Tracking People's movements for ITS applications

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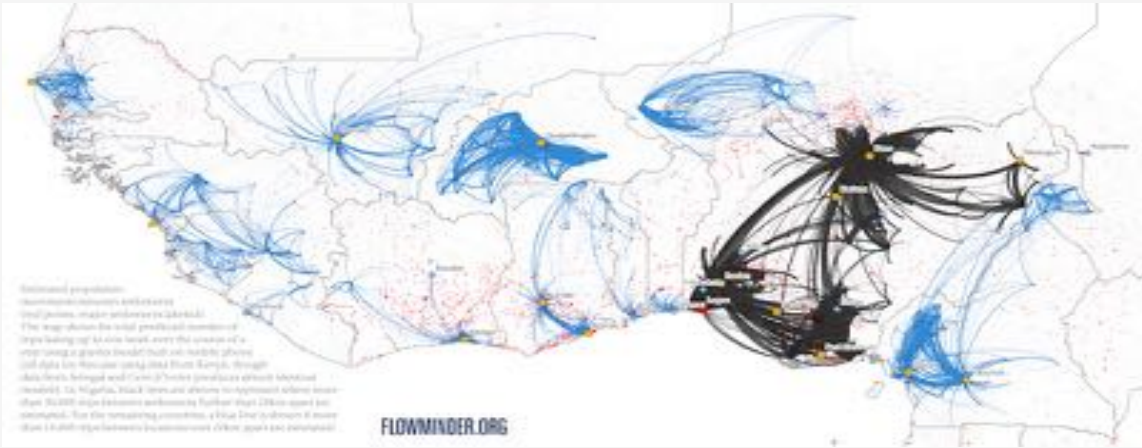
Cell Phone Network Technologies

- As a tool to distribute information
  - Provision to disaster information
  - e.g.) Frontline SMS crowd

http://www.frontlinesms.com/

- As a tool to collect information
  - Real-time monitoring for movement of people, car, and goods including cross-boarder transfer

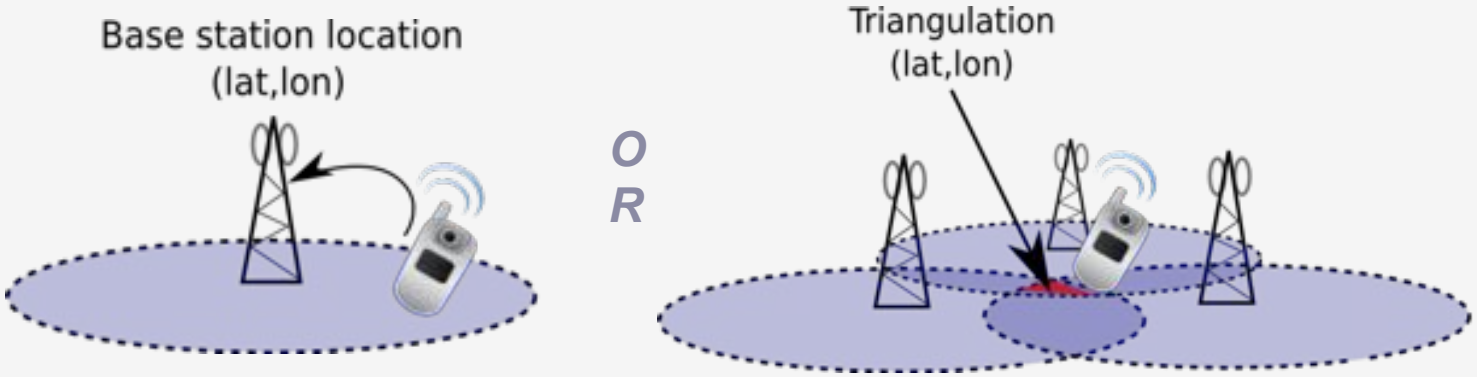
People flow of Tokyo, Mar.11, 2011
Courtesy: Shinsai Big Data (H.Abe edit, NHK publishing, 2014)



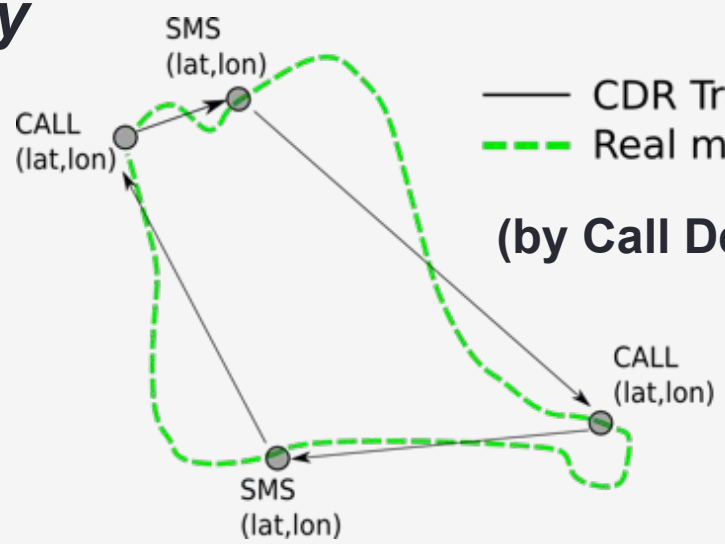
http://www.worldpop.org.uk/ebola/

How to Mesure the Location of and Track Mobile Phone Users?

1) Localizaton by cell towers



2) Trajectory



CDR Trajectory
Real movement

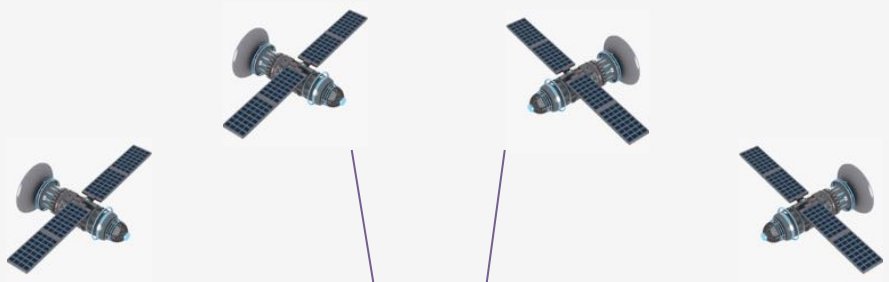
(by Call Detail Record: CDR)

Cell Phone Network Technologies

2014/3/11 Tokyo
Before and After the Earthquake
Courtesy: Shinsai Big Data (H.Abe edit, NHK publishing, 2014)

Bangkok Taxi Probe's Big Data Processing

GPS Satellite



GPS Signal

Data Element
•Position and Time
Other Sensor Data
•Speed, Direction etc

10,000 Probe Vehicle

GPS Data Transmission

Transmitted Probe data using Communication platform
E.g. : Cellular Network

Data Collection & Processing

Probe vehicle Information

BIG DATA
archive + Probe Data Processor

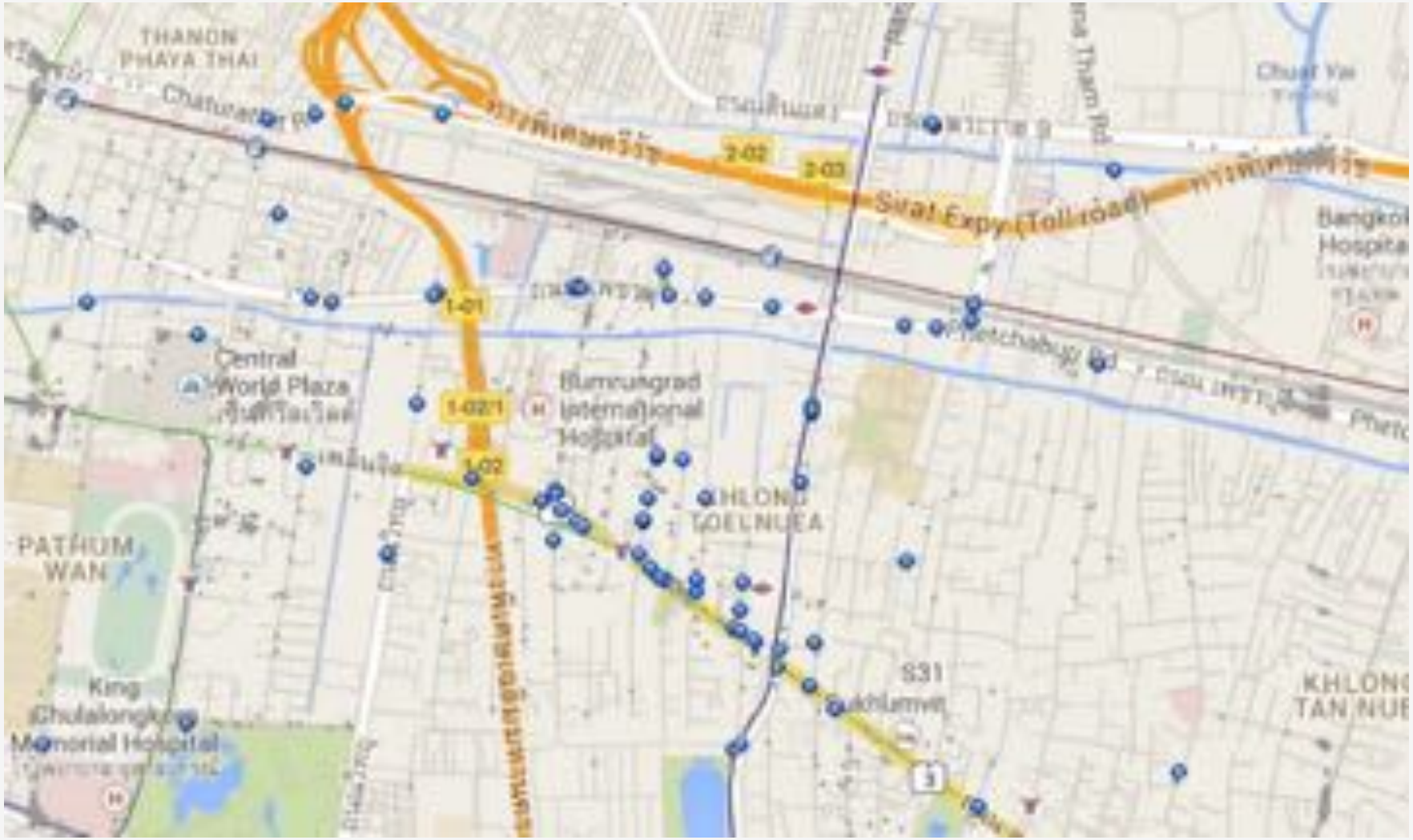
Bangkok Taxi Probe's Big Data Processing

