Space based information service for flood mapping _ case study of Malaysia

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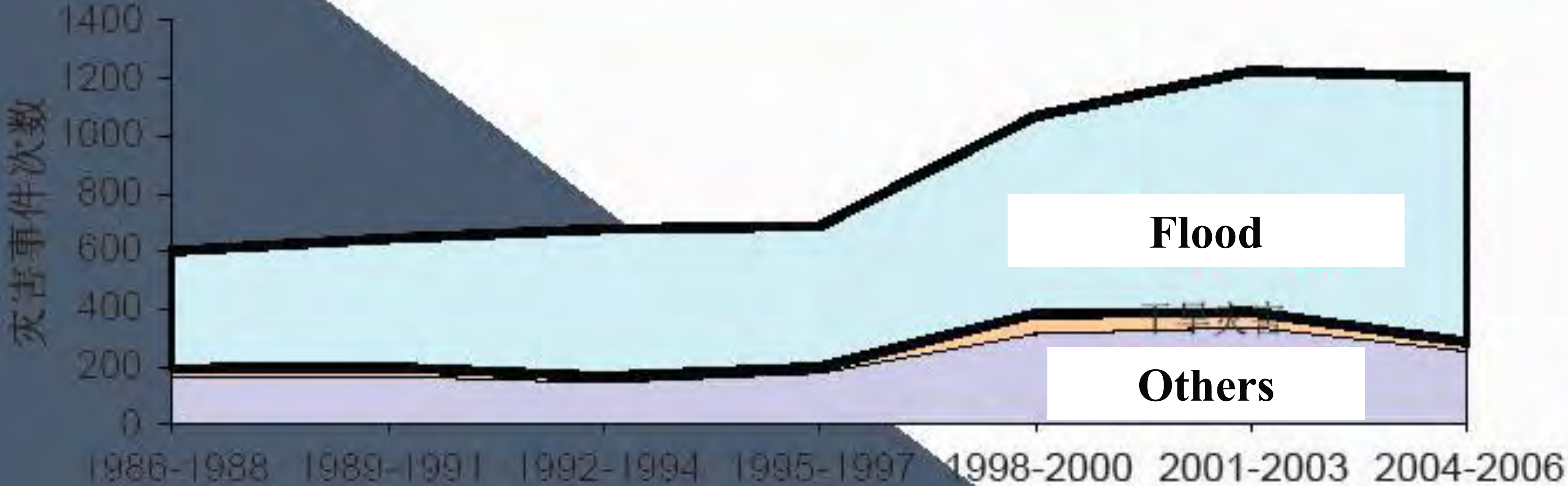
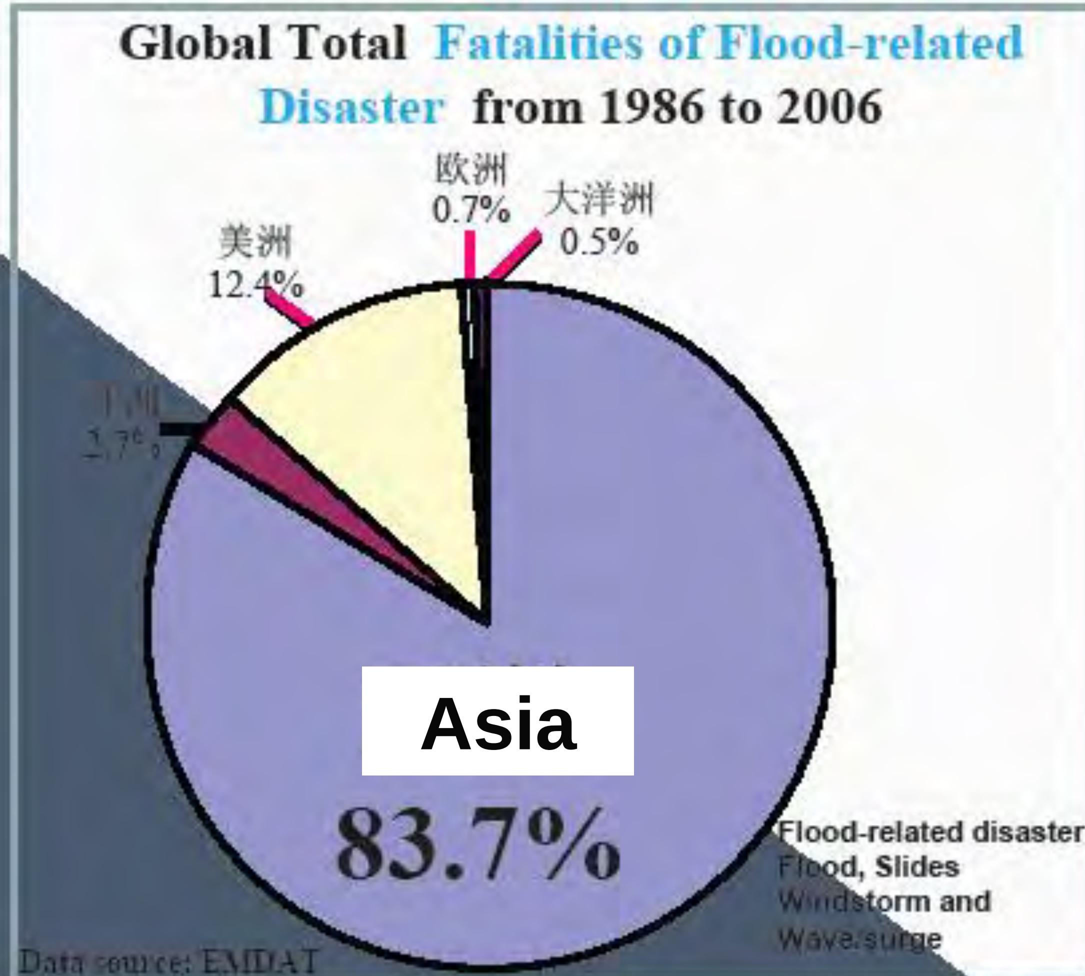
Global Disaster number (1986-2006)



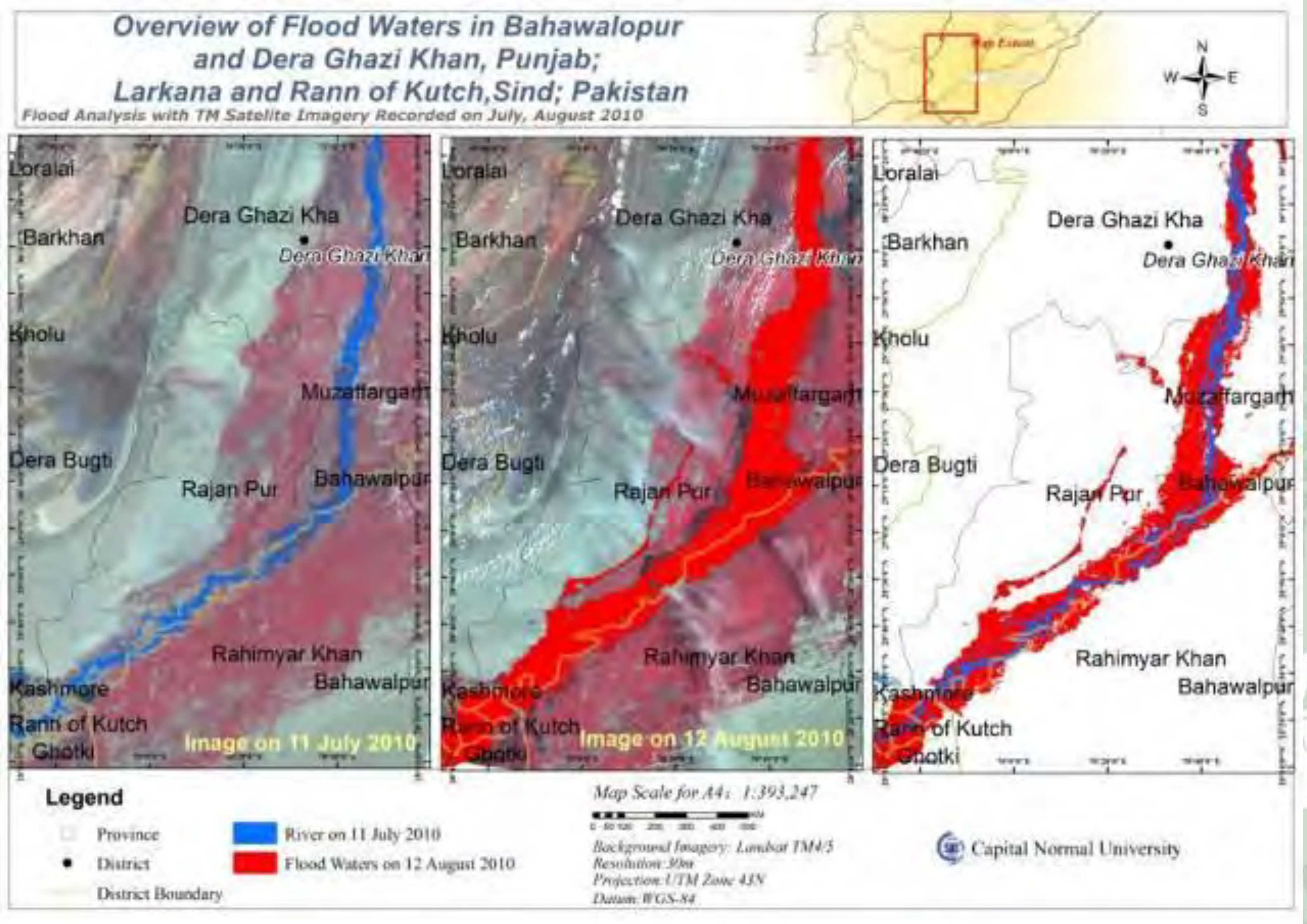
It show: flood frequency increase more fast than other disaster

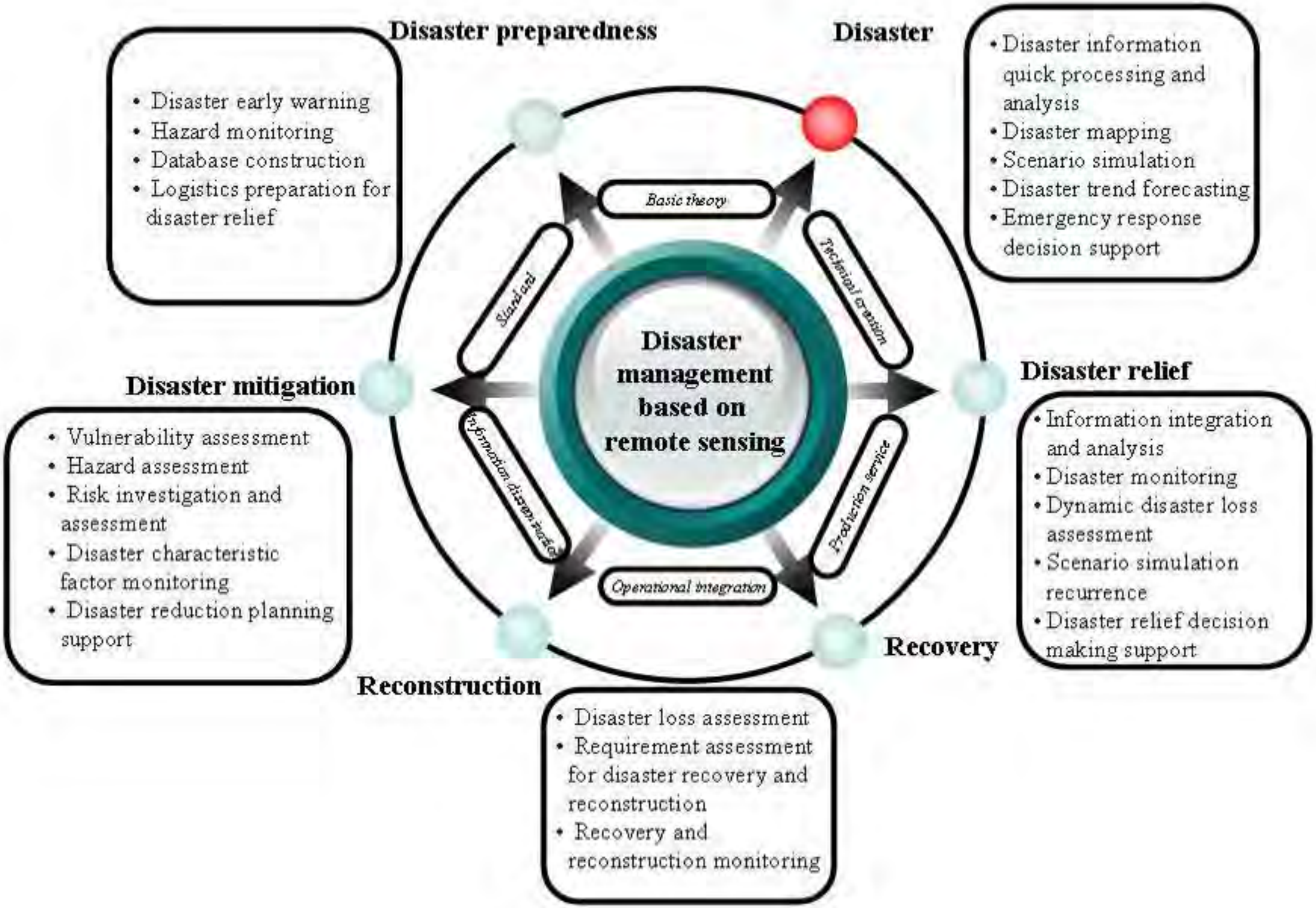
Total Fatalities of Flood Related Disaster: 1986-2006

