



MDMAT Specification

Technical description of the EFEU data cube concept

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Preface

This manual describes the data cube concept of the Erich Fruehstueck Entwicklungs Umgebung (EFEU).

The name mdat stands for **m**ultidimensional **d**ata **m**atrix. This indicates, that this is not only a concept for providing multidimensional data but also assists some matrix operations for arithmetic data types.

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Chapter 1

Basic concepts

Chapter 2

File formats

This chapter describes the different data formats to represent multidimensional data cubes.

2.1 The compact binary format

2.2 The fast accessible image format

2.3 The XML data format

Chapter 3

Interfaces

3.1 Simple data retrieval commands

3.2 XML data retrieval language

3.3 Data cube functions

3.4 C library functions

Commands

NAME

md2edb – convert data cube to efeu data files

SYNOPSIS

```
md2edb [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -1 ]
      [ --fast ] [ -9 ] [ --best ] [ -E expr ] [ -F file ] [ -v var ] [ -r ] [ -T title ] [ -p mode ] [ -d ]
      [ -n lim ] [ -f def ] in { name=var } [ out ]
```

DESCRIPTION

The following options and arguments are accepted from command `md2edb`:

- `--help[=type]`
create command usage. The optional parameter *type* determines the formatting and output of the description.
- term
display on terminal (default)
- raw
output raw data for `efeudoc`
- man
output nroff/troff source for `man`
- lp send postscript data to `lpr`
- `--version`
show version information
- `--info[=entry]`
show command information
- `--debug[=mode]`
set debug level for command See for details.
- `--verbose`
set debug level to `.info`.
- `-1, --fast`
use fast compression by writing with `gzip`.
- `-9, --best`
use best compression by writing with `gzip`.
- `-E expr`
evaluate expression *expr*
- `-F file`
execute command lines in file *file*
- `-v var`
select type components of data cube
- `-r` remove singular axis
- `-T title`
set title of output file
- `-p mode`
output mode

- d** print data without header
- n *lim***
Limit of output data lines
- f *def***
apply filter *def* on efeu data files
- in*** input file name
- name=var***
selection parameter for data cube
- out*** output file name

ENVIRONMENT

APPLPATH
path for configuration files.

LANG
locale information

COPYRIGHT

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NAME

mdcat – concatenate data cubes

SYNOPSIS

```
mdcat [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -T title ]
      [ -n name ] [ -m map ] [ -o out ] [ file(s) ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdcat`:

`--help[=type]`
 create command usage. The optional parameter *type* determines the formatting and output of the description.

term
 display on terminal (default)

raw
 output raw data for `efeudoc`

man
 output nroff/troff source for `man`

lp
 send postscript data to `lpr`

`--version`
 show version information

`--info[=entry]`
 show command information

`--debug[=mode]`
 set debug level for command See for details.

`--verbose`
 set debug level to `.info`.

`-T title`
 set title of output file

`-n name`
 name of axis, default X

`-m map`
 create file mapping

`-o out`
 output file

file(s)
 input file(s)

ENVIRONMENT

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 path for configuration files.

`LANG`
 locale information

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NAME

mdcmp – compare two data cubes

SYNOPSIS

```
mdcmp [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -F file ]
      [ -E expr ] [ -f func ] [ -e expr ] [ -r ] [ -v var ] [ -T title ] file1 file2 { name=var } [ aus ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdcmp`:

`--help[=type]`

create command usage. The optional parameter *type* determines the formatting and output of the description.

term

display on terminal (default)

raw

output raw data for `efeudoc`

man

output nroff/troff source for `man`

lp send postscript data to `lpr`

`--version`

show version information

`--info[=entry]`

show command information

`--debug[=mode]`

set debug level for command See for details.

`--verbose`

set debug level to `.info`.

