LAB 3 : Data Resources netCDF

(Network Common Data Form)

What is netCDF?

- **NetCDF** (network Common Data Form) is an interface for array-oriented data access and a library that provides an implementation of the interface. The **NetCDF** library also defines a machine-independent format for representing scientific data. Together, the interface, library, and format support the creation, access, and sharing of scientific data.
- **NetCDF** maintains a collection of **reanalysis datasets** for use in climate diagnostics and attribution.

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LAB 3 : Data Resources netCDF

- **Reanalysis datasets** are created by assimilating ("inputting") climate observations using the same climate model throughout the entire reanalysis period in order to reduce the affects of modeling changes on climate statistics. Observations are from many different sources including ships, satellites, ground stations, RAOBS, and radar.
- Currently, PSD makes available these reanalysis datasets to the public in our standard **NetCDF format.**
- **PSD is Physical Sciences Division in ESRL Earth System Research Laboratory of NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION**

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LAB 3 : NetCDF Data Model

❑ **NetCDF (Network Common Data Form)**

Topics Covered:

1. The **ncdisp** command : Open NetCDF File
2. The **ncinfo** command : Get Information About NetCDF File
3. The **ncread** command : Read Data from NetCDF File

LAB 3 : NetCDF Data Model

❑ **A quick guide on how to use Matlab netCDF functions**

A netCDF file contains two parts:

- A "header" that describes the names, dimensions, etc., of the variables stored in the file.
- And the main body that contains the real data.

❑ To process a netCDF file, we need to first extract the information in the header and determine what portion/segment of the data we want to use.

- ❖ This is usually done by using a set of stand-alone tools. we will discuss in Part (A).
- ❖ Once the content of a netCDF file is known, it is rather straight forward to read the data as will be discussed in Part (B).

LAB 3 : NetCDF Data Model

Part (A) Inspect the content of a netCDF file

We will use the netCDF data file, PRESSURE_9.nc, as an example to explain how the MATLAB functions work. This file, extracted and downloaded from the NOAA ESRL-PSD web portal (www.esrl.noaa.gov/psd), contains the Atmospheric model CMAP gridded data for the long-term Mean sea level pressure for the global domain on a regular longitude latitude grid for the climatological means for January, February, ..., December.

OR use this link for retrieve data from The European Centre for Medium-Range Weather Forecasts (ECMWF)

http://apps.ecmwf.int/datasets/data/interim-full-daily

http://apps.ecmwf.int/datasets/data/macc-reanalysis/levtype=sfc/

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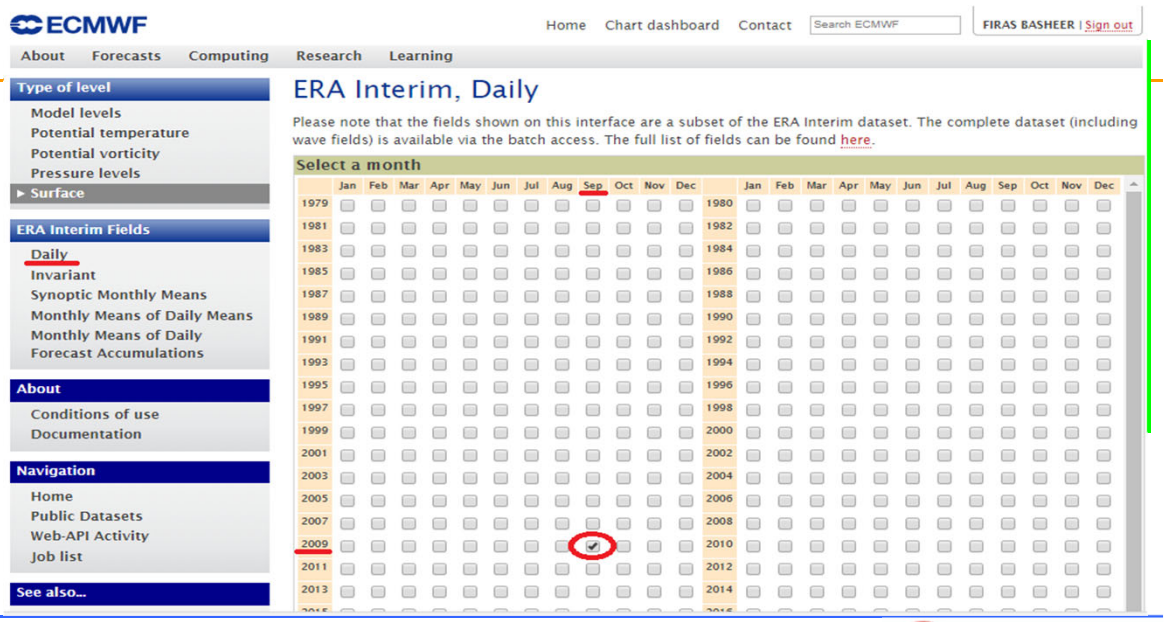

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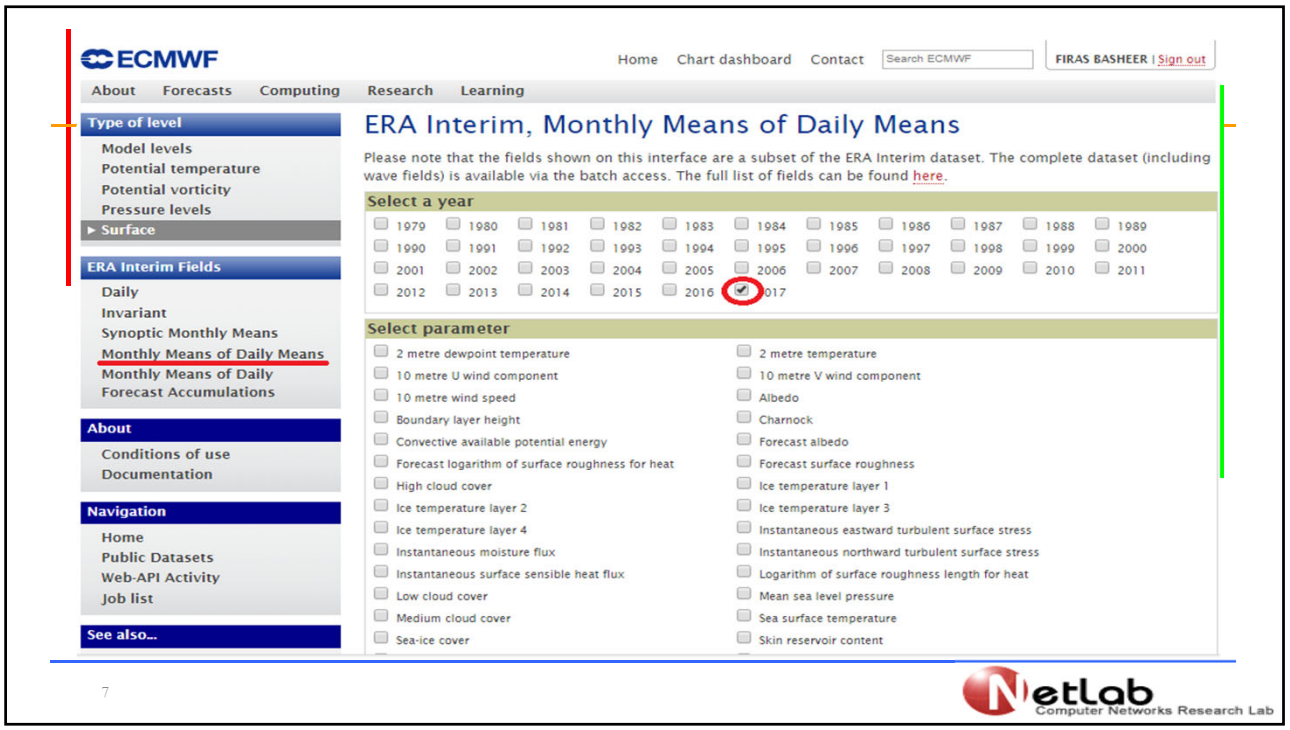
ECMWF
Home
Chart dashboard
Contact
Search ECMWF
FIRAS BASHEER | Sign out
About
Forecasts
Computing
Research
Learning
Type of level
Model levels
Potential temperature
Potential vorticity
Pressure levels
Surface
ERA Interim Fields
Daily
Invariant
Synoptic Monthly Means
Monthly Means of Daily Means
Monthly Means of Daily Forecast Accumulations
About
Conditions of use
Documentation
Navigation
Home
Public Datasets
Web-API Activity
Job list
See also...
ERA Interim, Monthly Means of Daily Means
Please note that the fields shown on this interface are a subset of the ERA Interim dataset. The complete dataset (including wave fields) is available via the batch access. The full list of fields can be found here.
Select a year
1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
2012 2013 2014 2015 2016 2017
Select parameter
2 metre dewpoint temperature
2 metre temperature
10 metre U wind component
10 metre V wind component
10 metre wind speed
Albedo
Boundary layer height
Charnock
Convective available potential energy
Forecast albedo
Forecast logarithm of surface roughness for heat
Forecast surface roughness
High cloud cover
Ice temperature layer 1
Ice temperature layer 2
Ice temperature layer 3
Ice temperature layer 4
Instantaneous eastward turbulent surface stress
Instantaneous moisture flux
Instantaneous northward turbulent surface stress
Instantaneous surface sensible heat flux
Logarithm of surface roughness length for heat
Low cloud cover
Mean sea level pressure
Medium cloud cover
Sea surface temperature
Sea-ice cover
Skin reservoir content

