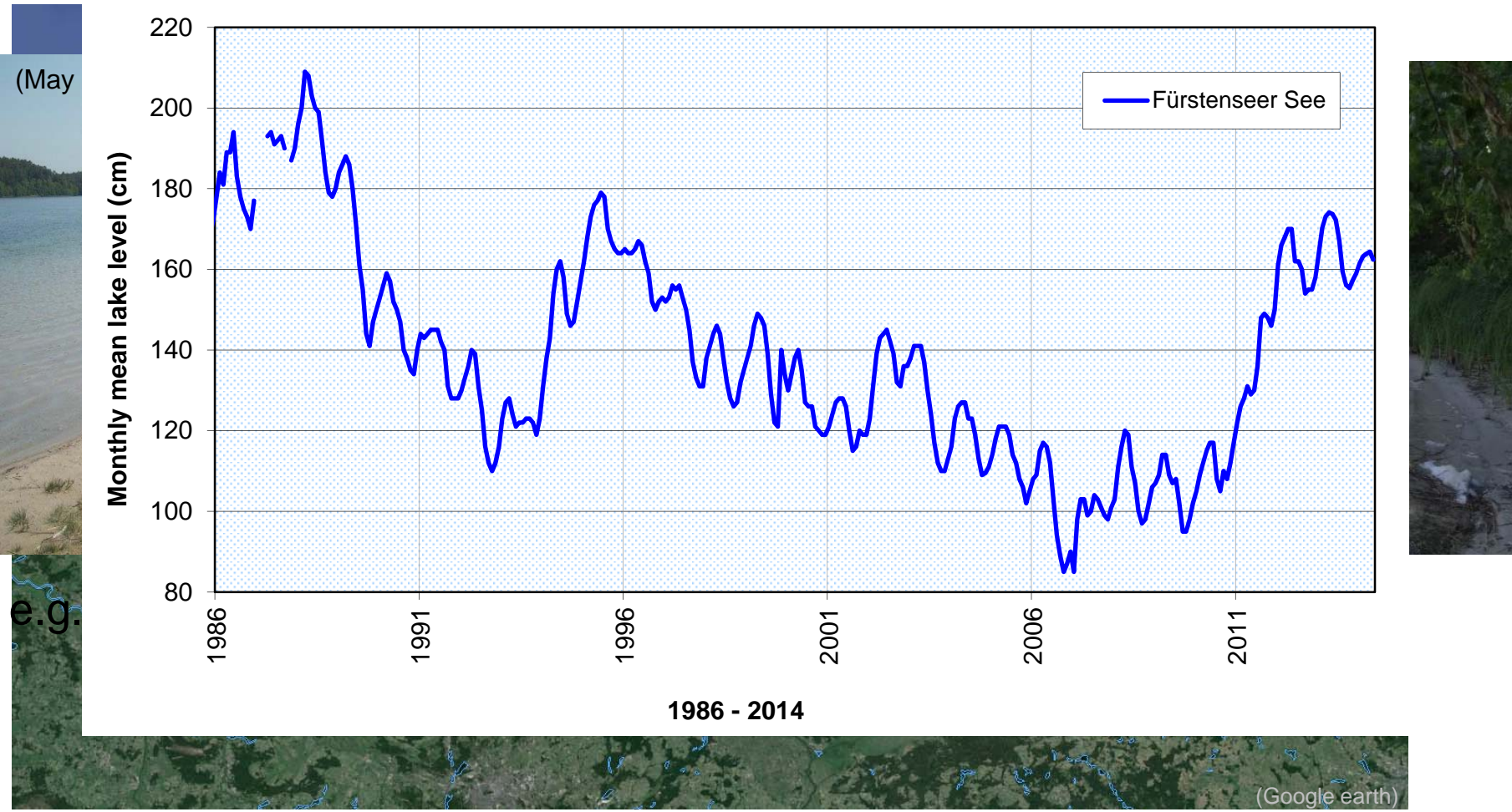


Reconstruction of historic lake levels in NE Germany using remote sensing archive data

