NCArray Toolkit 1.0.7

NetCDF file Array implementaion for GNU Octave.

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To download a copy of the GNU Octave NCArray package, please visit `https://gnu-octave.github.io/octave-ncarray/`.

Table of Contents

1 Installing and loading 1
1.1 Online Direct install 1
1.2 Off-line install 1
1.3 Loading 1

2 Basic Usage Overview 2

3 Function Reference 3
3.1 ncArray 3
3.1.1 @ncArray/coord 3
3.1.2 @ncArray/subsasgn 3
3.1.3 @ncArray/subsref 3
3.1.4 cached_decompress 4
3.1.5 ncArray 4
3.1.6 ncCatArray 5
3.1.7 nccoord 5
3.1.8 ncreadtime 6
3.1.9 nctimeunits 6
3.2 ncBaseArray 6
3.2.1 @BaseArray/BaseArray 6
3.2.2 @BaseArray/end 7
3.2.3 @BaseArray/full 7
3.2.4 @BaseArray/isnumeric 7
3.2.5 @BaseArray/max 7
3.2.6 @BaseArray/mean 7
3.2.7 @BaseArray/min 7
3.2.8 @BaseArray/moment 7
3.2.9 @BaseArray/numel 7
3.2.10 @BaseArray/prod 7
3.2.11 @BaseArray/reduce 7
3.2.12 @BaseArray/size 7
3.2.13 @BaseArray/std 8
3.2.14 @BaseArray/sum 8
3.2.15 @BaseArray/sumsq 8
3.2.16 @BaseArray/var 8
3.3 Test script 8
3.3.1 test_ncarray 8

Appendix A GNU General Public License 9

Index 19

1 Installing and loading

The toolkit must be installed and then loaded to be used.

It can be installed in GNU Octave directly from octave-forge, or can be installed in an off-line mode via a downloaded tarball.

The toolkit must be then be loaded once per each GNU Octave session in order to use its functionality.

The toolkit requires the statistics package and the netcdf package to be installed ebfore installing the ncArray toolkit.

To verify the required packages are installed run:

```
pkg list netcdf
pkg statistics
```

Install the required toolkits if they are not installed before installing the ncarray toolkit.

1.1 Online Direct install

With an internet connection available, the toolkit can be installed from octave-forge using the following command within GNU Octave:

```
pkg install -forge ncarray
```

The latest released version of the toolkit will be downloaded and installed.

1.2 Off-line install

With the NcArray toolkit package already downloaded, and in the current directory when running GNU Octave, the package can be installed using the following command within GNU Octave:

```
pkg install ncarray-1.0.7.tar.gz
```

1.3 Loading

Regardless of the method of installing the toolkit, in order to use its functions, the toolkit must be loaded using the pkg load command:

```
pkg load ncarray
```

The toolkit must be loaded on each GNU Octave session.

2 Basic Usage Overview

Using ncArray

Create a array object:

```
SST = ncArray('file1.nc','SST');
```

Load / access the file as an array

```
# load the whole file
data = SST(:,:,:);
# Load a single value
data = SST(3,2,1);
```

Get the attrubute 'units'

```
units = SST.units;
```

Using ncCatArray

Concatentate files over the 3rd dimention

```
SST = ncCatArray(3,{'file1.nc','file2.nc','file3.nc'},'SST');
```

Load / access the file as an array

```
# load all the files file
data = SST(:,:,:);
# Load a single value from the 3rd file
data = SST(1,2,3);
```

3 Function Reference

The functions currently available in the toolkit are described below;

3.1 ncArray

3.1.1 @ncArray/coord

`c = coord(A)`

Get a array of structures with the coordinate of ncArray A.

Inputs

A - ncArray value

Outputs

c - array of coordinates

3.1.2 @ncArray/subsasgn

`subsasgn(A, idx, rhs)`

Perform the subscripted assignment operation according to the subscript specified by idx.

A slice of the NetCDF variable can be saved by using A(index1,index2,...) = rhs;

Inputs

A - ncArray value

idx - idx structure

rhs - value to assign

Outputs

None

3.1.3 @ncArray/subsref

`out = subsref(A, idx)`

Perform the subscripted element selection operation according to the subscript specified by idx.

