A methodology for inexpensive GPS data storage and analysis

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The big squeeze

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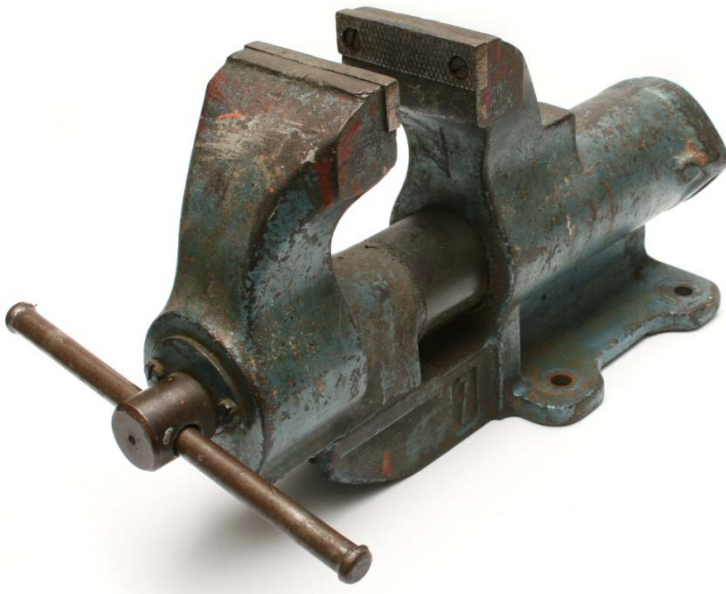
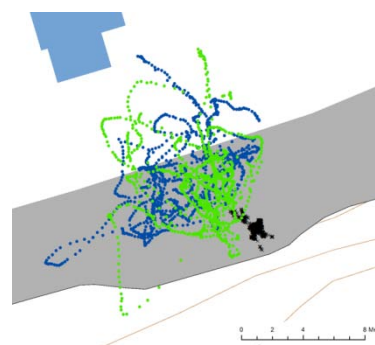# What's the alternative?

Free is nice but what can it do?
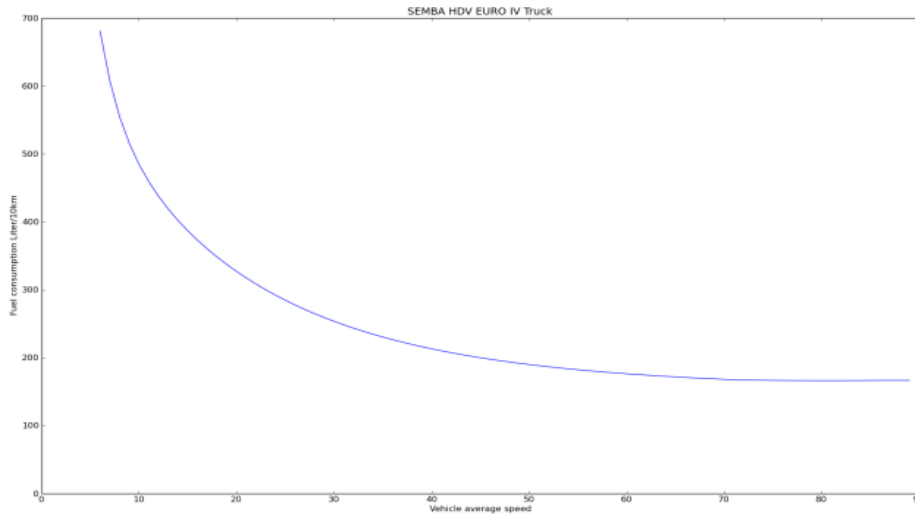
Emission estimation:
- Speed
- Acceleration
- Gradients
- Surroundings

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Hardware prototype - winmob

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Hardware test - GPS

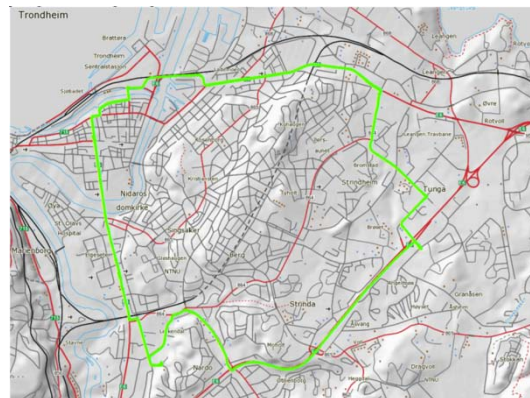**Scatterplot of RTCU 2 and RTCU 6 vs Vbox**