It shows that Asia is the region where has most serious flood



Remote sensing technology is very useful tool for flood disaster management

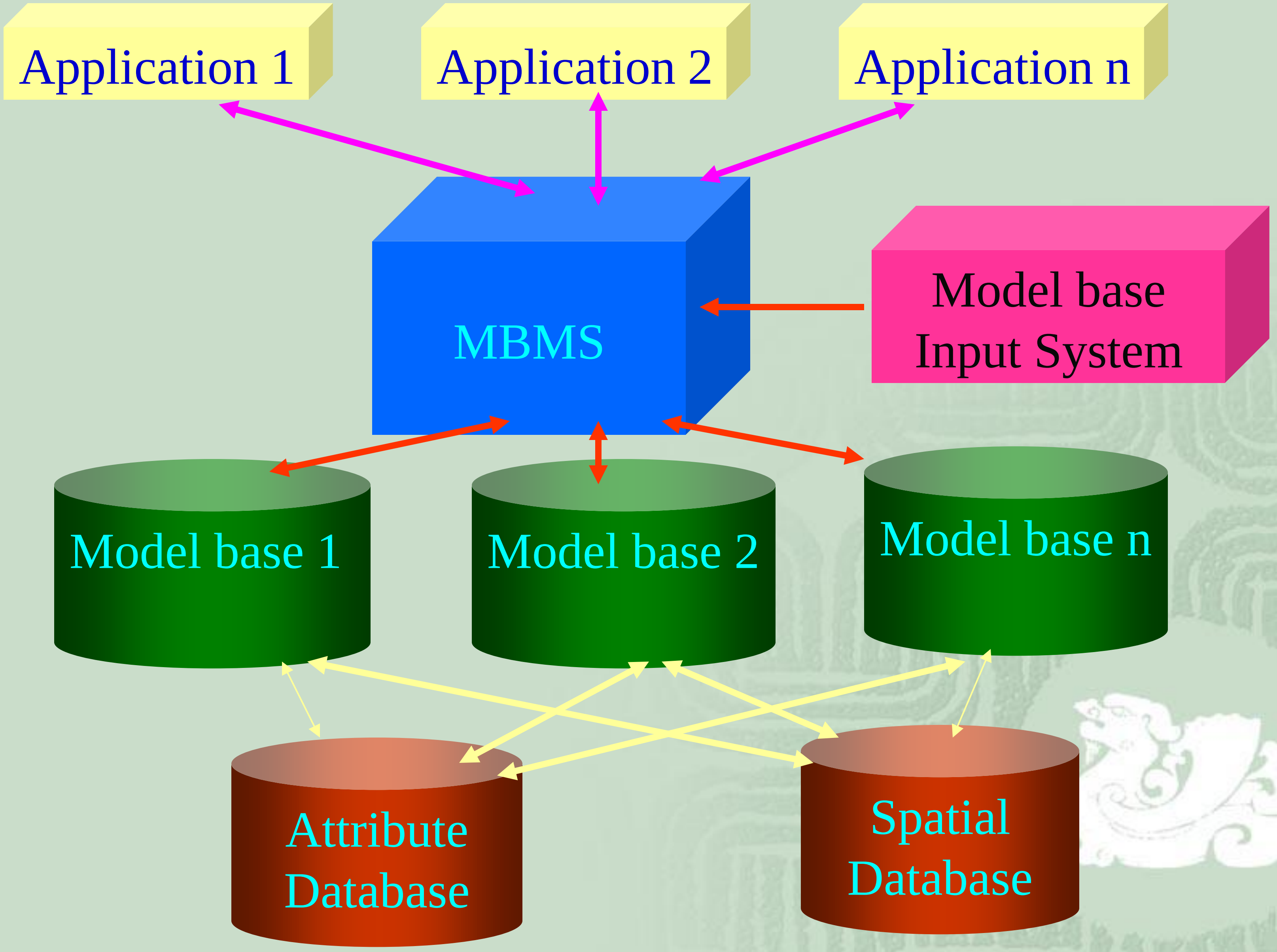


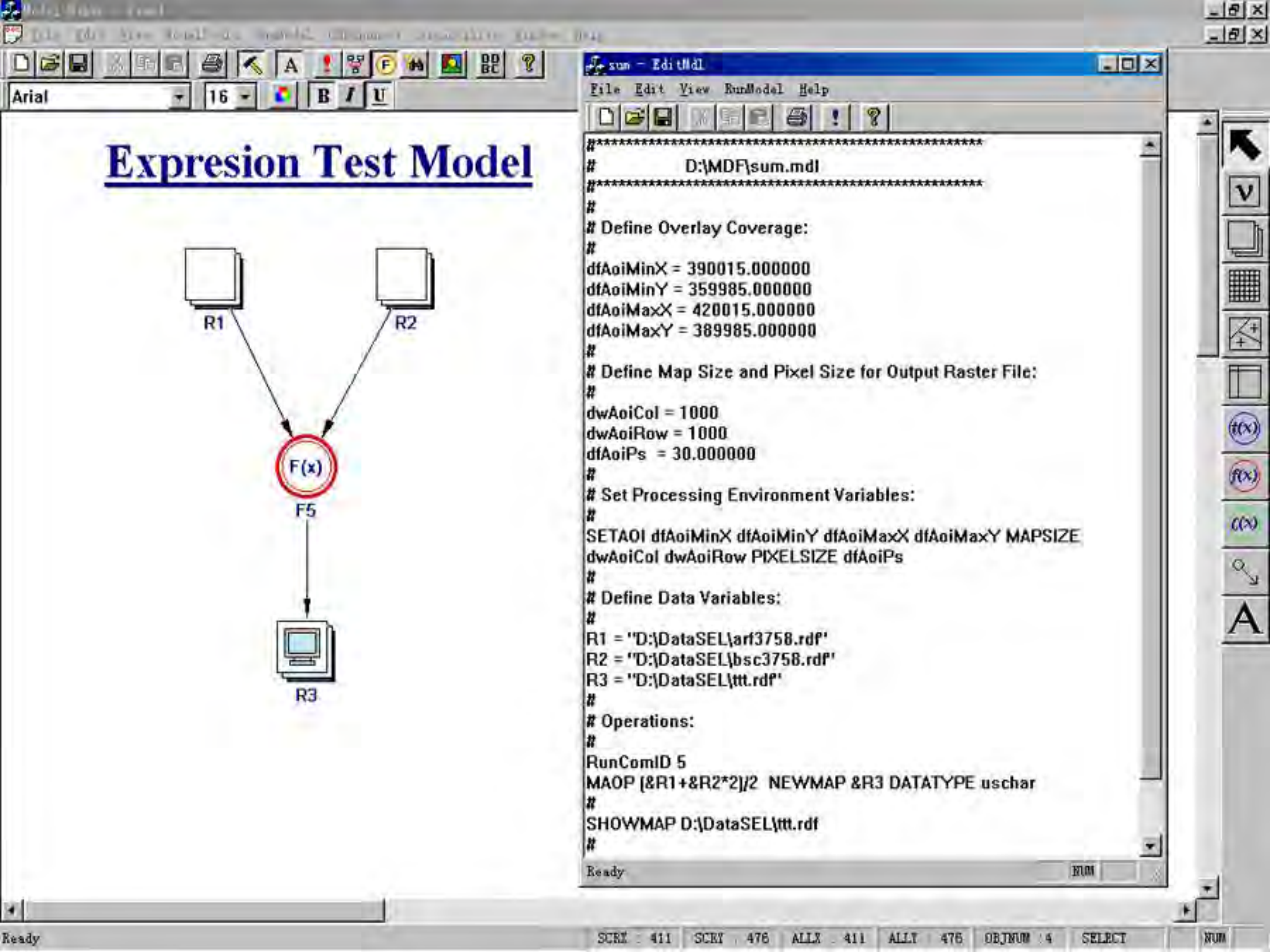

Disaster preparedness
Disaster early warning
Hazard monitoring
Database construction
Logistics preparation for disaster relief
Disaster
Disaster information quick processing and analysis
Disaster mapping
Scenario simulation
Disaster trend forecasting
Emergency response decision support
Basic theory
Standard
Technical creation
Disaster management based on remote sensing
Disaster mitigation
Vulnerability assessment
Hazard assessment
Risk investigation and assessment
Disaster characteristic factor monitoring
Disaster reduction planning support
Disaster relief
Information integration and analysis
Disaster monitoring
Dynamic disaster loss assessment
Scenario simulation recurrence
Disaster relief decision making support
Information dissemination
Production service
Operational integration
Reconstruction
Recovery
Disaster loss assessment
Requirement assessment for disaster recovery and reconstruction
Recovery and reconstruction monitoring

Spatial Model Base System

Spatial Model Base System (SMBS) is a computer software system which classify and maintain a great number of spatial models, and support generation, storage, query, running and analysis of the spatial models.

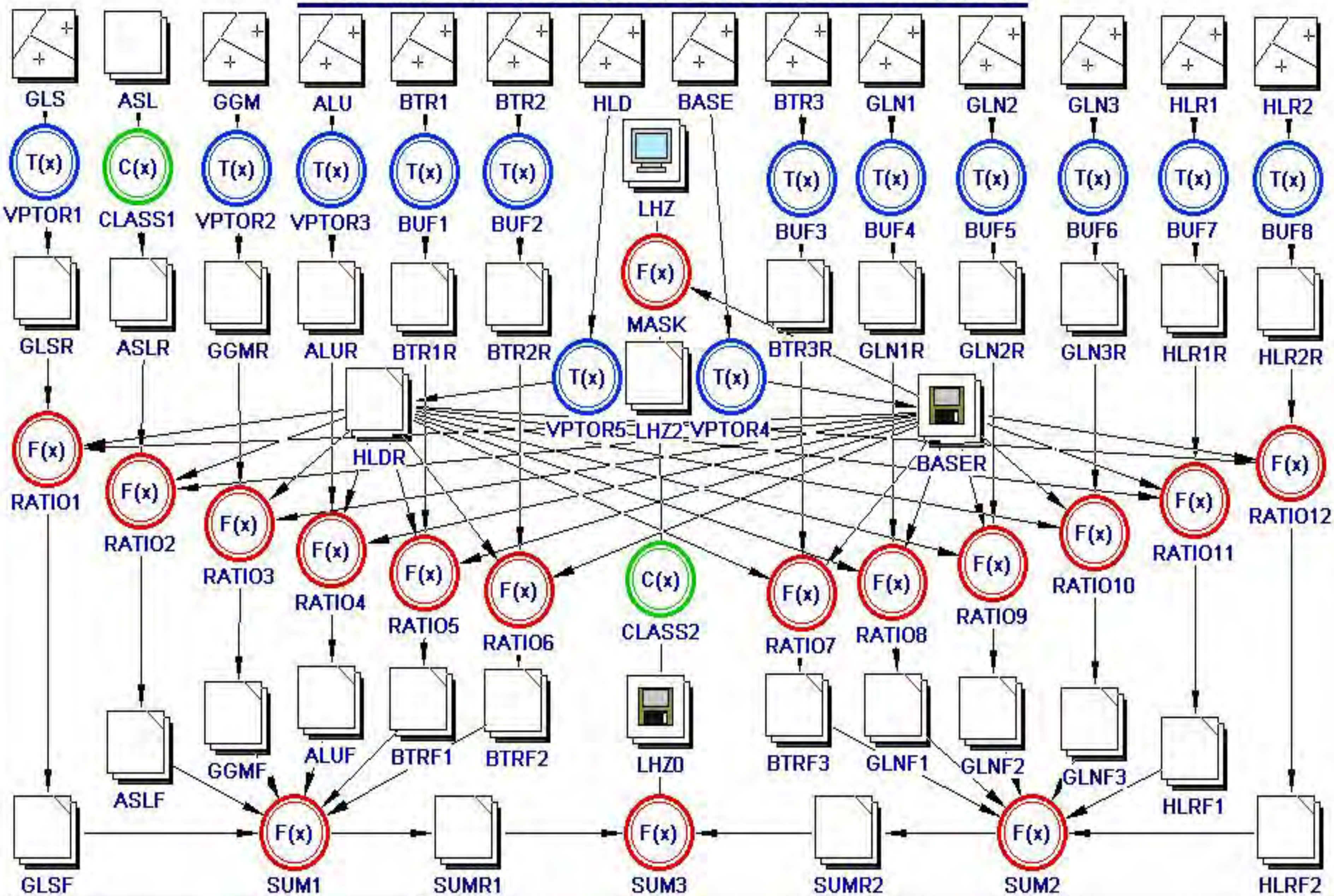
MBS Architecture

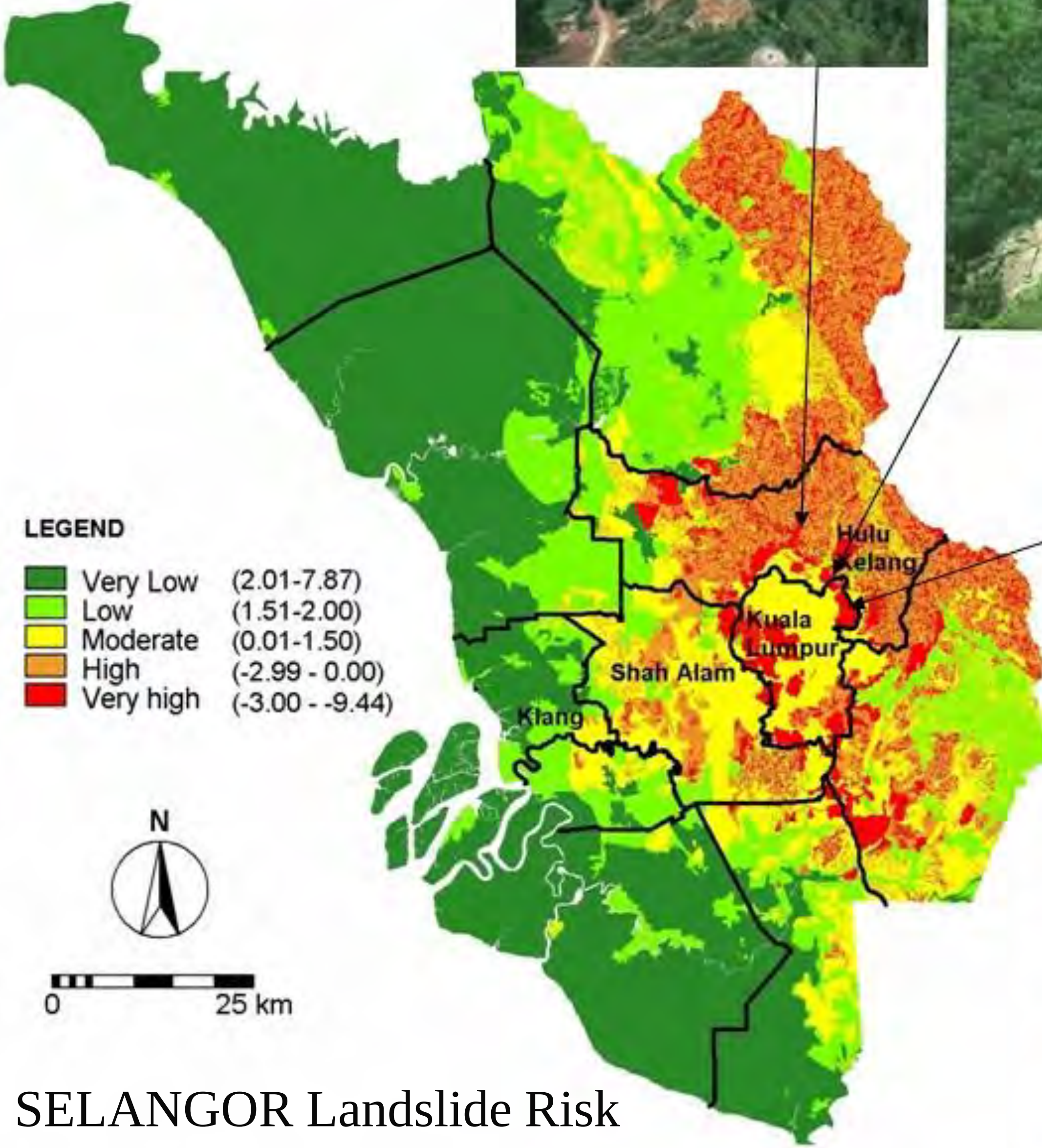




Arial
16
Expresion Test Model
R1
R2
F(x)
F5
R3
sum - EditMdl
File Edit View RunModel Help
#***
D:\MDF\sum.mdl
#***
#
Define Overlay Coverage:
#
dfAoiMinX = 390015.000000
dfAoiMinY = 359985.000000
dfAoiMaxX = 420015.000000
dfAoiMaxY = 389985.000000
#
Define Map Size and Pixel Size for Output Raster File:
#
dwAoiCol = 1000
dwAoiRow = 1000
dfAoiPs = 30.000000
#
Set Processing Environment Variables:
#
SETAOI dfAoiMinX dfAoiMinY dfAoiMaxX dfAoiMaxY MAPSIZE dwAoiCol dwAoiRow PIXELSIZE dfAoiPs
#
Define Data Variables:
#
R1 = "D:\DataSEL\arf3758.rdf"
R2 = "D:\DataSEL\bsc3758.rdf"
R3 = "D:\DataSEL\ttt.rdf"
#
Operations:
#
RunComID 5
MAOP (&R1+&R2*2)/2 NEWMAP &R3 DATATYPE uschar
#
SHOWMAP D:\DataSEL\ttt.rdf
#
Ready
NUM
Ready
SCRX 411
SCRY 476
ALLX 411
ALLY 476
OBJNUM 4
SELECT
NUM

Landslide Hazard Zonation Model





LANDSLIDE HAZARD CLASSES

LOW TO VERY LOW HAZARD

Low probability of occurrence of landslides is very low even with existence of strong triggering factors, such as drastic landuse change and intense rainfall.

(Environmentally non sensitive – development can take place with standard conservation practices)

MODERATE HAZARD

Some landslides will occur under the influence of strong triggering factors.

