Spatial Information Science using FOSS4G
or
Geoinformatics using FOSS4G

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FOSS4G = Free & **O**pen **S**ource **S**olutions for **G**eoinformatics

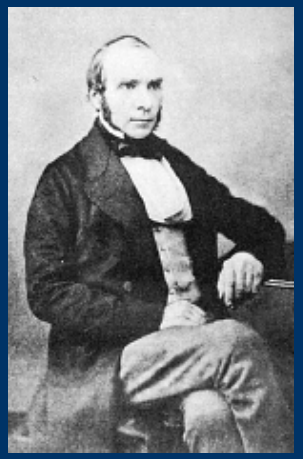
Agenda

1. A bit of the past
2. About spatial data
3. About FOSS4G and OSGeo
4. Activities and initiatives
5. Into the future
6. Q&A

Dr. John Snow

and the 1854 Cholera outbreak in London's Broad Street region

Dr John Snow is known as the 'father of modern epidemiology' and the 'father of GIS' because of the famous case of the 1854 Cholera outbreak in London's Broad Street region.



Source: John Snow Inc. www.jsi.com

In the 1850s, cholera was very poorly understood and massive outbreaks were a common occurrence in major industrial cities. An outbreak in London in 1854 in the Soho district was typical of the time, and the deaths it caused are shown in the map on the right.

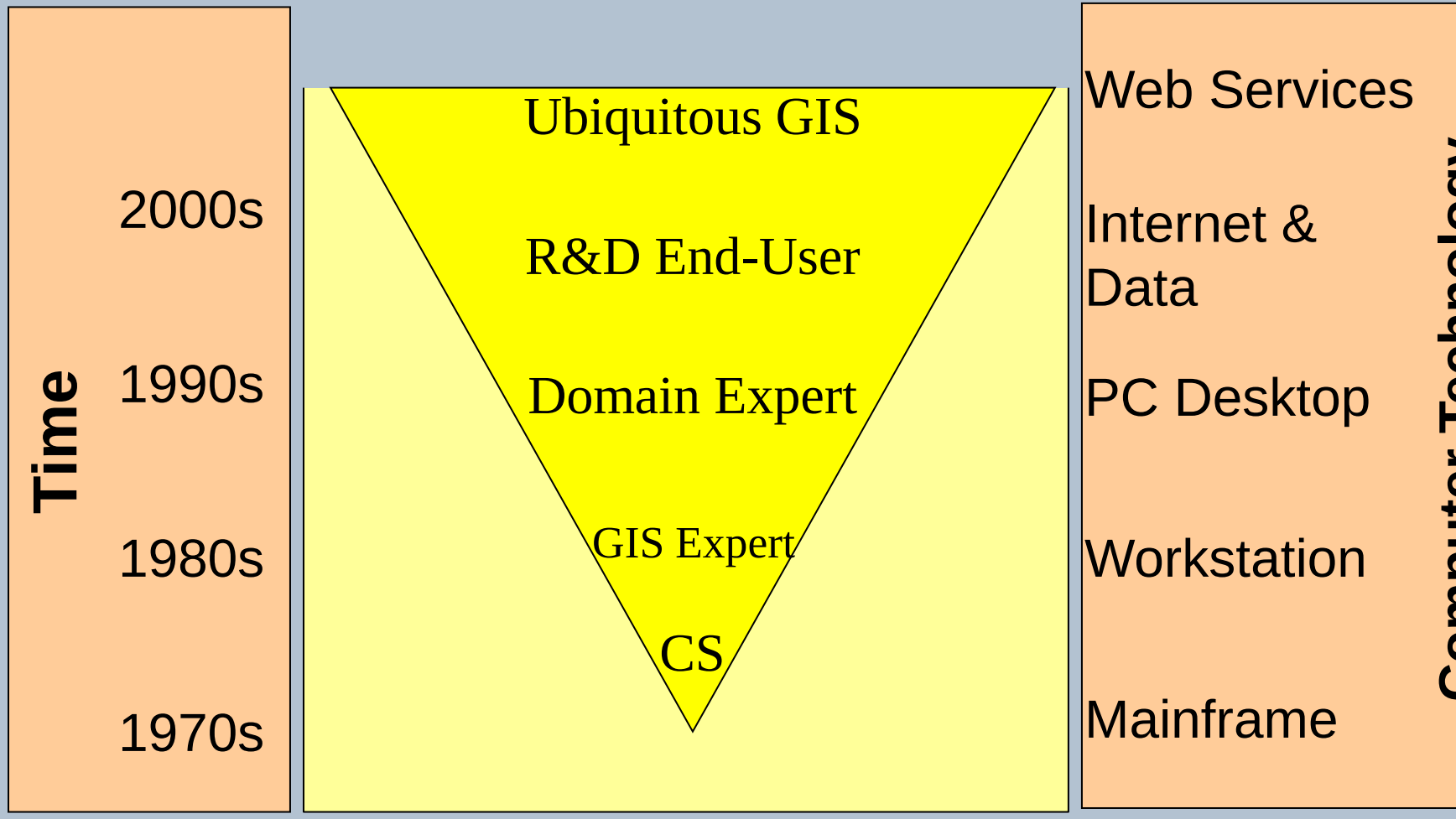
Text source: Longley et al (2005) *Geographic Information Systems and Science.* 2nd Edition. John Wiley and Sons Ltd. (Chapter 14, pages 317-319)

Source: UCLA http://www.ph.ucla.edu/epi/snow/snowmap1_1854_lge.htm

Evolution from Geographic Information Systems to Spatial Information Ser

	Mainframe	Mini-Mainframe	Mini-Mainframe Workstation	Mini-frame UNIX Workstation Workstation PC Desktop PC	UNIX Workstation Workstation PC Desktop PC		Clo SNS Sen
Time	1960's	1970's	1980's	1990's	2000's	2005	20
						Web GIS	
						Gmap	
	Prototypes	Odyssey	GRASS Arc/Info Intergraph	Arc/Info ArcView MapInfo GRASS Idrisi	ArcGIS GRASS	OpenLayers	

GIS Growth


Time
2000s
1990s
1980s
1970s
Ubiquitous GIS
R&D End-User
Domain Expert
GIS Expert
CS
Web Services
Internet & Data
PC Desktop
Workstation
Mainframe
Computer Technology
+← User Base →+

SPATIAL DATA and GEOGRAPHIC INFORMATION

Spatial Data:

Data that are tied to a location

If data can be mapped, they are spatial

Geographic Information:

Information that is tied to location on Earth

If information can be mapped, it is geographic

SPATIAL DATA

Crimes during 2011		
Date	**Location**	**Type**
22-Jan	123 James St.	Robbery
24-Jan	22 Smith St.	Burglary
10-Feb	9 Elm St. #4A	Assault
13-Feb	12 Fifth Avenue	Breaking and Entering
14-Feb	17 Del Playa	Drunk and Disorderly

NON-SPATIAL DATA

For example, a person's height, weight, and age are non-spatial data because they are independent of the person's location.

SPATIAL DATA and GEOGRAPHIC INFORMATION

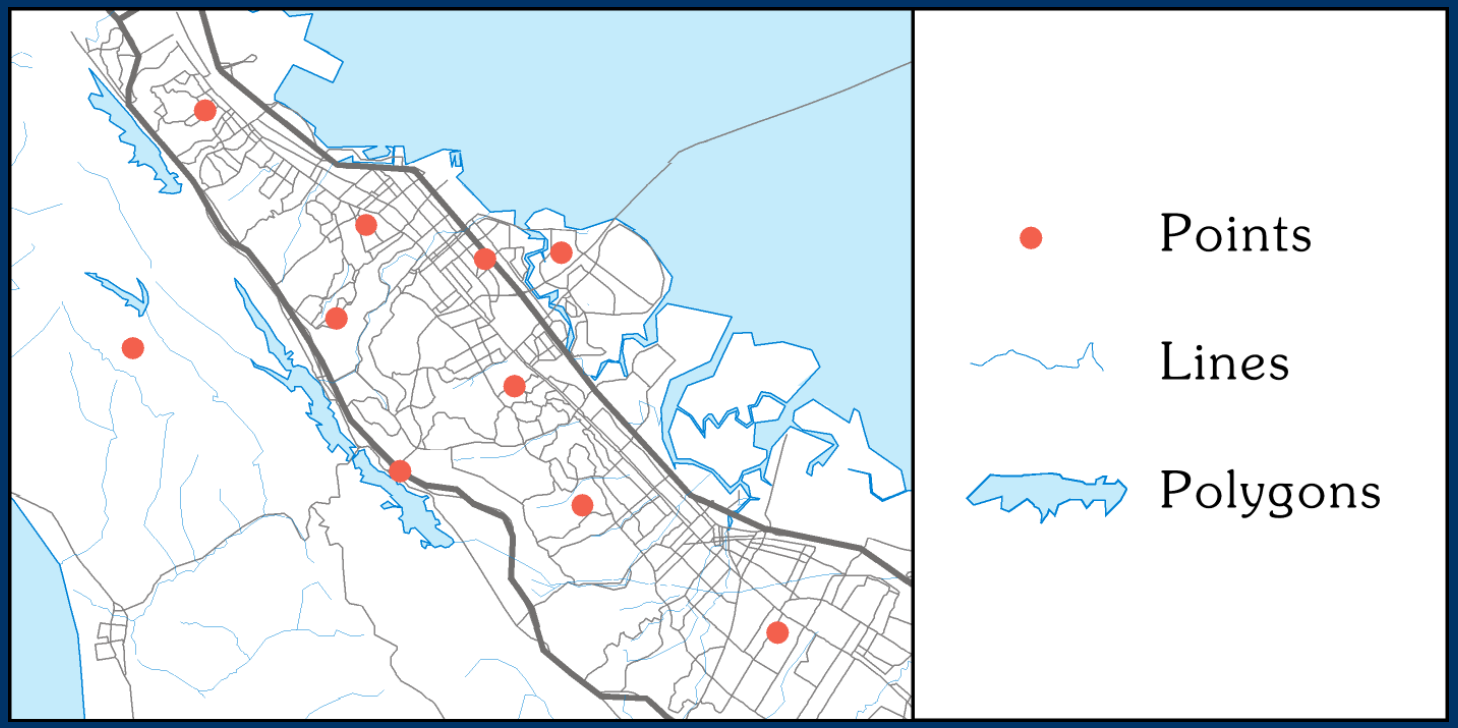
Four Dimensions of spatial data and geographic information:

x, y, z, (long, lat, elev.) and time

x, y, z are *coordinates*

THE FEATURE MODEL

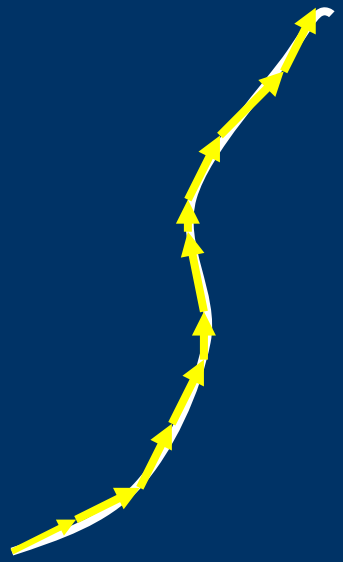
Divides a mapped landscape into points, lines, or areas (polygons)



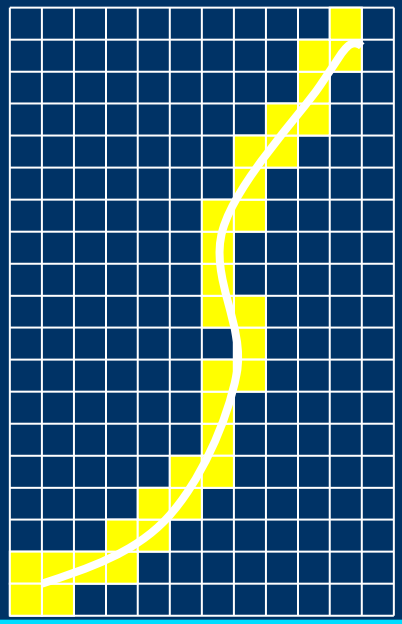
Vector and Raster Data Model for Line *Map Featu*

Map Feature

GIS Vector Format



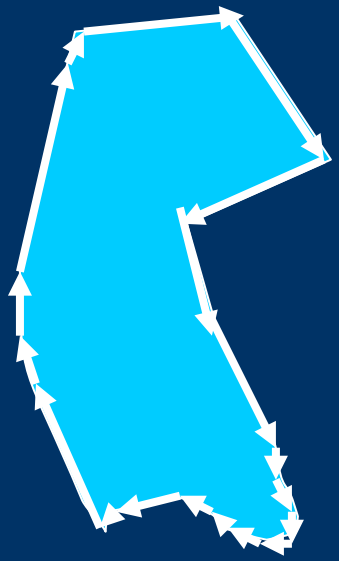
GIS Raster Format



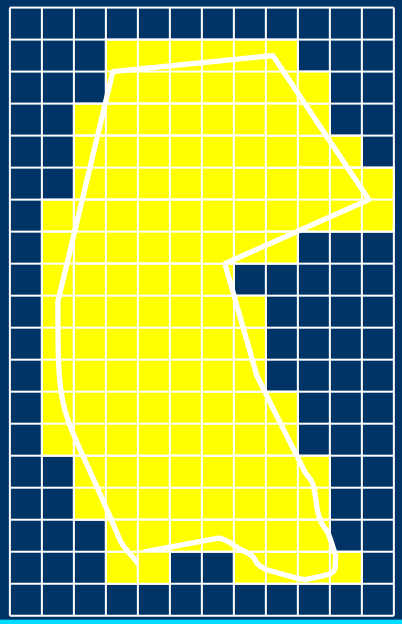
Vector and Raster Data Model for Area Map Featu