Speed are in km/h, Vbox speed on X axiz and RTCU 2 and RTCU 6 on Y axis

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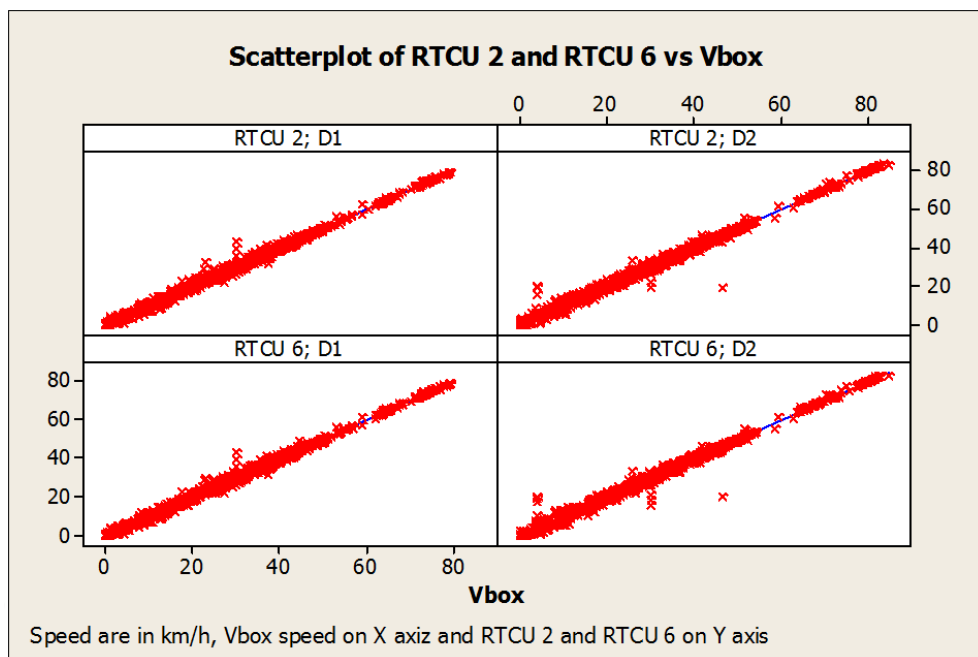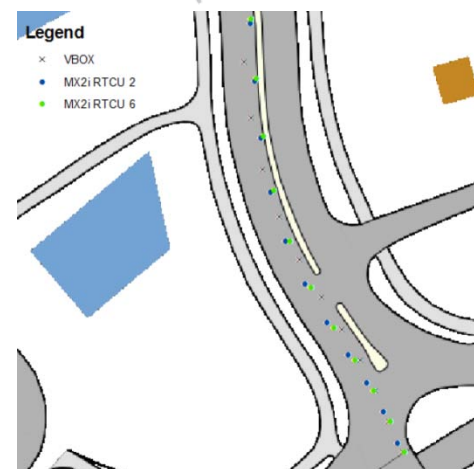
Software

Mature
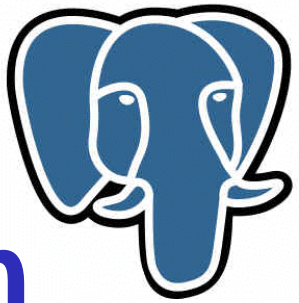
Open

Standards

Documentation
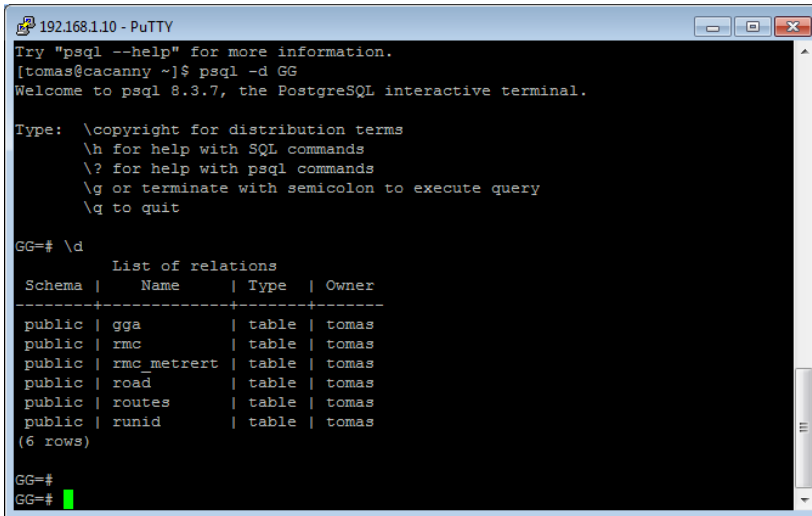
One language to rule them all