`-F file`

execute command lines in file *file*

`-E expr`

evaluate expression *expr*

`-f func`

compare function

`-e expr`

compare expression

`-r` remove singular axis

`-v var`

select type components

`-T title`

set title of output file

file1

name of first data cube

file2
name of second data cube

name=var
selection parameter

aus
output file

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LANG
locale information

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NAME

mdcreate – create data cube

SYNOPSIS

```
mdcreate [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ]
        [ -v value ] [ -T title ] [ -m map ] type { name=var } [ aus ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdcreate`:

`--help[=type]`

create command usage. The optional parameter *type* determines the formatting and output of the description.

term

display on terminal (default)

raw

output raw data for `efeudoc`

man

output nroff/troff source for `man`

lp send postscript data to `lpr`

`--version`

show version information

`--info[=entry]`

show command information

`--debug[=mode]`

set debug level for command See for details.

`--verbose`

set debug level to `.info`.

`-v value`

default value

`-T title`

set title of output file

type

type of data

`-m map`

create file mapping

name=var

list of axis

aus

name of output file

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NAME

mddiag – diagonalize axis of data cube

SYNOPSIS

```
mddiag [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -r ]
      [ -v var ] [ -T title ] [ -x axis ] [ -m map ] ein { name=var } [ aus ]
```

DESCRIPTION

The following options and arguments are accepted from command `mddiag`:

`--help[=type]`

create command usage. The optional parameter *type* determines the formatting and output of the description.

term

display on terminal (default)

raw

output raw data for `efeudoc`

man

output nroff/troff source for `man`

lp send postscript data to `lpr`

`--version`

show version information

`--info[=entry]`

show command information

`--debug[=mode]`

set debug level for command See for details.

`--verbose`

set debug level to `.info`.

`-r` remove singular axis

`-v var`

select type components

`-T title`

set title of output file

`-x axis`

name of axis

`-m map`

create file mapping

ein input file

name=var

selection parameter

aus

output file

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NAME

mddiff – show differences of data cubes

SYNOPSIS

```
mddiff [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ]
      [ -E expr ] [ -F file ] [ -r ] [ -v var ] [ -p prec ] file1 file2 { name=var } [ out ]
```

DESCRIPTION

The following options and arguments are accepted from command `mddiff`:

`--help[=type]`

create command usage. The optional parameter *type* determines the formatting and output of the description.

term

display on terminal (default)

raw

output raw data for `efeudoc`

man

output nroff/troff source for `man`

lp send postscript data to `lpr`

`--version`

show version information

`--info[=entry]`

show command information

`--debug[=mode]`

set debug level for command See for details.

`--verbose`

set debug level to `.info`.

`-E expr`

evaluate expression *expr*

`-F file`

execute command lines in file *file*

`-r` remove singular axis

`-v var`

select type components

`-p prec`

precision of floating numbers

file1

name of first data cube

file2

name of second data cube

name=var

selection parameter

out name of output file

ENVIRONMENT

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LANG

locale information

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NAME

mdfile – show structure of data cube

SYNOPSIS

```
mdfile [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -a ]
      [ -s ] [ -h ] [ -d ] [ -X ] [ -x ] [ -l ] [ file(s) ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdfile`:

`--help[=type]`
 create command usage. The optional parameter *type* determines the formatting and output of the description.

term
 display on terminal (default)

raw
 output raw data for `efeudoc`

man
 output nroff/troff source for `man`

lp send postscript data to `lpr`

`--version`
 show version information

`--info[=entry]`
 show command information

`--debug[=mode]`
 set debug level for command See for details.

`--verbose`
 set debug level to `.info`.

`-a` status of all files

`-s` show structure of data cube

`-h` show type and header

`-d` show description

`-X` short axis list

`-x` verbose axis list

`-l` long listing, equivalent to `-hdx`

file(s)
 files

ENVIRONMENT

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NAME

mdfunc – data cube function

SYNOPSIS

```
mdfunc [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -F file ]
      [ -E expr ] [ -r ] [ -m map ] [ -v var ] [ -T title ] [ --neg ] [ --not ] [ --cpl ] [ --rnd ]
      [ -f func ] [ -t type ] [ -e expr ] [ -x list ] [ -p prec ] file { name=var } [ out ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdfunc`:

--help[=*type*]

create command usage. The optional parameter *type* determines the formatting and output of the description.

term

display on terminal (default)

raw

output raw data for `efeudoc`

man

output nroff/troff source for `man`

lp send postscript data to `lpr`

--version

show version information

--info[=*entry*]

show command information

--debug[=*mode*]

set debug level for command See for details.

--verbose

set debug level to `.info`.

-F *file*

execute command lines in file *file*

-E *expr*

evaluate expression *expr*

-r remove singular axis**-m *map***

create file mapping

-v *var*

select type components

-T *title*

set title of output file

--neg

negation

--not

Boolean not

--cpl
bitwise complement

--rnd
round to nearest integer

-f *func*
function/operator

-t *type*
data type

-e *expr*
expression

-x *list*
list of column axis, default "#-1"

-p *prec*
floating number precision

file input file

name=var
selection parameter

out output file

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locale information

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NAME

mdmul – matrix multiplication

SYNOPSIS

