File Formats and Pre-Processing

- File Formats
- Pre-processing Tools
- Useful Links

FILE FORMATS

Supported File Formats

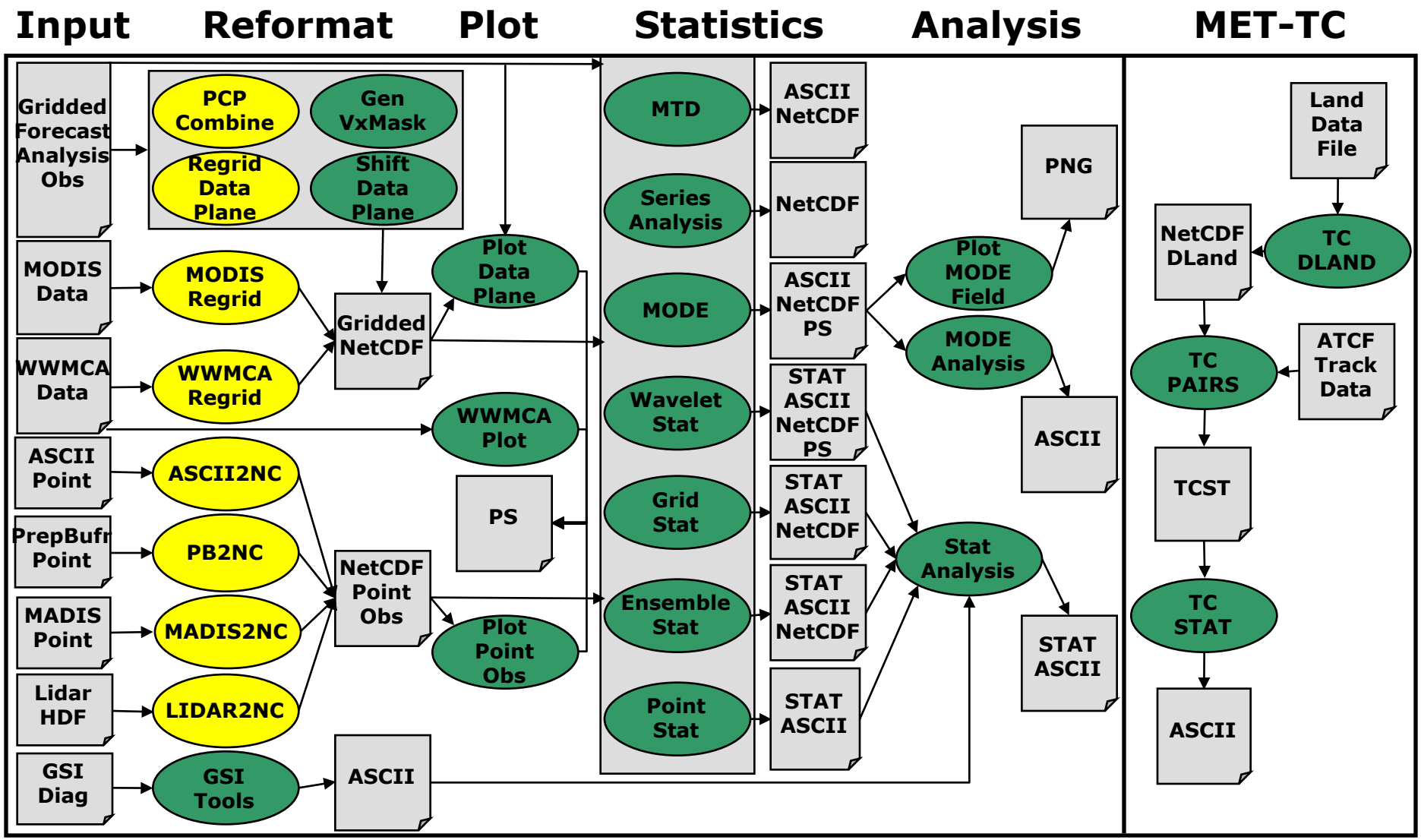
- **Forecasts**
  - **GRIB1** – GRIdded Binary file
  - **GRIB2** – GRIB version 2 disabled by default (***--enable-grib2***)
  - **NetCDF** – Output from wrf_interp WRF-ARW utility, CF-Compliant versions 3 and 4, and internal MET NetCDF format
- **Gridded Analyses**
  - Same as Forecast file formats
  - GRIB Stage II/IV, MRMS, URMA, Model Analyses
  - **WWMCA** – World Wide Merged Cloud Analysis
  - **TRMM** – Tropical Rainfall Measuring Mission
  - **MODIS** – Moderate-Resolution Imaging Spectroradiometer
- **Point Observations**
  - **PREPBUFR** – binary data assimilation product (NDAS or GDAS)
  - **ASCII** – "MET specific" 11-column, little-r, SURFRAD, WWSIS, Aeronet
  - **MADIS** – Metar, Raob, Profiler, Maritime, Mesonet, or acarsProfiles
  - **LIDAR** - CALIPSO