(Environmentally moderately sensitive – limited development activities may take place provided strong conservation measures are implemented)

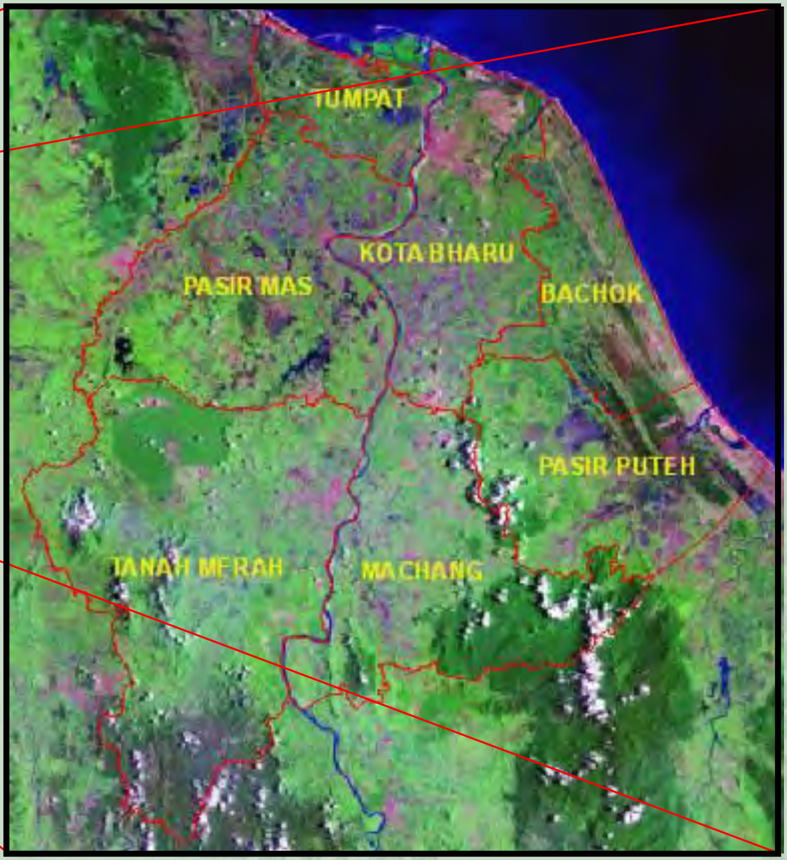
HIGH TO VERY HIGH HAZARD

A considerable number of landslides will occur even with the presence of weak triggering factors.

(Environmentally very sensitive – no development activities should be considered)

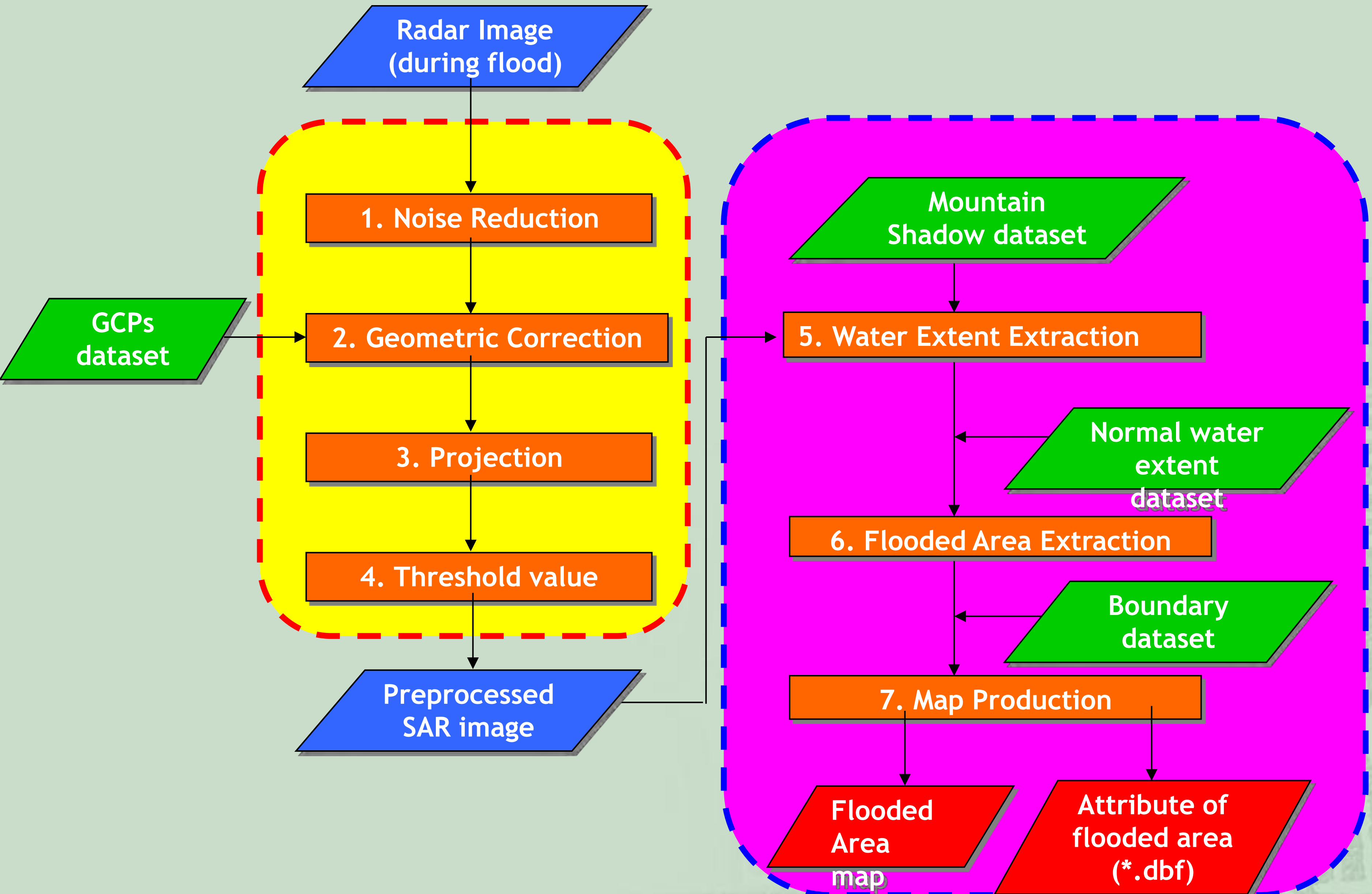
SELANGOR Landslide Risk Map (1:50,000)

Flood Disaster Mapping



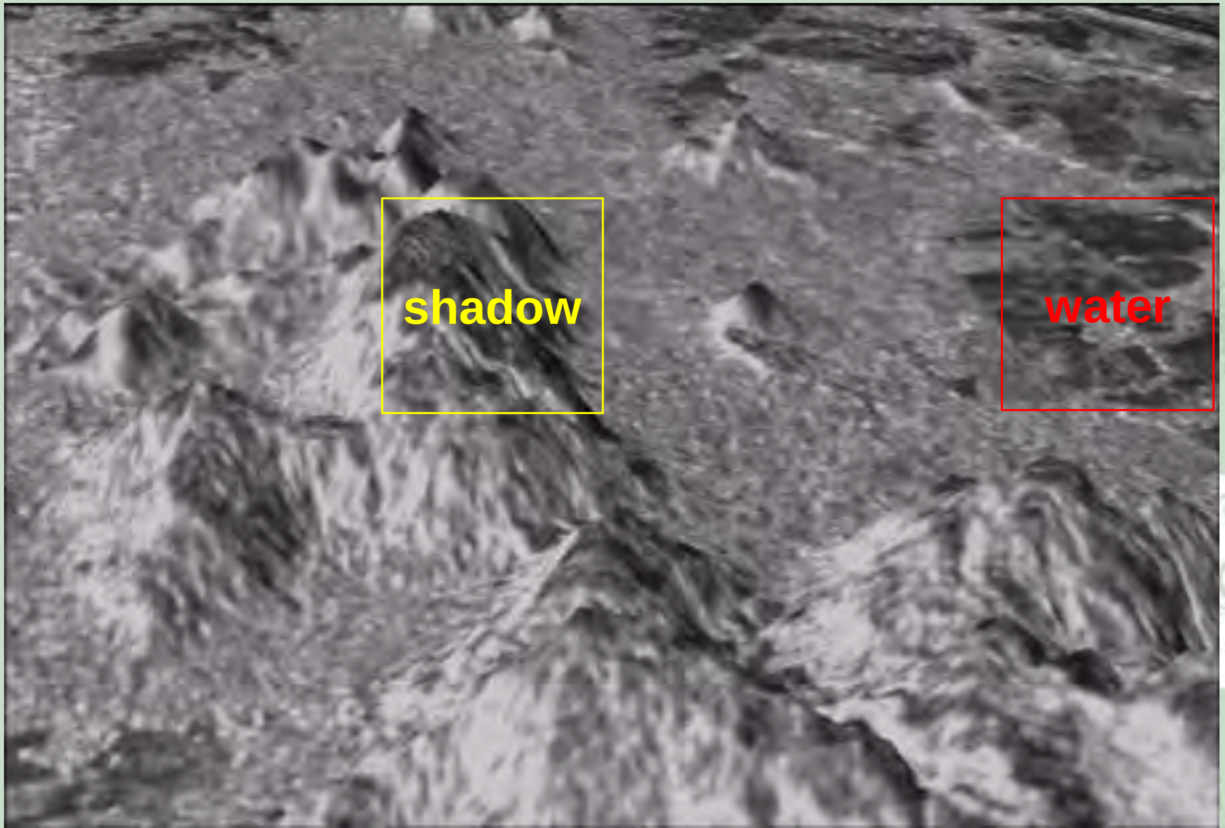
Study area is located north of the Kelantan

Flooded Area Extraction using remote sensing

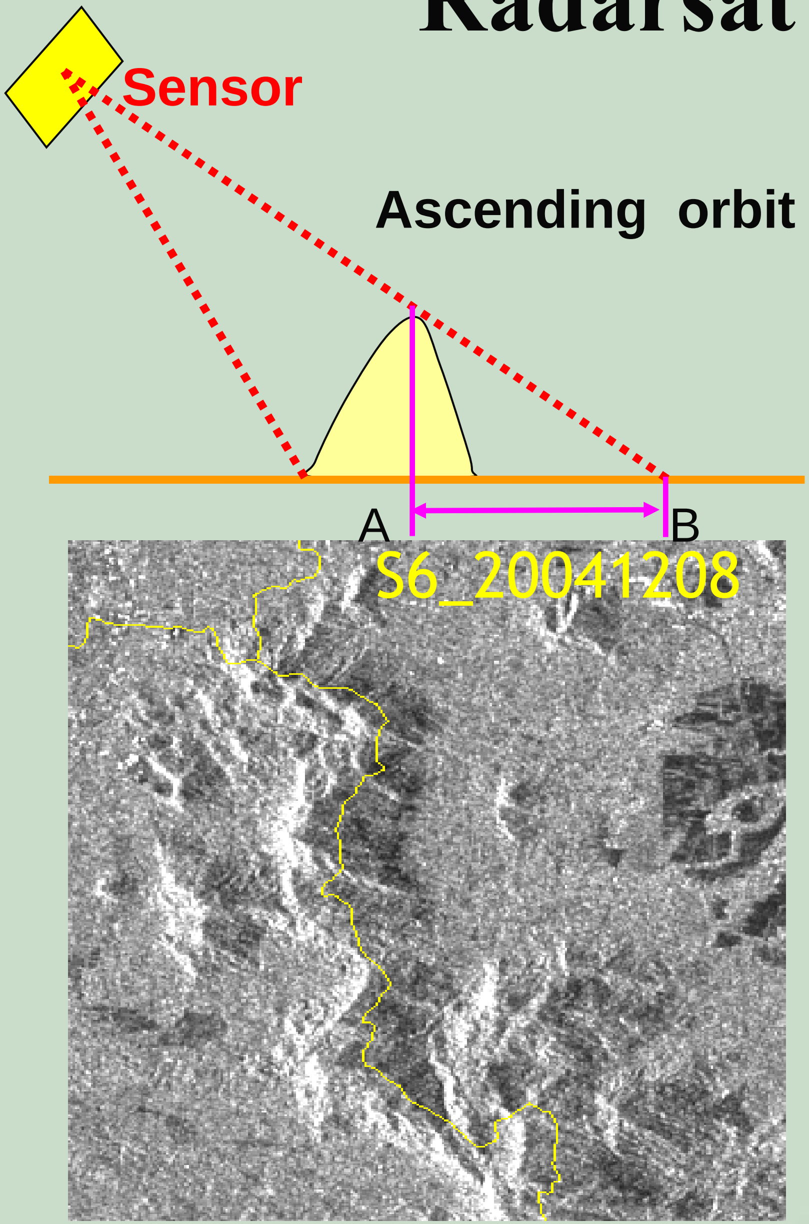


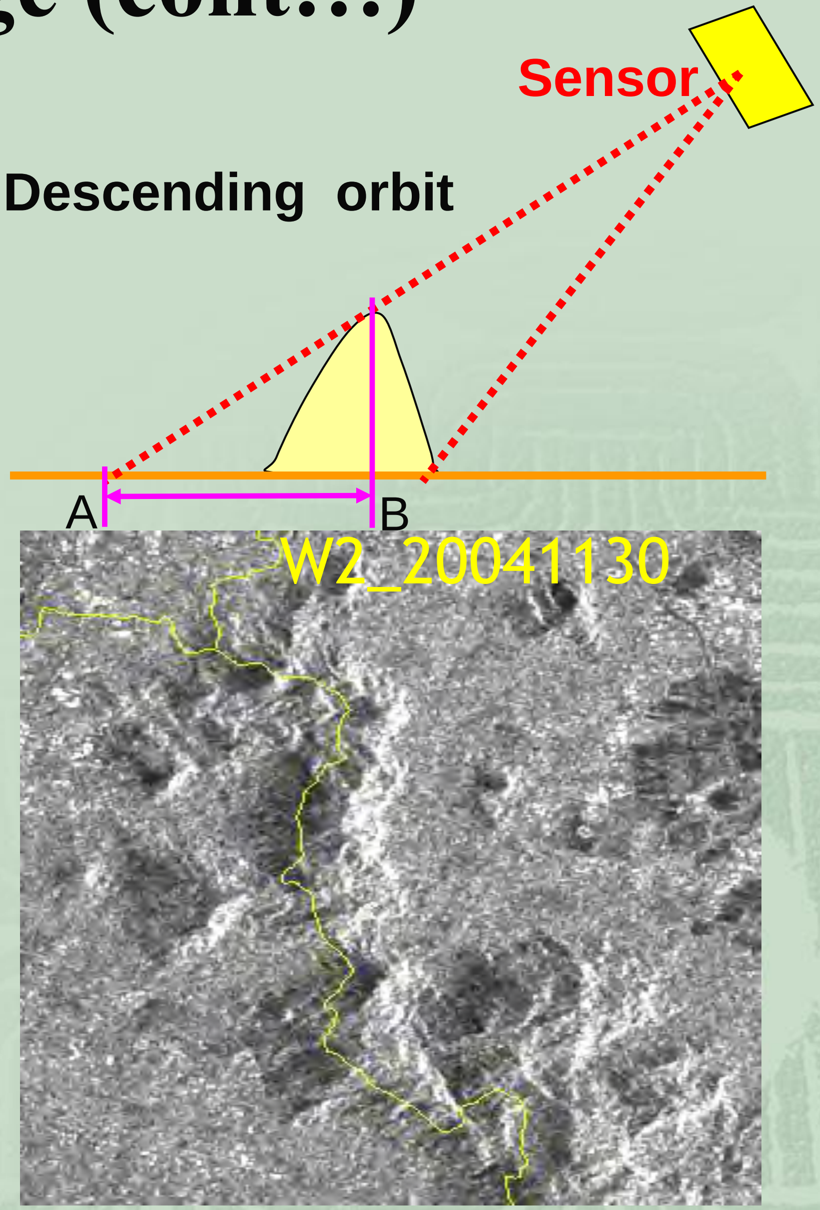
Shadow extraction of Radarsat image

Gray value of shadow is close with that of water in the Radarsat images. Shadow and water have low gray value while other has high gray value. So shadow extraction is very difficult from Radarsat image directly.



