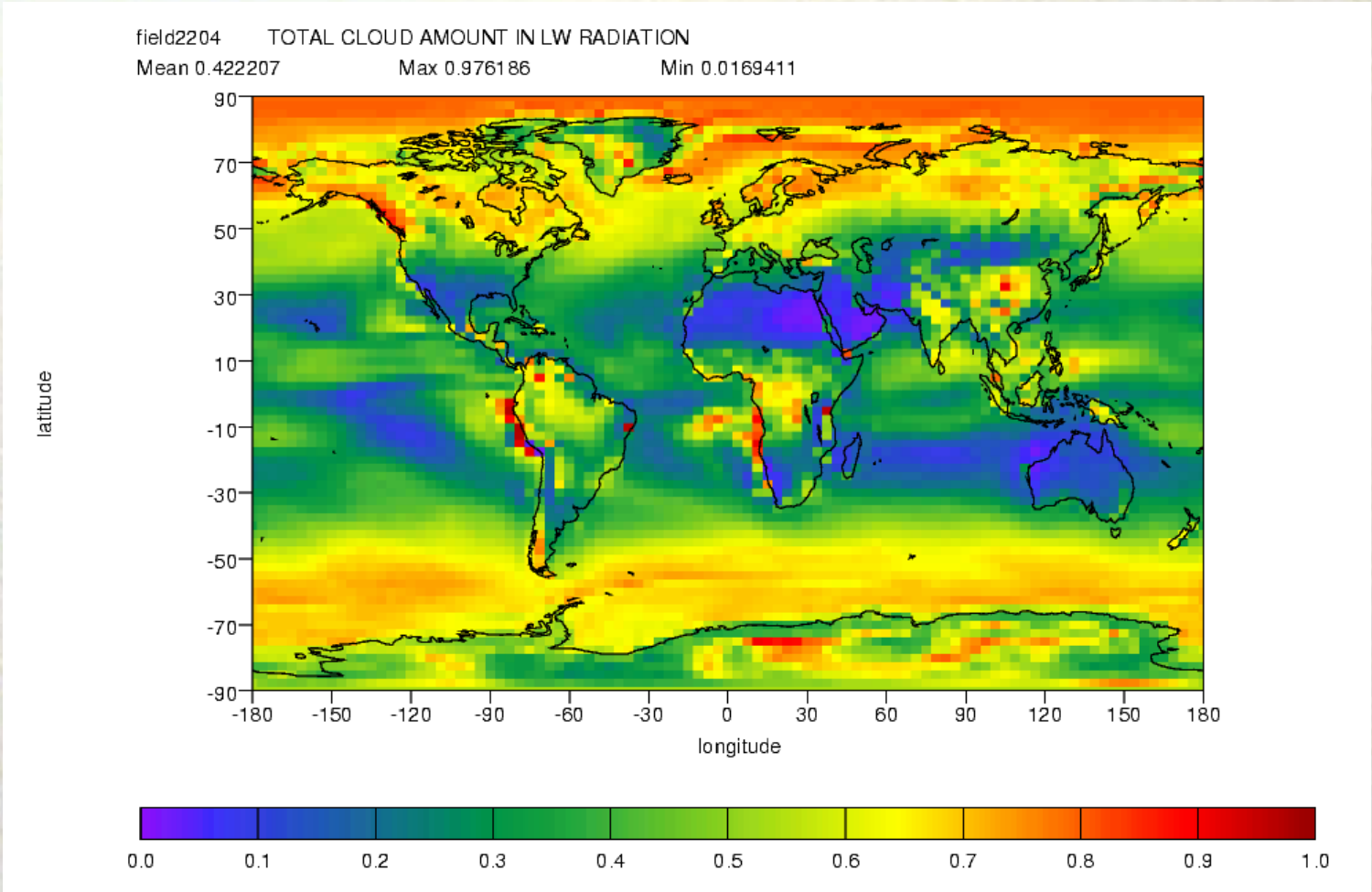
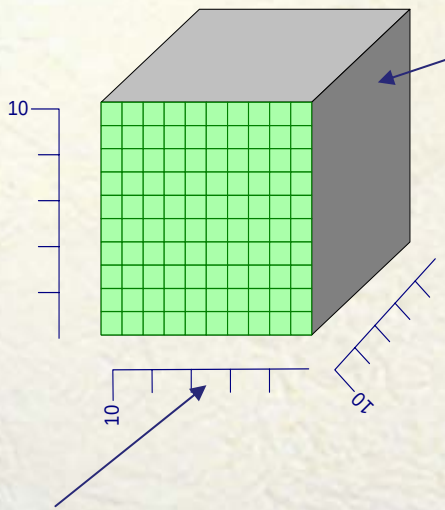
NetCDF and the CF metadata convention