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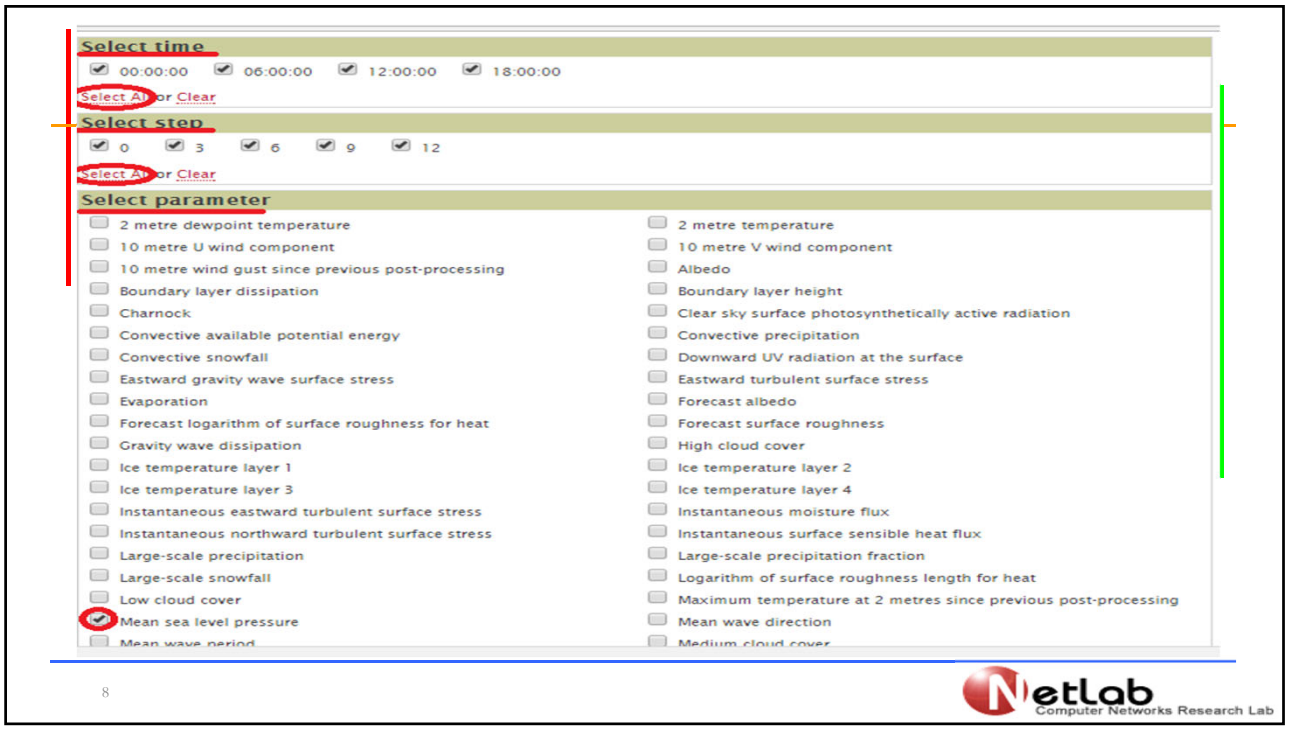
Select time
00:00:00 06:00:00 12:00:00 18:00:00
Select All or Clear
Select step
0 3 6 9 12
Select All or Clear
Select parameter
2 metre dewpoint temperature
2 metre temperature
10 metre U wind component
10 metre V wind component
10 metre wind gust since previous post-processing
Albedo
Boundary layer dissipation
Boundary layer height
Charnock
Clear sky surface photosynthetically active radiation
Convective available potential energy
Convective precipitation
Convective snowfall
Downward UV radiation at the surface
Eastward gravity wave surface stress
Eastward turbulent surface stress
Evaporation
Forecast albedo
Forecast logarithm of surface roughness for heat
Forecast surface roughness
Gravity wave dissipation
High cloud cover
Ice temperature layer 1
Ice temperature layer 2
Ice temperature layer 3
Ice temperature layer 4
Instantaneous eastward turbulent surface stress
Instantaneous moisture flux
Instantaneous northward turbulent surface stress
Instantaneous surface sensible heat flux
Large-scale precipitation
Large-scale precipitation fraction
Large-scale snowfall
Logarithm of surface roughness length for heat
Low cloud cover
Maximum temperature at 2 metres since previous post-processing
Mean sea level pressure
Mean wave direction
Mean wave period
Medium cloud cover