- Toyota Tsusho Electronic Thailand Co Ltd
  - Providing real time traffic information of Bangkok area
  - 10,000 GPS enabled Taxi in Bangkok
  - Collects traffic raw data from 10K taxi probes every 3 to 5 and stores in cloud server
  - Reliable and predictable traffic information
  - Tsquare App -> https://app.rtic-thai.info/tsquare/

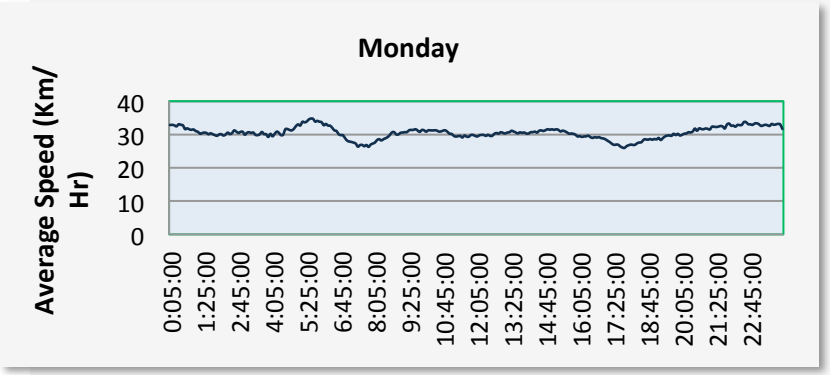
Taxi in "TSQUARE" Group

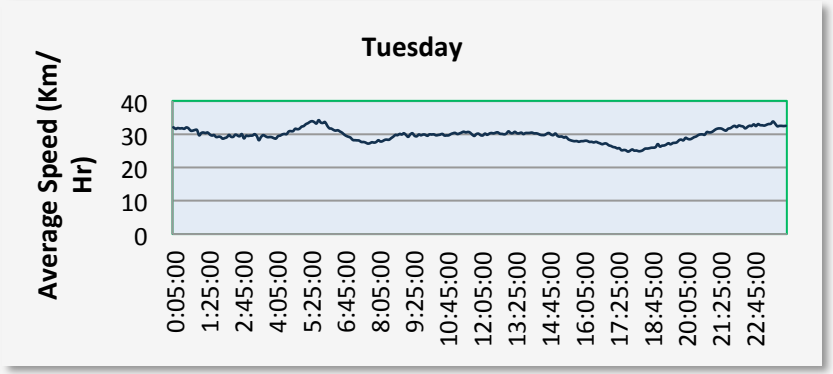
“TSQUARE” VICS/RTIC traffic service in Thailand