Map Feature

GIS Vector Format

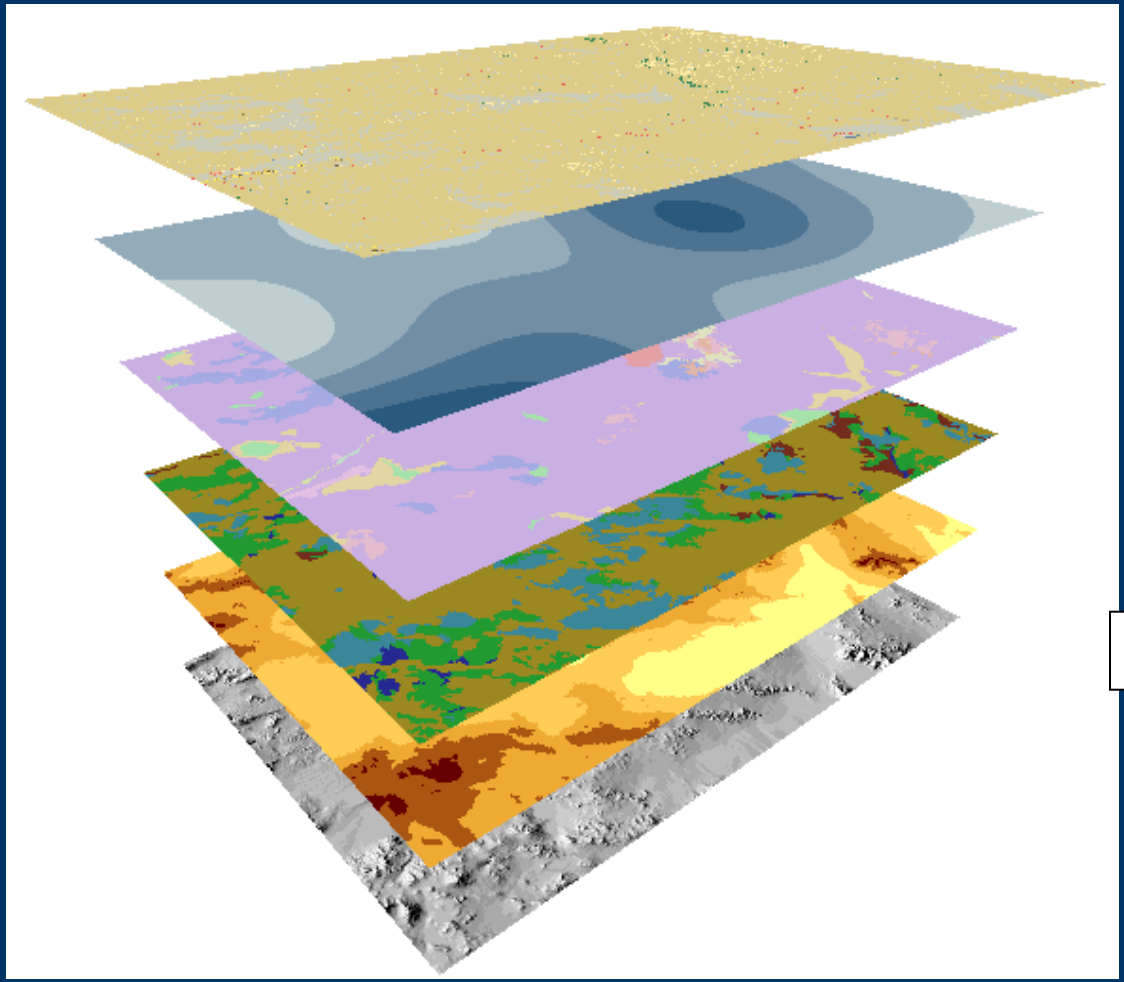


GIS Raster Format



Creating a GIS DB

Layers of Information



Land Cover

Precipitation

Vegetation

Rock Type

Elevation

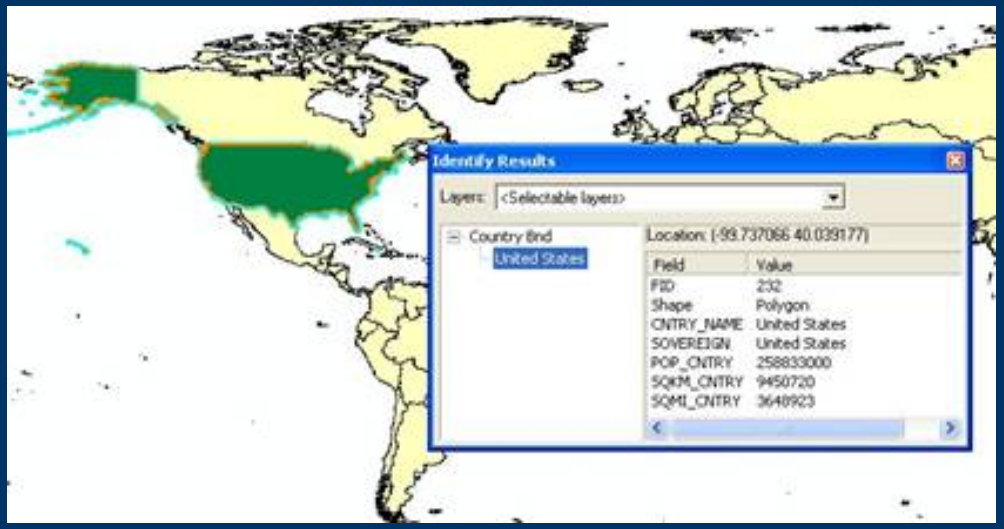
Land Surface Fo

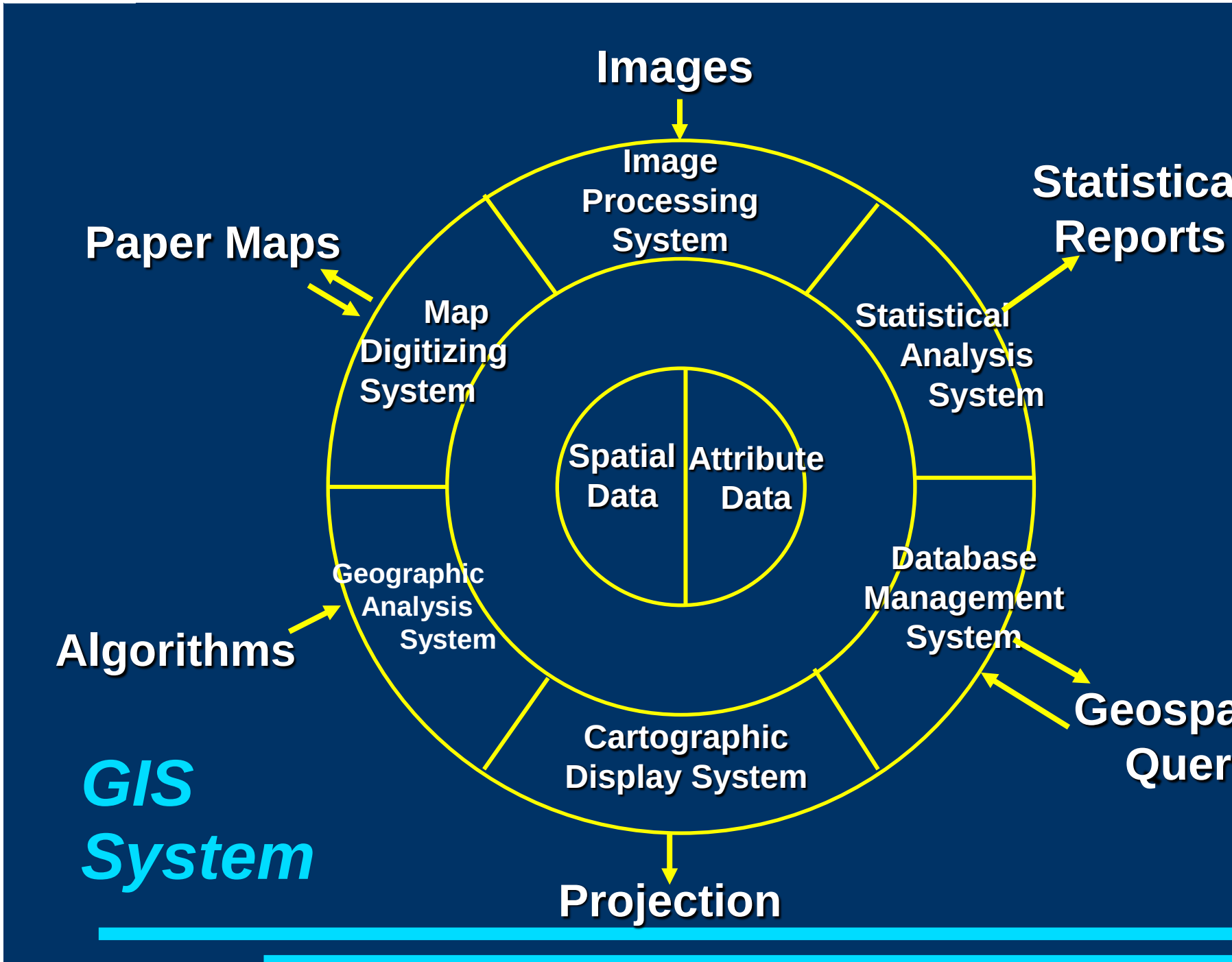
A GIS consists of:

Geographic features (map)

Attributes (database)

A computer-based link between the two: *The Geo-relational Model*




Images
Image Processing System
Paper Maps
Map Digitizing System
Statistica
Reports
Statistical Analysis System
Spatial Data
Attribute Data
Algorithms
Geographic Analysis System
Database Management System
Geospa
Quer
Cartographic Display System
Projection
GIS System

FOSS4G Ecosystem for Open Education & Researc

Open Source Software
Open Data and
Open Standard
leading to
Open Innovation!!

The big picture of Open Spatial Information Science

Open Standards

Open Data

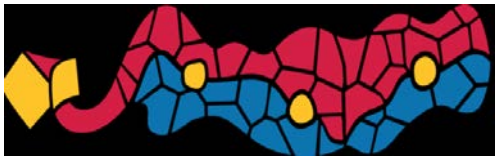
+

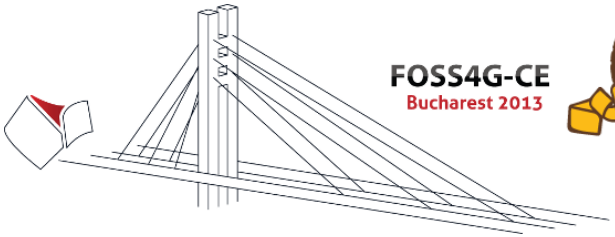
FOSS4G

Ten years ago in 2004!

FOSS/GRASS User Conference in Bangkok, Thailand

FOSS4G is now a worldwide phenomenon





Home Brewed at

Japan, Korea, India, Malaysia, The Philippines, Sri Lanka…and Asia

Current Needs in Open Geo-Learnin

- Easy access to geospatial tools
- Affordable and Stable solutions
- Open Geospatial Data
- Localization and Customization
- Standards support (data sharing)
- Text-books, training material, e-learning
- Professional certification for Trainers & Learner

Why FOSS4G?

- Easily accessible
- Affordable & Stable
- Vibrant communities
- Innovative
- Full Standards support
- Backed by OSGeo worldwide
- University Network worldwide

OSGeo's Mission Statement

International Open Source Geospatial Foundation established in 2006

"To support the development of open source geospatial software, and promote its widespread use."

FDO

MapGuide Open Source

GEOS

Mapbender

deegree

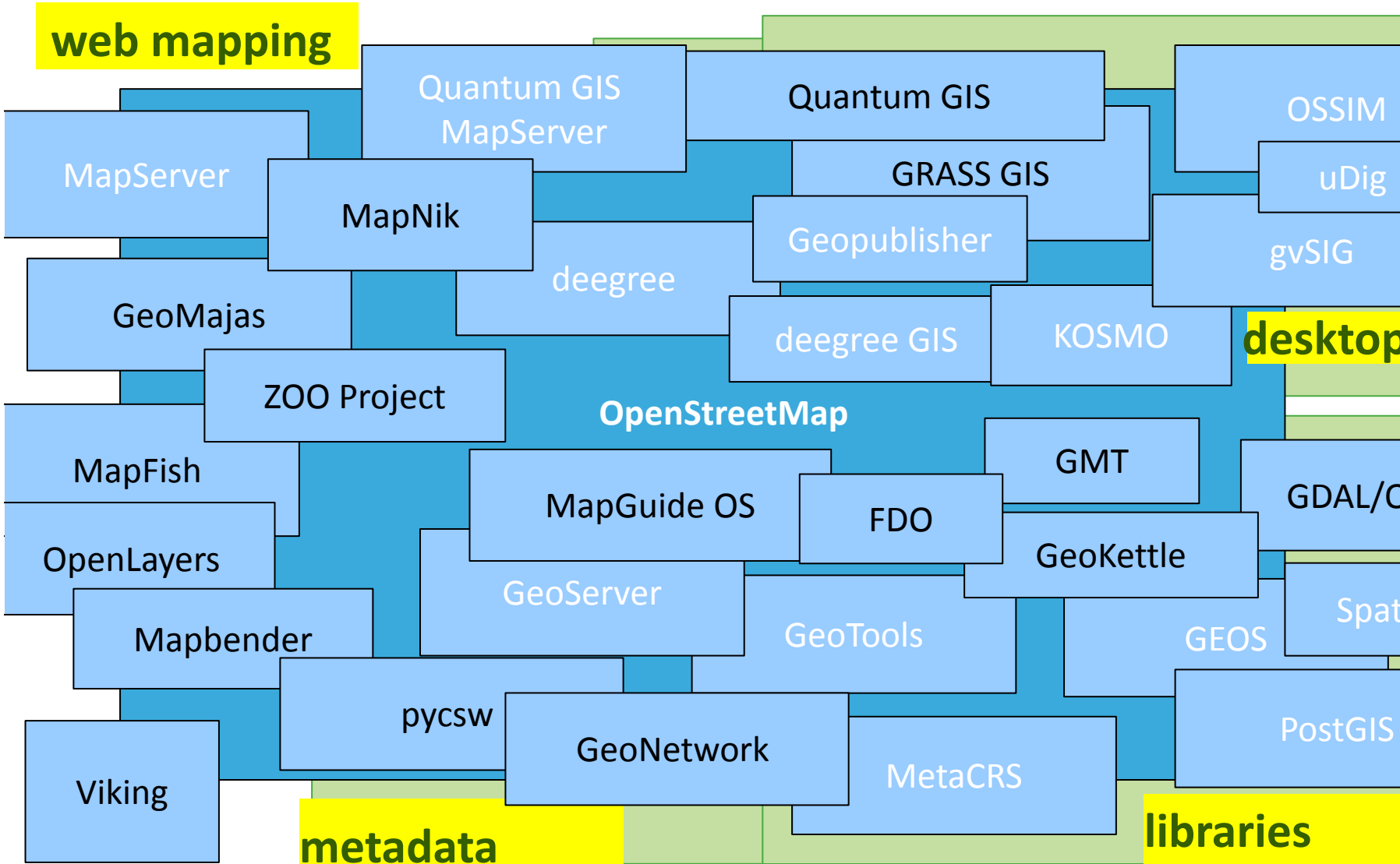
http://www.osgeo.or

osgeo.jp
osgeo.in
osgeo.kr
osgeo.cn ....

