UNITED NATIONS
Office for Outer Space Affairs

DLR

Federal Ministry
for Economic Affairs
and Energy

LAPAN

www.lapan.go.id

Impact of land use and land cover changes on the urban climate and environment, studied with satellite observation, GIS, weather research forecast model, and atmospheric database management

Laras Tursilowati
Center for Atmospheric Science and Technology
National Institute of Aeronautics and Space (LAPAN)
laras.toersilowati@lapan.go.id

United Nations/Germany International Conference on Earth Observation Global Solutions for the Challenges of Sustainable Development in Societies at Risk
Bonn, Germany; 26-28 May 2015

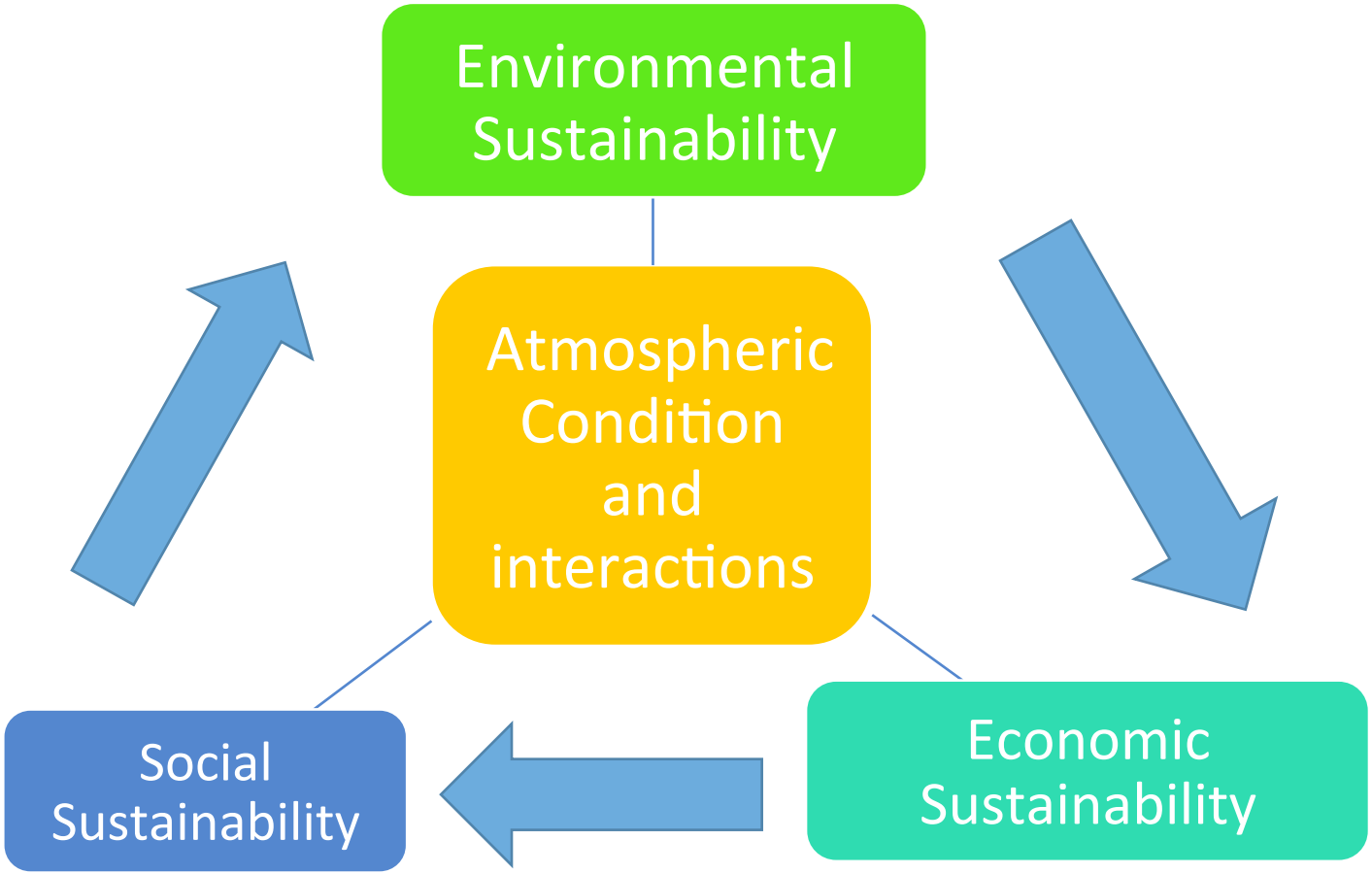
OUTLINE

- ✓ **INTRODUCTION/BACKGROUND;**
  - **Climate Change Impact:**
    - **Natural vulnerability vs Sustainability;**
    - **Indication of Changes and Variability;**
  - **Challenge of Atmospheric Sciences and Technology (Indonesian Condition)**
    - **Climate Control System;**
    - **Observation System.**
- ✓ **PROBLEMS & SOLVING**
  1. **Relationship between land cover change and Urban Heat Island (UHI).**
  2. **Analysis of Surface Energy Balance (SEB)**
  3. **Drought Monitoring**
  4. **Design of Surface Energy Balance Interface Software (SEBALIS)**
  5. **Urban Climate Modelling using Weather Research Forecast (WRF) model for sustainable development**
  6. **ATMOSPHERIC DATABASE MANAGEMENT (BISMA)**

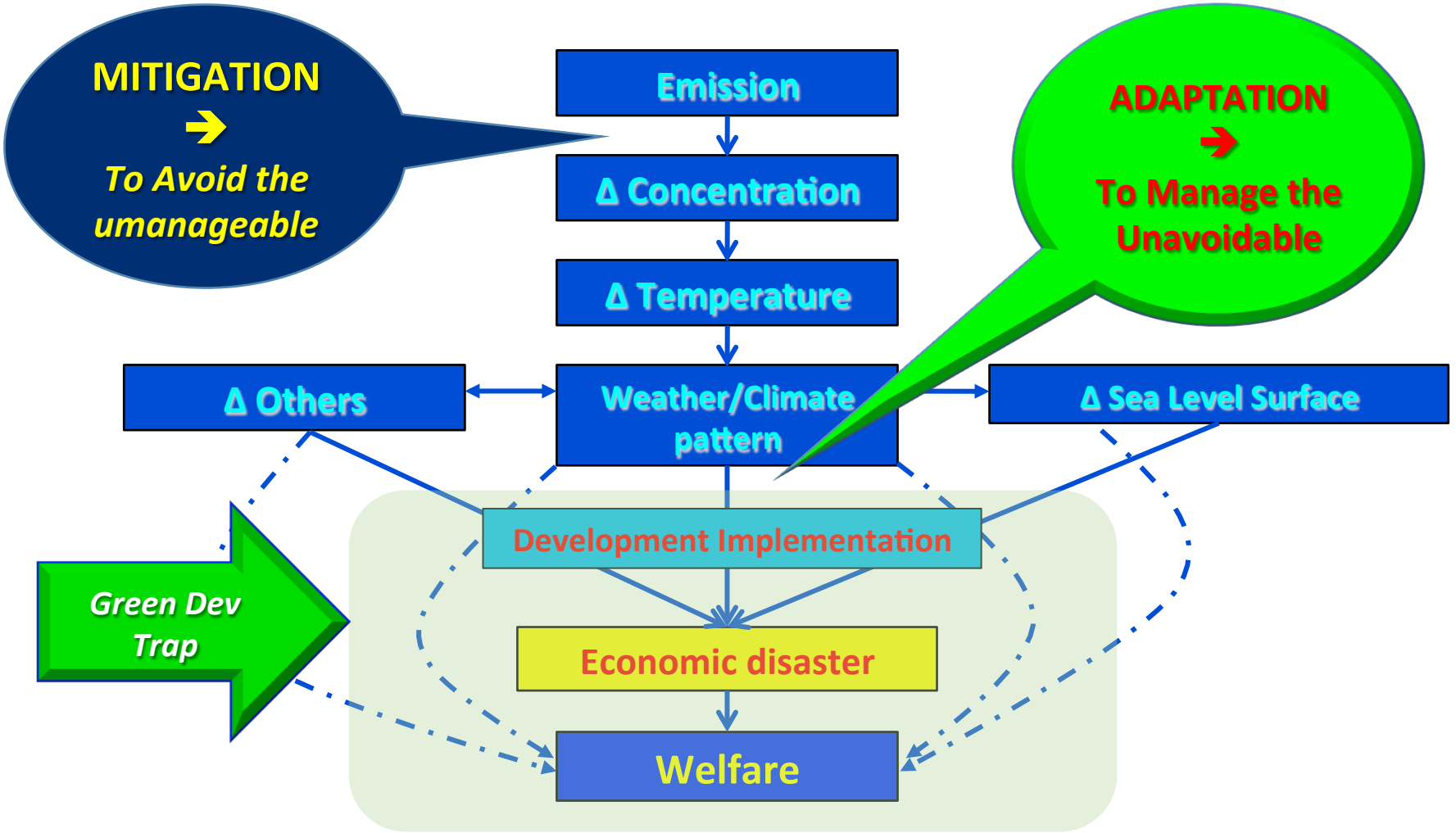
  7. **SATELLITE DISASTER EARLY WARNING SYSTEM (SADEWA)**

- ✓ **CONCLUSION**
- ✓ **Future plan & recommendation**

INTRODUCTION



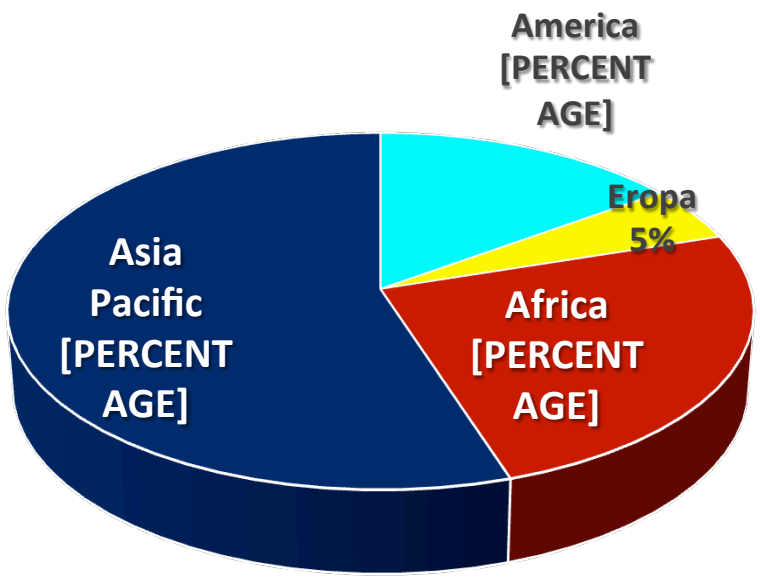
SUSTAINABLE DEVELOPMENT



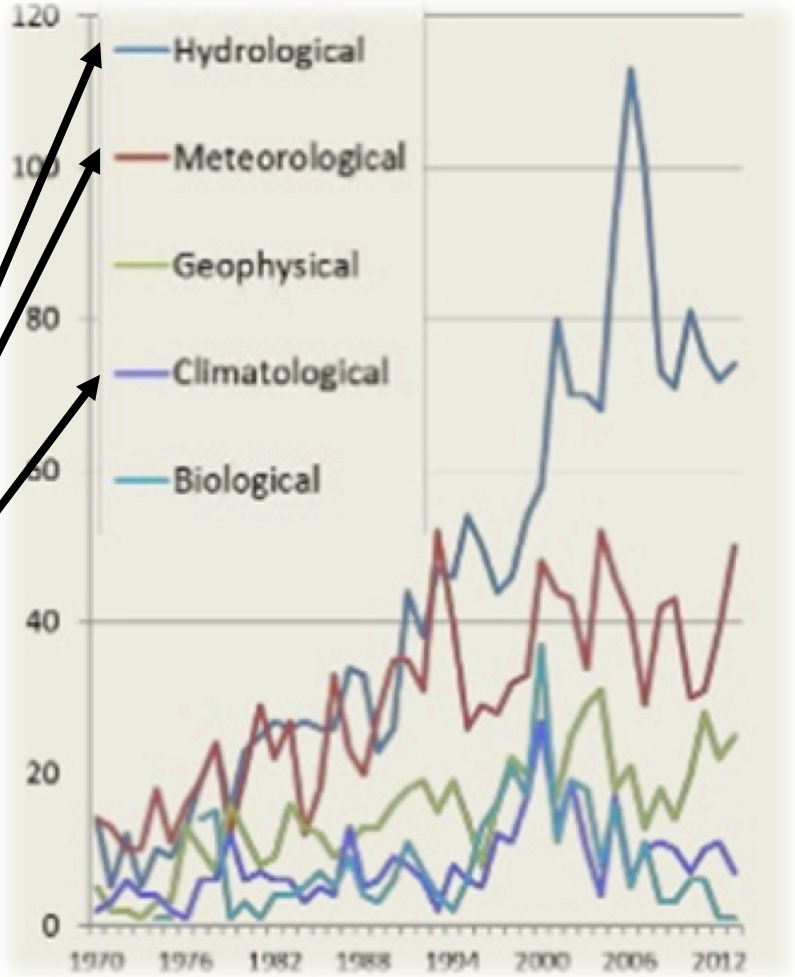
Climate Change Impacts

1. **Increase of Green House Gases;**
2. **Increase of Surface Temperature:**
3. **Decrease of ice area;**
4. **Sea Level Rise (SLR)**
5. **Increase of Tropical Precipitation;**
6. **Decrease of Tropical Salinity;**
7. **Decrease of Global Circulation because of thermocline difference;**
8. **Decrease of Global Circulation because of Surface Temperature difference between Tropical and high latitude;**
9. **Increase of Evaporation rate:**
10. **Decrease of rainfall amount;**
11. **Dry days getting longer;**
12. **The water content of diminishing ⇔ drought;**
13. **The increasing acidity of the ocean and the atmosphere;**
14. **Increased frequency of occurrence of weather and climate extremes.**

Statistic of Global Disaster



Global Statistic (1970 – 2013)



Hydro-meteorology Disaster

Damage rate of Land/Forest

Kerusakan Lahan (10^6 Ha)		
1	Rusia	36,5
2	Brazil	36,0
3	Canada	26,4
4	USA	26,4
5	Indonesia	15,8

Between 2000 - 2012 ⇔ 230 million Ha deforestation

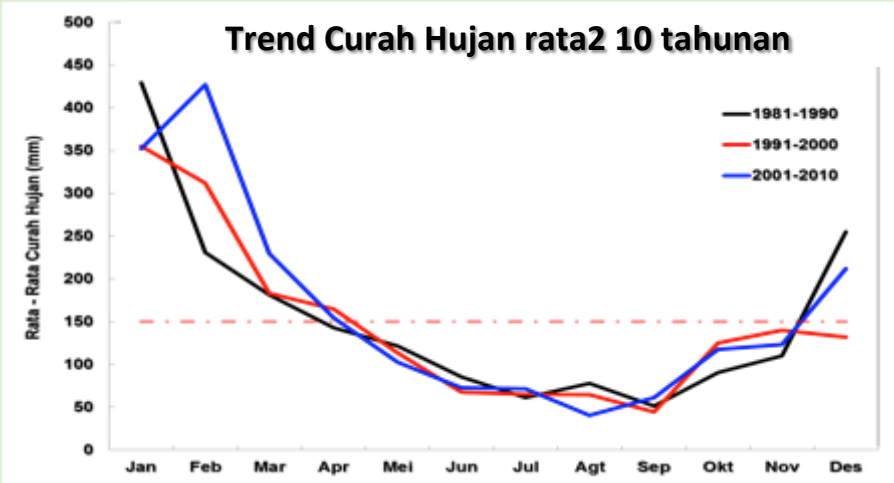
Zoning changes: farm or ranch

➔

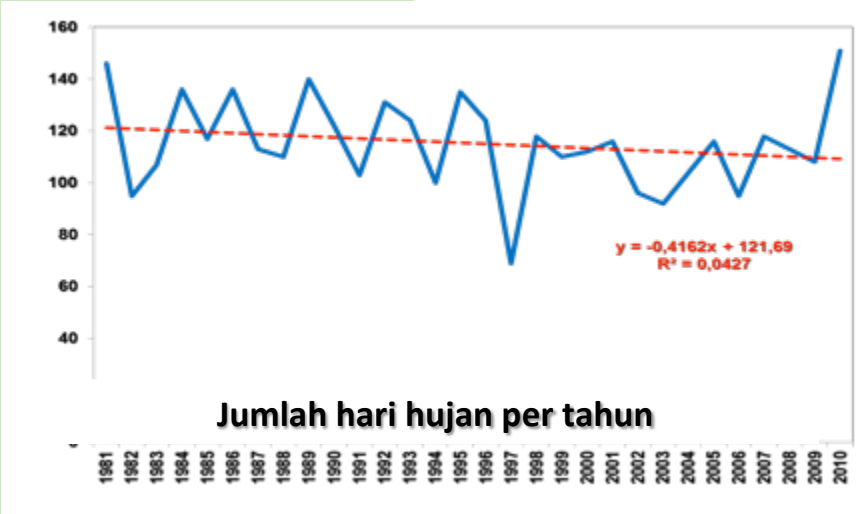
Processes at industrial level

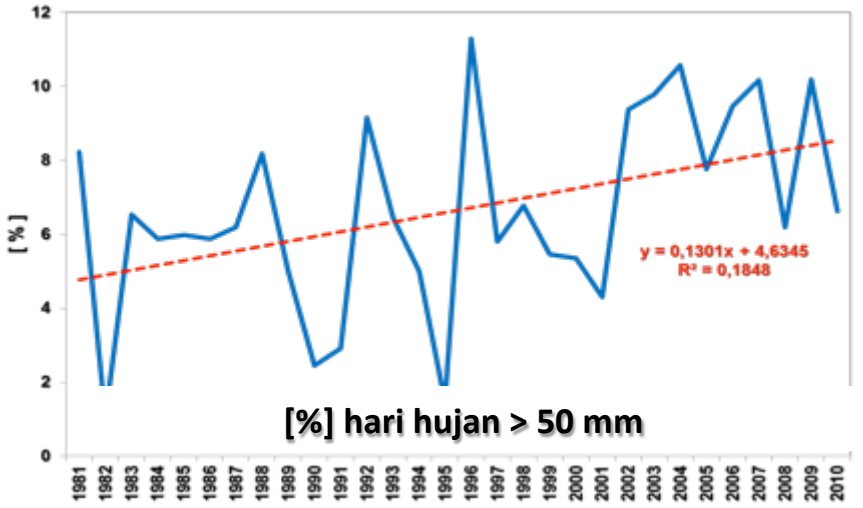
Trend Pattern of Precipitation in Jakarta

- Dry season getting shorter;
- The number of rainy days is decreasing.



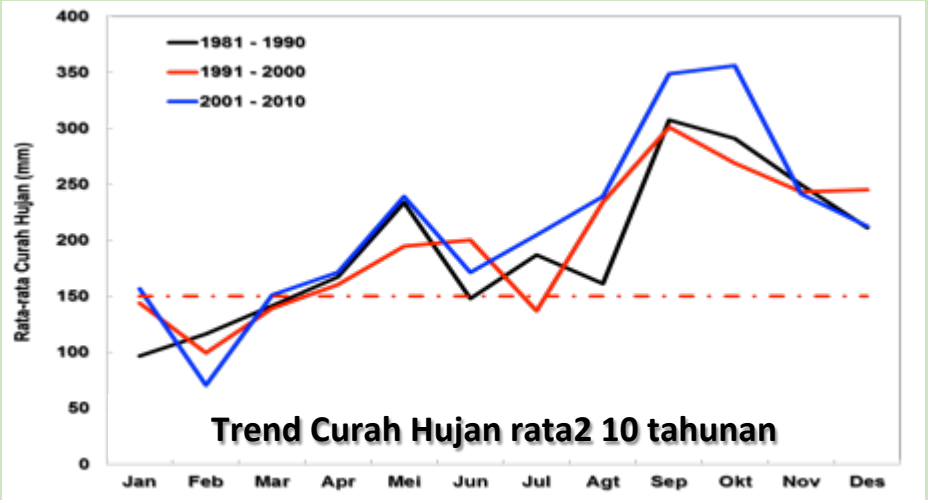
- The number of days of heavy rainfall is increasing.



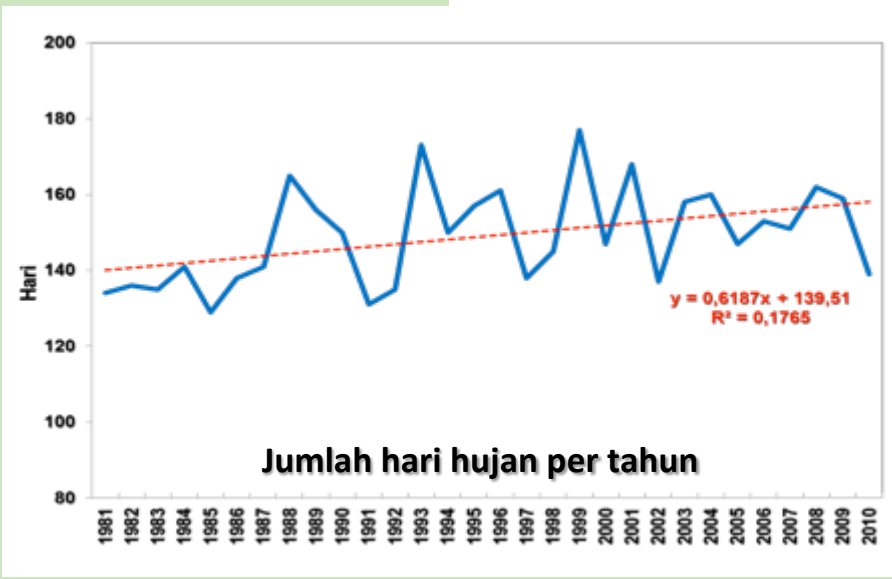


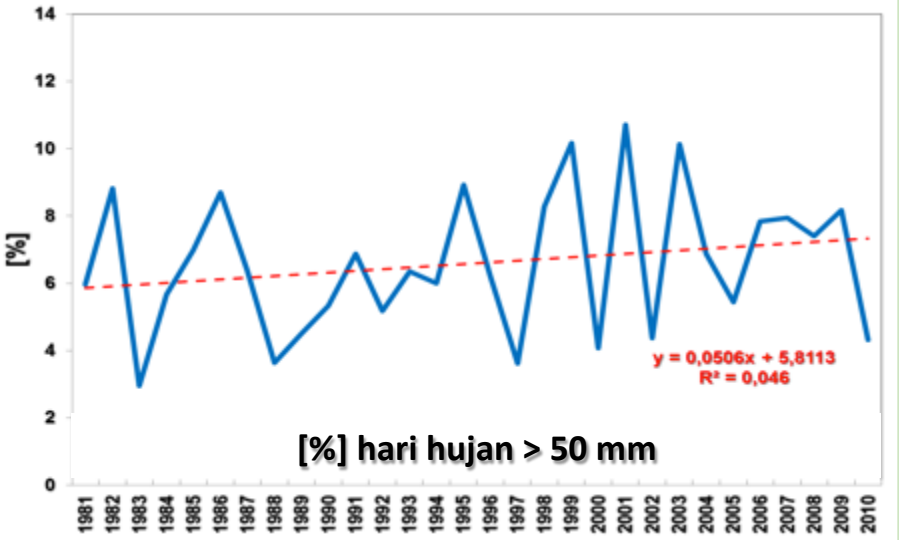
Trend Pattern of Precipitation in Medan

- Season Pattern unclear and getting wet;
- The number of rainy days is increasing.



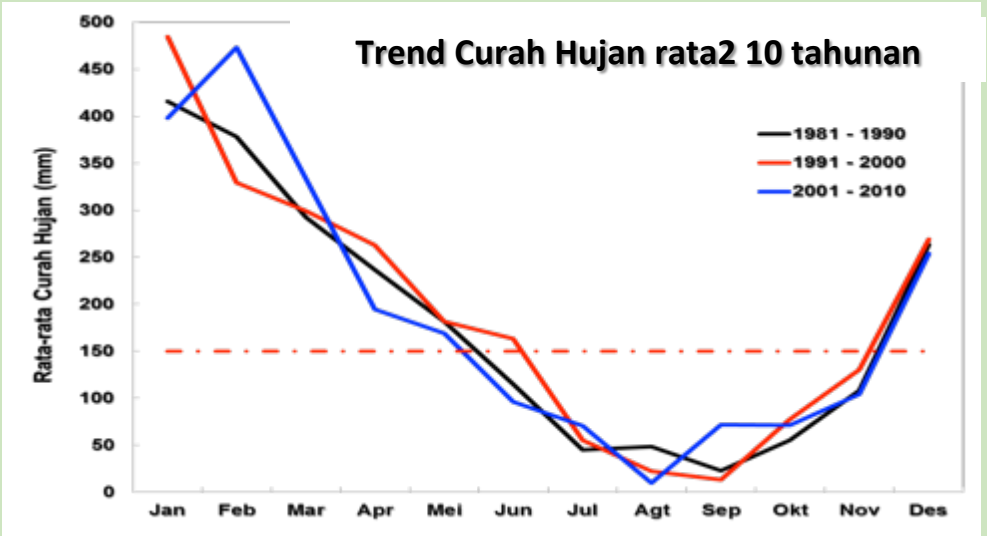
- The number of heavy rain is increasing.