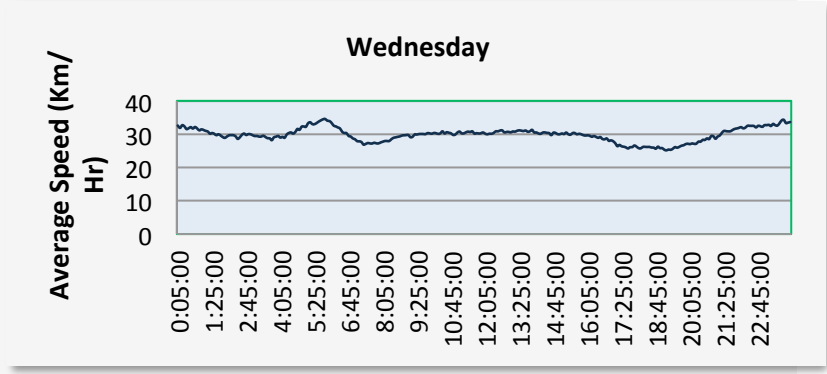
Visualization of Taxi Probe data

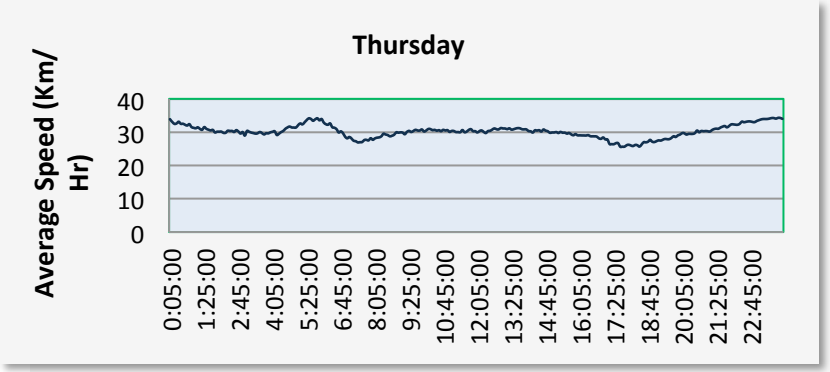


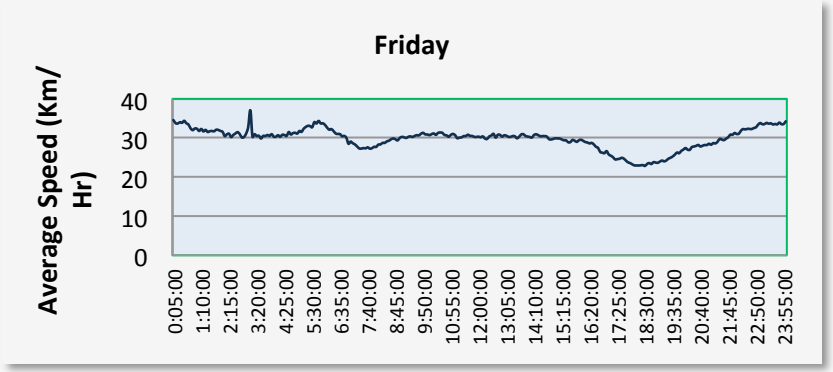
Data Analysis: Average Speed Pattern

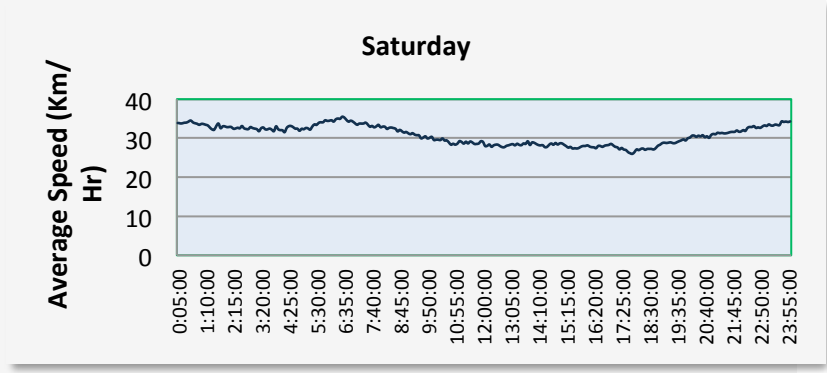


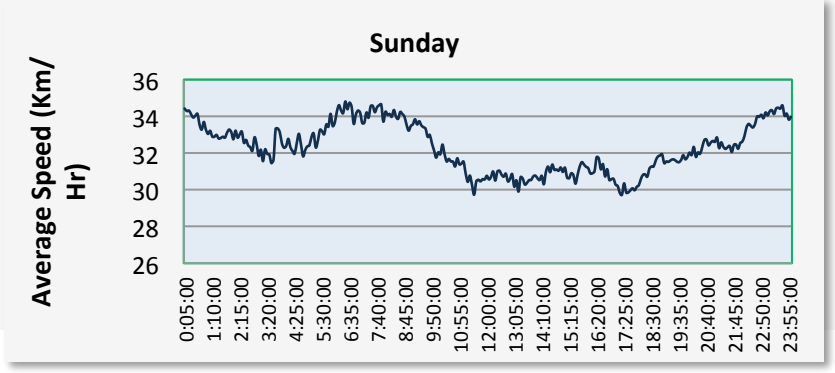










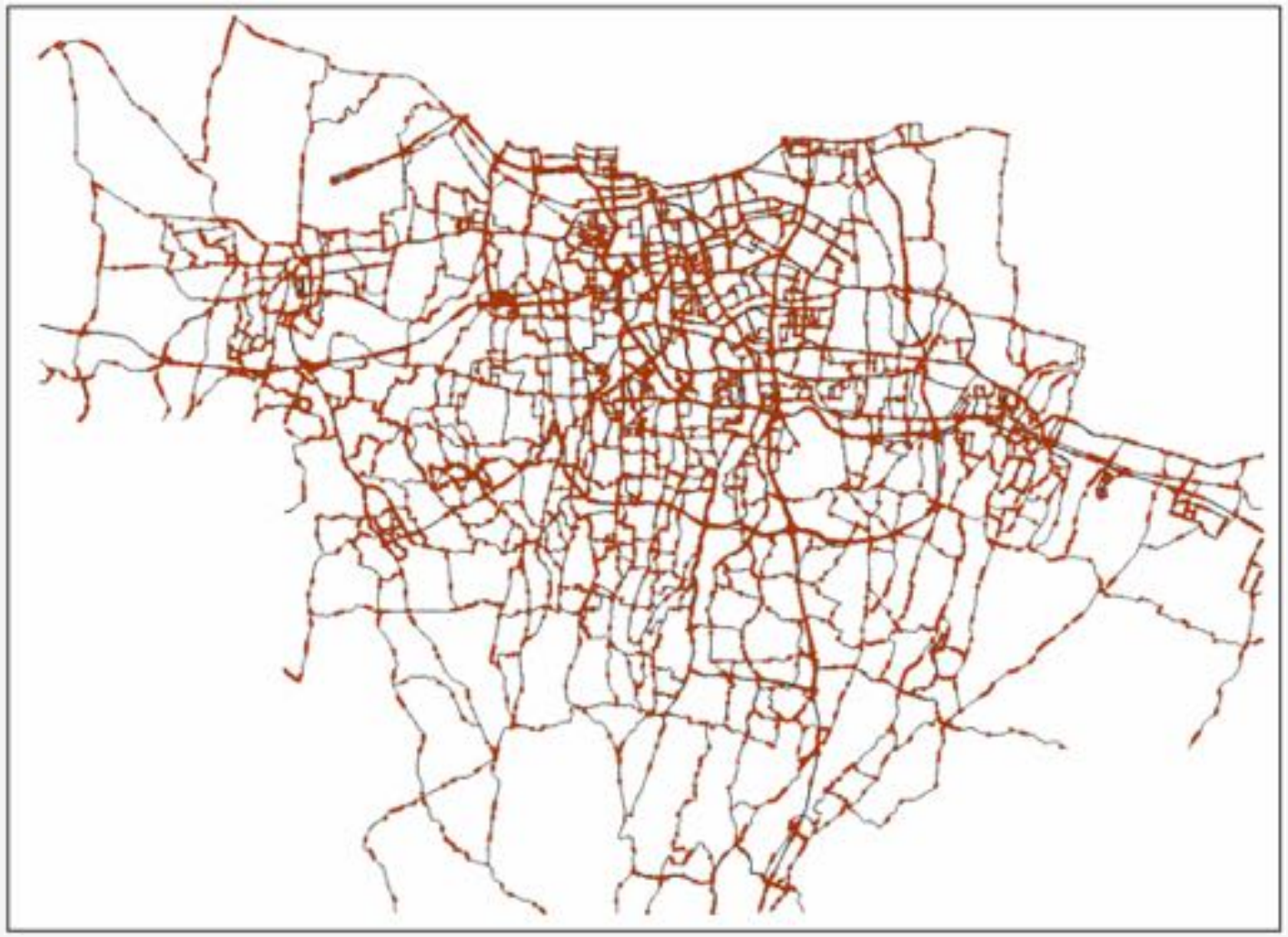


Average speed change for each 5 minutes for 1 week data set

“TSQUARE” VICS/RTIC traffic service in Thailand

Applying “Taxi Probe” data for “Flood”

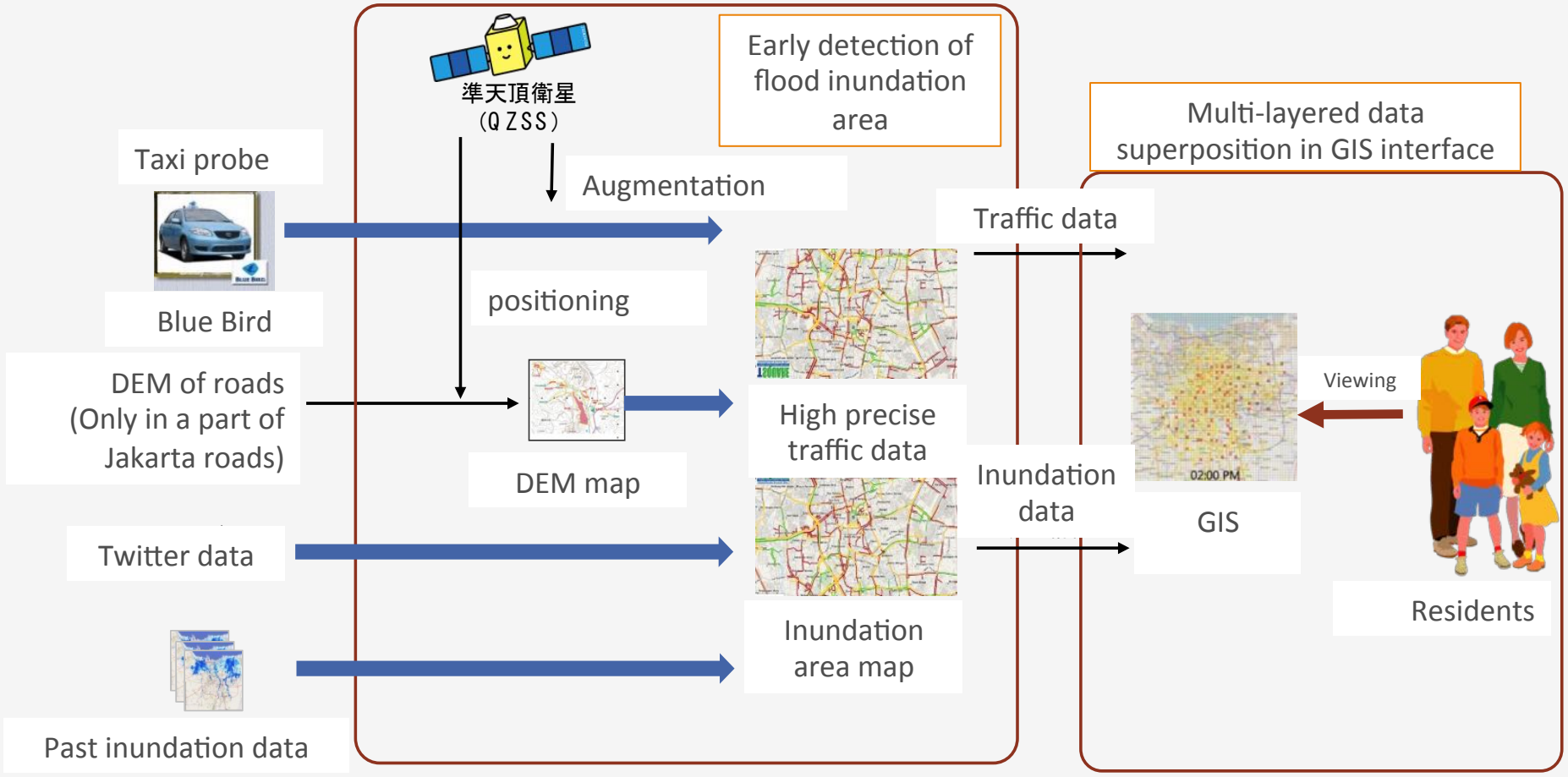
Taxi Probe data in Jakarta by Blue Bird Taxi