OSGeo Live

live.osgeo.org

Ready for any Classroo



FOSS4G Community Activities in Japan

- We have many local activities including
  - Annual Conferences
  - Seminars, hands-on training
  - Homepages
  - wiki pages
  - Mailing lists
  - Localization
  - Special Interest Group @ GIS Academy Japan
  - twitter, facebook
  - Mapping parties, beer parties …

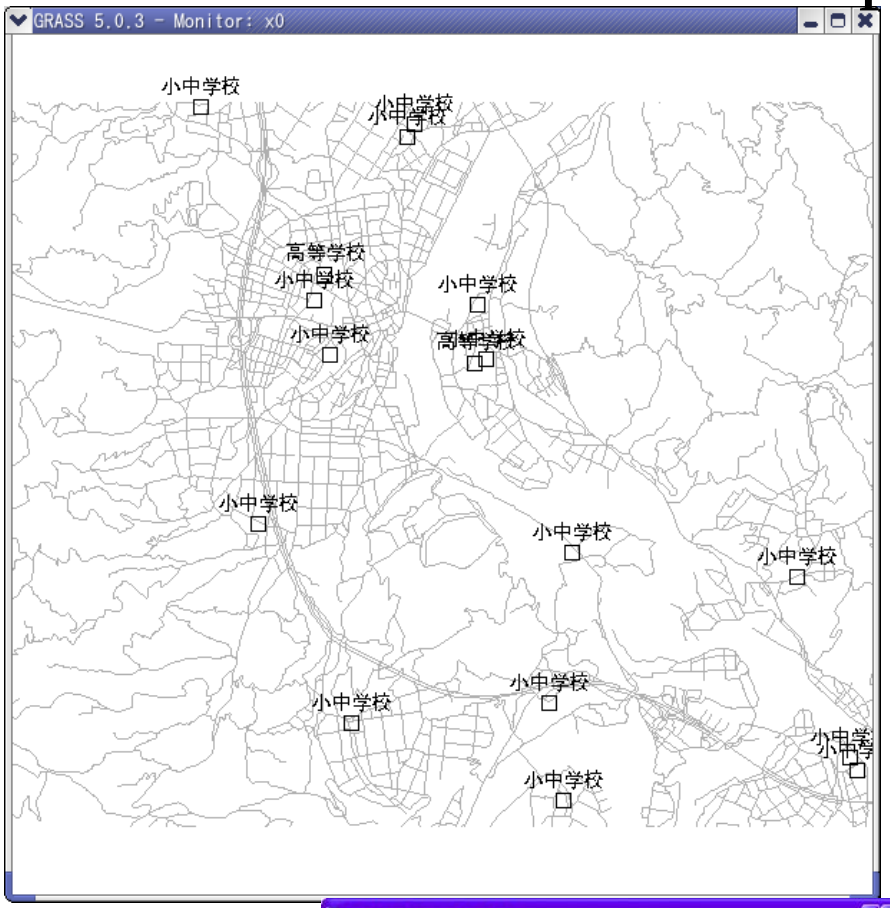
all for Japan in Japanese（日本語）☺

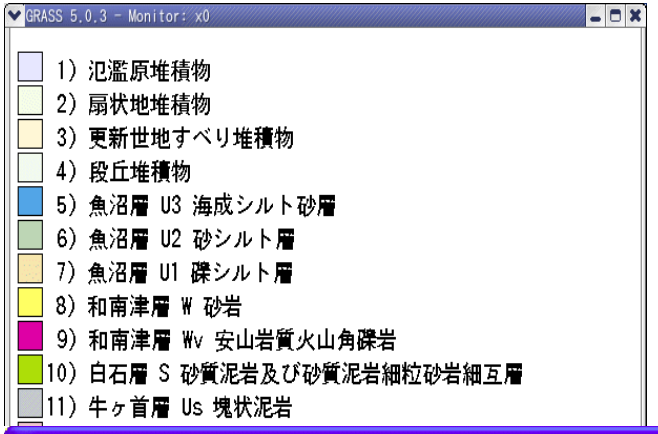
1994-2003

- Learning to play with FOSS4G tools (1994-1998)
- Landslide hazard mapping (1994)
- 3D Geological Modeling using GRASS GIS (1997~)
- Web-GIS GRASSLinks Linux port at OCU (1998-2003)
- Designed a GIS Internet Course at OCU (1999-2000)
  http://www.sci.osaka-cu.ac.jp/~masumoto/vuniv99/
  http://www.sci.osaka-cu.ac.jp/~masumoto/vuniv2000/

- GRASS-GIS and MapServer (Web-GIS) I18n and L10n (Orkney Inc. and OCU)

GRASS/MapServer I18N





Recent Projects

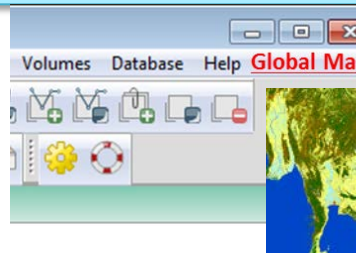
- JSPS Project ”Urban Transformation and Sustainability of Red River Basin in Vietnam based on Water Environment Monitoring”, Led by Dr. Yonezawa
- MEXT Project “Construction of Assessment System for Environmental Degradation Using Satellite Data and Global Map”, OCU Team led by Raghavan
- MOET Project, Vietnam Project “Developing Research Capacity for Assessing Typical Environmental Changes for Sustainable Development of Major River Basins in Vietnam” Led by Dr. Luan at HUMG, Vietnam

Tasks

- Developing geoenvironmental database
- Integrate, analyze, validate geoprocessing and geostatistical algorithms
- Preparation of thematic maps
- Urbanization and Environmental Studies
- Outreach (Capacity building)

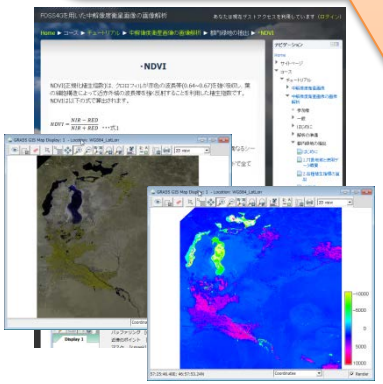
Project 2: Construction of Assessment System for Environmental Degradation Using Satellite Data and Global Map

Facilitate of image processing
Improvement of GIS and field survey tools



Thematic map Generation

Human resources development
Tutorial
E-Learning
Workshop

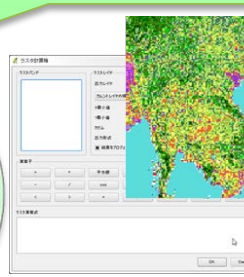


Assessment & monitoring of environmental degradation using satellite data

Outreach

System Development

Facilitation of advanced analy
Interoperability & S

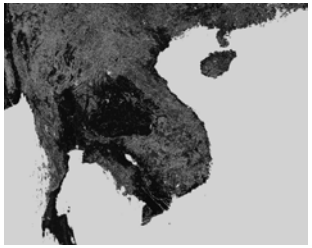


Project 2: Construction of Assessment System for Environmental Degradation Using Satellite Data and Global Map

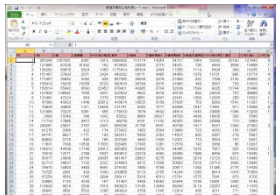
Development of Open Source toolkit for assessment and monitoring for environmental degradation

○Global map data

○Environmental degradation data

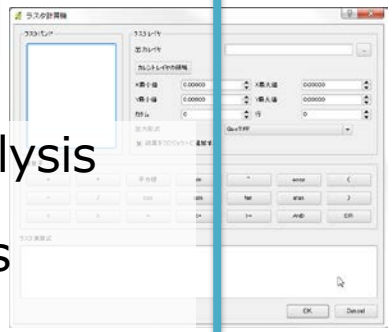


○Landuse data



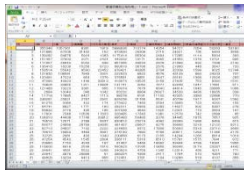
Assessment system for environmental degradation

- Overlay analysis
- Geostatistics
- Geoprocessing
- etc…



○Map of assessme
Environmental degradation

○Impact assessme



Recent Student Research

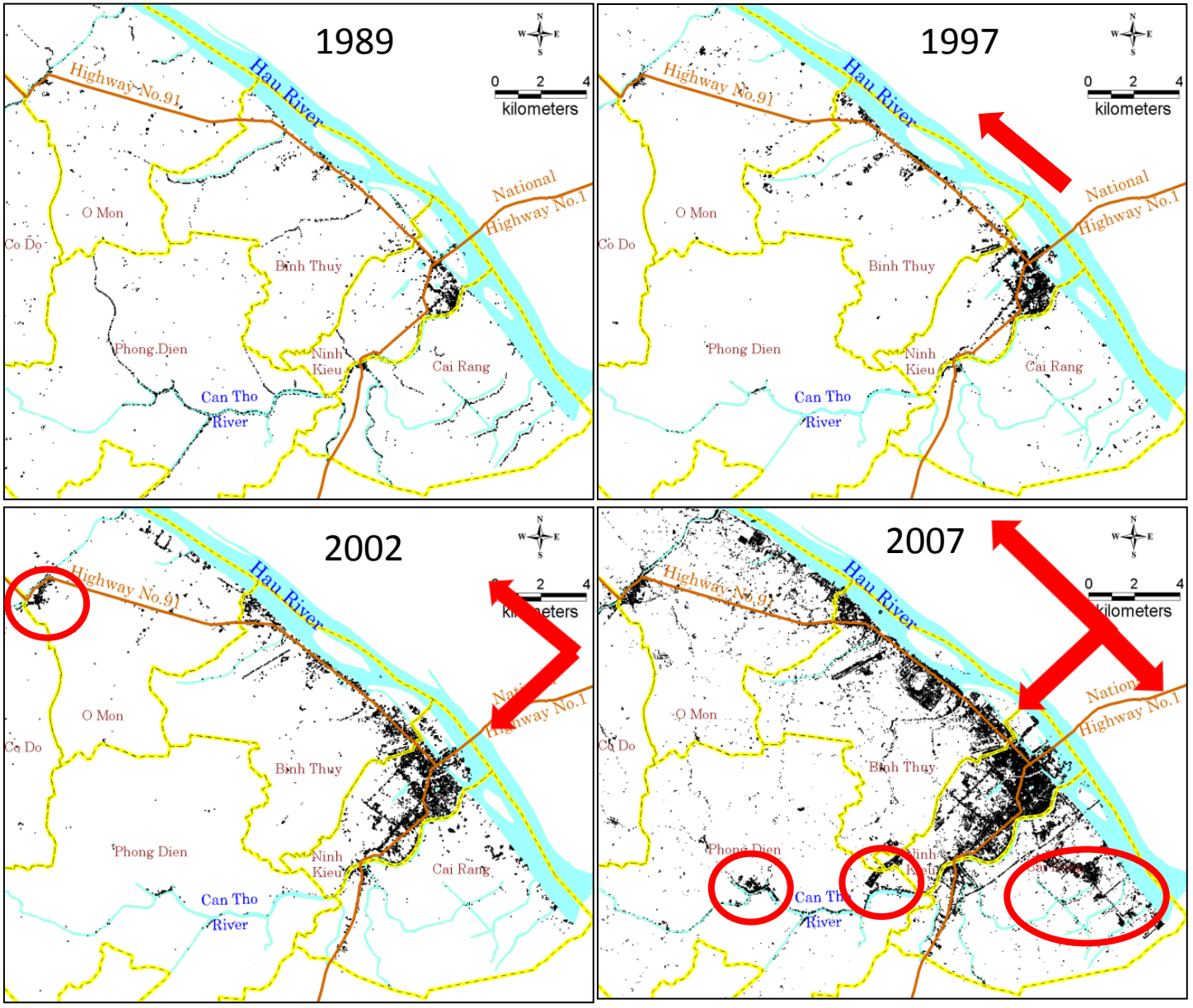
URBAN EXPANSION, LAND COVER CHANGE AND IMPACT ON FLOOD INUNDATION IN CAN THO CITY, VIETNAM

PHAM THI MAI THY

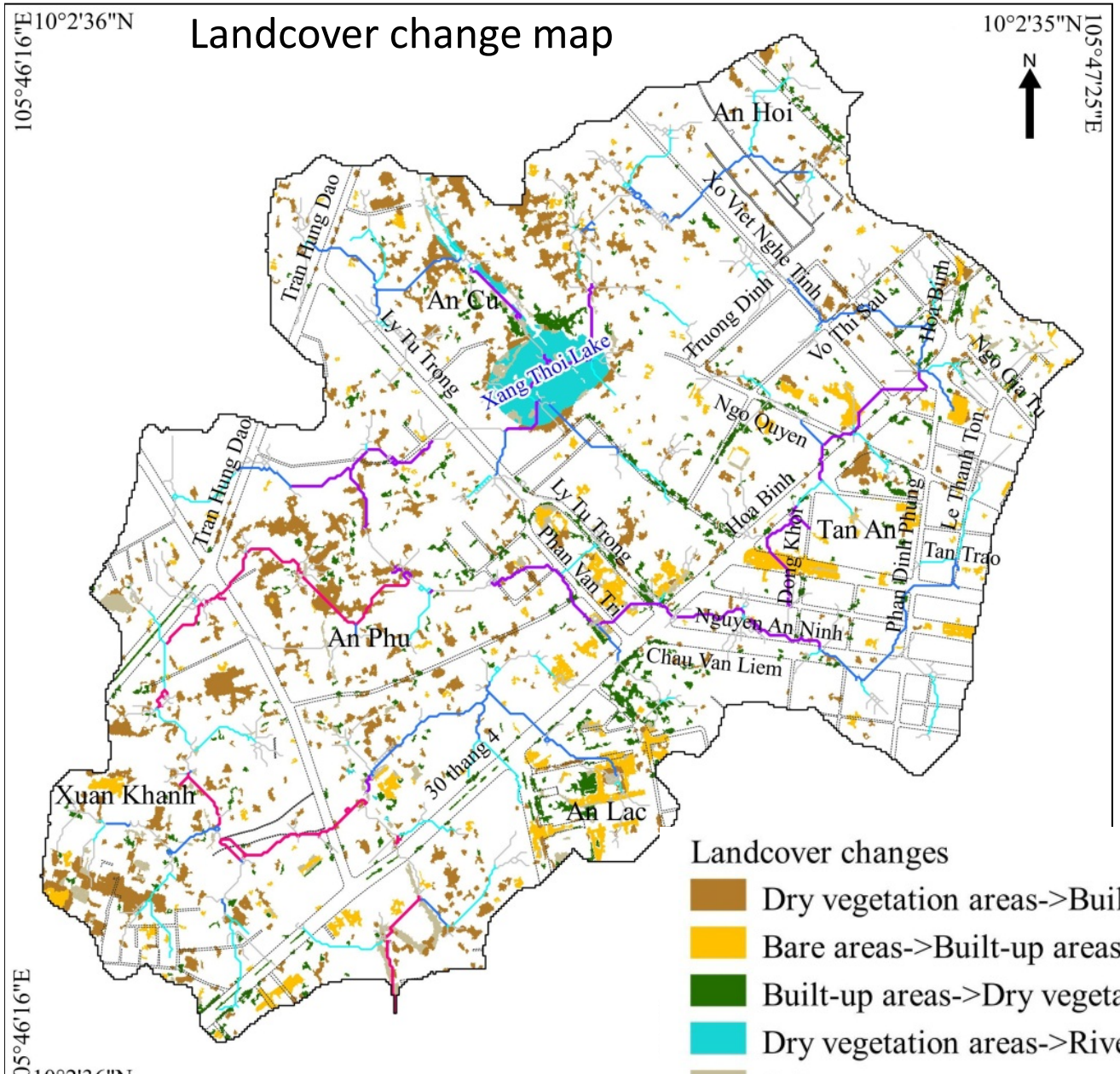
Hochiminh City Institute of Resources Geography

Vietnam Academy of Science and Technology

RESULTS - Urban expansion

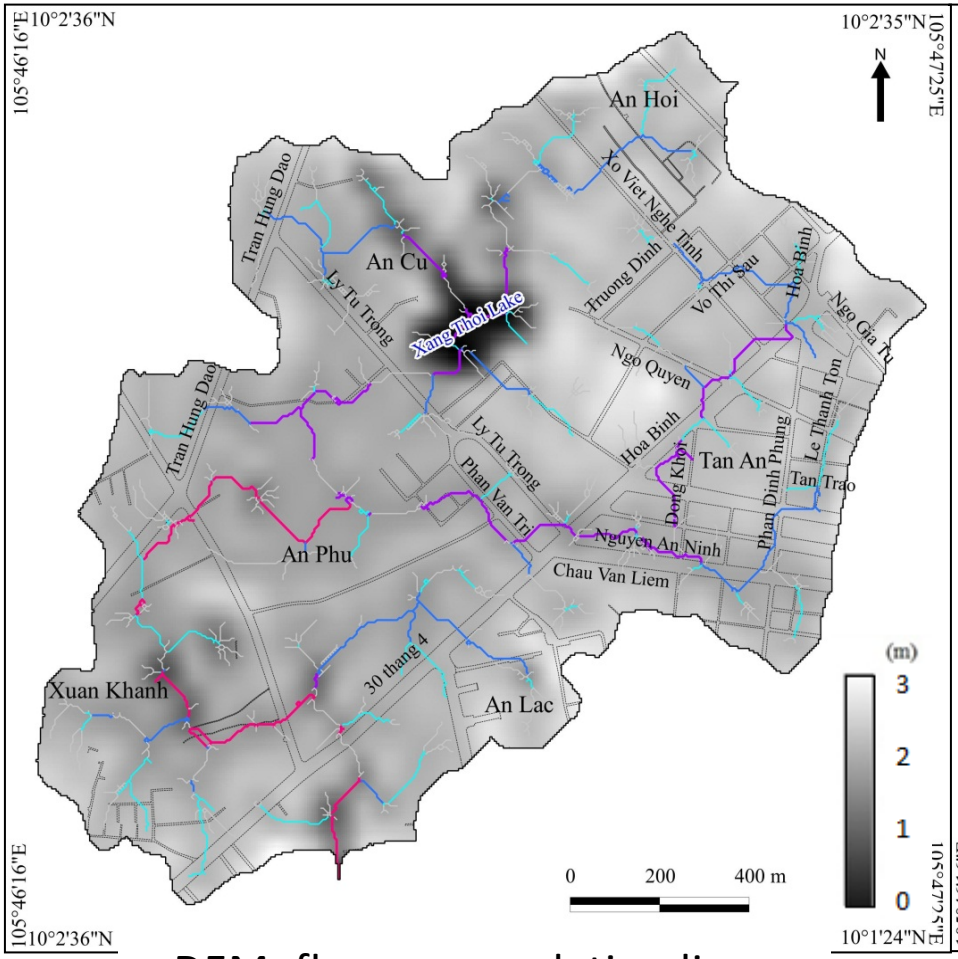


Watershed A (Ninh Kieu District)

