>
-V	<i>diagnostic output</i>
-PDS/-PDS10	<i>print PDS in hex/decimal</i>
-GDS/-GDS10	<i>print GDS in hex/decimal</i>
-verf	<i>print forecast verification time</i>
-4yr	<i>print year using 4 digits</i>
-d [record no]	<i>decode record number</i>
-text/-ieee/ -grib/-bin	<i>convert to text/ieee/grib/bin</i>
-nh/-h	<i>output will have no headers/headers</i>
-H	<i>output will include PDS and GDS</i>
-append	<i>append to output file</i>
-o [file]	<i>output file name</i>

GRIB data : wgrib

122:3513554:D=2004123000:HGT:850

mb:kpds=7,100,850:anl:"Geopotential height [gpm]

123:3549446:D=2004123000:TMP:850

mb:kpds=11,100,850:anl:"Temp. [K]

125:3597364:D=2004123000:UGRD:850

mb:kpds=33,100,850:anl:"u wind [m/s]

126:3624306:D=2004123000:VGRD:850

mb:kpds=34,100,850:anl:"v wind [m/s]

5:152514:D=2004123000:TMP:2 m above

gnd:kpds=11,105,2:anl:"Temp. [K]

46:1242222:D=2004123000:SPFH:2 m above

gnd:kpds=51,105,2:anl:"Specific humidity [kg/kg]

Vtables

GRIB1 Param	Level Type	From Level1	To Level2	REGRID Name	REGRID Units	REGRID Description
11	100	*		T	K	Temperature
33	100	*		U	m s-1	U
34	100	*		V	m s-1	V
52	100	*		RH	%	Relative Humidity
7	100	*		HGT	m	Height
11	105	2		T	K	Temperature at 2 m
52	105	2		RH	%	Relative Humidity at 2 m

GRIB data

- **ncl_filedump**
generates an ASCII representation of a supported file (netCDF, HDF, GRIB) on the standard output
- **ncl_grib2nc**
translates a GRIB file that NCL can read and generates a netCDF formatted file supported file (netCDF, HDF, GRIB) on the standard output
- **<http://www.ncl.ucar.edu/Document/Tools>**

More tools

- **WPS util / directory**

- plotfmt.exe
graphical interface for intermediate file
- plotgrids.exe
*quick look at domains you want to create
(reads namelist information to generate plot)*

Graphics

- **ncgm2gif**

- <http://ngwww.ucar.edu/info/ncgm2gif>
- Can split into separate images
- Can create loops and movies (*not very good quality*)
- Optional libraries
 - gifmerge
(<http://the-labs.com/GIFMerge/>)
 - gifsicle
(<http://www.lcdf.org/~eddi/two/gifsicle/>)

Graphics: Magick & ctrans

- **.pdf**

```
convert hur_track.pdf hur_track.png  
convert hur_track.pdf hur_track.gif
```

- **.ncgm**

```
ctrans -d sun hur_track.ncgm >  
hur_track.ras  
convert hur_track.ras hur_track.png
```

Domain Wizard

- **GUI to create model domain and run WPS executables**
 - Created by Paula McCaslin - paula.mccaslin@noaa.gov and Jeff Smith - jeff.s.smith@noaa.gov (NOAA)
- **Tutorials and code are available from:**
<http://www.wrfportal.org/tutorial.html>
<http://www.wrfportal.org/DomainWizard.html>
- **Suggestion** – if you are interested in using Domain Wizard, **first get familiar with WPS by running it manually**
- **Currently MPI options not recommend**