Some geophysical data



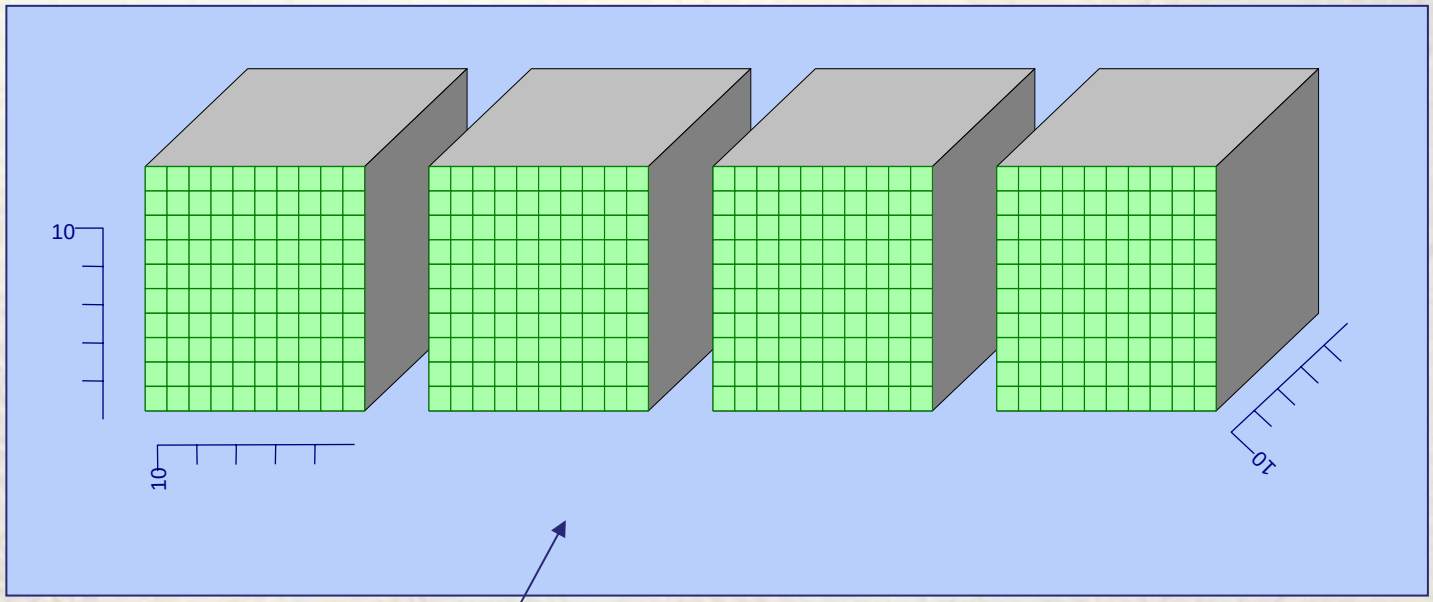
Modelling geophysical data

Name	TAS
Units	K
	…



Name	Latitude
Units	Degrees
Bounds	…

Modelling geophysical data 2



Title	
Institution	
History	

NetCDF goals

http://my.unidata.ucar.edu/content/software/netcdf/index.html

- Portable: byte order neutral.
- Efficient: random access
- Appendable
- Simple

NetCDF data model

- Three types of object
  - **dimension**: The length of an array dimension. One dimension can have unlimited length (i.e. the file is appendable along that dimension).
  - **variable**: An array of data. Variables are composed of:
    - A list of dimensions (e.g. time, latitude, longitude).
    - A datatype (e.g. float)
  - **attribute**: A named property of a variable or the whole file.
    - attributes have a datatype
    - attributes can be one dimensional arrays (to support strings).

Example

```
netcdf example.nc {
  dimensions:
    lat=90;
    lon=180;
    time=1;
  variables:
    float TS_var(time,lat,lon);
      TS_var:long_name="surface air temperature variance"
      TS_var:units="K2";
  float time(time);
      time:units="days since 1990-01-01 00:00:00";
  ...
}
```

- Extra information is supported by conventions
  - Variables with the same name as a dimension => axis
  - Standard attributes, e.g. "units"

CF convention

- A Domain specific NetCDF convention
  - Climate & Forecast
- Self describing
  - The metadata is sufficiently standardised to be understandable by humans and applications.
- Main features
  - Standard global and variable attributes
  - Standard names for variables and units
  - Indirect coordinate and grid descriptions

CF standard names

Standard names for atmosphere dynamics

Units	GRIB	PCMDI		Standard name
Pa	1	plev	?	air_pressure
Pa	26		?	air_pressure_anomaly
Pa			?	air_pressure_at_cloud_base
Pa			?	air_pressure_at_cloud_top
Pa			?	air_pressure_at_convective_cloud_base
Pa			?	air_pressure_at_convective_cloud_top
Pa			?	air_pressure_at_freezing_level
Pa	2 E151	psl	?	air_pressure_at_sea_level
s-1	41		?	atmosphere_absolute_vorticity

Parameterised coordinate variables

```
float lev(lev) ;
  lev:long_name = "sigma at layer midpoints" ;
  lev:positive = "down" ;
  lev:standard_name = "atmosphere_sigma_coordinate" ;
  lev:formula_terms = "sigma: lev ps: PS ptop: PTOP" ;
float PS(n,j,i) ;
float PTOP(single) ;

float field1(lev, lat, lon) ;
```

- "atmospheric_sigma_coordinate" is defined in the standard as:
  - p(n,k,j,i) = ptop + sigma(k)*(ps(n,j,i)-ptop)
- PS and PTOP are auxiliary coordinate variables parametising the pressure coordinate.

NetCDF and CF future

- NetCDF4
  - An extended data model (hierarchal)
  - Internally based on HDF4
  - Externally consistent interface
- CF
  - Work on new grid descriptions
  - Community evolving