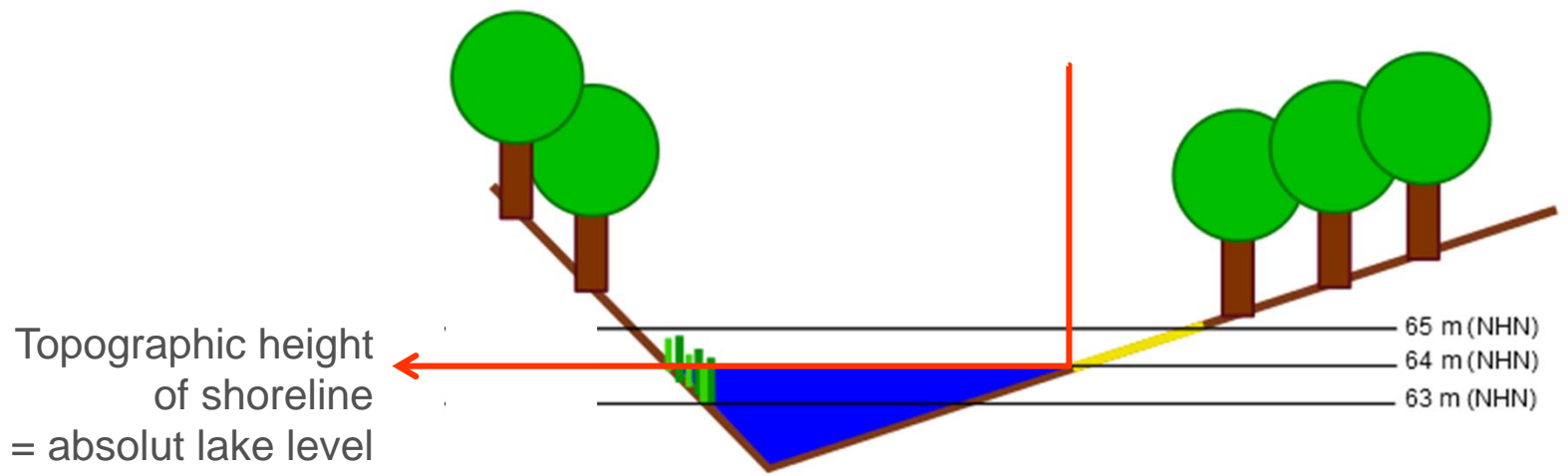
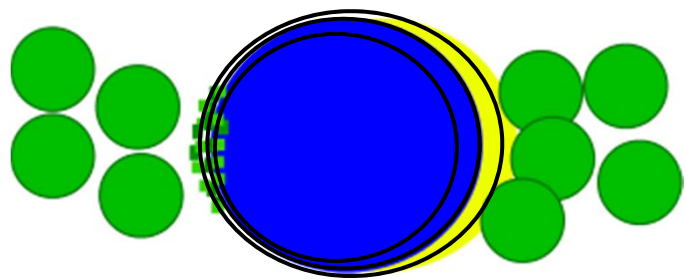
Iris Heine (email: iris.heine@gfz-potsdam.de)
Julian Oeser, Sibylle Itzerott

