

**OSGeo-ICA-ISPRS  
International Labs  
Network  
“Geo for All”**

# **Free and Open Source Software and Web Services specializing in the Water Resources Domain**

## **Webinar Series**

**Maria Brovelli**  
Politecnico Di Milano

**Rafael Moreno**  
University of Colorado  
Denver

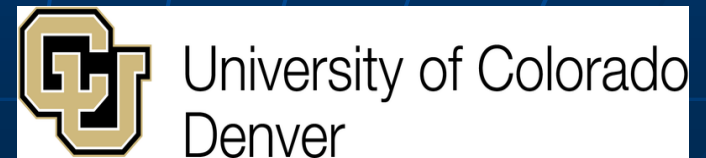
September 2014



**Maria Brovelli**



**Rafael Moreno**



# Presentation Organization

20-25 minutes (Rafael):

- Basics of FOSS and FOSS4G
- Overview of some FOSS and FOSS4 in the water domain.

20-25 minutes (Maria):

- FOSS and FOSS4G Geospatial Web tools in the water domain.

10 minutes:

- Questions and comments.

**FOSS**

(Free and Open Source Software)

**and**

**FOSS4G**

(FOSS for Geospatial Applications)

**OVERVIEW**

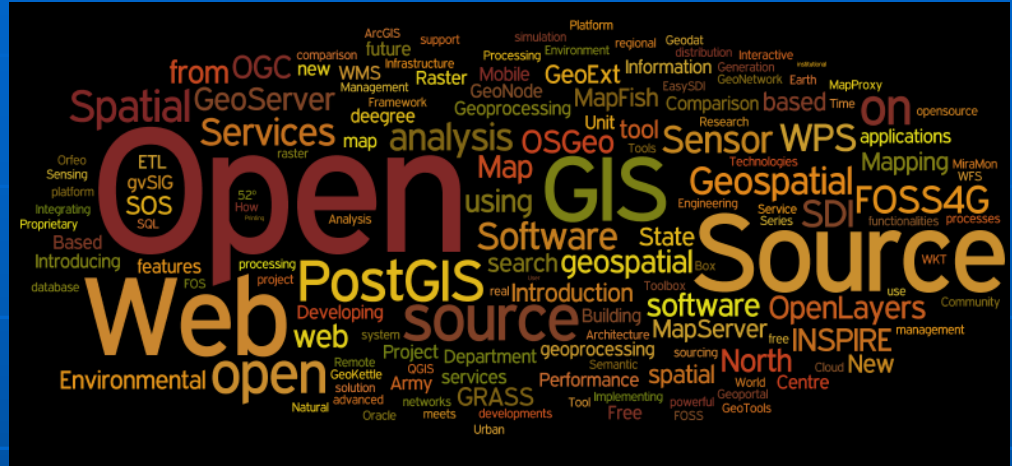
# What is FOSS and FOSS4G?

- Free Software refers to **liberty**, not price.
- It means that the program's users have the freedom to run the program for any purpose, access the code to study how it works and change it, redistribute copies, and redistribute copies of modified versions of the software.
- Software must offer more than just access to the source code, it must comply with 10 criteria listed in the Open Source Initiative.

**GNU Project** (<http://www.gnu.org/philosophy/free-sw.html>)

**Open Source Initiative**  
(<http://www.opensource.org/docs/osd>)

## Some Highlights



1. There are numerous mature and capable FOSS/FOSS4G projects.
2. Their features and development philosophy offer advantages to deliver the systems and geospatial information demanded by citizens, businesses, governments, educators and researchers around the world.

3. For almost every geospatial software need and niche (e.g. desktop GIS, spatial extensions to Database Management Systems, WebGIS, code libraries, etc...) there is at least one mature FOSS4G project with a well-documented record of successful application in diverse contexts.



**GRASS GIS**





4. FOSS/FOSS4G not only provide healthy competition for private/close solutions but also opportunities for mutual benefit and complementarity.





5. Several myths and misunderstanding about FOSS/FOSS4G are not true such as (Wheatley, 2004) :
- “FOSS4G is not ready for the desktop/end user, it is only good for backend/developer applications”
  - “There is no support” “It is difficult to learn and there are no education resources”.
  - “It is not good for mission-critical applications”
  - “It can’t be that good if it is free (no cost)”

## 6. FOSS/FOSS4G is **not new nor rare...**

- FOSS movement has a history of 20-40 years.