```
mdmul [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -F file ]
      [ -E expr ] [ -r ] [ -m map ] [ -v var ] [ -T title ] [ -n dim ] [ -x axis ] [ -a name=var ]
      [ -b name=var ] file1 file2 { name=var } [ out ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdmul`:

- `--help[=type]`
create command usage. The optional parameter *type* determines the formatting and output of the description.
- term
display on terminal (default)
- raw
output raw data for `efeudoc`
- man
output nroff/troff source for `man`
- lp send postscript data to `lpr`
- `--version`
show version information
- `--info[=entry]`
show command information
- `--debug[=mode]`
set debug level for command See for details.
- `--verbose`
set debug level to `.info`.
- `-F file`
execute command lines in file *file*
- `-E expr`
evaluate expression *expr*
- `-r` remove singular axis
- `-m map`
create file mapping
- `-v var`
select type components
- `-T title`
set title of output file
- `-n dim`
number of common axis
- `-x axis`
name of common axis

-a name=var
selection parameter for first input file

-b name=var
selection parameter for second input file

file1
name of first data cube

file2
name of second data cube

name=var
selection parameter for both data files

out output file

ENVIRONMENT

APPLPATH
path for configuration files.

LANG
locale information

COPYRIGHT

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NAME

mdpaste – paste data cubes with regard to axis

SYNOPSIS

```
mdpaste [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -r ]
        [ -m map ] [ -v var ] [ -T title ] [ -s ] [ -u ] [ -e expr ] [ -n name ] [ -o aus ] { name=var }
        file(s) ...
```

DESCRIPTION

The following options and arguments are accepted from command `mdpaste`:

- `--help[=type]`
create command usage. The optional parameter *type* determines the formatting and output of the description.
- term
display on terminal (default)
- raw
output raw data for `efeudoc`
- man
output nroff/troff source for `man`
- lp send postscript data to `lpr`
- `--version`
show version information
- `--info[=entry]`
show command information
- `--debug[=mode]`
set debug level for command See for details.
- `--verbose`
set debug level to `.info`.
- `-r` remove singular axis
- `-m map`
create file mapping
- `-v var`
select type components
- `-T title`
set title of output file
- `-s` sort labels of axis
- `-u` sort labels of axis, use only last of repeated labels
- `-e expr`
expression for comparing, default is "cmp(a,b)".
- `-n name`
name of axis for pasting, default is #1
- `-o aus`
output file

name=var
selection parameter

file(s) ...
list of input files.

ENVIRONMENT

APPLPATH
path for configuration files.

LANG
locale information

COPYRIGHT

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NAME

mdpermut – reorder axis of data cube

SYNOPSIS

```
mdpermut [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -r ]
        [ -v var ] [ -T title ] file { name=var } [ out ] [ name(s) ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdpermut`:

`--help[=type]`

create command usage. The optional parameter *type* determines the formatting and output of the description.

term

display on terminal (default)

raw

output raw data for `efeudoc`

man

output nroff/troff source for `man`

lp send postscript data to `lpr`

`--version`

show version information

`--info[=entry]`

show command information

`--debug[=mode]`

set debug level for command See for details.

`--verbose`

set debug level to `.info`.

`-r` remove singular axis

`-v var`

select type components

`-T title`

set title of output file

file input file

name=var

selection parameter

out output file

name(s)

name of axis to order first

ENVIRONMENT

`APPLPATH`

path for configuration files.

`LANG`

locale information

COPYRIGHT

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NAME

mdprint – print data cube

SYNOPSIS