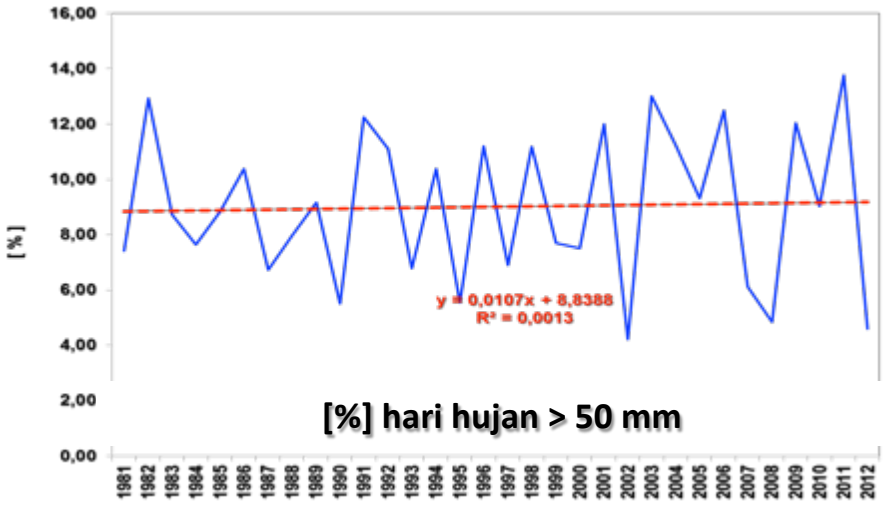


Trend Pattern of Precipitation in Medan

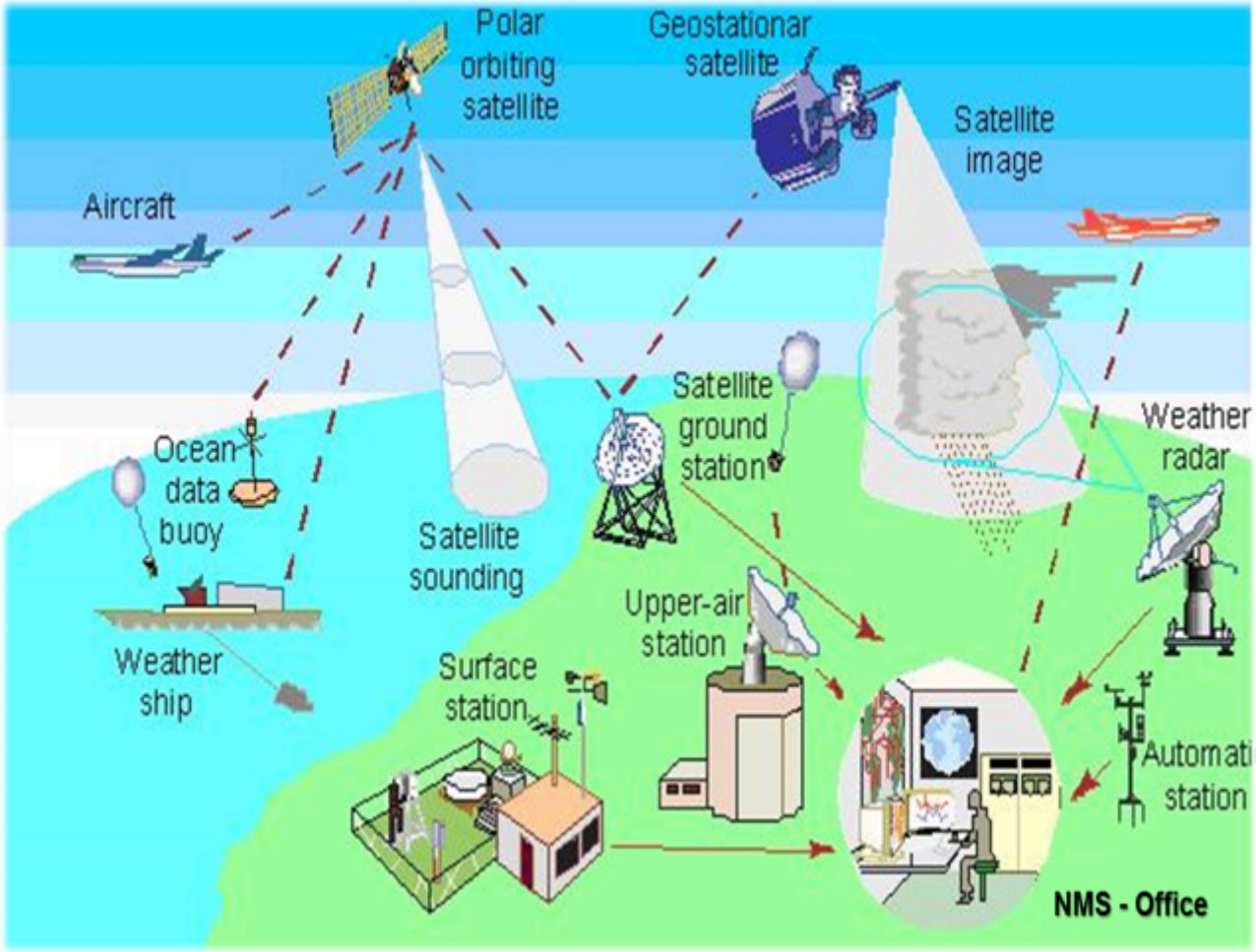
- Dry season became longer;
- Decrease in number of rain day



- Increase in number of heavy rain



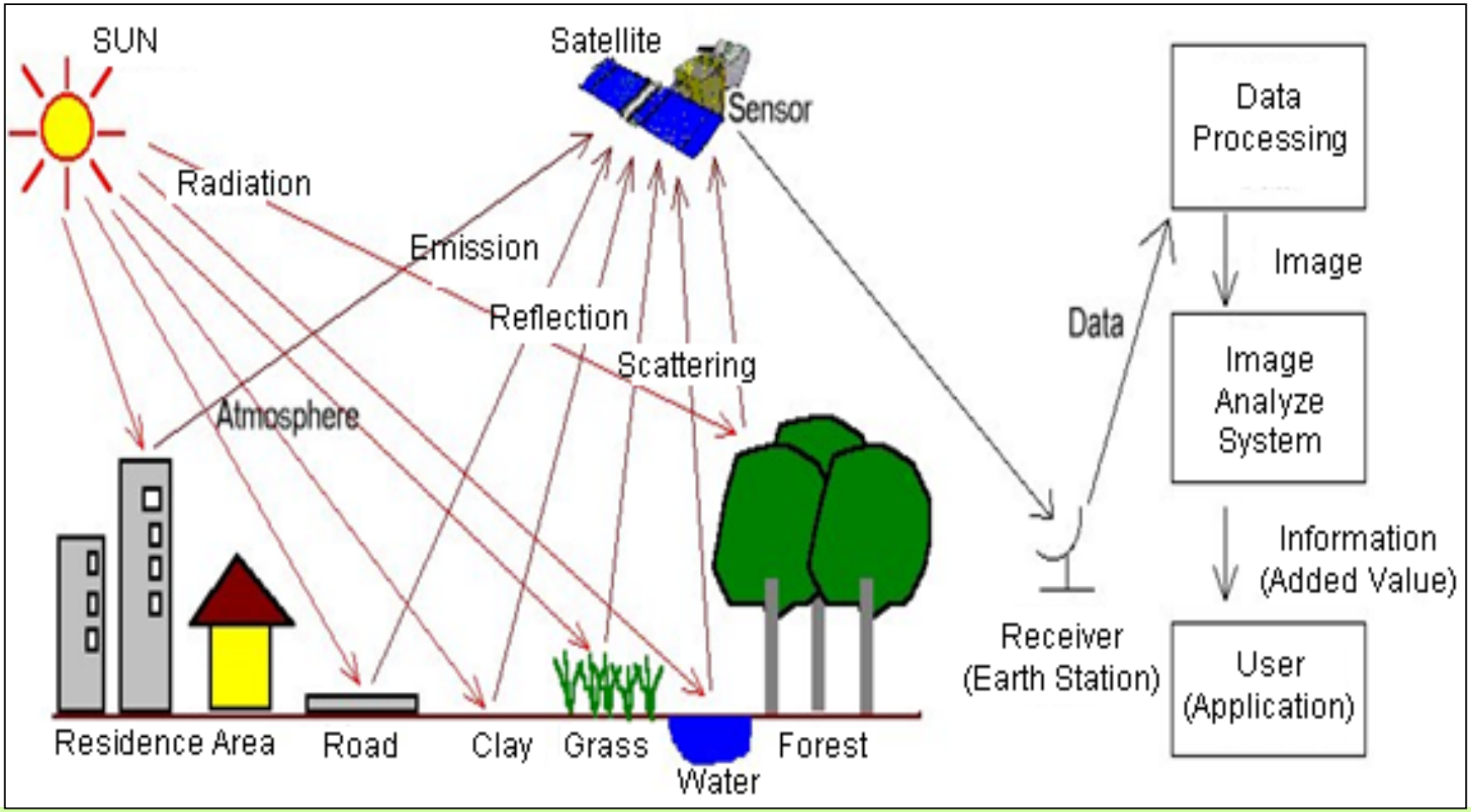
Observation Technology



PROBLEMS

- Solid technology;
- High investment;
- Facing the pace of automation;
- Required “special skill" to operate ⇔ certification;
- Regulatory policies on the data;
- Multi-parameter information;
- Processing technology

Basic Concept of Remote Sensing



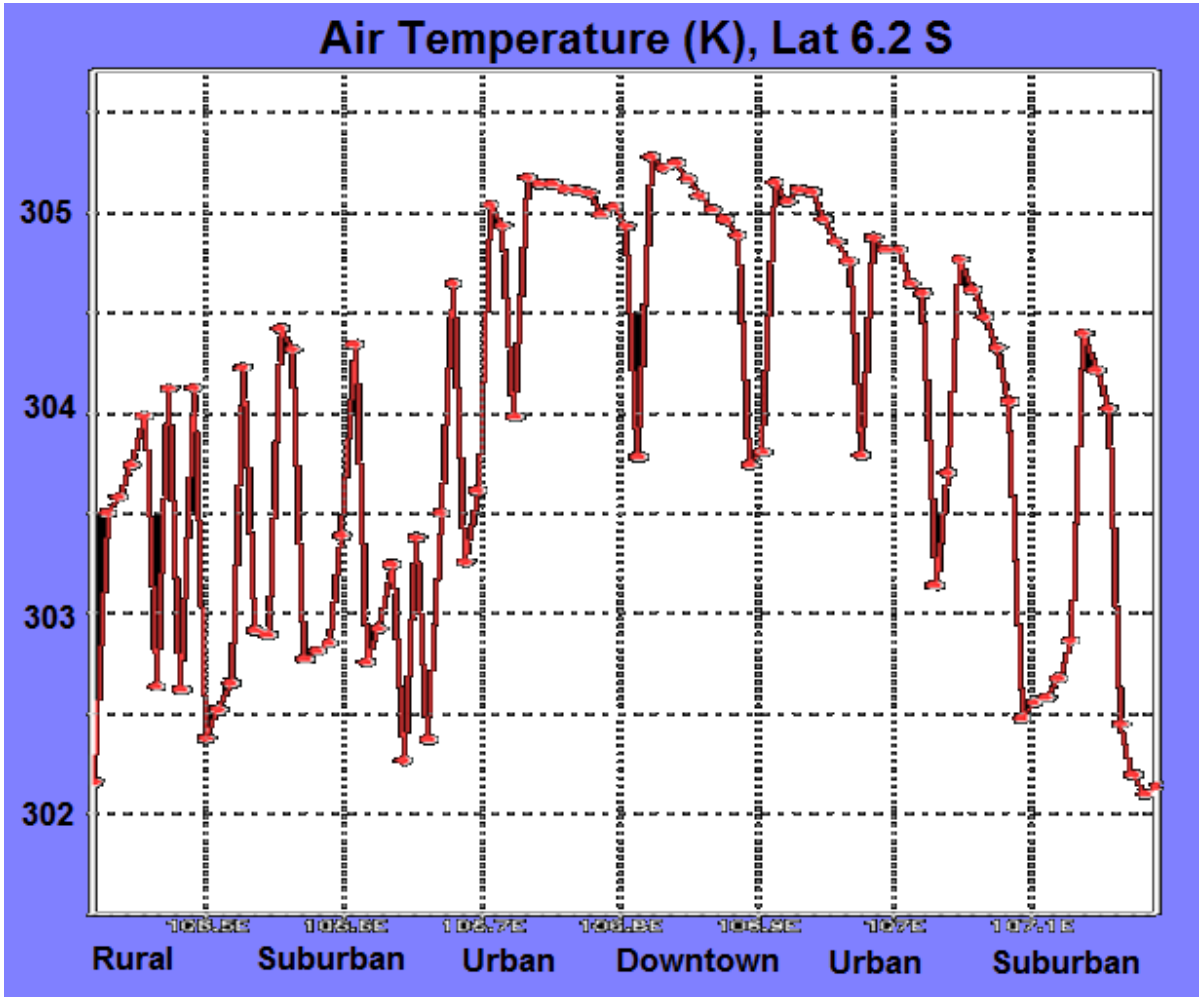
PROBLEMS

- ✓Rapid urbanization is progressing in big cities in Indonesia, which resulted in urban climate change.
- ✓Limited study about urban climate and its application in Indonesia.
- ✓Drought is a problem that often arises in Indonesia during the dry season.
- ✓Non efficiency data processing in Remote Sensing Software.
- ✓Required good urban design, environmentally friendly and sustainable development.
- ✓Limited atmospheric data online

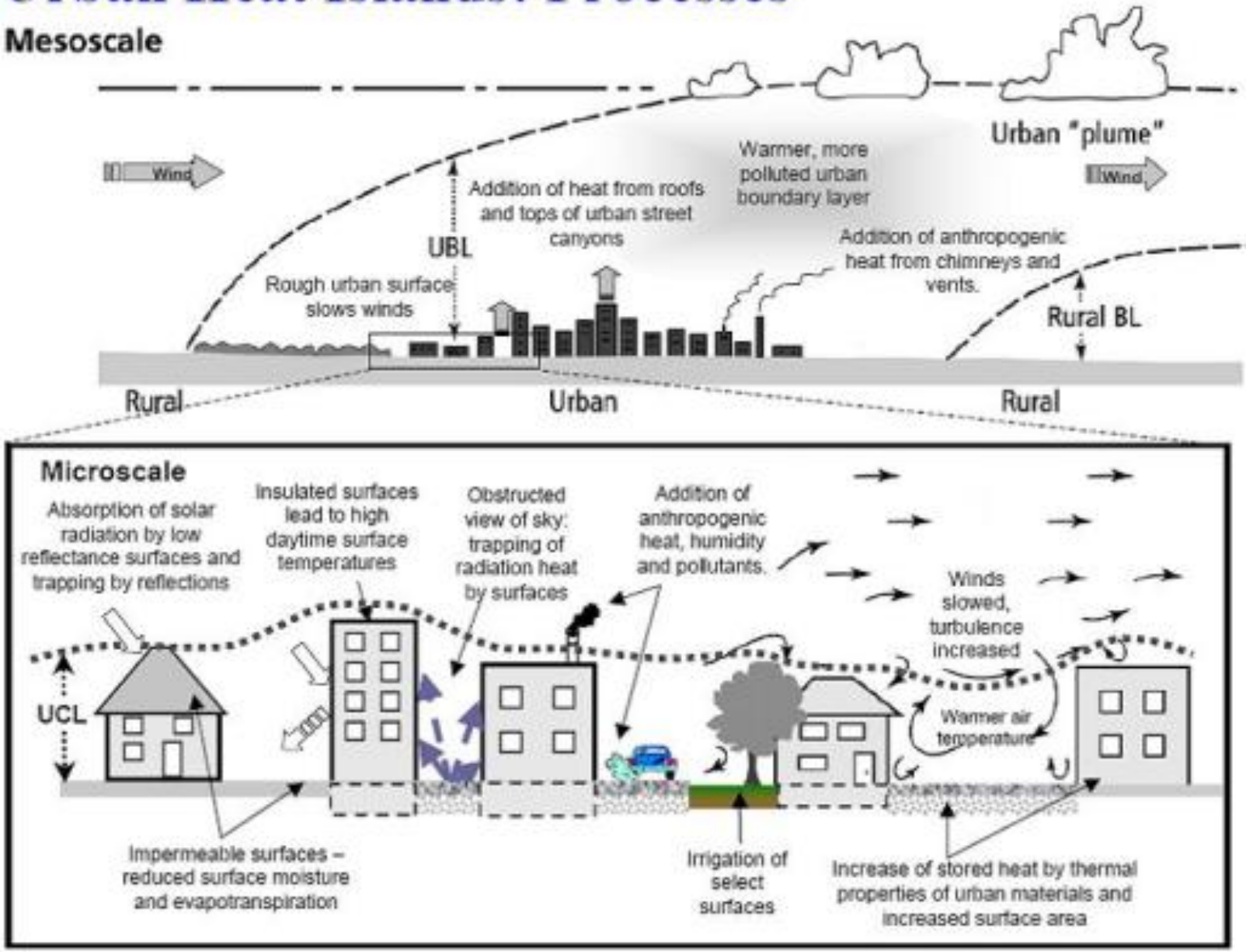
PROBLEMS SOLVING

- ✓Investigate relationship between land cover change and Urban Heat Island (UHI) change using remote sensing data, spatially and statistically, estimation of area changes
- ✓Estimate and Analyze SEB composition in each landcover type using remote sensing.
- ✓Drought monitoring using Bowen Ratio (BR) and Evaporative Fraction (EF) using remote sensing, spatially & statistically, define empirical equation of Bowen Ratio.
- ✓Design of Interface Software for Satellite Data processing (SEBALIS).
- ✓City design and its aspect on the Urban Heat Island using Weather Research Forecast (WRF) Model.
- ✓Atmospheric Database Management

Urban Heat Island (UHI)



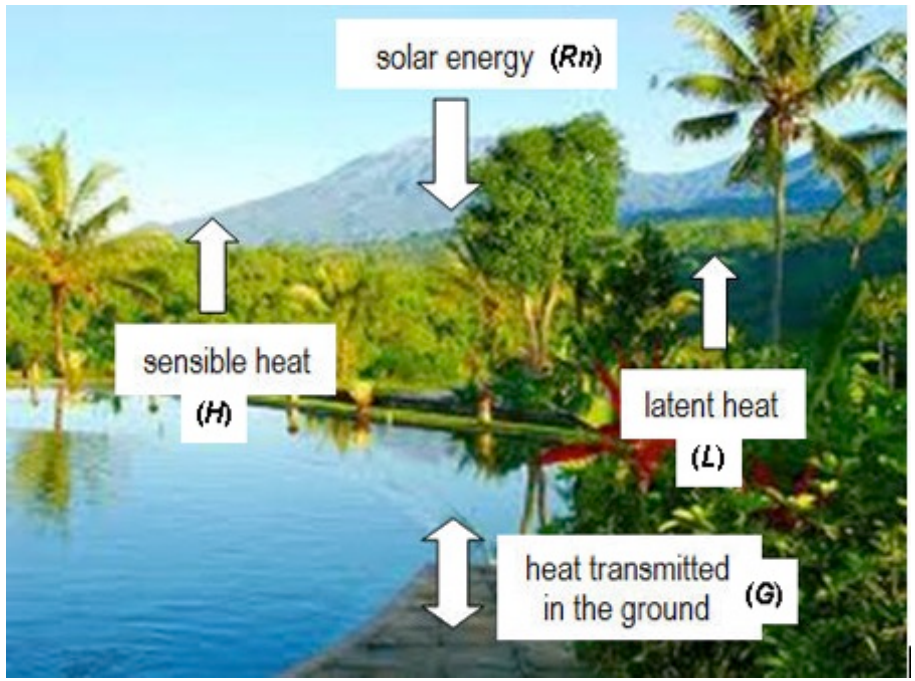
Urban Heat Islands: Processes



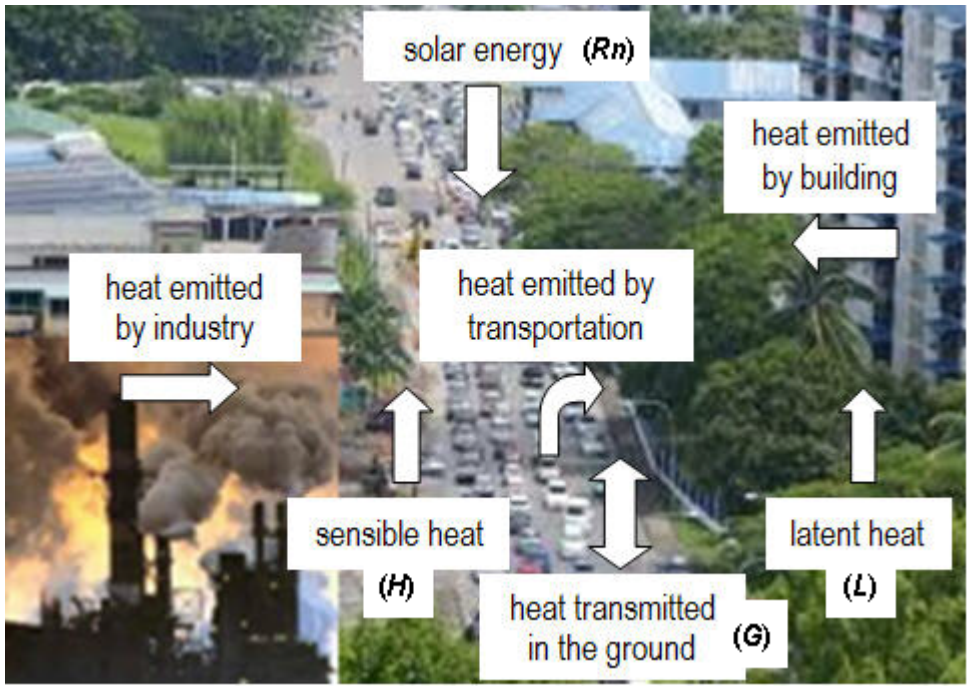
Effect of Land Cover Change to Surface Energy Balance (SEB)

$$R_n = L + G + H$$

R_n = Net Radiation
L = Latent Heat Flux
G = Soil Heat Flux
H = Sensible Heat Flux



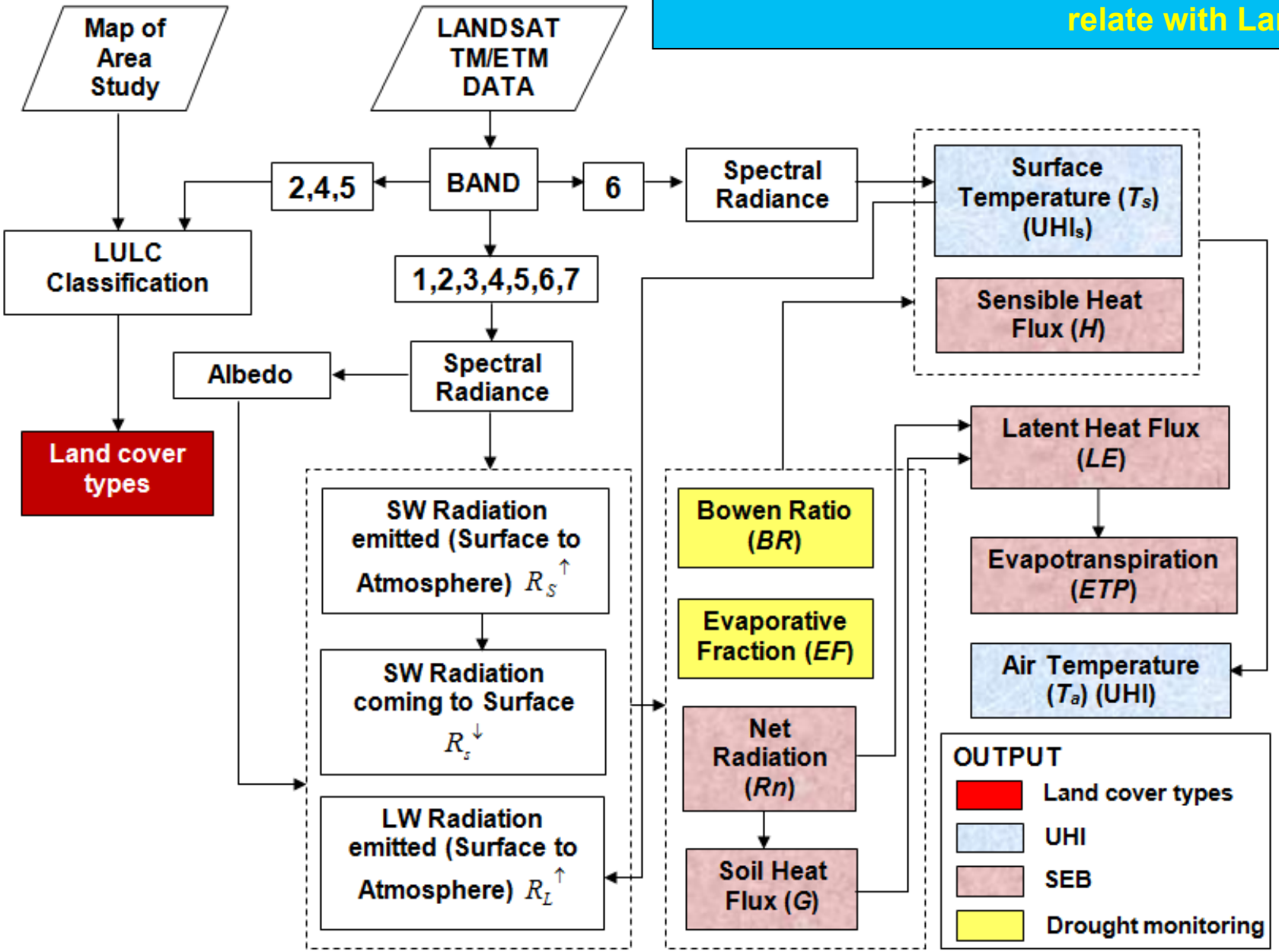
RURAL



URBAN / CITY

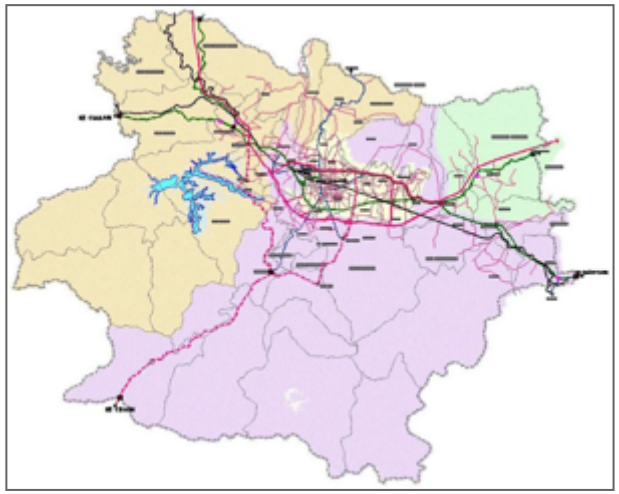
METHODOLOGY

UHI, SEB and Drought monitoring estimation relate with Land cover

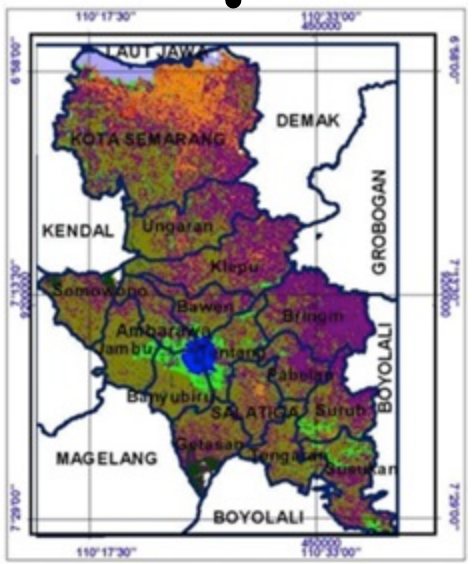


Study area

JAKARTA
640 km^2

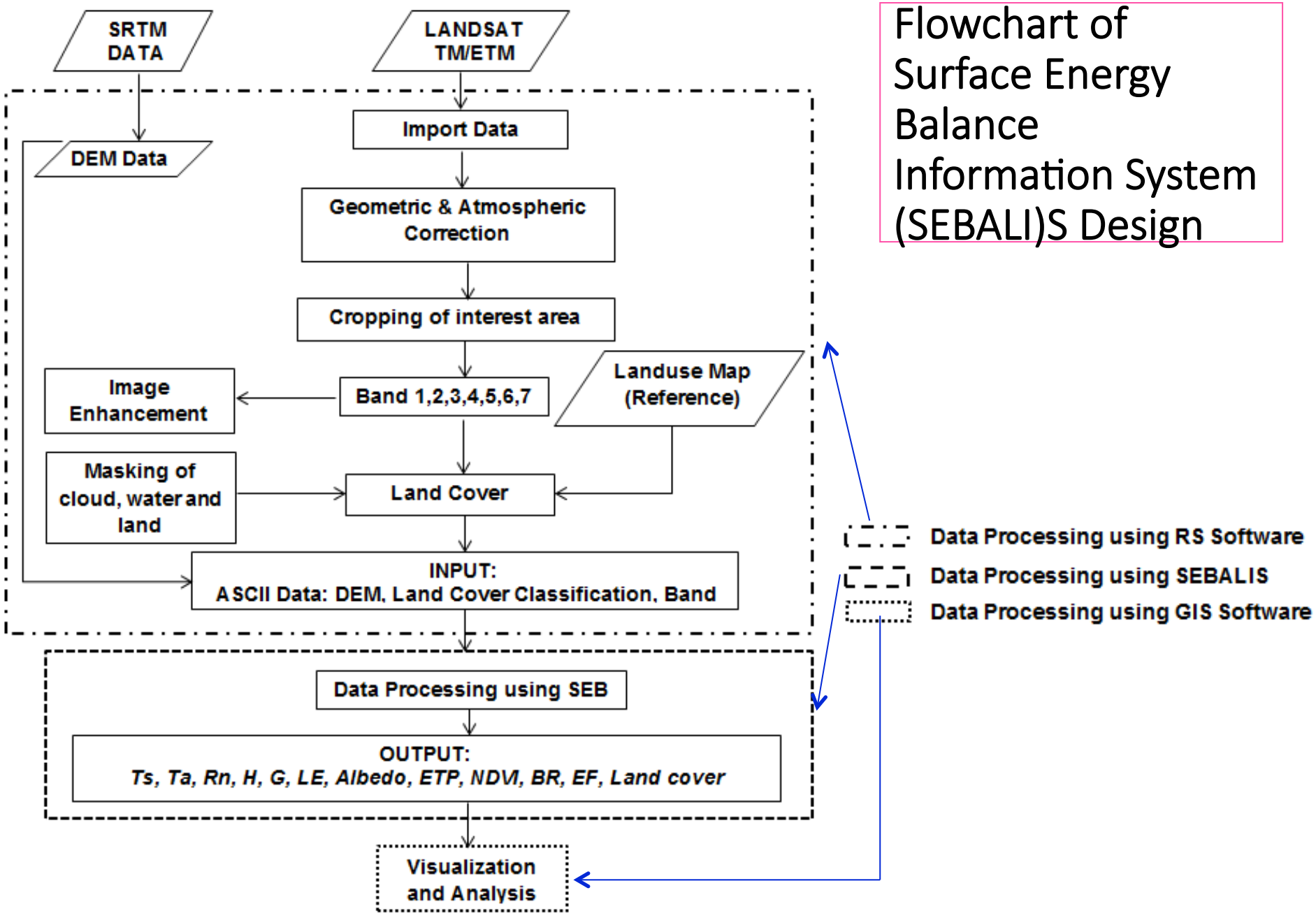


BANDUNG
2820 km^2



SEMARANG & surrounding
1441 km^2

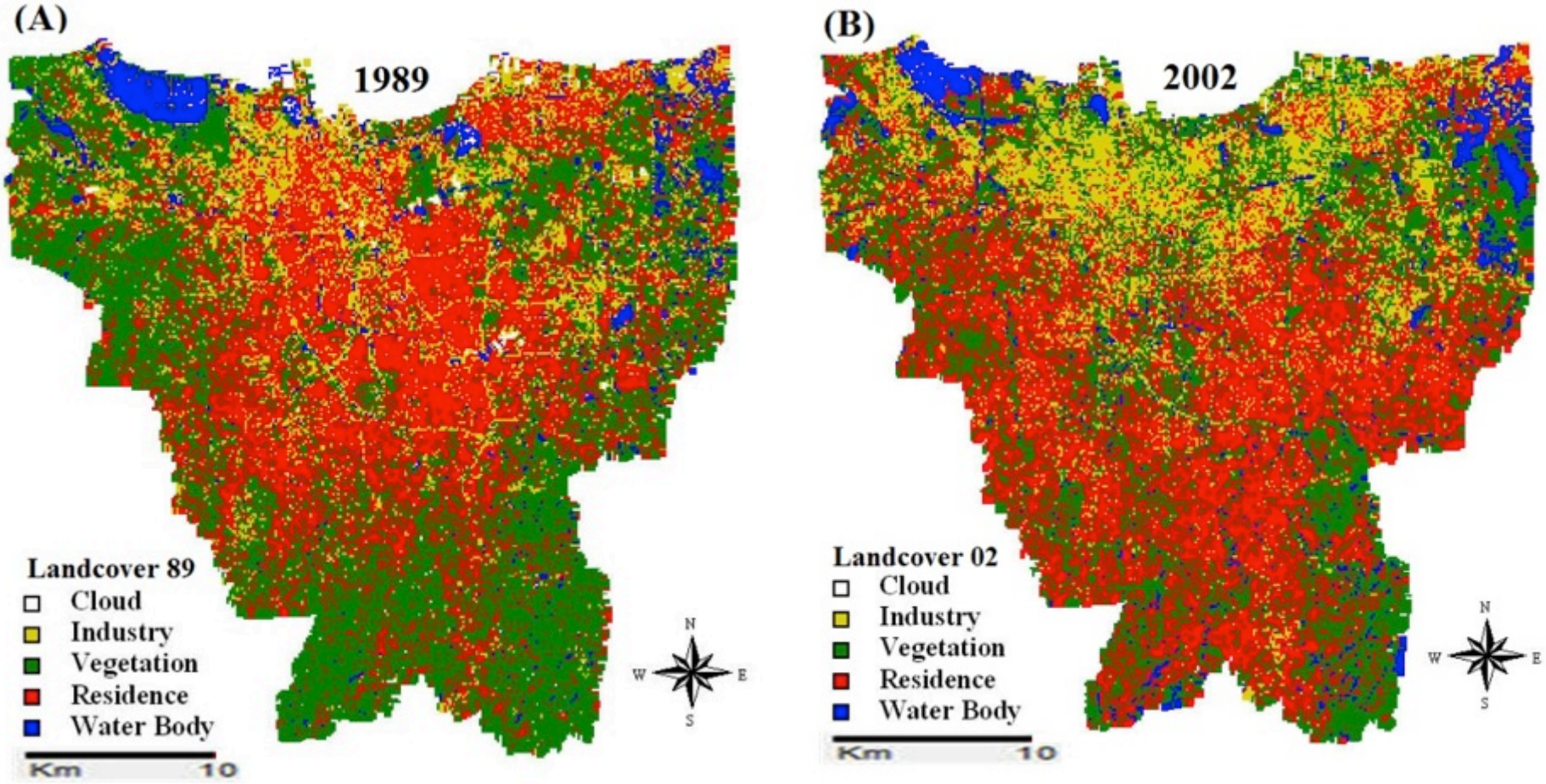
Flowchart of Surface Energy Balance Information System (SEBALI)S Design