Data Inventory Tools

- **wgrib** – dumps GRIB1 headers and data.
  - http://www.cpc.ncep.noaa.gov/products/wesley/wgrib.html
- **wgrib2** – dumps GRIB2 headers and data.
  - http://www.cpc.ncep.noaa.gov/products/wesley/wgrib2/
- **ncdump -** dumps NetCDF headers and data.
  ncview – plots gridded NetCDF data.
  - http://www.unidata.ucar.edu/software/netcdf/
- **GrADS** – command line interface to produce plots.
  - http://www.iges.org/grads/downloads.html
- **NCL** – command line interface to produce plots.
  - http://www.ncl.ucar.edu/
- **IDV** – gui-driven visualization of many gridded and point datasets.
  - http://www.unidata.ucar.edu/software/idv/

PRE-PROCESSING TOOLS

Pre-Processing / Reformatting



Data Reformating Tools

- **PB2NC, ASCII2NC, MADIS2NC, LIDAR2NC**
  - Reformat point observations to the NetCDF format expected by Point-Stat and Ensemble-Stat.
- **MODIS_Regrid, WWMCA_Regrid**
  - Regrid HDF MODIS or binary WWMCA observations to the gridded NetCDF format expected by the MET statistics tools.
- **Regrid_Data_Plane**
  - Regrid one or more gridded data fields to user-specified grid.
- **PCP_Combine**
  - Add, subtract, or sum precipitation values across multiple gridded data files and write to the gridded NetCDF format expected by the MET statistics tools.

PB2NC

1. PB2NC Tool

- **Stands for "PREPBUFR to NetCDF"**
- **Functionality:**
  - Filters and reformats binary PREPBUFR and BUFR point observations into intermediate NetCDF format.
  - Configuration file specifies:
    - Observation types, variables, locations, elevations, quality marks, and times to retain or derive for use in Point-Stat or Ensemble-Stat.
- **Data formats:**
  - Reads PREPBUFR and BUFR using NCEP's BUFRLIB.
  - Writes point NetCDF as input to Point-Stat or Ensemble-Stat.

PB2NC

PREPBUFR

- **BUFR** is the World Meteorological Organization (WMO) standard binary code for the representation and exchange of observational data.
  - http://www.nco.ncep.noaa.gov/sib/decoders/BUFRLIB/
  - http://www.ecmwf.int/products/data/software/
- The **PREPBUFR** format is produced by NCEP for analyses and data assimilation. The system that produces this format:
  - Assembles observations dumped from a number of sources
  - Encodes
    - information about the observational error for each data type
    - background (first guess) interpolation for each data location
  - Performs both rudimentary multi-platform quality control and more complex platform-specific quality control
  - North American and Global datasets
- Only works with NCEP datasets with embedded tables.
- Support for external BUFR tables coming soon.

PB2NC: Usage

Usage: pb2nc

prepbufr_file

netcdf_file

config_file

[-pbfile prepbufr_file]

[-valid_beg time]

[-valid_end time]

[-nmsg n]

[-index]

[-dump path]

[-log file]

[-v level]

[-compress level]

prepbufr_file	**Input PrepBufr file name**
netcdf_file	**Output NetCDF file name**
config_file	**PB2NC configuration file**
-pbfile	**Additional input PrepBufr files**
-valid_beg -valid_end	**Beginning/Ending of valid time window** [YYYYMMDD_[HH[MMSS]]
-nmsg	**Number of PrepBufr messages to process**
-index	**Lists available BUFR variables**
-dump	**Dump entire contents o PrepBufr file to file in path**
-log	**Output file for log messages**
-v	**Level of logging**
-compress	**Compression level**

PB2NC: Run

- **met-6.1/bin/pb2nc** \
  ndas.t00z.prepbufr.tm12.20070401.nr \
  out/tutorial_pb.nc PB2NCConfig_tutorial -v 2

Q: What obs are in a PREPBUFR file?