```
mdprint [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ]
[ -F file ] [ -E expr ] [ -M mode ] [ --ascii ] [ --csv ] [ --tex ] [ --tab ] [ --data ] [ --sc ]
[ --std ] [ --ps ] [ --psq ] [ --lp ] [ --lpq ] [ --mark ] [ --nomark ] [ -h ] [ -b ] [ -H ]
[ -t ] [ -z ] [ -L loc ] [ --locale loc ] [ -f font ] [ -l width ] [ -3 ] [ -w width ] [ -p prec ]
[ -d delim ] [ -g ] [ -e ] [ -x list ] [ -s list ] [ -r ] [ -R list ] [ -v var ] [ -T title ] [ -P name=list ]
[ --paste name=list ] [ --paste-delim key ] [ -S list ] [ --split list ] file { name=var }
[ out ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdprint`:

`--help[=type]`

create command usage. The optional parameter *type* determines the formatting and output of the description.

term

display on terminal (default)

raw

output raw data for `efeudoc`

man

output nroff/troff source for `man`

lp

send postscript data to `lpr`

`--version`

show version information

`--info[=entry]`

show command information

`--debug[=mode]`

set debug level for command See for details.

`--verbose`

set debug level to `.info`.

`-F file`

execute command lines in file *file*

`-E expr`

evaluate expression *expr*

`-M mode`

set output mode, default is "std"

`--ascii`

prepare as ascii file

`--csv`

prepare for excel

`--tex`

prepare for LaTeX

`--tab`
prepare for LaTeX tabular environment

`--data`
print only data values

`--sc`
output sc spreadsheet

`--std`
fixed column alignment

`--ps`
output PostScript file

`--psq`
output PostScript file in landscape

`--lp`
print data cube

`--lpq`
print data cube in landscape

`--mark`
mark column marker as comment

`--nomark`
suppress column marker

`-h` show header only

`-b` show data only

`-H` show complete header

`-t` show only title in header

`-z` suppress 0 values

`-L loc, --locale loc`
set locale for number format to *loc*

`-f font`
font size in point

`-l width`
width of line label

`-3` align exponent to multiples of 3

`-w width`
field width for values

`-p prec`
floating number precision

`-d delim`
delimiter of lists

`-g` use universal float format

`-e` use exponential float format

-x *list*
mark axis as column

-s *list*
accumulate list of axis

-r remove singular axis

-R *list*
remove singular axis from List *list*

-v *var*
select type components

-T *title*
set title of output file

-P *name=list*, **--paste** *name=list*
paste list *list* of axis to new axis *name*

--paste-delim *key*
delimiter for pasting axis, default: _

-S *list*, **--split** *list*
split data matrix by axis *list*.

file input file

name=var
selection parameter

out output file

ENVIRONMENT

APPLPATH
path for configuration files.

LANG
locale information

COPYRIGHT

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NAME

mdread – read data cube

SYNOPSIS

```
mdread [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ]
[ -x name ] [ -y name ] [ -t type ] [ -M ] [ -L loc ] [ --locale loc ] [ --sc ] [ -r ] [ -m map ]
[ -v var ] [ -T title ] file { name=var } [ out ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdread`:

- `--help[=type]`
create command usage. The optional parameter *type* determines the formatting and output of the description.
- term
display on terminal (default)
- raw
output raw data for `efeudoc`
- man
output nroff/troff source for `man`
- lp send postscript data to `lpr`
- `--version`
show version information
- `--info[=entry]`
show command information
- `--debug[=mode]`
set debug level for command See for details.
- `--verbose`
set debug level to `.info`.
- `-x name`
column axis name(s)
- `-y name`
row axis name(s)
- `-t type`
data type
- `-M` check magic number
- `-L loc, --locale loc`
set locale for number format to *loc*
- `--sc`
convert sc spreadsheet
- `-r` remove singular axis
- `-m map`
create file mapping
- `-v var`
select type components

-T title set title of output file
file input file
name=var selection parameter
out output file

ENVIRONMENT

APPLPATH
path for configuration files.

LANG
locale information

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NAME

mdround – round values of data cube

SYNOPSIS

```
mdround [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -r ]
        [ -m map ] [ -v var ] [ -T title ] [ -s val ] [ -m val ] file { name=var } [ out ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdround`:

`--help[=type]`

create command usage. The optional parameter *type* determines the formatting and output of the description.

term

display on terminal (default)

raw

output raw data for `efeudoc`

man

output nroff/troff source for `man`

lp send postscript data to `lpr`

`--version`

show version information

`--info[=entry]`

show command information

`--debug[=mode]`

set debug level for command See for details.