A Virtual Institute within the Helmholtz Association

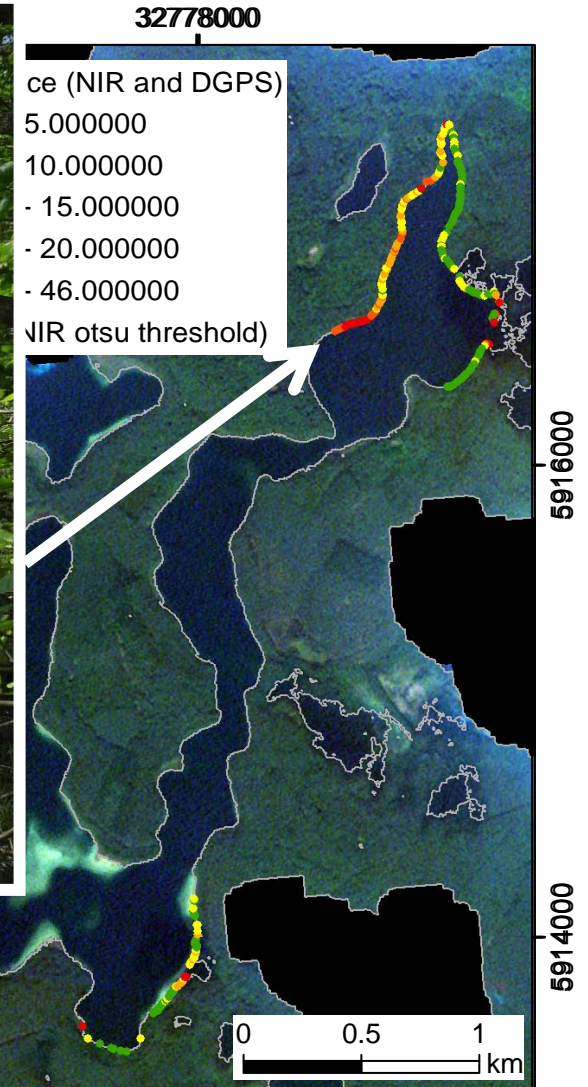
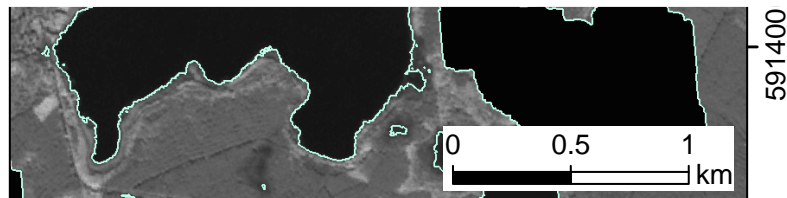