A: Use "-index" option in PB2NC

>/usr/local/met-6.1/bin/pb2nc nam.20120410.t12z.prepbufr.tm00.nr pb2nc_test.nc /usr/local/met-6.1/share/met/config/PB2NCConfig_default -index

```
DEBUG 1:    Header variables:
DEBUG 1:      SID: STATION IDENTIFICATION
DEBUG 1:      XOB: LONGITUDE
DEBUG 1:      YOB: LATITUDE
DEBUG 1:      DHR: OBSERVATION TIME MINUS CYCLE TIME
DEBUG 1:      ELV: STATION ELEVATION
DEBUG 1       TYP: PREPBUFR REPORT TYPE
DEBUG 1:      T29: DATA DUMP REPORT TYPE
DEBUG 1:      ITP: INSTRUMENT TYPE
DEBUG 1:
DEBUG 1:    Observation variables:
DEBUG 1:      QOB: SPECIFIC HUMIDITY OBSERVATION          types: ADPUPA  AIRCFT  SATWND  PROFLR  VADWND  ADPSFC
DEBUG 1:      TOB: TEMPERATURE OBSERVATION                types: ADPUPA  AIRCFT  SATWND  PROFLR  VADWND  ADPSFC  SFCSHP
DEBUG 1:      ZOB: HEIGHT OBSERVATION                     types: ADPUPA  ADPSFC  SFCSHP
DEBUG 1:      UOB: U-COMPONENT WIND OBSERVATION           types: ADPUPA  AIRCFT  ADPSFC  SFCSHP  RASSDA
DEBUG 1:      VOB: V-COMPONENT WIND OBSERVATION           types: ADPUPA  AIRCFT  ADPSFC  SFCSHP  RASSDA
DEBUG 1:      CLTP: CLOUD TYPE                            types: AIRCFT  ADPSFC
DEBUG 1:      CLAM: CLOUD AMOUNT                          types: ADPUPA  AIRCFT  ADPSFC  SFCSHP
```

2. ASCII2NC Tool

- **Stands for "ASCII to NetCDF"**
- **Functionality:**
  - Reformat ASCII point observations into intermediate NetCDF format.
  - Multiple input ASCII formats supported (11-column, little-r, SURFRAD, WWSIS, and Aeronet).
  - Configuration file optional to define time summaries and message type mappings for little-r.
- **Data formats:**
  - Reads various input formats and writes point NetCDF as input to Point-Stat and Ensemble-Stat.
- ***Support for additional standard ASCII formats may be added as time and funding allow.***

ASCII2NC: Usage

Usage: ascii2nc

ascii_file

netcdf_file

[-format ascii_format]

[-config file]

[-mask_grid string]

[-mask_poly file]

[-mask_sid file|list]

[-log file]

[-v level]

[-compress level]

ascii_file	**Input ASCII file name**
netcdf_file	**Output NetCDF file name**
-format string	**met_point, little_r, surfrad, wwsis, aeronet**
-config file	**Optional configuration file name**
-mask_grid string	**Retain points within a named grid or gridded data file.**
-mask_poly file	**Retain points within a lat/lon polyline.**
-mask_sid file|list	**Retain a list of station ID's.**

ASCII2NC

MET-Point ASCII Format

Msg	STID	ValidTime	Lat	Lon	Elev	Var	Lvl	Hgt	QC	Ob	Ob assigns value to variable
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**7**	837.0	1618	NA	**1618**	***HGT**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**11**	837.0	1618	NA	**273.05**	***TMP**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**17**	837.0	1618	NA	**271.85**	***DPT**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**52**	837.0	1618	NA	**92**	***RH**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**53**	837.0	1618	9	**0.00417**	***MixRat**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**7**	826.0	1724	2	**1724**	***HGT**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**11**	826.0	1724	3	**274.55**	****TMP**

* *Use a value of "-9999" to indicate missing data*

Msg	**Message type**
STID	**Station ID**
ValidTime	**Valid time for observation**
Lat	**Latitude** [North]
Lon	**Longitude** [East]
Elev	**Elevation** [m] *(Note: currently not used by MET code so can be filled with -9999.)*
Var	**GRIB code or variable name** ***(i.e. AccPrecip or 61, MSLP or 2, Temp or 11, etc…)*** http://www.cpc.ncep.noaa.gov/products/wesley/opn_gribtable.html
Lvl	**Pressure** [mb] or **Accumulation Interval** [hr]
Hgt	**Height (MSL or AGL)**
QC flag	Quality control flag value
Ob	**Observed value**

ASCII2NC

MET-Point ASCII Format

Msg	STID	ValidTime	Lat	Lon	Elev	Var	Lvl	Hgt	QC	Ob
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**HGT**	837.0	1618	NA	**1618**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**TMP**	837.0	1618	NA	**273.05**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**DPT**	837.0	1618	NA	**271.85**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**RH**	837.0	1618	NA	**92**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**MIXR**	837.0	1618	9	**0.00417**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**HGT**	826.0	1724	2	**1724**
ADPUPA	72365	20070331_120000	35.03	-106.62	1618.0	**TMP**	826.0	1724	3	**274.55**

* *Use a value of "-9999" to indicate missing data*

Msg	**Message type**
STID	**Station ID**
ValidTime	**Valid time for observation**
Lat	**Latitude** [North]
Lon	**Longitude** [East]
Elev	**Elevation** [m] *(Note: currently not used by MET code so can be filled with -9999.)*
Var	**GRIB code or variable name** ***(i.e. AccPrecip or 61, MSLP or 2, Temp or 11, etc…)*** http://www.cpc.ncep.noaa.gov/products/wesley/opn_gribtable.html
Lvl	**Pressure** [mb] or **Accumulation Interval** [hr]
Hgt	**Height (MSL or AGL)**
QC flag	Quality control flag value
Ob	**Observed value**