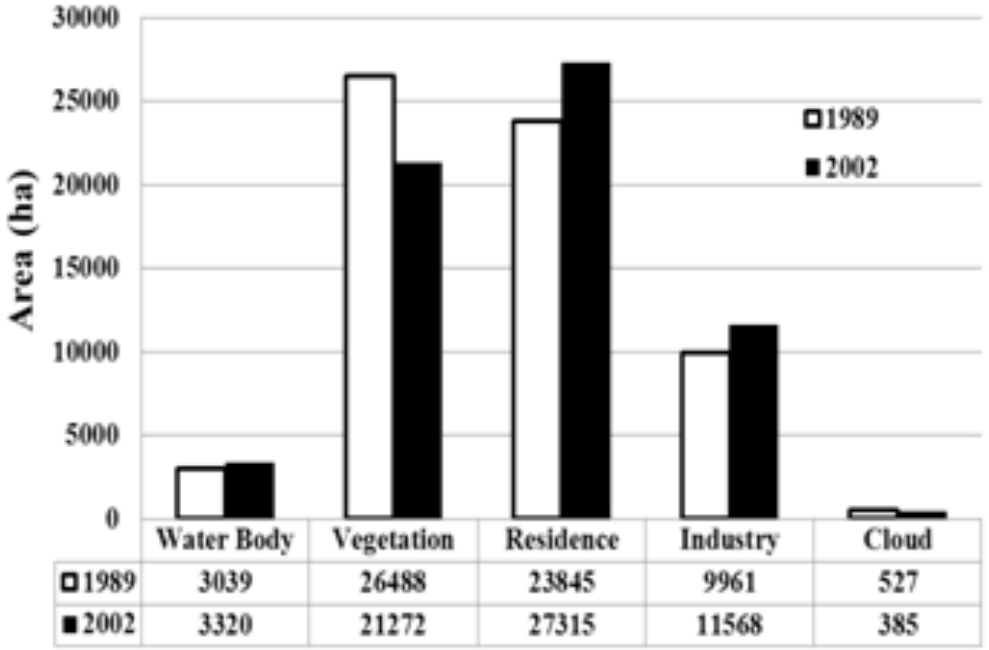
RESULT AND ANALYSIS

1. Relationship between UHI and Land cover

Spatial map of land cover classification in Jakarta **(A)** 1989 and **(B)** 2002



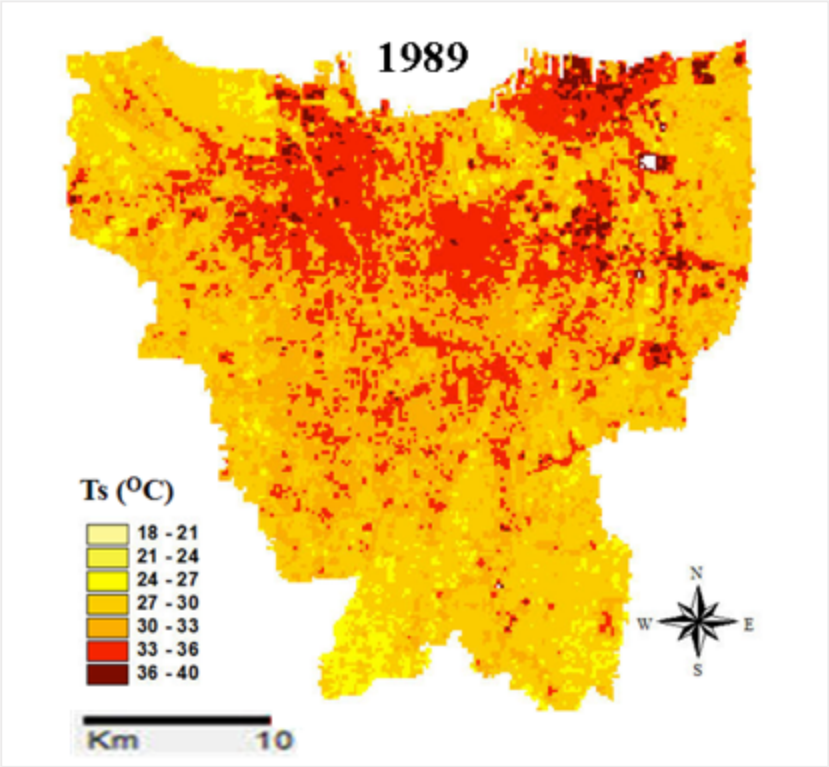
STATISTIC OF LAND COVER, Jakarta

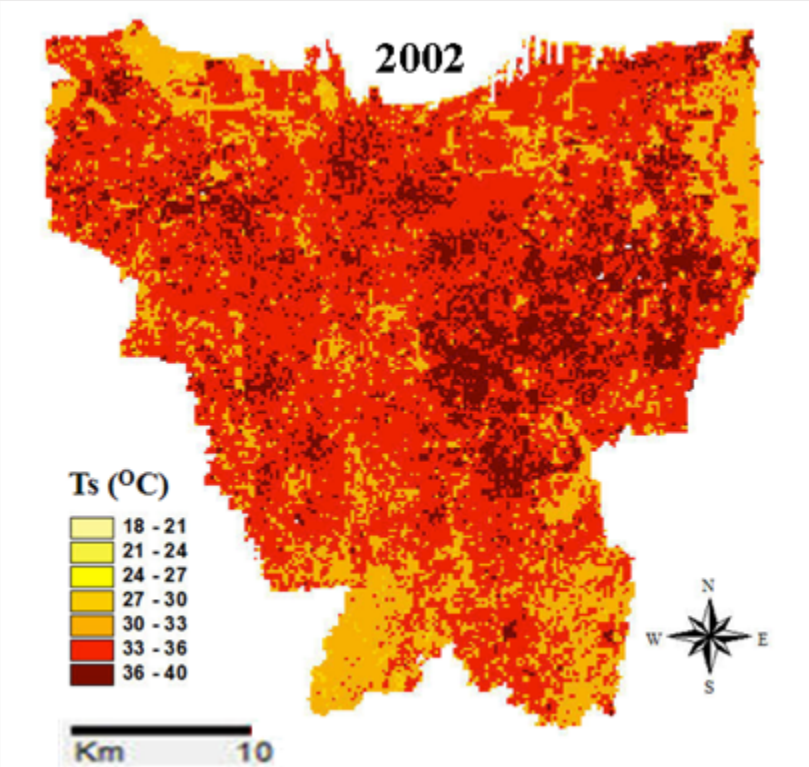


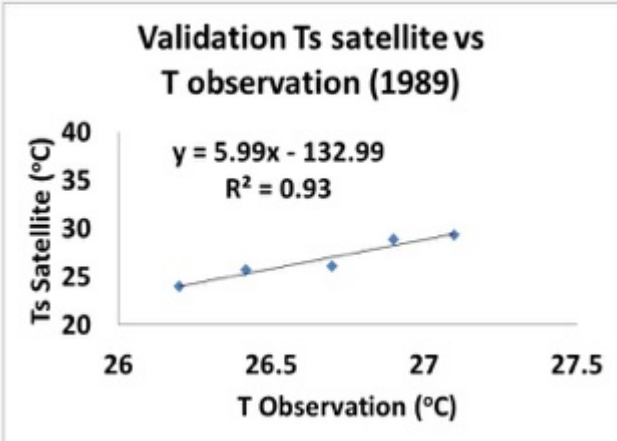
Change detection of Landcover change using overlay matrix in Jakarta

Land cover (ha)	Waterbody (ha)	Industry (ha)	Residence (ha)	Vegetation (ha)	Cloud (ha)
Waterbody	970	415	605	1014	35
Industry	360	3236	3061	3217	360
Residence	489	5162	12600	5517	77
Vegetation	1447	2610	10909	11364	158
Cloud	54	145	140	160	35

URBAN HEAT ISLAND, Jakarta

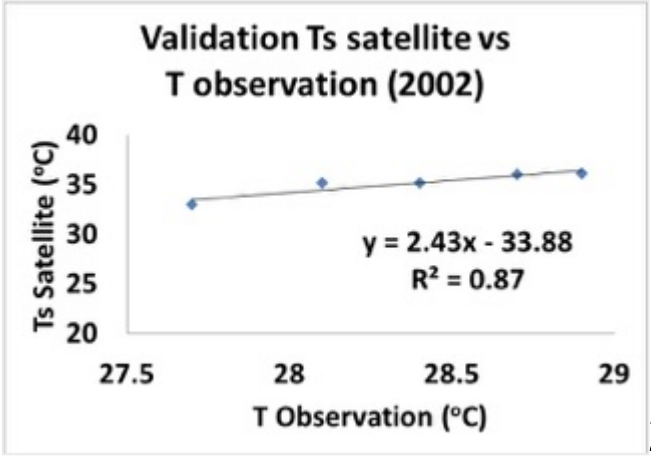




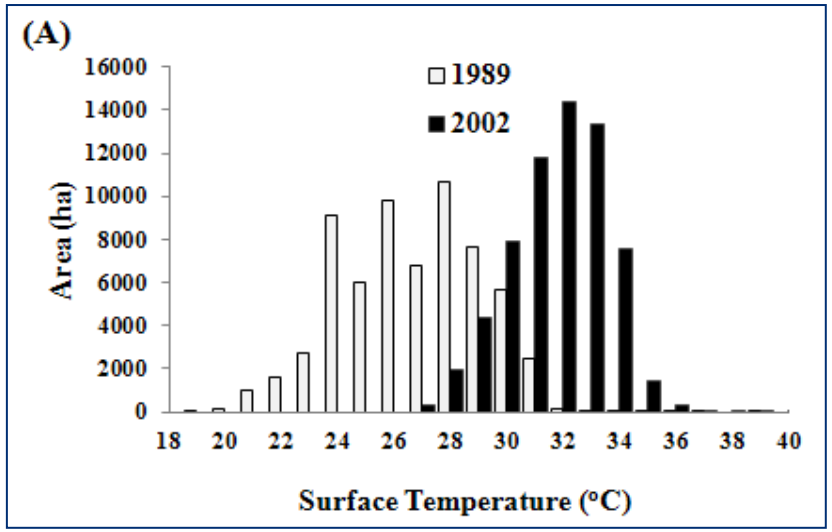


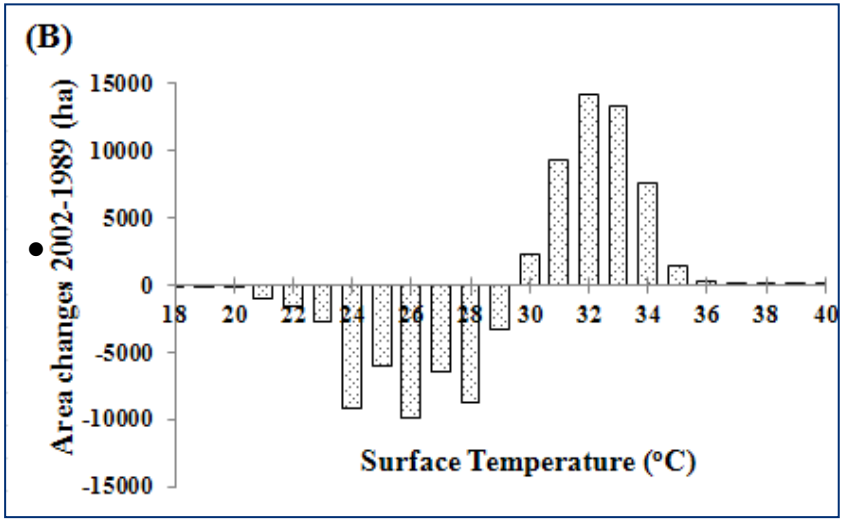
●Criteria of Correlation Coefficienti:

1. 0,00 – 0,20 : very weak
2. 0,21 – 0,40 : weak
3. 0,41 – 0,70 : strong
4. 0,71 – 0,90 : very strong
5. 0,91 – 0,99 : very very strong
6. 1,00 : perfect

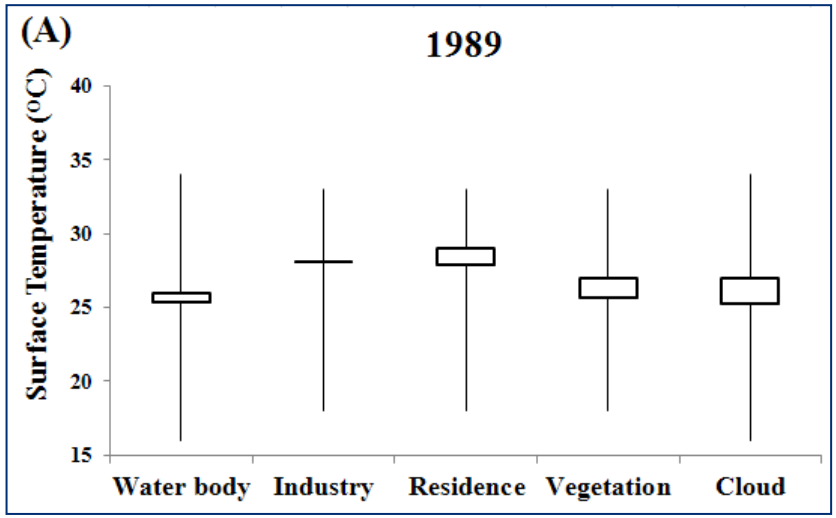


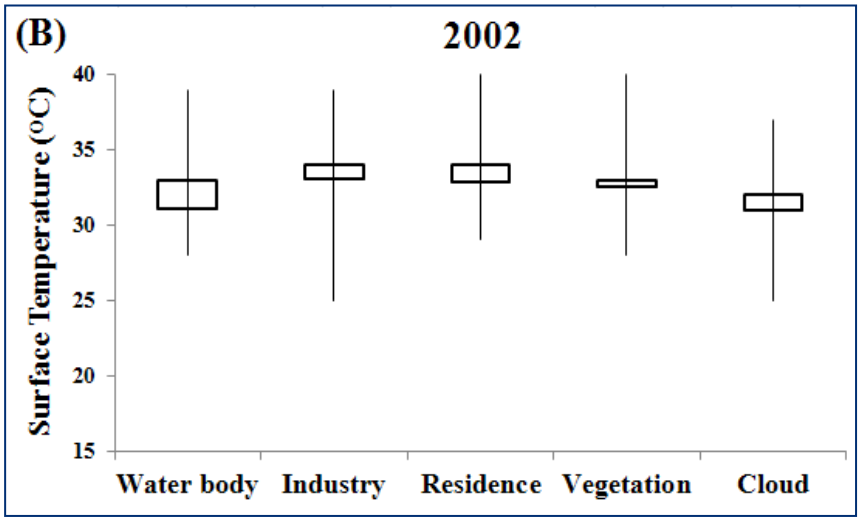
Statistic of Surface Temperature, Jakarta





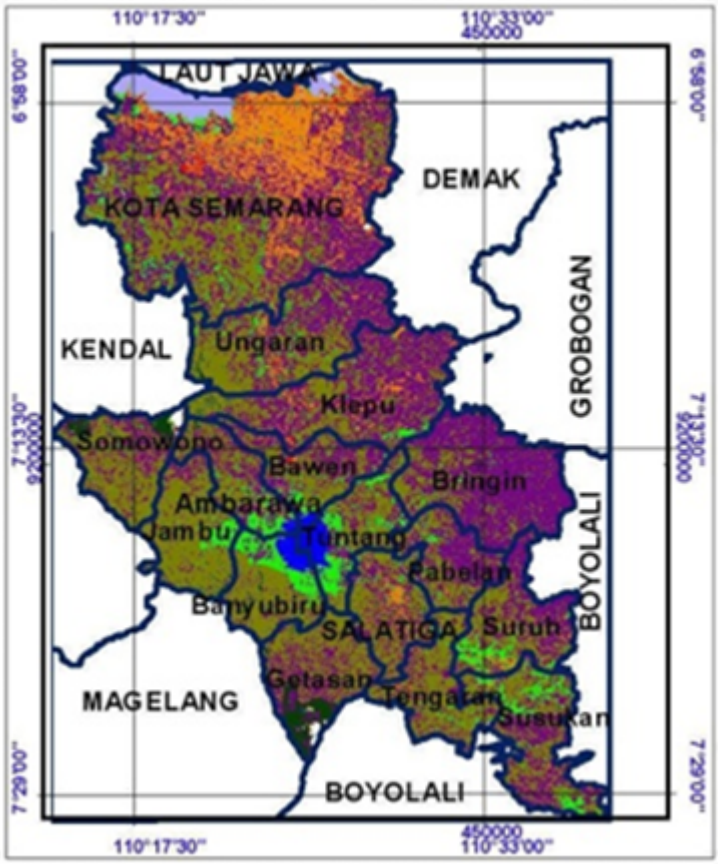
Boxplot Ts in land cover types

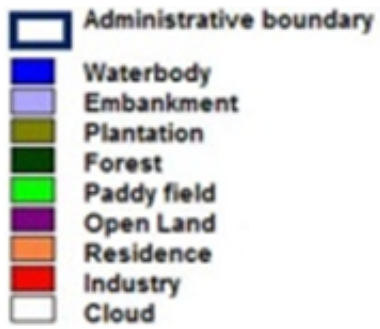


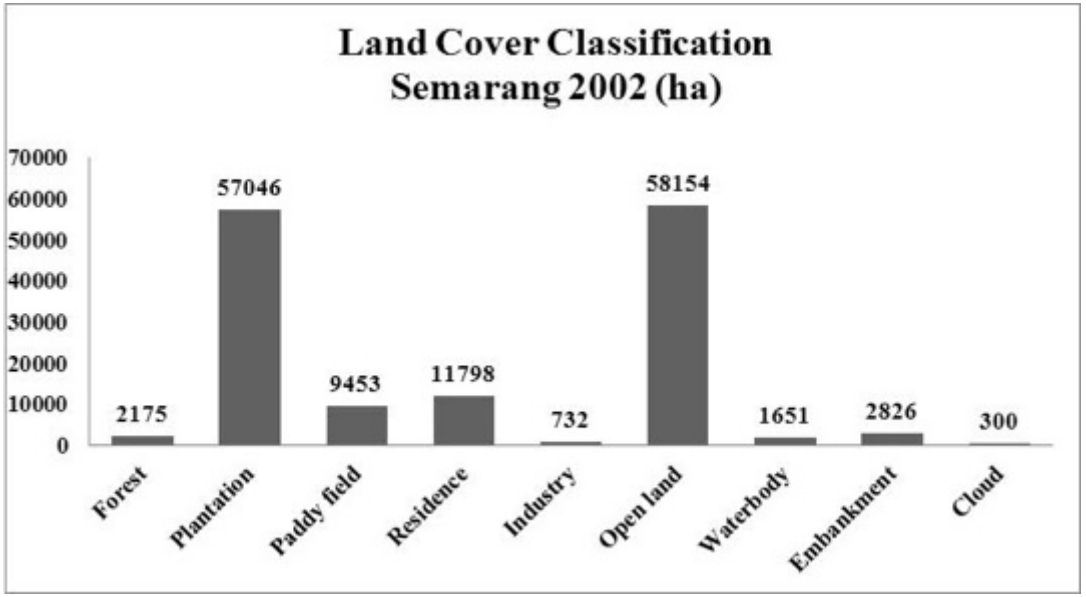


2. Surface Energy Balance (SEB) analysis

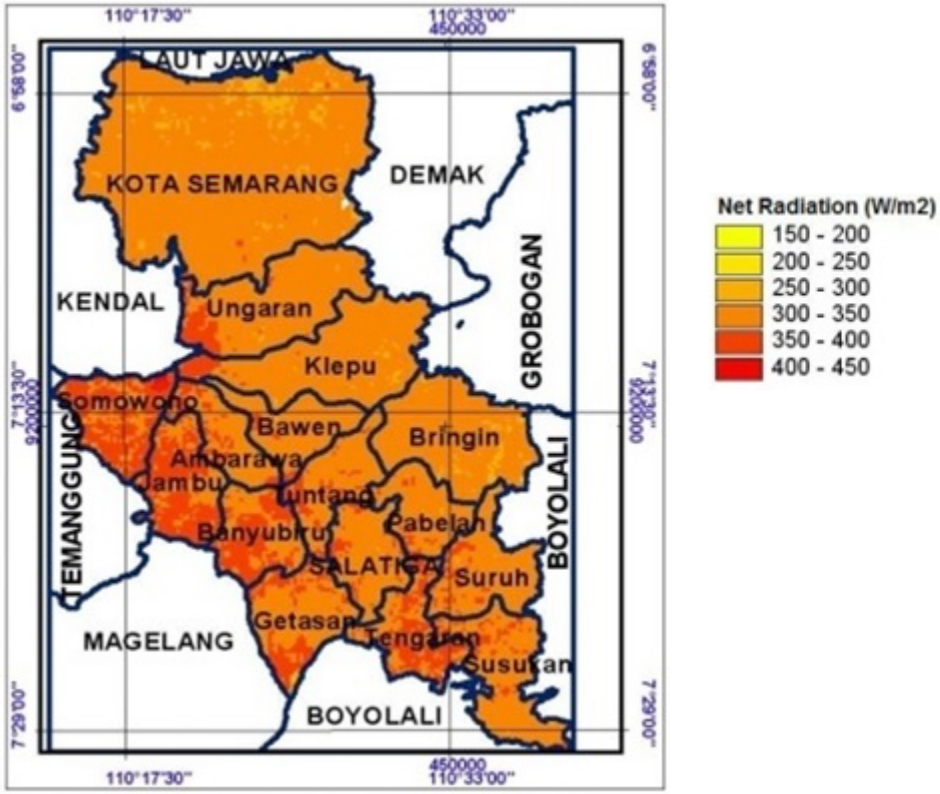
Land cover classification of Semarang & surrounding 2002



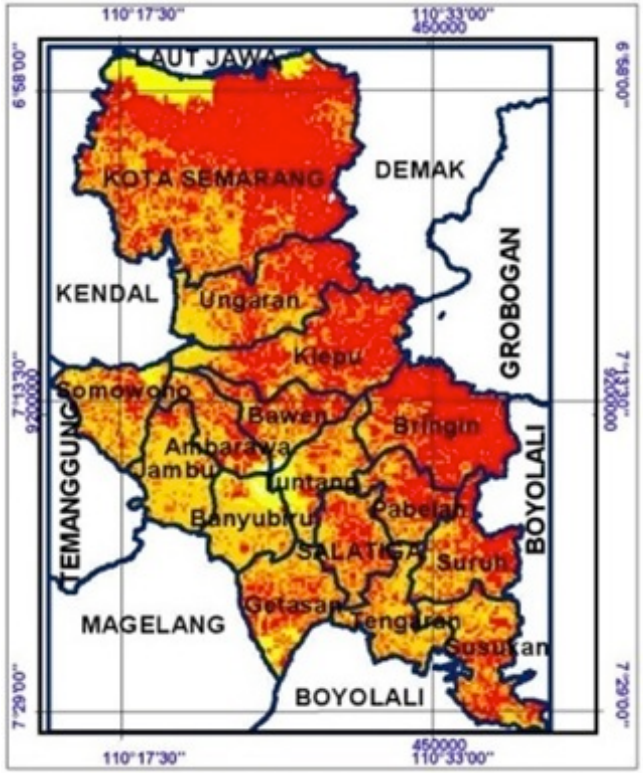


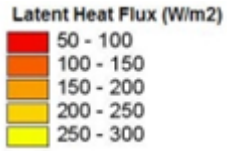


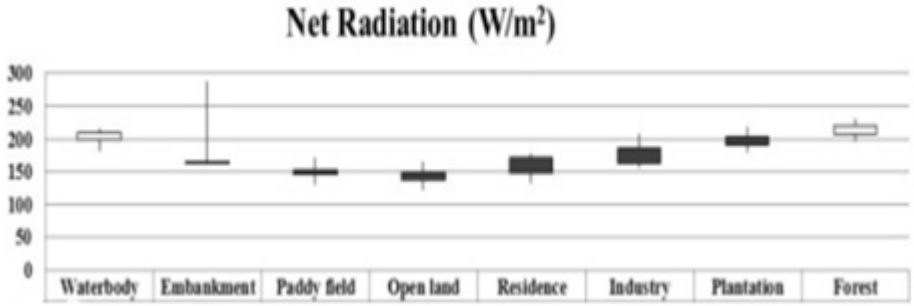
Net Radiation (Rn) (W/m^2)

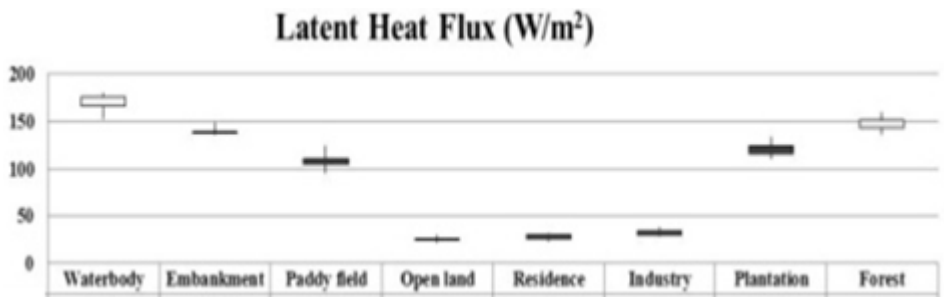


Latent Heat Flux (LE) (W/m^2)