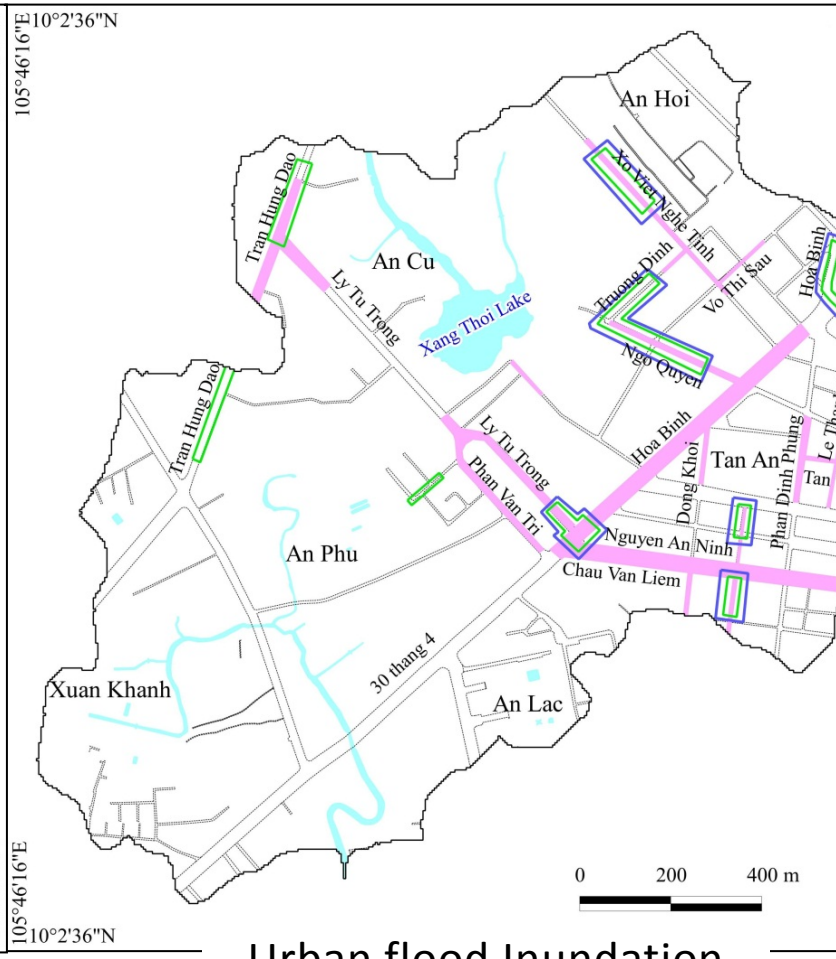


Landcover change classification	Area (ha)	
Dry vegetation → Built-up	14.49	4
Bare → Built-up	6.18	1
Built-up → Dry vegetation	5.46	1
Dry vegetation → Water bodies	2.88	
Others	2.66	
TOTAL OF CHANGED AREA	31.67	

Watershed A (Ninh Kieu District)



DEM, flow accumulation lines



Urban flood Inundation

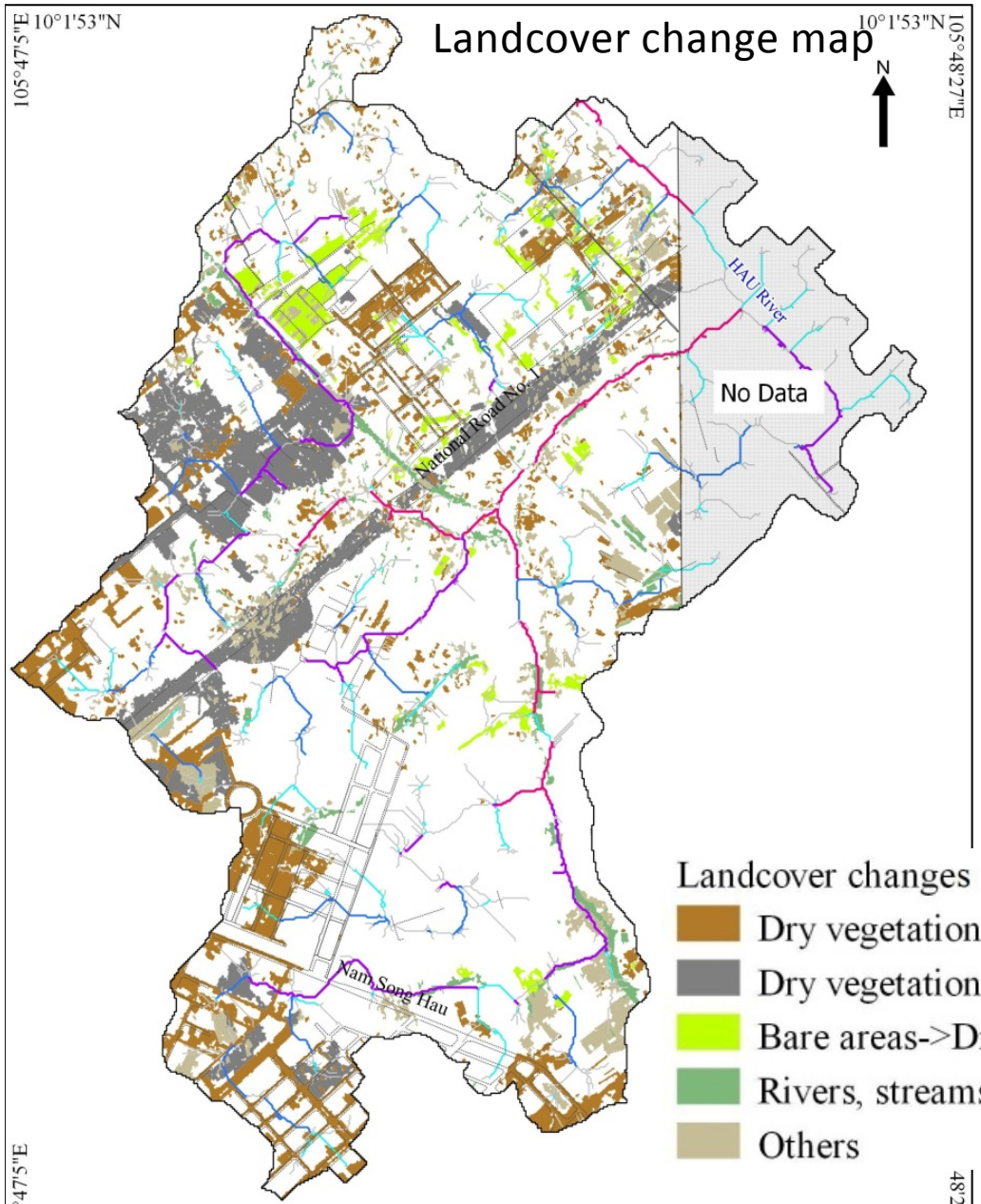
Accumulation (ha)

- 0.125 - 0.625
- 0.625 - 3.125
- 3.125 - 15.625
- 15.625 - 78.125
- 78.125 - 390.625
- >390.625

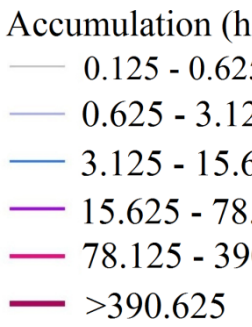
Inundation

- Inundation area in 2004
- Inundation area in 2007
- Inundation area in
- Lakes, streams and

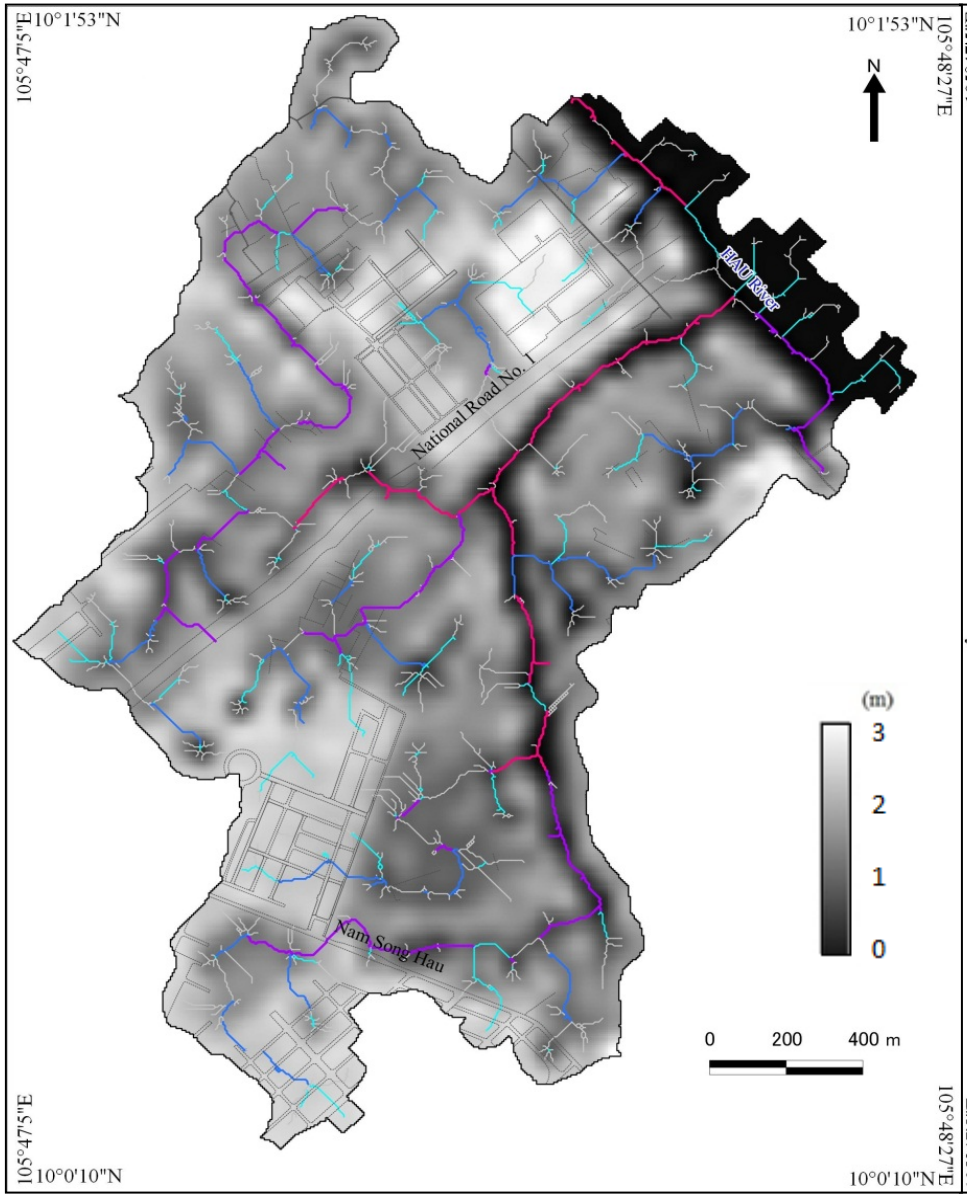
Watershed B (Cai Rang District)

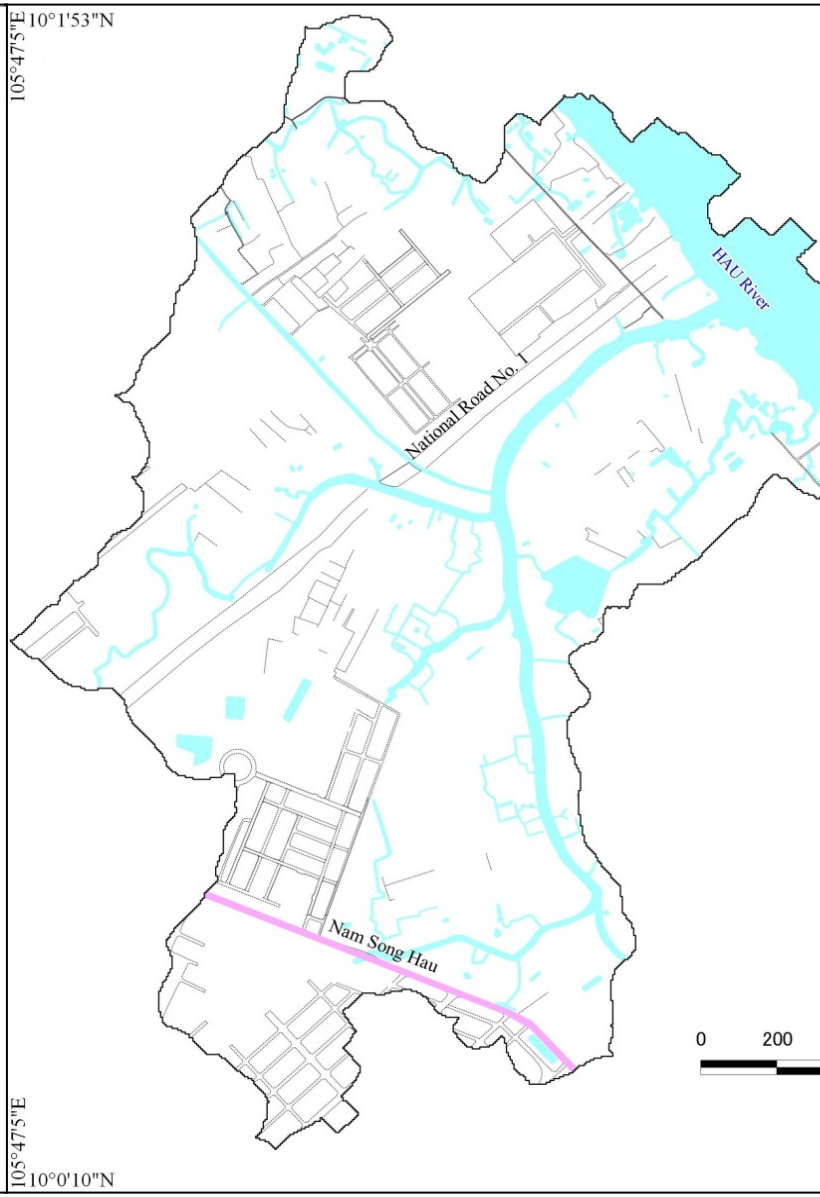


Landcover change classification	Area (ha)	%
Dry vegetation → Built-up	32.50	35.
Dry vegetation → Bare	28.15	31.
Bare → Dry vegetation	6.84	7.6
Water bodies → Dry vegetation	6.26	6.9
Others	16.96	18.
TOTAL OF CHANGED AREA	90.71	100