ASCII2NC: Run

- **met-6.1/bin/ascii2nc** sample_obs.txt sample_ascii.nc -v 2

```
netcdf sample_ascii {
dimensions:
        mxstr = 15 ;
        hdr_arr_len = 3 ;
        obs_arr_len = 5 ;
        nhdr = 5 ;
        nobs = UNLIMITED ; // (2140 currently)
variables:
        char hdr_typ(nhdr, mxstr) ;
                hdr_typ:long_name = "message type" ;
        char hdr_sid(nhdr, mxstr) ;
                hdr_sid:long_name = "station identification" ;
        char hdr_vld(nhdr, mxstr) ;
                hdr_vld:long_name = "valid time" ;
                hdr_vld:units = "YYYYMMDD_HHMMSS UTC" ;
        float hdr_arr(nhdr, hdr_arr_len) ;
                hdr_arr:long_name = "array of observation station header values" ;
                hdr_arr:_fill_value = -9999.f ;
                hdr_arr:columns = "lat lon elv" ;
                … ;
        float obs_arr(nobs, obs_arr_len) ;
                obs_arr:long_name = "array of observation values" ;
                obs_arr:_fill_value = -9999.f ;
                obs_arr:columns = "hdr_id gc lvl hgt ob" ;
                obs_arr:hdr_id_long_name = "index of matching header data" ;
                … ;
```

Result of ncdump –h

Result of ncdump –v obs_arr

```
obs_arr =
 0, 7, 837, 1618, 1618,
 1, 11, 837, 1618, 273.05,
 2, 17, 837, 1618, 271.85,
 3, 52, 837, 1618, 92,
 4, 53, 837, 1618, 0.00417,
 5, 7, 826, 1724, 1724,
 6, 11, 826, 1724, 274.55,
 7, 17, 826, 1724, 272.15,
 8, 52, 826, 1724, 84,
 9, 53, 826, 1724, 0.00432,
 10, 7, 815.3, 1829, 1829,
 11, 11, 815.3, 1829, 276.45,
 12, 17, 815.3, 1829, 265.75,
 13, 52, 815.3, 1829, 45,
 14, 53, 815.3, 1829, 0.0027,
 15, 7, 815, 1832, 1832,
 16, 11, 815, 1832, 276.55,
 17, 17, 815, 1832, 265.55,
 18, 52, 815, 1832, 44,
 19, 53, 815, 1832, 0.00266,
 20, 7, 784.7, 2134, 2134,
 21, 11, 784.7, 2134, 274.05,
 22, 17, 784.7, 2134, 264.15,
 23, 52, 784.7, 2134, 47,
…
```

3. MADIS2NC Tool

- **Stands for "MADIS to NetCDF"**
- **Functionality:**
  - Reformat MADIS point observations into intermediate NetCDF format.
  - No configuration file.
- **Data formats:**
  - Reads MADIS METAR, ROAB, Profiler, Maritime, Mesonet, or acarsProfiles types.
  - Writes point NetCDF as input to Point-Stat or Ensemble-Stat.

MADIS2NC: Usage

Usage: madis2nc

madis_file

out_file

-type str

[-qc_dd list]

[-lvl_dim list]

[-rec_beg n]

[-rec_end n]

[-mask_grid string]

[-mask_poly file]

[-mask_sid file|list]

[-log file]

[-v level]

[-compress level]

madis_file	**Input MADIS NetCDF file name**
out_file	**Output NetCDF file name**
-type str	**metar, raob, profiler, maritime, mesonet, or acarsProfiles**
-qc_dd list	**QC flag values to be accepted (Z,C,S,V,X,Q,K,G,B)**
-lvl_dim list	**Vertical level dimensions to be processed**
-rec_beg n	**First MADIS record to process**
-rec_end n	**Last MADIS record to process**
-mask_grid string	**Retain points within a named grid or gridded data file.**
-mask_poly file	**Retain points within a lat/lon polyline.**
-mask_sid file|list	**Retain a list of station ID's.**

MADIS2NC: Run

- **met-6.1/bin/madis2nc** \
  profiler_20150409_1800.nc test.nc -type profiler -v 2

```
DEBUG 1: Reading MADIS File:        profiler_20120409_1800.nc
DEBUG 1: Writing MET File:          test.nc
DEBUG 2: Processing PROFILER recs   = 22
DEBUG 2: Rejected based on QC       = 0
DEBUG 2: Rejected based on fill     = 1674
DEBUG 2: Retained or derived        = 1494
```