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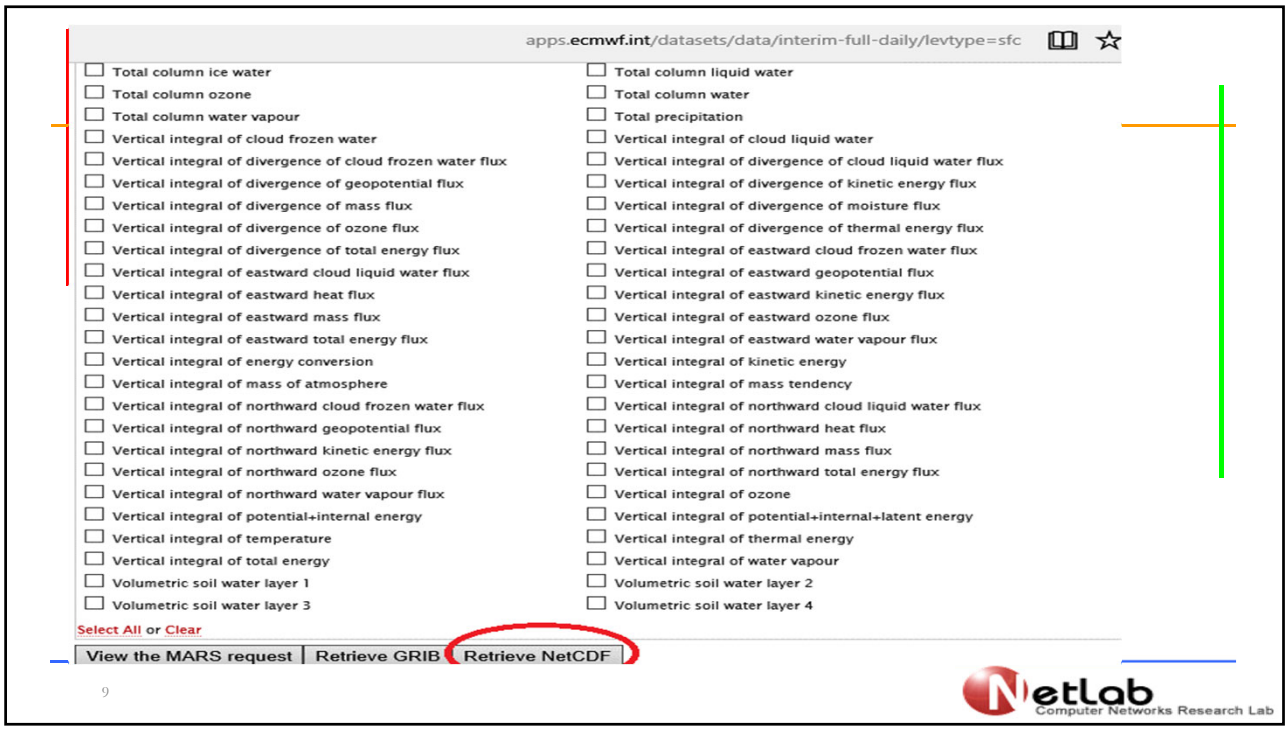
apps.ecmwf.int/datasets/data/interim-full-daily/levtype=sfc
Total column ice water
Total column liquid water
Total column ozone
Total column water
Total column water vapour
Total precipitation
Vertical integral of cloud frozen water
Vertical integral of cloud liquid water
Vertical integral of divergence of cloud frozen water flux
Vertical integral of divergence of cloud liquid water flux
Vertical integral of divergence of geopotential flux
Vertical integral of divergence of kinetic energy flux
Vertical integral of divergence of mass flux
Vertical integral of divergence of moisture flux
Vertical integral of divergence of ozone flux
Vertical integral of divergence of thermal energy flux
Vertical integral of divergence of total energy flux
Vertical integral of eastward cloud frozen water flux
Vertical integral of eastward cloud liquid water flux
Vertical integral of eastward geopotential flux
Vertical integral of eastward heat flux
Vertical integral of eastward kinetic energy flux
Vertical integral of eastward mass flux
Vertical integral of eastward ozone flux
Vertical integral of eastward total energy flux
Vertical integral of eastward water vapour flux
Vertical integral of energy conversion
Vertical integral of kinetic energy
Vertical integral of mass of atmosphere
Vertical integral of mass tendency
Vertical integral of northward cloud frozen water flux
Vertical integral of northward cloud liquid water flux
Vertical integral of northward geopotential flux
Vertical integral of northward heat flux
Vertical integral of northward kinetic energy flux
Vertical integral of northward mass flux
Vertical integral of northward ozone flux
Vertical integral of northward total energy flux
Vertical integral of northward water vapour flux
Vertical integral of ozone
Vertical integral of potential+internal energy
Vertical integral of potential+internal+latent energy
Vertical integral of temperature
Vertical integral of thermal energy
Vertical integral of total energy
Vertical integral of water vapour
Volumetric soil water layer 1
Volumetric soil water layer 2
Volumetric soil water layer 3
Volumetric soil water layer 4
Select All or Clear
View the MARS request
Retrieve GRIB
Retrieve NetCDF
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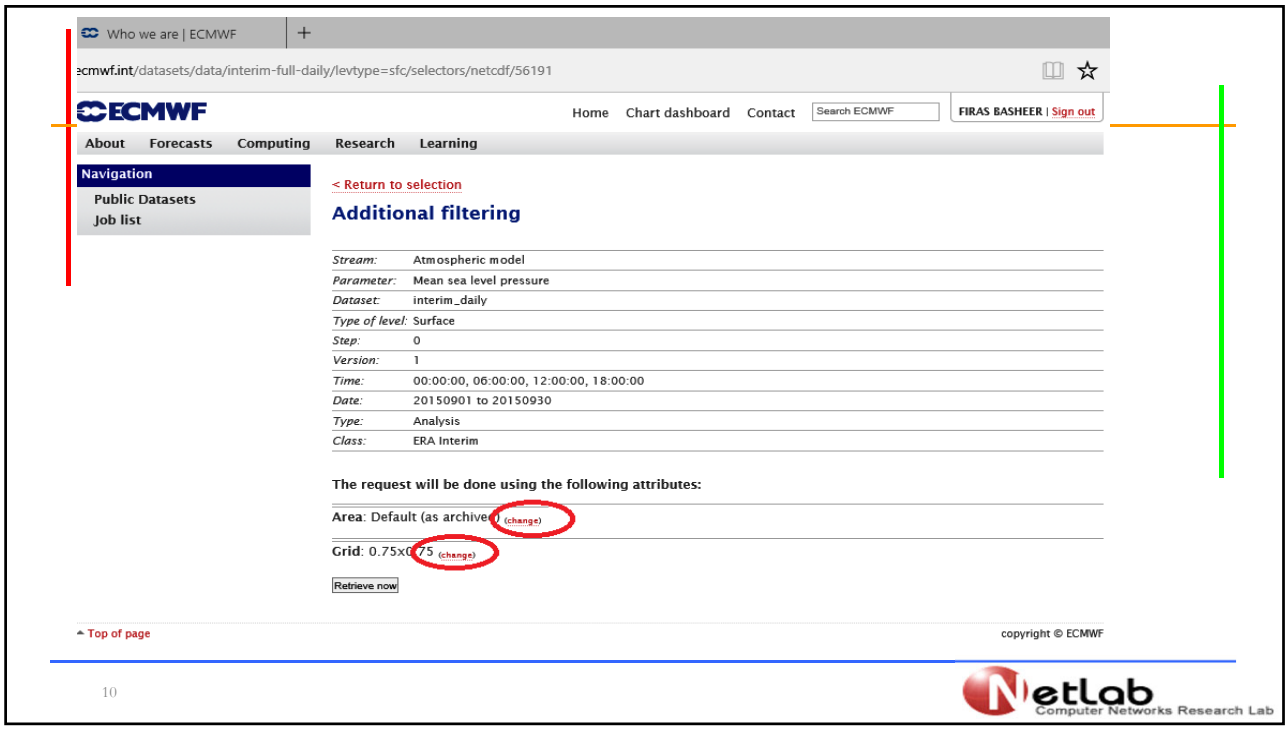
Who we are | ECMWF
ecmwf.int/datasets/data/interim-full-daily/levtype=sfc/selectors/netcdf/56191
ECMWF
Home
Chart dashboard
Contact
Search ECMWF
FIRAS BASHEER | Sign out
About
Forecasts
Computing
Research
Learning
Navigation
Public Datasets
Job list
< Return to selection
Additional filtering
Stream: Atmospheric model
Parameter: Mean sea level pressure
Dataset: interim_daily
Type of level: Surface
Step: 0
Version: 1
Time: 00:00:00, 06:00:00, 12:00:00, 18:00:00
Date: 20150901 to 20150930
Type: Analysis
Class: ERA Interim
The request will be done using the following attributes:
Area: Default (as archived) (change)
Grid: 0.75x0.75 (change)
Retrieve now
Top of page
copyright © ECMWF