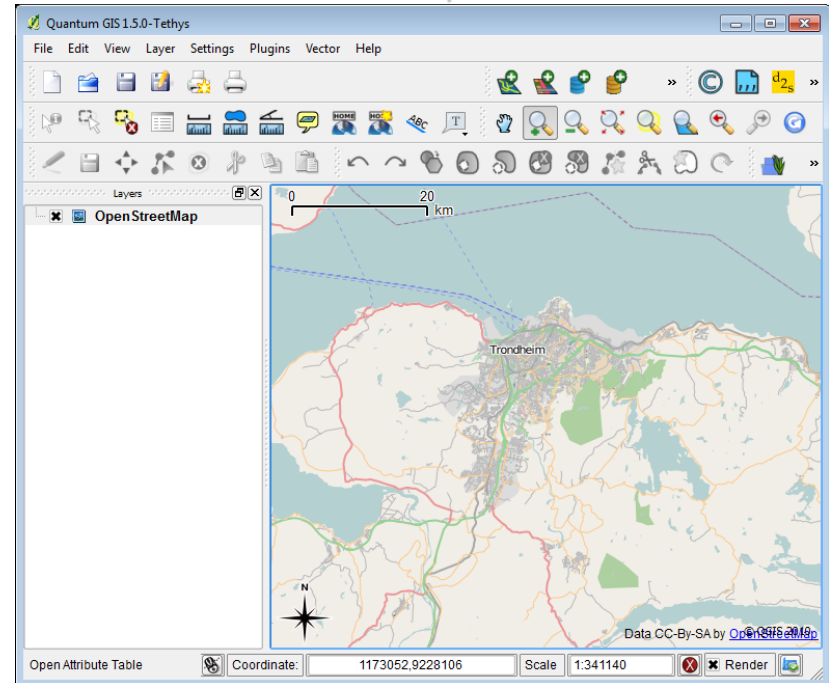## I'm a researcher not a computer programmer

Command line GIS

Postgis mapmatching

```
CREATE TABLE link AS
SELECT DISTINCT ON (gps.rmcid) gps.rmcid, road.transid FROM gprmc AS gps
LEFT JOIN veger AS road ON ST_Dwithin(gps.the_geom_utm33n,road.the_geom2d, 25)
ORDER BY rmcid, ST_distance(gps.the_geom_utm33n,road.the_geom2d);
```

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Green Freight Transport Data
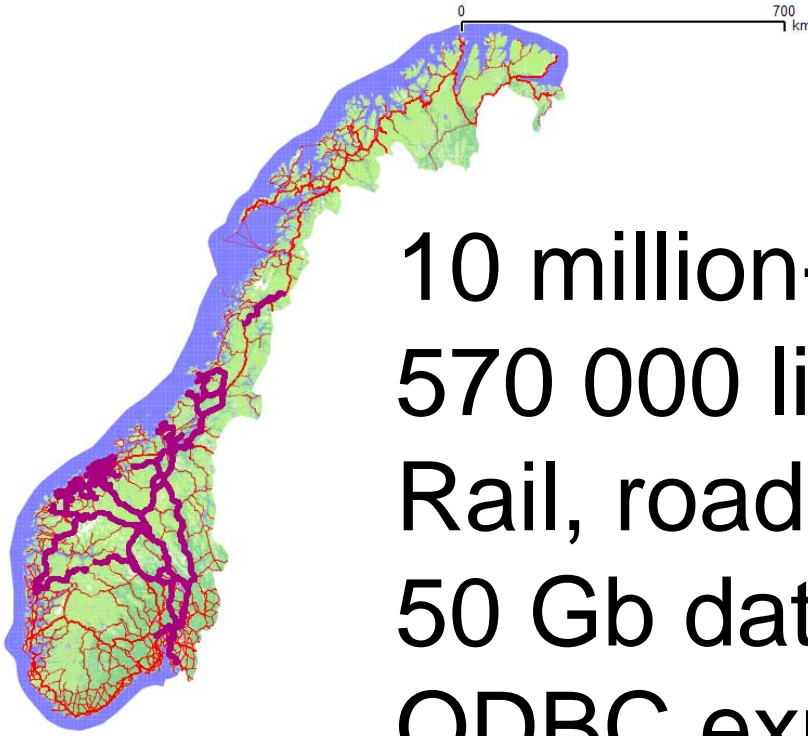
10 million+ observations
570 000 link road network
Rail, road and sea terminals
50 Gb database
ODBC export tables