**1991**



**1995**



**GRASS GIS**

<http://grass.osgeo.org/>

**Early 1980's**

## They are not rare ...

- The following FOSS websites contain ...

**Freecode**: 45,000 projects  
(<http://freecode.com>)

**Sourceforge**: 326,613 projects  
(<http://sourceforge.net>)

- Sourceforge reported **4 million downloads** in one day.
- According to Sourceforge the most popular project (eMule <http://sourceforge.net/projects/emule/>) has been downloaded **600 million times**.

**FreeGIS.org**

(<http://freegis.org>)



**Open Source GIS**

(<http://opensourcegis.org>)

The Future of GIS

**Open Source GIS**

contain **355 FOSS4G projects.**

7. FOSS/FOSS4G are relevant for developing and developed countries.

# FOSS4G Resources and Education

- There is an increasing number of commercial support services, on-line tutorials, books, and education resources to help FOSS/FOSS4G users to choose the right software and use it.

(Holck et al. 2005, Woods and Guliani 2005, Ven et al. 2008,  
**The FOSS Evaluation Center**

<http://foss.technologyevaluation.com/>, OpenGeo

<http://opengeo.org/products/suite/>

**OSGeo Education and Curriculum**

<http://www.osgeo.org/education>

[http://www.osgeo.org/educational\\_content](http://www.osgeo.org/educational_content)

**OSGeo Live** <http://live.osgeo.org/es/index.html>


**ELOGeo platform** <http://elogeo.nottingham.ac.uk/> ).

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Self-contained bootable DVD that allows you to try a wide variety of open source geospatial software without installing anything.

<http://live.osgeo.org/es/index.html>

# FLOSS4G local user groups





Search for topics



Welcome to the new Google Groups! Learn about the [new features you'll find](#).



Groups

NEW TOPIC

Filters ▾

Front Range Users of Geospatial Open Source  +1  0

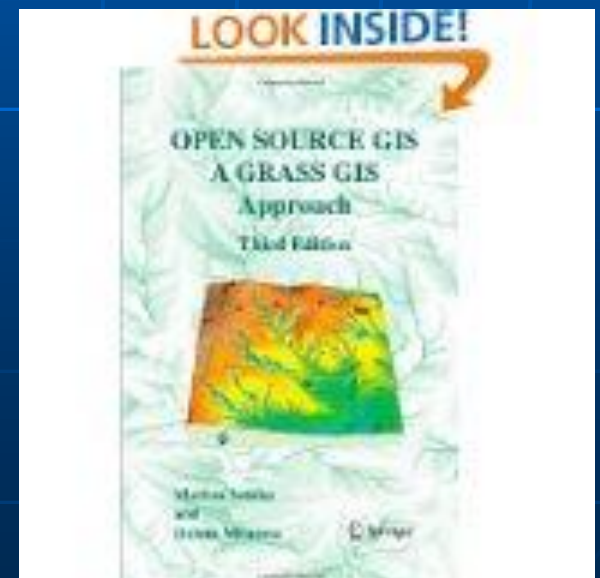
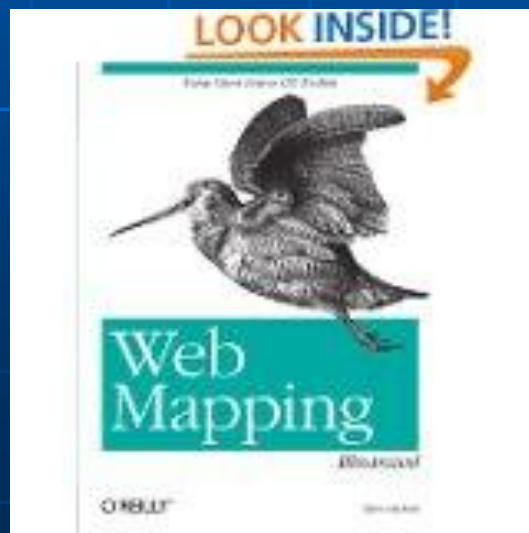
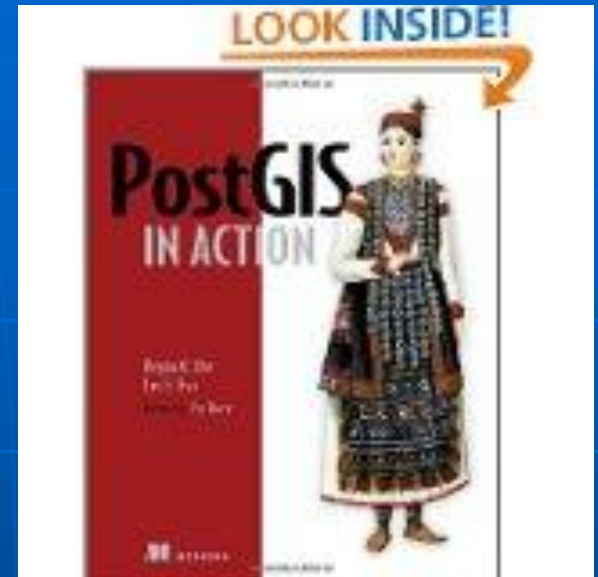
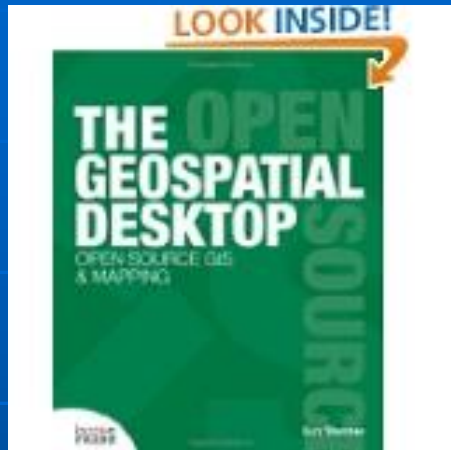
 Reminder: Tomorrow GeoGeek Meetup/Rogues/Frugos/WhereCamp Planning  
By Eric Wolf - 2 posts - 0 views - updated 11/13/12