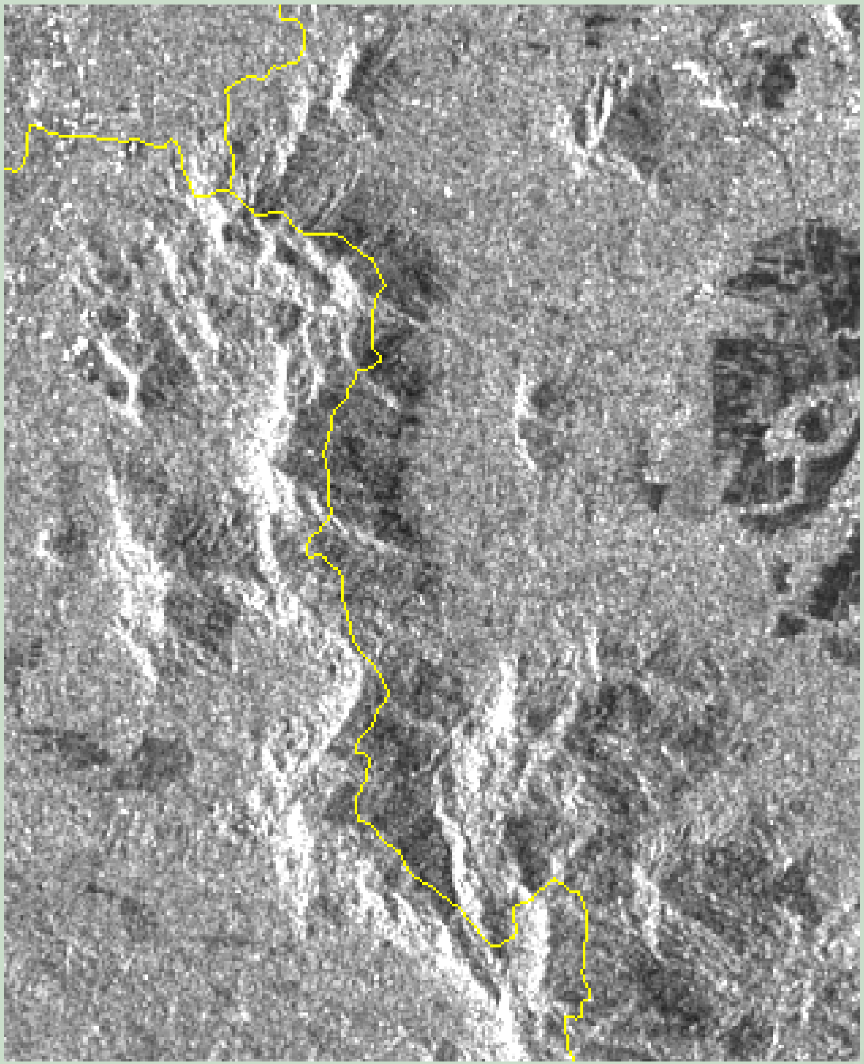
Shadow extraction of Radarsat image (cont…)