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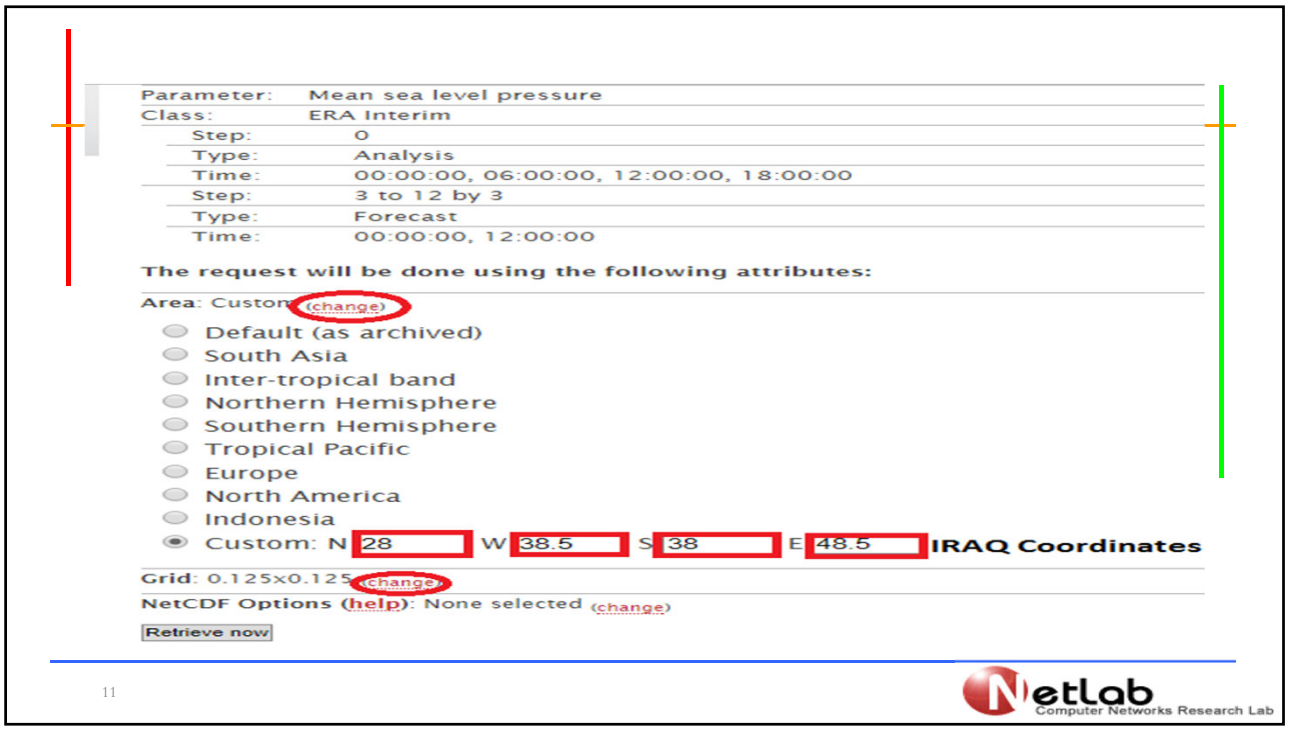
Parameter: Mean sea level pressure
Class: ERA Interim
Step: 0
Type: Analysis
Time: 00:00:00, 06:00:00, 12:00:00, 18:00:00
Step: 3 to 12 by 3
Type: Forecast
Time: 00:00:00, 12:00:00
The request will be done using the following attributes:
Area: Custom (change)
Default (as archived)
South Asia
Inter-tropical band
Northern Hemisphere
Southern Hemisphere
Tropical Pacific
Europe
North America
Indonesia
Custom: N 28 W 38.5 S 38 E 48.5
IRAQ Coordinates
Grid: 0.125x0.125 (change)
NetCDF Options (help): None selected (change)
Retrieve now
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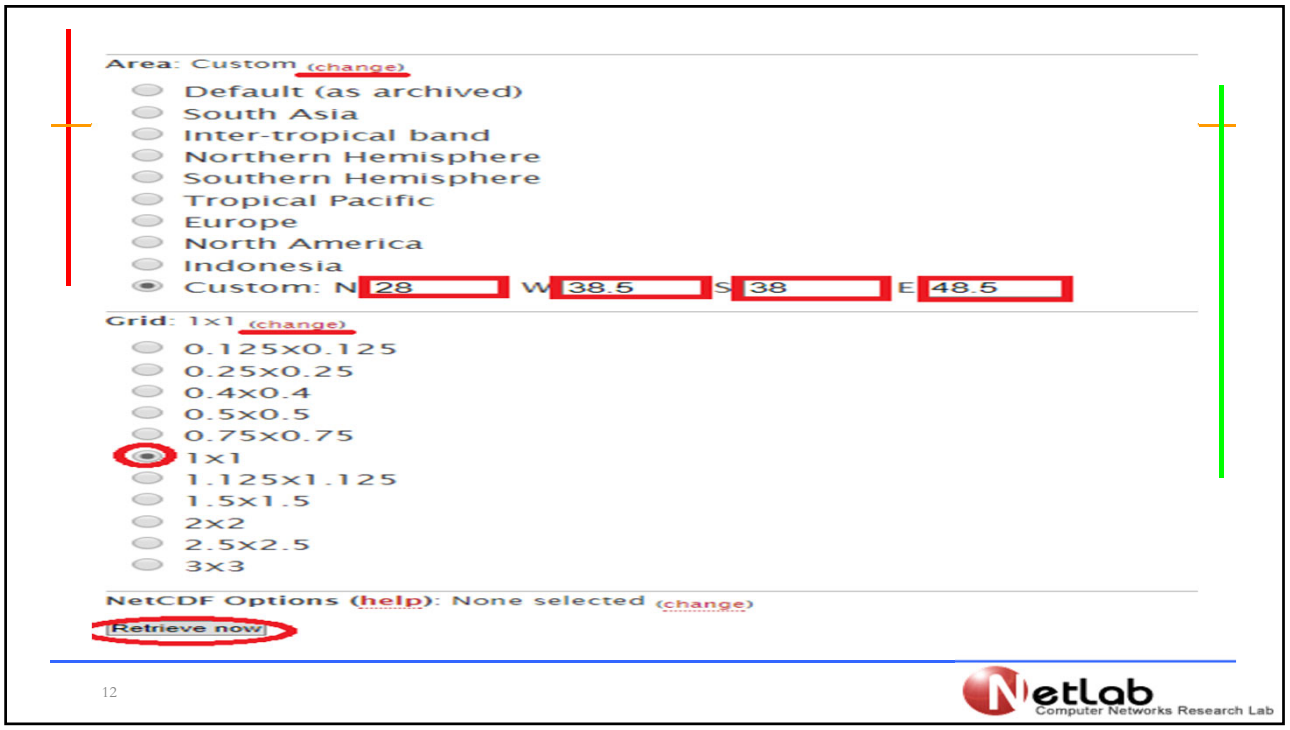
Area: Custom (change)
Default (as archived)
South Asia
Inter-tropical band
Northern Hemisphere
Southern Hemisphere
Tropical Pacific
Europe
North America
Indonesia
Custom: N 28 W 38.5 S 38 E 48.5
Grid: 1x1 (change)
0.125x0.125
0.25x0.25
0.4x0.4
0.5x0.5
0.75x0.75
1x1
1.125x1.125
1.5x1.5
2x2
2.5x2.5
3x3
NetCDF Options (help): None selected (change)
Retrieve now
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NetLab
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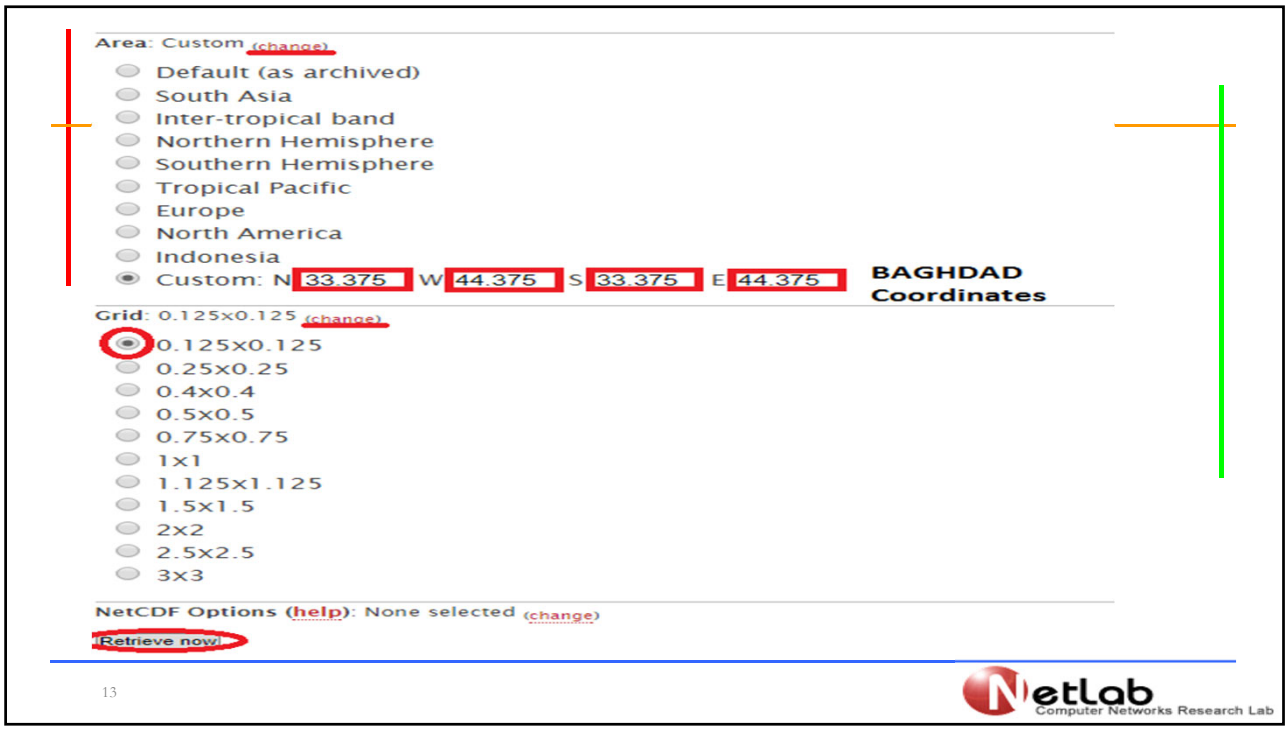
Area: Custom (change)
Default (as archived)
South Asia
Inter-tropical band
Northern Hemisphere
Southern Hemisphere
Tropical Pacific
Europe
North America
Indonesia
Custom: N 33.375 W 44.375 S 33.375 E 44.375
BAGHDAD Coordinates
Grid: 0.125x0.125 (change)
0.125x0.125
0.25x0.25
0.4x0.4
0.5x0.5
0.75x0.75
1x1
1.125x1.125
1.5x1.5
2x2
2.5x2.5
3x3
NetCDF Options (help): None selected (change)
Retrieve now!
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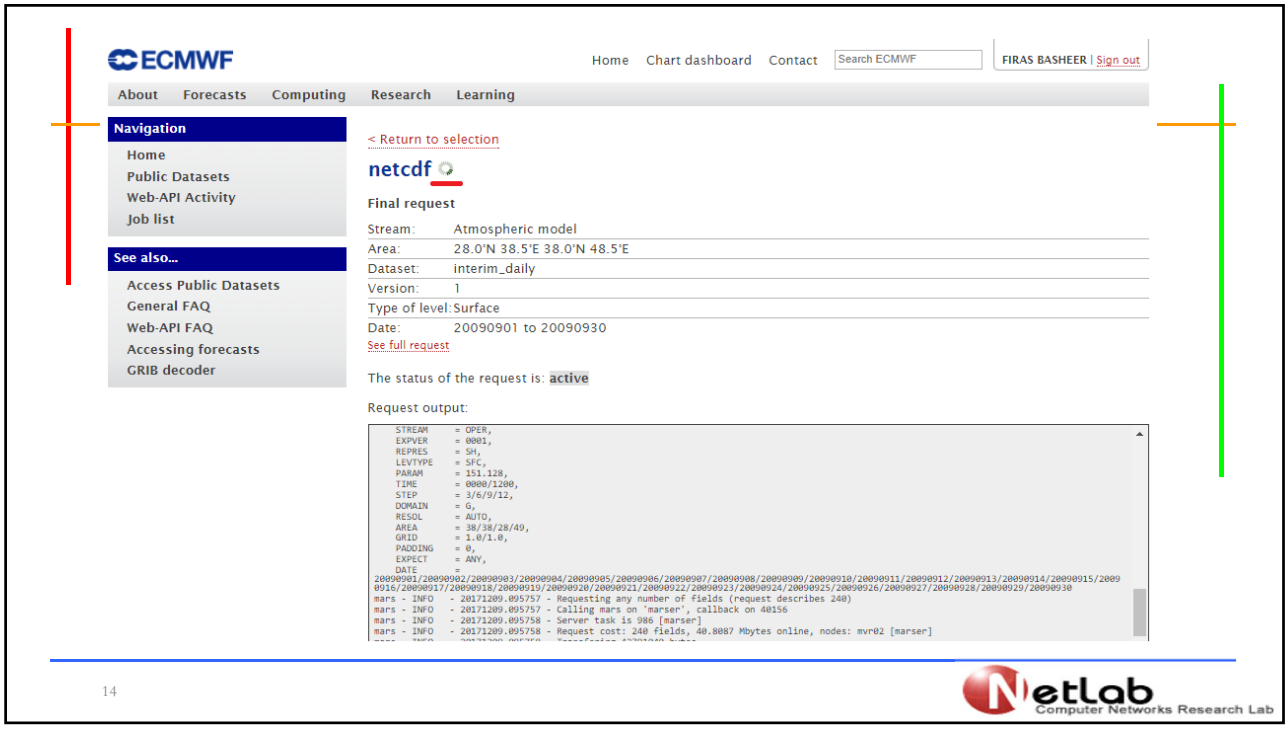
ECMWF
Home
Chart dashboard
Contact
Search ECMWF
FIRAS BASHEER | Sign out
About
Forecasts
Computing
Research
Learning
Navigation
Home
Public Datasets
Web-API Activity
Job list
See also...
Access Public Datasets
General FAQ
Web-API FAQ
Accessing forecasts
GRIB decoder
< Return to selection
netcdf
Final request
Stream: Atmospheric model
Area: 28.0'N 38.5'E 38.0'N 48.5'E
Dataset: interim_daily
Version: 1
Type of level: Surface
Date: 20090901 to 20090930
See full request
The status of the request is: active
Request output:
STREAM = OPER,
EXPVER = 0001,
REPRES = SH,
LEVTYPE = SFC,
PARAM = 151.128,
TIME = 0000/1200,
STEP = 3/6/9/12,
DOMAIN = G,
RESOL = AUTO,
AREA = 38/38/28/49,
GRID = 1.0/1.0,
PADDING = 0,
EXPECT = ANY,
DATE =
20090901/20090902/20090903/20090904/20090905/20090906/20090907/20090908/20090909/20090910/20090911/20090912/20090913/20090914/20090915/20090916/20090917/20090918/20090919/20090920/20090921/20090922/20090923/20090924/20090925/20090926/20090927/20090928/20090929/20090930
mars - INFO - 20171209.095757 - Requesting any number of fields (request describes 240)
mars - INFO - 20171209.095757 - Calling mars on 'marser', callback on 40156
mars - INFO - 20171209.095758 - Server task is 986 [marser]
mars - INFO - 20171209.095758 - Request cost: 240 fields, 40.8087 Mbytes online, nodes: mvr02 [marser]
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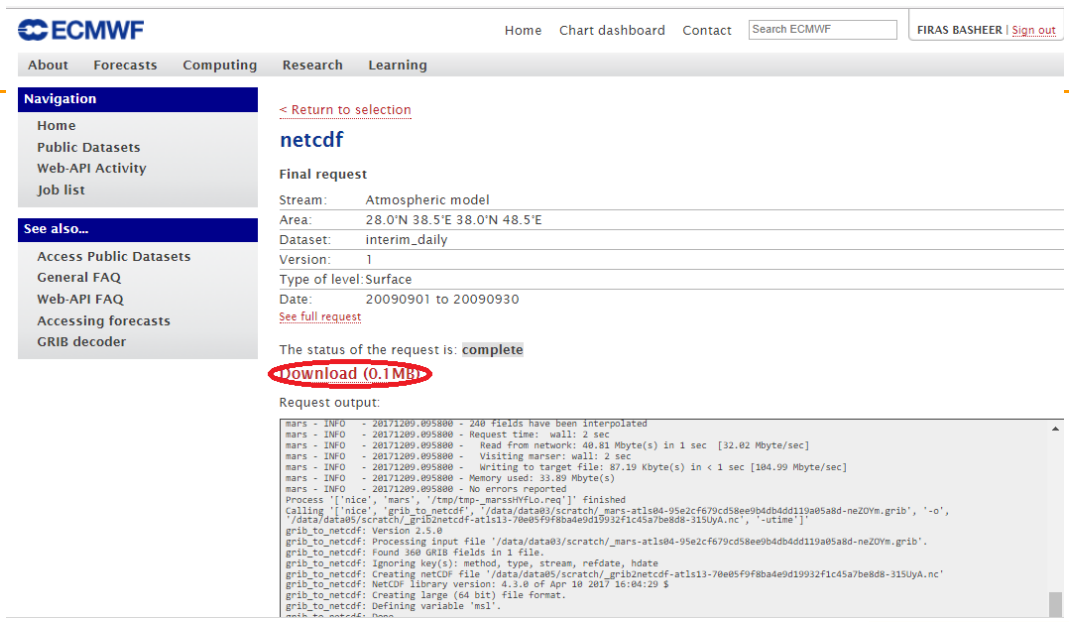