Result of ncdump –v obs_arr →

```
obs_arr =
 0 , 33 , -9999 , 1000 , -0.6316155 ,
 0 , 34 , -9999 , 1000 , -0.9334552 ,
 0 , 33 , -9999 , 1250 , -0.4383373 ,
 0 , 34 , -9999 , 1250 , 1.078402 ,
 0 , 33 , -9999 , 2250 , 1.004951 ,
 0 , 34 , -9999 , 2250 , -0.9307967 ,
 0 , 33 , -9999 , 2500 , 0.9661151 ,
 0 , 34 , -9999 , 2500 , -1.082675 ,
 0 , 33 , -9999 , 3750 , 6.587607 ,
 0 , 34 , -9999 , 3750 , -8.664121 ,
 1 , 33 , -9999 , 500 , 0.2172839 ,
 1 , 34 , -9999 , 500 , -2.199575 ,
 1 , 33 , -9999 , 750 , -0.242378 ,
 1 , 34 , -9999 , 750 , -1.682394 ,
 1 , 33 , -9999 , 1000 , 0.2787634 ,
 1 , 34 , -9999 , 1000 , -1.51813 ,
 1 , 33 , -9999 , 1250 , 2.726679 ,
 1 , 34 , -9999 , 1250 , -1.324189 ,
 1 , 33 , -9999 , 1500 , 4.239741 ,
 1 , 34 , -9999 , 1500 , -1.897019 ,
 1 , 33 , -9999 , 1750 , 3.581409 ,
 1 , 34 , -9999 , 1750 , -5.975054 ,
```

Regrid Data Plane

4. Regrid_Data_Plane Tool

- **Functionality:**
  - Stand-alone tool implementing the automated regridding capability of the MET statistics tools.
  - Extract one or more user-specified fields from the input data file.
  - Regrid to the output grid using the specified interpolation method and width.
  - No configuration file.
- **Data formats:**
  - Reads any MET supported gridded data file (i.e. GRIB1/2 and flavors of NetCDF).
  - Writes gridded NetCDF as input to the MET statistics tools.

Regrid Data Plane

Regrid-Data-Plane: Usage

Usage: regrid_data_plane

input_filename
to_grid
output_filename
-field string
[-method type]
[-width n]
[-shape type]
[-vld_thresh n]
[-name list]
[-log file]
[-v level]
[-compress level]

input_filename	Input gridded data file name
to_grid	Output grid as a named grid, gridded data file, or grid specification
output_filename	Output NetCDF file name
-field string	Input field configuration string (may be used multiple times)
-method type	Interpolation method
-shape type	Interpolation shape (SQUARE or CIRCLE)
-width n	Interpolation width
-vld_thresh n	Interpolation required valid data ratio
-name list	Output NetCDF variable name(s)

Regrid Data Plane

Regrid-Data-Plane: Run

- **met-6.1/bin/regrid_data_plane** \
  in.grb G212 tmp_p500_G212.nc \
  -field ‘name=“TMP”; level=“P500”;’
- **met-6.1/bin/regrid_data_plane** \
  in.grb gfs.t06z.pgrb2full.0p50.f078 \
  surface_winds.nc \
  -field ‘name=“UGRD”; level=“Z10”;’ \
  -field ‘name=“VGRD”; level=“Z10”;’ \
  -field ‘name=“WIND”; level=”Z10”;’ \
  -name UWind,VWind,WindSpeed

PCP Combine

5. PCP-Combine Tool

- **Stands for "Precip-Combine"**
- **Functionality:**
  - Mathematically combines precipitation fields across multiple files.
    - Add precipitation over 2 files
      - *2 NMM output files to go from 3-hr to 6-hr accumulation.*
    - Sum precipitation over more than 2 files
      - *12 WSR-88D Level II data to go from 5 min accumulation to 1-hr accumulation.*
    - Subtract precipitation in 2 files
      - *2 ARW output files to go from 12 hr accumulations to 6 hour accumulation*
  - Specify field name on the command line.
  - No configuration file.
- **Data formats:**
  - Reads GRIB1, GRIB2, or pinterp or CF compliant NetCDF format.
  - Writes gridded NetCDF as input to stats tools.

PCP-Combine: Usage

Usage: pcp_combine

[-sum sum_args]

or [-add add_args]

or [-subtract sub_args]

[-field string]

[-name variable_name]

[-log file]

[-v level]

[-compress level]

-sum	**Accumulates data over multiple files.** ***Sum_args***: (init_time, in_accum, valid_time, out_accum, out_file, -pcpdir path, -pcprx reg_exp)
-add	**Accumulates data over two files.** ***Add_args:*** (in_file1, Accum1, in_file2, Accum2, out_file).
-subtract	**Subtracts data over two files.** ***Sub_args:*** (in_file1, Accum1, in_file2, Accum2, out_file).
-field	**Defines the data to be extracted from the input files.**
-name	**Name of combined variable in output NetCDF file.**

PCP-Combine: Sum

- **Two examples of the –sum option**

1) Sum two 6-hourly accumulation forecast files into a single 12-hour accumulation forecast.

***met-6.1/bin/pcp_combine ***
-sum 20050807_000000 6 20050807_120000 12
sample_fcst.nc -pcpdir data/2005080700

2) Summing 12 1-hourly accumulation observation files into a single 12-hour accumulated observation.