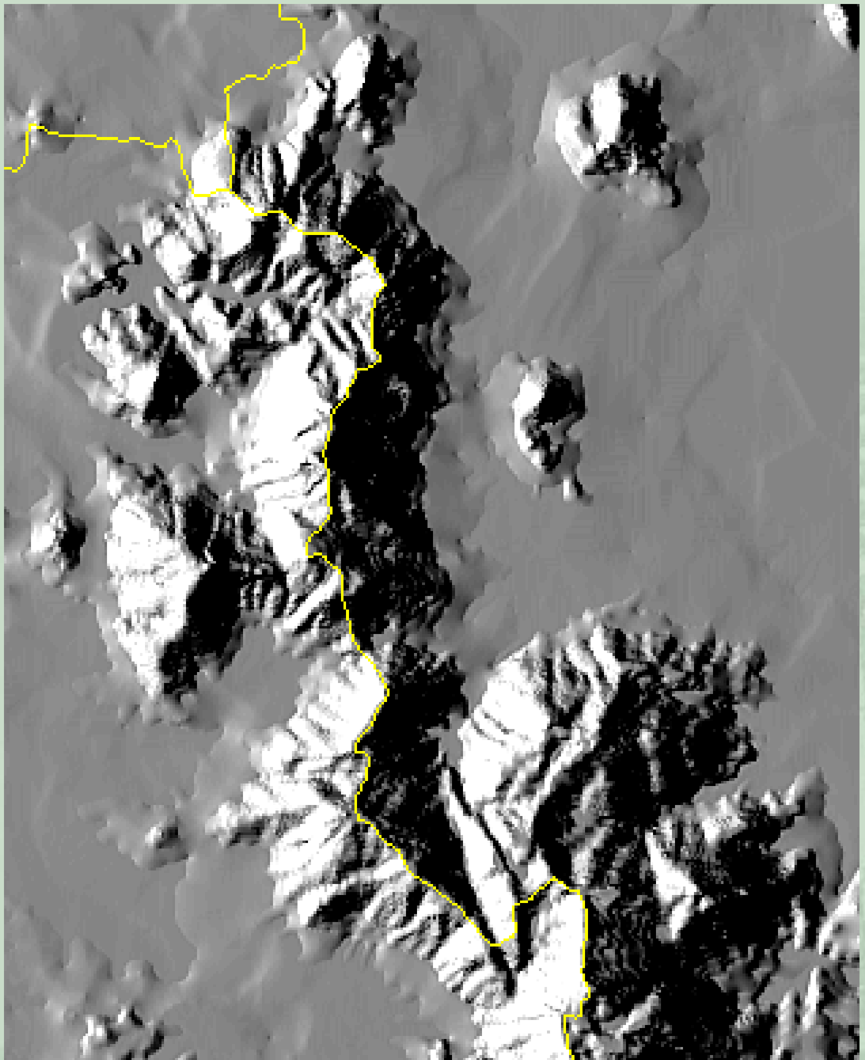


Simulate image based on DEM

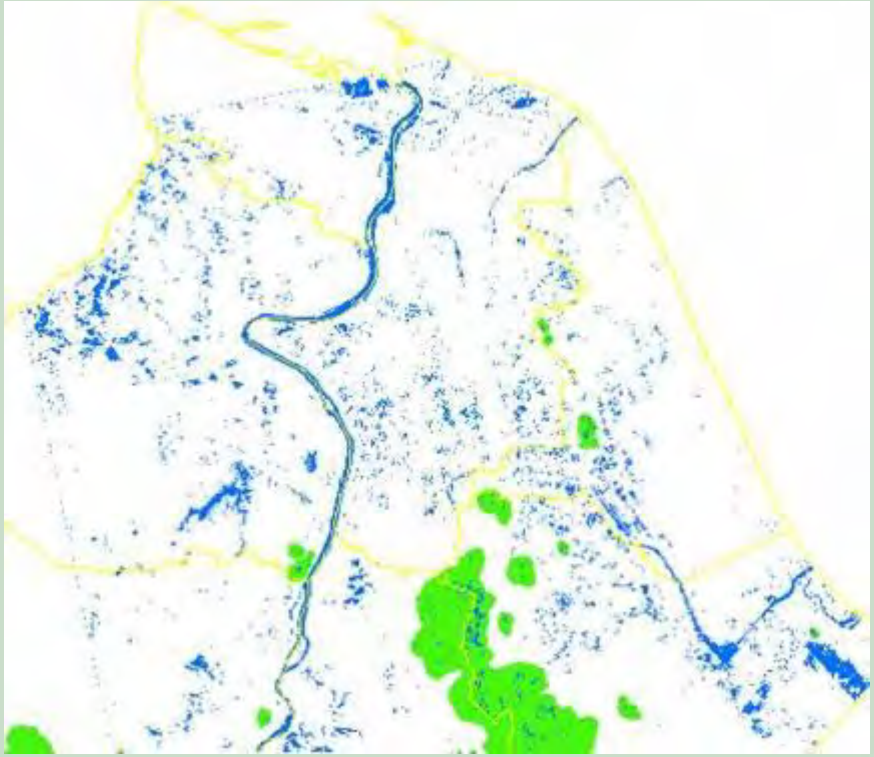
S6_20041208



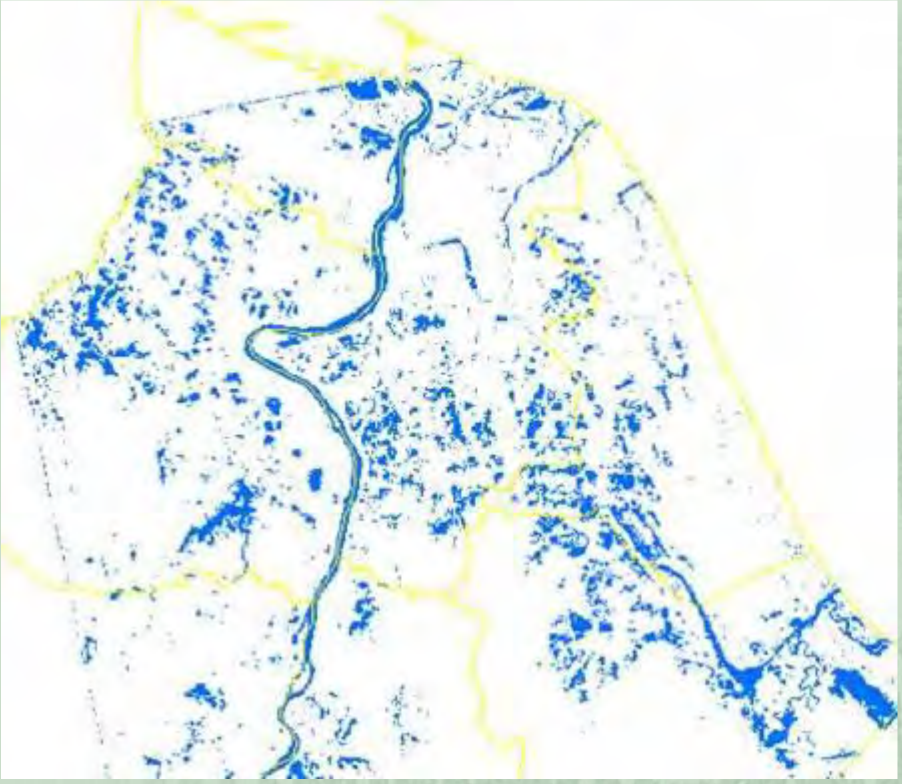
Simulate image



Water+shadow

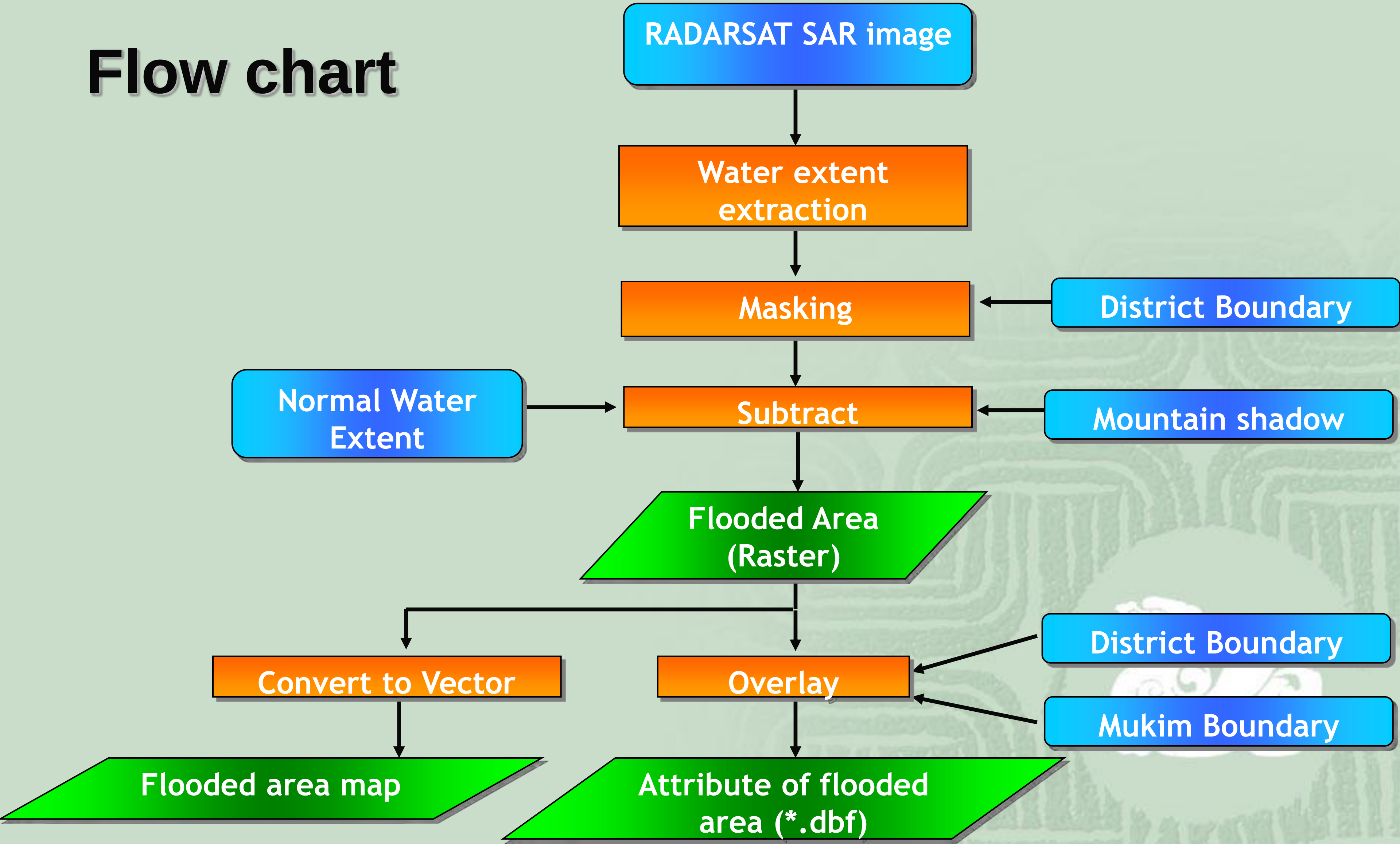


water



Flooded area extraction

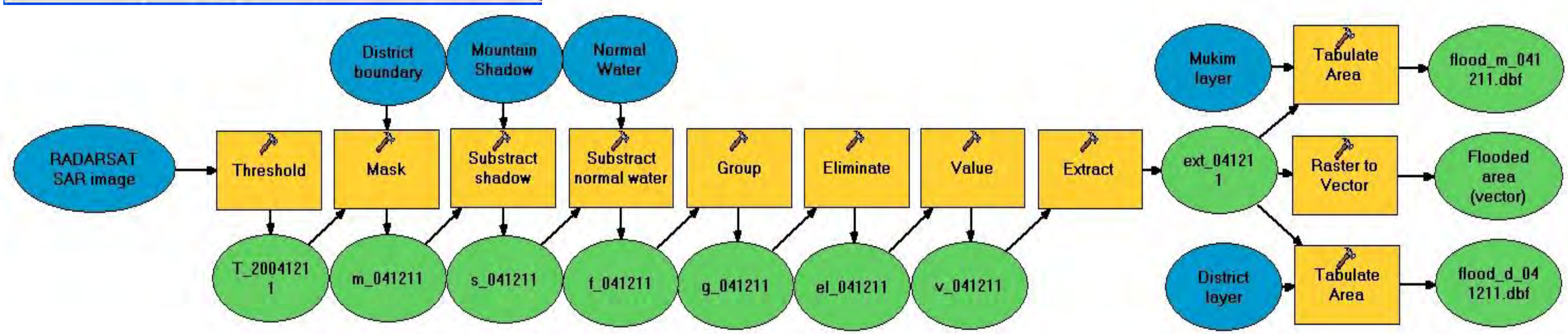
Flow chart



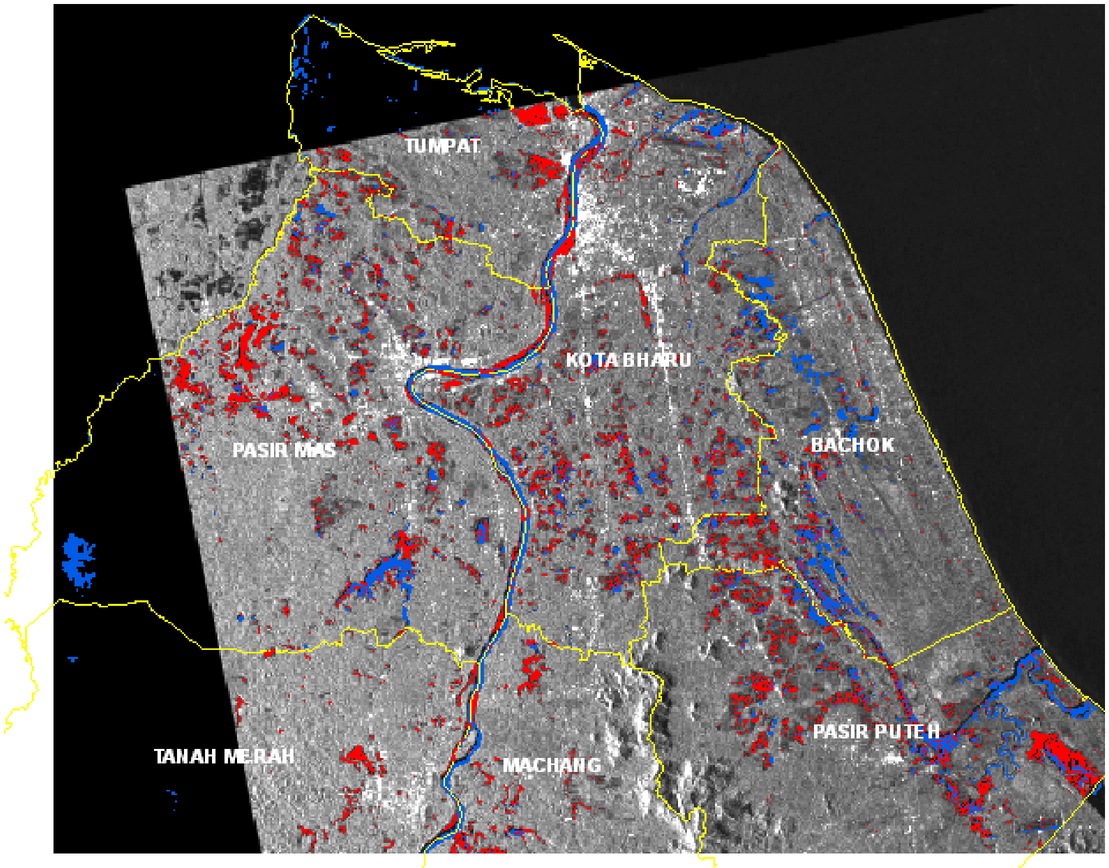
Flooded Area Extraction Model

- The flooded Area extraction model (FAEM) has been created by using ArcGIS ModelBuilder.

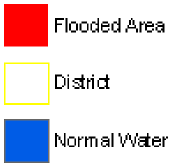
- The model includes 11 processes,5 dataset, 11 results. The whole run time is less than 5 minutes.



Flooded Area in District of Kelantan 11 Dec 2004



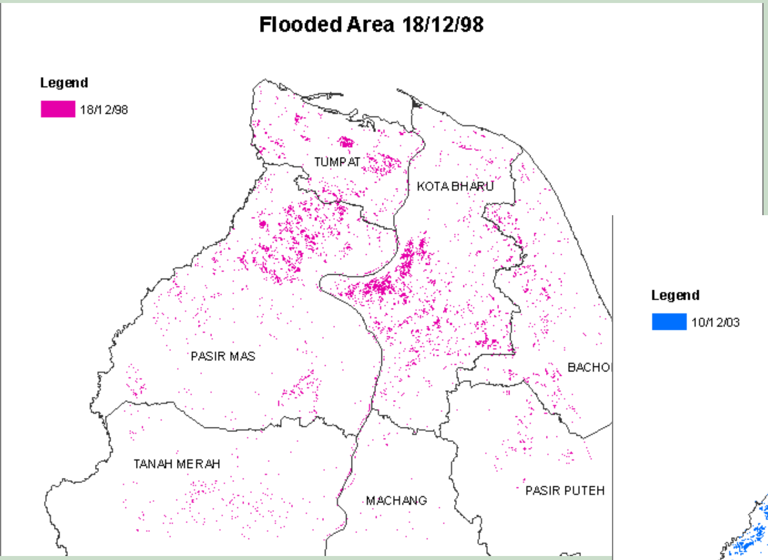
Legend



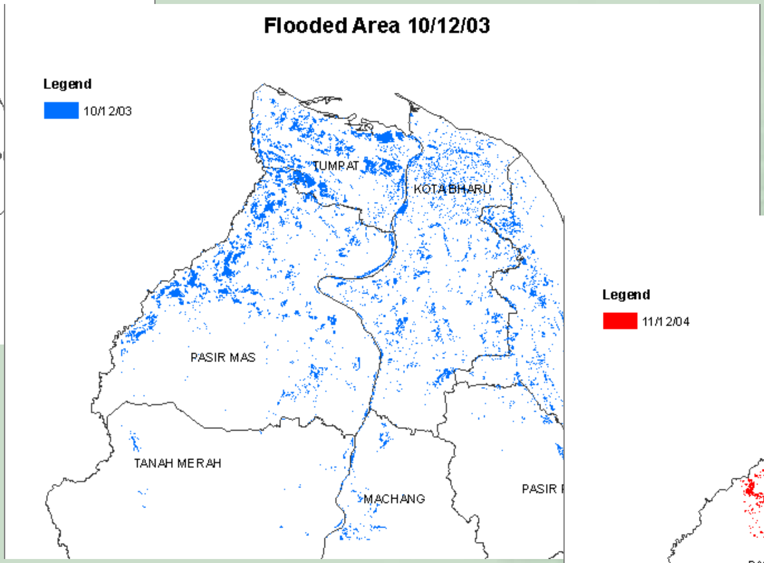
Code	Name	Flooded Area (ha)
03001	BACHOK	840.87
03002	KOTA BHARU	2,235.44
03003	MACHANG	513.59
03004	PASIR MAS	2,798.78
03005	PASIR PUTEH	2,121.84
03006	TANAH MERAH	494.84
03007	TUMPAT	719.35
	Total :	9,724.71