Inputs

A - ncArray value

idx - idx structure

Outputs

out - output value of operation

A slice of the NetCDF variable can be load by using A(index1,index2,...) and attributes can be loaded by A.attribute_name or A.('attribute_name')

If index selection is followed by struct selection 'coord', then the coordinates corresponding to the slice are loaded:

For example, the coordinate of element A(4,3):

```
[lon,lat] = A(4,3).coord;
```

3.1.4 cached_decompress

fname = cached_decompress(*filename*)

Decompress a file using a cache.

Inputs

filename: name of the file which is possibly compressed

Outputs

fname: the filename of the uncompressed file

Global variables

CACHED_DECOMPRESS_DIR (default is the result of tempname) cache directory of decompressed files.

CACHED_DECOMPRESS_LOG_FID (default 1): file id for log message

CACHED_DECOMPRESS_MAX_SIZE (default 1e10): maximum size of cache in bytes.

3.1.5 ncArray

V = ncArray(*filename*, *varname*)
V = ncArray(*filename*, *varname*, *propertyname*, *propertyvalue*, ...)

Create a ncArray that can be accessed as a normal array.

Inputs

filename - filename to read

varname - variable name to read from file

propertyname, *propertyvalue* - property name and value pairs.

Outputs

V - a ncArray of the read file.

For read access filename can be compressed if it has the extensions ".gz" or ".bz2". It use the function cache_decompress to cache to decompressed files.

Data is loaded by ncread and saved by ncwrite. Values equal to _FillValue are thus replaced by NaN and the scaling (add_offset and scale_factor) is applied during loading and saving.

Example

Loading the variable (assuming V is 3 dimensional):

```
x = V(1,1,1);   % load element 1,1,1
x = V(:,:,:);   % load the complete array
x = V();  x = full(V)  % loads also the complete array
```

Saving data in the netcdf file:

```
V(1,1,1) = x;   % save x in element 1,1,1
V(:,:,:) = x;
```

Attributes

```
units = V.units; % get attribute called "units"
V.units = 'degree C'; % set attributes;
```

Note: use the '.()' notation if the attribute has a leading underscore (due to a limitation in the matlab parser):

```
V.('_someStrangeAttribute') = 123;
```

See also: cache_decompress, ncCatArray. Web: http://modb.oce.ulg.ac.be/mediawiki/index.php/ncArray

3.1.6 ncCatArray

C = ncCatArray(*dim*, *filenames*, *varname*)
C = ncCatArray(*dim*, *pattern*, *varname*)
C = ncCatArray(*dim*, *filenamefun*, *varname*, *range*)
C = ncCatArray(... *propertyname*, *properyvalue*)

Create an array that represent a concatenated NetCDF variables.

Create a concatenated array from variables (varname) in a list of netcdf files along dimension dim.Individual elements can be accessed by subscripts

e.g. C(2,3) and the corrsponding subset of the appropriate file is loaded

Inputs

dim - dimensions use for variables

varname - variable name to load

filenames - list of filenames as a cell array

pattern - shell wildcard pattern (e.g. file_*.nc)

filenamefunc - a function handle where the i-th filename is filenamefun(range(i)).

propertyname, *properyvalue* - propery name and value pairs.

Properties

'SameAttributes': false or true (default). If SameAttribute is true, the variables' NetCDF attribute of all files are assumed to be the same. Only the attributes of the first file is loaded in this case.

Outputs

C - a concatenated array from the read variables of the files.

Example

```
data = ncCatArray(3,{'file-20120708.nc','file-20120709.nc'},'SST')

data = ncCatArray(3,'file-*.nc','SST')

data = ncCatArray(3,@(t) ['file-' datestr(t,'yyyymmdd') '.nc'],'SST',...
            datenum(2012,07,08):datenum(2012,07,09));
```

Note: in Octave the glob function is used to determine files matching the shell wildcard pattern, while in Matlab rdir is used. The function rdir is available from Matlab exchange under BSD license (http://www.mathworks.com/matlabcentral/fileexchange/19550).

See also: cache_decompress, ncArray.

3.1.7 nccoord

[*dims*, *coord*] = nccoord(*filename*, *varname*)

Get coordinates of the variable varname in the netcdf file called filename. The netcdf is assumed to follow the CF convention.