***met-6.1/bin/pcp_combine ***
*-sum 00000000_000000 1 *
*20050807_120000 12 *
sample_obs.nc -pcpdir data/ST2ml

PCP Combine

PCP-Combine: Add and Subtract

- Use -**add** option for already binned precipitation:
  - Adding two 6-hourly accumulation forecast files into a single 12-hour accumulation forecast.

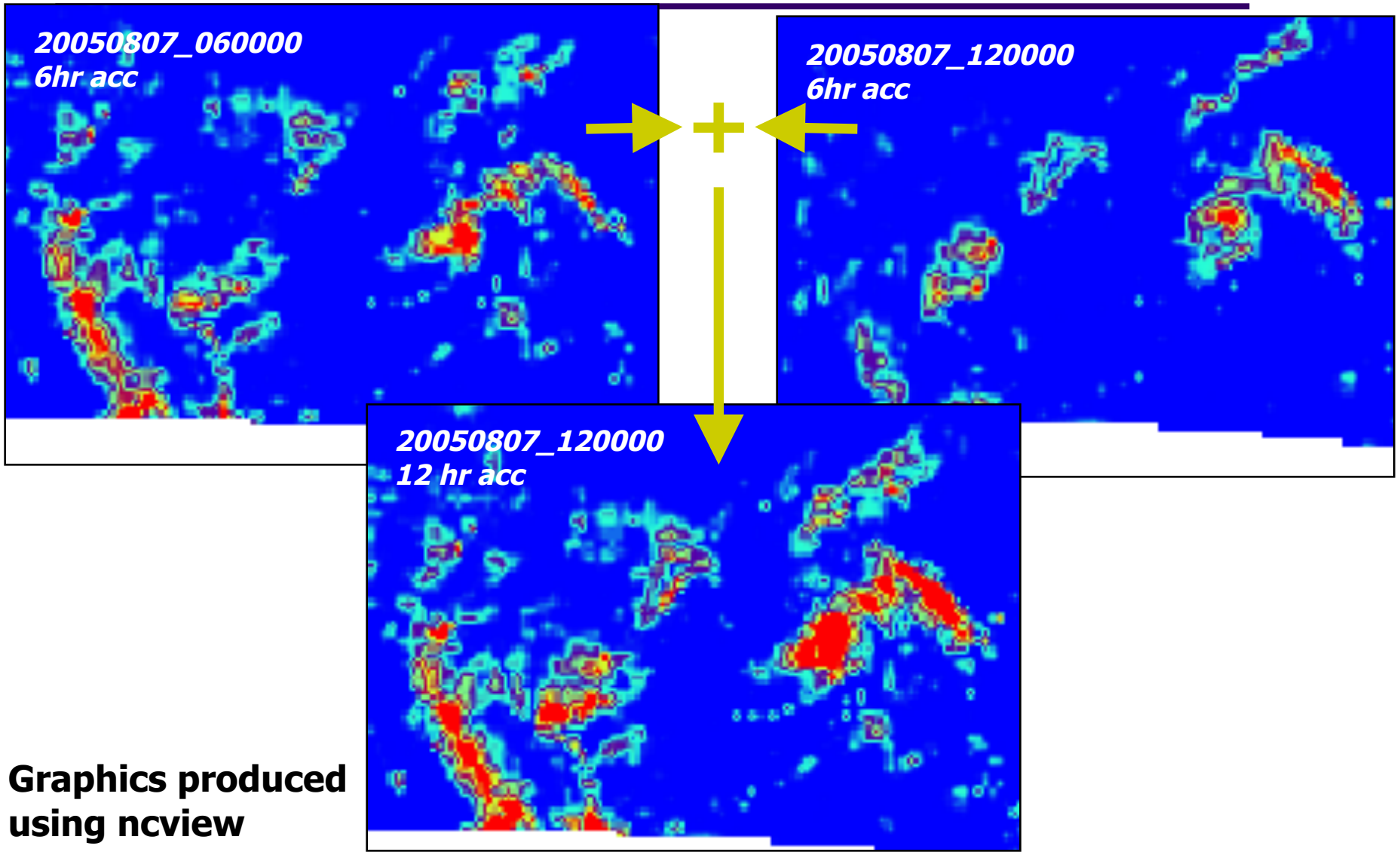
    ***met-6.1/bin/pcp_combine –add ***
    *20050807_060000.grb 6 *
    *20050807_120000.grb 6 *
    APCP_12_20050807_120000.nc

- Use -**subtract** option for “runtime” accumulations:
  - Subtract 36 hour accumulation minus 12 hour accumulation for 24 hours in between.

    ***met-6.1/bin/pcp_combine –subtract ***
    *nam_2012040900_F036.grib 36 *
    *nam_2012040900_F012.grib 12 *
    nam_2012040900_F036_APCP_24.nc

PCP Combine

PCP-Combine: Example #1



Graphics produced using ncview

SPECIALIZED SATELLITE PRE-PROCESSING TOOLS

MODIS Regrid

6. MODIS-Regrid Tool

- **Depends on HDF4/HDFEOS libraries.**
- **Compilation disabled by default *(--enable-modis*)**
- **Functionality:**
  - Reformat MODIS satellite observations into intermediate NetCDF format.
  - No configuration file.