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LAB 3 : Part(A) NetCDF Data Model(Header)

1.The ncdisp command

Display contents of NetCDF data source in Command Window

Syntax

1- ncdisp(source)

Displays as text in the Command Window ,all the group ,dimensions, variable definitions, and all attributes in the NetCDF data source

2- ncdisp(source,location)

Displays information about the variable or group specified by location in source.

3- ncdisp(source,location,modestr)

Displays the contents of the location in source according to the value of modestr.

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LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

It is strongly recommended that the information in the header be examined before one uses the data in a netCDF file.

1- ncdisp(source)

1- ncdisp(source) source — Name of NetCDF file

Displays all the groups, dimensions, variable definitions, and all attributes in the NetCDF data source, as text in the Command Window.

Example:

```
>>ncdisp('PRESSURE_9.nc')
```

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LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

1- ncdisp(source)

```
>>ncdisp('PRESSURE_9.nc')

Global Attributes:
        history     = '2017-12-09 09:58:01 GMT by grib_to_netcdf-2.5.0:
   Dimensions:
        longitude = 12
        latitude  = 11
        time      = 241   (UNLIMITED)
```

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LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

1- ncdisp(source)

```
>>ncdisp('PRESSURE_9.nc')

Variables:
  longitude
      Size:      12x1
 Dimensions: longitude
    Datatype:   single
 Attributes:
             units     = 'degrees_east'
             long_name = 'longitude'
```

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LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

1- ncdisp(source)

```
>>ncdisp('PRESSURE_9.nc')

latitude
      Size:      11x1
      Dimensions: latitude
      Datatype:   single
      Attributes:
             units     = 'degrees_north'
             long_name = 'latitude'
```

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LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

1- ncdisp(source)

```
>>ncdisp('PRESSURE_9.nc')

time
        Size:      241x1
        Dimensions: time
        Datatype:   int32
        Attributes:
                units     = 'hours since 1900-01-01 00:00:0.0'
                long_name = 'time'
```


LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

1- ncdisp(source)

```
>>ncdisp('PRESSURE_9.nc')

 msl
        Size:      12x11x241
        Dimensions: longitude,latitude,time
        Datatype:   int16
        Attributes:
units       = 'Pa'
                long_name     = 'Mean sea level pressure'
                standard_name = 'air_pressure_at_sea_level'
```

LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

2- ncdisp(source,location)

```
>>ncdisp('PRESSURE_9.nc','longitude')
Dimensions:
        longitude = 12
Variables:
   longitude
        Size:      12x1
        Dimensions: longitude
        Datatype:   single
        Attributes:
                units     = 'degrees_east'
                long_name = 'longitude'
```


LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

2- ncdisp(source,location)

```
>>ncdisp('PRESSURE_9.nc','latitude')
Dimensions:
        latitude = 11
Variables:
   latitude
        Size:      11x1
        Dimensions: latitude
        Datatype:   single
        Attributes:
                units     = 'degrees_north'
                long_name = 'latitude'
```

LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

2- ncdisp(source,location)

>>ncdisp('PRESSURE_9.nc','time')

```
Dimensions:
        time = 241
Variables:
   time
        Size:      241x1
        Dimensions: time
        Datatype:   int32
        Attributes:
                units     = 'hours since 1900-01-01 00:00:0.0'
                long_name = 'time'
```


LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

2- ncdisp(source,location)

>>ncdisp('PRESSURE_9.nc','msl')

```
Dimensions:
        longitude = 12
        latitude  = 11
        time      = 241   (UNLIMITED)
Variables:
   msl
        Size:      12x11x241
        Dimensions: longitude,latitude,time
        Datatype:   int16
```

LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

2- ncdisp(source,location)

```
>>ncdisp('PRESSURE_9.nc','msl')
 Attributes:
units         = 'Pa'
              long_name     = 'Mean sea level pressure'
              standard_name = 'air_pressure_at_sea_level'
```


LAB 3 : Part(A) NetCDF Data Model(Header)

Step 0: Display/check the header of the netCDF file

3- ncdisp(source,location,modestr)

source Text string specifying the name of the NetCDF file

location Text string specifying the location of the variable or group in the NetCDF file .

Set location to / (forward slash) to display the entire contents of the file.

Default: /

modestr specifies the type of display .

'min' Display group hierarchy and variables definitions.

'full' Display group hierarchy with dimensions, attributes, and variable definitions.

Default :full

LAB 3 : Part(A) NetCDF Data Model(Header)

3- ncdisp(source,location,modestr)

```
>> ncdisp('PRESSURE_9.nc', '/' , 'min')
Source:  D:\MATLAB\PRESSURE_9.nc
Format:  64bit
Variables:
  longitude                          time
      Size:      12x1                    Size:      241x1
      Dimensions: longitude              Dimensions: time
      Datatype:   single                 Datatype:   int32
  latitude                           msl
      Size:      11x1                    Size:      12x11x241
      Dimensions: latitude               Dimensions: longitude,latitude,time
      Datatype:   single                 Datatype:   int16
```


LAB 3 : Part(A) NetCDF Data Model(Header)

3- ncdisp(source,location,modestr)

```
>> ncdisp('PRESSURE_9.nc', '/' , 'full')
Is the same command
>>ncdisp('PRESSURE_9.nc')
>>ncdisp('PRESSURE_9.nc', 'msl' , 'min')
Source:
        D:\MATLAB\PRESSURE_9.nc
Format: 64bit
Variables:
   msl
        Size:      12x11x241
        Dimensions: longitude,latitude,time
        Datatype:   int16
```

LAB 3 : Part(A) NetCDF Data Model(Header)

2.The ncinfo command Return information about NetCDF data source

Syntax

finfo = ncinfo(source)
vinfo = ncinfo(source,varname)
ginfo = ncinfo(source,groupname)

```
>> finfo=ncinfo('PRESSURE_9.nc')
>> finfo_msl=ncinfo('PRESSURE_9.nc','msl')
```

```
finfo =
      Filename: 'D:\MATLAB\PRESSURE_9.nc'
          Name: '/'
    Dimensions: [1x3 struct]
     Variables: [1x4 struct]
    Attributes: [1x2 struct]
        Groups: []
        Format: '64bit'
```


LAB 3 : Part(B) NetCDF Data Model(Contains)

1.The ncread command

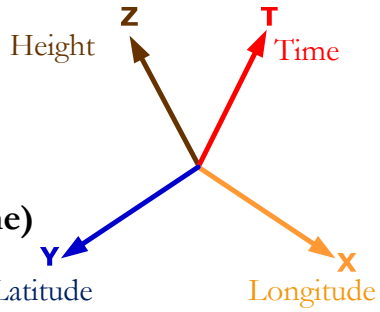
A NetCDF dataset contains :

- ❑ Dimensions
- ❑ Variables
- ❑ Attributes

- ❑ Dimensions
  - ➢ Longitude
  - ➢ Latitude
  - ➢ Time

- ❑ Variables(long , lat ,time)

lat \ Variables long		
	10	11
	12	13



For each location **one** value so for this **ex.** we have **four** locations .