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Average speed calculation
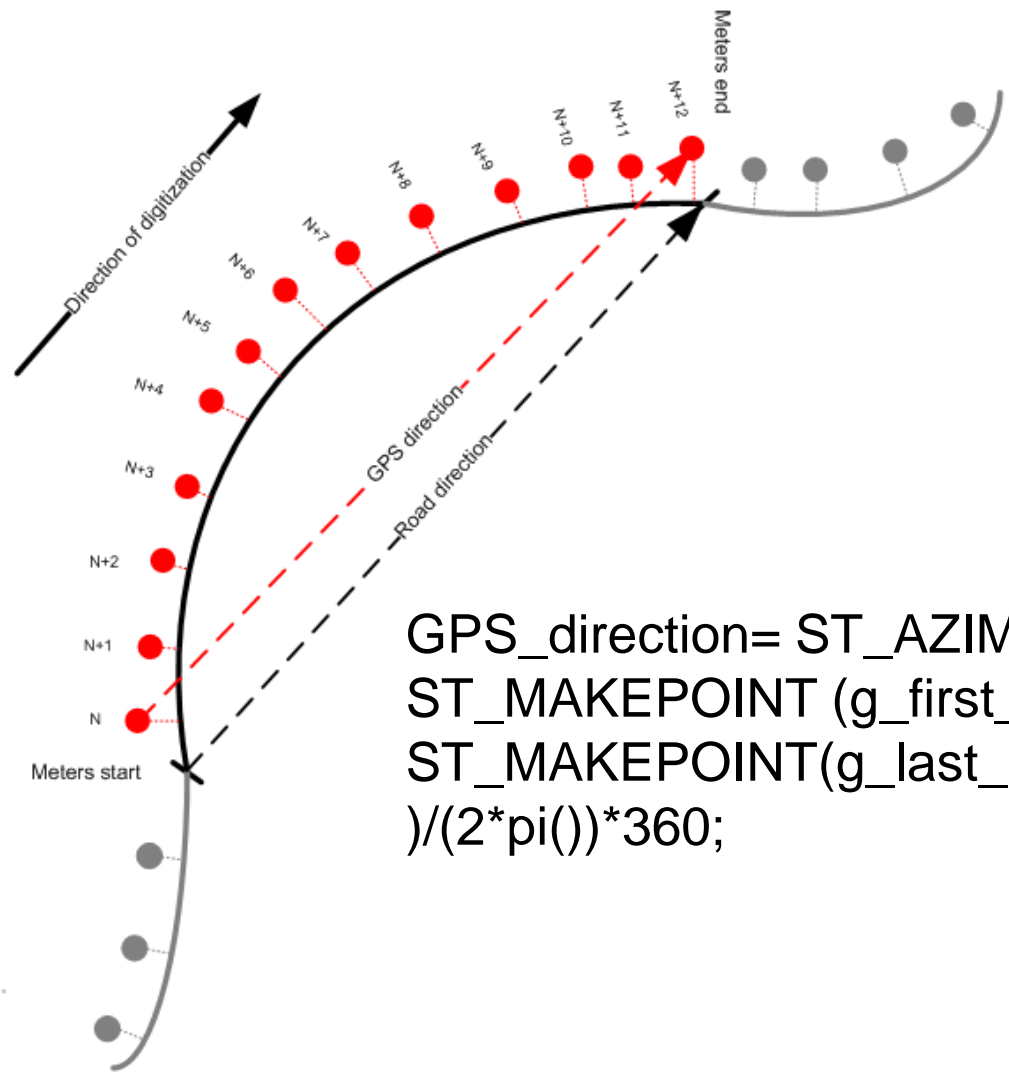
GPS_direction= ST_AZIMUTH (
ST_MAKEPOINT (g_first_X_utm33n,g_first_Y_utm33n),
ST_MAKEPOINT(g_last_X_utm33n,g_last_Y_utm33n)
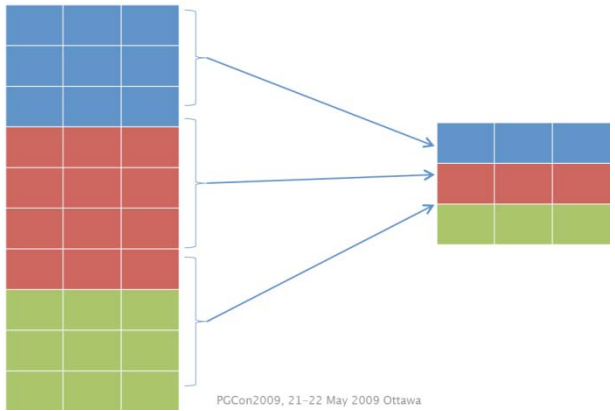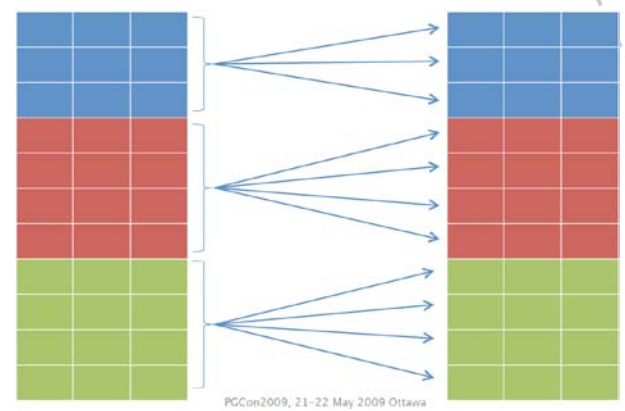)/(2*pi())*360;