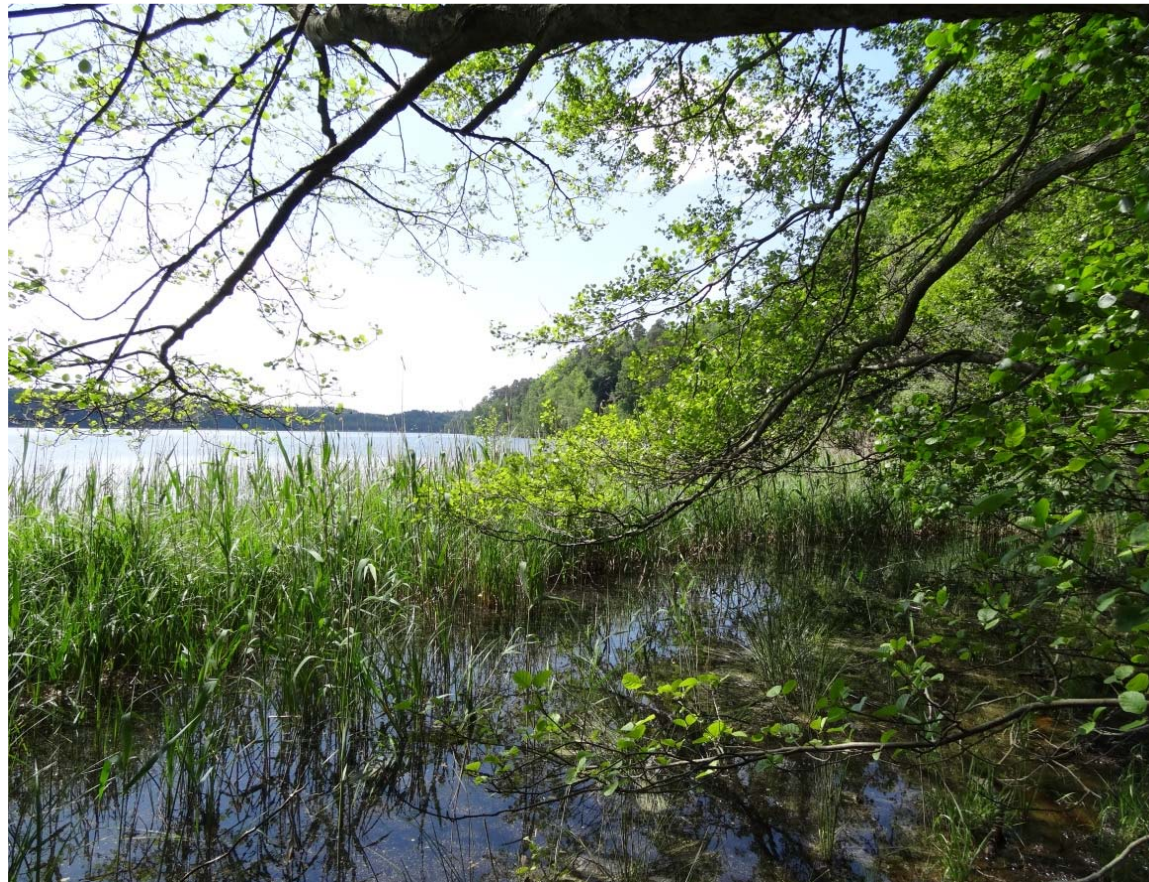
The issue of lake level changes



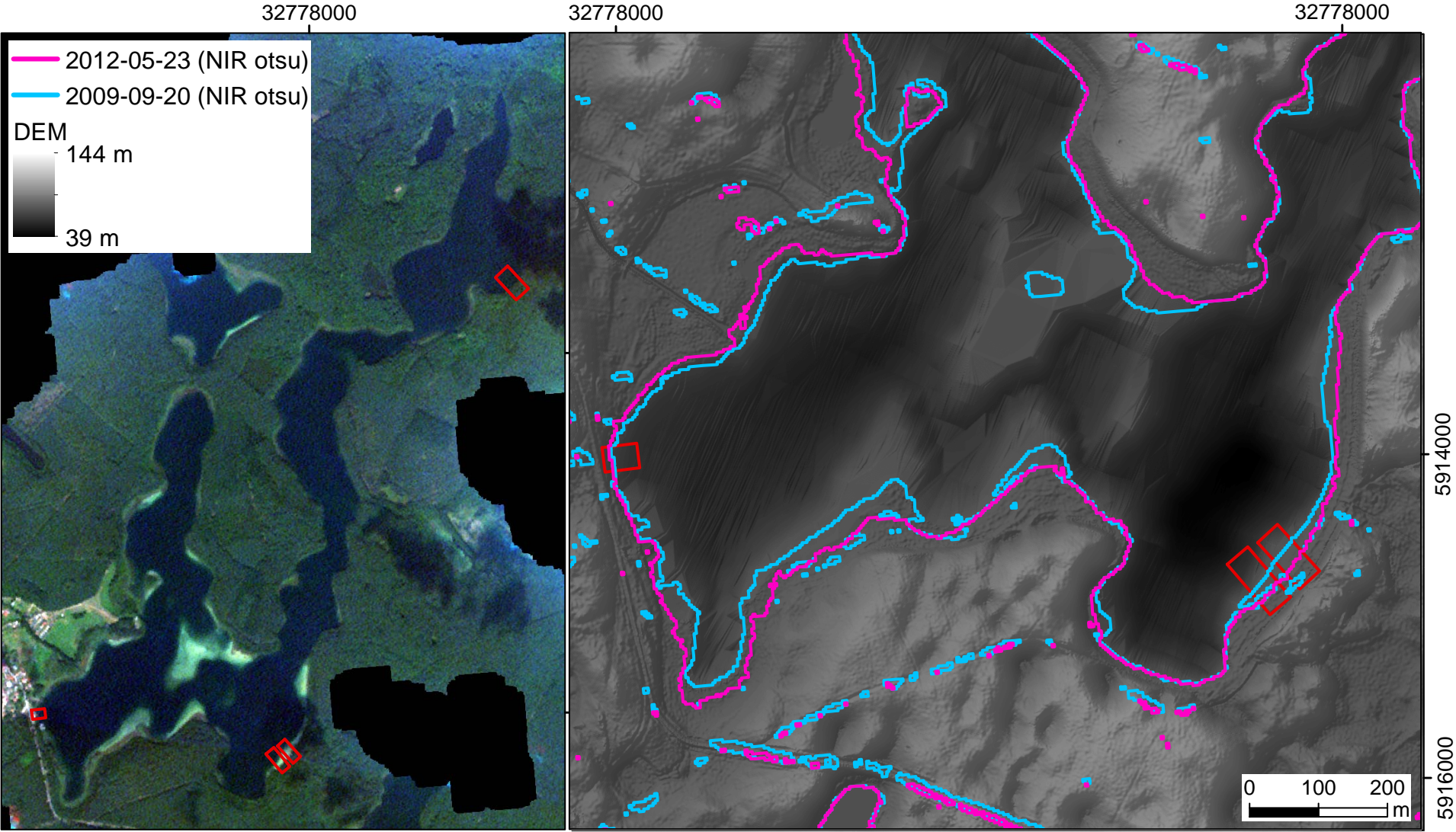
