

## NetCDF Format

### netCDF Format

- NetCDF (network Common Data Form) used by a variety of software packages in a wide range of scientific disciplines.
- developed and updated by the Unidata Program Center, in Boulder, Colorado, who provide free code to process files of this format (see <http://www.unidata.ucar.edu/packages/netcdf>).
- Organizations currently using netCDF include NASA, NOAA, JPL, NCAR, NCSA, CSIRO, and many of the U.S. National Laboratories.
- It is a binary file format, and libraries are provided in several programming languages to import and export netCDF formats into one's program.
- An ASCII version of files can be generated, with the results printed in CDL (Common Data Language).
- Routines for converting CDL files into binary netCDF files are also available.

The example below shows some of the basic components of a netCDF file, namely:

**dimensions:** used to represent a physical dimension, such as time, or an index into other quantities, such as a sequence number. The length of a dimension is a positive integer used as an index into the array structure. One dimension can have an UNLIMITED length, which means it can take on arbitrary values.

**variables:** used to store the data itself. Variables have a type (e.g., integer or float) and a shape (the number of indices used to access a data element).

**attributes:** used to store *metadata*, or information about the data, such as the units and perhaps a descriptive name. They are always associated with a variable, and have a name containing the variable's name.

```

netcdf example_1 { // example of CDL notation for a netCDF dataset

dimensions:          // dimension names and lengths are declared first
    lat = 5, lon = 10, level = 4, time = unlimited;

variables:           // variable types, names, shapes, attributes
    float    temp(time,level,lat,lon);
                temp:long_name      = "temperature";
                temp:units          = "celsius";
    float    rh(time,lat,lon);
                rh:long_name        = "relative humidity";
                rh:valid_range      = 0.0, 1.0;          // min and max
    int      lat(lat), lon(lon), level(level);
                lat:units           = "degrees_north";
                lon:units           = "degrees_east";
                level:units         = "millibars";
    short    time(time);
                time:units          = "hours since 1996-1-1";
    // global attributes
                :source = "Fictional Model Output";

data:                // optional data assignments
    level      = 1000, 850, 700, 500;
    lat        = 20, 30, 40, 50, 60;
    lon        = -160,-140,-118,-96,-84,-52,-45,-35,-25,-15;
    time       = 12;
    rh         = .5,.2,.4,.2,.3,.2,.4,.5,.6,.7,
                .1,.3,.1,.1,.1,.1,.5,.7,.8,.8,
                .1,.2,.2,.2,.2,.5,.7,.8,.9,.9,
                .1,.2,.3,.3,.3,.3,.7,.8,.9,.9,
                0,.1,.2,.4,.4,.4,.4,.7,.9,.9;
}

```

Figure 1: Sample netCDF file converted to CDL.