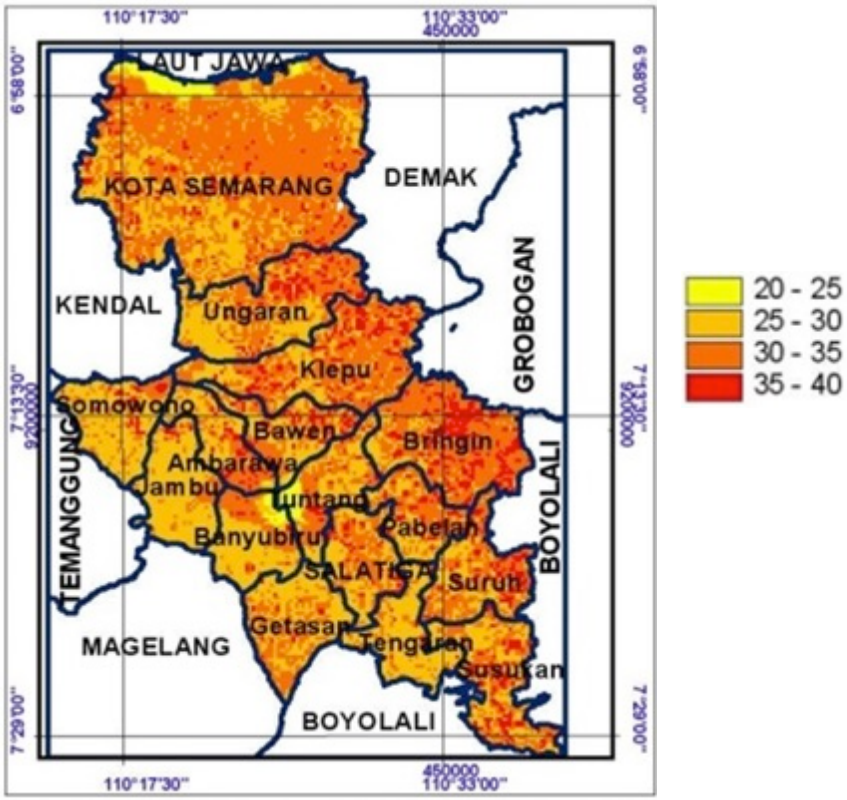




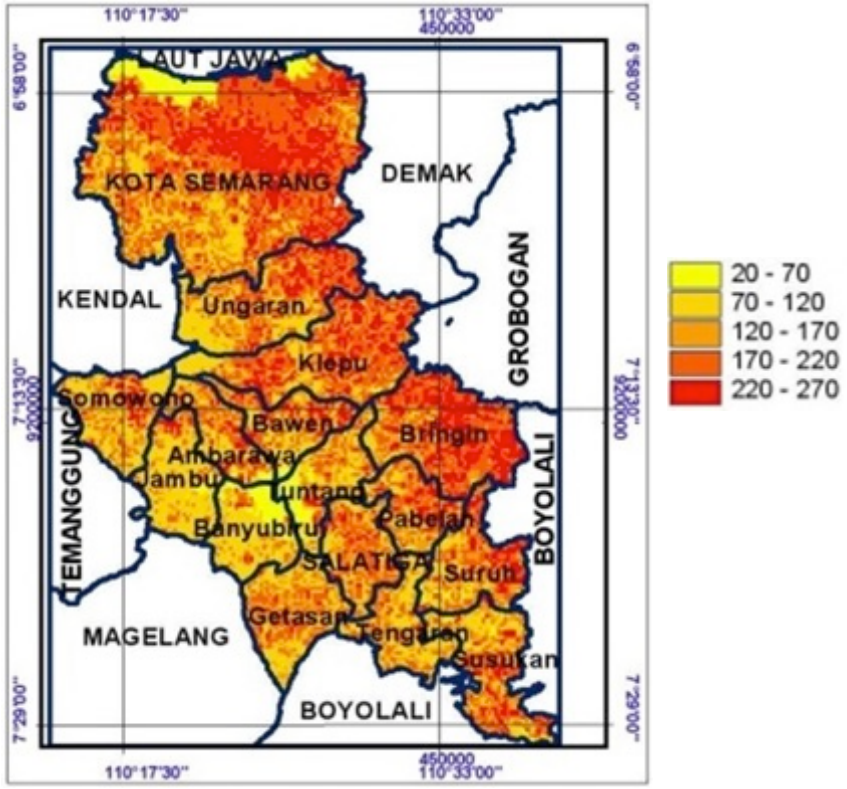


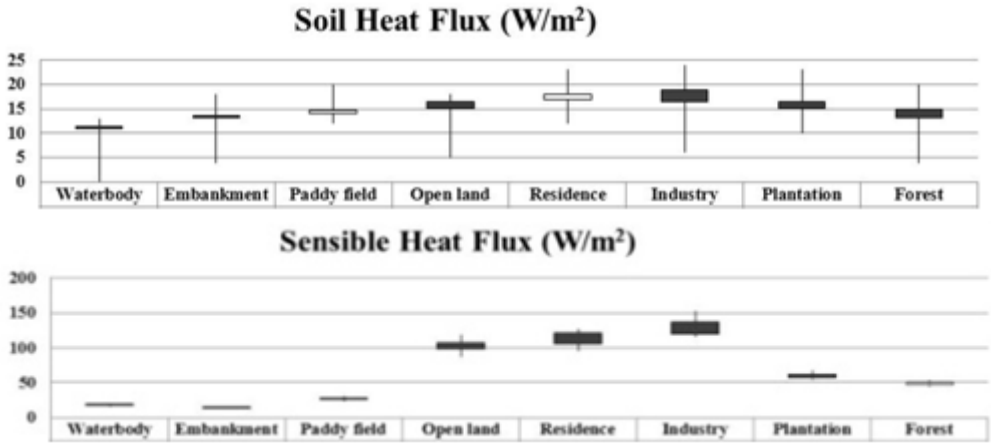


Soil Heat Flux (G) W/m^2



Sensible Heat Flux (H) W/m^2

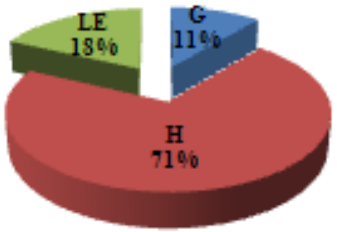




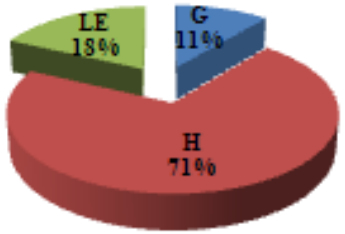
Composition of surface energy balance in land cover types

Urban Area

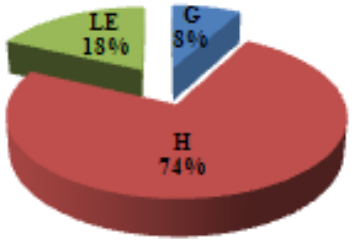
RESIDENCE



OPEN LAND

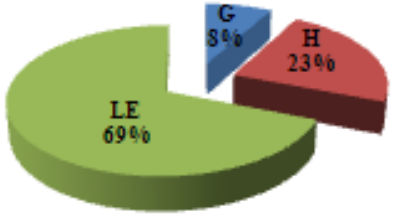


INDUSTRY

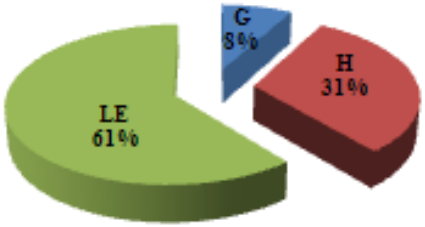


Vegetation Area

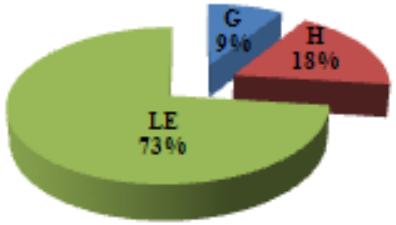
FOREST



PLANTATION

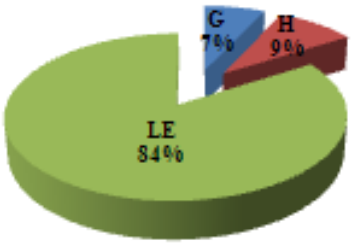


PADDY FIELD

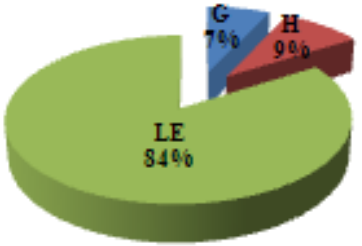


Wet/water Area

WATER BODY



EMBANKMENT



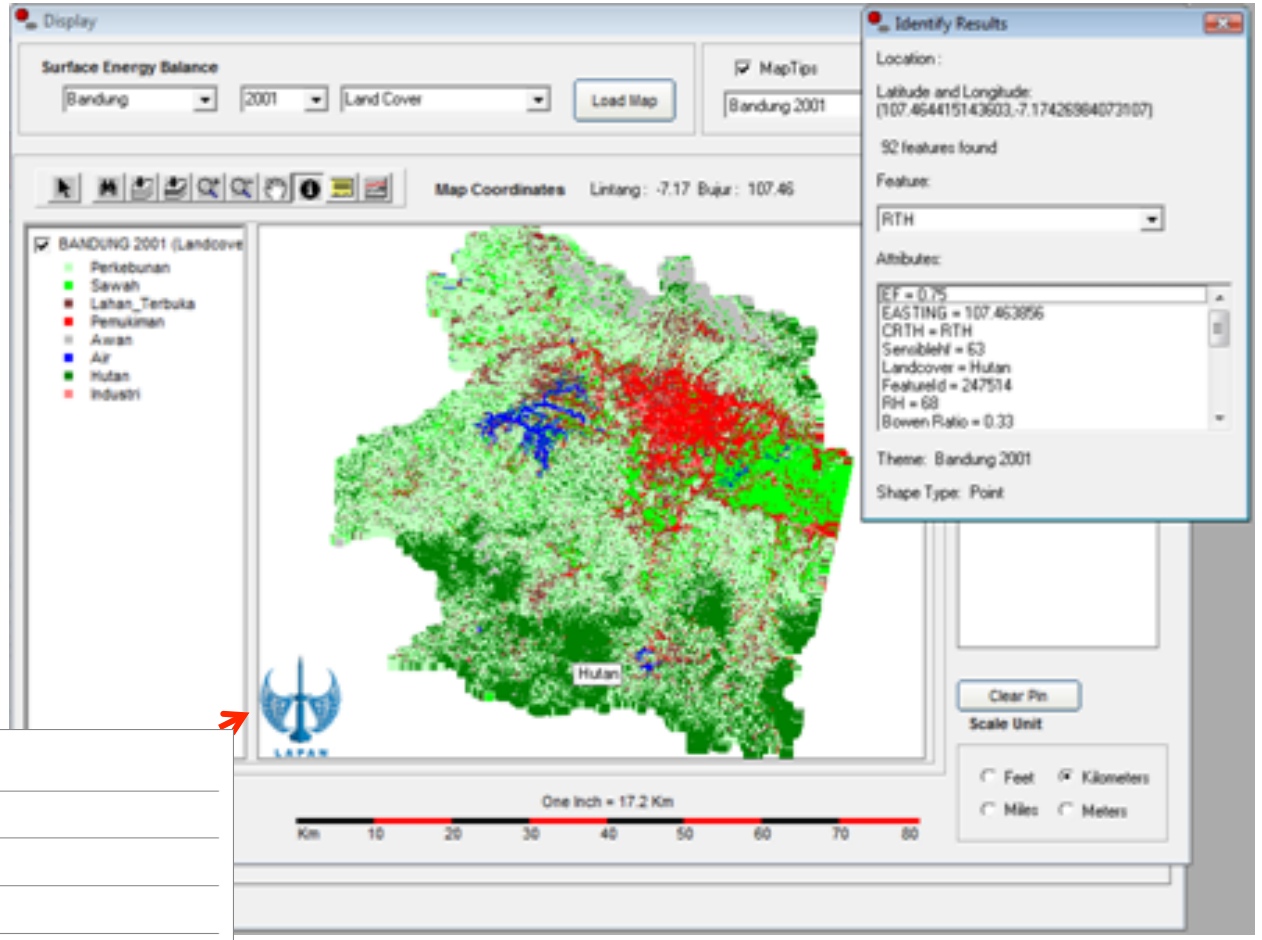
3. Drought Monitoring

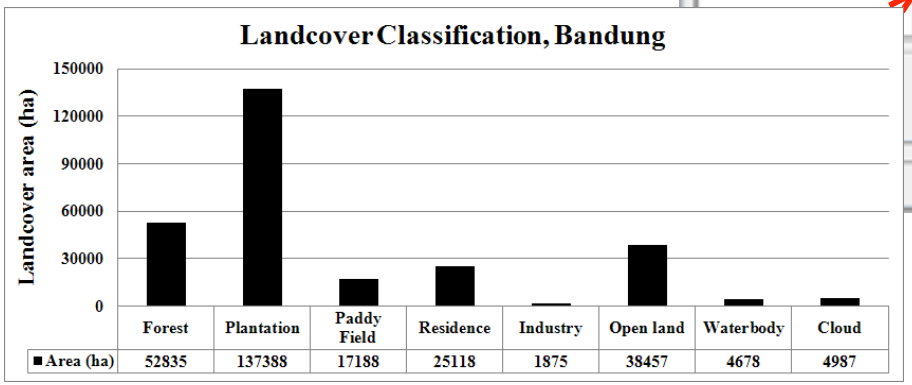
Land use classification, Bandung 2001

$$L = \frac{Rn - G}{1 + BR},$$

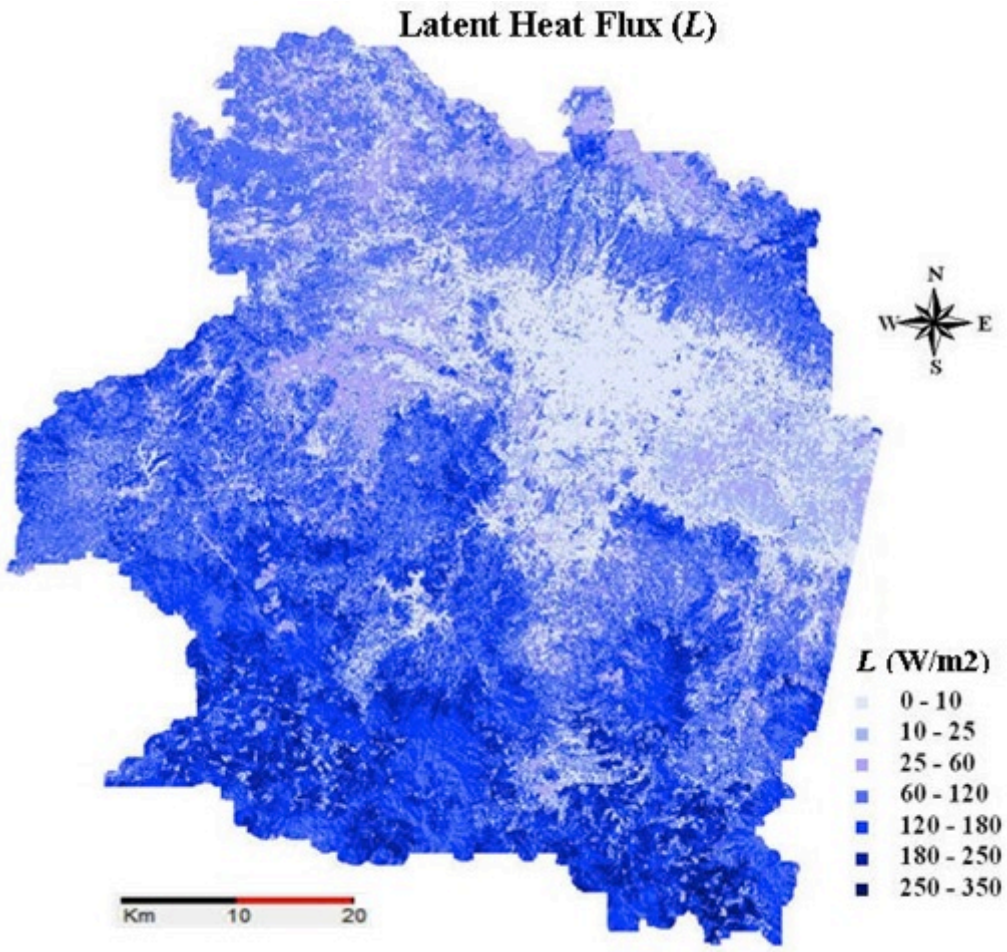
$$EF = \frac{L}{Rn - G},$$

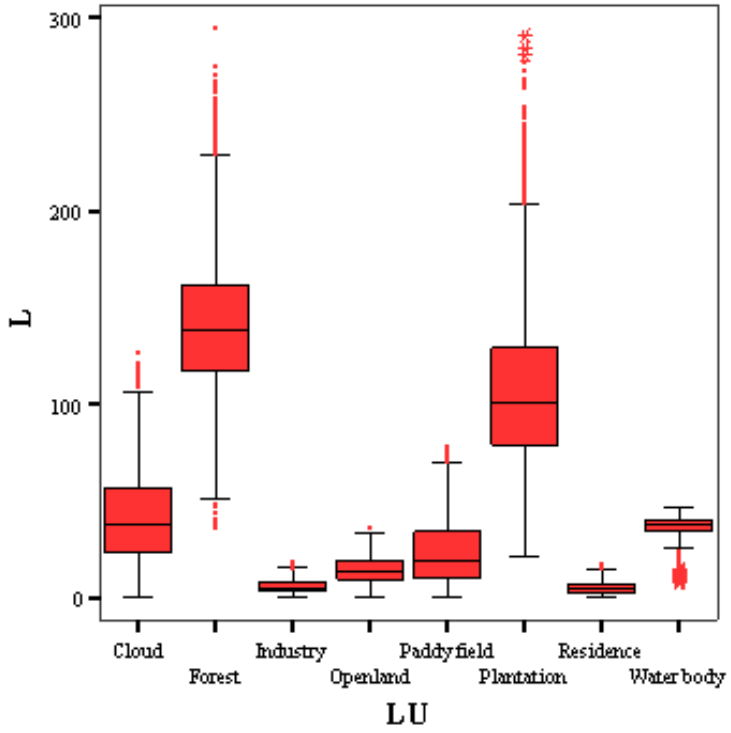
$$EF = (1 + BR)^{-1}$$





Latent Heat Flux (*L*)





Bowen ratio and Evaporative Fraction using satellite data for Practical Drought Risk Monitoring

- Crop failure, no harvest ???

BOWEN RATIO

$$\beta = \frac{H}{\lambda E}$$

- Bowen Ratio (β) is the comparison between the flux of air heating (*H*) and heating the water vapor flux (*λE*) can be expressed as a ratio of Bowen (Bowen Ratio)
- Bowen ratio was higher, the higher level of drought

EVAPORATIVE FRACTION

- The concept of energy balance to calculate the fraction of evaporation for monitoring drought is the evaporative Fraction (EF), which would low value for the dry areas.

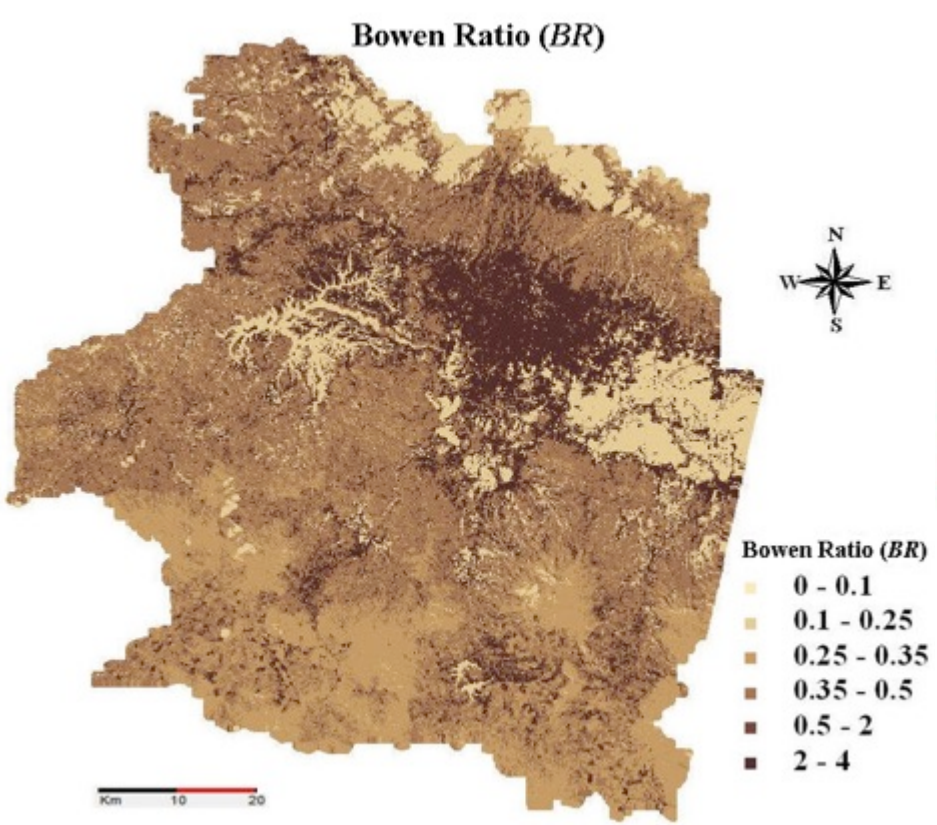
$$EF = \frac{\lambda ET}{Rn - G}$$

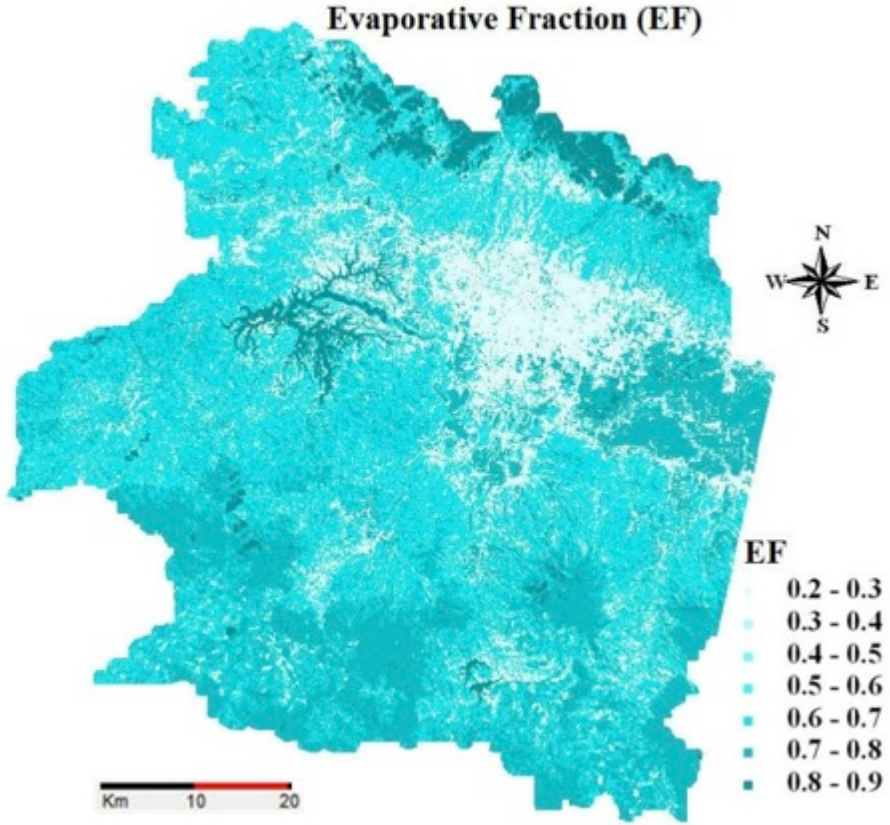
- *EF* is the evaporative Fraction, λET is the energy for evapotranspiration, *Rn* is net radiation and *G* is the energy to heating the soil.

Bowen Ratio & Evaporative Fraction, Bandung 2001

DRY if BR >>

DRY if EF <<





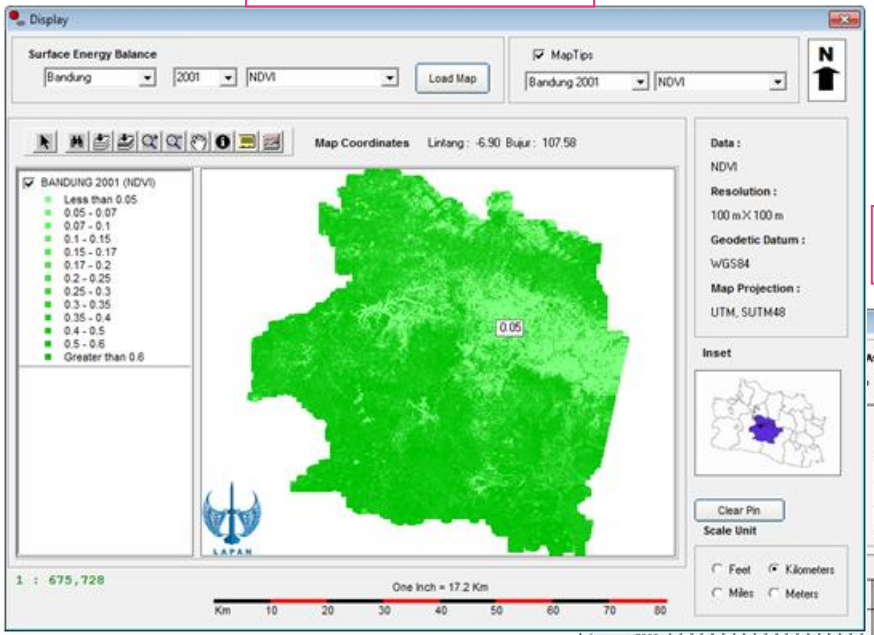
4. Design of SEBALIS using Visual Basic and GIS

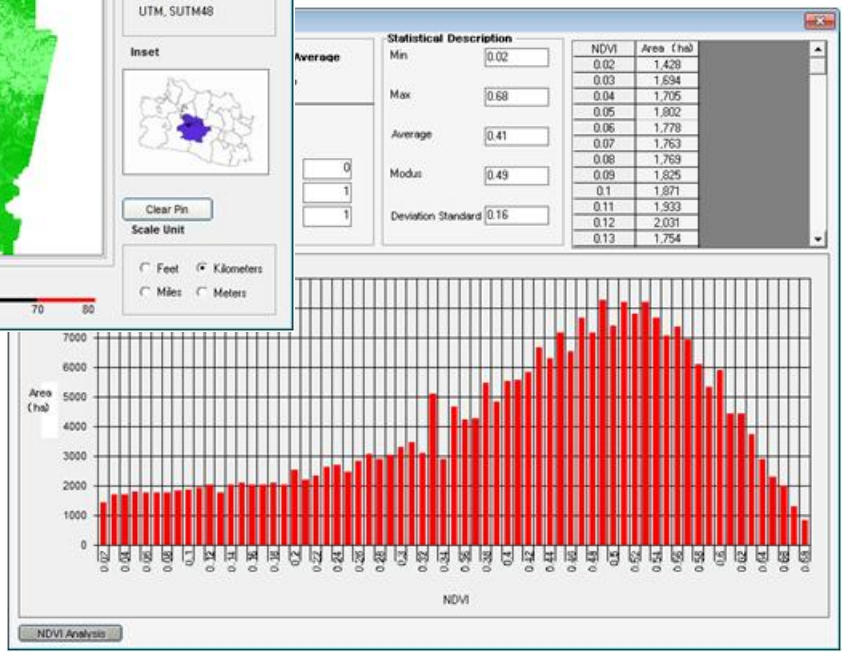
Menu map, table & graph in SEBALIS for NDVI