 6/9/13/12: GeoGeek Meetup/Rogues/Frugos/WhereCamp Planning  
By Eric Wolf - 1 post - 2 views - updated 9/1/12





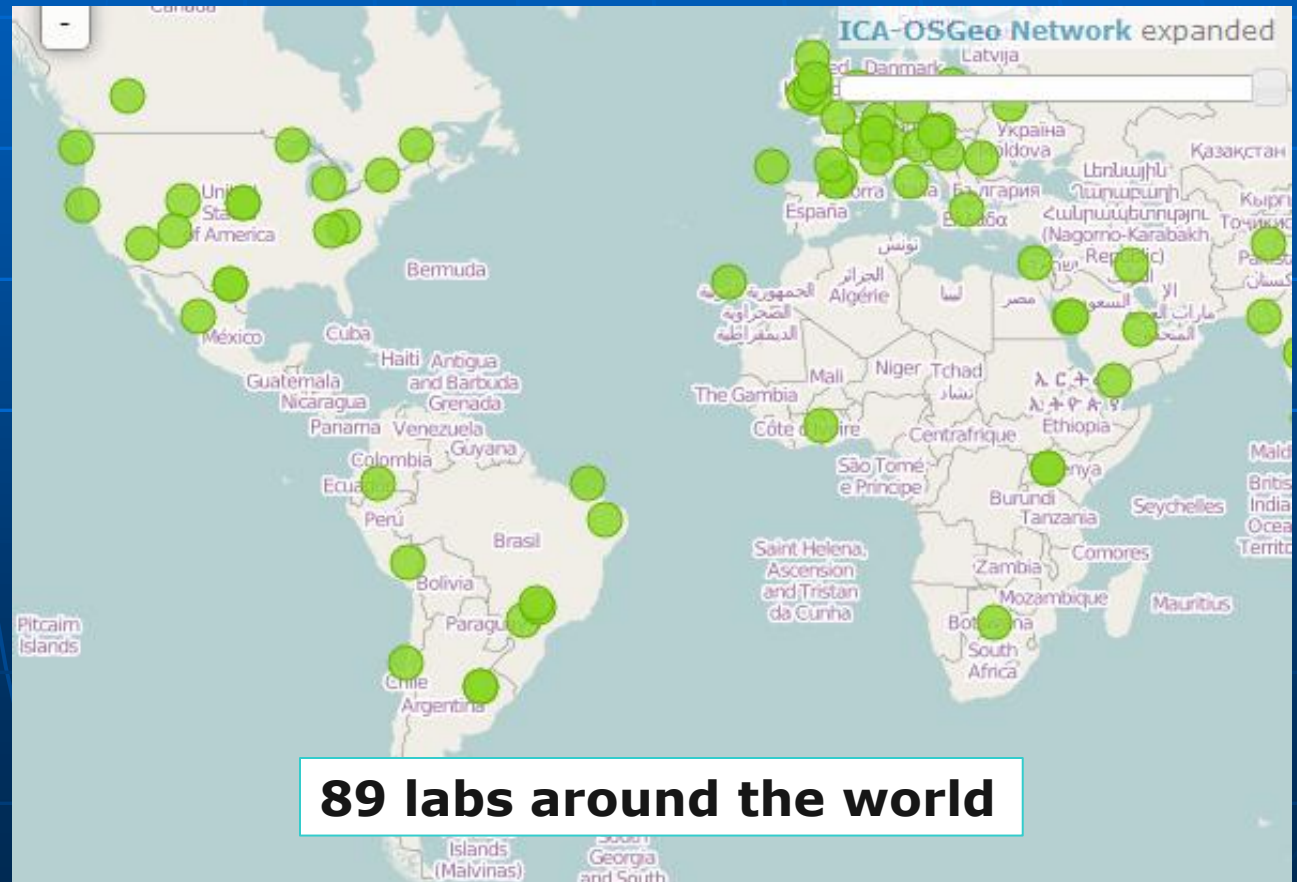
# Books



# OSGeo-ICA-ISPRS-International Labs Network

[www.geoforall.org](http://www.geoforall.org)

[http://wiki.osgeo.org/wiki/Edu\\_current\\_initiatives](http://wiki.osgeo.org/wiki/Edu_current_initiatives)











# Laboratorio di Geomatica

## Politecnico di Milano - Polo Territoriale di Como

via Valleggio, 11 - 22100 Como






### Sections

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-  **Geomatics Workbooks**
  -  **Courses**
  -  **e@Lab!**
  -  **Software & Documents**
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### Tools

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-  Location Map
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  -  Usage Statistics
- 

<http://geomatica.como.polimi.it/>



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Home

Mission: FOSS4G at UCD

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Tr

**FOSS4G** Free and Open Source Software for  
Geospatial Applications  
Education, Research and Service



<http://geospatial.ucdenver.edu/foss4g/>