LAB 3 : Part(B) NetCDF Data Model(Contains)

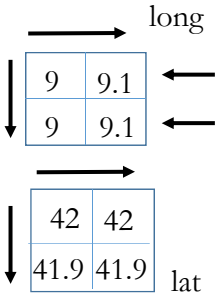
A NetCDF dataset contains :

- ❑ Dimensions
- ❑ Variables
- ❑ Attributes

- ❑ Dimensions
  - ➢ Longitude
  - ➢ Latitude
  - ➢ Time
- ❑ Variables(long , lat ,time)

Variables

lat \ long	10	11
12	13	



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LAB 3 : Part(B) NetCDF Data Model(Contains)

A NetCDF dataset contains :

- ❑ Dimensions
- ❑ Variables
- ❑ Attributes

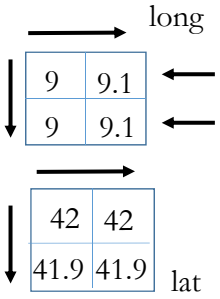
- ❑ Dimensions
  - ➢ Longitude
  - ➢ Latitude
  - ➢ Time
- ❑ Variables(long , lat ,time)

Variables

lat \ long	9	9.1
42		
41.9		

$V_{(9,42)}$ $V_{(9.1,42)}$

$V_{(9,41.9)}$ $V_{(9.1,41.9)}$



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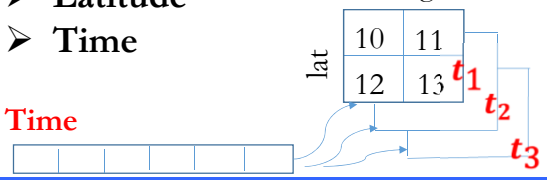
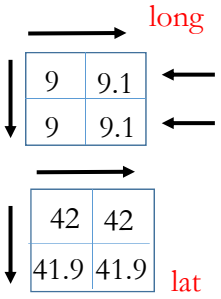
LAB 3 : Part(B) NetCDF Data Model(Contains)

A NetCDF dataset contains :

- ❑ Dimensions
- ❑ Variables
- ❑ Attributes

- ❑ Dimensions
  - ➢ Longitude
  - ➢ Latitude
  - ➢ Time
- ❑ Variables(long , lat ,time)





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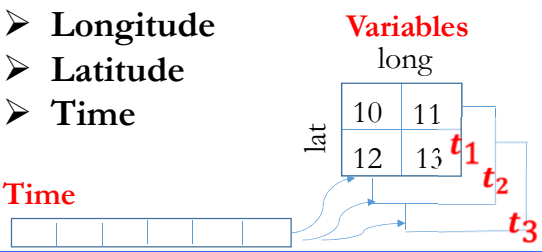
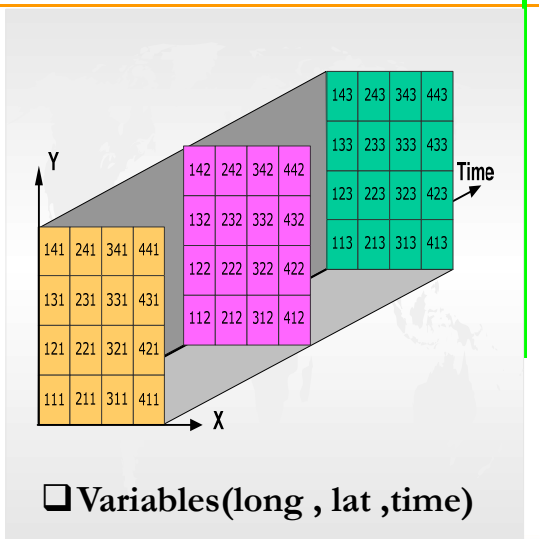
LAB 3 : Part(B) NetCDF Data Model(Contains)

A NetCDF dataset contains :

- ❑ Dimensions
- ❑ Variables
- ❑ Attributes

- ❑ Dimensions
  - ➢ Longitude
  - ➢ Latitude
  - ➢ Time
- ❑ Variables(long , lat ,time)





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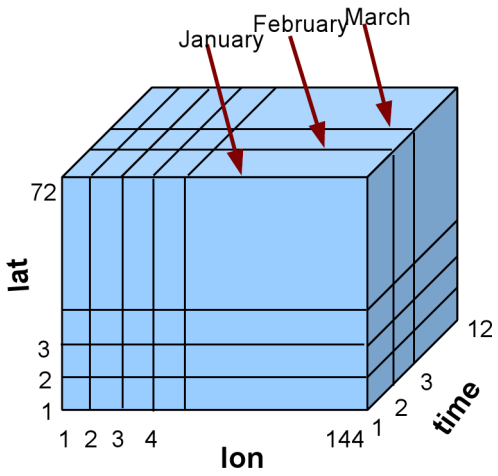
LAB 3 : Part(B) NetCDF Data Model(Contains)

- Here, we use the "normal" convention with each of the indices, i, j, and k, starting from 1.



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NetLab Computer Networks Research Lab

LAB 3 : NetCDF Data Model

1. Dimensions (for example, time, latitude, longitude, or height.)

A dimension may be used to represent a real physical dimension, for example, time, latitude, longitude, or height. A dimension might also be used to index other quantities, for example station or model-run-number.
A netCDF dimension has both a name and a length.

2. Variables (represents an array of values of the same type, which store the bulk data.)

Variables are used to store the bulk of the data in a netCDF dataset. A variable represents an array of values of the same type. A scalar value is treated as a 0-dimensional array. A variable has a name, a data type, and a shape described by its list of dimensions specified when the variable is created. A variable may also have associated attributes, which may be added, deleted or changed after the variable is created.

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NetLab Computer Networks Research Lab

LAB 3 : NetCDF Data Model

3. Attributes(are used to store data about the data ,ancillary data or metadata).

NetCDF attributes are used to store data about the data (ancillary data or metadata), similar in many ways to the information stored in data dictionaries and schema in conventional database systems. Most attributes provide information about a specific variable. These are identified by the name (or ID) of that variable, together with the name of the attribute.

LAB 3 : Part(B) NetCDF Data Model(Contains)

3.The ncread command Read data from variable in NetCDF data source

Syntax

vardata = ncread(source,varname)

- **source** Text string specifying the name of the NetCDF file
- **Varname** Text string specifying the name of a variable in the NetCDF file
- **Vardata** The data in the variable, **ncread** uses the MATLAB datatype that is the closest type to the corresponding NetCDF datatype .

Example:

```
>> ncdisp('PRESSURE_9.nc', '/' , 'min' )
>>long=ncread('PRESSURE_9.nc' , 'longitude' )
```

LAB 3 : Part(B) NetCDF Data Model(Contains)

3.The ncread command

vardata = ncread(source,varname)

Example:

```
>> ncdisp( 'PRESSURE_9.nc', '/' , 'min')
>>long=ncread( 'PRESSURE_9.nc' , 'longitude')
>>lat=ncread( 'PRESSURE_9.nc' , 'latitude')
>>time=ncread( 'PRESSURE_9.nc' , 'time')
>>msl=ncread( 'PRESSURE_9.nc' , 'msl')
```

Example(1) :-

Retrieve data from nc-file (PRESSURE_9.nc) to read again in excel sheet for Iraq region .

LAB 3 : NetCDF Data Model

```
% Example 1: This is program to transfer data from
% netCDF source file to excel sheet
% Retrieve data for All grid
clc , clear all
format longE
% Step 1 : Display all varaibles in nc file using
% command: ncdisp
filename='PRESSURE_9.nc';
ncdisp( filename, '/','min')
%%%%%%%%%%%%%%%%%%%%%%%%%%
```

LAB 3 : NetCDF Data Model

```
% Step 2 : Read varaibles from nc file by command: ncread
variable=input('write your main variable=','s');
msl=ncread(filename,variable);
long=ncread(filename,'longitude');
lat=ncread(filename,'latitude');
time=ncread(filename,'time');
msl=0.01*msl;      % 1mb=0.01*Pa
```


LAB 3 : NetCDF Data Model

```
% Step 3 : Read all longitude and latitude for all grid
% in 2-D (2 dimensional) of array
m=numel(long);% m:number of element of longitude
n=numel(lat); % n:number of element of latitude
h=0;g=0;
for i=1:n
    for j=1:m
        h=h+1;
        latt(h)=lat(i);
        longg(h)=long(j);
    end
end
latt1=[longg ; latt];
```

LAB 3 : NetCDF Data Model

```
% Step 4 :Convert 3-D array to 2-D array for all
% stations
mm=length(time);
for i=1:n
    for j=1:m
        g=g+1;
        MSL(:,g)=msl(j,i,:);
     end
end
```


LAB 3 : NetCDF Data Model

```
% Step 5 :Convert time from netCDF format to MATLAB
% format using its units and sort data in nc file
time=double(time);
A=time./24+datenum('1900-01-01 0:0:0');
[time,I] = sort(A);
MSL=MSL(I,:);
yy=year(time);mm=month(time);dd=day(time);hh=hour(time);
Date=[yy mm dd hh];
% Step 6:Display data in excel sheet or save data in .mat
% file
C={'LOCATION:IRAQ','FROM','TO','Longitude';'DATE','1/9/200
9','30/9/2009','Latitude'};
DD={'Year','Month','Day','Hour'};
```