Principles of the reconstruction of lake levels



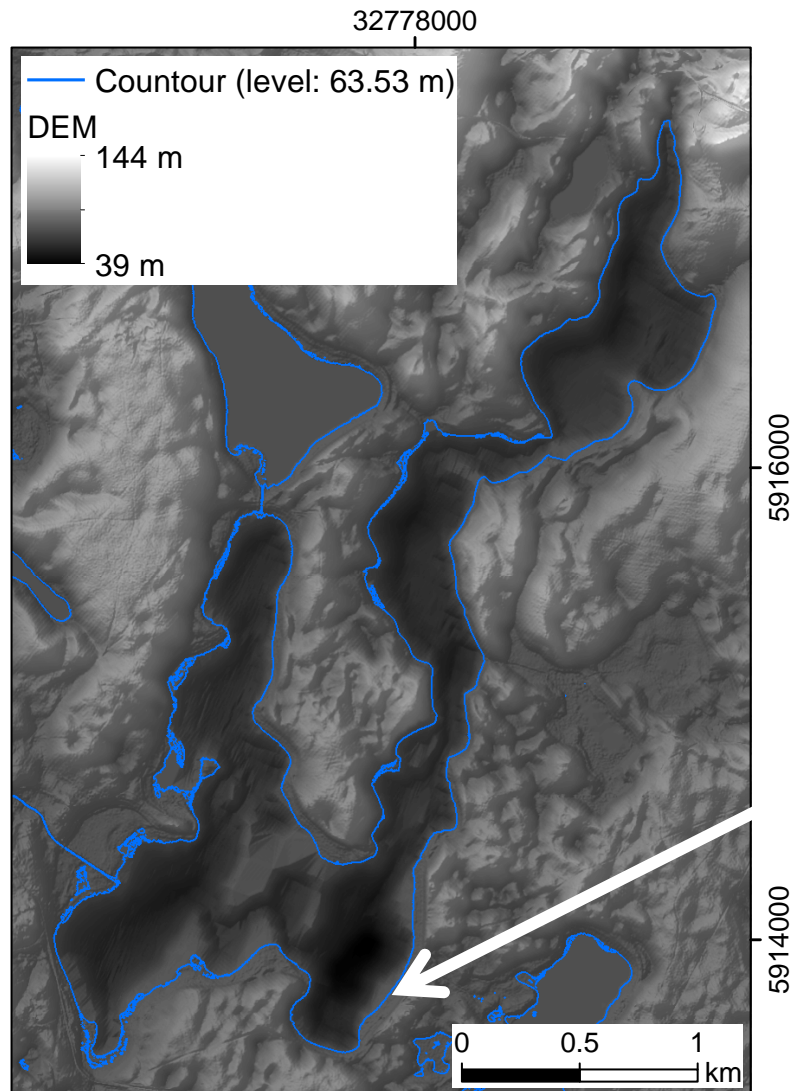
Shoreline extraction + validation



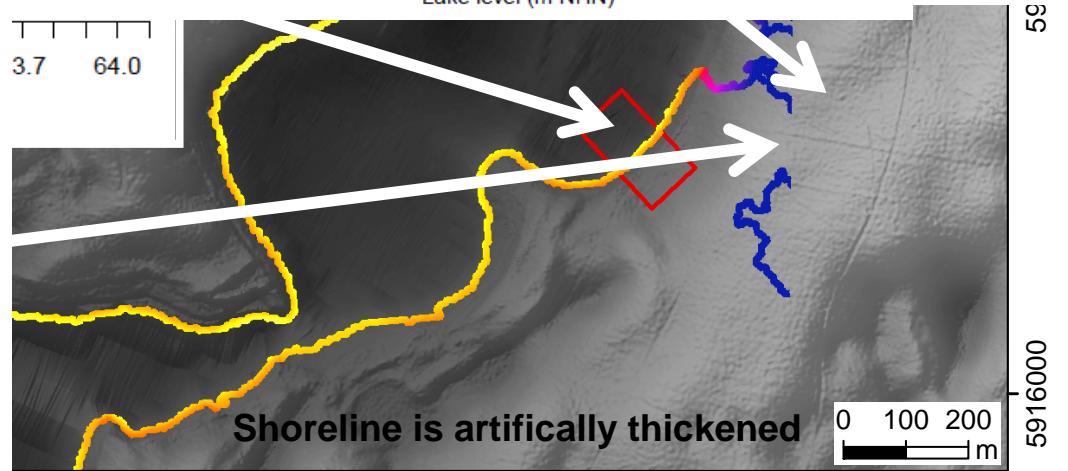