# Examples of Mature popular FOSS4G

## 1. Desktop GIS:

- KOSMO (<http://www.opengis.es/>)
- gvSIG (<http://www.gvsig.com>)
- uDig (<http://udig.refractions.net/>)
- Quantum GIS (QGIS) (<http://www.qgis.org/>)
- GRASS (<http://grass.osgeo.org/>)

## 2. Remote Sensing:

- ImageJ (<http://rsbweb.nih.gov/ij/>)
- OSSIM ([www.ossim.org](http://www.ossim.org))
- OpenEV (<http://openev.sourceforge.net/>)
- ILWIS Open (<http://52north.org/>)
- Opticks  
([http://opticks.org/confluence/display/opticks/Welco  
me+To+Opticks](http://opticks.org/confluence/display/opticks/Welco+me+To+Opticks))

### 3. Web GIS servers and clients:

#### SERVERS:

- MapServer (<http://mapserver.org/>)
- GeoServer  
(<http://geoserver.org/display/GEOS/Welcome>)
- MapGuide Open Source  
(<http://mapguide.osgeo.org/>)

#### CLIENTS:

- OpenLayers (<http://openlayers.org/>)
- Mapfish (<http://mapfish.org/>)

## 4. Database Management Systems with Spatial Extensions

- PostGIS (<http://postgis.refrations.net/>) extension for PostgreSQL.
- MySQL Spatial Extensions (<http://dev.mysql.com/doc/refman/4.1/en/spatial-extensions.html>)
- GearScape (<http://www.fergonco.es/gearscape/>)