SQL window functions

Group by

Window

Database meets the spreadsheet

Fetter & Harada – PGCon 2009

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Comparing micro trips

Box plot of observed RPA (Relative Possitive Accelerations)

Boxplot of ARTEMIS RPA (Relative Possitive Accelerations)

Plot of mean

ARTEMIS and Norwegian truck driving behavior
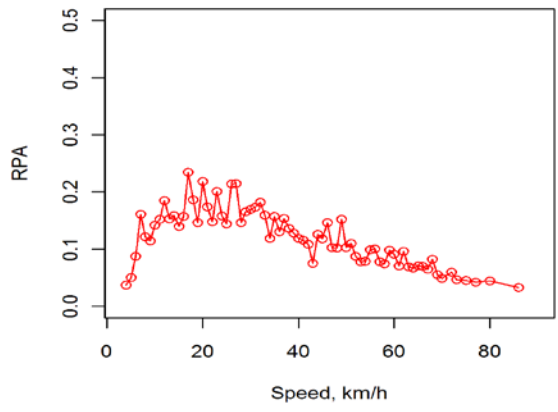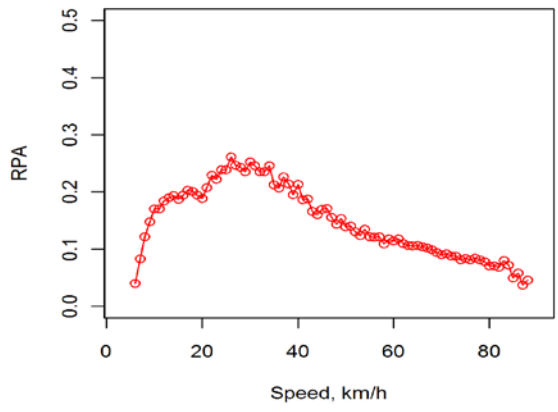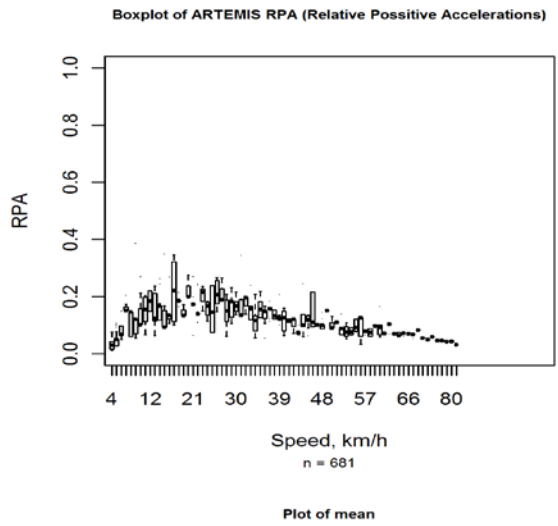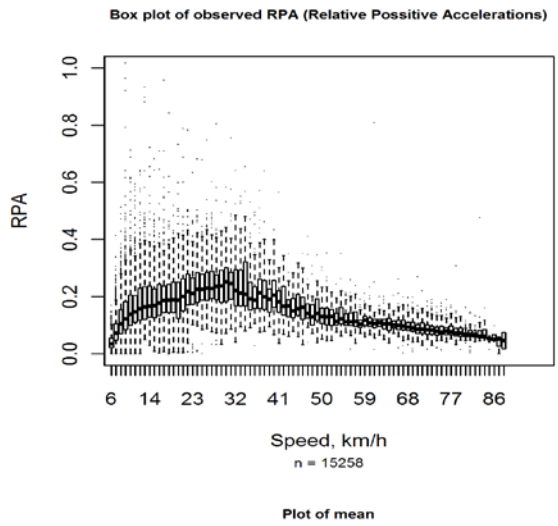
$$RPA = \frac{\int_0^T (v_i * a_i^+)dt}{x}$$