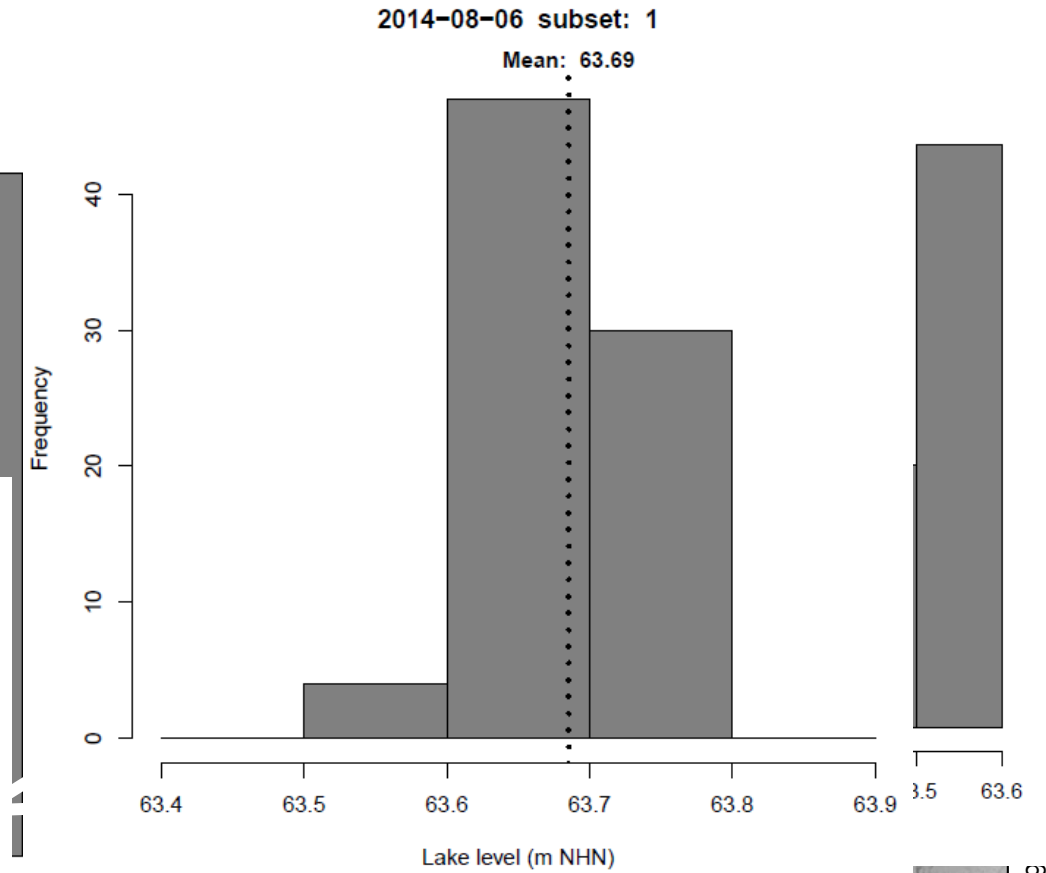
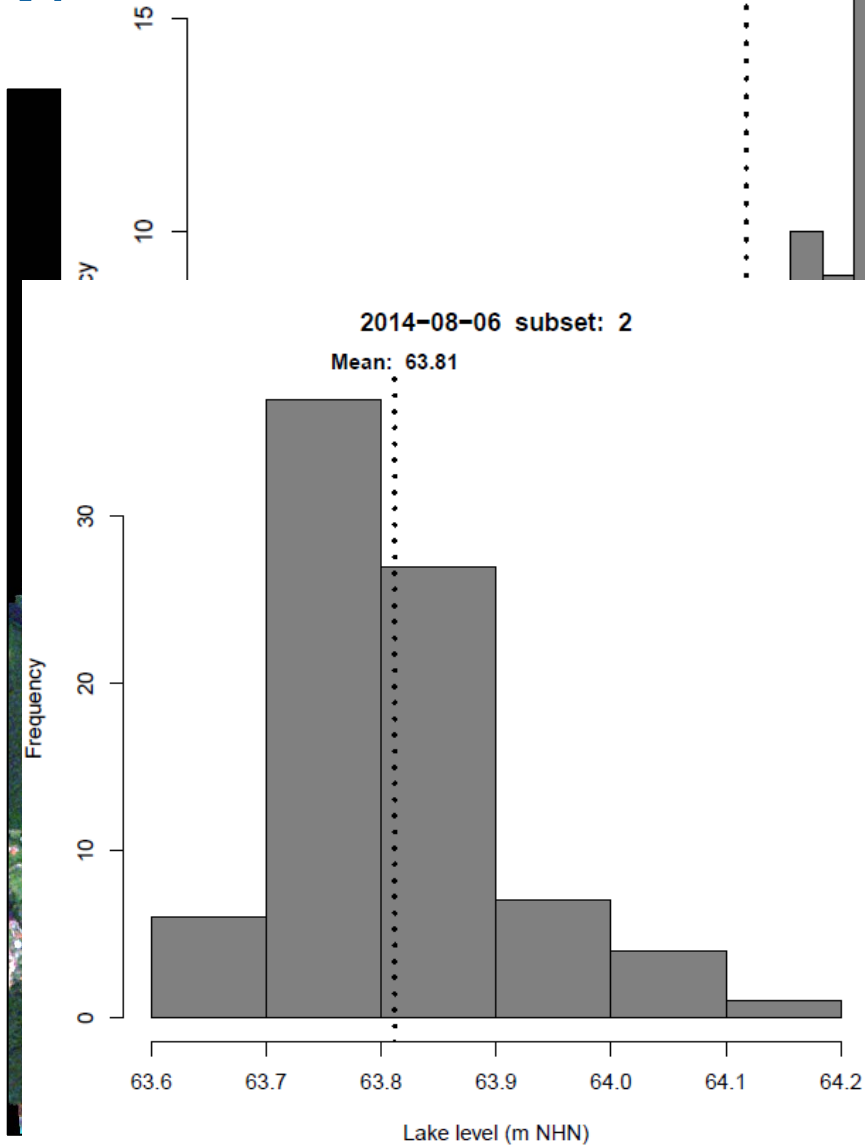
Shoreline topography