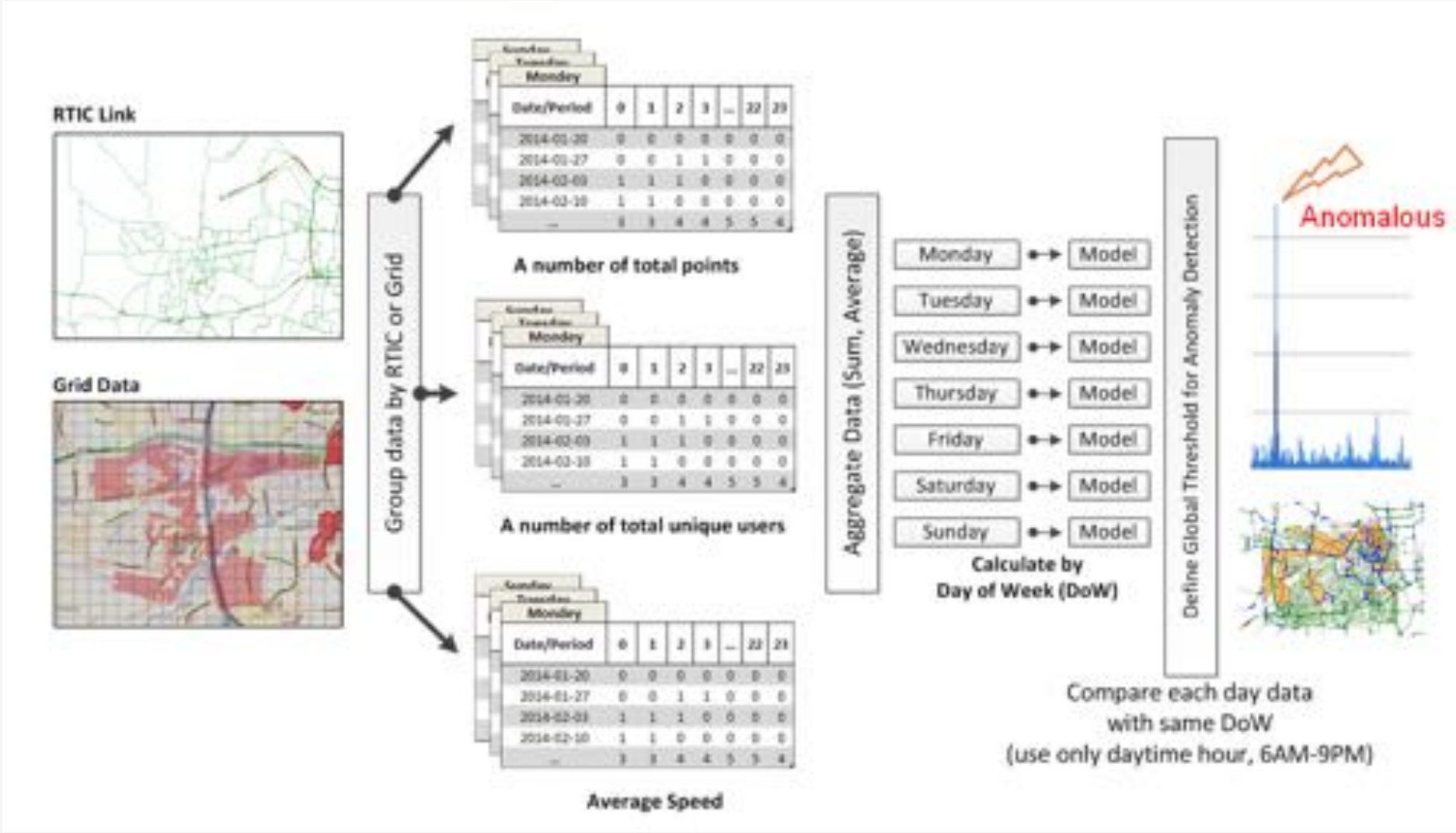
Specification of data set

- IMEI (International Mobile Station Equipment Identification)
- Latitude / Longitude (In Decimal Degree)
- Speed (Km/hr)
- Direction (In Degree)
- Meter (0/1)
- Unix Time Stamp (Second)
- Rticlink

“Urban Flood Response Support” system



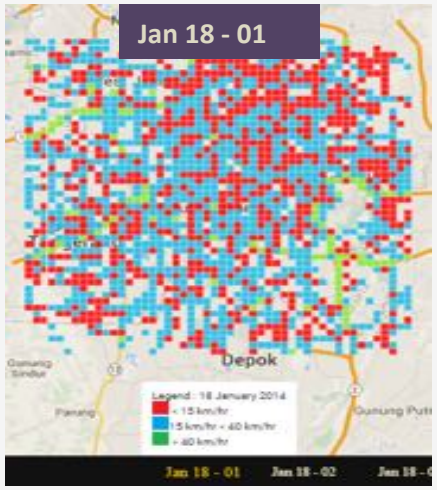
Overall Data Analysis Flow

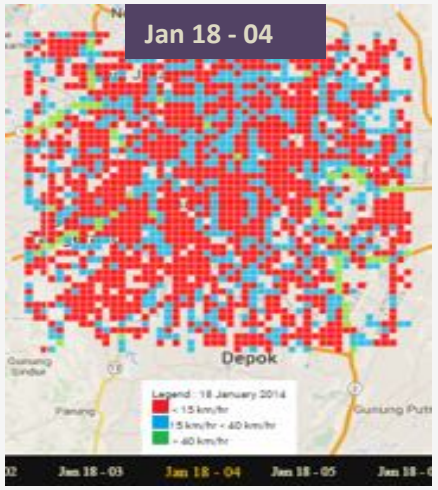


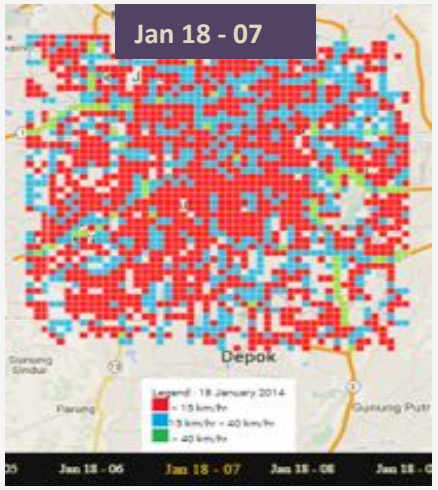
Data analysis in the region of interest in time series

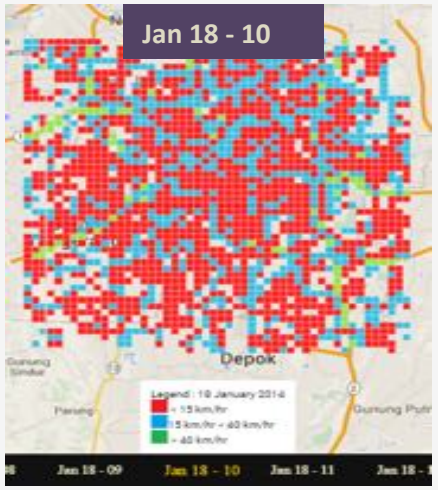
Legend :
Average Speed

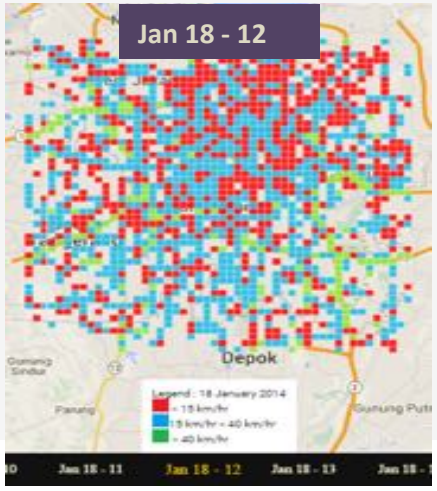
- Less than 15km/hr
- Between 15 km/hr To 40 km/hr
- Greater than 40 km/hr