Inputs

filename - netcdf filename

varname - variable name

Outputs

dims - a cell-array of the dimensions of varname

coord - an array of structures with the field 'name' for the variable name, 'dims' with a cell-array of the netcdf dimensions, the units and NetCDF-CF standard name.

coord is an empty structure if no coordinate information have been found.

3.1.8 ncreadtime

`t = ncreadtime(filename, varname)`
Read a time variable as serial day number.

Inputs

filename - netcdf filename

varname - time variable called varname.

Outputs

t serial day number (days since 31 December 1 BC, as datenum).

3.1.9 nctimeunits

`[t0, f] = nctimeunits(u)`
Parse netCDF time unit.

Inputs

u - netCDF time unit

Outputs

t0 - time offset (days since 31 December 1 BC, as datenum)

f - scaling factor (in days)

See the netCDF CF convention for the structure of the time units. http://cfconventions.org/Data/cf-conventions/cf-conventions-1.6/build/cf-conventions.html#time-coordinate and http://www.unidata.ucar.edu/software/thredds/current/netcdf-java/CDM/CalendarDateTime.html

3.2 ncBaseArray

3.2.1 @BaseArray/BaseArray

`BA = BaseArray(SZ)`
Create a BaseArray of size SZ. BaseArray is an abstract class.

Derived classes should implement the methods subsref and subsasgn. BaseArray implements several reduction methods such as sum, prod and mean.

Inputs

SZ - size of the array. SZ should have least two elements.

Outputs

BA - a BaseArray object

3.2.2 @BaseArray/end

`e = end(A, k)`
Return last index along a dimension.

3.2.3 @BaseArray/full

`F = full(A)`
Make full (dense) array.

3.2.4 @BaseArray/isnumeric

`isn = isnumeric(A)`
Test if array is numeric.

3.2.5 @BaseArray/max

`s = max(A, [], dim)`
Compute the maximum along dimension DIM.

3.2.6 @BaseArray/mean

`s = end(A, dim)`
Compute the mean along dimension DIM.

3.2.7 @BaseArray/min

`s = end(A, [], dim)`
Compute the minimum along dimension DIM.

3.2.8 @BaseArray/moment

`s = moment(A, order, dim)`
Compute the central moment of the given order along dimension DIM.

3.2.9 @BaseArray/numel

`n = numel(A)`
Number of elements.

3.2.10 @BaseArray/prod

`P = prod(A, dims)`
Compute the product of all elements along dimension DIM.

3.2.11 @BaseArray/reduce

`[s, n] = reducce(A, funred, funelem, dim)`
Reduce array using callback fundtions.

Reduce array using the function FUNRED applied to all elements after the function FUNELEM was applied along dimension DIM.

3.2.12 @BaseArray/size

`isz = size(A)`
Size of array

3.2.13 @BaseArray/std

`s = std(A, opt, dim)`
Compute the standard deviation.

3.2.14 @BaseArray/sum

`s = sum(A, dim)`
Compute sum along a dimension.

3.2.15 @BaseArray/sumsq

`s = end(A, dim)`
Compute the sum squared.

Compute the sum squared along dimension DIM.

3.2.16 @BaseArray/var

`s = var(A, opt, dim)`
Compute the variance along dimension DIM.

If OPT is equal to 1, then the variance is bias-corrected.

3.3 Test script

3.3.1 test_ncarray

`test_ncarray()`
Test ncBaseArray, ncCatArray and ncArray.

Appendix A GNU General Public License

Version 3, 29 June 2007

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Index

B

BaseArray . . . 6
Basic Usage Overview . . . 2

C

cached_decompress . . . 4
coord . . . 3
copyright . . . 9

E

end . . . 7

F

full . . . 7
Function Reference . . . 3

I

Installing and loading . . . 1
isnumeric . . . 7

L

Loading . . . 1

M

max . . . 7
mean . . . 7
min . . . 7
moment . . . 7

N

ncArray . . . 3, 4
ncBaseArray . . . 6
ncCatArray . . . 5
nccoord . . . 5
ncreadtime . . . 6
nctimeunits . . . 6
numel . . . 7

O

Off-line install . . . 1
Online install . . . 1

P

prod . . . 7

R

reduce . . . 7

S

size . . . 7
std . . . 8
subsasgn . . . 3
subsref . . . 3
sum . . . 8
sumsq . . . 8

T

Test script . . . 8
test_ncarray . . . 8

V

var . . . 8

W

warranty . . . 9