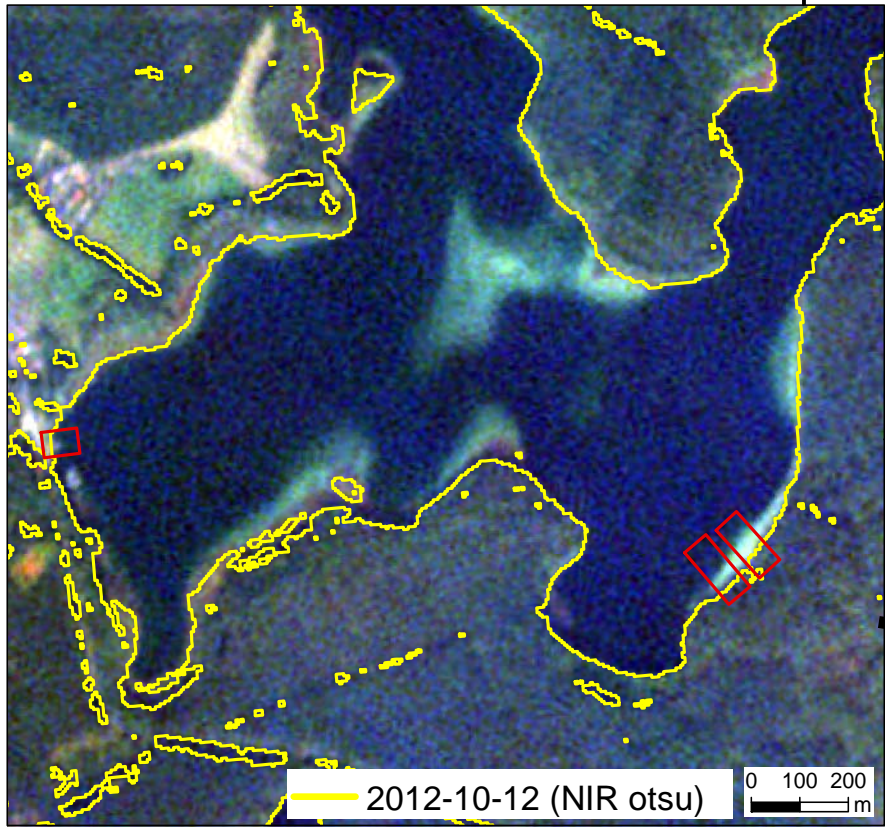
Digital elevation model (DEM)



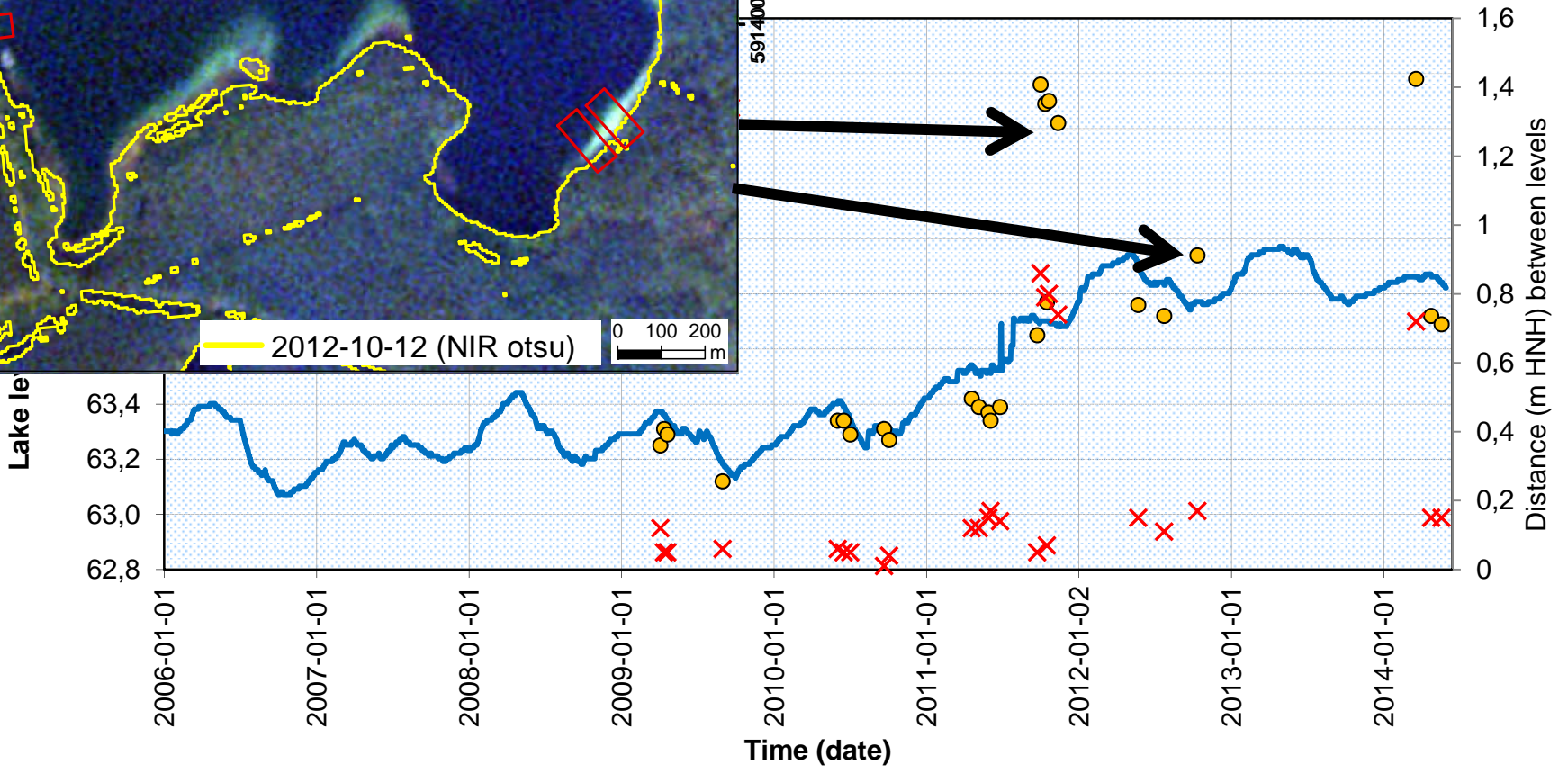
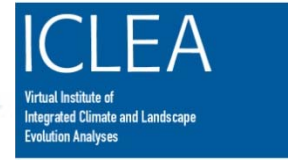