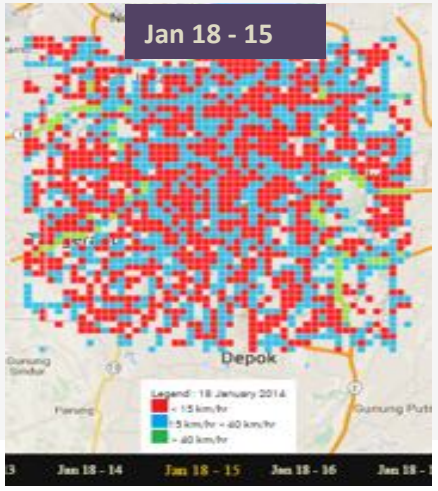


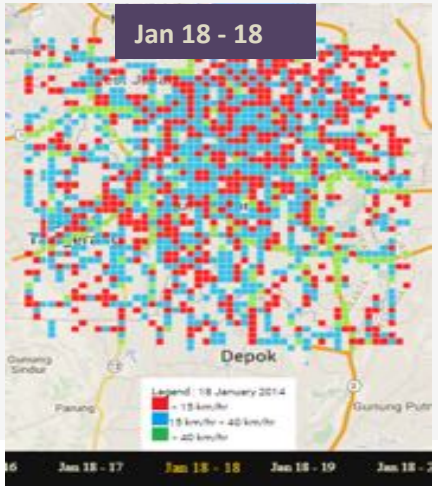


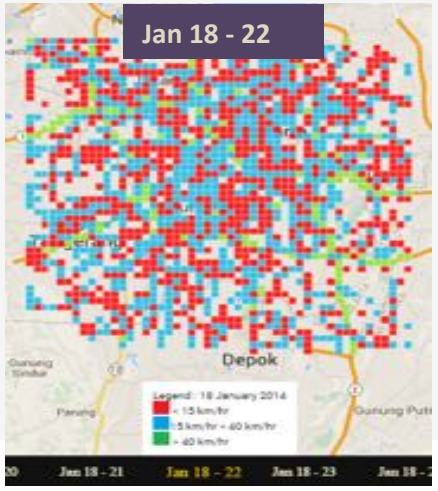






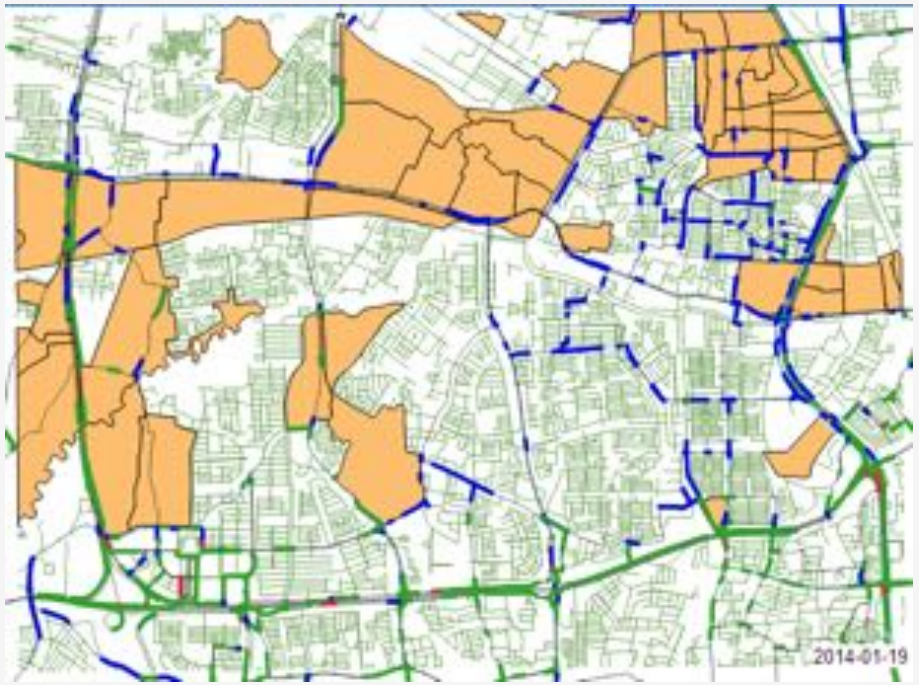


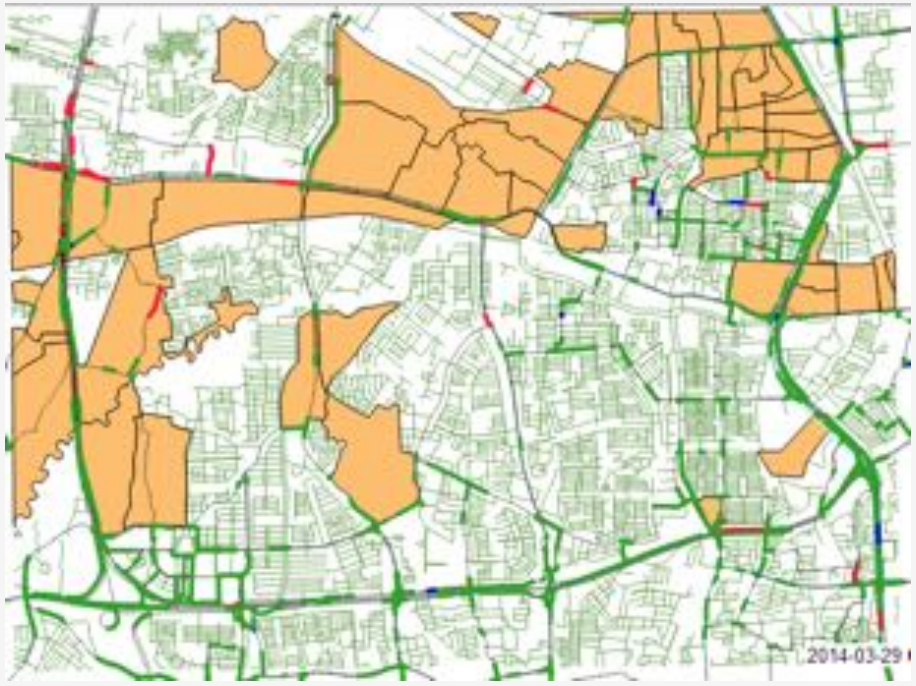




Anomaly at date level

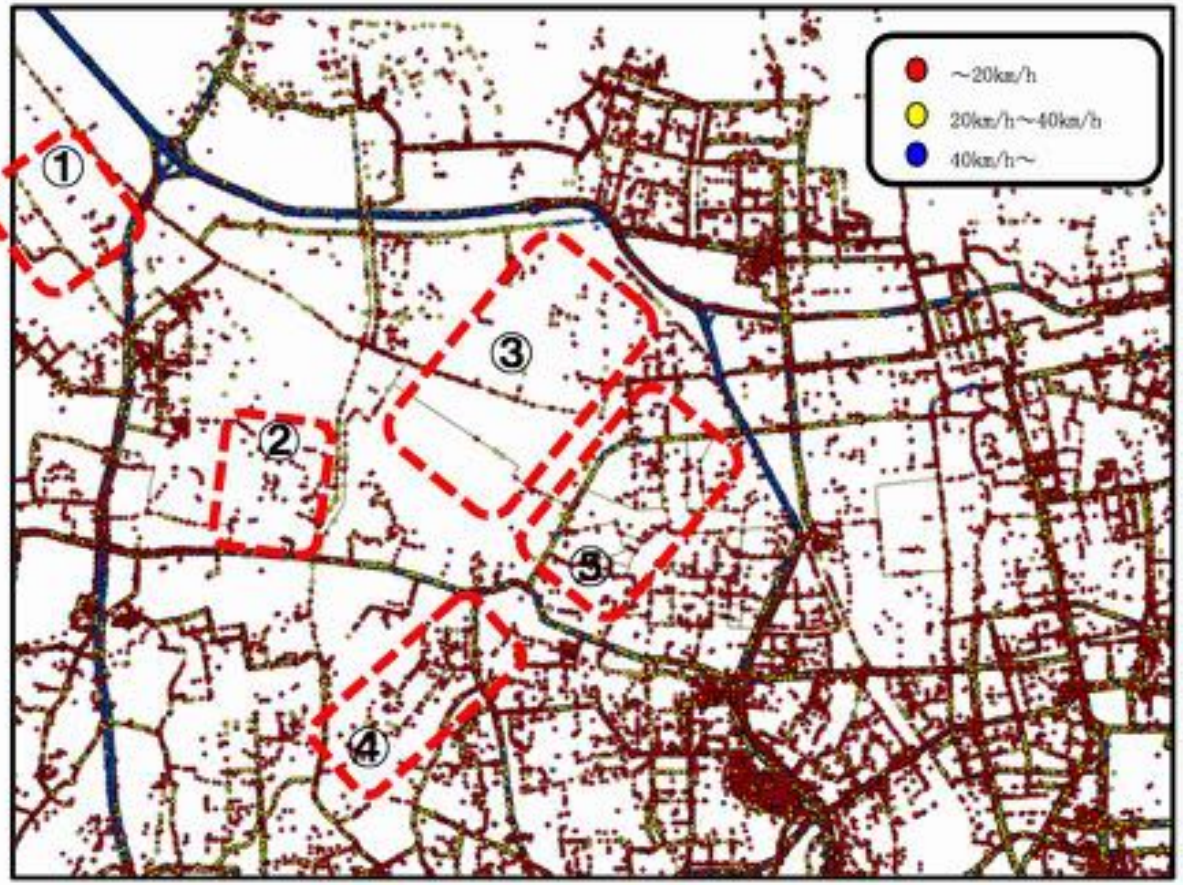
- Compare during flood (2014-01-19) and not flood (2014-03-29)