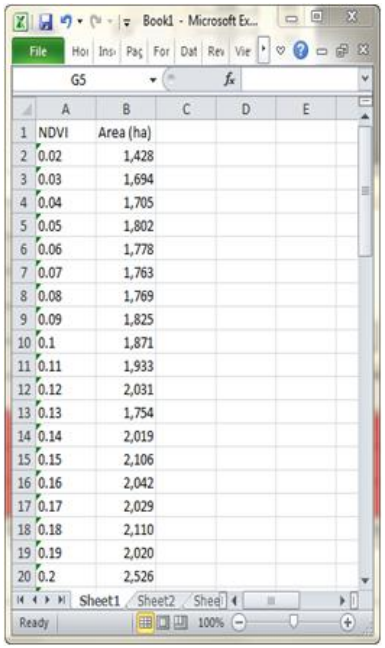
Map of NDVI

Data processing :
Without SEBALIS ~ 1 week
With SEBALIS ~ 1 hours

Table & Graph → Export to Excel



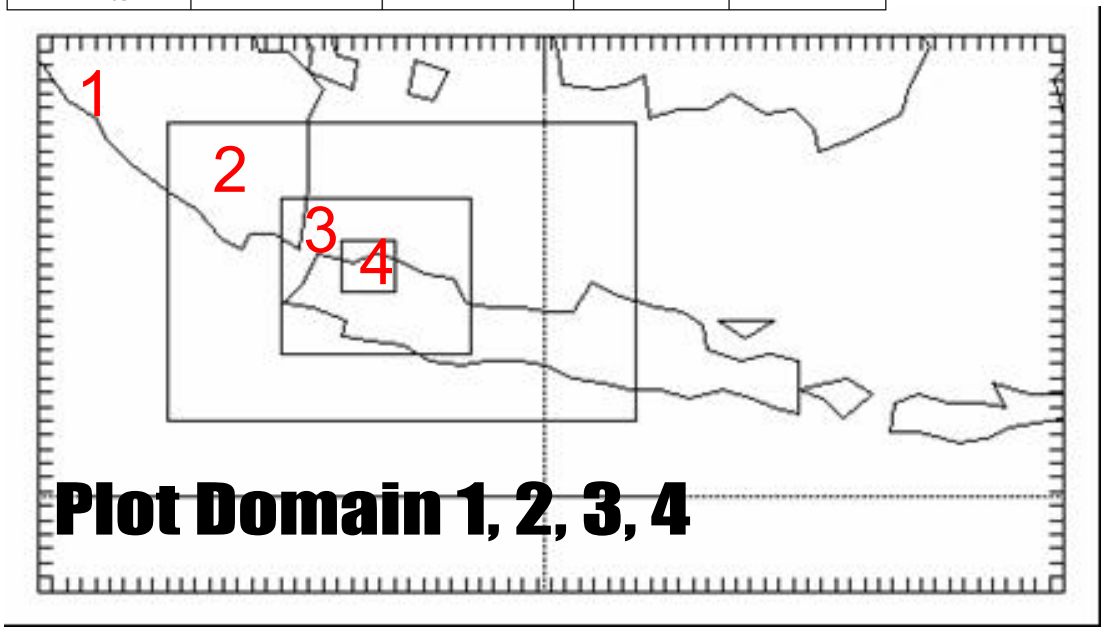




5. Urban Climate Modelling using Weather Research Forecast (WRF)

Domain configuration

Field	Domain 1	Domain 2	Domain 3	Domain 4
Meridional Grid Dimensions	73	100	121	100
Zonal Grid Dimensions	40	64	100	100
Vertical Level	31	31	31	31
Grid Resolution	27 km	9 km	3 km	1 km
Terrain Resolution	10 min (~18 km)	5 min (~9 km)	2 min (~4 km)	30 s (~0.9 km)
Explicit Moisture Scheme	WRF SM 3-class scheme	WRF SM 3-class scheme	Purdue Lin scheme	No microphysic
Longwave Radiation Scheme	RRTM scheme	RRTM scheme	RRTM scheme	RRTM scheme
Shortwave Radiation Scheme	Dudhia scheme	Dudhia scheme	Dudhia scheme	Dudhia scheme
Surface Layer	MM5 similarity	MM5 similarity	MM5 similarity	MM5 similarity
Land Surface Physics	5-layer thermal diffusion	5-layer thermal diffusion	5-layer thermal diffusion	5-layer thermal diffusion
Cumulus Scheme	Betts-Miller-Janjic scheme	Betts-Miller-Janjic scheme	Kain-Fritsch scheme	No cumulus scheme
PBL Type	YSU scheme	YSU scheme	YSU scheme	YSU scheme



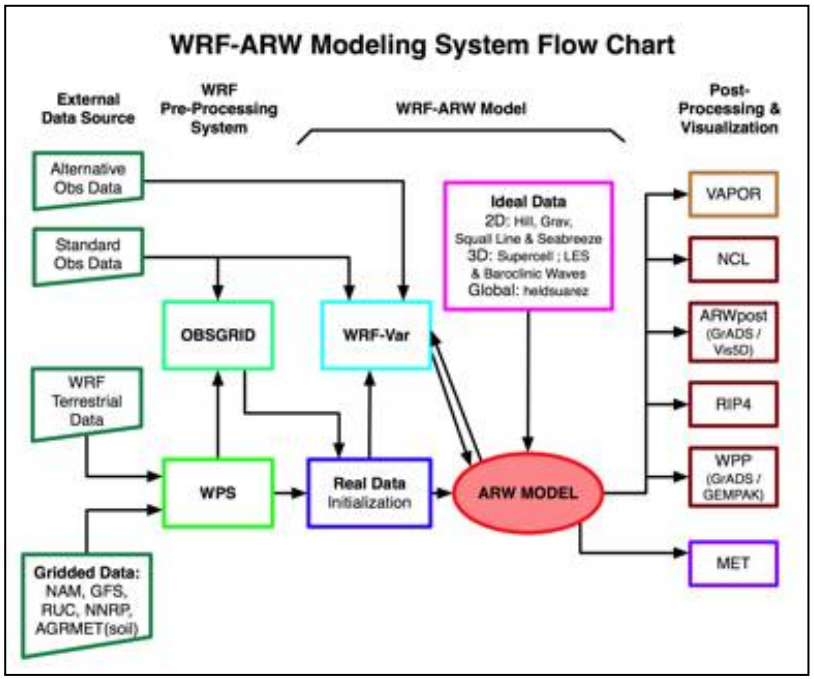
Plot Domain 1, 2, 3, 4

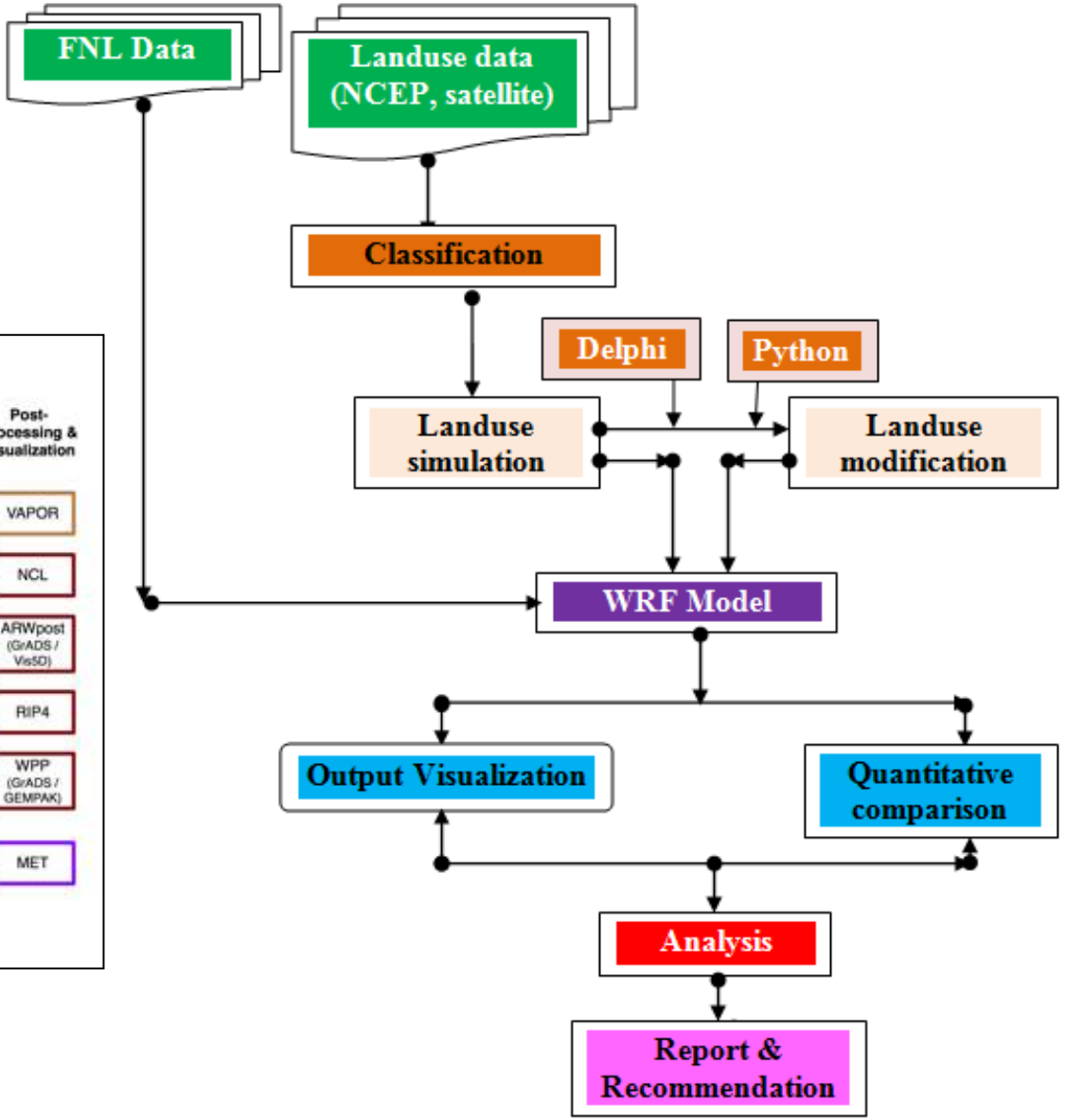
Benchmark configuration of PC Cluster, to run WRF Model

- Application: Advance Research WRF V 3
- 1 server: Processor dual core AMD, Motherboard, Memory DDR2 4112232KB (4GB), SATA 300GB.
- 15 Nodes of Cluster:

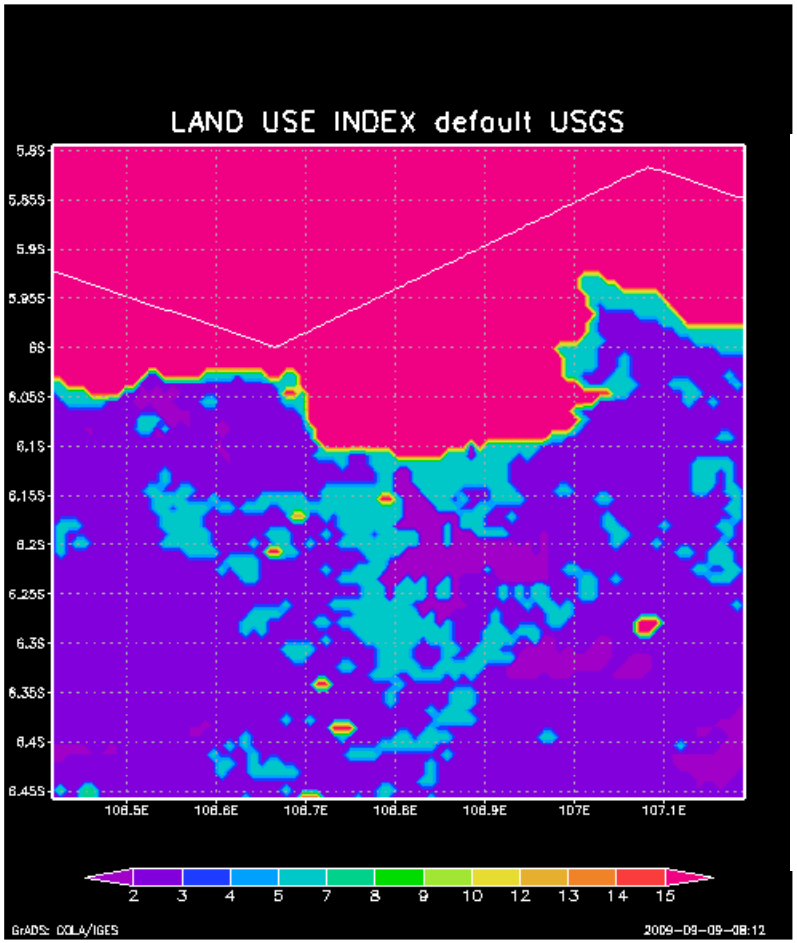
  1 node: Processor Dual core AMD1212 1GHz, Motherboard sata Raid, Memory DDR2 2GB, Hardisk SATA 500GB.
- OS: Redhat Enterprise Linux 5, Linux version 2.6.18-8.el5
- Compilers: Fortran 77
- Softwares: GrADS, NetCDF, HDF4, Matlab, Vis5D, MPICH2(PGI+GCC), Apache, Php, mySQL.

Urban Climate Modeling with landuse modification

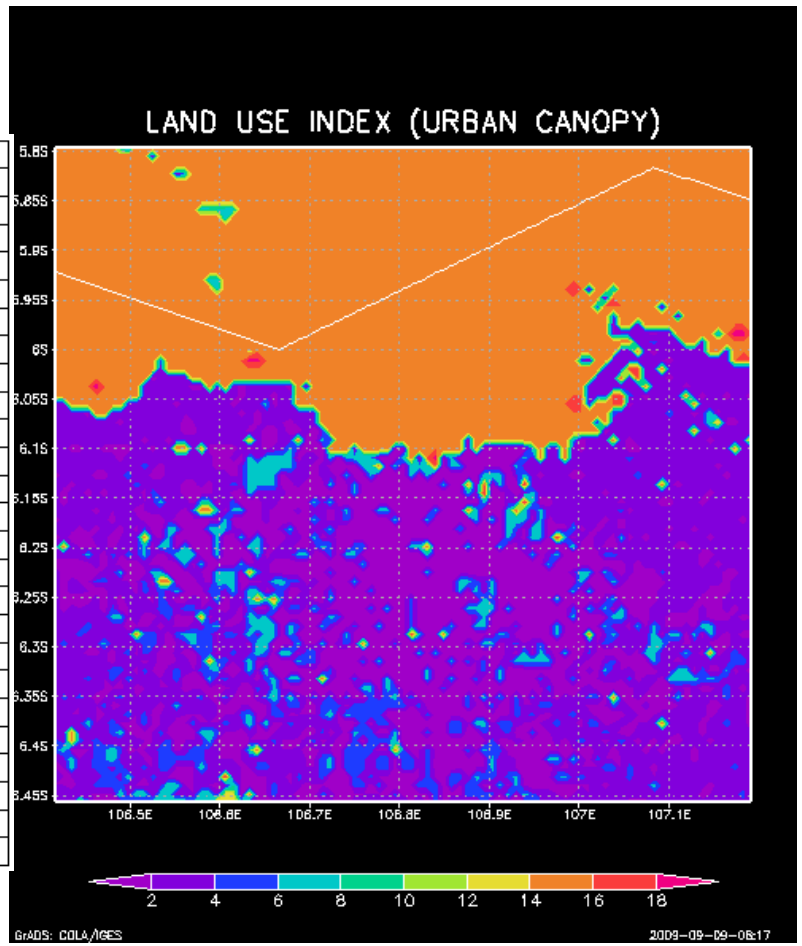




Comparison of Land Use USGS and Land Use from Urban Classification



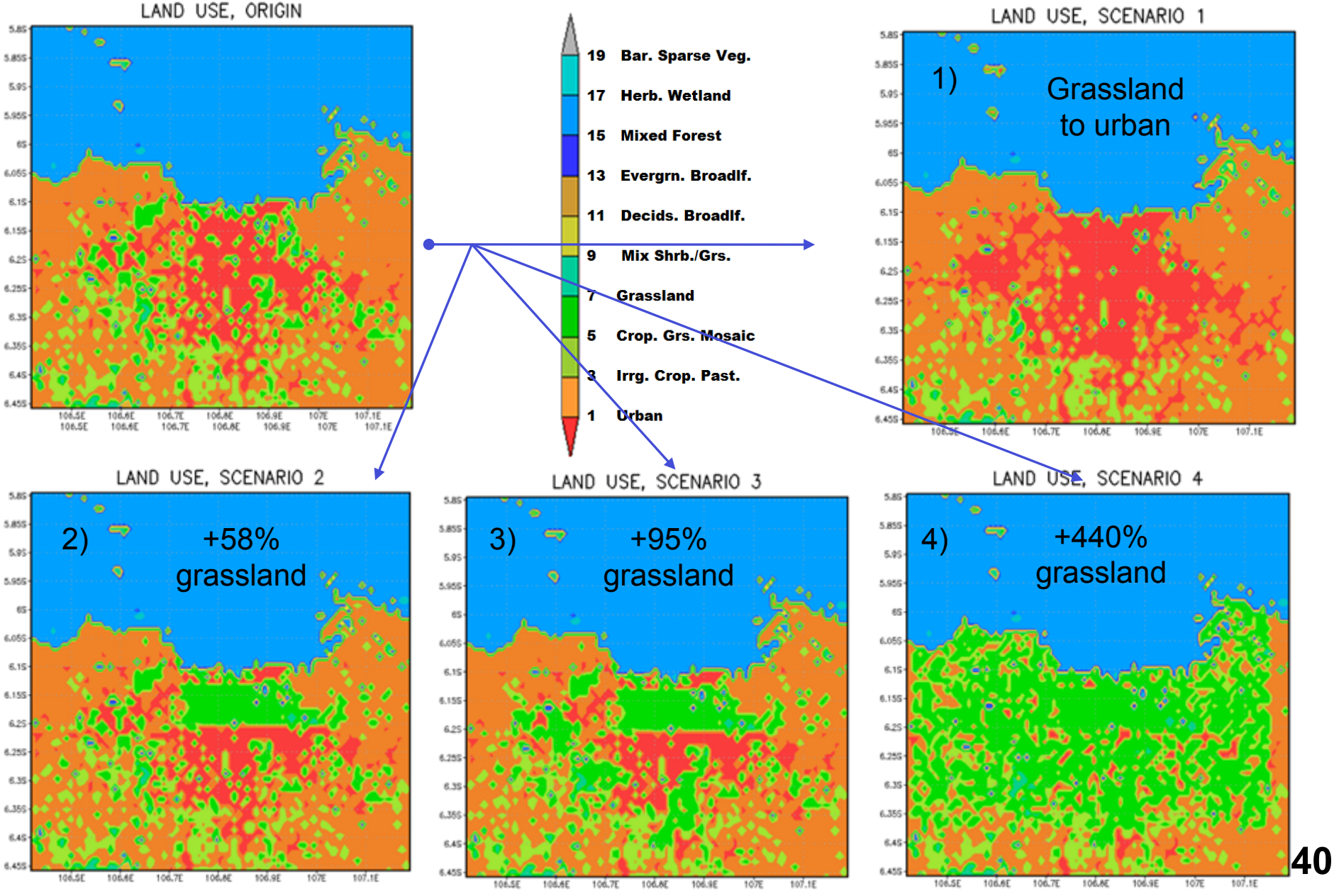
Index	Description
1	Urban
2	Dryland Crop. Past.
3	Irrg. Crop. Past.
4	Mix. Dry/Irrg.C.P.
5	Crop./Grs. Mosaic
6	Crop./Wood Mosc
7	Grassland
8	Shrubland
9	Mix Shrb./Grs.
10	Savanna
11	Decids. Broadlf.
12	Decids. Needlf.
13	Evergrn. Braodlf.
14	Evergrn. Needlf.
15	Mixed Forest
16	Water Bodies
17	Herb. Wetland
18	Wooded wetland
19	Bar. Sparse Veg.
20	Herb. Tundra
21	Wooden Tundra
22	Mixed Tundra
23	Bare Grnd. Tundra
24	Snow or Ice
25	No data



LU USGS (default)

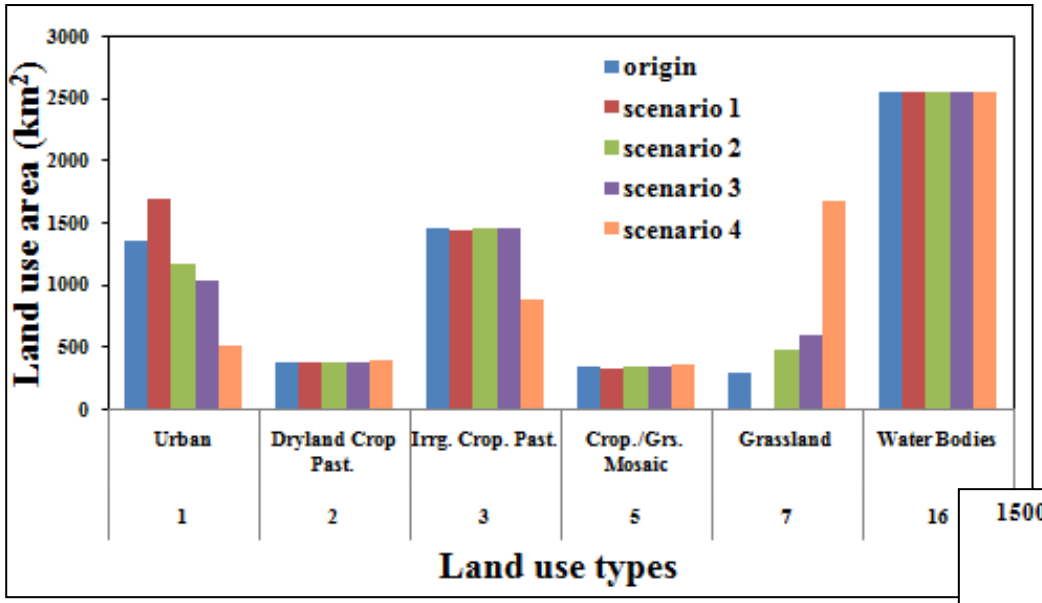
LU Reclassification using LU actual/origin

Modification of Landuse runs in Weather Research Forecast (WRF) model

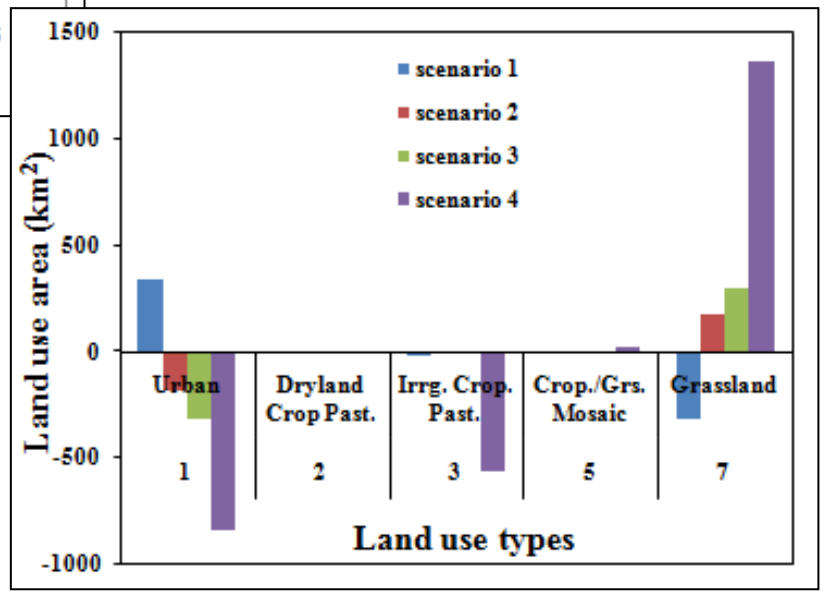


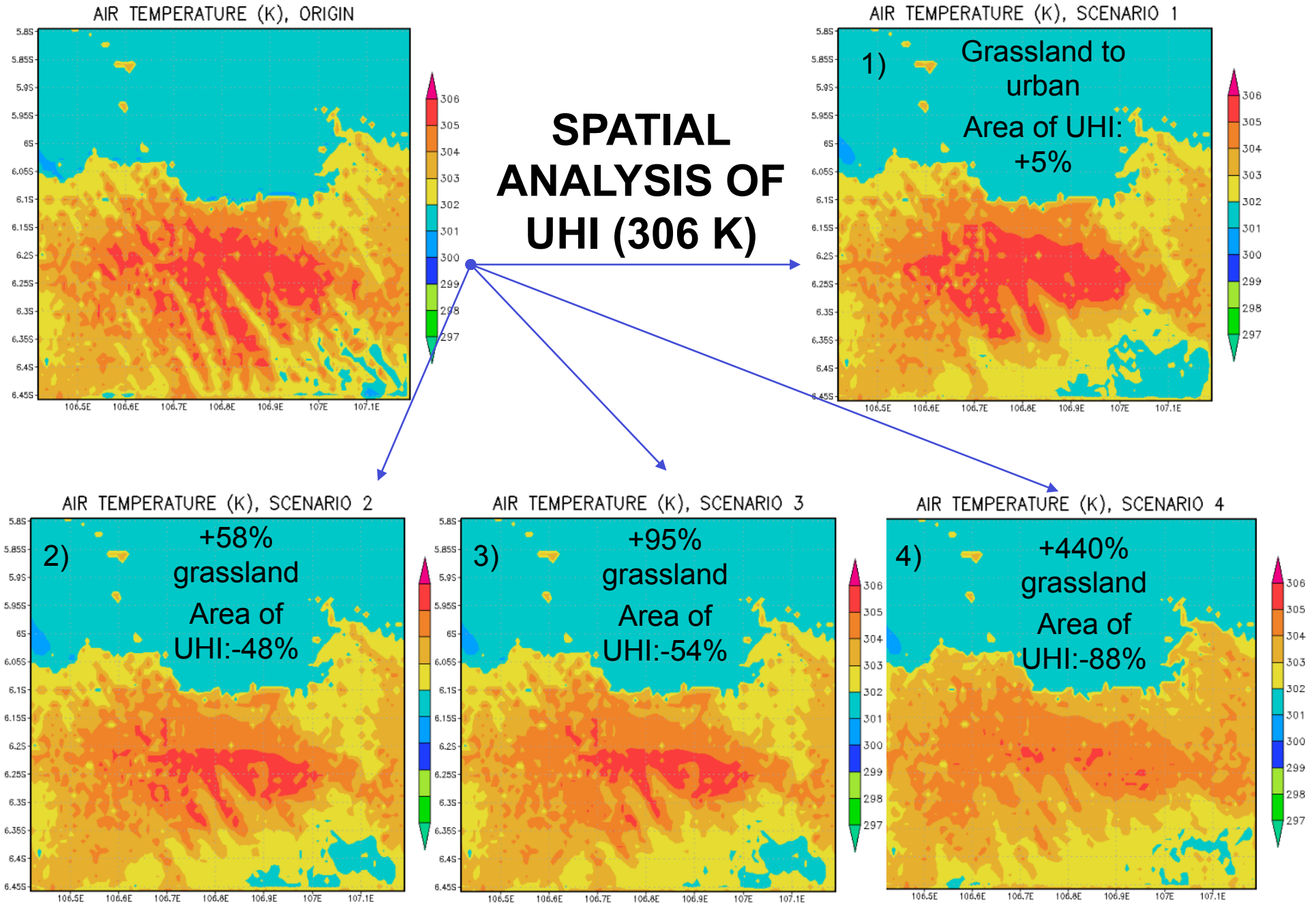
Statistical Analysis of Landuse

Land use before and after modification (km^2)



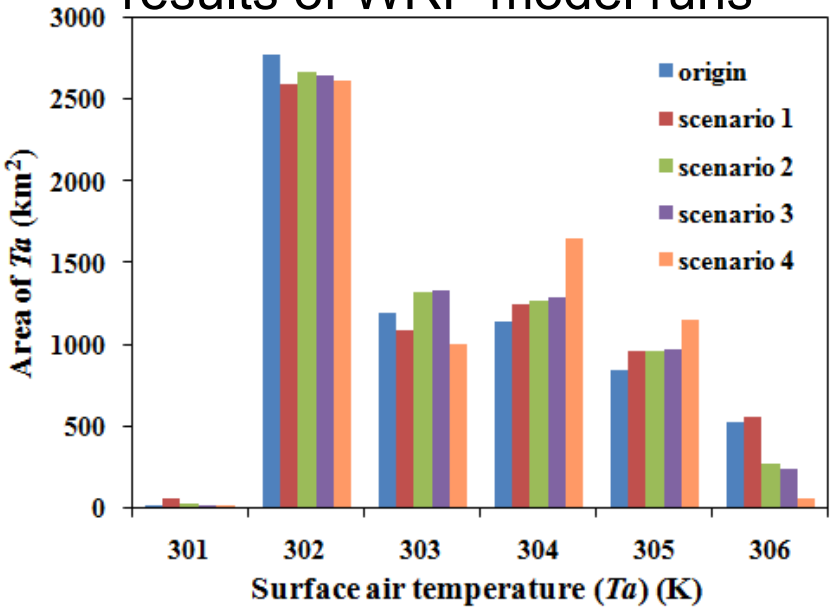
Land use changes of LU after modification (km^2)



