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# OpenGIS Workshop. Gridded data

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November 3, 2014

**Deltares**

# Index

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Definition

Multidimensional rectangular array of grid points containing values?

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## Features of gridded data

### Features

Format

Dimensionality

Spacing

Number and type of values stores

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## Applications

#### Data world

Data exploration

Data dissemination

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Applications

### Data world

Data exploration

Data dissemination

### Models

Numerical modelling...

Meteorology/Oceanography/Climate

Finite volume/difference methods

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# Data grids

## Data grids

- Dataset type?
- Main variables?
- Number of dimensions?

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## Data grids

- Dataset type?
- Main variables?
- Number of dimensions?
- Showing concentration plots for given time and space
- Showing inflows from rivers of nutrients a user defined stretches / patches
- Calculate spatially distributed data products

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## Grids (math)

A grid usually refers to two or more infinite sets of evenly-spaced parallel lines at particular angles to each other in a plane, or the intersections of such lines.
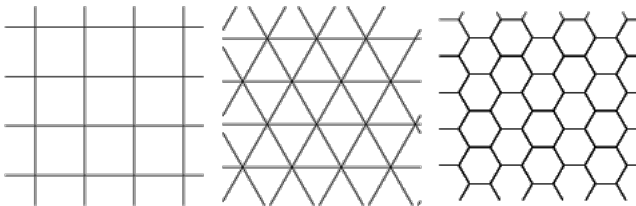
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## Grids (math)

A grid usually refers to two or more infinite sets of evenly-spaced parallel lines at particular angles to each other in a plane, or the intersections of such lines.



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## Regular grids

Tessellation of regular polygons

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# Regular grids

Tessellation of regular polygons



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## Rectilinear grids

Congruent Tessellation.
Uniform?

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## Rectilinear grids

Congruent Tessellation.
Uniform?



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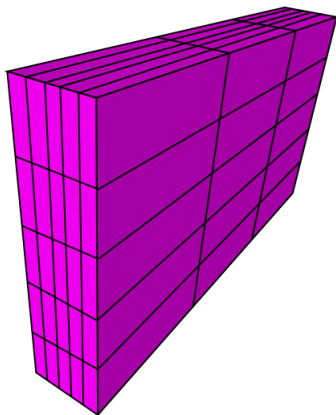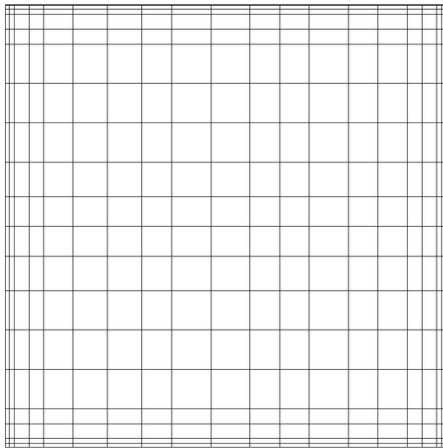
## Rectilinear grids

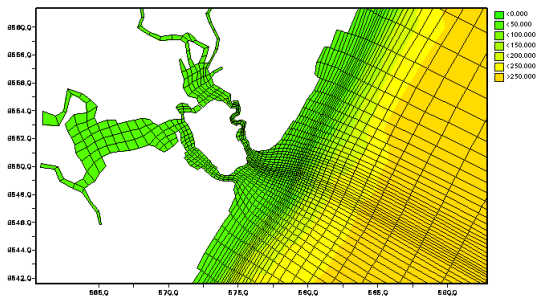Congruent Tessellation. Curvilinear grids



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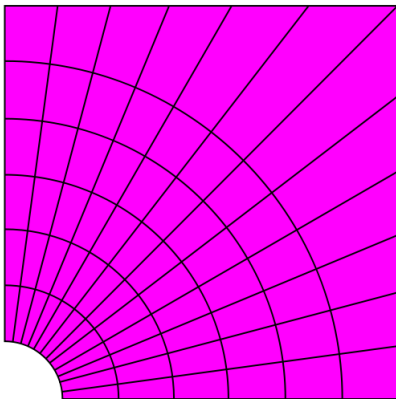
# Delft3d grids

Congruent Tessellation.

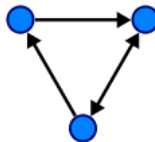# Delft3d grids

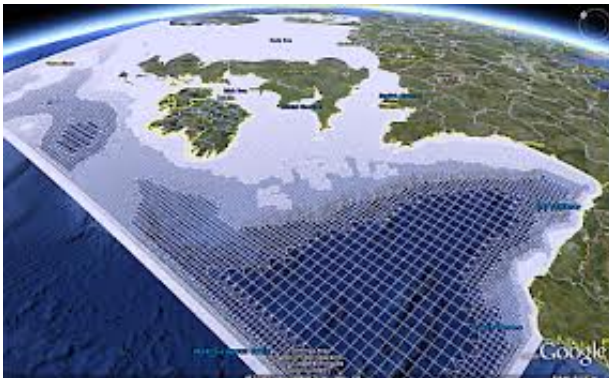Congruent Tessellation.
Delft3D
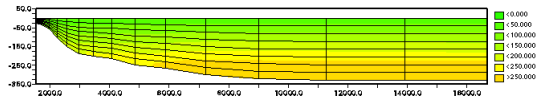
# Unstructured grids