Watershed B (Cai Rang District)





DEM, accumulation and inundation maps

A high-resolution water vapor monitoring system using a dense network of low-cost GNSS receivers

GPS receivers

Geodetic (dual-frequency) receiver: **JAVAD**

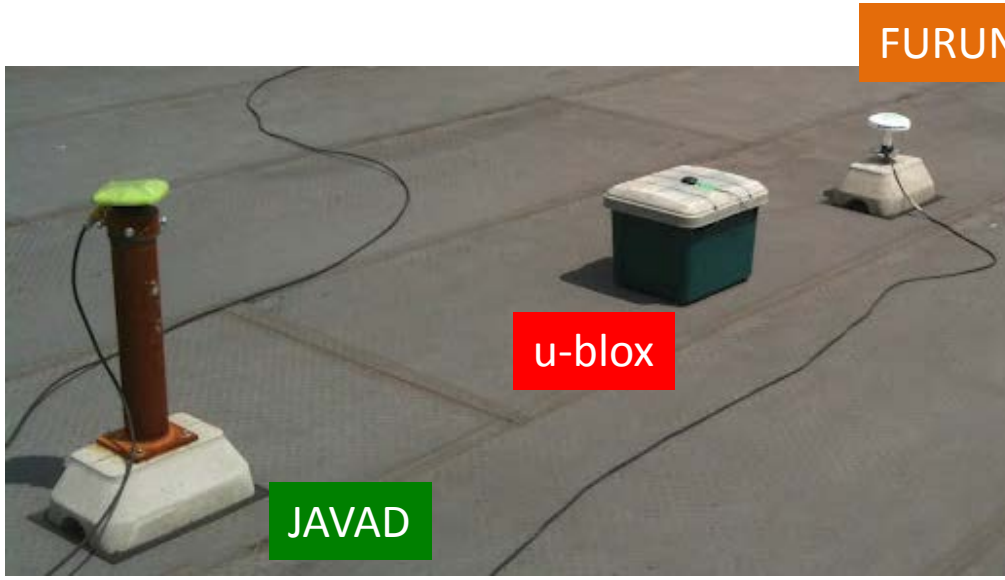
~ 25,000 USD

Mid-cost single-frequency receiver: **FURUNO**

~ 6,000 USD

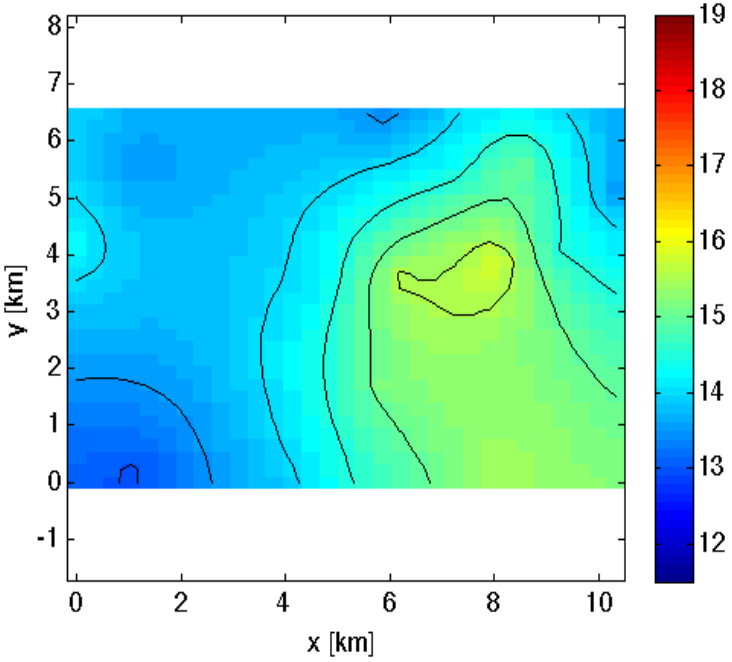
Low-cost single-frequency receiver: **u-blox**

~ 600 USD

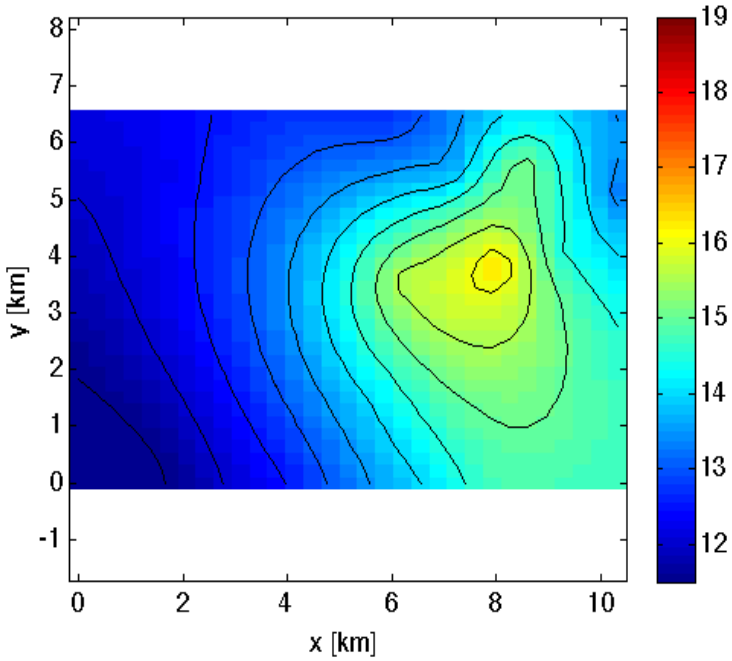


(raw data logger prototy
built at Osaka City Unive

PWV estimation by high elevation satellites



PWV horizontal distribution using GPS satellites above 10° [mm]



PWV horizontal distribution using GPS satellites above 60° [mm]

2. SOIL-LANDSCAPE MODEL

Conceptual Basis:

(1)Soil and landscape co-evolve and are closely interrelated, consequently, similar soil regimes occur within similar landscape units.

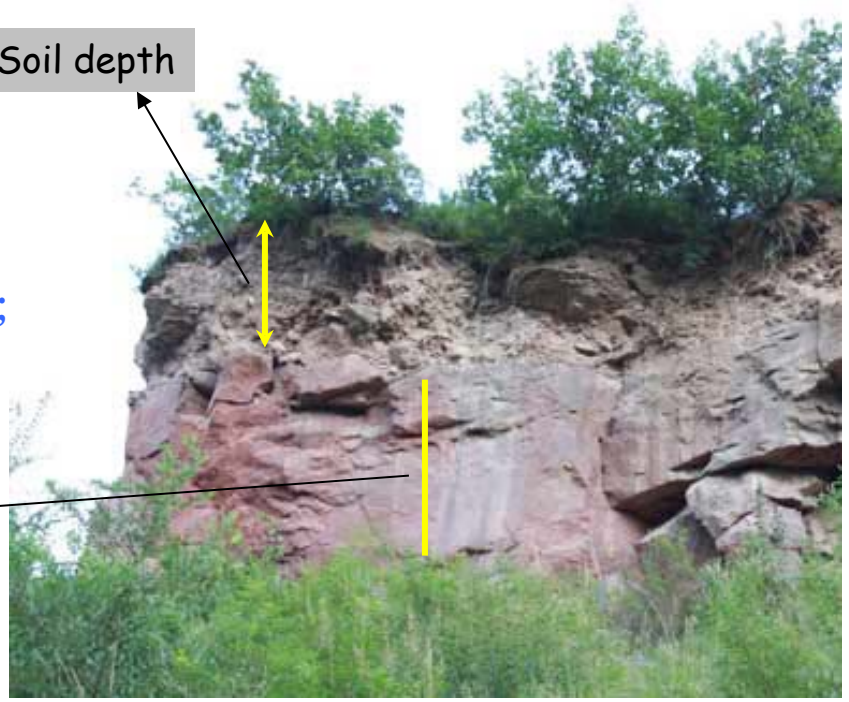
(2)The site-specific combination of soil forming environment creates a unique niche where certain soil types are formed.

1. Objective

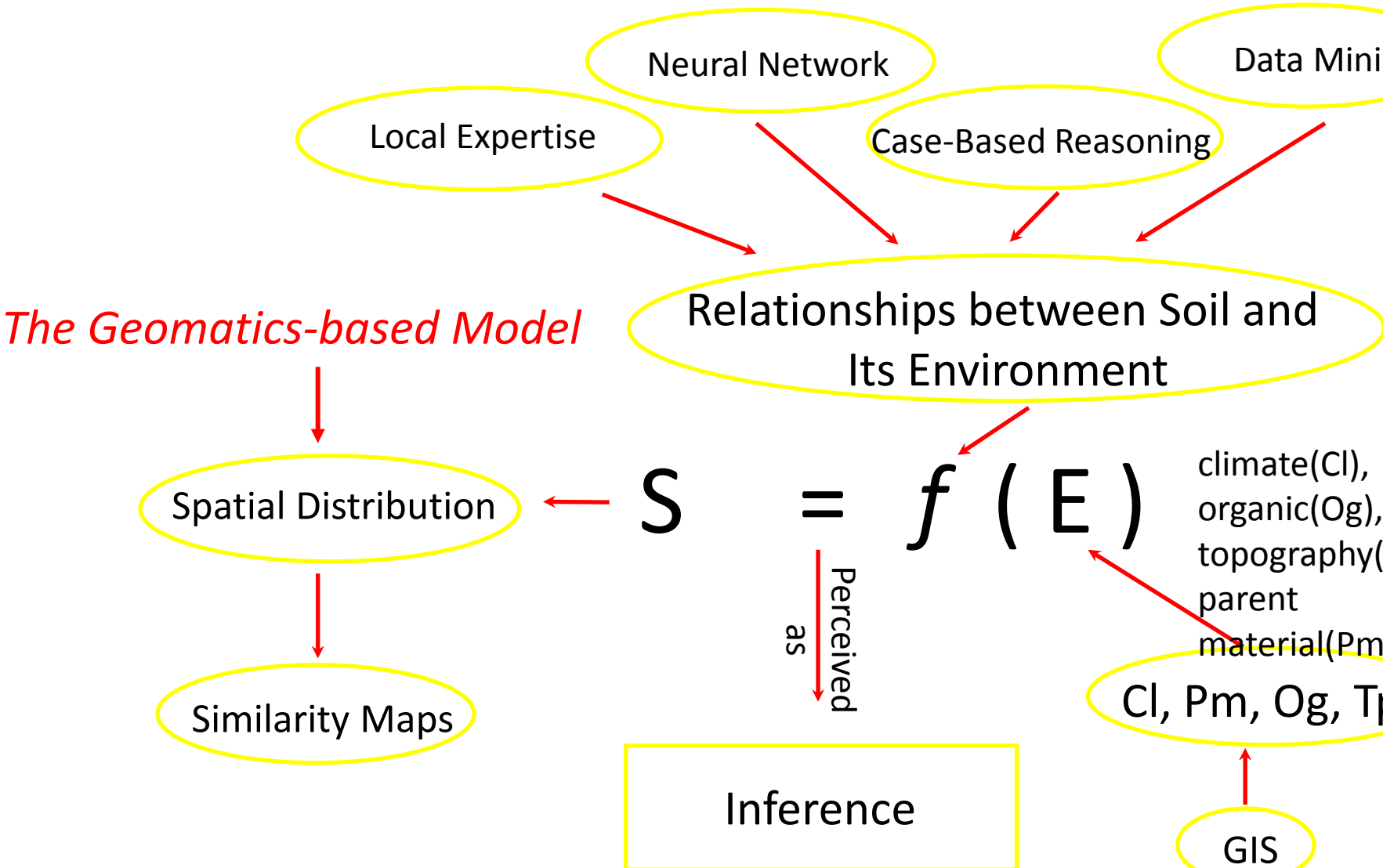
1.1 What is soil depth?

Soil depth, often referred to in geotechnics as “Regolith thickness”, is defined as the depth from the surface to underlying bedrock.

Soil depth in landscapes influences vegetation growth and hydro-mechanical responses of the slopes (Fuhlendorf and Smeins,1998; Bertoldi,2004; DeRose et al.,1991)