- **Data formats:**
  - Reads MODIS level 2 data.
  - Writes gridded NetCDF as input to the MET statistics tools.

MODIS Regrid

MODIS-Regrid: Usage

Usage: modis_regrid

-data_file path

-field name

-out path

-scale value

-offset value

-fill value

[-units text]

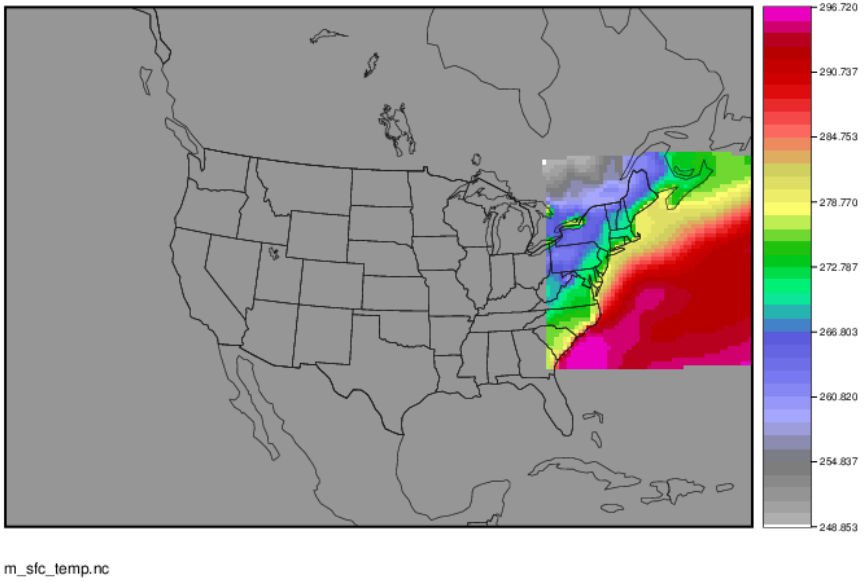
[-compress level]

modis_file

-data_file path	Gridded data file defining output grid
-field name	Field to process in MODIS file, e.g. temperature
-out path	Output NetCDF file name
-scale value	Scale factor to use
-offset value	Offset factor
-fill value	Bad data value
-units text	Units string to be written to the output file
modis_file	Input file MODIS file name

MODIS-Regrid: Run

- **met-6.1/bin/modis_regrid** -field Cloud_Fraction \
  -data_file grid_file -out t2.nc \
  -units percent -scale 0.01 -offset 0 -fill 127 \
  ~/modis_regrid_test_data/modisfile



WWMCA Regrid

7. WWMCA-Regrid Tool

- **Functionality:**
  - Reformat Air Force binary World Wide Merged Cloud Analysis into intermediate NetCDF format.
  - Configuration file required to define regridding logic, output variables, and pixel age information.
- **Data formats:**
  - Reads binary WWMCA files.
  - Writes gridded NetCDF as input to the MET statistics tools.

WWMCA-Regrid: Usage

Usage: wwmca_regrid

-out filename

-config filename

-nh filename

[pt_filename]

-sh filename

[pt_filename]

[-log file]

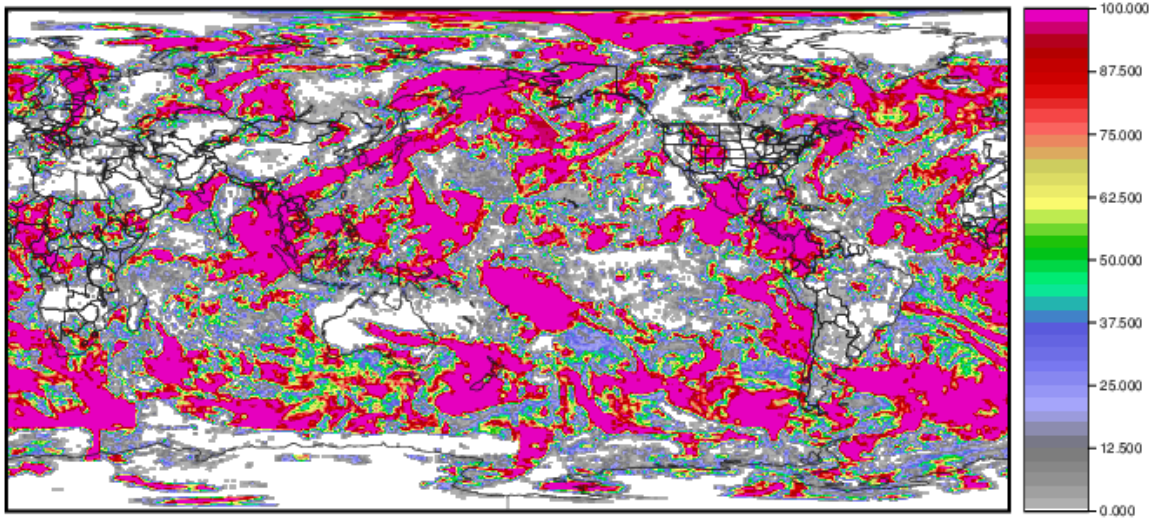
[-v level]