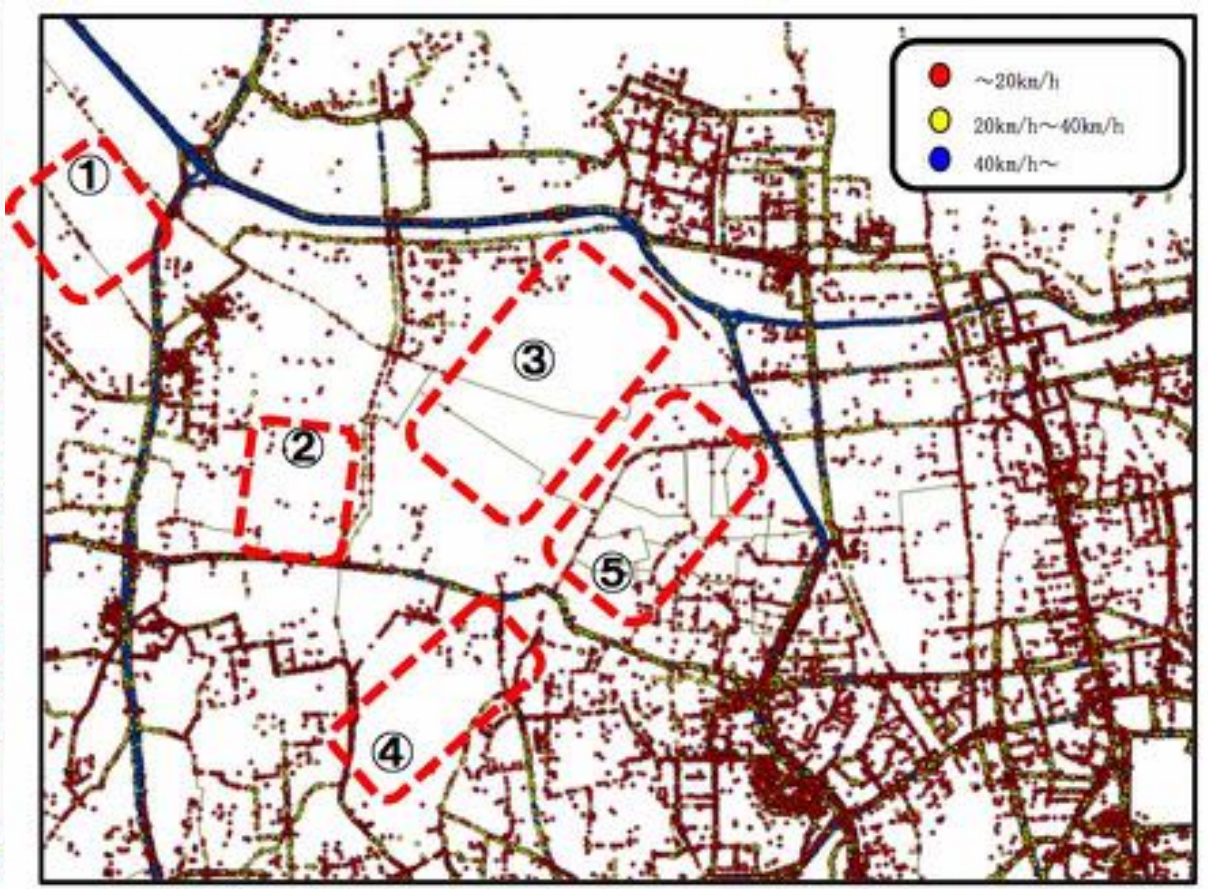


Blue : very less traffic, Green: normal, Red: very high traffic

Comparison between Normal and Flood

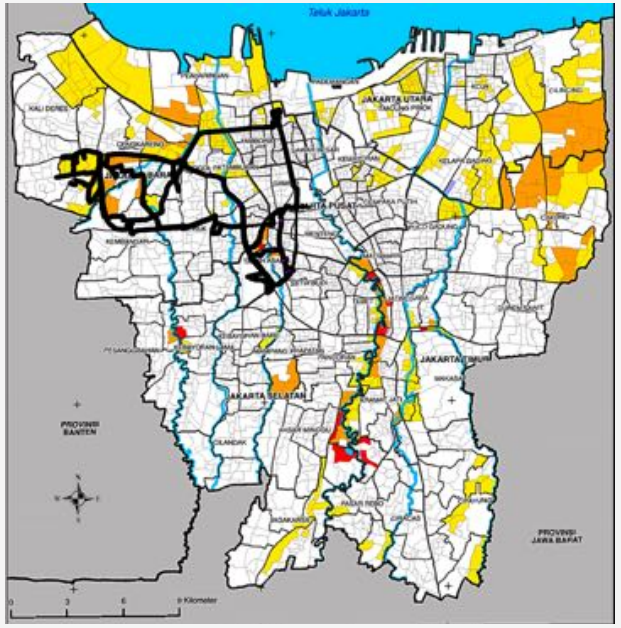


Normal: 19/03/2014