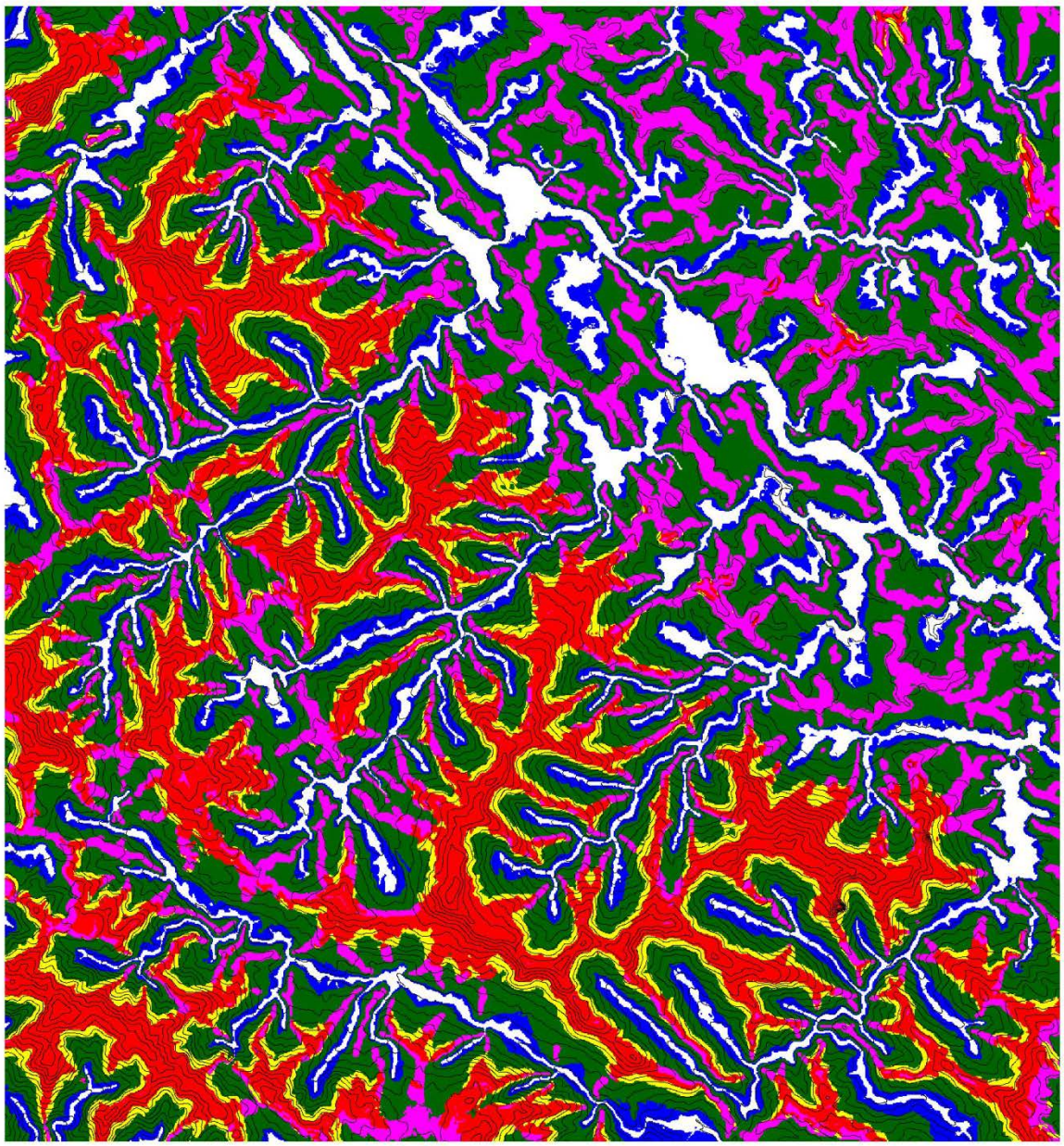
2. SOIL-LANDSCAPE MODEL



(3) Landfo

ridge,
slope shou
backslope,
slope foot,
Valley

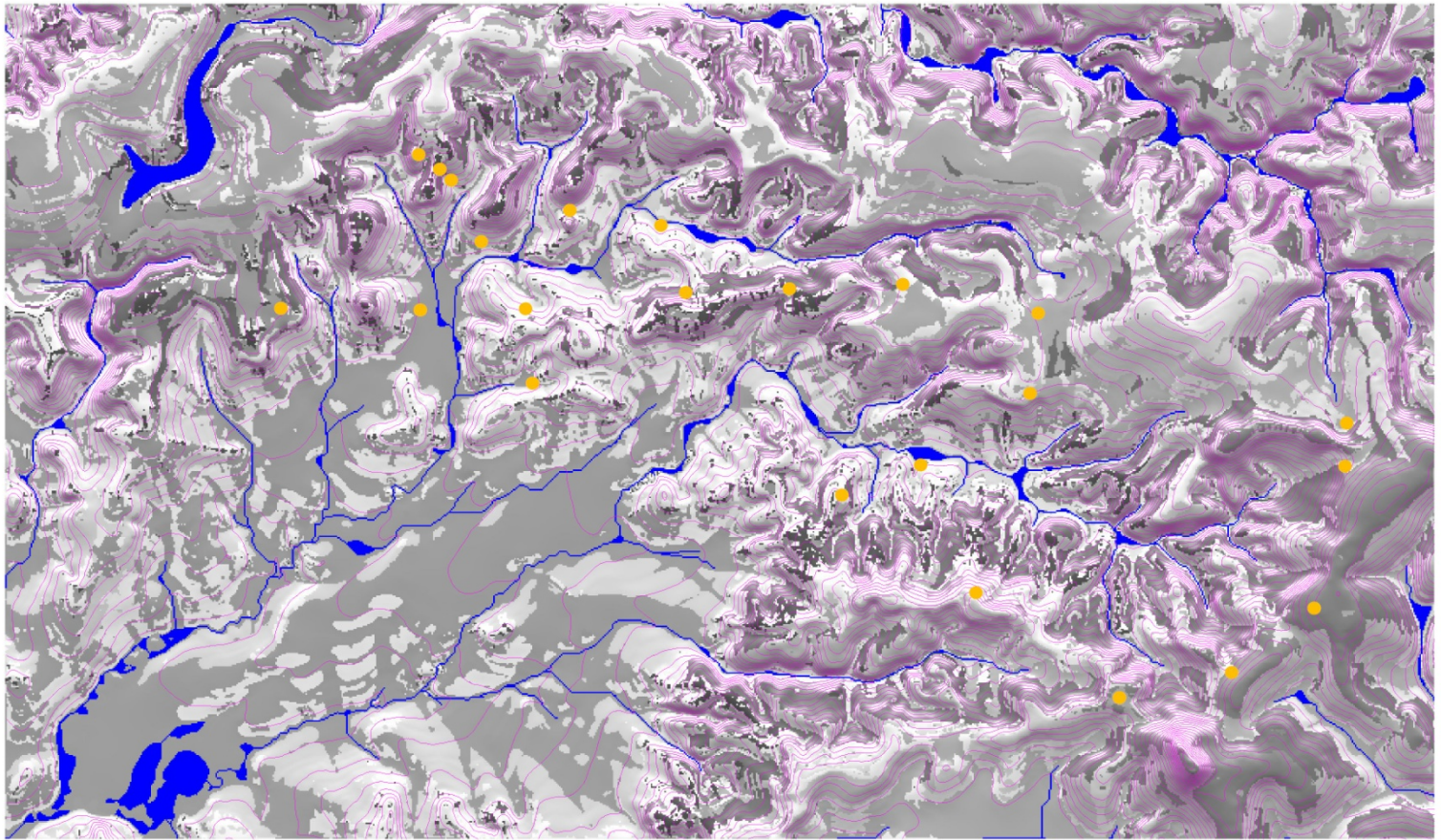
LaoCai,
Vietnam



Soil Property Mapping

Suoi Rat Catchment, Binh Phuoc, Vietnam

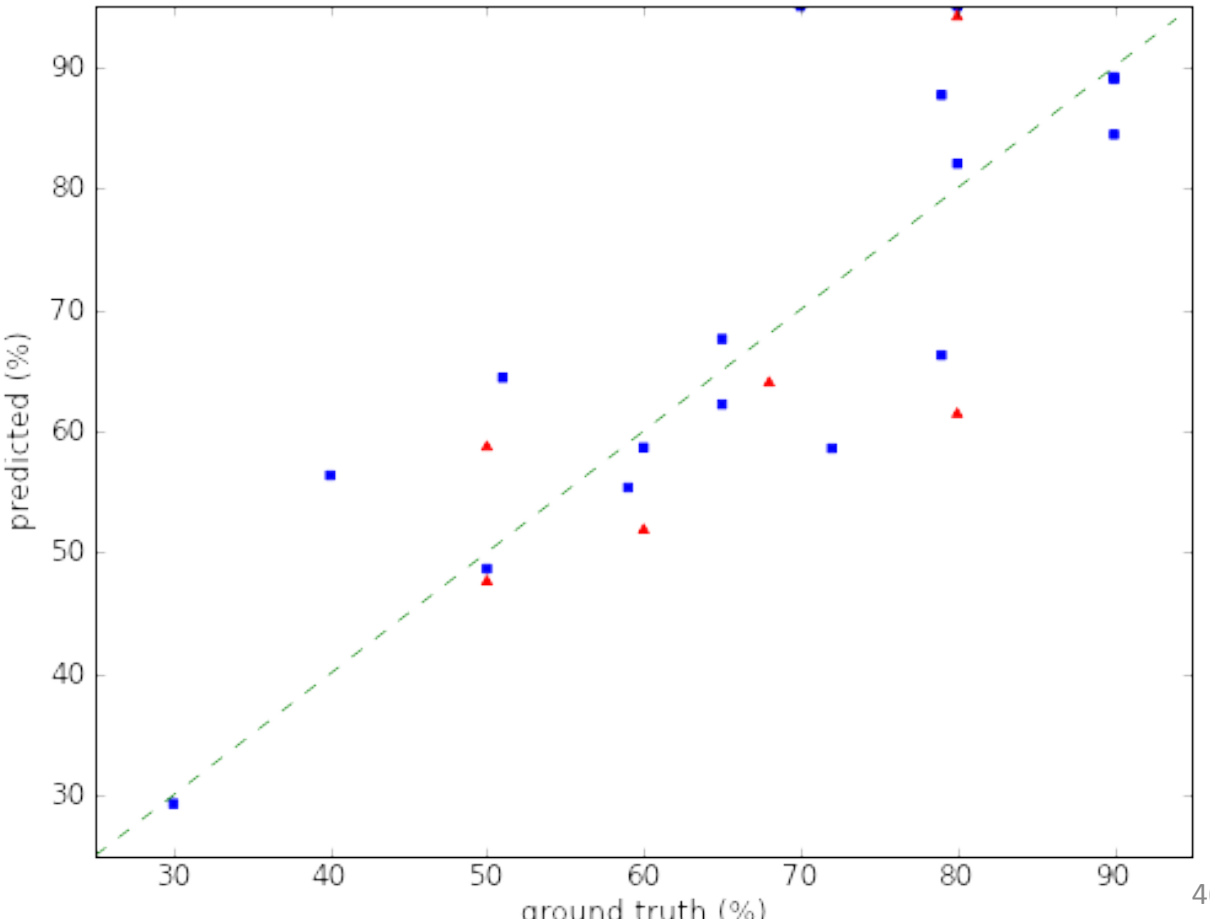
Soil Moisture



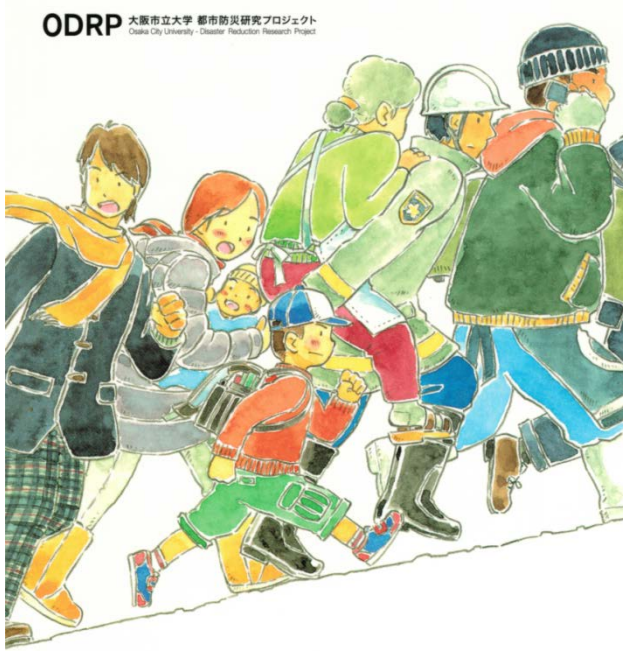
Validation

Suoi Rat catchment, Binh Phuoc, Vietnam

RMSE: 10.87
STD: 12.47



“Community based disaster mitigation using FOSS4

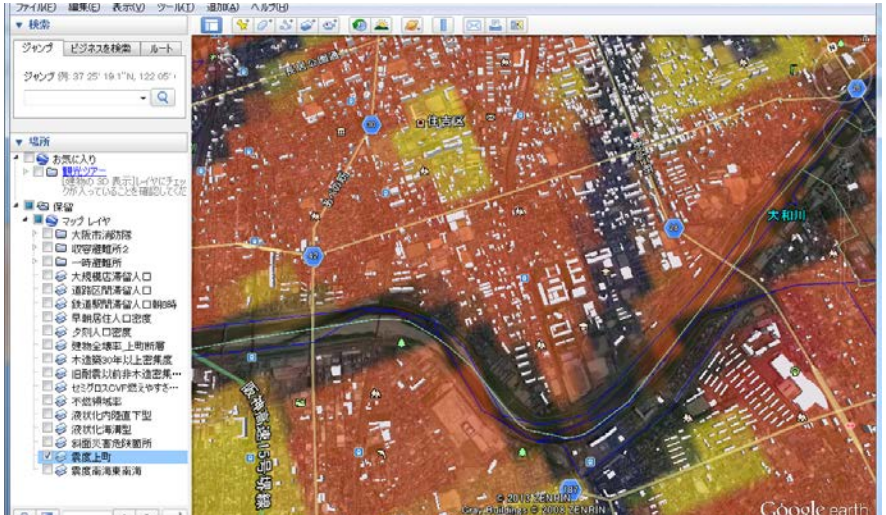


Visibility on local disaster risks with WebGIS

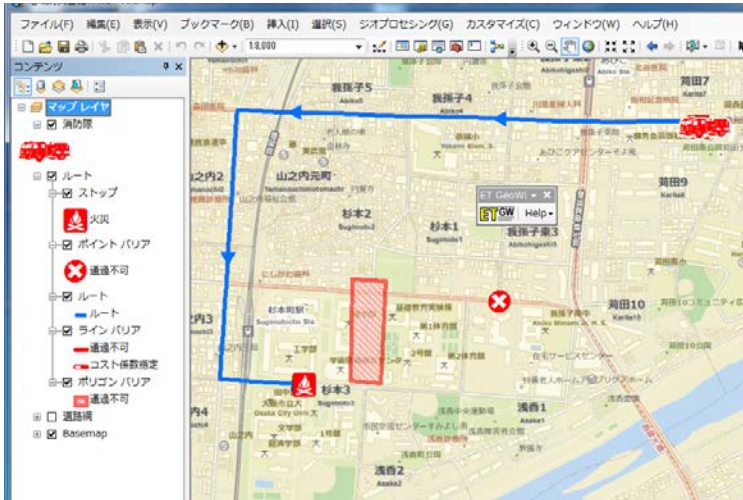
- Establishment of database on regional disaster risks
  - Anticipated hazards data in Osaka by national agency
  - Disaster response facility (evacuation sites & medical agency etc.)
  - Data on local community (population census & vulnerable people etc.)

  → Overlaying of multiple data with Google Earth and Web GIS
- Disaster risk checking interface
  - Tablet Terminals installed GPS for Town Walking on Risk Check

Seismic Intensity Map of Uemachi Earthquake on Google Map



Routing of fire fighters to disaster s with WebGIS



ODRP都市防災研究プロジェ

wps.media.osaka-cu.ac.jp/osaka/

ODRP 大阪市立大学 都市防災研究プロジェクト
Osaka City University - Disaster Reduction Research Project

1. あなたの家の場所は？
地図をクリックしてください.
緯度: 34.6162799921221
経度: 135.4819641017951

2. あなたの家はどんな家？
木造

3. あなたの家の古さ(築年)は？
1965年

4. 家やアパートの高さは？
2階建

5. 住んでいる階は？
1階

Input data:
Building type
Building ages
Number of building floors
Living floor

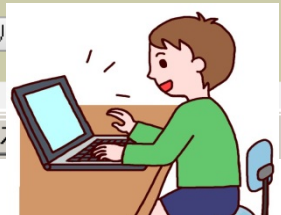
Designated locality of residence

The three shortest possible way to evacuation area

あなたの地域の想定震度(上町断層地震)	6強
あなたの地域の想定震度(南海トラフ地震)	5強
想定される家の被害(上町断層地震)【全壊率、全半壊率】	2~23%、8~50%
想定される家の被害(南海トラフ地震)【全壊率、全半壊率】	全・半壊に至る可能性は低い
地盤沈下の可能性(南海トラフ地震)【S】	不等沈下はほとんどなし
地盤液状化の可能性(南海トラフ地震)【PL】	PL>15：液状化の可能性が大
津波浸水の可能性(南海トラフ地震)【m】	0.3-1.0
高潮氾濫【m】	1.0-2.0
大雨の浸水(内水氾濫)【m】	0.5-1.0
河川氾濫による浸水【m】	2.0-5.0
最寄りの避難所1(直線距離)【m】	175
最寄りの避難所2(直線距離)【m】	391
最寄りの避難所3(直線距離)【m】	408