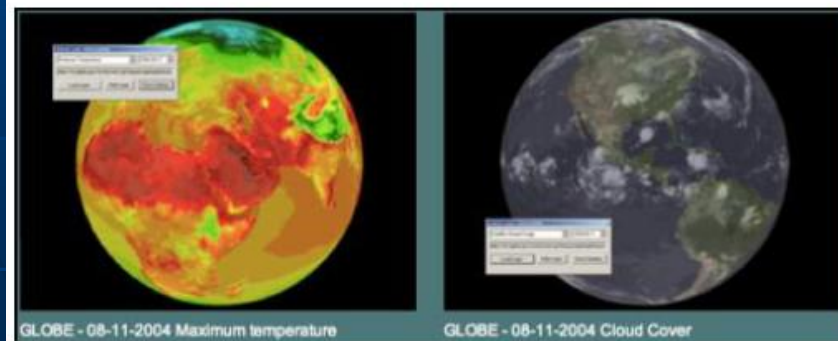


## 5. Code Libraries

- STARS (Space-Time Analysis of Regional Systems)  
(<http://regionalanalysislab.org/index.php/Main/STARS>)
- PySAL (<http://geodacenter.asu.edu/projects/pysal>)

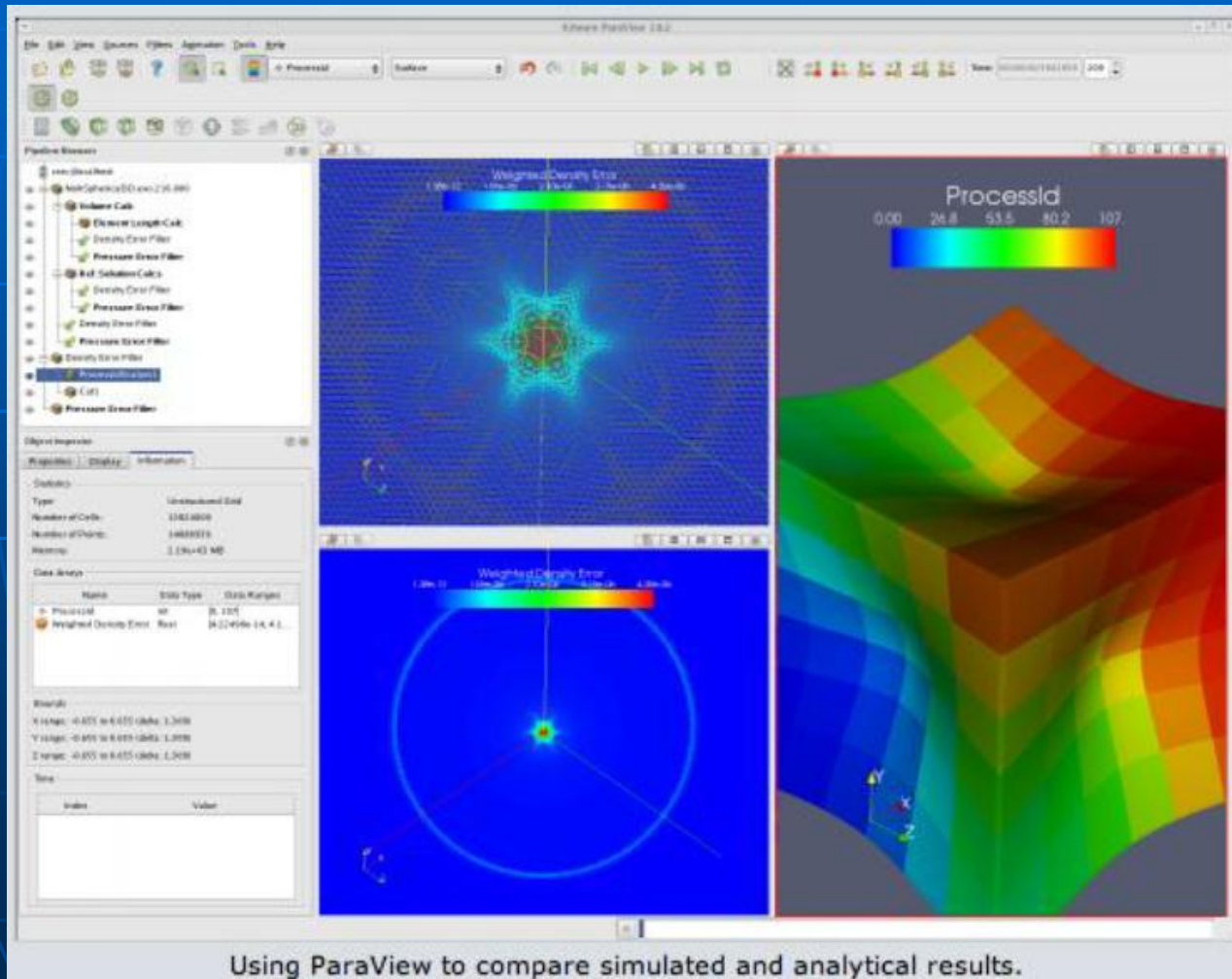
## 6. Virtual Globes

- NASA World Wind:  
(<http://worldwind.arc.nasa.gov/download.html>)
- ossimPlanet:  
(<http://www.ossim.org/OSSIM/ossimPlanet.html>)



## 7. Tools for visualization and analysis.

- ParaView (<http://www.paraview.org/>)



**Overview of Some**

**FOSS**

**(and FreeWare)**

**in the Water Domain**

# SWAT

Soil & Water  
Assessment Tool

<http://swat.tamu.edu/>

- The objective of the SWAT model is to predict the effect of management decisions on water, sediment, nutrient and pesticide yields with reasonable accuracy on large, ungaged river basins.
- 40 years of development.

**SOFTWARE**

**DOCUMENTATION**

**WORKSHOPS**

**SWAT Executables**

**ArcSWAT**

**SWAT-CUP**

**VIZSWAT** water, sediment, nutrient and pesticide y

**MWSWAT**

**SWAT Check**

**Baseflow Filter Program**

**Potential Heat Unit Program**

**AVSWAT**

**Links to Related Software**

# SWAT

Soil & Water  
Assessment Tool

## SOFTWARE DOWNLOADS

### ArcSWAT 2012.10.16

SEPTEMBER 10, 2014

For ArcGIS 10.2; Fixes a bug in watershed delineation not present in other versions

### ArcSWAT 2012.10.15

JUNE 24, 2014

For ArcGIS 10.1 SP1, and 10.0 SP5

### SWATeditor 2012.10.15

JUNE 24, 2014

Companion to ArcSWAT

### SWAT2012 rev. 627

JUNE 24, 2014

Executables and source code

### SWAT Check

AUGUST 13, 2014

Identify potential model input problems

# SWAT

Soil & Water  