LAB 3 : NetCDF Data Model

```
for i=1:n*m
     X(i)={'Pressure (mb)'};
end
fileName='PRESSURE_9.xlsx';
sheet =1 ;
xlswrite(fileName,C,sheet,'A1')
xlswrite(fileName,DD,sheet,'A3')
xlswrite(fileName,latt1,sheet,'E1')
xlswrite(fileName,X,sheet,'E3')
xlswrite(fileName,Date,sheet,'A4')
xlswrite(fileName,MSL,sheet,'E4')
save PRESSURE_9
```

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NetLab Computer Networks Research Lab

LAB 3 : NetCDF Data Model

>> NC_FILE

```
Variables:
   longitude
        Size:      12x1
        Dimensions: longitude
latitude
        Size:      11x1
        Dimensions: latitude
time
        Size:      241x1
        Dimensions: time
msl
        Size:      12x11x241
        Dimensions: longitude,latitude,time
write your main variable=msl
```

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NetLab Computer Networks Research Lab

Example(1) :- Retrieve data from nc-file to read again in excel sheet for all location

	A	B	C	D	E	F	G	H	I	J	K	L	M	
1	LOCATION:IRAQ	FROM	TO	Longitude	38	39	40	41	42	43	44	45	46	
2	DATE	01/09/2009	30/09/2009	Latitude	38	38	38	38	38	38	38	38	38	
3	Year	Month	Day	Hour	Pressure (mb)	Pressure (mb)	Pressure (mb)	Pressure (mb)	Pressure (mb)	Pressure (mb)	Pressure (mb)	Pressure (mb)	Pressure (mb)	Pressu
4	2009	9	1	0	1011.195727	1008.988508	1007.183011	1006.616669	1008.339856	1012.477471	1015.979128	1015.281745	1015.65644	1017
5	2009	9	1	3	1011.818581	1009.884909	1008.081869	1007.519213	1009.23421	1013.423012	1016.821475	1016.478312	1016.968896	1018
6	2009	9	1	6	1012.115061	1010.471727	1008.809146	1008.370159	1009.943468	1013.48239	1016.758412	1016.780934	1016.519262	1017
7	2009	9	1	9	1010.300555	1008.717417	1007.358278	1007.112986	1008.529046	1011.495483	1014.368554	1014.117938	1013.616707	1015
8	2009	9	1	12	1008.049109	1006.445906	1005.403312	1005.395941	1006.825925	1010.260833	1013.465191	1012.006543	1011.443886	1013
9	2009	9	1	15	1006.832067	1005.13386	1004.3599	1004.587583	1006.344759	1010.086794	1013.407451	1012.14864	1012.503269	1015
10	2009	9	1	18	1008.195711	1006.093324	1005.276367	1005.736648	1007.818559	1012.052407	1015.497143	1014.727278	1015.599519	1018
11	2009	9	1	21	1009.122416	1006.768594	1005.614616	1006.031489	1008.267374	1012.425464	1015.893132	1015.822698	1016.50452	1018
12	2009	9	2	0	1009.607267	1007.377934	1006.098238	1006.351721	1008.46844	1012.524973	1016.104436	1016.302226	1016.618771	1018
13	2009	9	2	3	1010.47705	1008.224376	1006.731739	1006.801764	1008.641659	1012.33824	1015.770282	1015.989366	1016.289121	1017
14	2009	9	2	6	1011.380413	1009.421352	1007.90865	1007.697346	1009.033144	1012.212113	1015.392311	1015.556931	1015.339894	1016
15	2009	9	2	9	1009.871396	1008.159265	1006.741158	1006.431164	1007.649844	1010.090889	1012.599503	1012.544629	1012.136765	1013
16	2009	9	2	12	1007.954923	1006.326741	1005.111747	1005.015513	1006.289067	1008.502838	1010.386141	1009.428314	1009.119549	1011
17	2009	9	2	15	1007.767781	1006.144922	1004.939755	1004.849665	1006.330426	1008.648211	1010.173609	1008.368931	1008.636336	1011
18	2009	9	2	18	1009.321434	1007.715364	1006.489723	1006.17072	1007.624455	1010.239539	1012.15683	1010.716609	1011.540119	1014
19	2009	9	2	21	1009.882862	1008.278431	1006.970479	1006.523712	1007.806683	1010.448795	1012.676489	1012.136765	1012.766989	1014
20	2009	9	3	0	1010.038882	1008.533551	1007.283749	1006.874655	1008.024948	1010.692039	1013.217852	1013.098686	1013.344797	1014
21	2009	9	3	3	1010.595806	1009.03642	1007.893498	1007.750172	1009.074094	1011.984839	1014.638416	1014.393943	1014.472977	1015
22	2009	9	3	6	1011.585164	1010.224797	1009.134701	1009.001612	1010.217835	1012.995492	1015.51639	1014.950457	1014.391896	1015
23	2009	9	3	9	1010.115459	1008.895142	1007.887765	1007.630597	1008.699809	1011.010632	1013.140865	1012.525792	1011.858303	101
24	2009	9	3	12	1008.338218	1007.176049	1006.341073	1006.246478	1007.436493	1009.635522	1011.346424	1010.32103	1009.863615	101

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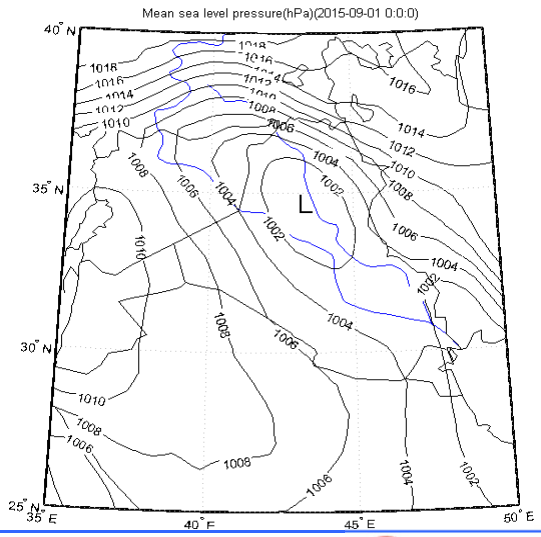
NetLab Computer Networks Research Lab

LAB 3 : NetCDF Data Model

```
>> load pressure_9
>>map_pressure(MSL,longg,latt,time)
input hour=9
input day=9
input month=9
input year=2009
```



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NetLab Computer Networks Research Lab

LAB 3 : NetCDF Data Model

>> NC_FILE

Variables:
longitude
Size: 12x1
Dimensions: longitude
latitude
Size: 11x1
Dimensions: latitude
time
Size: 241x1
Dimensions: time
msl
Size: 12x11x241
Dimensions: longitude,latitude,time
write your main variable=msl

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LAB 3 : NetCDF Data Model

	A	B	C	D	E	F	G
1	LOCATION:IRAQ	FROM	TO	Longitude	44.375		
2	DATE	01/09/2009	30/09/2009	Latitude	33.375		
3	Year	Month	Day	Hour	Pressure (mb)		
4	2009	9	1	0	1002.919		
5	2009	9	1	3	1003.381		
6	2009	9	1	6	1004.433		
7	2009	9	1	9	1003.442		
8	2009	9	1	12	1001.978		
9	2009	9	1	15	1002.047		
10	2009	9	1	18	1003.093		
11	2009	9	1	21	1003.003		
12	2009	9	2	0	1002.876		
13	2009	9	2	3	1004.017		
14	2009	9	2	6	1005.26		
15	2009	9	2	9	1004.522		
16	2009	9	2	12	1002.861		
17	2009	9	2	15	1002.797		
18	2009	9	2	18	1003.614		
19	2009	9	2	21	1003.116		
20	2009	9	3	0	1002.611		
21	2009	9	3	3	1003.529		
22	2009	9	3	6	1005.149		
23	2009	9	3	9	1004.225		
24	2009	9	3	12	1002.602		

ورقة١ ورقة٢

Example(2) :-
Retrieve data from nc-file to read again in excel sheet for Baghdad only .

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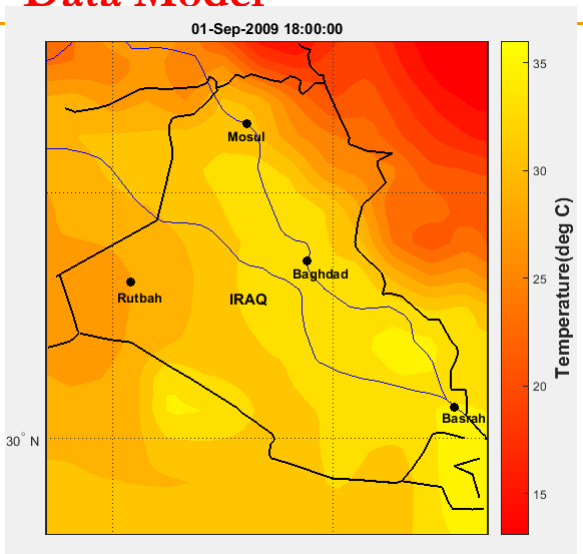
LAB 3 : NetCDF Data Model

```
>> load temp_9
>>map(MSL,longg,latt,time)
input hour=18
input day=1
input month=9
input year=2009
```