[-compress level]

-out filename	Output NetCDF file name
-config filename	Configuration file name
-nh filename	Northern Hemisphere data file
-sh filename	Southern Hemisphere data file
[pt_filename]	Pixel time files for the Northern and Southern hemispheres to mask data by pixel age

WWMCA-Regrid: Run

- **met-6.1/bin/wwmca_regrid** \
  -config WWMCARegridConfig \
  -nh WWMCA_TOTAL_CLOUD_PCT_NH_2009083005 \
  -sh WWMCA_TOTAL_CLOUD_PCT_SH_2009083005 \
  -out WWMCA_TOTAL_CLOUD_PCT_2009083005_GFS_LATLON.nc \
  -v 2



WWMCA_TOTAL_CLOUD_PCT_2009083005_GFS_LATLON.nc

LIDAR2NC

8. LIDAR2NC Tool

- **Stands for "LIDAR to NetCDF"**
- **Depends on HDF4/HDFEOS libraries.**
- **Compilation disabled by default *(--enable-lidar2nc*)**
- **Functionality:**
  - Reformat LIDAR point observations into intermediate NetCDF format.
  - No configuration file.
- **Data formats:**
  - Reads CALIPSO Lidar data.
  - Writes point NetCDF as input to Point-Stat or Ensemble-Stat.
- ***Support for additional LIDAR formats may be added as time and funding allow.***

LIDAR2NC: Usage

Usage: lidar2nc

lidar_file

-out out_file

[-log file]

[-v level]

[-compress level]

lidar_file	**Input LIDAR HDF file name**
-out out_file	**Output NetCDF file name**

LIDAR2NC: Run

- **met-6.1/bin/lidar2nc** \
  CAL_LID_L2_05kmCLay-Prov-V3-40.2016-12-01T01-24-58ZN.hdf \
  -out CAL_LID_L2_05kmCLay-Prov-V3-40.2016-12-01T01-24-58ZN.nc

```
DEBUG 1: Processing Lidar File:   data/lidar_data/CAL_LID_L2_05kmCLay-Prov-V3-40.2016-12-01T01-24-58ZN.hdf
DEBUG 1: Writing MET File:        tutorial/out/lidar2nc/CAL_LID_L2_05kmCLay-Prov-V3-40.2016-12-01T01-24-58ZN.nc
DEBUG 2: Processing Lidar points = 3728
```

```
obs_arr =
 0, 500, _, 0, 1,
 0, 501, 995.6906, 142.5747, 142.5747,
 0, 502, 865.9296, 1160.472, 1160.472,
 0, 503, 995.6906, 142.5747, 0,
 0, 504, 995.6906, 142.5747, 100,
 0, 601, 995.6906, 142.5747, 2,
 0, 602, 995.6906, 142.5747, 0,
 0, 603, 995.6906, 142.5747, 0,
 0, 604, 995.6906, 142.5747, 3,
 0, 600, 995.6906, 142.5747, 2,
 0, 601, 995.6906, 142.5747, 2,
 0, 505, 995.6906, 142.5747, 142.5747,
 0, 506, 865.9296, 1160.472, 1160.472,
 1, 500, _, 0, 1,
 1, 501, 999.7334, 112.6365, 112.6365,
 1, 502, 862.3634, 1190.41, 1190.41,
 1, 503, 999.7334, 112.6365, 0,
 1, 504, 999.7334, 112.6365, 100,
 1, 601, 999.7334, 112.6365, 2,
 1, 602, 999.7334, 112.6365, 0,
 1, 603, 999.7334, 112.6365, 0,
```

Table 4.5: lidar2nc GRIB codes and their meaning, units, and abbreviations

GRIB Code	Meaning	Units	Abbreviation
500	Number of Cloud Layers	NA	NLayers
501	Cloud Layer Base AGL	m	Layer_Base
502	Cloud Layer Top AGL	m	Layer_Top
503	Cloud Opacity	%	Opacity
504	CAD Score	NA	CAD_Score
505	Minimum Cloud Base AGL	m	Min_Base
506	Maximum Cloud Top AGL	m	Max_Top
600	Feature Type	NA	Feature_Type
601	Ice/Water Phase	NA	Ice_Water_Phase
602	Feature Sub-Type	NA	Feature_Sub_Type
603	Cloud/Aerosol/PSC Type QA	NA	Cloud_Aerosol_PSC_Type_QA
604	Horizontal Averaging	NA	Horizontal_Averaging