Flooded Area in different year

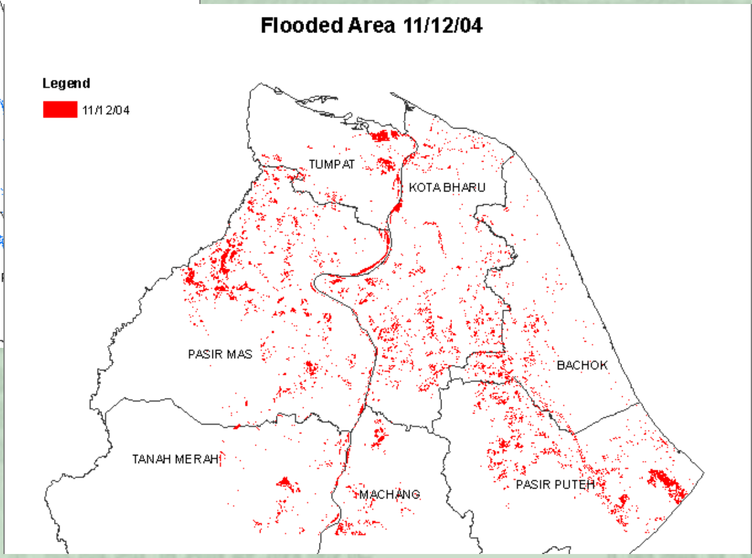
1998



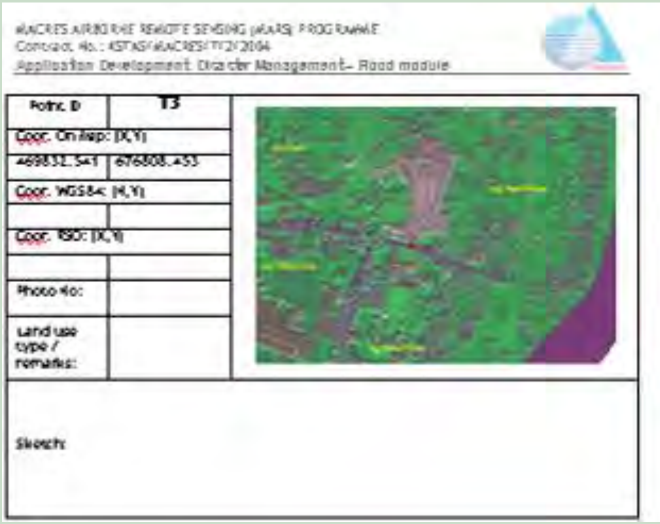
2003

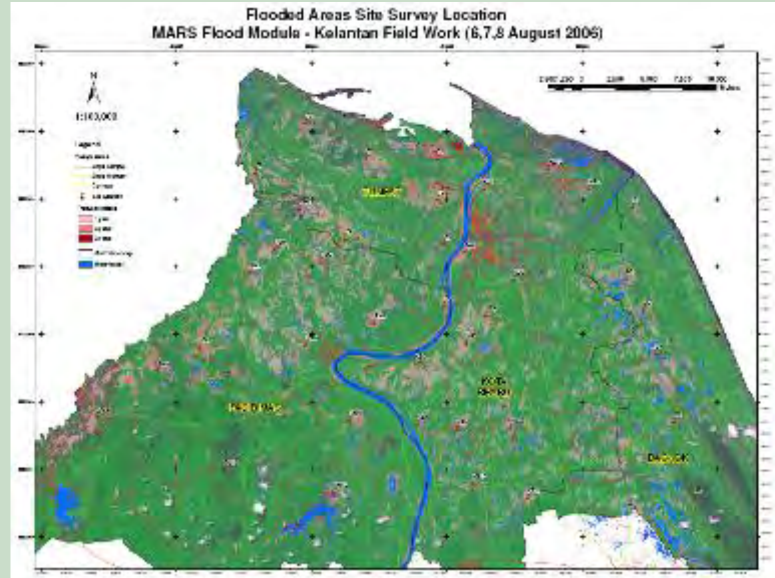


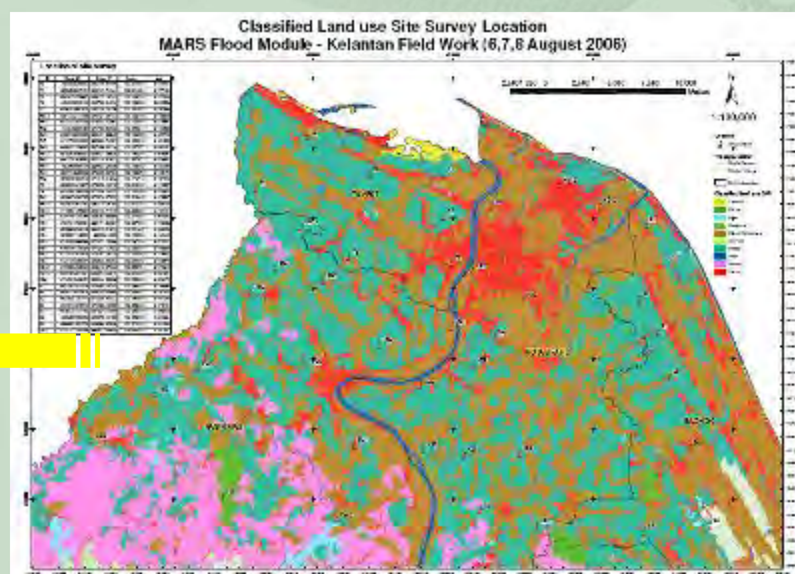
2004



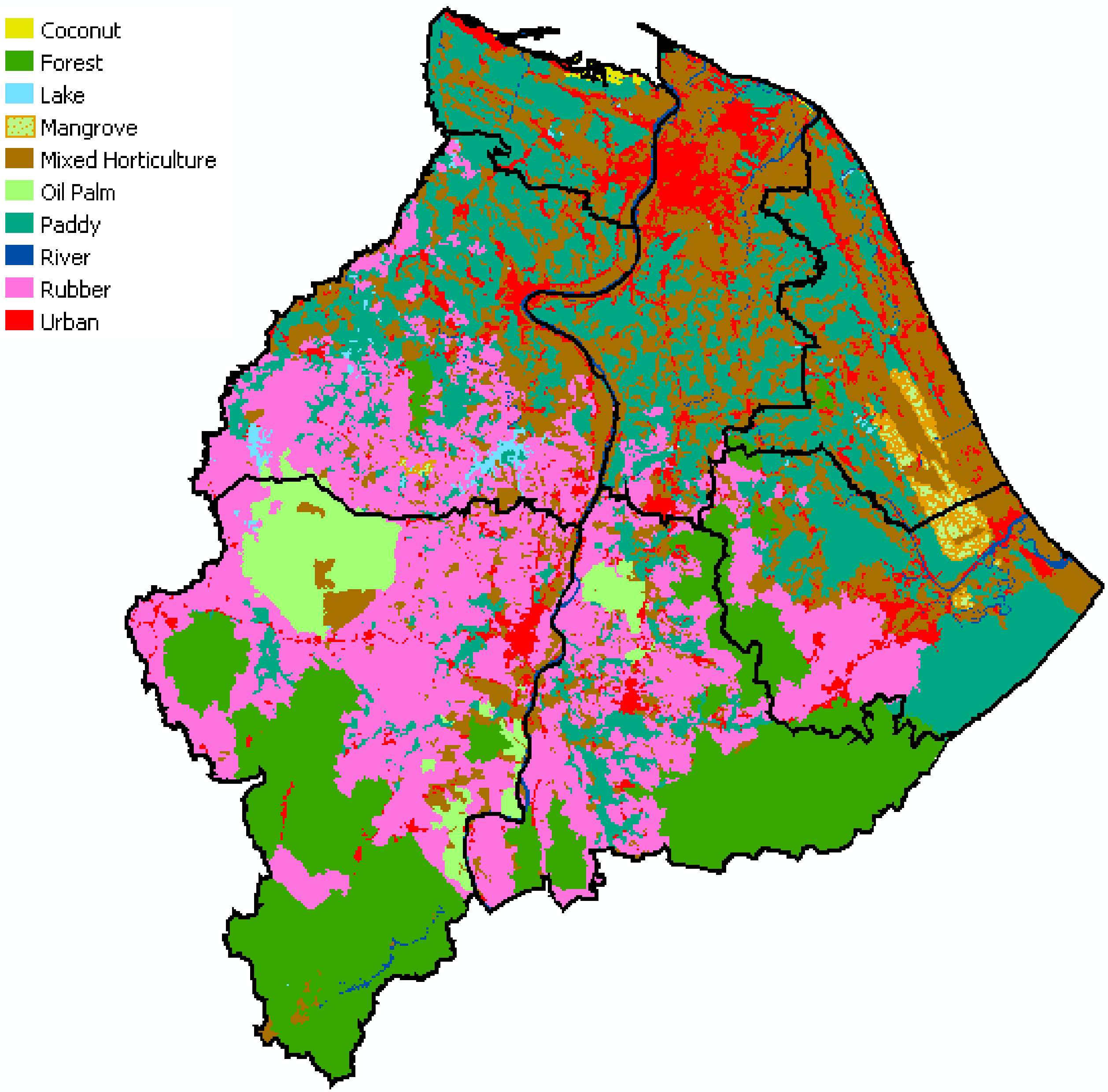
Remote sensing + field work





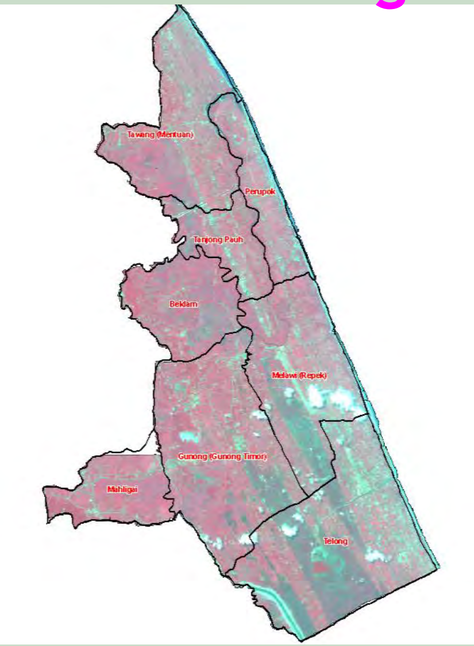


Landuse map

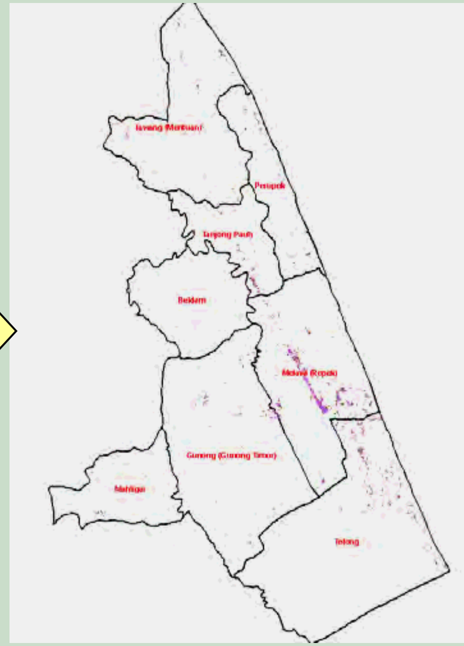


Name	Area (ha.)
Coconut	1288.26
Forest	46167.03
Lake	1431.45
Mangrove	3551.94
Mixed horticulture	48902.4
Oil palm	12189.87
Paddy	77983.2
River	4798.44
Rubber	104794.65
Urban	23072.13