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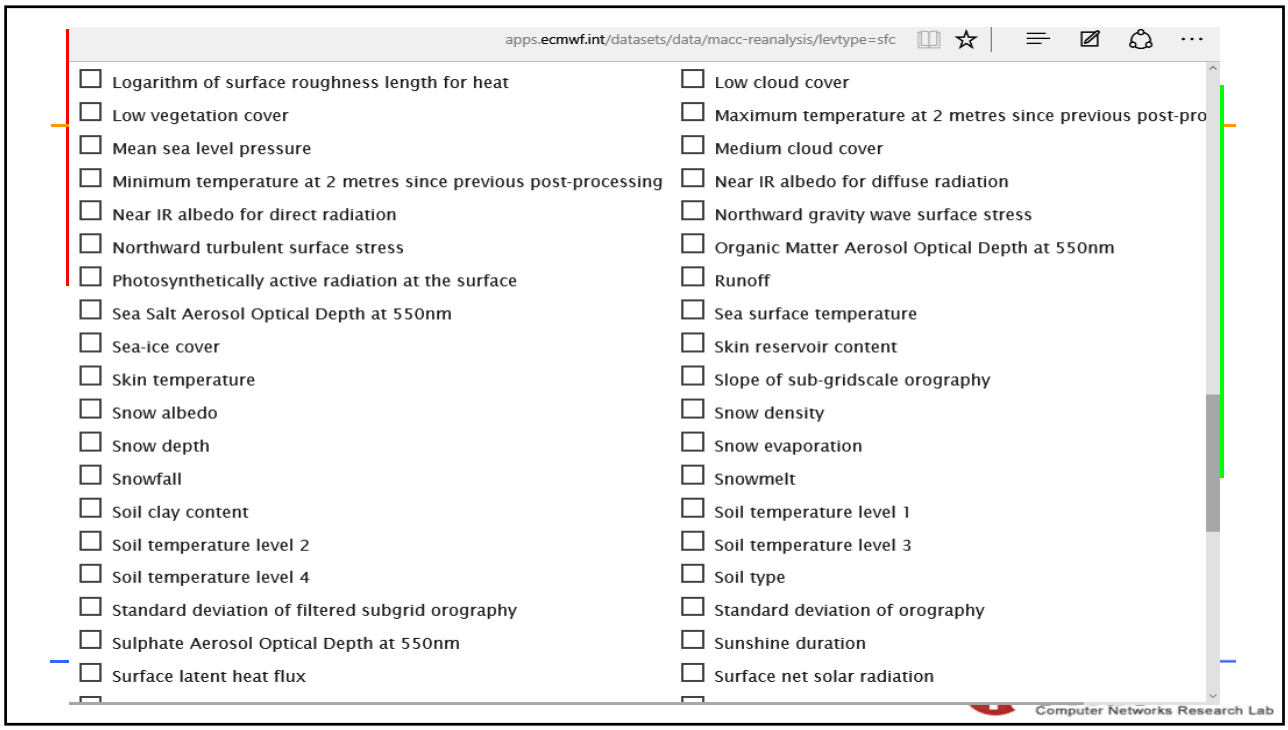
apps.ecmwf.int/datasets/data/macc-reanalysis/levtype=sfc

Select parameterhttp://apps.ecmwf.int/datasets/data/macc-reanalysis/levtype=sfc/

☐ 2 metre dewpoint temperature	☐ 2 metre temperature
☐ 10 metre U wind component	☐ 10 metre V wind component
☐ 10 metre wind gust since previous post-processing	☐ Albedo
☐ Angle of sub-gridscale orography	☐ Anisotropy of sub-gridscale orography
☐ Black Carbon Aerosol Optical Depth at 550nm	☐ Boundary layer dissipation
☐ Boundary layer height	☐ Budget values
☐ Convective available potential energy	☐ Convective precipitation
☐ Downward UV radiation at the surface	☐ Dust Aerosol Optical Depth at 550nm
☐ Dust emission potential	☐ Eastward gravity wave surface stress
☐ Eastward turbulent surface stress	☐ Evaporation
☐ Forecast albedo	☐ Forecast logarithm of surface roughness for heat
☐ Forecast surface roughness	☐ GEMS Total column ozone
☐ Geopotential	☐ Gravity wave dissipation
☐ High cloud cover	☐ High vegetation cover
☐ Ice temperature layer 1	☐ Ice temperature layer 2
☐ Ice temperature layer 3	☐ Ice temperature layer 4
☐ Land-sea mask	☐ Large-scale precipitation
☐ Large-scale precipitation fraction	☐ Lifting threshold speed


apps.ecmwf.int/datasets/data/macc-reanalysis/levtype=sfc
Logarithm of surface roughness length for heat
Low vegetation cover
Mean sea level pressure
Minimum temperature at 2 metres since previous post-processing
Near IR albedo for direct radiation
Northward turbulent surface stress
Photosynthetically active radiation at the surface
Sea Salt Aerosol Optical Depth at 550nm
Sea-ice cover
Skin temperature
Snow albedo
Snow depth
Snowfall
Soil clay content
Soil temperature level 2
Soil temperature level 4
Standard deviation of filtered subgrid orography
Sulphate Aerosol Optical Depth at 550nm
Surface latent heat flux
Low cloud cover
Maximum temperature at 2 metres since previous post-pro
Medium cloud cover
Near IR albedo for diffuse radiation
Northward gravity wave surface stress
Organic Matter Aerosol Optical Depth at 550nm
Runoff
Sea surface temperature
Skin reservoir content
Slope of sub-gridscale orography
Snow density
Snow evaporation
Snowmelt
Soil temperature level 1
Soil temperature level 3
Soil type
Standard deviation of orography
Sunshine duration
Surface net solar radiation
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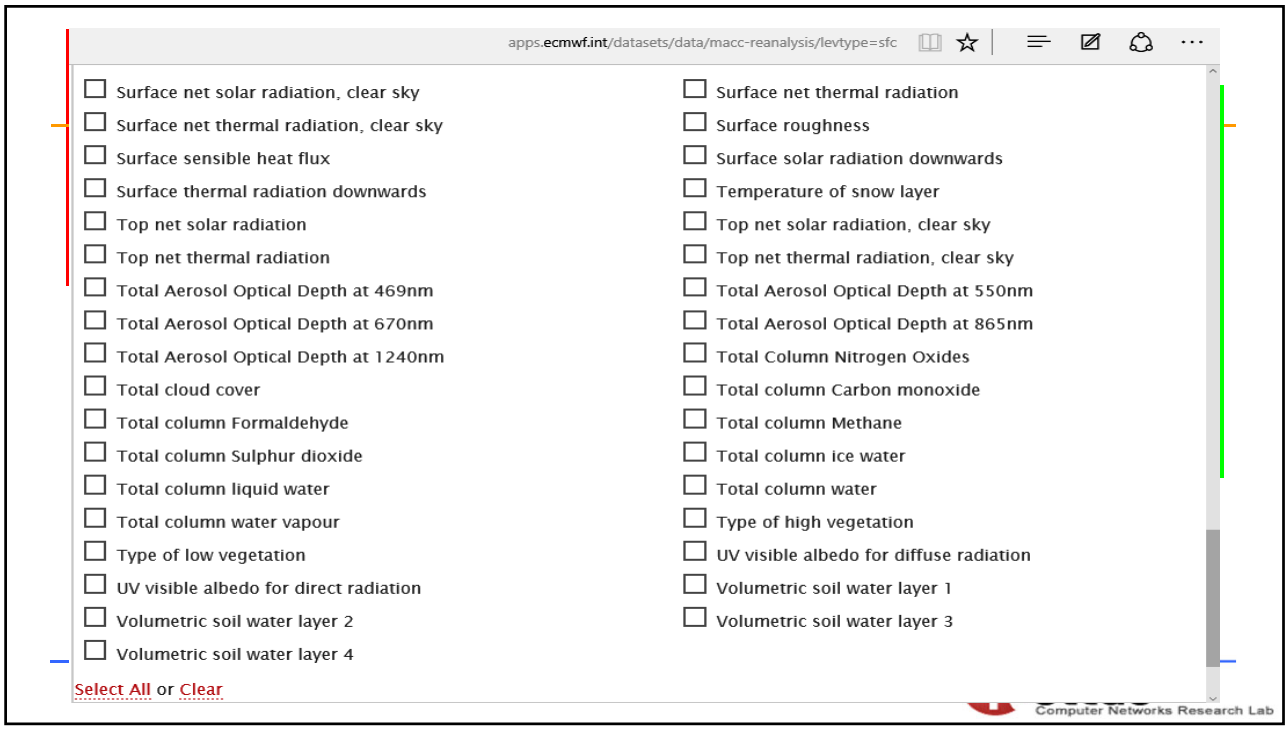
apps.ecmwf.int/datasets/data/macc-reanalysis/levtype=sfc
Surface net solar radiation, clear sky
Surface net thermal radiation, clear sky
Surface sensible heat flux
Surface thermal radiation downwards
Top net solar radiation
Top net thermal radiation
Total Aerosol Optical Depth at 469nm
Total Aerosol Optical Depth at 670nm
Total Aerosol Optical Depth at 1240nm
Total cloud cover
Total column Formaldehyde
Total column Sulphur dioxide
Total column liquid water
Total column water vapour
Type of low vegetation
UV visible albedo for direct radiation
Volumetric soil water layer 2
Volumetric soil water layer 4
Surface net thermal radiation
Surface roughness
Surface solar radiation downwards
Temperature of snow layer
Top net solar radiation, clear sky
Top net thermal radiation, clear sky
Total Aerosol Optical Depth at 550nm
Total Aerosol Optical Depth at 865nm
Total Column Nitrogen Oxides
Total column Carbon monoxide
Total column Methane
Total column ice water
Total column water
Type of high vegetation
UV visible albedo for diffuse radiation
Volumetric soil water layer 1
Volumetric soil water layer 3
Select All or Clear
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