Irregular tessellation of simple shapes

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## Unstructured grids

Irregular tessellation of simple shapes
Similarity with graph data structure



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# Unstructured grids: FEWS



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## Unstructured grids: D-Flow FM

# Unstructured grids: D-Flow FM

# Unstructured grids: D-Flow FM

...FM stands for flexible mesh



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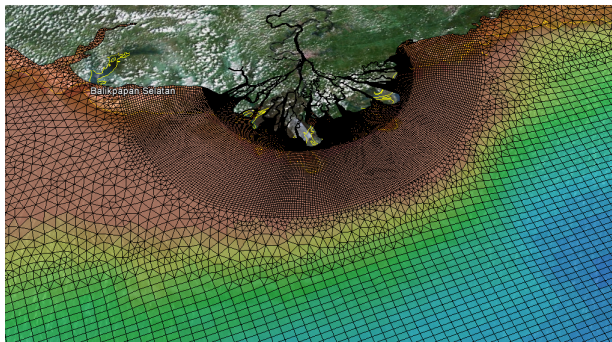
# Working with Raster

**Grid image**
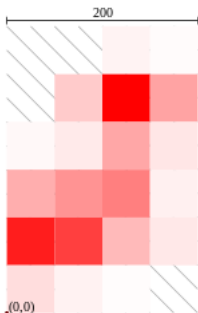


**Values**

|  | 25 | 75 | 125 | 175 |
|---|---|---|---|---|
| **275** | NA | NA | 5 | 2 |
| **225** | NA | 20 | 100 | 36 |
| **175** | 3 | 8 | 35 | 10 |
| **125** | 32 | 42 | 50 | 6 |
| **75** | 88 | 75 | 27 | 9 |
| **25** | 13 | 5 | 1 | NA |

**ASCII grid format**

```
ncols           4
nrows           6
xllcorner       0.0
yllcorner       0.0
cellsize        50.0
NODATA_value   -9999
-9999 -9999 5 2
-9999 20 100 36
3 8 35 10
32 42 50 6
88 75 27 9
13 5 1 -9999
```

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## WMS

openlayers WMS
NOAA WMS

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# gdal library

## gdal

Gdal is a translator library for raster and vector geospatial data formats

Features

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# gdal library

### gdal

Gdal is a translator library for raster and vector geospatial data formats

Features Raster utility programs:
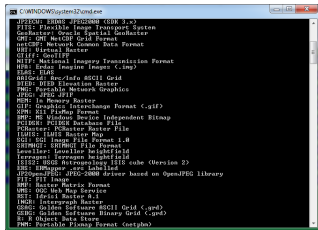gdalinfo, gdal_translate, gdaladdo, gdalwarp, ...
Vector utility programs:
ogrinfo, ogr2ogr, ogrtindex, ...
gdal webpage
QGIS uses it in the back-end.

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# gdal in other languages

- Shell (cross-platform)



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# gdal in other languages

- Shell (cross-platform)



Bindings:

- C++
- Python osgeo
- R rgdal
- Matlab MEXGDAL
- ...

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# Working with NetCDF

# Working with NetCDF



- File Format

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# Working with NetCDF



- File Format
- Library

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# Working with NetCDF



- File Format
- Library
- Interface

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## Working with NetCDF



- File Format
- Library
- Interface

General information on NetCDF are available.

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## Working with NetCDF

Openearth.eu

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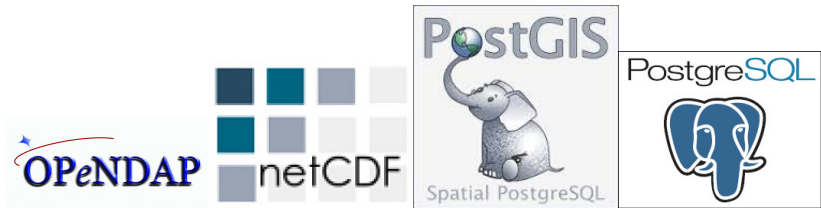
## CF Conventions

NetCDF Climate and Forecast Metadata Conventions
cfconventions

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## OET & NetCDF

Links in OET:
Python:
OET python nc, OET python tutorial
Matlab:
OET matlab nc, OET matlab tutorial

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## Opendap

It strongly depends on the language. Many tutorials are available on line. Creating netCDF files that are fully self-descriptive and comply with the CF convention is not trivial

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# Opendap

It strongly depends on the language. Many tutorials are available
on line. Creating netCDF files that are fully self-descriptive and
comply with the CF convention is not trivial

As a start you could use OET netcdfkickstarter.
kickstarter wiki page
netcdfkickstarter

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## Opendap

Browse

- Deltares OPeNDAP server http://opendap.deltares.nl/
- List of OPeNDAP servers worldwide (remote servers)

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opendap.deltares.nl

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## Tutorials

### OET OpenGIS

bit.ly/gisworkshop

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