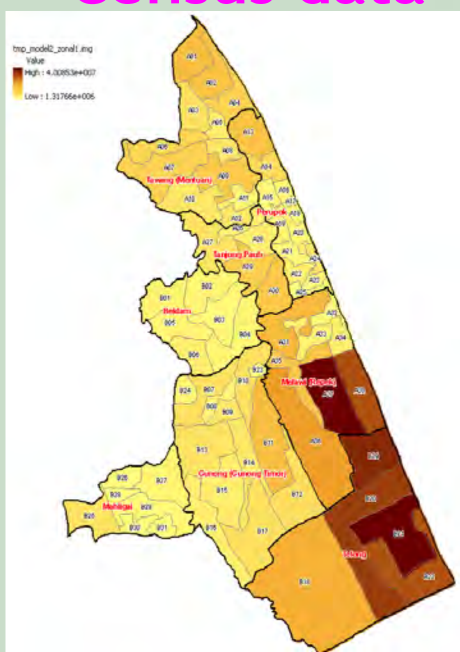
SPOT image



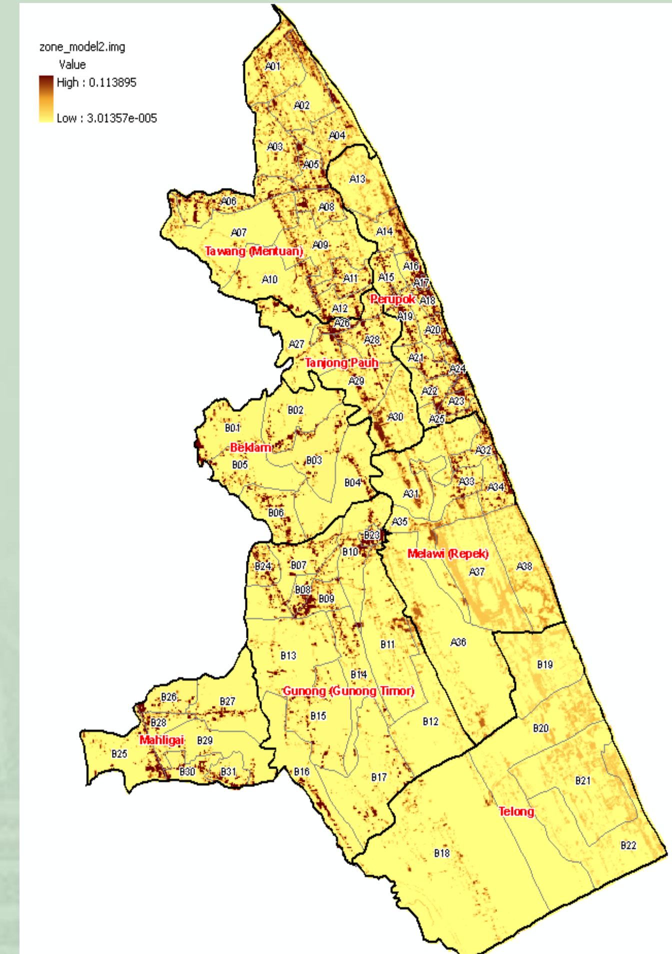
Residential area



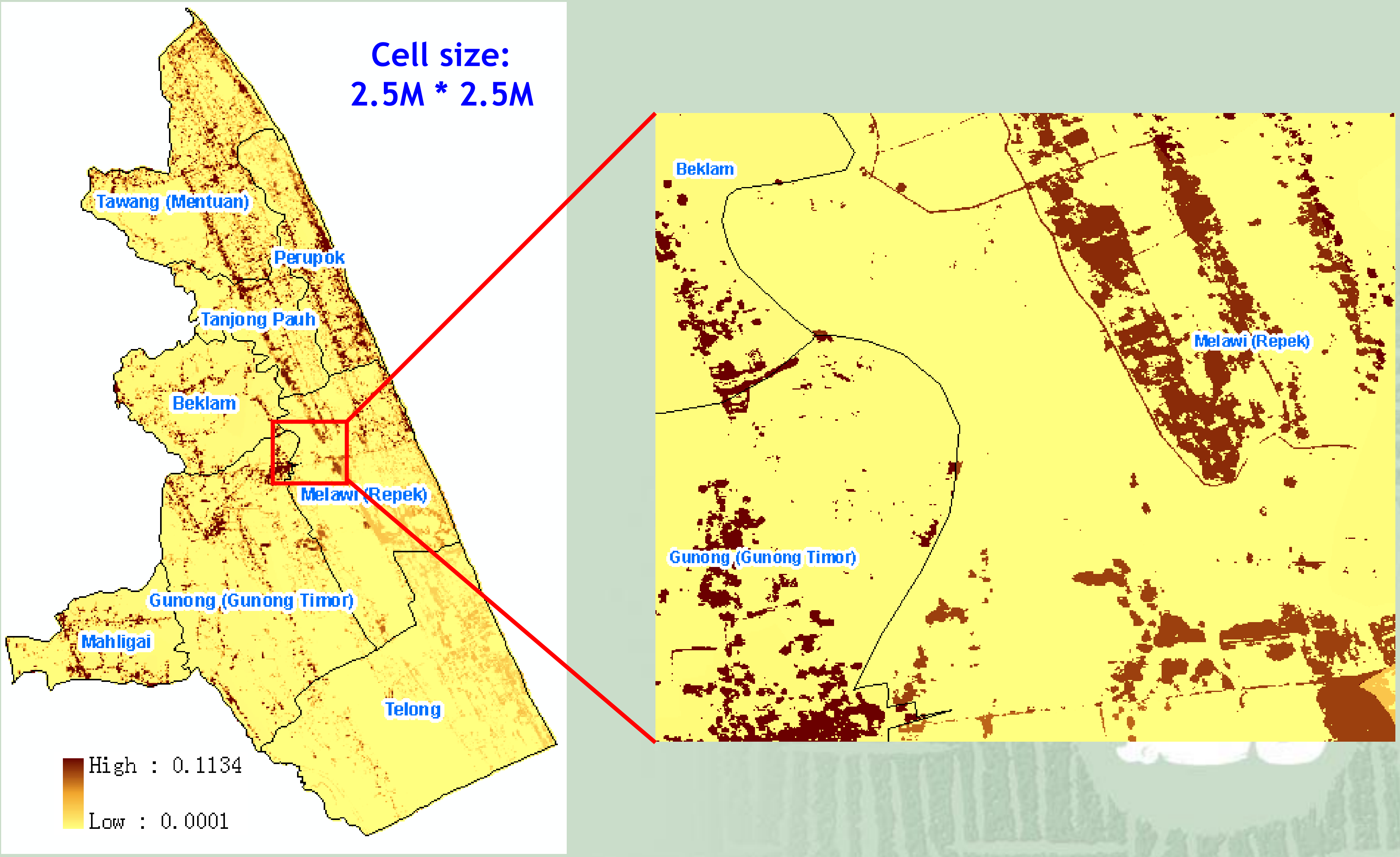
Census data



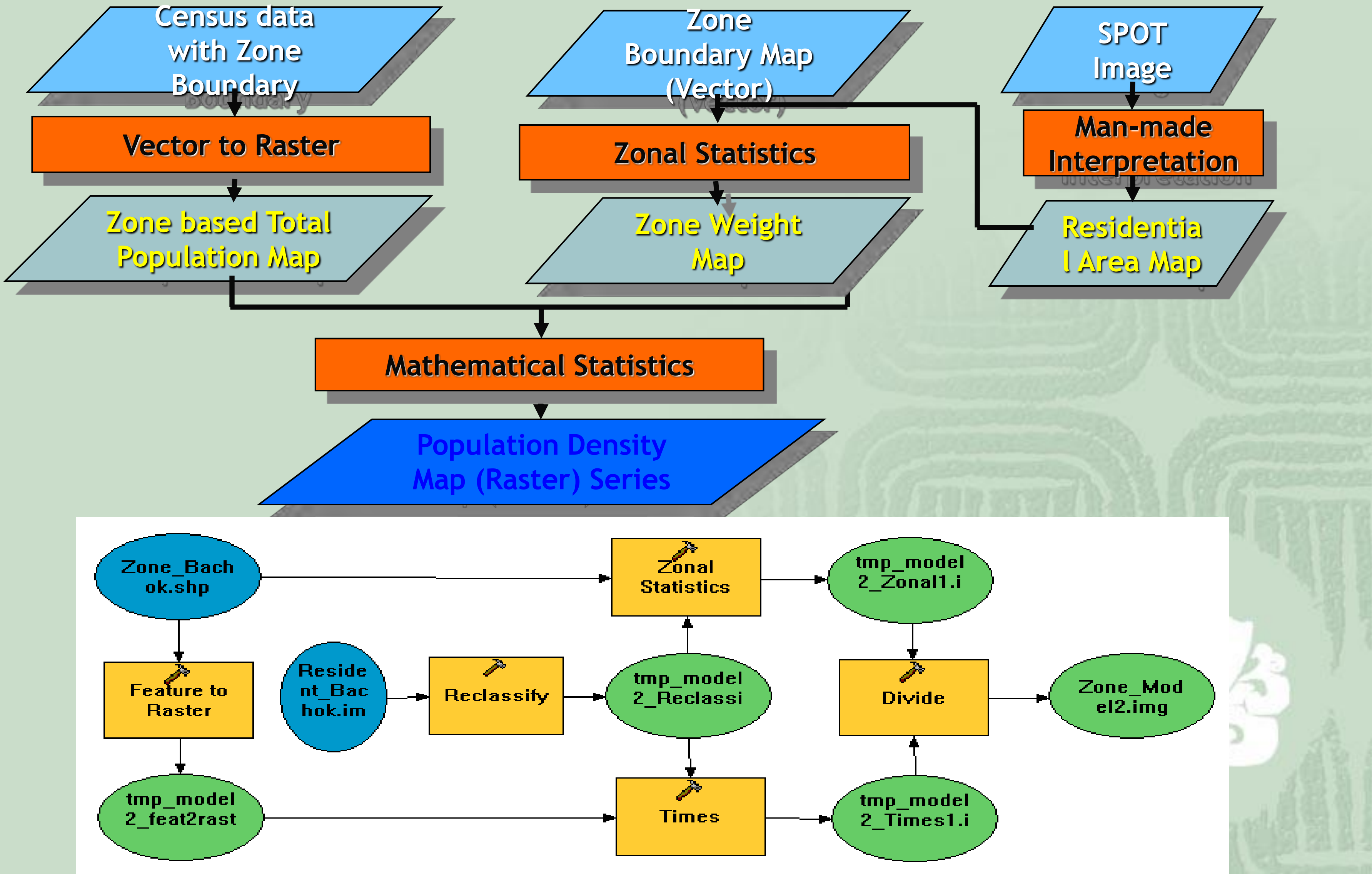
Population Density



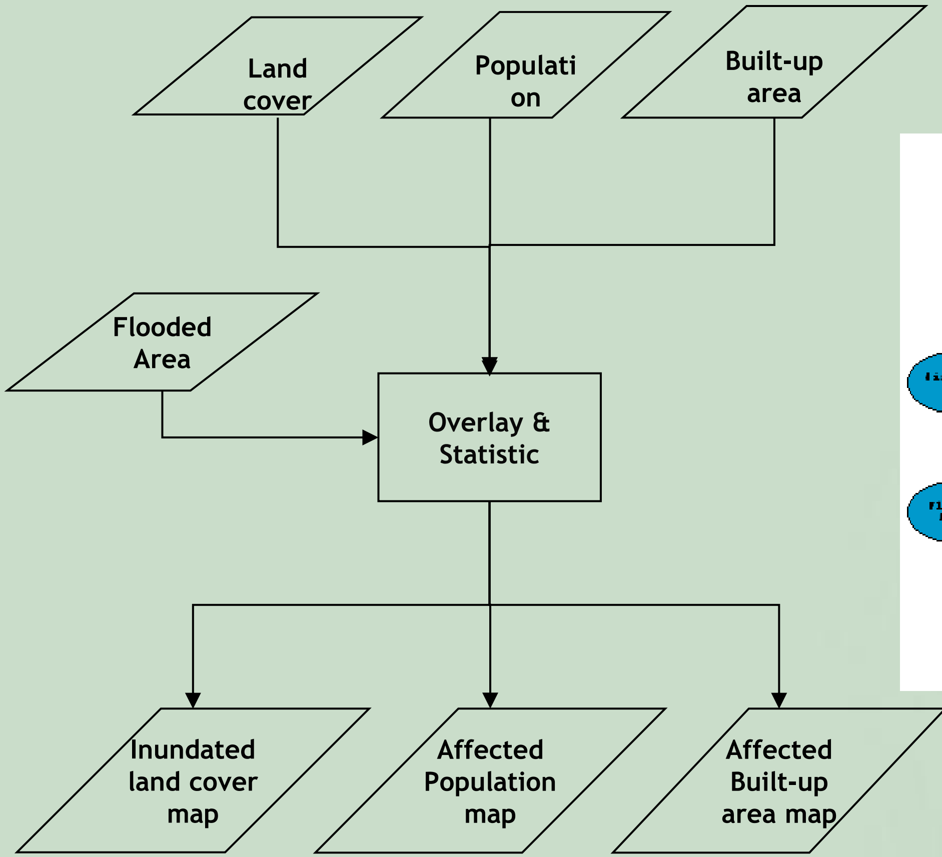
Population Density Mapping

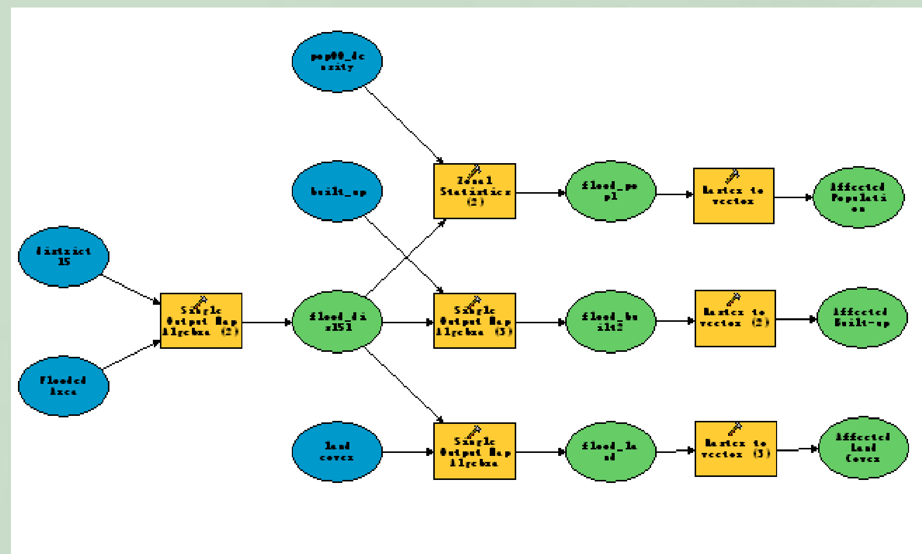


Population Density Simulation Model

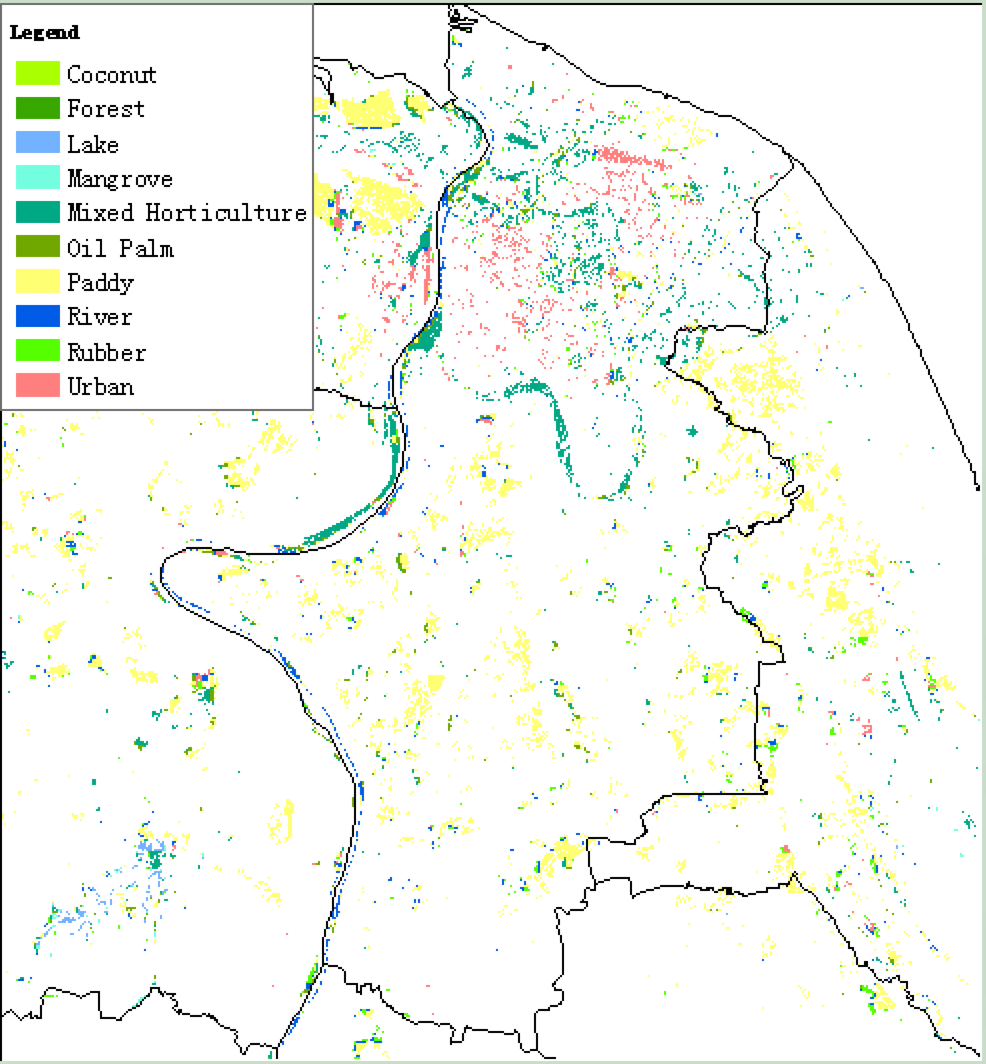


Disaster Assessment Model





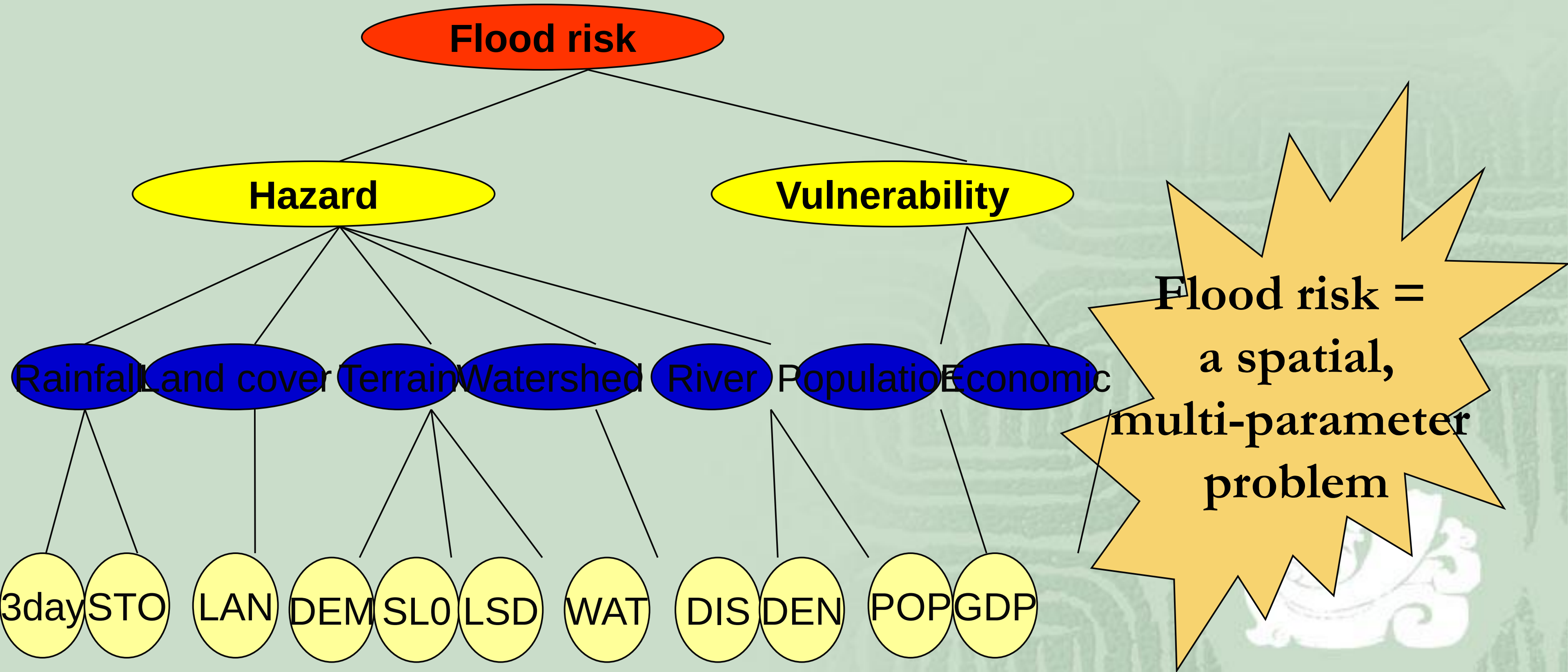
Disaster Assessment - Inundated land cover area



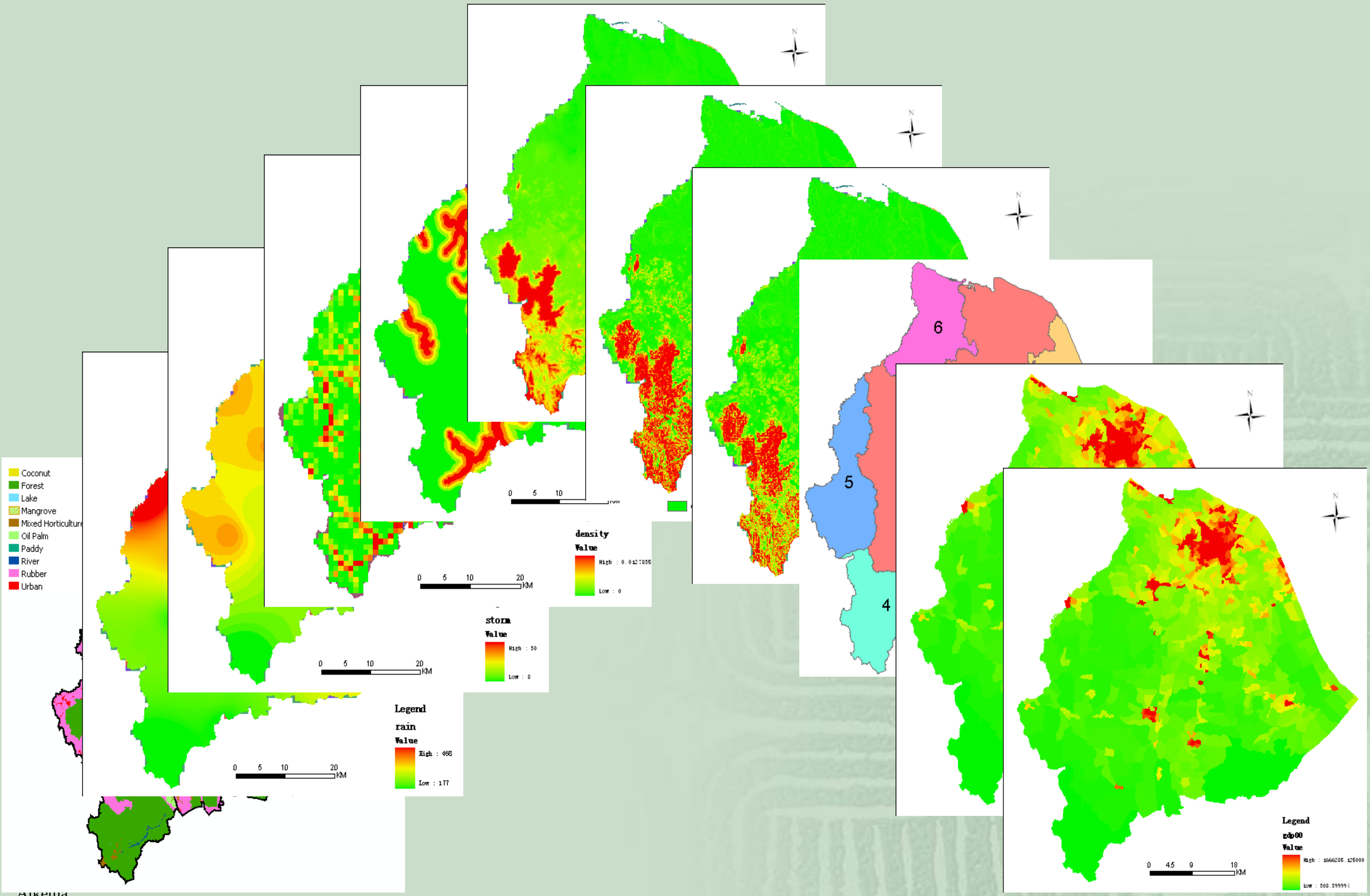
Name	Area (ha.)
Coconut	0.00
Forest	0.00
Lake	0.74
Mangrove	1.06
Mixed horticulture	776.59
Oil palm	224.57
Paddy	1475.71
River	323.39
Rubber	144.70
Urban	402.82

Flood Risk Assessment

Flood risk depends on more than hazard and vulnerability



Flood risk: A multi-criteria issue



Multi-Criteria Analysis

Hazard Index

$$HI(x) = \sum_{j=1}^{9} \left[W_j \times HI_{ji}(x) \right]$$

Vulnerability Index

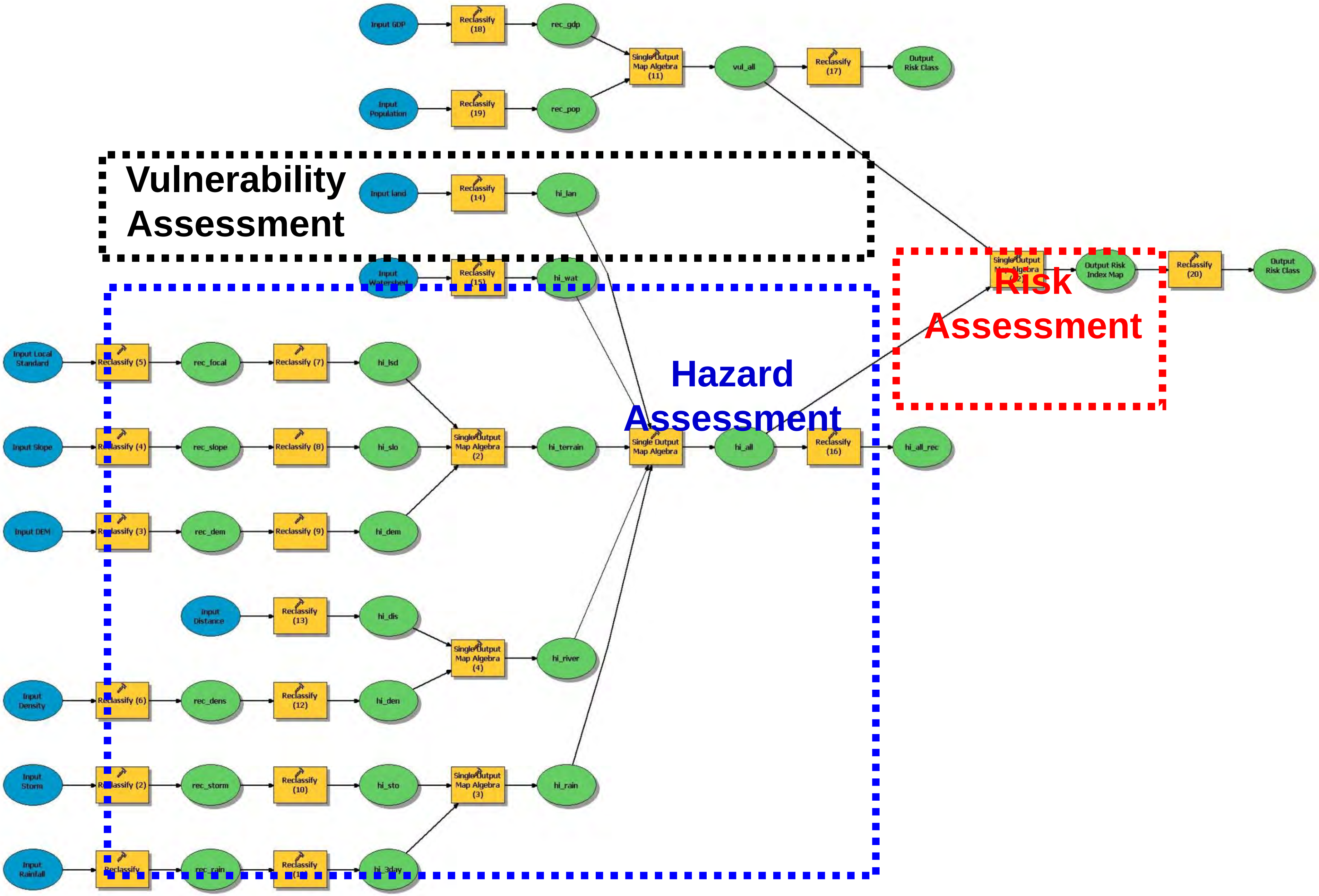
$$VI(x) = \sum_{j=1}^{2} \left[W_j \times VI_{ji}(x) \right]$$