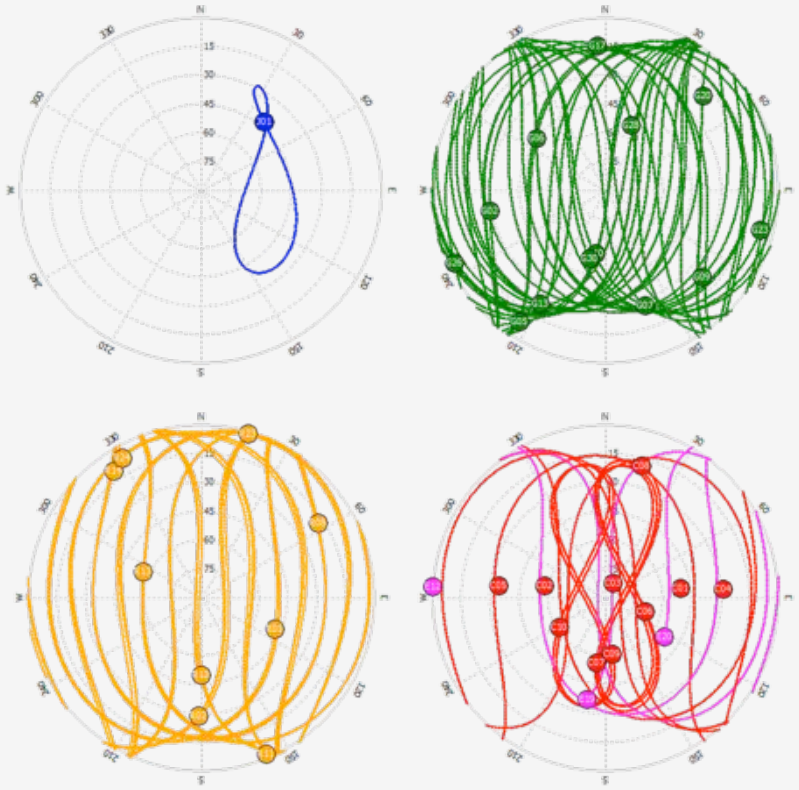


Flood: 22/01/2014

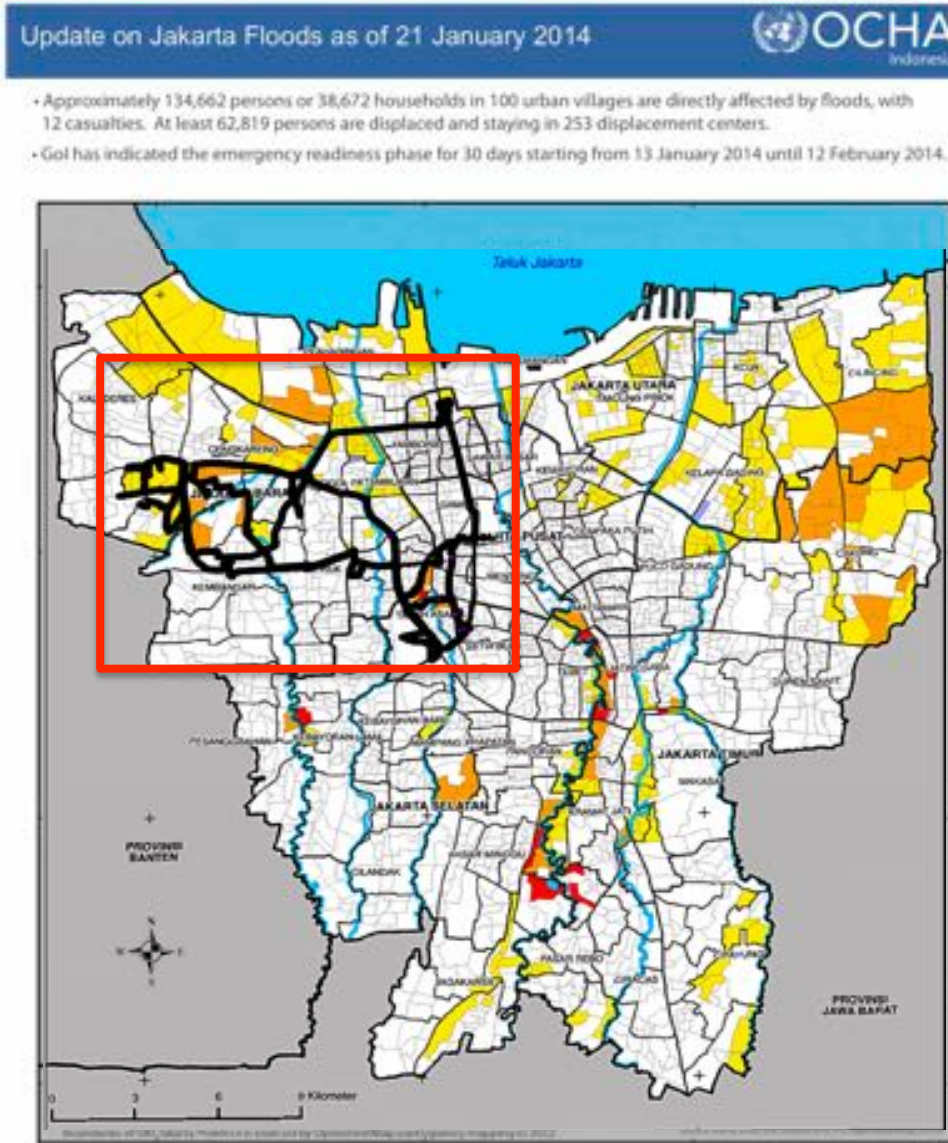
Multi-GNSS Experiment for DEM



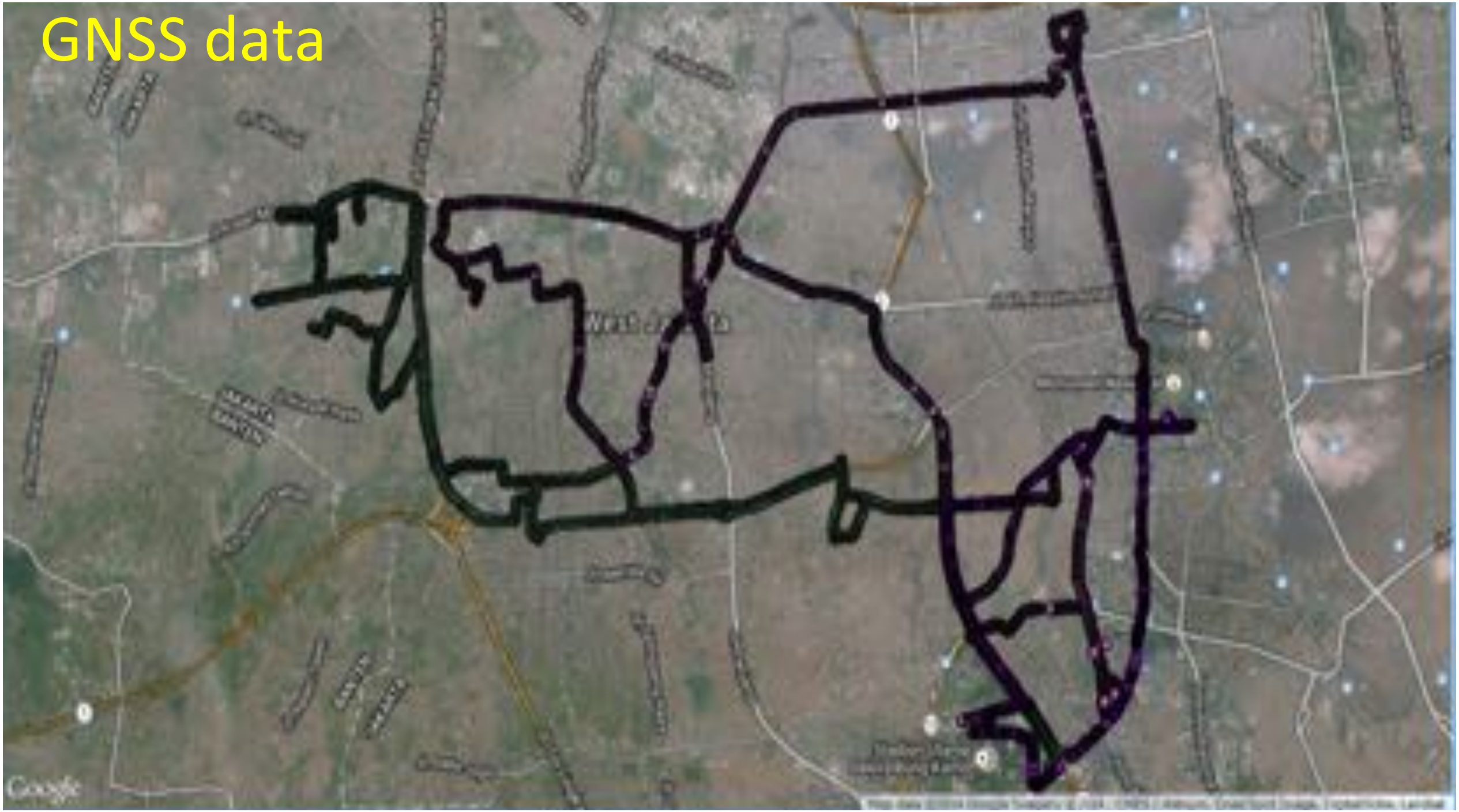
2014/12/01
Jakarta, INDONESIA (UTC+7)
6°13’ S
106°48’ E