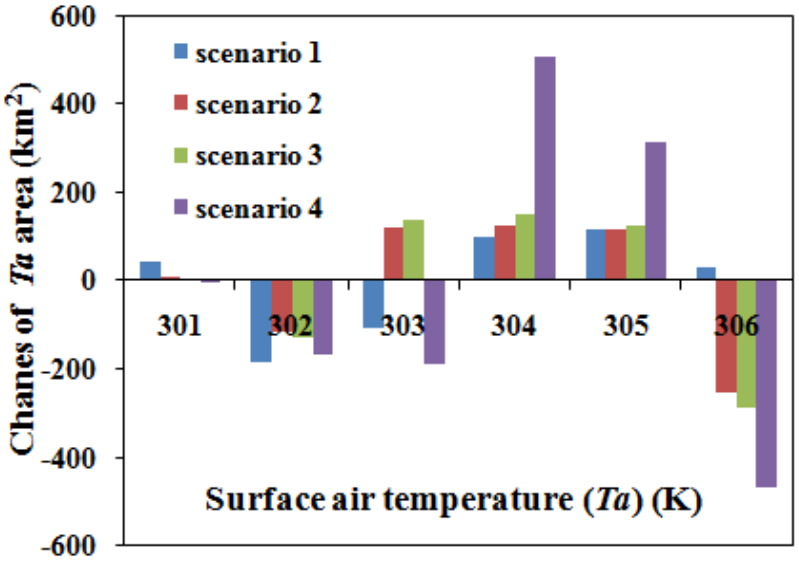

AIR TEMPERATURE (K), ORIGIN
AIR TEMPERATURE (K), SCENARIO 1
1)
Grassland to urban
Area of UHI: +5%
SPATIAL ANALYSIS OF UHI (306 K)
AIR TEMPERATURE (K), SCENARIO 2
2)
+58% grassland
Area of UHI:-48%
AIR TEMPERATURE (K), SCENARIO 3
3)
+95% grassland
Area of UHI:-54%
AIR TEMPERATURE (K), SCENARIO 4
4)
+440% grassland
Area of UHI:-88%
306
305
304
303
302
301
300
299
298
297

Statistical analysis of Air Temperature (Ta or T2m)

Distributions of *Ta* from the results of WRF model runs



The changes of *Ta* area after land use modification



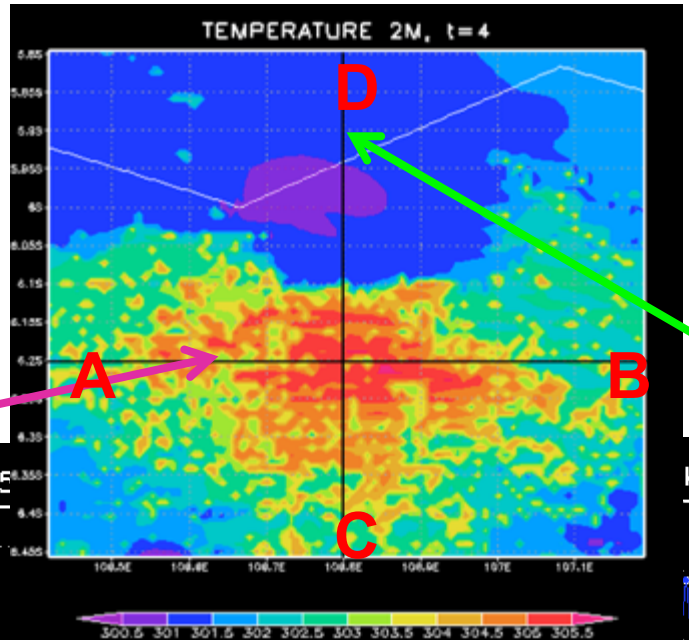
Ta (K)	scenario 1	scenario 2	scenario 3	scenario 4
301	226%	47%	16%	5%
302	-7%	-4%	-5%	-6%
303	-9%	10%	11%	-16%
304	9%	11%	13%	44%
305	14%	14%	15%	37%
306	5%	-48%	-54%	-88%

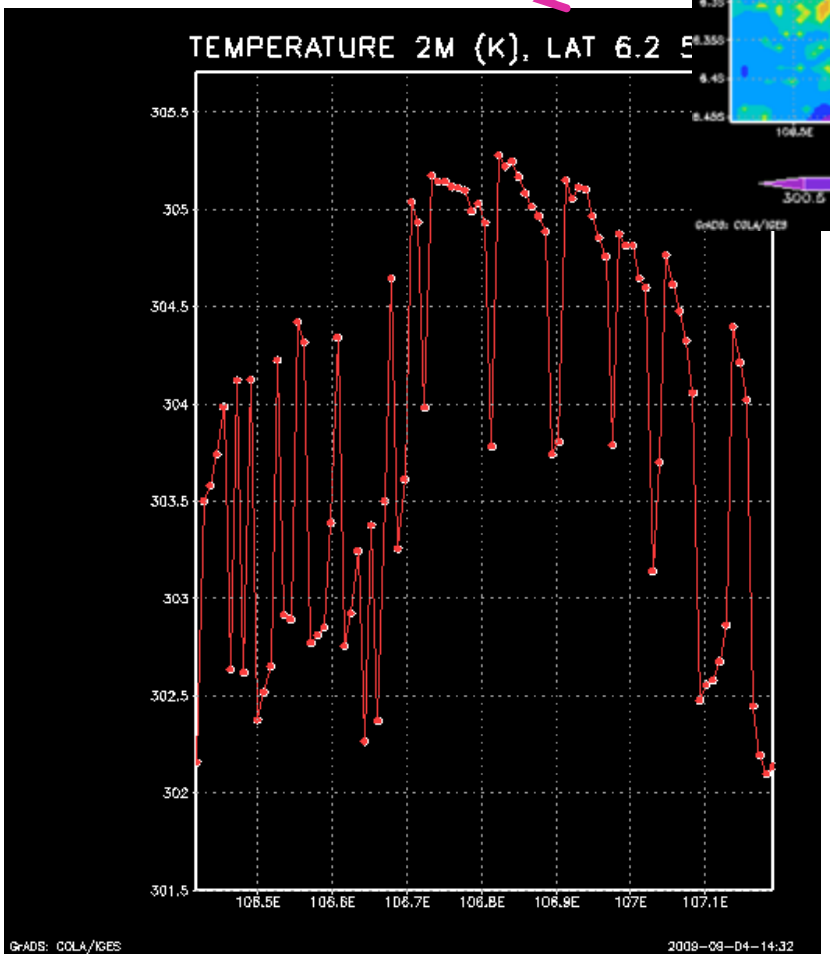
Changes of *Ta* area from origin in percentage

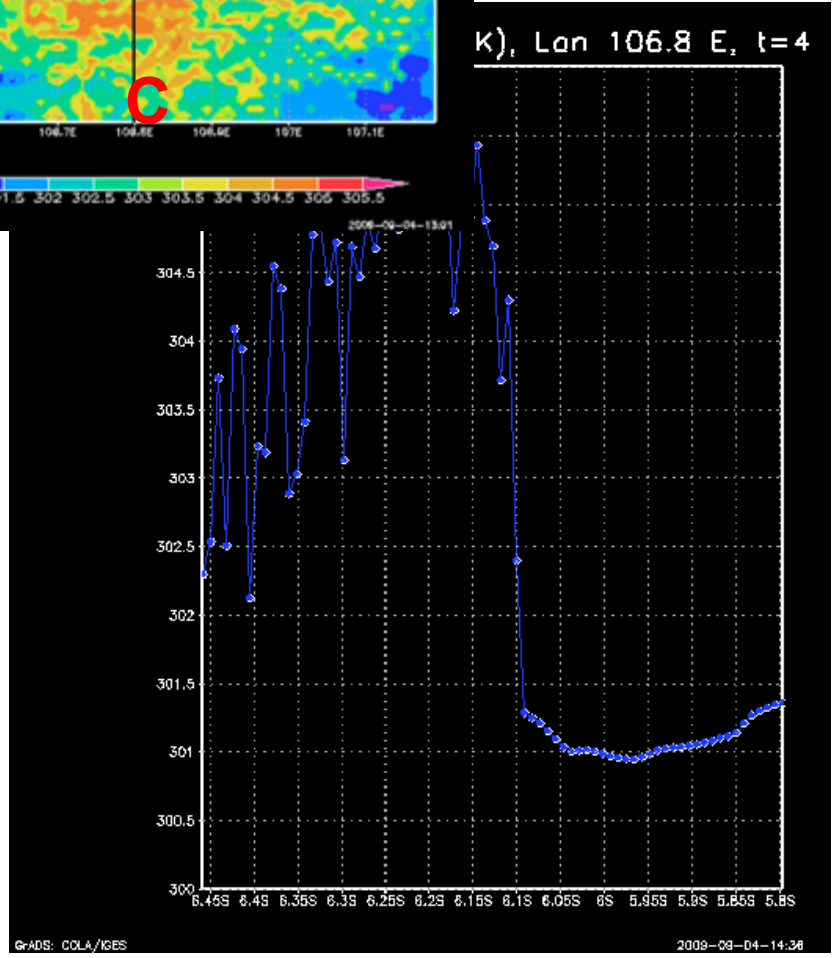
Cross section
of Ta (T2m)

A - B

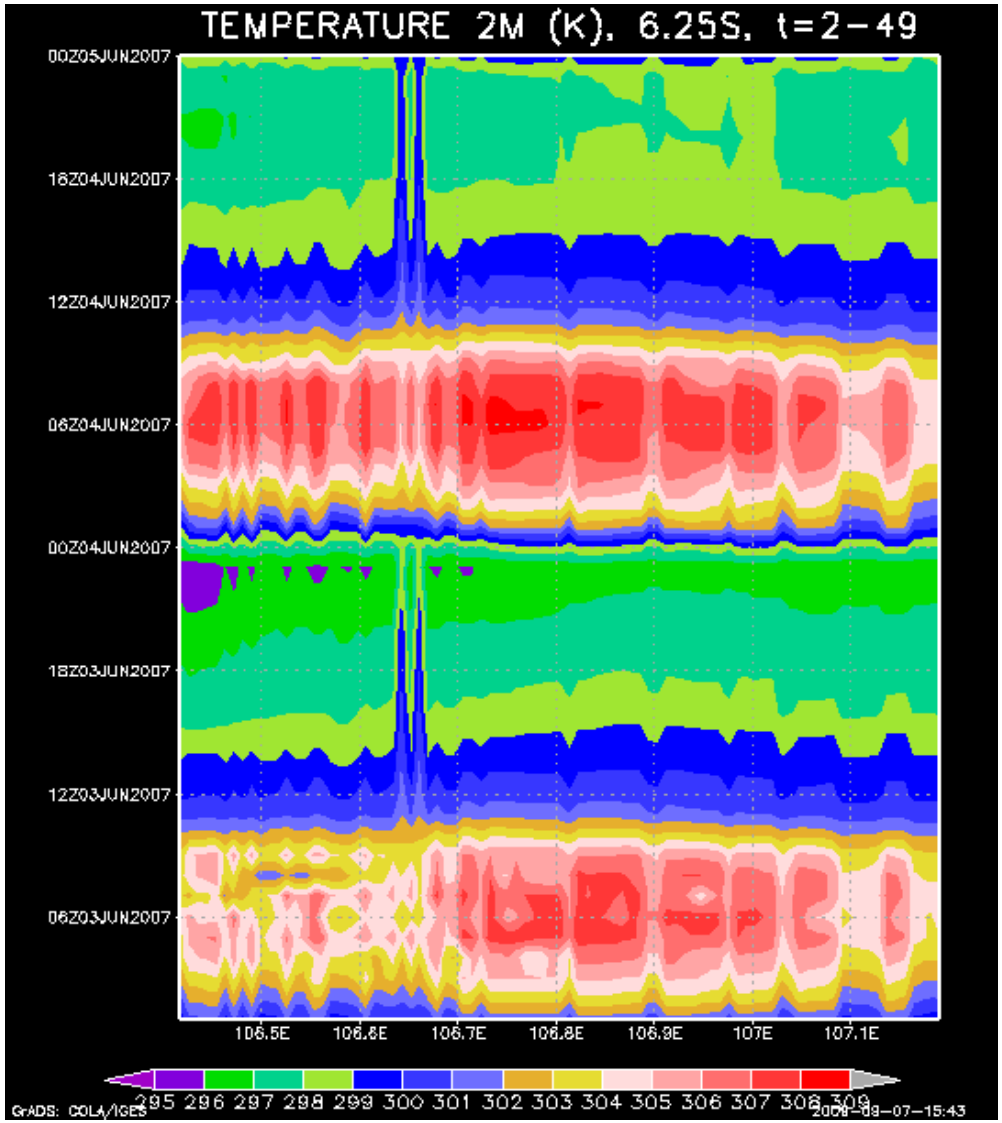
C - D



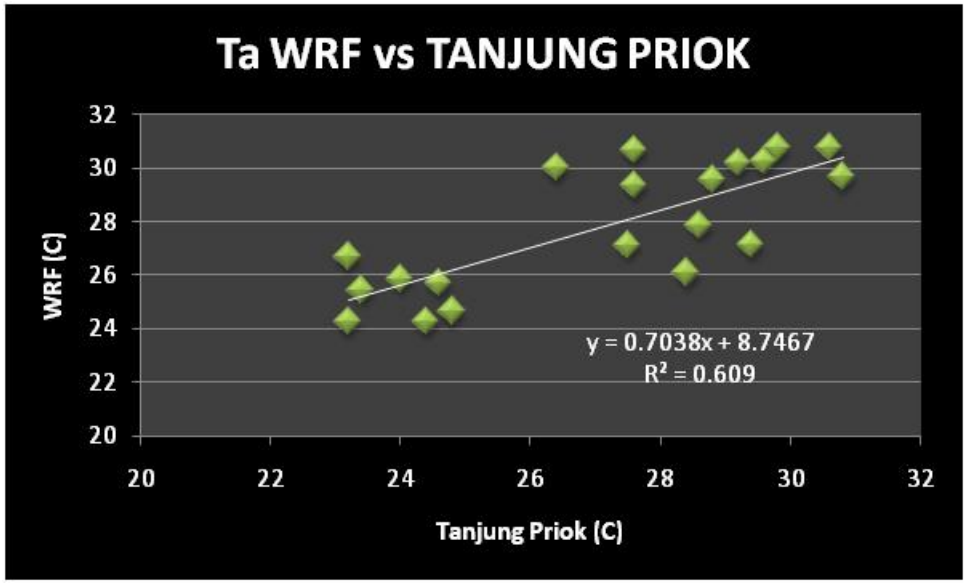


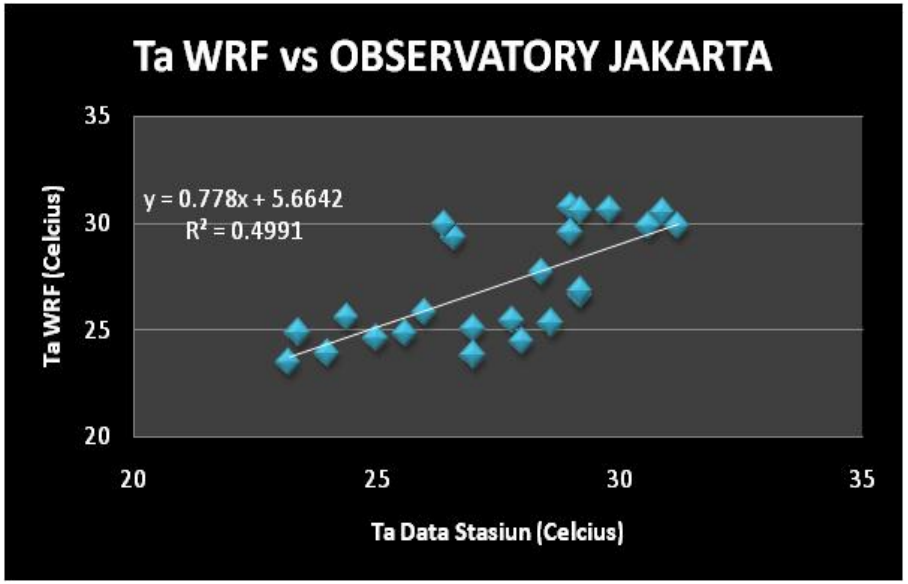


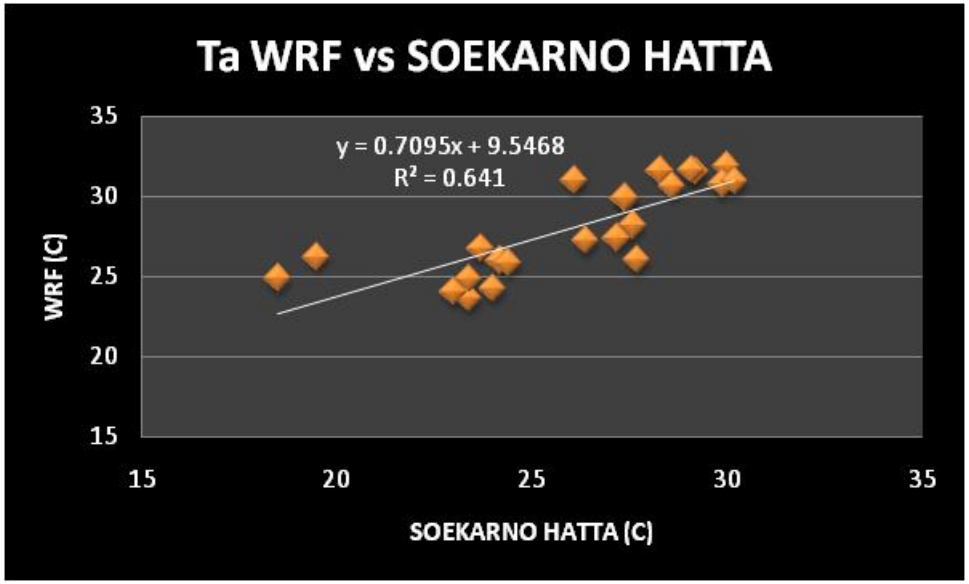
Air Temperature (UHI) (T2m) for 48 hours
WRF Model runs in 6.25 S (A-B) cross section



MODEL VALIDATION







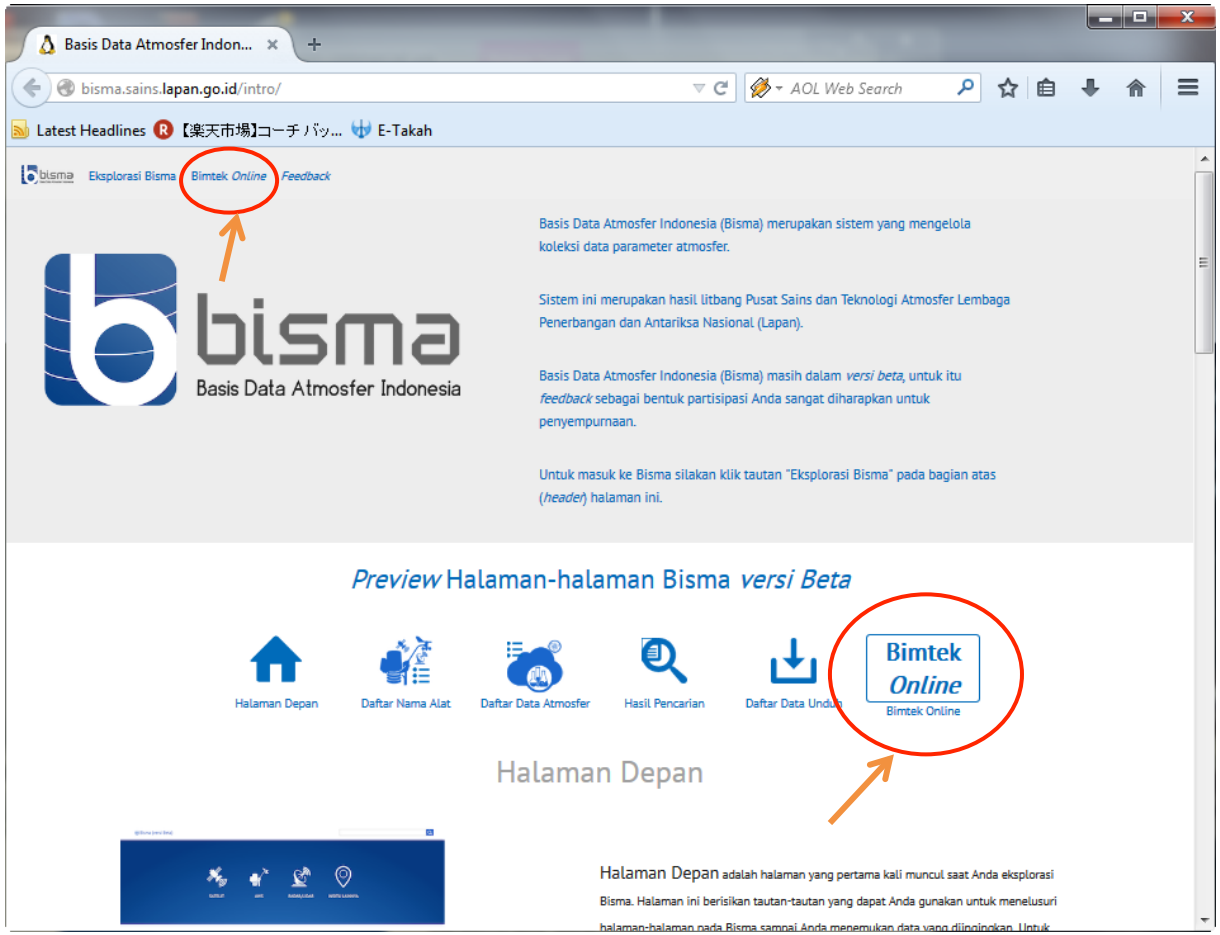
●Criteria of Correlation Coefficienti:

1. 0,00 – 0,20 : very weak
2. 0,21 – 0,40 : weak
3. 0,41 – 0,70 : strong
4. 0,71 – 0,90 : very strong
5. 0,91 – 0,99 : very very strong
6. 1,00 : perfect

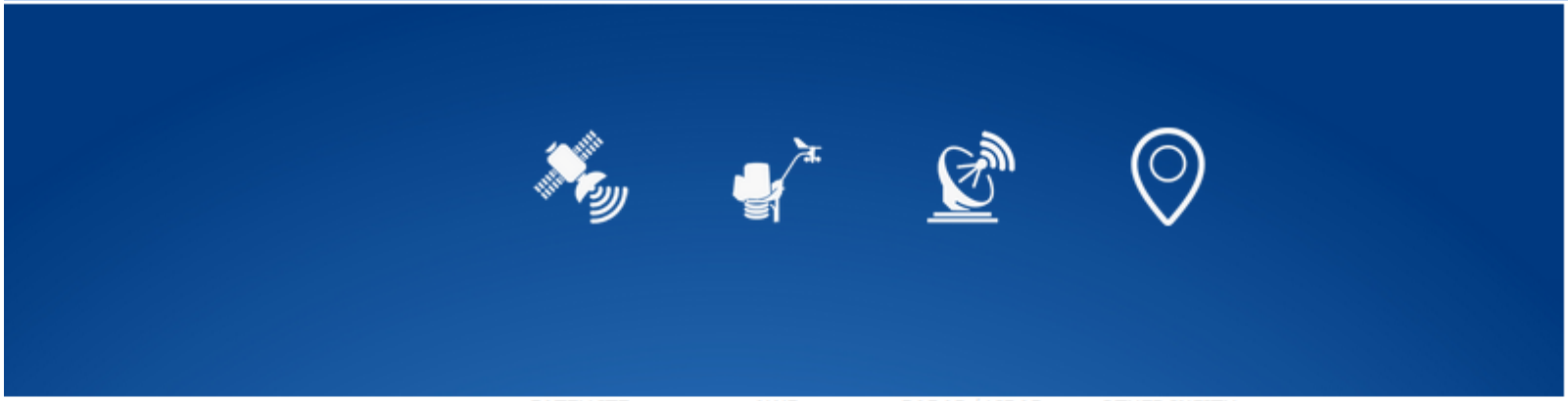
BASIS DATA ATMOSFER INDONESIA (BISMA)

[INDONESIAN ATMOSPHERIC DATABASE]

http://bisma.sains.lapan.go.id/



Bisma (Beta)



SATELLITE AWS RADAR / LIDAR OTHER INSITU

Parameters for Atmospheric Physics

Atmospheric Chemistry Parameters

SATELLITE

- MTSAT
- Aqua Pare Pare
- Terra Pare Pare
- Aqua Rumpin
- Terra Rumpin

AWS

- AWS Bandung
- AWS Watukosek
- AWS Pontianak
- AWS Kototabang
- AWS Tanjung Sari

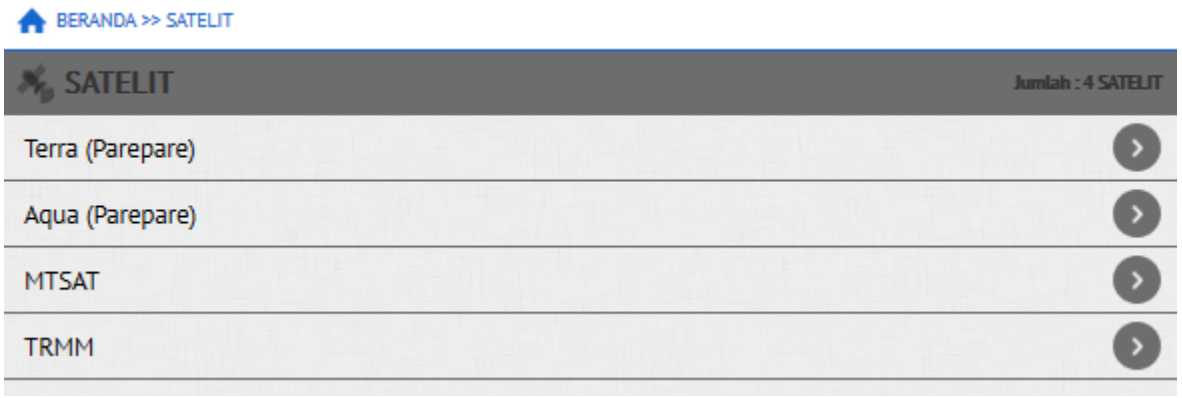
RADAR / LIDAR

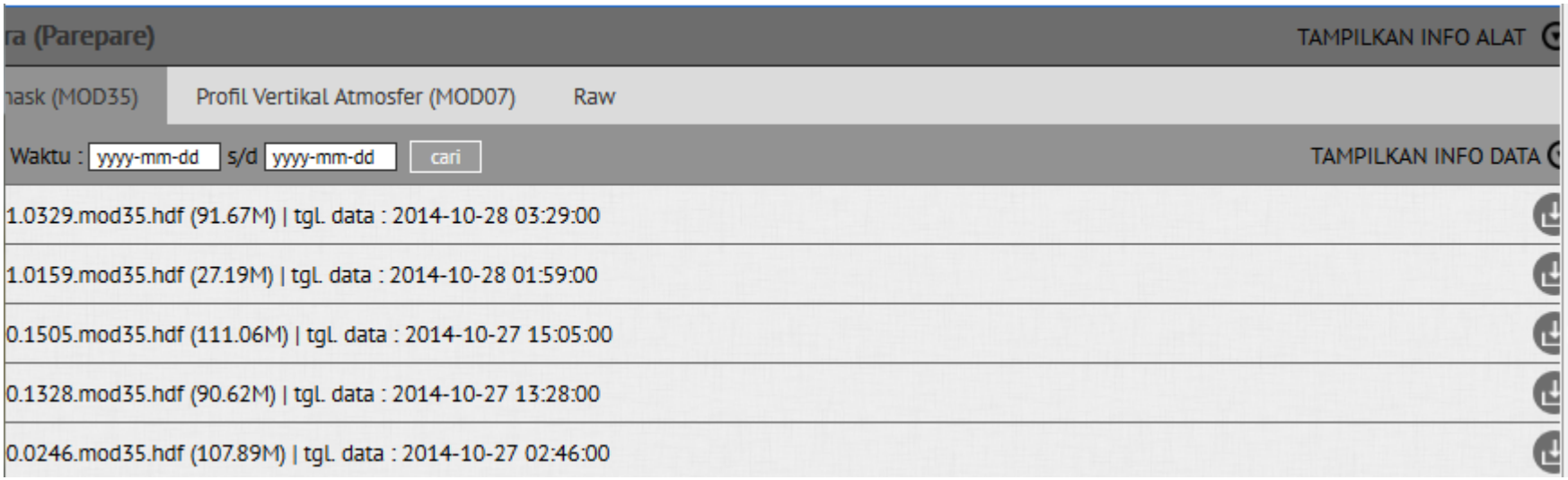
- Transforable Radar
- X-Band Radar Rain
- Equatorial Atmosphere Radar

