



1. Measurements of linear features – first results
2. GNSS measurements in afforested areas – a problem?
3. Certification of GNSS equipment

1.



# Measurements of linear features – first results

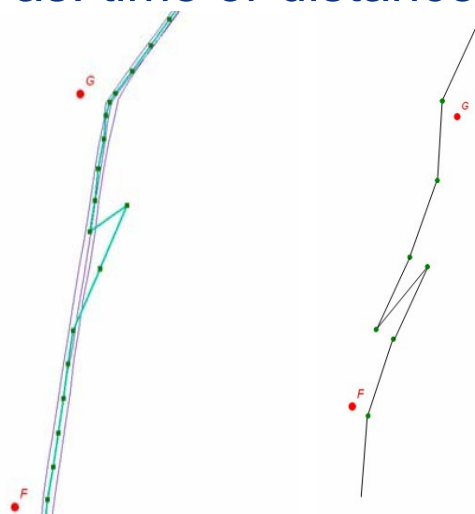
## Rationale

- lack of experiences to update the technical recommendation ( $>500\text{m}$ )
- increasing performance of the GNSS system
- need of traceability of measurements taken during control on the spot

## Two methods: Kinematic vs. Stop & go



- logging data continuously
- logging interval expressed as: time or distance

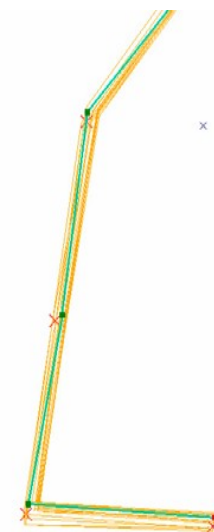


Pros: a lot of data logged – high reliability

Cons: length of the features exaggerated!

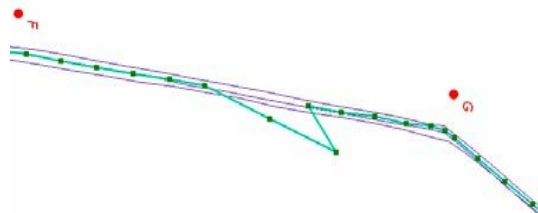


- logging data only at the key-points
- point = operator's decision

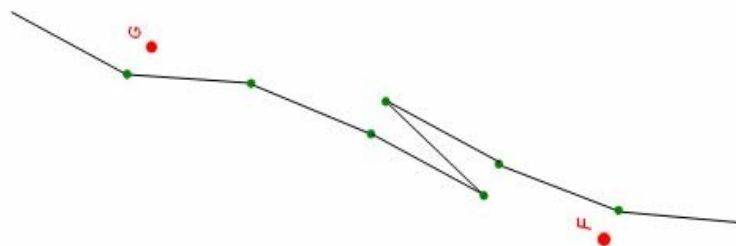


Pros: length of the features not exaggerated

Cons: fewer measurements – reliable?