`--verbose`

set debug level to `.info`.

`-r` remove singular axis

`-m map`

create file mapping

`-v var`

select type components

`-T title`

set title of output file

`-s val`

adjust data sum to value *val*

`-m val`

scalar multiplication with value *val*

file input file

name=var

selection parameter

out output file

ENVIRONMENT

APPLPATH

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LANG

locale information

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NAME

mdselect – select part of data cube

SYNOPSIS

```
mdselect [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ]
        [ -F file ] [ -E expr ] [ -r ] [ -m map ] [ -s list ] [ -v var ] [ -T title ] ein { name=var } [ aus ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdselect`:

- `--help[=type]`
create command usage. The optional parameter *type* determines the formatting and output of the description.
- `term`
display on terminal (default)
- `raw`
output raw data for `efeudoc`
- `man`
output nroff/troff source for `man`
- `lp` send postscript data to `lpr`
- `--version`
show version information
- `--info[=entry]`
show command information
- `--debug[=mode]`
set debug level for command See for details.
- `--verbose`
set debug level to `.info`.
- `-F file`
execute command lines in file *file*
- `-E expr`
evaluate expression *expr*
- `-r` remove singular axis
- `-m map`
create file mapping
- `-s list`
accumulate list of axis
- `-v var`
select type components
- `-T title`
set title of output file
- ein* input file
- name=var*
selection parameter

aus
output file

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NAME

mdsum – accumulate axis of data cube

SYNOPSIS

```
mdsum [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -r ]
      [ -v var ] [ -T title ] in out { name=var } [ name(s) ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdsum`:

`--help[=type]`

create command usage. The optional parameter *type* determines the formatting and output of the description.

term

display on terminal (default)

raw

output raw data for `efeudoc`

man

output nroff/troff source for `man`

lp send postscript data to `lpr`

`--version`

show version information

`--info[=entry]`

show command information

`--debug[=mode]`

set debug level for command See for details.

`--verbose`

set debug level to `.info`.

`-r` remove singular axis

`-v var`

select type components

`-T title`

set title of output file

in input file name

out output file name

name=var

selection parameter

name(s)

name of axis to cumulate

ENVIRONMENT

APPLPATH

path for configuration files.

LANG

locale information

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NAME

mdterm – evaluate data cube expression

SYNOPSIS

```
mdterm [ --help[=type] ] [ --version ] [ --info[=entry] ] [ --debug[=mode] ] [ --verbose ] [ -F file ]
      [ -E expr ] [ --add ] [ --sub ] [ --mul ] [ --div ] [ --min ] [ --max ] [ -f func ] [ -t type ]
      [ -e expr ] [ -p prec ] [ -r ] [ -m map ] [ -v var ] [ -T title ] file1 file2 { name=var } [ out ]
```

DESCRIPTION

The following options and arguments are accepted from command `mdterm`:

- `--help[=type]`
create command usage. The optional parameter *type* determines the formatting and output of the description.
- `term`
display on terminal (default)
- `raw`
output raw data for `efeudoc`
- `man`
output nroff/troff source for `man`
- `lp` send postscript data to `lpr`
- `--version`
show version information
- `--info[=entry]`
show command information
- `--debug[=mode]`
set debug level for command See for details.
- `--verbose`
set debug level to `.info`.
- `-F file`
execute command lines in file *file*
- `-E expr`
evaluate expression *expr*
- `--add`
cell by cell addition
- `--sub`
cell by cell subtraction
- `--mul`
cell by cell multiplication
- `--div`
cell by cell division
- `--min`
cell minimum
- `--max`
cell maximum

- f** *func*
cell by cell function/operator
- t** *type*
data type
- e** *expr*
expression
- p** *prec*
floating number precision
- r** remove singular axis
- m** *map*
create file mapping
- v** *var*
select type components
- T** *title*
set title of output file
- file1*
name of first data cube
- file2*
name of second data cube
- name=var*
selection parameter
- out* output file

ENVIRONMENT

- APPLPATH**
path for configuration files.
- LANG**
locale information

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