OTHER INSITU

- AQMS
- Pyranometer
- Brewer
- Radiometer
- Microbarograph
- CO2

more >>


BERANDA >> SATELIT
SATELIT
Jumlah : 4 SATELIT
Terra (Parepare)
Aqua (Parepare)
MTSAT
TRMM


ra (Parepare)
TAMPILKAN INFO ALAT
nask (MOD35)
Profil Vertikal Atmosfer (MOD07)
Raw
Waktu : yyyy-mm-dd s/d yyyy-mm-dd cari
TAMPILKAN INFO DATA
1.0329.mod35.hdf (91.67M) | tgl. data : 2014-10-28 03:29:00
1.0159.mod35.hdf (27.19M) | tgl. data : 2014-10-28 01:59:00
0.1505.mod35.hdf (111.06M) | tgl. data : 2014-10-27 15:05:00
0.1328.mod35.hdf (90.62M) | tgl. data : 2014-10-27 13:28:00
0.0246.mod35.hdf (107.89M) | tgl. data : 2014-10-27 02:46:00

TRMM

TAMPILKAN INFO ALAT

Info Alat TRMM

Nama Sumber Data/Alat	TRMM
Deskripsi	Unduh dari ftp server trmm
Lokasi	-
Posisi Lintang	-
Posisi Bujur	-
Lembaga/Badan Pemilik	NASA
Tahun Mulai Beroperasi	-

Curah hujan (3B42RT)

Rentang Waktu : yyyy-mm-dd s/d yyyy-mm-dd cari

TAMPILKAN INFO DATA

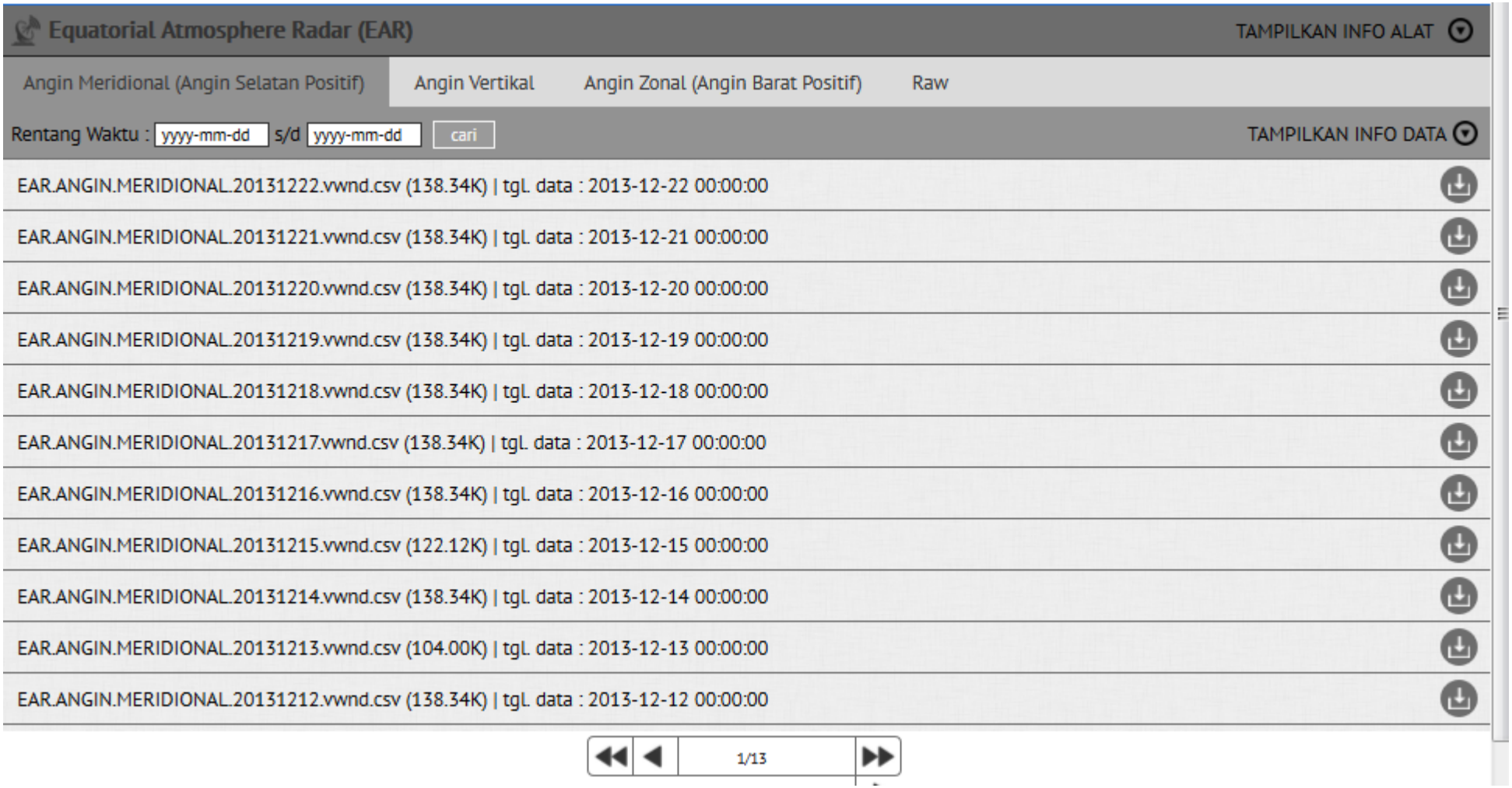
3B42RT.2014102821.7.bin.gz (231.81K) | tgl. data : 2014-10-28 21:00:00

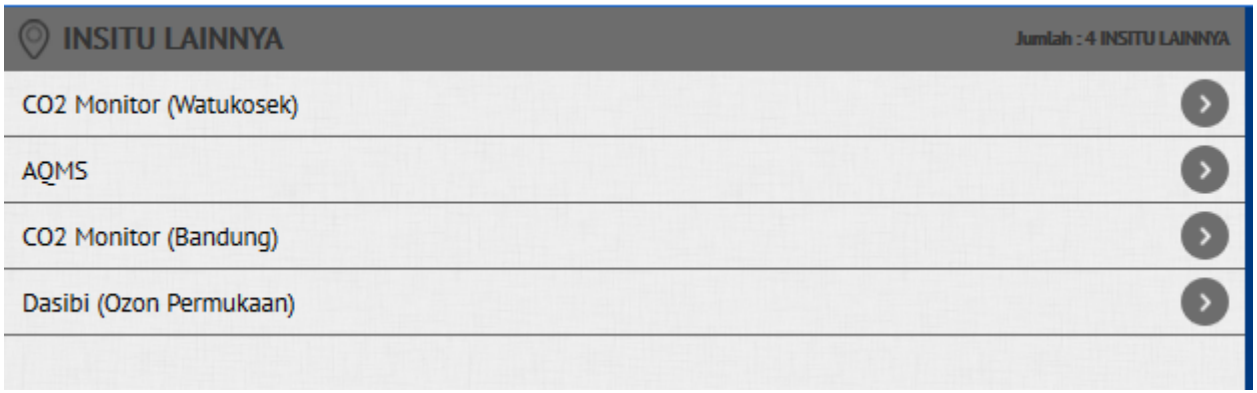
3B42RT.2014102818.7.bin.gz (243.14K) | tgl. data : 2014-10-28 18:00:00

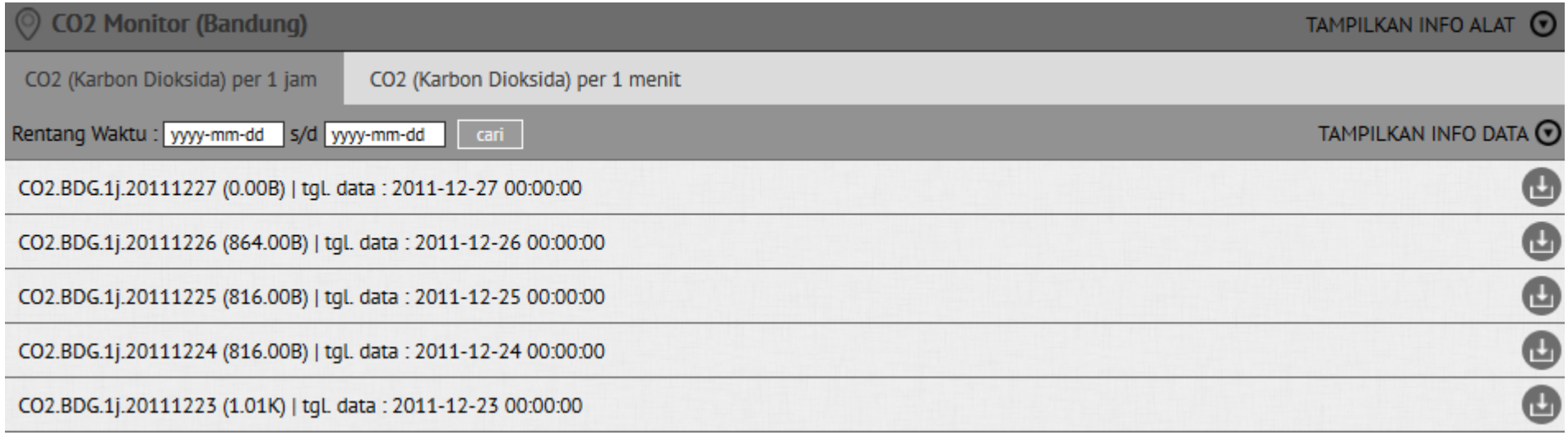
3B42RT.2014102815.7.bin.gz (232.49K) | tgl. data : 2014-10-28 15:00:00

3B42RT.2014102812.7.bin.gz (235.24K) | tgl. data : 2014-10-28 12:00:00


RADAR/LIDAR
Jumlah : 2 RADAR/LIDAR
Equatorial Atmosphere Radar (EAR)
Lidar (Kototabang)

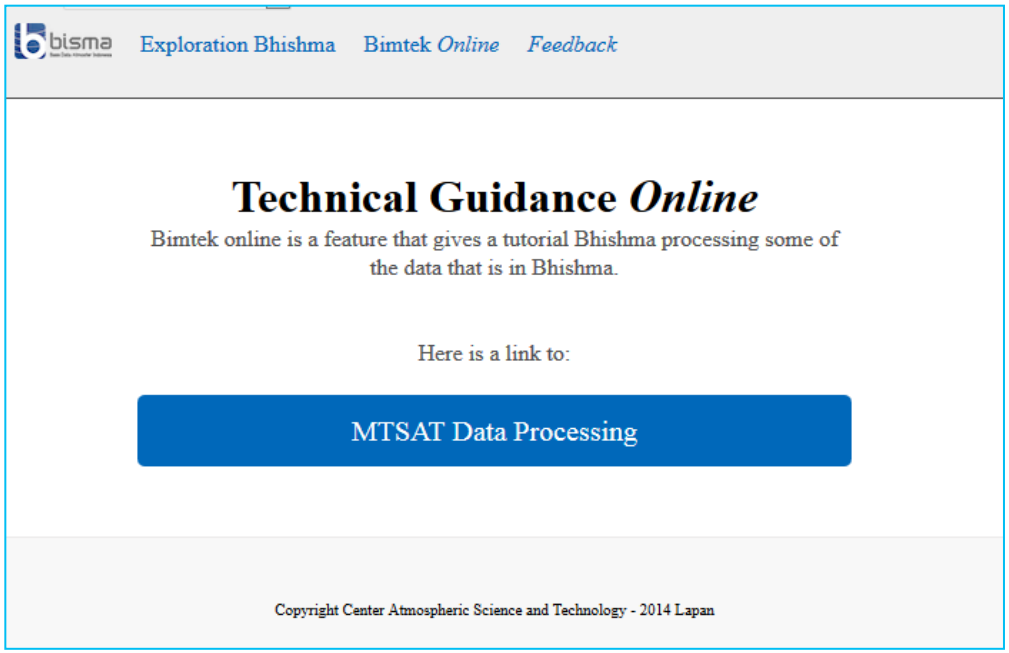

Equatorial Atmosphere Radar (EAR)
TAMPILKAN INFO ALAT
Angin Meridional (Angin Selatan Positif)
Angin Vertikal
Angin Zonal (Angin Barat Positif)
Raw
Rentang Waktu : yyyy-mm-dd s/d yyyy-mm-dd cari
TAMPILKAN INFO DATA
EAR.ANGIN.MERIDIONAL.20131222.vwnd.csv (138.34K) | tgl. data : 2013-12-22 00:00:00
EAR.ANGIN.MERIDIONAL.20131221.vwnd.csv (138.34K) | tgl. data : 2013-12-21 00:00:00
EAR.ANGIN.MERIDIONAL.20131220.vwnd.csv (138.34K) | tgl. data : 2013-12-20 00:00:00
EAR.ANGIN.MERIDIONAL.20131219.vwnd.csv (138.34K) | tgl. data : 2013-12-19 00:00:00
EAR.ANGIN.MERIDIONAL.20131218.vwnd.csv (138.34K) | tgl. data : 2013-12-18 00:00:00
EAR.ANGIN.MERIDIONAL.20131217.vwnd.csv (138.34K) | tgl. data : 2013-12-17 00:00:00
EAR.ANGIN.MERIDIONAL.20131216.vwnd.csv (138.34K) | tgl. data : 2013-12-16 00:00:00
EAR.ANGIN.MERIDIONAL.20131215.vwnd.csv (122.12K) | tgl. data : 2013-12-15 00:00:00
EAR.ANGIN.MERIDIONAL.20131214.vwnd.csv (138.34K) | tgl. data : 2013-12-14 00:00:00
EAR.ANGIN.MERIDIONAL.20131213.vwnd.csv (104.00K) | tgl. data : 2013-12-13 00:00:00
EAR.ANGIN.MERIDIONAL.20131212.vwnd.csv (138.34K) | tgl. data : 2013-12-12 00:00:00
1/13

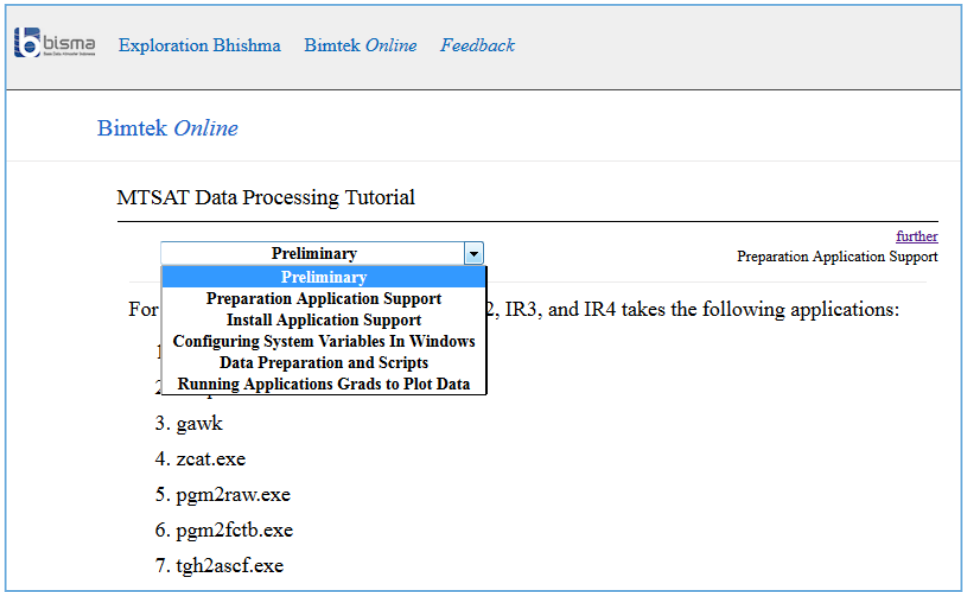

INSITU LAINNYA
Jumlah : 4 INSITU LAINNYA
CO2 Monitor (Watukosek)
AQMS
CO2 Monitor (Bandung)
Dasibi (Ozon Permukaan)

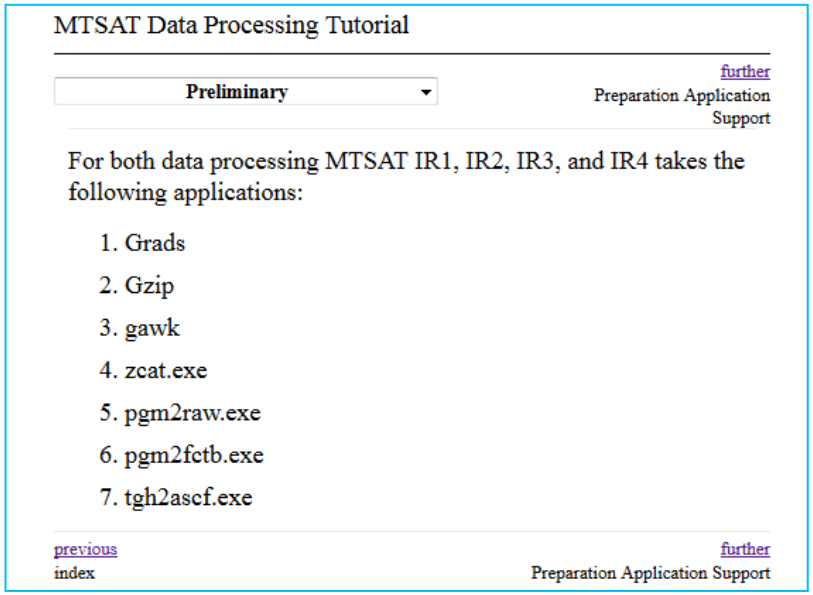

CO2 Monitor (Bandung)
TAMPILKAN INFO ALAT
CO2 (Karbon Dioksida) per 1 jam
CO2 (Karbon Dioksida) per 1 menit
Rentang Waktu : yyyy-mm-dd s/d yyyy-mm-dd cari
TAMPILKAN INFO DATA
CO2.BDG.1j.20111227 (0.00B) | tgl. data : 2011-12-27 00:00:00
CO2.BDG.1j.20111226 (864.00B) | tgl. data : 2011-12-26 00:00:00
CO2.BDG.1j.20111225 (816.00B) | tgl. data : 2011-12-25 00:00:00
CO2.BDG.1j.20111224 (816.00B) | tgl. data : 2011-12-24 00:00:00
CO2.BDG.1j.20111223 (1.01K) | tgl. data : 2011-12-23 00:00:00


Bisma (versi Beta)
Parameter Fisika Atmosfer
Parameter Kimia Atmosfer
Visible
Data hasil pengukuran dari alat MTSAT
Profil Vertikal Atmosfer (MOD07)
Data hasil pengukuran dari alat Terra (Parepare)
Profil Vertikal Atmosfer (MOD07)
Data hasil pengukuran dari alat Aqua (Parepare)
IR4
Data hasil pengukuran dari alat MTSAT
IR3
Data hasil pengukuran dari alat MTSAT
IR2
Data hasil pengukuran dari alat MTSAT
IR1
Data hasil pengukuran dari alat MTSAT
Data AWS (Temperatur, Curah Hujan, Angin, UV, Radiasi Matahari)
Data hasil pengukuran dari alat AWS (Tanjung Sari)
Data AWS (Temperatur, Curah Hujan, Angin, UV, Radiasi Matahari)
Data hasil pengukuran dari alat AWS (Bandung)
Curah hujan (3B42RT)
Data hasil pengukuran dari alat TRMM


Parameter Fisika Atmosfer
Parameter Kimia Atmosfer
O3 (Ozon) Permukaan
Data hasil pengukuran dari alat Dasibi (Ozon Permukaan)
Data AQMS (CH4, NMHC, THC, CO, NO, NO2, NOx, O3, SO2, PM10) per 30 Menit
Data hasil pengukuran dari alat AQMS
Data AQMS (CH4, NMHC, THC, CO, NO, NO2, NOx, O3, SO2, PM10) per 3 menit
Data hasil pengukuran dari alat AQMS
CO2 (Karbon Dioksida) per 1 jam
Data hasil pengukuran dari alat CO2 Monitor (Bandung)
CO2 (Karbon Dioksida)
Data hasil pengukuran dari alat CO2 Monitor (Watukosek)


bisma
Exploration Bhishma
Bimtek Online
Feedback
Technical Guidance Online
Bimtek online is a feature that gives a tutorial Bhishma processing some of the data that is in Bhishma.
Here is a link to:
MTSAT Data Processing
Copyright Center Atmospheric Science and Technology - 2014 Lapan


bisma
Exploration Bhishma
Bimtek Online
Feedback
Bimtek Online
MTSAT Data Processing Tutorial
Preliminary
Preliminary
Preparation Application Support
Install Application Support
Configuring System Variables In Windows
Data Preparation and Scripts
Running Applications Grads to Plot Data
further
Preparation Application Support
For
2, IR3, and IR4 takes the following applications:
3. gawk
4. zcat.exe
5. pgm2raw.exe
6. pgm2fctb.exe
7. tgh2ascf.exe


MTSAT Data Processing Tutorial
Preliminary
further
Preparation Application Support
For both data processing MTSAT IR1, IR2, IR3, and IR4 takes the following applications:
1. Grads
2. Gzip
3. gawk
4. zcat.exe
5. pgm2raw.exe
6. pgm2fctb.exe
7. tgh2ascf.exe
previous
index
further
Preparation Application Support

MTSAT Data Processing Tutorial

previous
Preliminary

Preparation Application Support

further
Install Application Support

Please download the application support for MTSAT data processing, by clicking the link below:

1. Grads
2. Gzip
3. gawk
4. zcat.exe
5. pgm2raw.exe
6. pgm2fctb.exe
7. tgh2ascf.exe

MTSAT Data Processing Tutorial

previous
Preparation Application Support

Install Application Support

further
Configuring *System Variables* In Windows

When finished downloading the required application, the next is doing the install for each application.

1. **Install Applications Grads**

   To install the application for Men- grads please *double click* the downloaded *installer* with filename "grads-2.0.a4.oga.1.win32_superpack.exe". And follow the instructions provided when installing. No special configuration is done during install, you just need to press the *next* button and *finish*. Ensure grads applications stored in the directory C: \ GrADS20 *(default setting)*

2. **Install Applications GZIP**

   To install the application for Men- gzip please *double click* the downloaded *installer* with the file name "gzip-1.3.12-1-setup.exe". And follow the instructions provided when installing. No special configuration is done during install, you just need to press the *next* button and *finish*.

3. **Install Applications gawk**

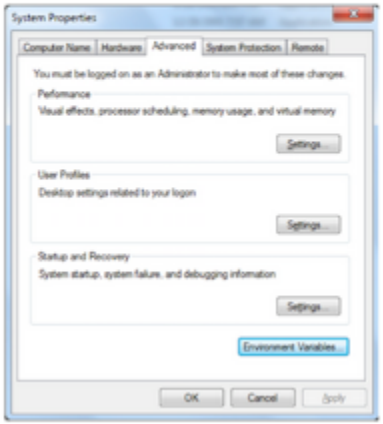
   Same thing with installing GZIP, To install gawk application for Men- please *double click* the downloaded *installer* with filename "gawk-3.1.6-1-setup.exe". And follow the instructions provided when installing. No special configuration is done during install, you just need to press the *next* button and *finish*.

4. ***Copy* and *Paste* zcat.exe, pgm2raw.exe, pgm2fctb.exe, tgh2ascf.exe, tail.exe**

   Create a folder in C: \ with the name PelatihanMTSAT and create folders within folders PelatihanMTSAT support. *Copy* and *Paste* application with the file name "zcat.exe", "pgm2raw.exe", "pgm2fctb.exe", "tgh2ascf.exe", "tail .exe "to the folder C: \ PelatihanMTSAT \ support \ that was created earlier.

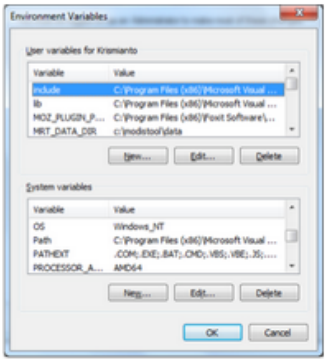
To be able to support applications MTSAT data processing, first need to configure the Windows *system variables*, ie adding the *path* of supporting applications that are stored in the directory C: \ PelatihanMTSAT \ support. Here are the steps:

1. right-click My Computer and select Properties
2. System Properties window will appear and select Advanced system settings.
3. Select the Advanced tab as shown below

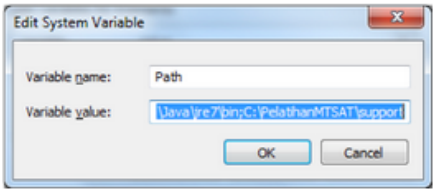


4. Click the Environment Variables button ...

5. Environment Variables window will appear.



6. In the System Variables, find the variable in the Variable column named Path, select it and click the Edit button.
7. It would appear form the Edit System Variables. There are two (2) input as shown.



8. Edit Variable value add the final section; C: \ PelatihanMTSAT \ support (note the semicolon (;)), and click the OK button.
9. Press the OK button in the Environment Variables window.
10. Press the OK button on the System Properties window.

In this tutorial MTSAT IR1 will process data at 00 UTC 2012-01-01 date. To get started please follow the steps below:

1. Create a directory with the name of "if" in the directory C: \ PelatihanMTSAT, and in the directory "if" create a directory "IR1".
2. Download and save the file MTIR1_2012010100.pgm.gz to the directory C: \ PelatihanMTSAT \ if \ IR1
3. Download and save the file MTS212050908CAL.dat.gz to the directory C: \ PelatihanMTSAT \ if
4. Open the application editor (notepad), copy and paste the script below:

```
echo off
set _pgmfile = MTIR1_2012010100.pgm
set _calfile = IR1CAL.dat
gzip -dc C: \ PelatihanMTSAT \ if \ IR1 \ MTIR1_2012010100.pgm.gz>% _pgmfile%
zcat C: \ PelatihanMTSAT \ if \ MTS212050908CAL.dat.gz | awk -F "/ IR1 Temperature / {print $ 2} '>% _calfile%
```

   save the script with the name "mtsatread1.bat" to the directory C: \ PelatihanMTSAT \ though, **make sure the Save As Type option is set to All files**

5. Open the application editor (notepad), copy and paste the script below:

```
pgm2raw.exe MTIR1_2012010100.pgm IR1cal.txt
```

   save the script with the name "pgm2raw.bat" to the directory C: \ PelatihanMTSAT \ though, **make sure the Save As Type option is set to All files**

6. Run the second script by double clicking the file "mtstaread1.bat" and then run "pgm2raw.bat".
7. After running "mtsatread1.bat", in direktrori C: \ PelatihanMTSAT \ if it will appear two files named "IR1CAL.dat", and "MTIR1_2012010100.pgm"
8. After running the script "pgm2raw.bat", in direktrori C: \ PelatihanMTSAT \ will appear if a file with the name "TB2001_2012010100.raw"

To perform a data plot with Grads, be prepared ctlnya files. Here are the steps to create a file ctl

1. Open the application editor (notepad), copy and paste the script below

```
yrev template options
DSET C: \ PelatihanMTSAT \ if \ TB2001_2012010100.raw
TITLE TBB
Undef -999
XDEF LINEAR 70 025 2800 0:05
YDEF 2800 0:05 -69 975 LINEAR
Linear ZDEF 1 1 1
TDEF 24 LINEAR 00z01Jan12 1d
VARS 1
IR1 0 -1,40,1 (kelvin)
ENDVARS
```

save the script with the file name "pelatihanmtsat.ctl" and stored in the directory C: \ GraDS20 \ data, **make sure the Save As Type option is set to All files.**

2. Run the program by clicking Grads

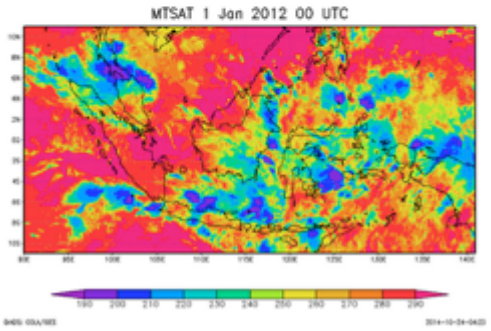
   Start -> All Programs -> Grads 2.0 -> Grads

   It would appear the two (2) new window. The first window is the place to give orders, and the 2nd is the window to display the results of the plot

3. Type in the first window: *open pelatihanmtsat.ctl and press the enter key*
4. Then type: *set gxout hires and press the enter key*
5. Then type: *cxmoot set on and press the enter key*
6. Then type: *set lat -11 11 and press the enter key*
7. Then type: *set lon 90 141 and press the enter key*
8. Then type: *d IR1 * 100 and press the enter key*
9. Then type: *cbarn and press the enter key*
10. Then type: *title draw MTSAT IR1 January 1, 2012 00 UTC and press the enter key*
11. To save the plot in the form of images with extension "PNG", type: *printim C: \ PelatihanMTSAT \ if \ mtsat_ir1_1jan201200utc.png png white and press the enter key*

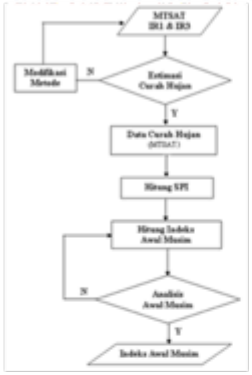
    images that are stored with the file name mtsat_ir1_1jan201200utc.png.