Risk Index

$$RI(x) = W_{HI} \times HI(x) + W_{VI} \times VI(x)$$

Where:

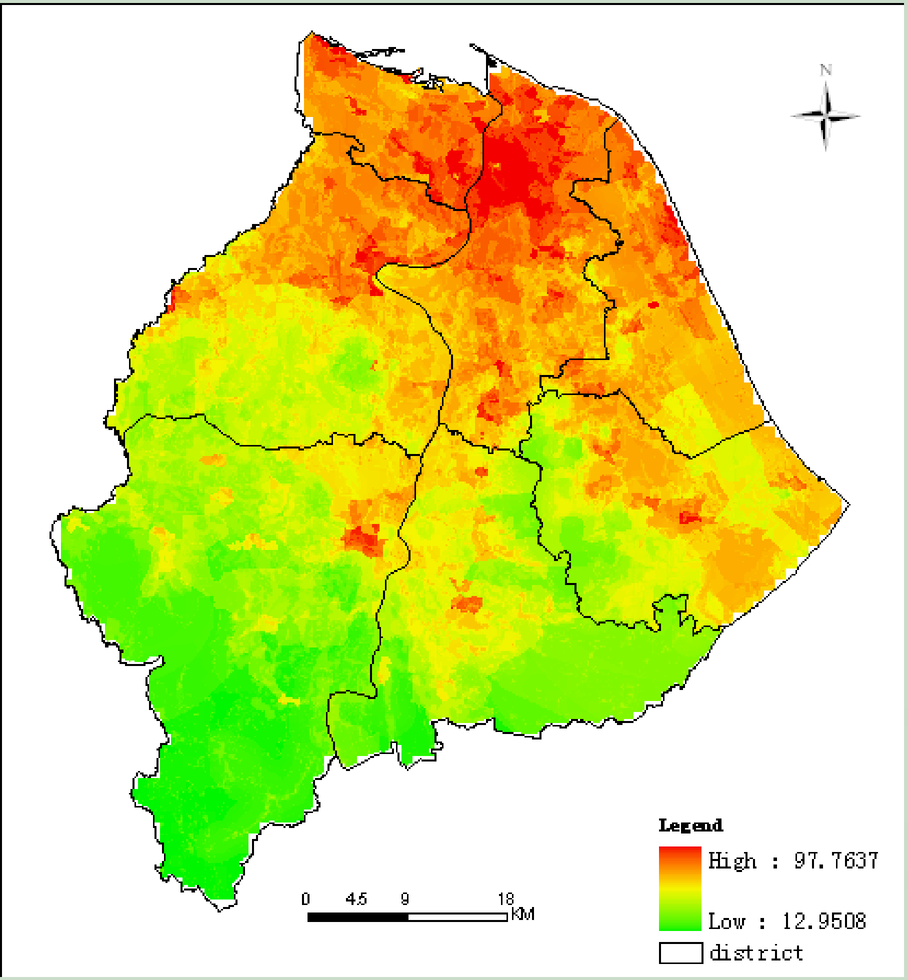
$W_1 \ldots W_j$ = the **WEIGHT** assigned to each criterion



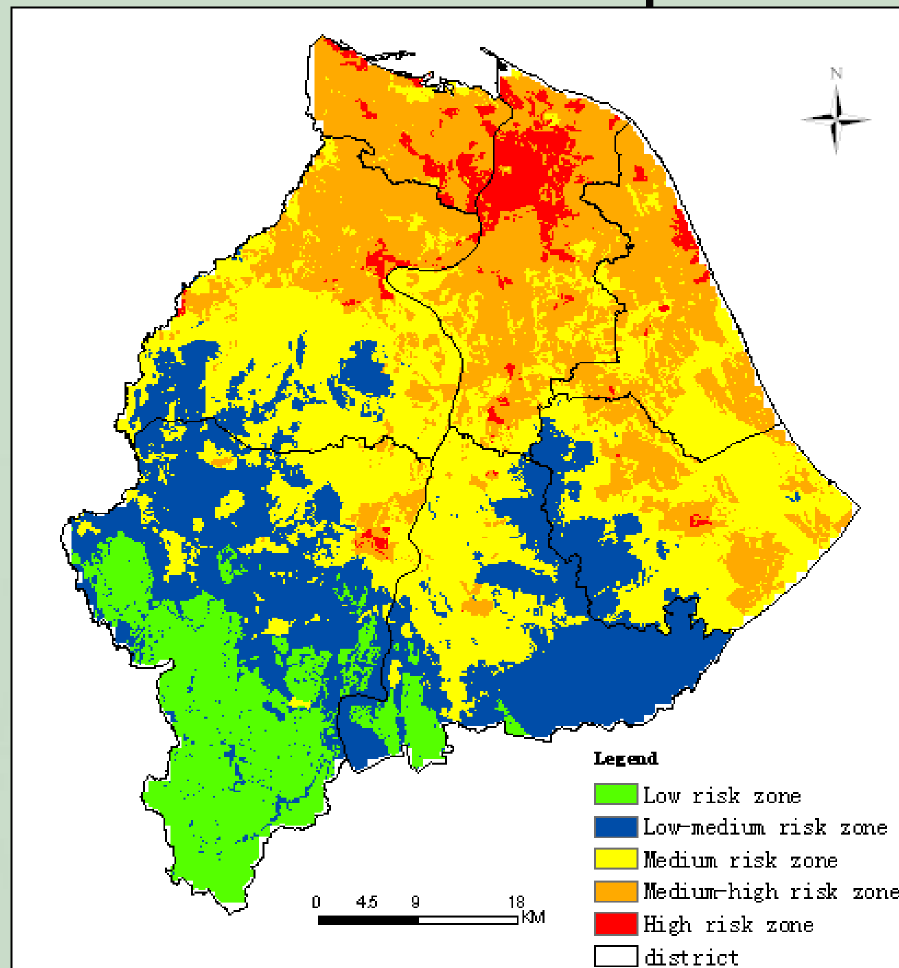
Vulnerability Assessment
Hazard Assessment
Risk Assessment
Input GDP
Reclassify (18)
rec_gdp
Input Population
Reclassify (19)
rec_pop
Single Output Map Algebra (11)
vul_all
Reclassify (17)
Output Risk Class
Input land
Reclassify (14)
hi_lan
Input Watershed
Reclassify (15)
hi_wat
Output Risk Index Map
Reclassify (20)
Output Risk Class
Input Local Standard
Reclassify (5)
rec_focal
Reclassify (7)
hi_lsd
Input Slope
Reclassify (4)
rec_slope
Reclassify (8)
hi_slo
Single Output Map Algebra (2)
hi_terrain
Single Output Map Algebra
hi_all
Reclassify (16)
hi_all_rec
Input DEM
Reclassify (3)
rec_dem
Reclassify (9)
hi_dem
Input Distance
Reclassify (13)
hi_dis
Single Output Map Algebra (4)
hi_river
Input Density
Reclassify (6)
rec_dens
Reclassify (12)
hi_den
Input Storm
Reclassify (2)
rec_storm
Reclassify (10)
hi_sto
Single Output Map Algebra (3)
hi_rain
Input Rainfall
Reclassify
rec_rain
Reclassify
hi_3day

Flood Risk Mapping

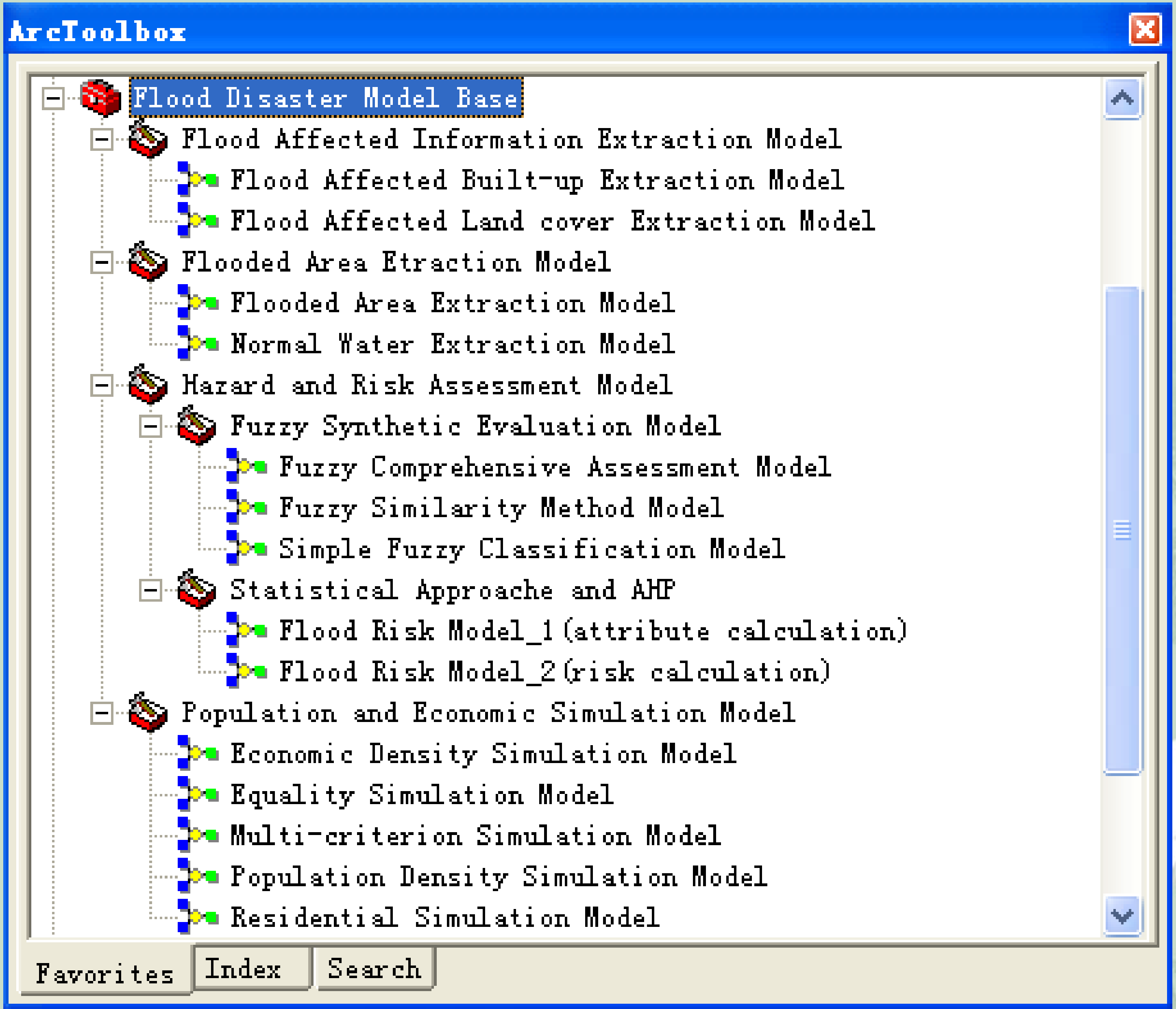
Risk index map



Risk class map

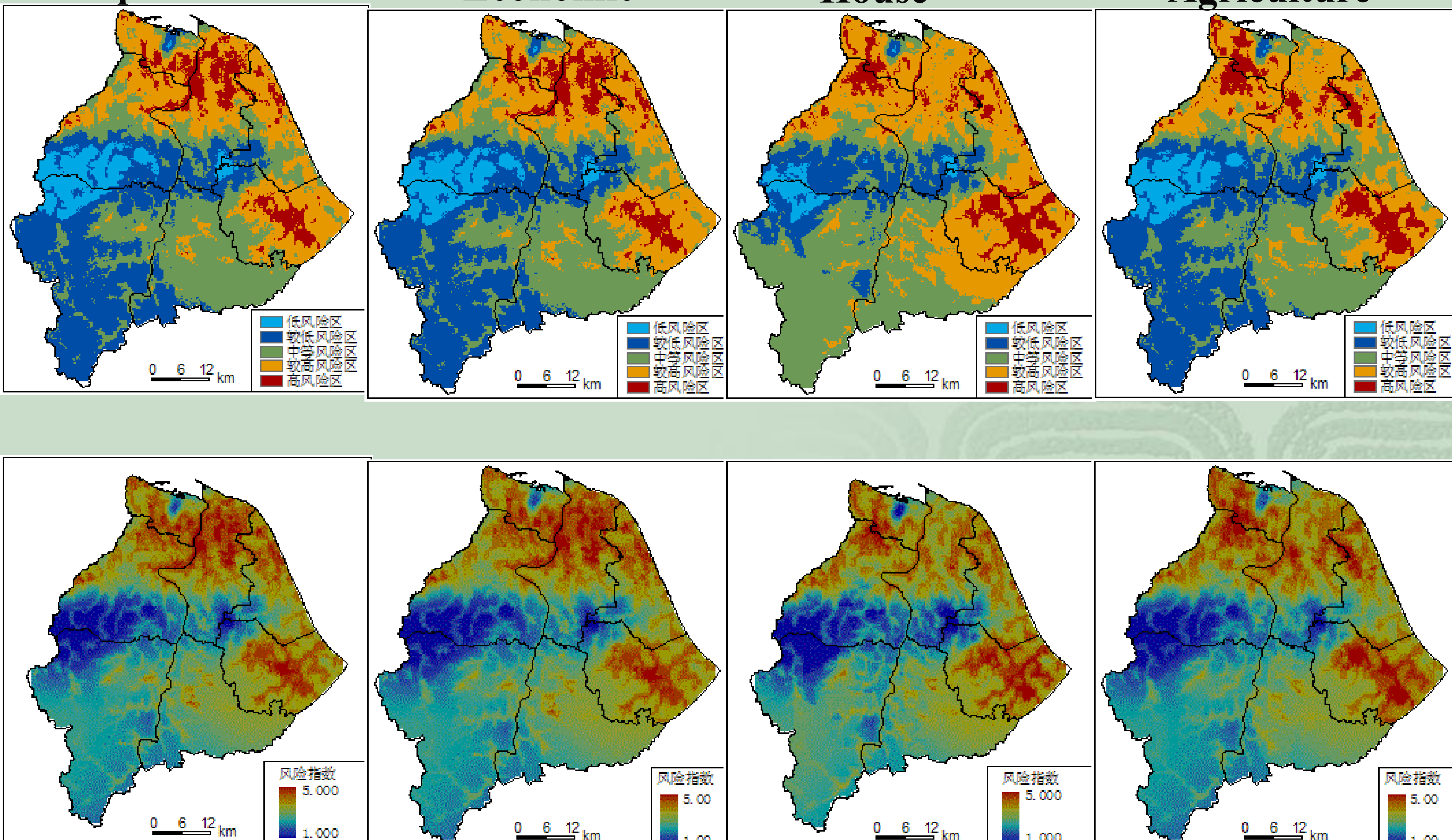


Flood Disaster Model Base (FDMB)



Risk Class and Index

Population | **Economic** | **House** | **Agriculture**




Thank You!