Analysis in R via ODBC

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Driving speeds

Box plot of driving speeds
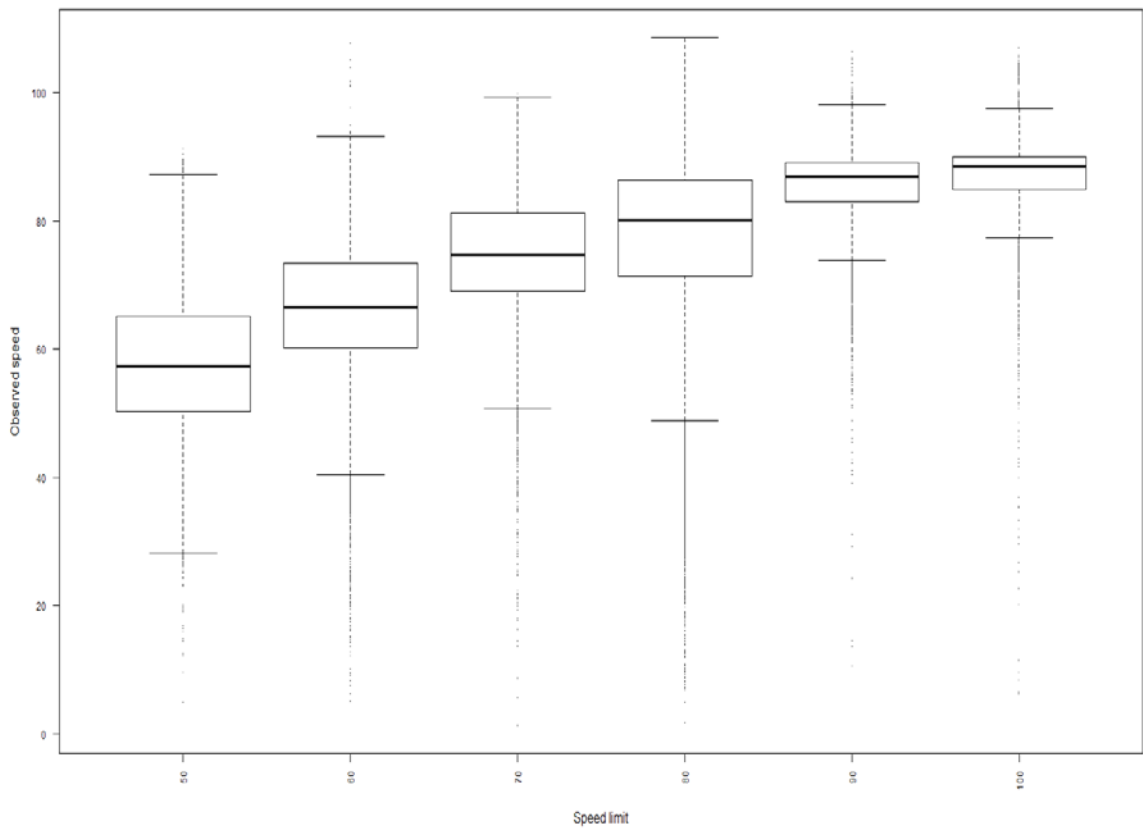
Speed limit	Mean observed speed	Standard Deviation	95% CI
50	57,8	11,9	57,4 - 58,2
60	66,4	11,2	66,2 – 66,6
70	74,6	9,3	74.5 – 74,8
80	77,4	11,4	77,3 – 77,5
90	85,1	6,48	85,0 – 85,2
100	86,6	8,49	86.3 – 86,9