Result of evaluation

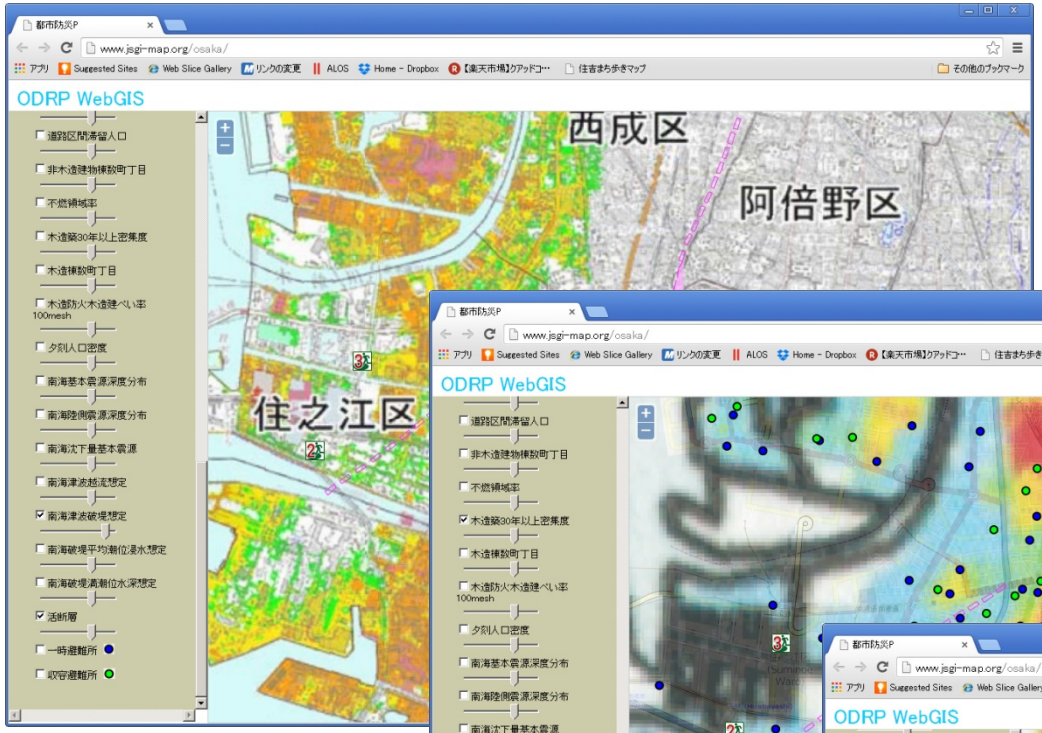
Self Checking on Risks

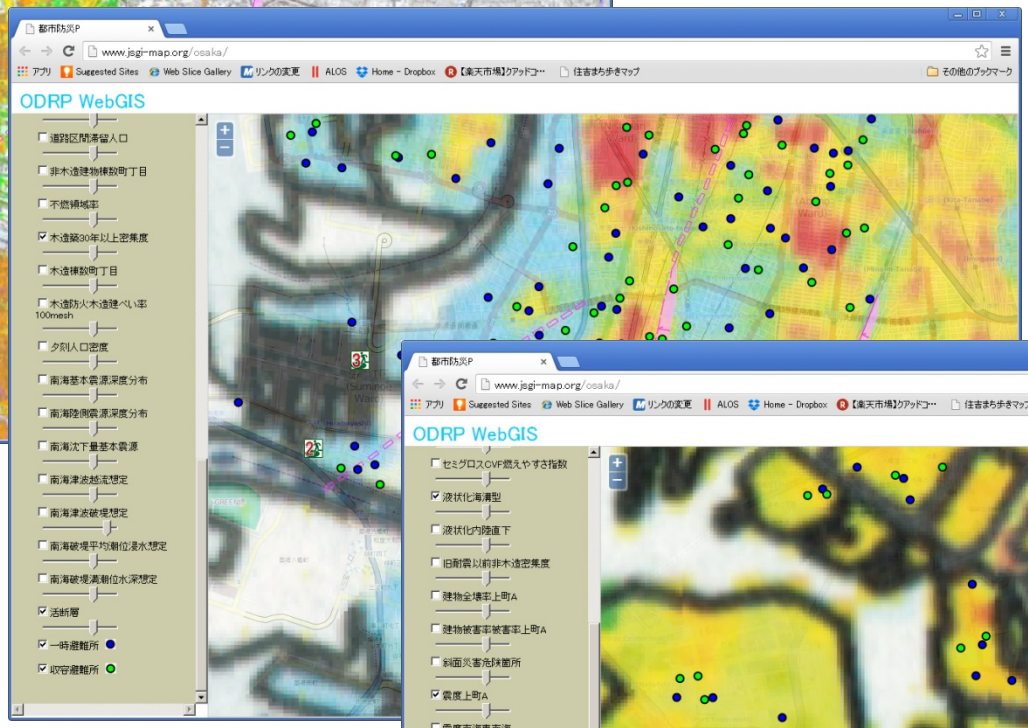


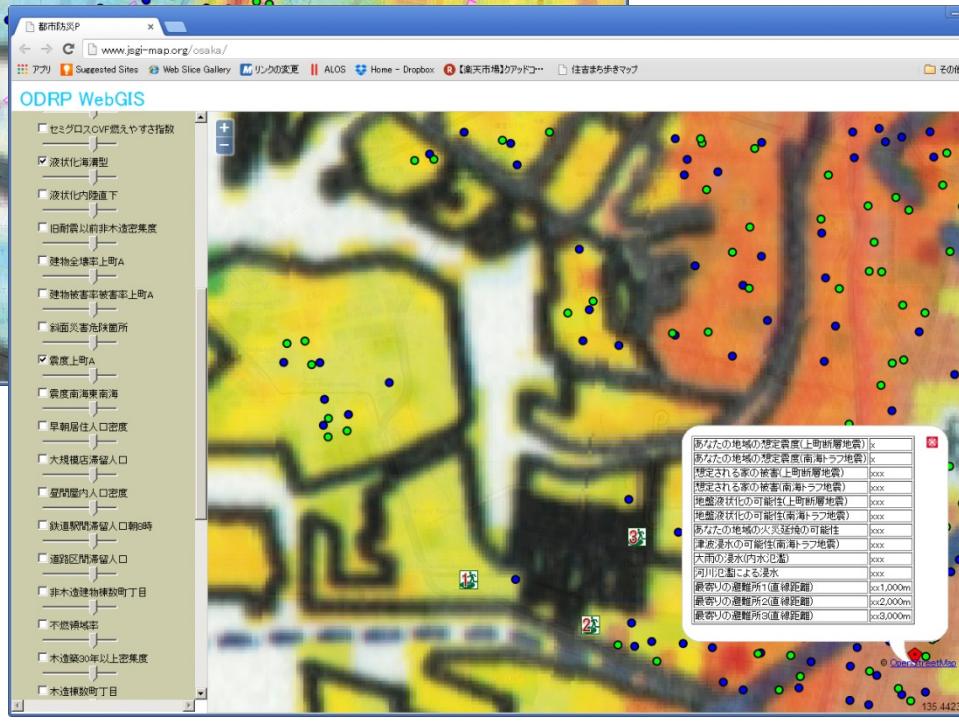
Set up by Dr. Nemoto and Dr. Yoshida

Disaster risk interface with Web GIS

Visualization of local disaster r with WebGIS



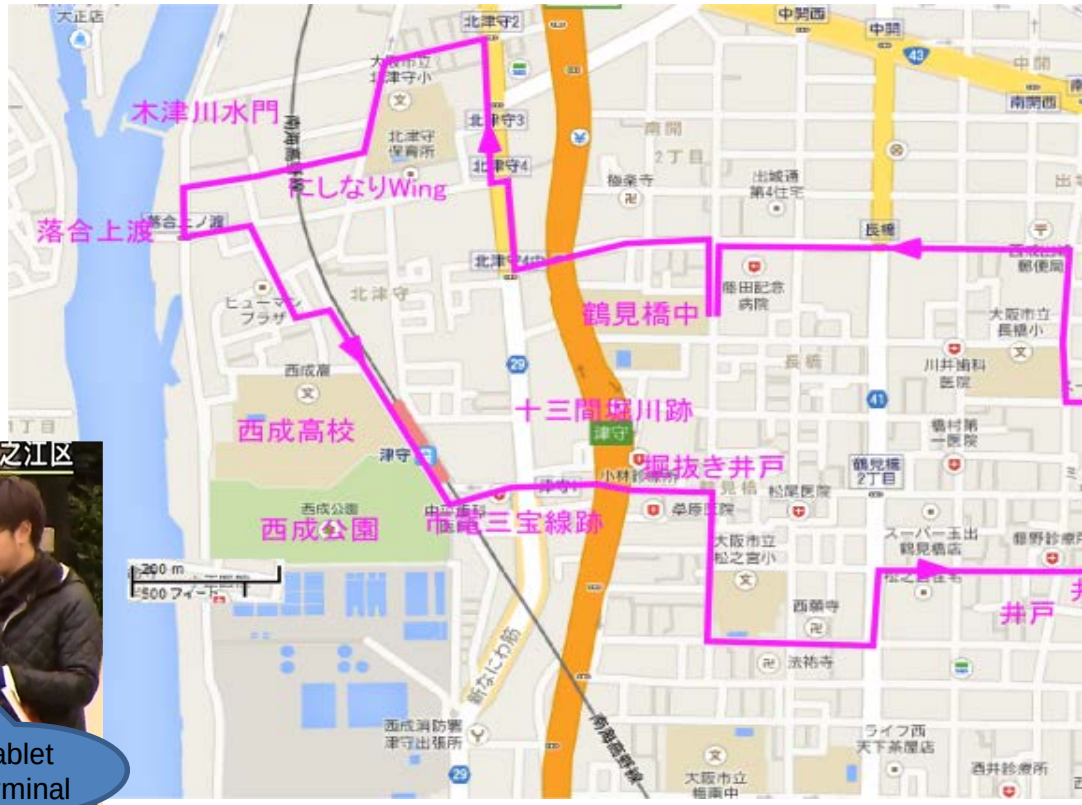




Self Cheking on Risks

Checking up disaster risks with Web GIS

Town Walking



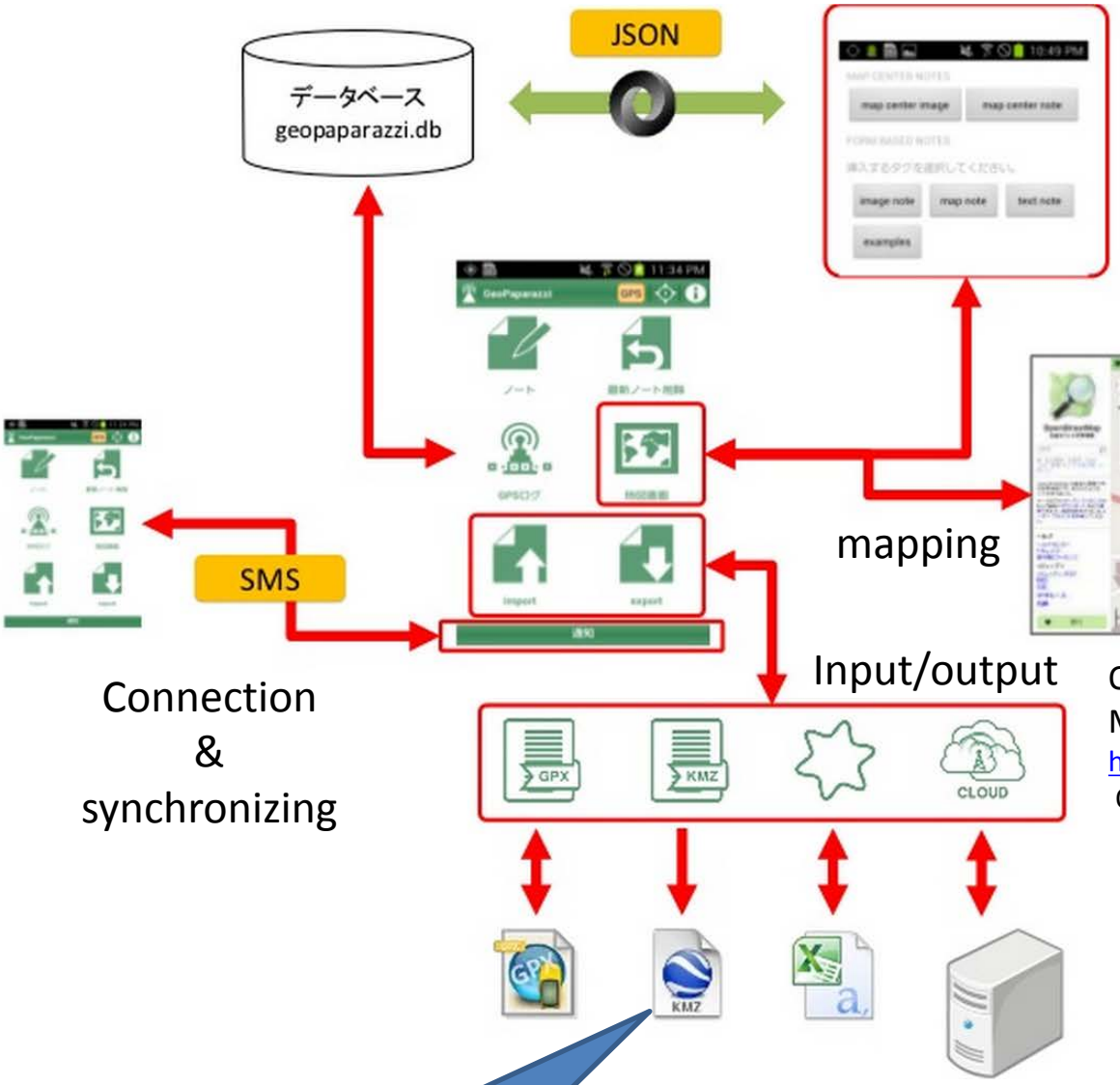
Learning through Town Walking

- Confirmation of evacuation facilities
- Tsunami evacuation buildings
- Road signage for evacuation
- Ground altitude and Flooding area
- Ground Properties (soft foundation & Liquefaction)
- Groundwater wells and Groundwater level
- Hazards along streets (weak block wall, narrow roads, aging houses)

“Geopaparazzi”

FOSS4G for Android devices

Customization



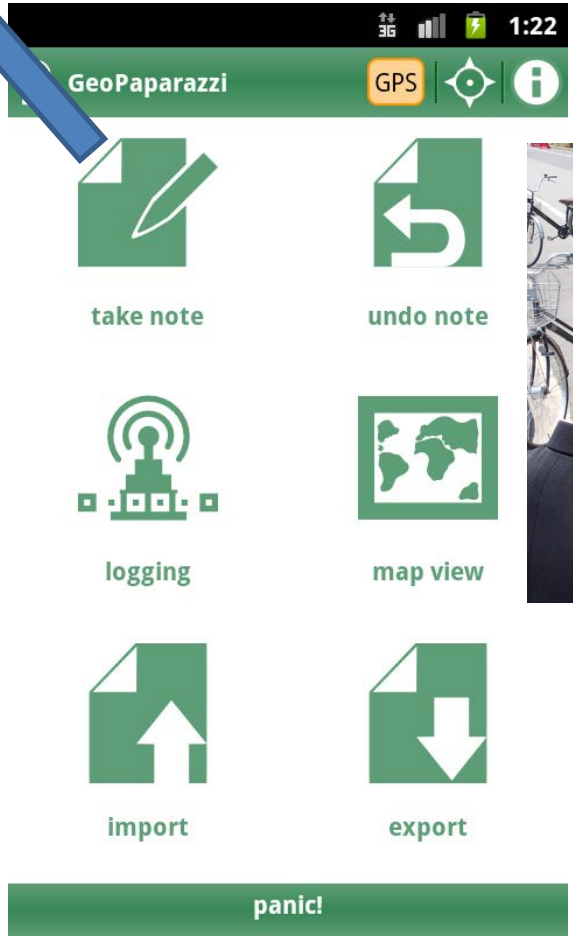
OpenStreetMap

Connection
&
synchronizing

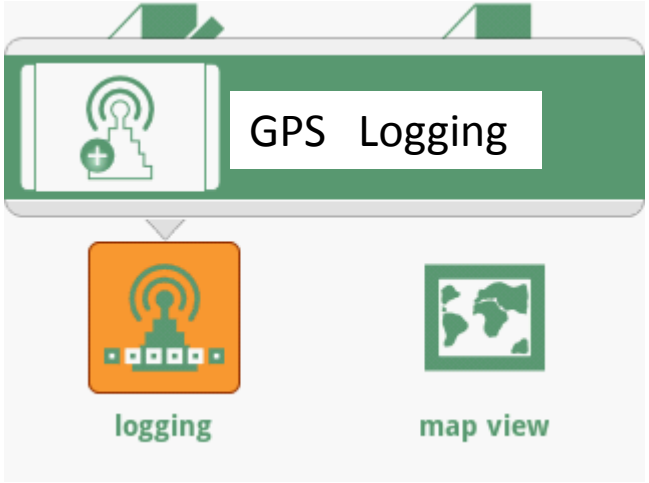
Offline map
MapForge site
https://code.google.com/p/mapsforge/
Original maps are also available