Assessment Tool

## GIS Interfaces

## SWAT-GRASS

### Good Resource:

Hydrological open source experiences using SWAT and OpenMI  
*Willy Bauwens, Narayan Shrestha, Olkeba Tolessa & Ann van Griensven*

[http://www.academia.edu/1468483/Hydrological\\_open\\_source\\_experiences\\_using\\_SWAT\\_and\\_OpenMI](http://www.academia.edu/1468483/Hydrological_open_source_experiences_using_SWAT_and_OpenMI)



# UNESCO's Hydro Free and FOSS Platform of Experts (HOPE) Initiative



HOPE -  
INITIATIVE .net  
*for Africa*

<http://www.hope-initiative.net/blog/>

HOPE would provide an alternative to the commercial specialized engineering software in the field of hydrology.

HOPE The Kit ver 1.0 includes....



# STOAT - Dynamic Modelling of Wastewater Treatment Plants

<http://www.wrcplc.co.uk/stoat.aspx>



**Water Research Center**

PC based computer modelling tool designed to dynamically (unsteady-state) simulate the performance of wastewater treatment works.

The first release of the software was in November 1994 and the latest (as of January 2014) in March 2013.

<http://www.hope-initiative.net/blog/wp-content/uploads/2013/07/Jeremy-Dudley.pdf>

# STOAT take-up



Map data ©2012 Google, Imagery ©2012 Google, Terms of Use



# MODFLOW and Related Programs

<http://water.usgs.gov/ogw/modflow/>

- Groundwater-flow simulation released in 1984.
- The family of MODFLOW-related programs now includes capabilities to simulate coupled groundwater/surface-water systems, solute transport, variable-density flow (including saltwater), aquifer-system compaction and land subsidence, parameter estimation, and groundwater management.