●:QZSS ●:GPS ●:GLONASS ●:BeiDou ●:Galileo

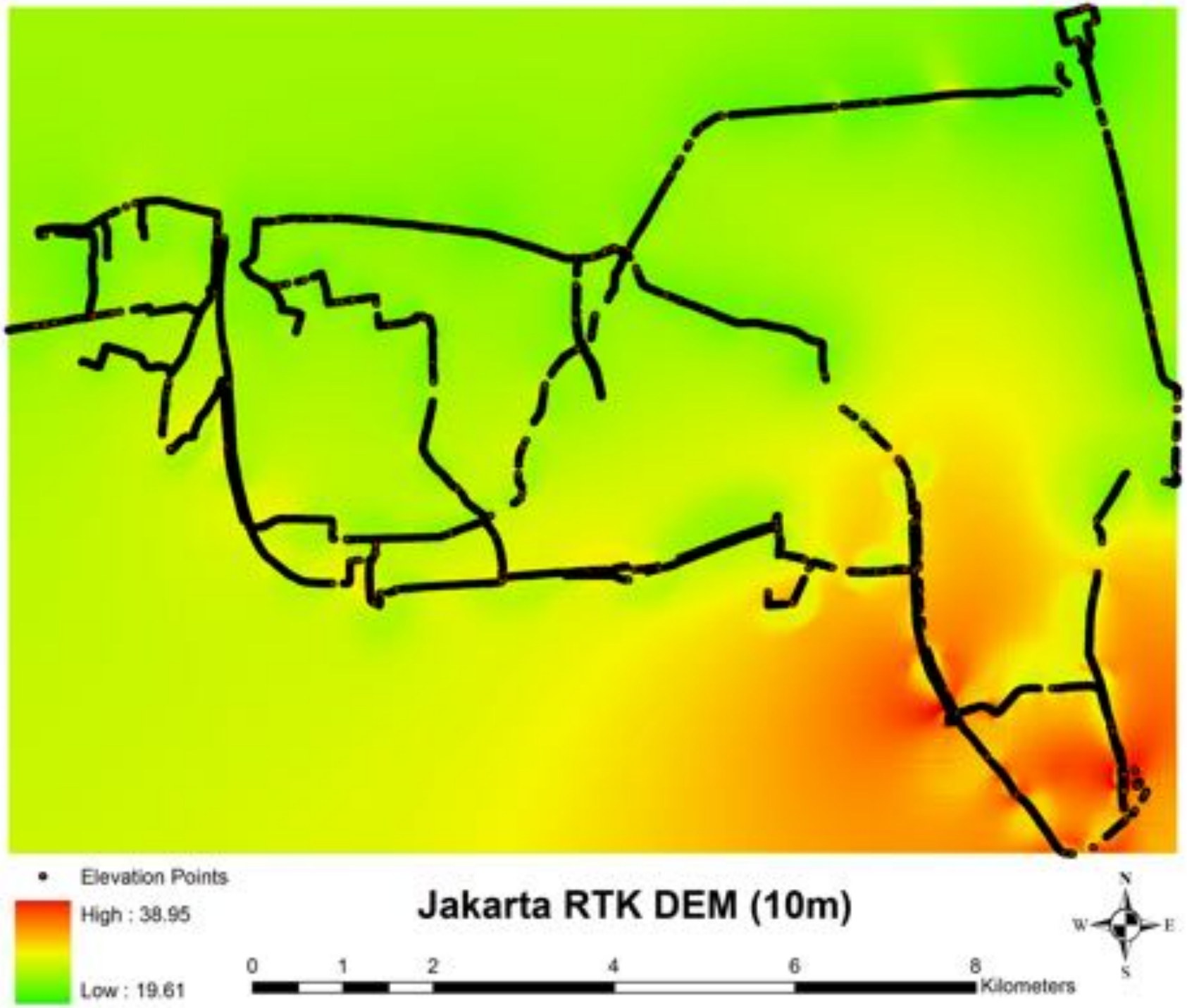


GNSS data

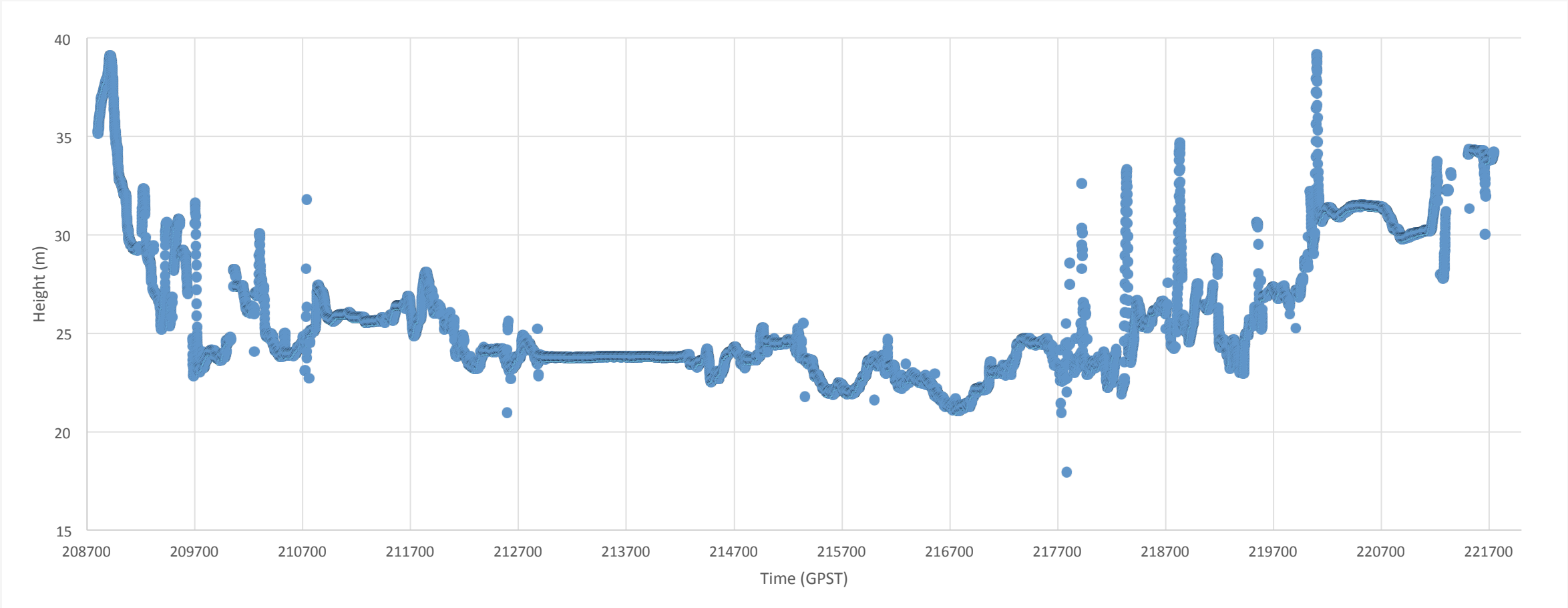


Statistics

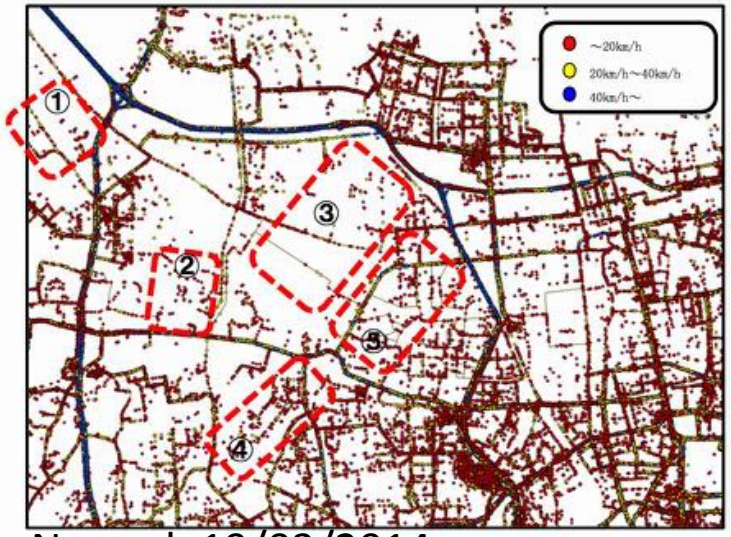
- Min: 19.61
- Max: 38.95
- Mean: 25.07
- Std Dev: 2.33



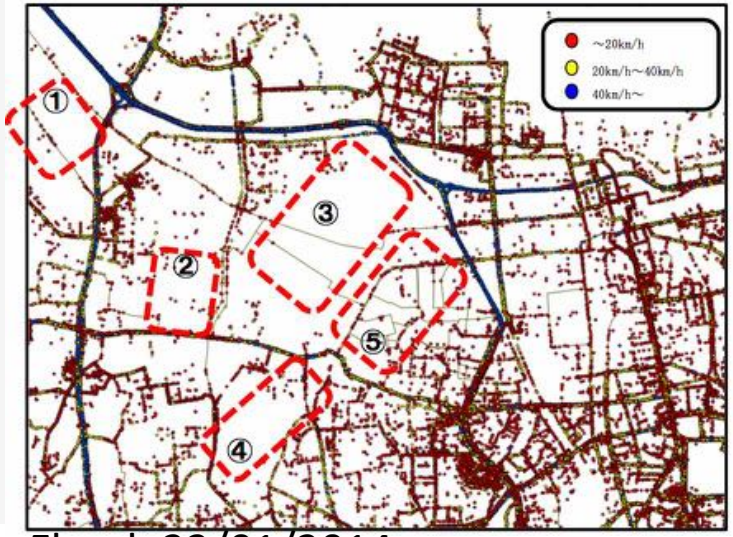
Height of Road Surface



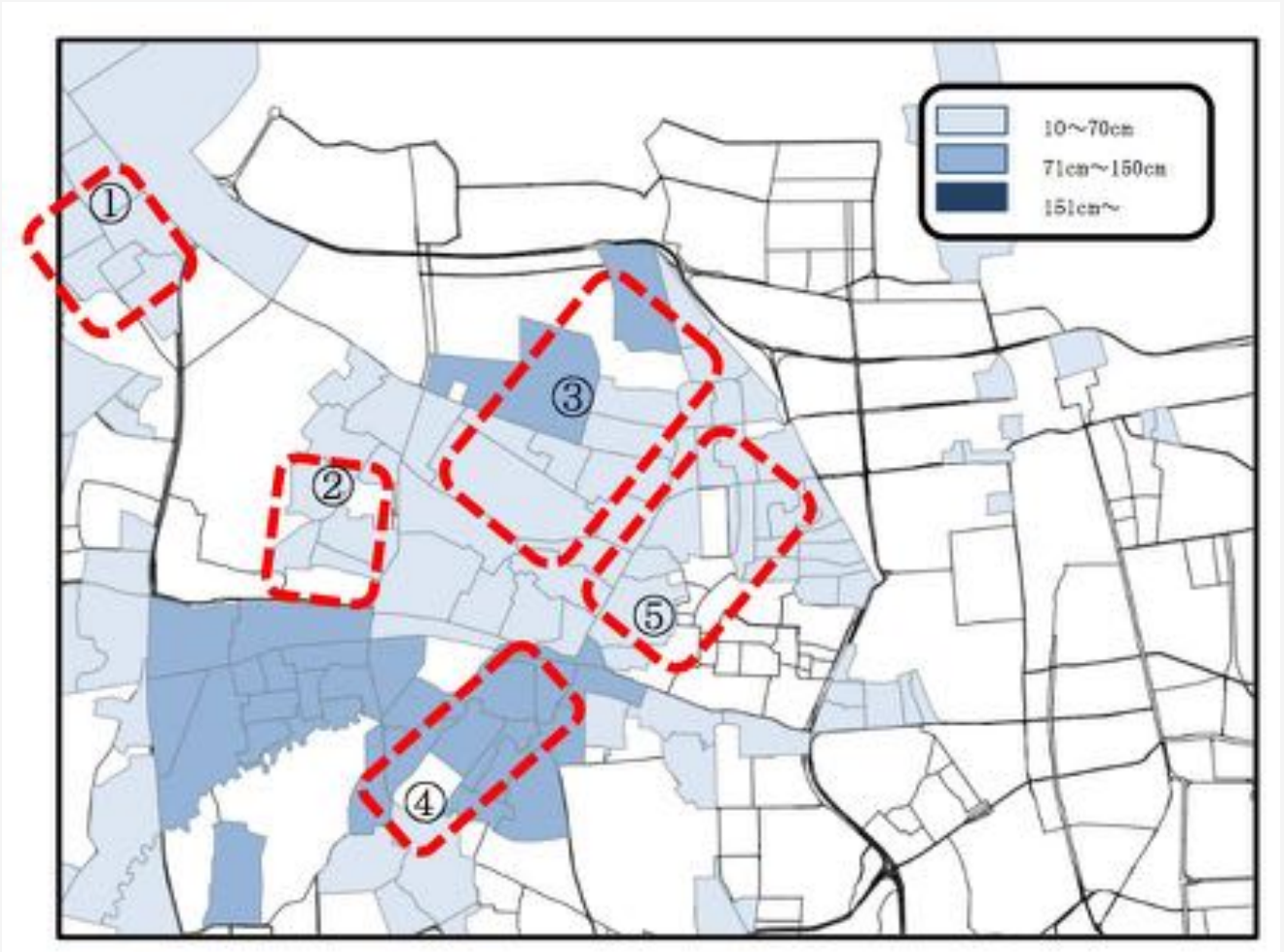
Outcomes



Normal: 19/03/2014



Flood: 22/01/2014



Flood: 22/01/2014

Conclusions

- Our team develops “Urban Flood Response Support” system with;
  - Analysis of taxi probe data,
  - Multi-layered superposition of flood inundation area map and digital elevation model data of roads.
  - Data disclosure with GIS interface.