# Kinematic method



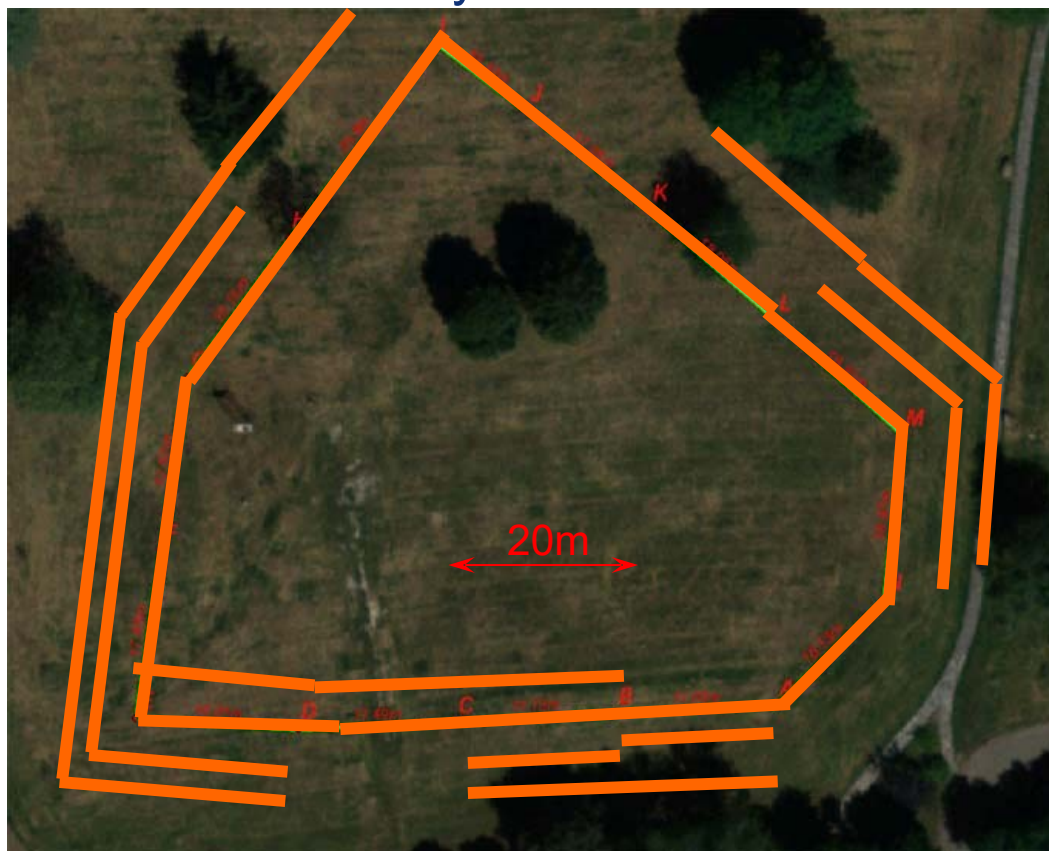
## Kinematic method – data acquisition

- Reference: Trimble 5700, Zephyr antenna, RKT method (cm precision)
- 9 segments - 24 measurements: 4 x 6days



Geo XT with Terra Sync:

- no postprocessing,
- no EGNOS

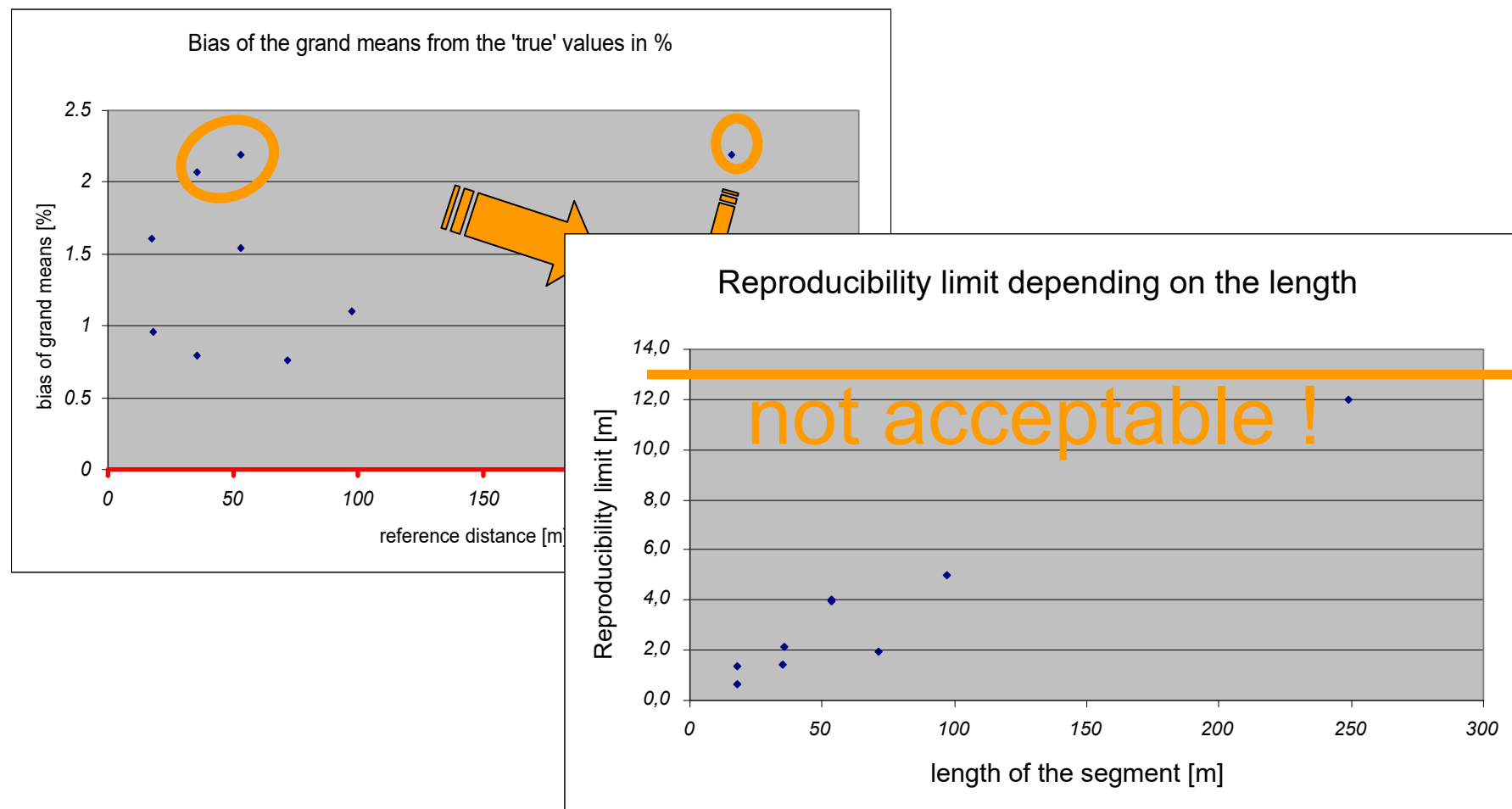


## Kinematic method – data processing

- tests for outliers: Cochran's and Grubb's (4 outliers, 4 strugglers)
- computation of the parameters:
  - grand mean
  - bias from the 'true value'
  - standard deviation
  - reproducibility limit (R)
- graphs preparation
  - $\sim 2.8 * \text{stdev}$



# Kinematic method – results



# Stop & go method

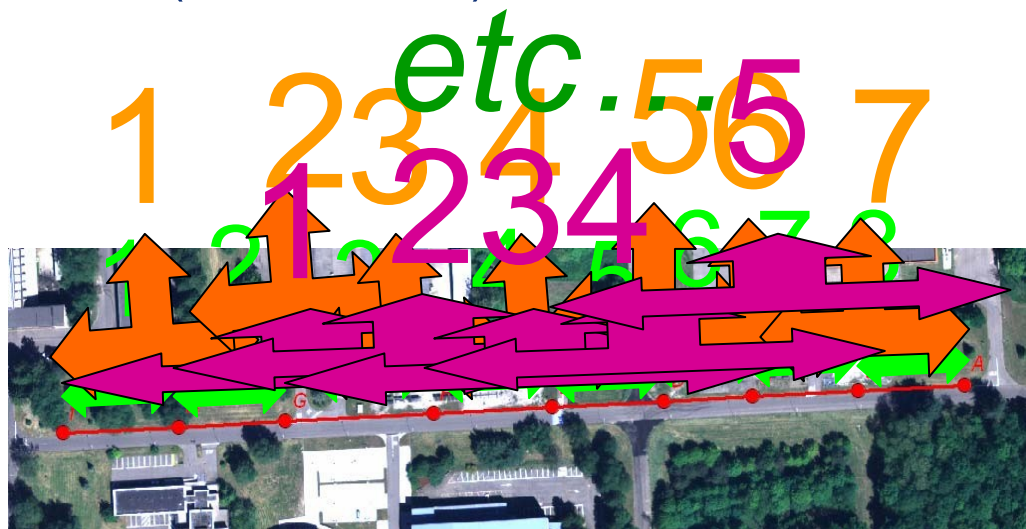


## Stop & go method – data acquisition

- reference: Trimble 5700, Zephyr antenna, RKT method
- 9 **points** measured: **one** position logged only!
- average distance between points ~50m
- each point = **24 measurements** (4 x 6 days)
- Length of 36 segments calculated (50m - 425m)

Geo XT with Terra Sync:

- no postprocessing,
- no EGNOS,

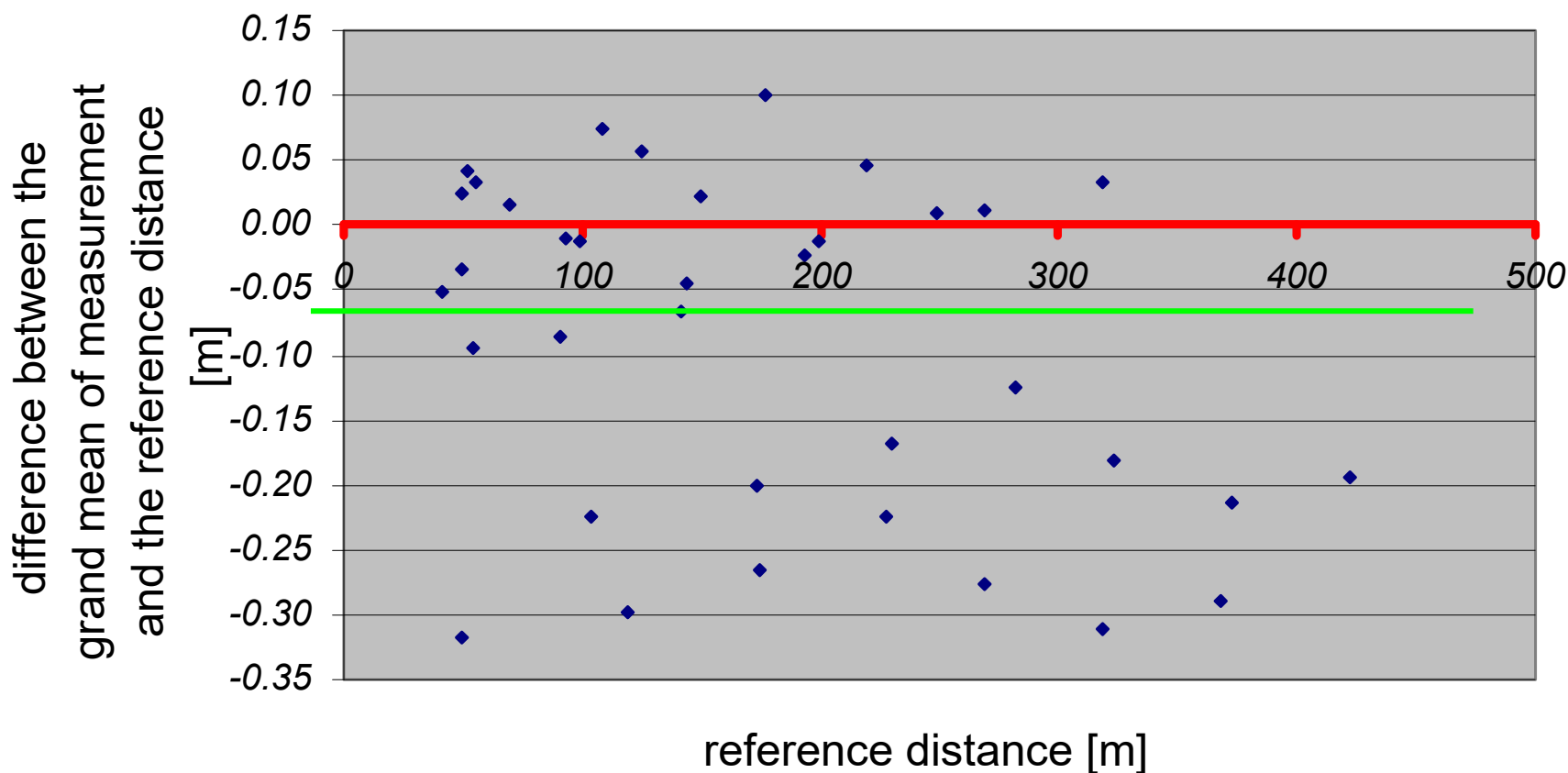


# Stop & go method – data acquisition

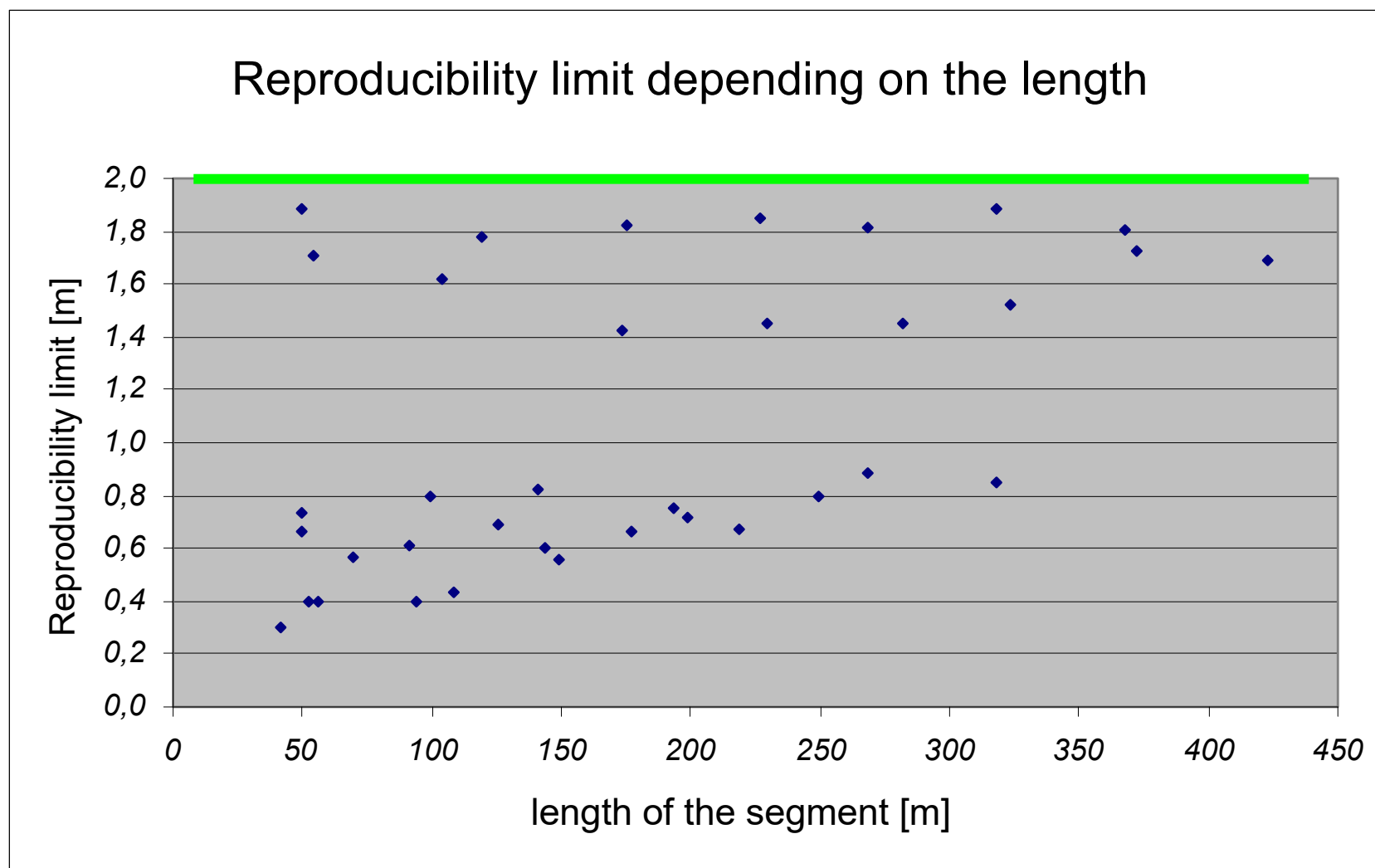


## Stop & go method – data processing & results

tests Bias of the grand means from the ('true' values, no strugglers)  
Bias of the grand means from the ('true' values, no strugglers)



## Stop & go method – results



## Results

- ~~Kinematic method does not give satisfactory results~~
  - Bias > 2% with reproducibility st dev ~ 1.5%
  - Reproducibility limit at 95% level of confidence even > 5% !

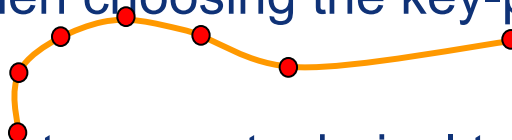
- Stop & go method of measurements gives satisfactory results when measuring features over 100m:
  - 'bias' of -0,07m with reproducibility st dev < 0.7m
  - Reproducibility limit at 95% level of confidence < 1.9m

Not bad !



## Conclusions

- Stand alone GNSS receivers can be used with satisfactory results for measuring features **longer than 100m**
- **Stop & go** method is recommended for measuring linear features
- Operator should pay attention when choosing the key-points of the feature to reflect the shape
- Based on this test we recommend to use a technical tolerance of **2m regardless of the distance measured**
- Extension of the time of logging would **?** probably improve the accuracy of the measurements
- The test should be extended to other receivers and longer segments



2.

