The utilization potential of airborne laser scanning in an INSPIRE-compliant hydrographic data revision

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Background and motivation

Small basins with low order streams comprise up to 75% of EU total stream length.

Conventional methods do not support current user & legal requirements.

To provide a solid interoperable framework for mapping, reporting and modelling purposes.
Hydrographic features at the TDB

Topographic data for a multitude of uses

5 000 - 10 000 scale

Dataset Revision
Continuous
5-10 year basis
INSPIRE data specification on hydrography

DQ follows the structure of “ISO 19138 Geographic information - Data quality measures” standard

Completeness (EC&EO)
Logical consistency
Positional accuracy
Thematic accuracy
Temporal accuracy
Data quality specification on hydrography

Hydrographic feature capturing specification

Features of permanent/temporary water

Categorization: Surface / Sub-surface

Selection criteria

>5 m (polygon) exceptionally

2-5 m (polyline)

<2 m (polyline)
Data quality specification on hydrography

Topographic data quality model 1995, 2006

Visibility ID of watercourses
3 (from 1 to 4)

Positional accuracy
RMSE, 5 metres
Airborne laser scanning (ALS)

Measures distance to surfaces by timing the outgoing laser pulse and corresponding return(s)

Vertical accuracy ≈15 cm

STUDY AREA DATA SETS

NLS ALS data
92,645,585 points  1.1 points/m²

Reference data (FGI ALS data)
1,041,530,264 points  8.9 points/m²
ALS for watercourse mapping

Limitations

Forest canopy
Plains
Detailing
Human-impacted landscapes
Flow extraction solely based on drainage area

Where do channels begin?
Research methodology

1. Creation of reference data

Completeness (FGI ALS)  PA (VRS-GPS)

2. Test on NLS ALS and TDB HY
Reference data completeness

ALS point cloud data

Calibration & classification

Gridded DEM

Hydrologic modelling

Manual data editing

NLS test data

ALS ground points

Gridded DEM

Hydrologic modelling

Reference data PA

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Reference data completeness

ALS point cloud data
Calibration & classification
Gridded
DEM

ALS ground points
Gridded
DEM

Hydrologic modelling

Hydrologic modelling

TDB

Manual data editing

NLS test data

Reference data PA
Completeness

Presence or absence of features

Sub-element C&O

- TDB Streams
- NLS ALS 1-m 2ha DT
- Swamps
  Reference data buffer

Distance (m):
- 1
- 2
- 3
- 4
- 5
- 7.5
- 10
Positional accuracy; RMSE

How to compare and assess similarity of polyline sets?

Absolute PA

Closeness of reported coordinate values to values accepted as or being true
Results; NLS ALS

Efficiency rates of ALS-based automatic methods vary

3 zones

Completeness 42%
PA (RMSE) 21.7 m

Completeness 54%
PA (RMSE) 8.1 m

Completeness 66%
PA (RMSE) 1.9 m
Results; NLS TDB

No errors of commission*, some errors of omission

EO
15% TDB
PA (RMSE) 93.9 m

Completeness
91%
PA (RMSE) 4.7 m
Results; NLS TDB RMSE values
Conclusions

• ALS takes feature capturing to the next level

• Fully automatic delineation not a solution

• Combination of all methods is Key for more scale-independent HY features
  • Measures for channel initiation precision

• TDB features are final product, ALS initial!
  • Superior results under demanding conditions
Want to know more?

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