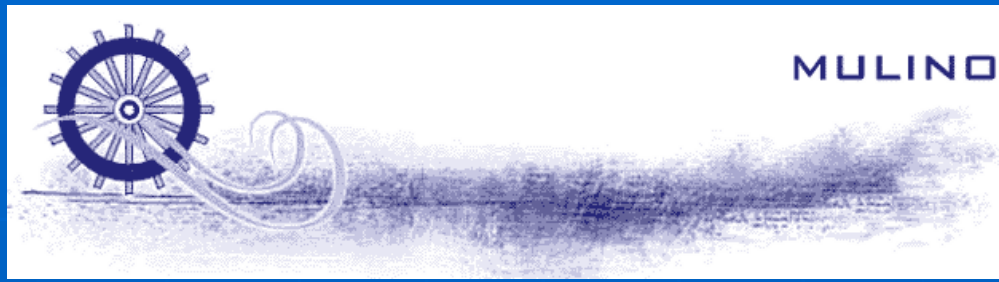
# CROPWAT 8.0



[http://www.fao.org/nr/water/infores\\_databases\\_cropwat.html](http://www.fao.org/nr/water/infores_databases_cropwat.html)

CROPWAT is a decision support tool for the calculation of crop water requirements and irrigation requirements based on soil, climate and crop data.

In addition, the program allows the development of irrigation schedules for different management conditions and the calculation of scheme water supply for varying crop patterns.



<http://siti.feem.it/mulino/>

## Multisectoral Integrated and Operational Decision Support System for Sustainable Use of Water Resource at the Catchment Scale

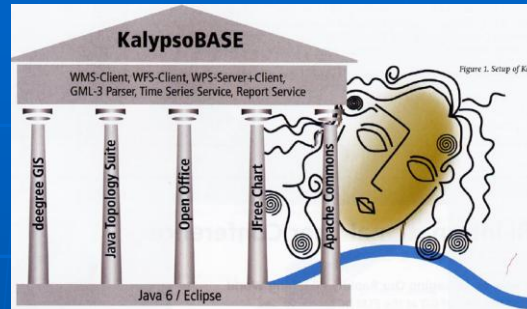


- The **mDSS** software is a generic Decision Support System (DSS) developed to assist decision makers in the management of environmental problems.
- mDSS was originally developed in the context of the project MULINO project.



# Kalypso

[http://en.wikipedia.org/wiki/Kalypso\\_%28software%29](http://en.wikipedia.org/wiki/Kalypso_%28software%29)



*Kalypso* is currently (November 2010) divided into six modules: three numerical simulation modules, two tools for complex flood and risk mapping and an evacuation tool.

1. Kalypso Hydrology (rainfall-runoff simulation)
2. Kalypso WSPM (one-dimensional steady hydrodynamic simulation)
3. Kalypso 1D/2D (coupled one- and two-dimensional unsteady hydrodynamic simulation)
4. Kalypso Flood (flood mapping tool)
5. Kalypso Risk (flood risk assessment tool)
6. Kalypso Evacuation (evacuation strategy tool)



# The Water Information System for Europe Portal

<http://water.europa.eu/>

The **Joint Research Centre** conducts environmental monitoring and water resources modelling including nowcasting and forecasting services.

## **Floods and drought**

The European Flood ALert System (**EFAS**) -  
<http://floods.jrc.ec.europa.eu/>

## **European Drought Observatory (**EDO**) -**

<http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1000>



<http://hydrodesktop.codeplex.com/>

- Web Services-Based Software for Hydrologic Data Discovery, Download, Visualization, and Analysis.
- FOSS GIS enabled desktop application that helps you search for, download, visualize, and analyze hydrologic and climate data registered with the CUAHSI (Consortium of Universities for the Advancement of Hydrological Sciences) Hydrologic Information System ([www.cuahsi.org](http://www.cuahsi.org)).

A university consortium sponsored by  
the National Science Foundation





**Maria's**

**Slides here**

**QUESTIONS?**

**COMMENTS?**

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