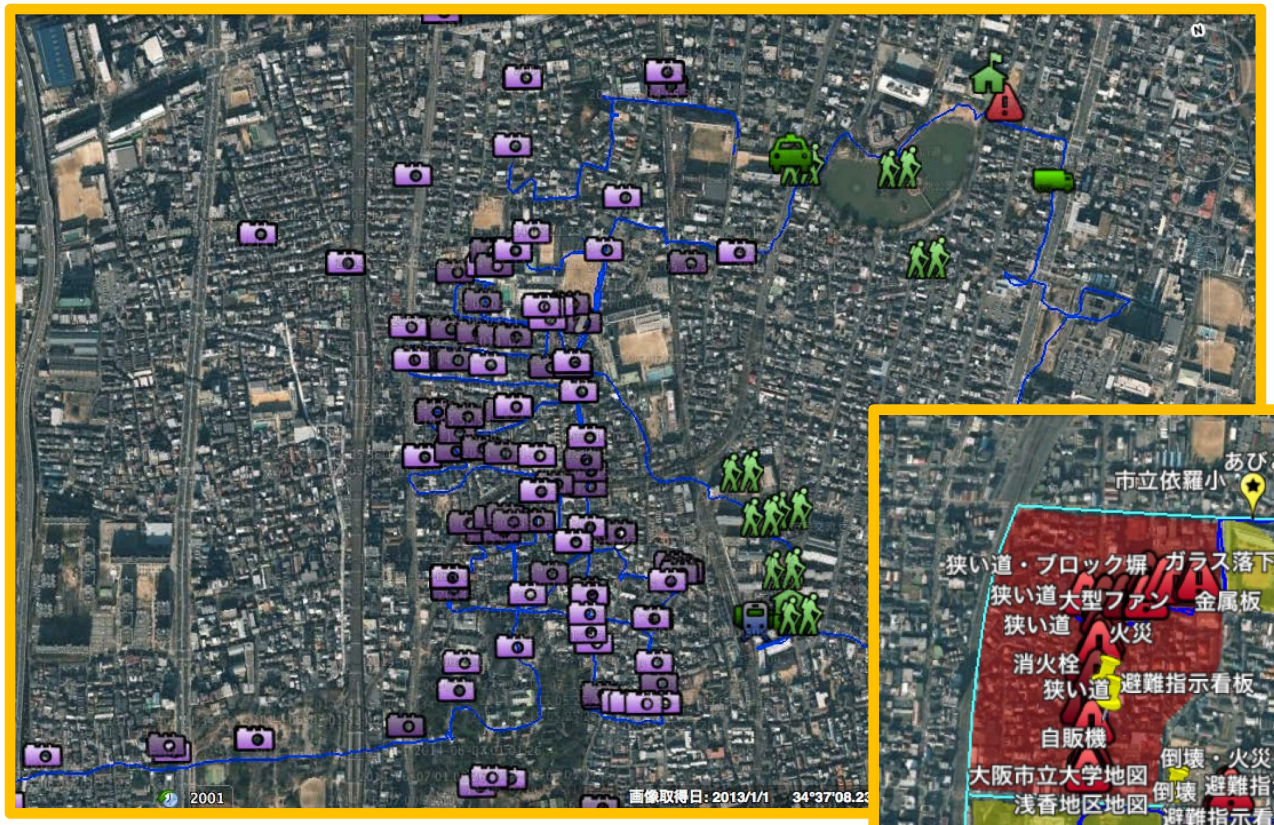
to Google Earth

Geopaparazzi
Main menu

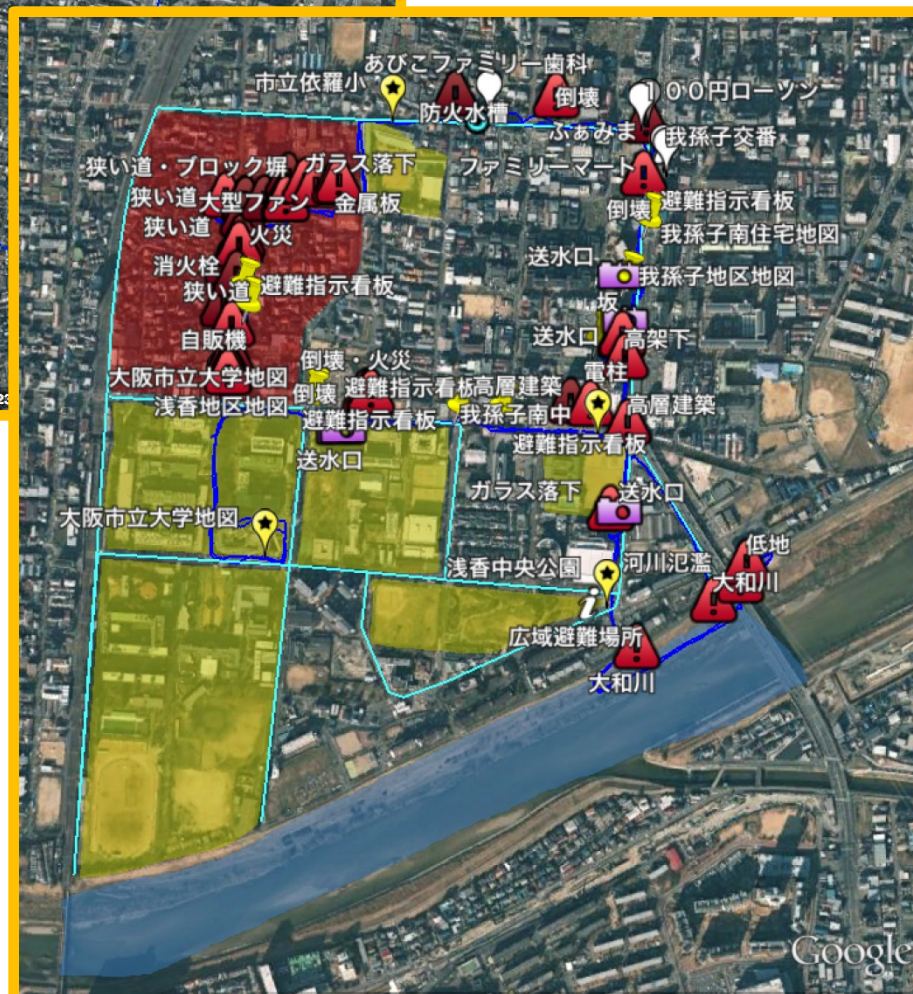


Hazard map for communi





Export of Geopaparazzi da
to Google Earth



Overlapping of risk information
With Google Earth

Open Geo-Learning Initiatives

- 「オープンソースGISと利用促進オープンシステムの研究」(平成21年
  OSGeo4W (FOSS4G Stack for Windows
  – Enhancement/Localization/Customization
    - funded by JST (Japan Science & Technology Agency)

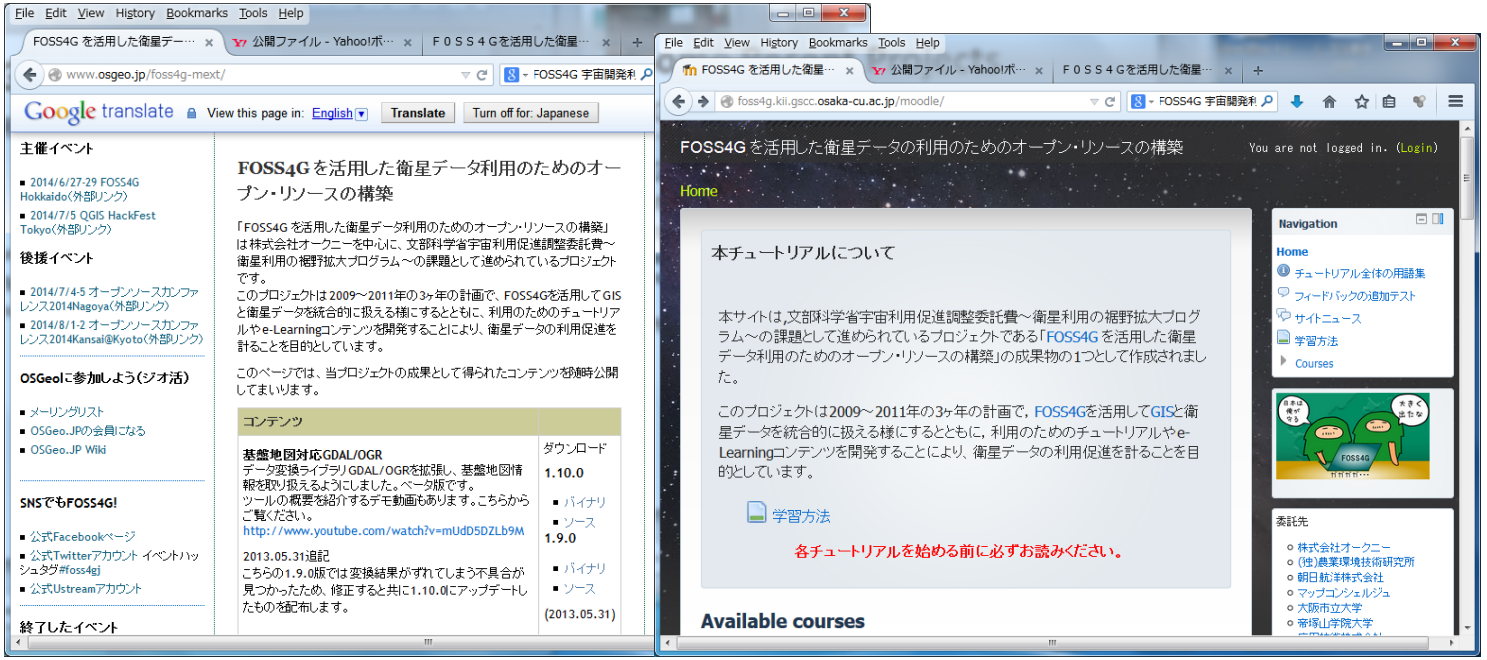
http://trac.osgeo.org/osgeo4w/wiki/OSGeo4W_jp

Open Geo-Learning Initiatives

- 「FOSS4Gを活用した衛星データの利用のためのオープン・リソースの構築」(平成21年度～平成23年)

  QGIS & GRASS

  - Enhancement, localization, customization
  - Japanese tutorial documents & e-learning contents
    - funded by MEXT（Ministry of Education, Culture, Sports, Science & Technology）



Open Geo-Learning Initiative

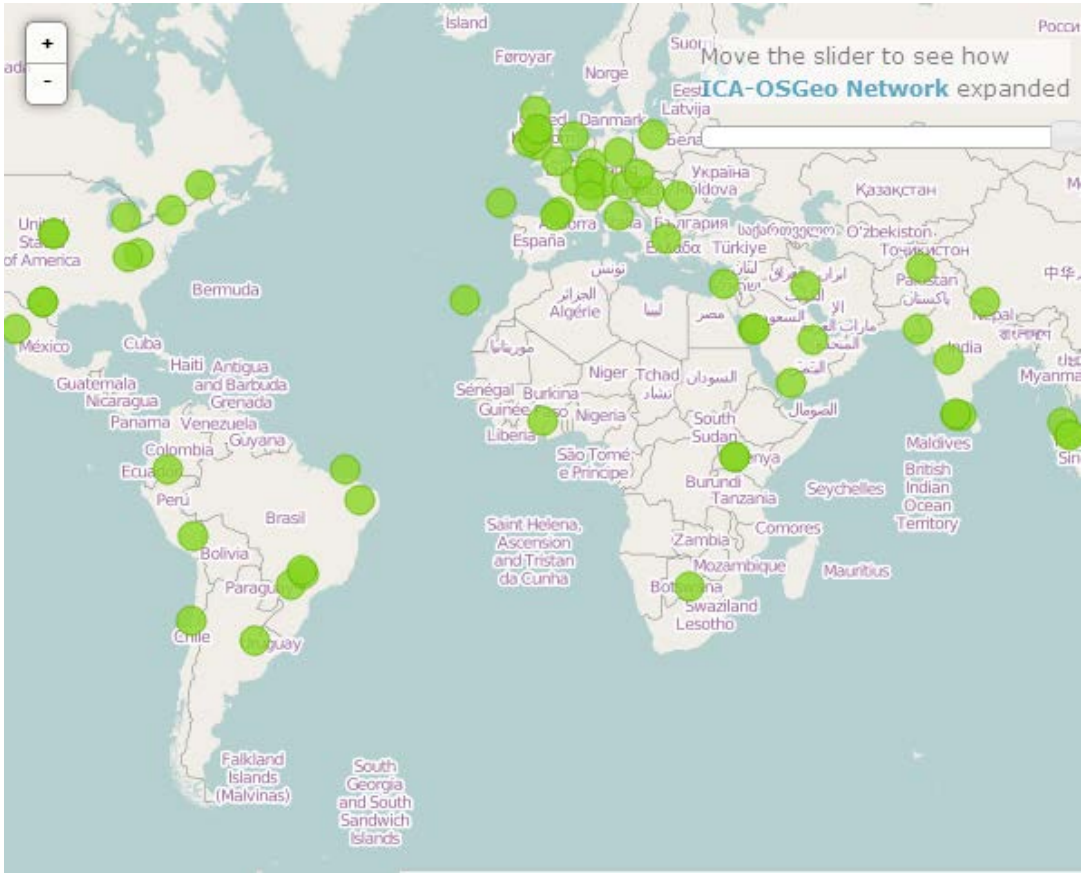
- 「衛星データと地球地図を用いた環境劣化評価システムの構築」
  (平成24年度～平成26年)

  Environmental Mapping Using FOSS4G & Open Data

  - Open Data support, Enhancement, Localization, Customization of GRASS, QGIS and Geopaparazzi
  - Training documents, e-learning, International outreach
  - funded by MEXT（Ministry of Education, Culture, Sports, Science Technology）

ICA-OSGeo Labs Network

International Cartographic Association
Association Cartographique Internationale



As of today More than 90 Geo4All Labs Worldwid

FOSS4G-ASIA

2-5 dec 2014 - BANGKOK

GIS-IDEAS International Conference since 20

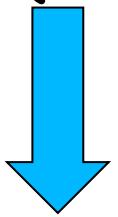
GISIDEAS

December 6-9 2014

Danang, Vietnam

FOSS4G 2015 and beyond

Moving Ahead from A(wareness) to B(elow)



- Brain-Power (New ideas, Students)
- Better Data
- Buck$ (Research Funding)
- Bug-fixes
- Brotherhood (collaborations and more collaborations…)
- (Post) Bachelor Course in SIS in Englis

2015 and beyond

More Open Data & Improved Open Standard

- Crowd Sourcing data
- Citizen Science
- Internet of Things (Open Hardware)
- Open Monozukuri (3D printers/cutters)
- Augmented Reality
- Optimization of Geoprocessing Algorithms
- ……

Lastly,

FOSS4G is never about「無料」and always about「自由」

*Providing the **Freedom** to use, change, improve and share FOSS4G, costs time, effort an money.*

Free as a

SIS can be fun with FOSS4G!

http://2015.foss4g.org