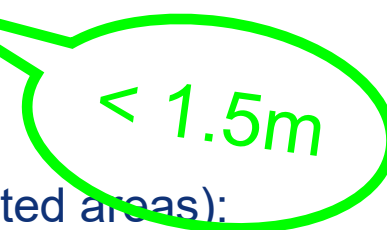


# GNSS measurements in afforested areas – a problem?

## Why to measure forest?

- COMMISSION REGULATION (EC) No 1975/2006, Article 15 (2) Elements of the on-the-spot checks and determination of areas

*However, for the measurements set out in Article 36(b) (iii), (iv) and (v) of Regulation (EC) No 1698/2005, the Member States may define appropriate tolerances, which shall in no case be greater than twice the tolerances set down in Article 10(1) of Regulation (EC) No 796/2004.*



COUNCIL REGULATION (EC) No 1698/2005, Article 36b (forested areas):

- (iii) first afforestation of non-agricultural land;
- (iv) Natura 2000 payments;
- (v) forest-environment payments;

**max 3 meters times perimeter**

## Measurements in the forest:

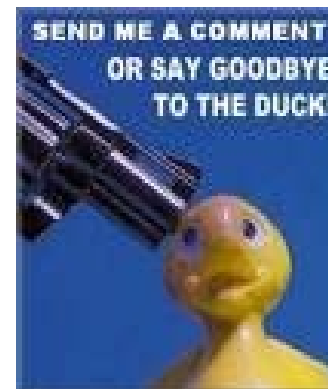
- Where is the object?
- Is there any signal?
- Quality of the signal ? No of sat, PDOP, SN ratio, strong multipath effect
- Kinematic? Stop & go (how long) ?
- Buffer < 3m ?



## Questions:

- Do you have to measure forested areas?
- If so, how? With what tolerance?

We wait for your feedback !



3.



# Certification of GNSS equipment

## What is obligatory ?

EU Directive 2004/22/EC on measuring instruments. As is noted in the pre-amble (2) of this text:

*Correct and traceable measuring instruments can be used for a variety of measurement tasks. Those responding to reasons of public interest, public health, safety and order, protection of the environment and the consumer, of levying taxes and duties and of fair trading, which directly and indirectly affect the daily life of citizens in many ways, may require the use of legally controlled measuring instruments.*

Commission Regulation 972/2007, Article 1 (9):

*Agricultural parcel areas shall be determined by any means proven to assure measurement of quality at least equivalent to that required by applicable technical standard, as drawn up at Community level.*

A document “proving” or assuring the quality of the instrument!

## How to produce this proof:

**New instrument:** probably manufacturers go to a *Certification Body* Still only one commercial Certification Body recognized by the JRC

## **Instruments in use pre-2008:**

use existing statements (e.g. JRC statements about some models of: Trimble, Thales, Leica and Satcon)

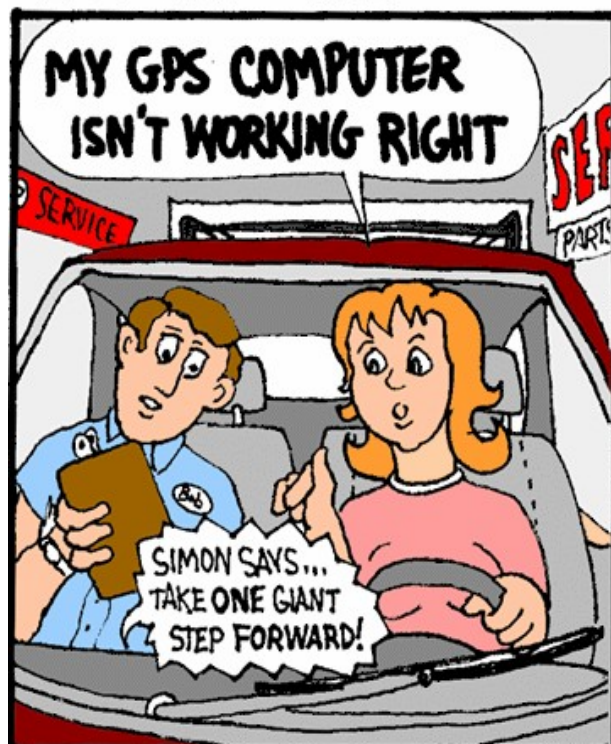
MS data collection and testing – following guidance and help from JRC

worst case - default values (WikiCAP) (careful!)

## Progress reporting:

- Still only one commercial Certification Body recognized by the JRC
- Progress in certification numbers
- Certification of the operator by Navcert – GNSS Workshop in Dublin, 9-11April

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Thank you for your attention...