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GPS artifacts

Dot plot of speed and acceleration
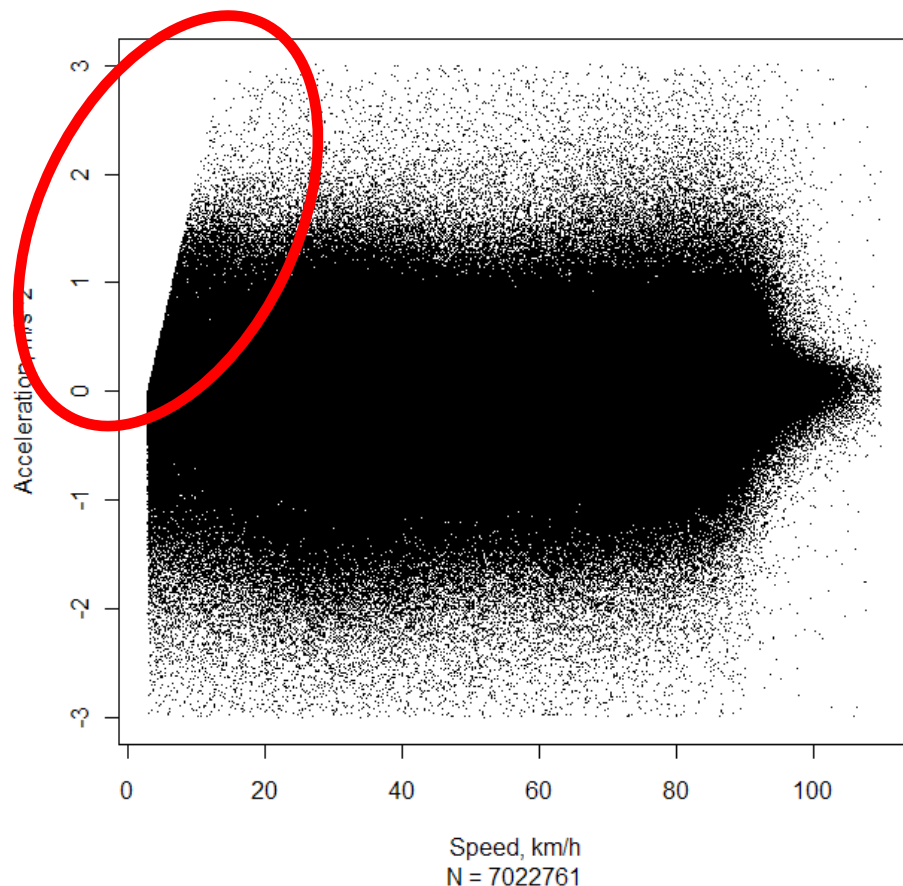
GPS chip post processing, Antaris GPS engine "correction"

Conclusion

- Cheap GPS units can be used, but prototype before going full scale.

- Open source alternatives exists, but don't expect GUI heaven.

- 10 million+ data: NO PROBLEM (7.2 million GPS points matched in 9 minutes and 54 seconds, 5.5 days in ESRI ArcEditor)

- Tools without license fees are capable of storing, analyzing and presenting large amounts of data!

Acknowledgements:

The GAZ project:

> for financing the server hardware

Norwegian public Roads Administration:

> for PHD funding

Research council of Norway:

> for project funding

Tollpost Globe:

> for getting the project of the ground

Green Freight Project partners:

> for valuable contributions

SINTEF:

> for good colleagues