    The result will be as shown below:



PREDICTION OF EARLY RAINY SEASON AND WET SEASON BASE ON SATELLITE DATA

Penentuan Awal Musim dari satelit MTSAT dan Data Grid SPI dari satelit MTSAT



Metode SPI :

$$SPI = \frac{x_i - \bar{x}_i}{\sigma}$$

dimana
X_i= curah hujan bulan ke i,
X_i bar = curah hujan rata-rata periode tertentu
σ = standart deviasi periode tertentu.

Nilai SPI : transformasi dari distribusi gamma G(x) menjadi standar normal

VALIDASI

Validasi data dilakukan dengan cara membandingkan kualitas data dengan menggunakan parameter statistika antara lain :

- koefisien korelasi,
- koefisien determinasi,
- RMSE,
- Bias,
- MAE
- STDEV.

$$r_{x,h} = \frac{\sum_n (y_i - \bar{y})(\hat{y} - \bar{\hat{y}})}{\sqrt{\sum_n (y_i - \bar{y}_i)^2}\sqrt{\sum_n (\hat{y}_i - \bar{\hat{y}}_i)^2}}$$

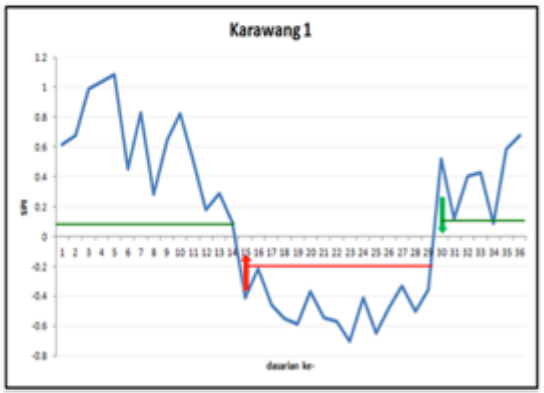
$$BIAS = \frac{1}{n}\sum_{i=1}^{n}(E_i - O_i)$$

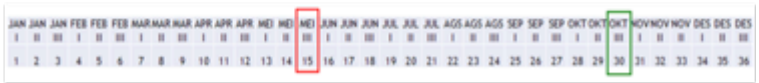
$$MAE = \frac{1}{n}\sum_{i=1}^{n}|(E_i - O_i)|$$

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(E_i - O_i)^2}$$

dimana Ei adalah nilai estimasi di sebuah stasiun pada hari tertentu, Oi adalah yang diamati atau pengukuran dan n adalah jumlah data yang dianalisis.

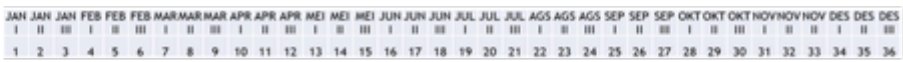
Normal AMK & AMH berdasarkan TRMM di Jabar





Normal MK & MH, PMK & PMH Berdasarkan SPI TRMM di Jabar

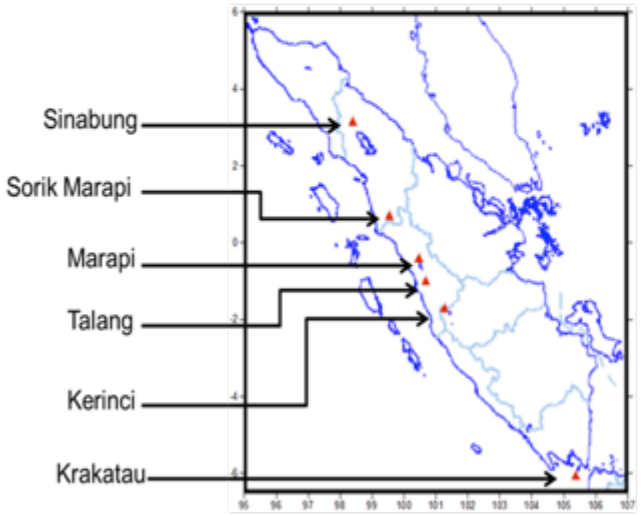
No.	Kaupaten	Posisi Grid Data	Posisi Bujur (BT)	Posisi Lintang (LS)	Rata-rata MK (dasarian ke-)	Panjang MK (dasarian)	Rata-rata MH (dasarian ke-)	Panjang MH (dasarian)
(1)	(2)	(3)	(4)	(5)	(7)	(8)	(7)	(8)
1	Bekasi 1	175-429	107.13	-6.38	15-29	15	30-14	21
2	Bekasi 2	176-429	107.13	-6.13	15-29	15	30-14	21
3	Karawang 1	175-430	107.38	-6.38	15-29	15	30-14	21
4	Karawang 2	176-430	107.38	-6.13	15-29	15	30-14	21
5	Subang 1	175-431	107.63	-6.38	15-29	15	30-14	21
6	Subang 2	175-432	107.88	-6.38	15-31	17	32-14	19
7	Subang 3	174-431	107.63	-6.63	15-29	15	30-14	21
8	Indramayu 1	175-433	108.13	-6.38	14-31	18	32-13	18
9	Indramayu 2	175-434	108.38	-6.38	15-31	18	32-14	18
10	Cirebon 1	174-434	108.38	-6.63	14-31	18	32-13	18
11	Cirebon 2	173-435	108.63	-6.88	14-31	18	32-13	18
12	Cianjur 3	173-429	107.13	-6.88	15-29	15	30-14	21
13	Cianjur 1	172-429	107.13	-7.13	15-29	15	30-14	21
14	Cianjur 2	171-429	107.13	-7.38	15-29	15	30-14	21
15	Purwakarta	174-430	107.38	-6.63	15-29	15	30-14	21
16	Sumedang 1	173-432	107.88	-6.88	15-31	18	32-14	18
17	Sumedang 2	173-433	108.13	-6.88	15-29	15	30-14	21
18	Majalengka 1	174-433	108.13	-6.63	15-29	15	30-14	21



Satellite Disaster Early Warning System (SADEWA)

SO_2 GAS DISTRIBUTION and Emission Particulate of Sinabung Mountain in Sumatera

Domain penelitian

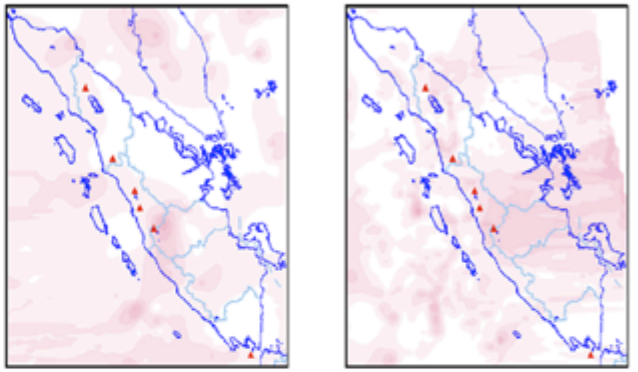


Sinabung

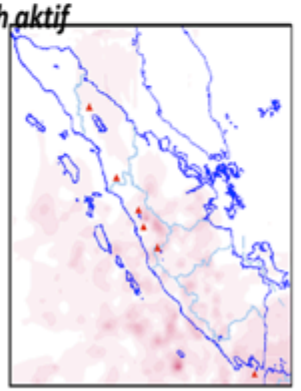
Hari aktif

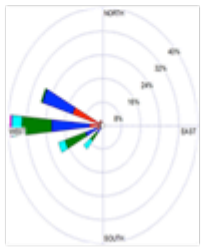
Tidak ada kenaikan SO_2 yang tinggi dalam domain yang diduga berasal dari Sinabung→ maksimum SO_2 di luar domain/ emisi SO_2 kecil

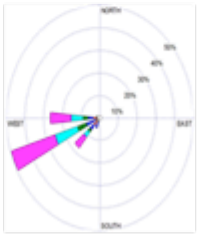
Hari sebelum aktif

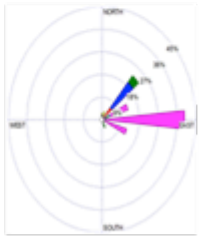


Hari setelah aktif



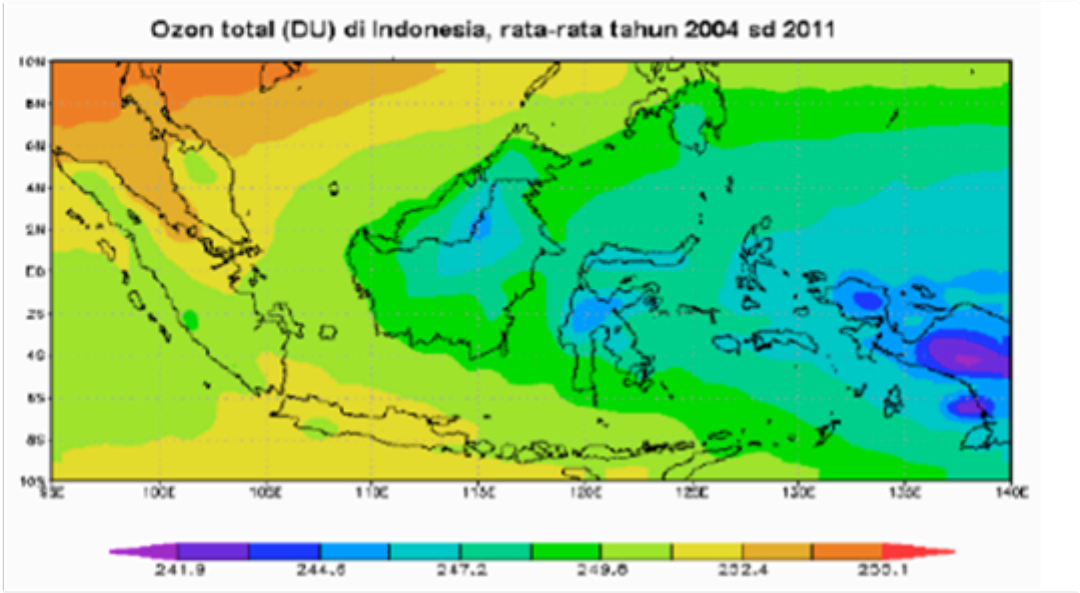


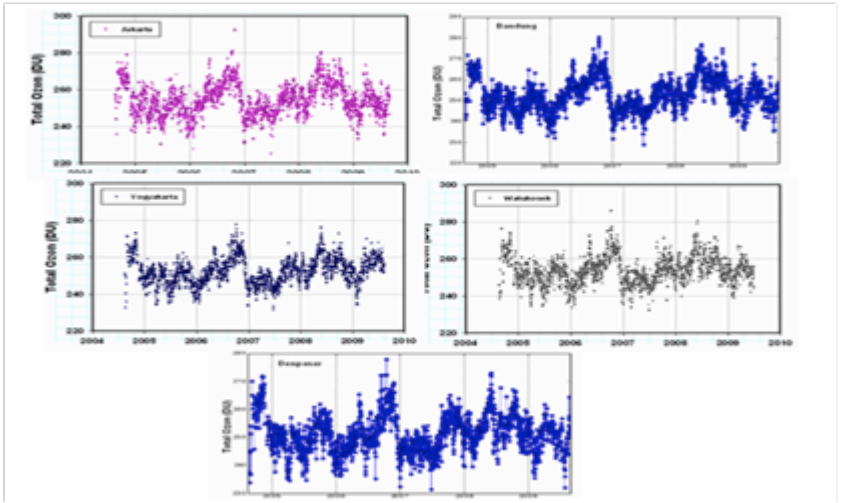




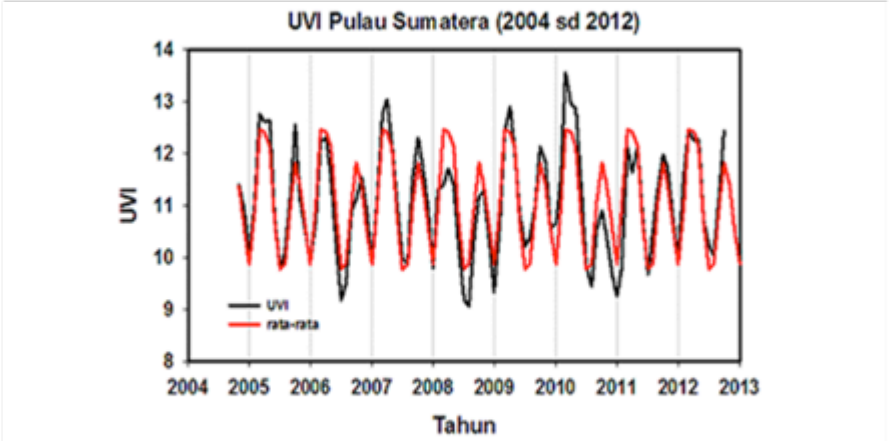
Level 1 (8 m) Level 9 (219 m) Level 25 (6375 m)

OZON AND UV RADIATION





Ozon Total di wilyah Jakarta, Bandung, Yogyakarta, Watukosek dan Denpasar

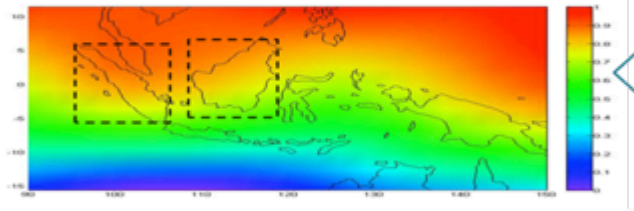


Gambar 3. Pola tahunan UVI tahun 2004 sampai dengan Desember 2012 (hitam) dan pola tahunan rata-rata 2004 sampai dengan Desember 2012 (merah).

ANALYSIS OF AEROSOL AND CO and the IMPACTS TO CLOUD ICE PARTICLE SIZE IN INDONESIA

ANALISIS CO SEBAGAI PROKSI AEROSOL

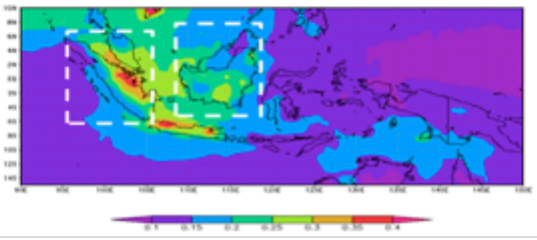
IWC Awan Terpolusi AURA MLS 215 hPa (CO > 108 ppbv)
Ags 2004 – Des 2011)



IWC (> 2 mg m^{-3}) dan CO > 108 ppbv (Sumatera dan Kalimantan)

AOD (> 0,2) (Sumatera dan Kalimantan)

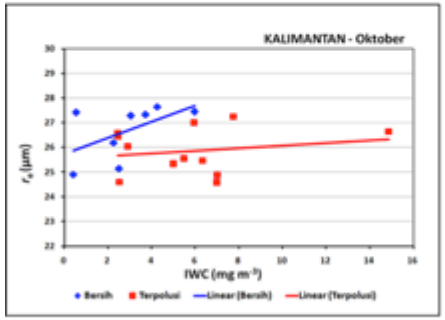
Nilai AOD rata-rata bulanan (Ags 2004 – Des 2011)



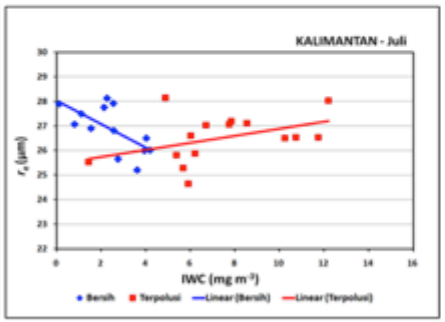
ANALISIS PENGARUH AEROSOL TERHADAP UKURAN PARTIKEL ES (r_e)

Korelasi antara AOD dan r_e rata-rata bulanan
(untuk **KALIMANTAN**)
(2004 – 2011)

CO high sensitivity ($\delta = 0{,}27$)



CO low sensitivity ($\delta = 0{,}04$)

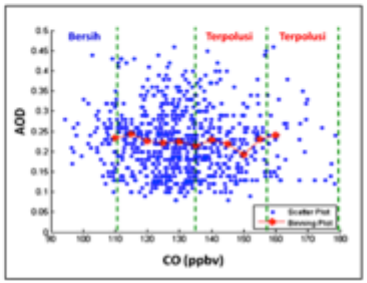


r_e pada kondisi awan terpolusi << kondisi bersih

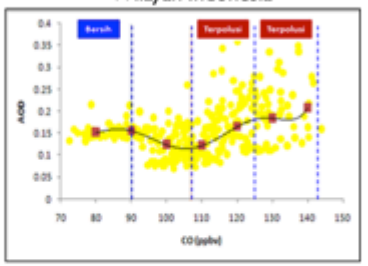
PENENTUAN CO SEBAGAI PROKSI AEROSOL

SUMATERA

Scatterplot AOD -MODIS terhadap CO-MLS pada kondisi berawan (IWC > 2 mg)
Untuk : Wilayah SUMATERA



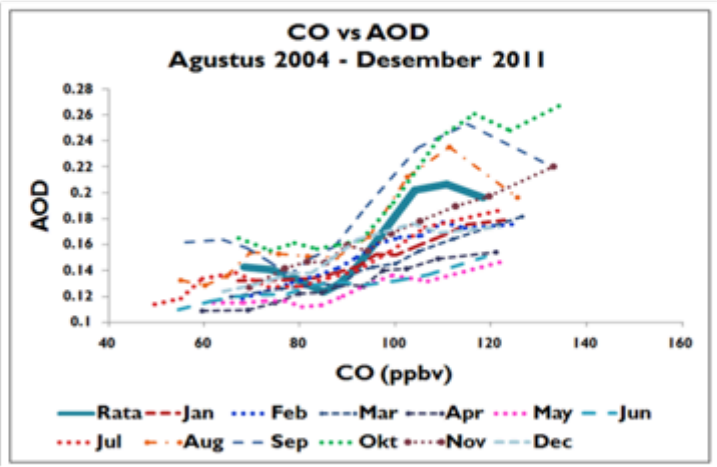
Wilayah Indonesia



Nilai maksimum CO = 180
Nilai minimum CO = 90

Kuartil 1 = 90 s.d 112 (awan bersih)
Kuartil 2 = 112 s.d 135
Kuartil 3 = 135 s.d 157 (awan terpolusi)
Kuartil 4 = 157 s.d 180 (awan terpolusi)

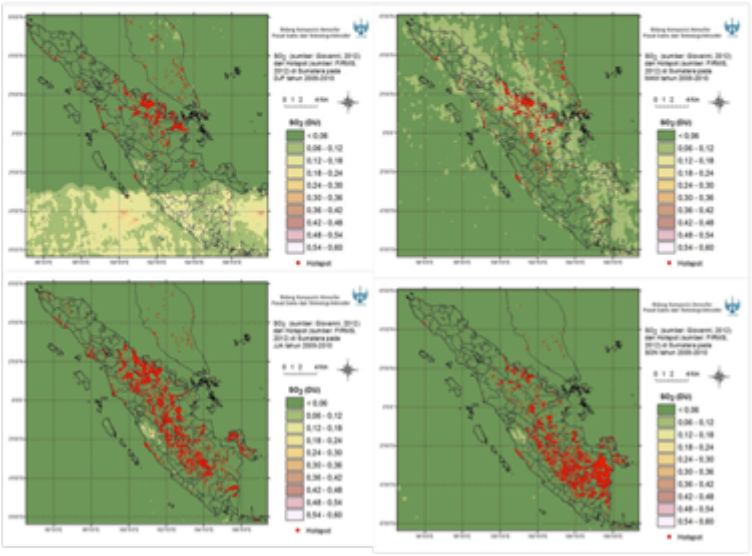
Analisis Korelasi AOD dan CO
Wilayah Indonesia



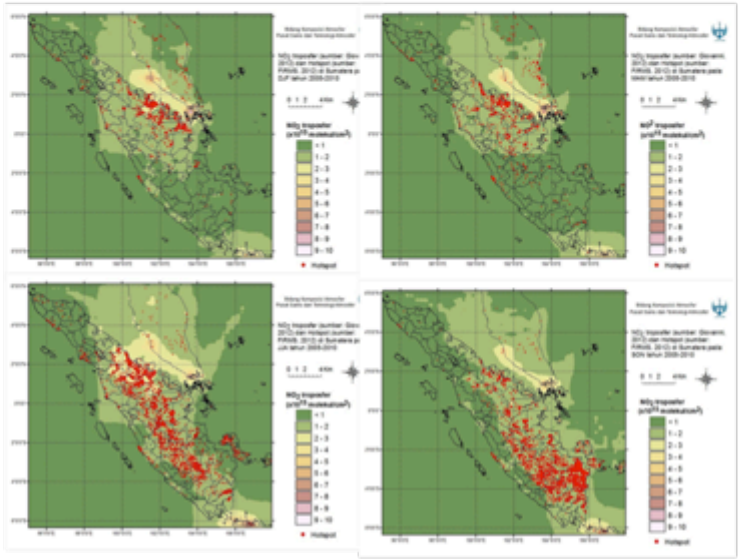
Sumber : Rosida 2012

Analysis of Acid Rain and Wet Deposition in Sumatera because of forest fire and antrophogenic

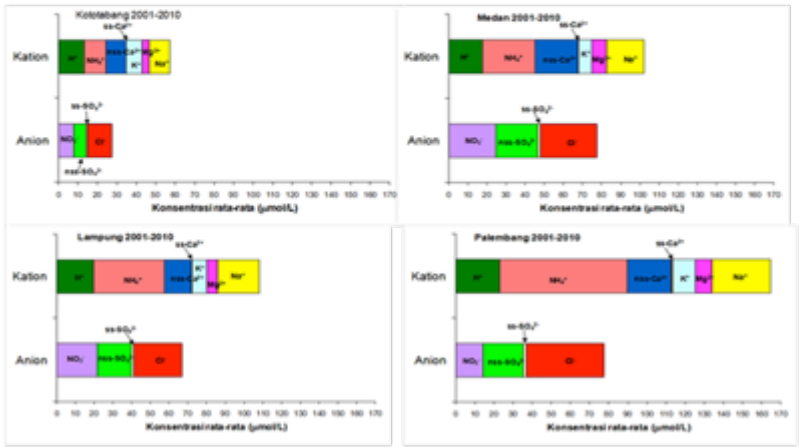
Distribusi SO_2 Total Kolom sumber AURA OMI 2004 - 2010 (Giovanni, 2012) dan Hotspot sumber dari MODIS AQUA/TERRA (FIRMS, 2012)



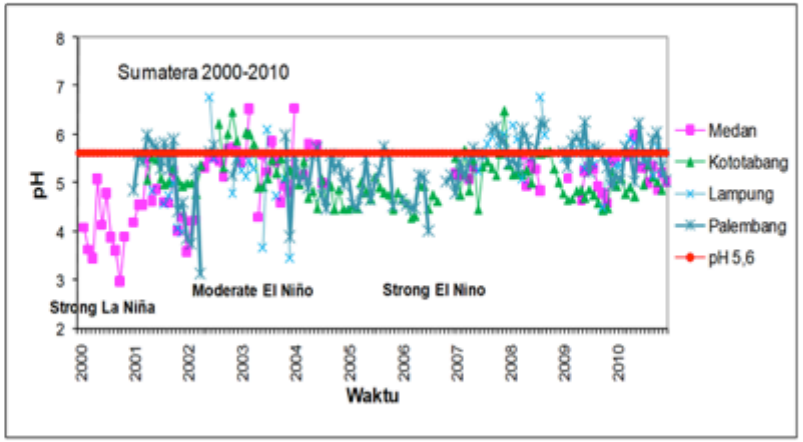
Distribusi NO_2 troposfer sumber AURA OMI 2005 - 2010 (Giovanni, 2012) dan Hotspot sumber dari MODIS AQUA/TERRA (FIRMS, 2012)



Komposisi kimia air hujan



Kecenderungan keasaman air hujan

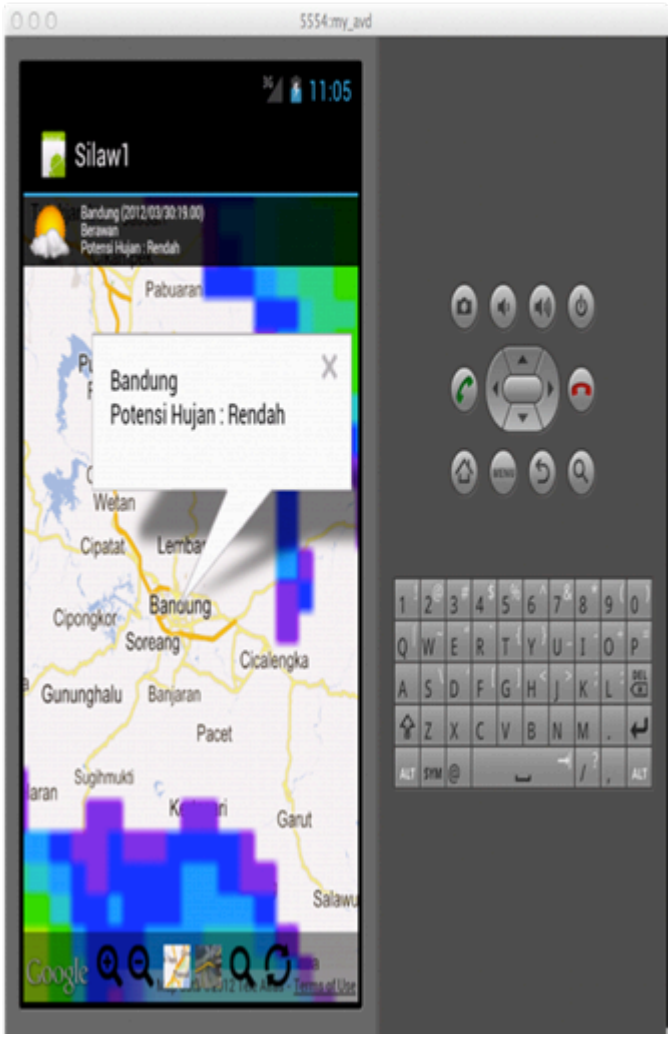


Sumber : Tuti B, 2012

INFORMATION SYSTEM OF CLOUD COVER (PRECIPITATION) BASED ON SATELLITE DATA IN MOBILE PHONE

Minimum kebutuhan sistem

1. Mobile Phone Android
2. Terhubung internet



Download file  di *http://60.253.114.151/silaw/*

Install dan kemudian jalankan aplikasinya.

Untuk non android → buka internet browser dan akses alamat :

http://60.253.114.151/silaw/silaw.php

CONCLUSION

- ✓ The relationship between Urban Heat Island (UHI) and land cover type has been studied comprehensively by remote sensing and GIS.
- ✓ UHI is found to be centralized in downtown areas and spreading to the surrounding area.
- ✓ Net Radiation (*Rn)* and Latent Heat Flux (*LE)* in urban area relatively lower than vegetation and water area, otherwise Sensible Heat Flux (*H)* and Soil Heat Flux (*G*) are higher than vegetation area.
- ✓ Evaporative Fraction *(EF)* and Bowen Ratio (*BR*) as Drought monitoring effectively analyse using satellite.
- ✓ *EF* will be high on the vegetation area and waterbodies, and vice versa will be low in non-vegetation. *BR* is the opposite value of *EF.*

CONCLUSION (continued)

- ✓SEBALIS could be to overcome obstacles that complicated and repetitive work in estimating urban climate variables that integrates counting process so that it becomes more practical and easier. Without SEBALIS need ~1 week, with SEBALIS only ~1 hour.
- ✓LU modification from grassland to urban (scenario 1) will expand area of UHI with highest temperature (Ta 306K (33^0C) by 5%). In the contrary with the addition of grassland / vegetation (scenario 2, 3 and 4) would reduce the area with high temperature (by -48%, -54% and -88% respectively).
- ✓Database management is benefit for R&D in climate change for researcher, student and public, DSS (such as SADEWA), and quick information on mobile phone.
- ✓These studies can be used as reference for good urban design and comfortable environment.

Thank you

laras.toersilowati@lapan.go.id

LAPAN

www.lapan.go.id

Clean, green, & beautiful