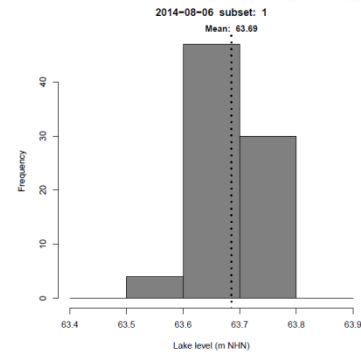
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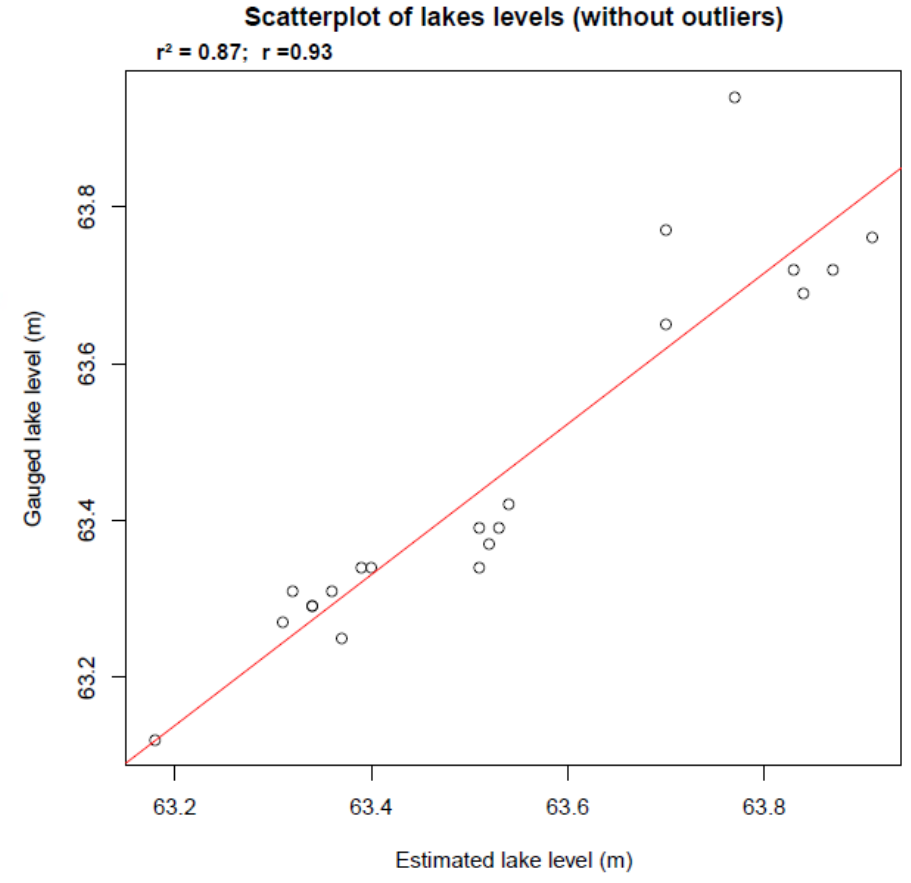
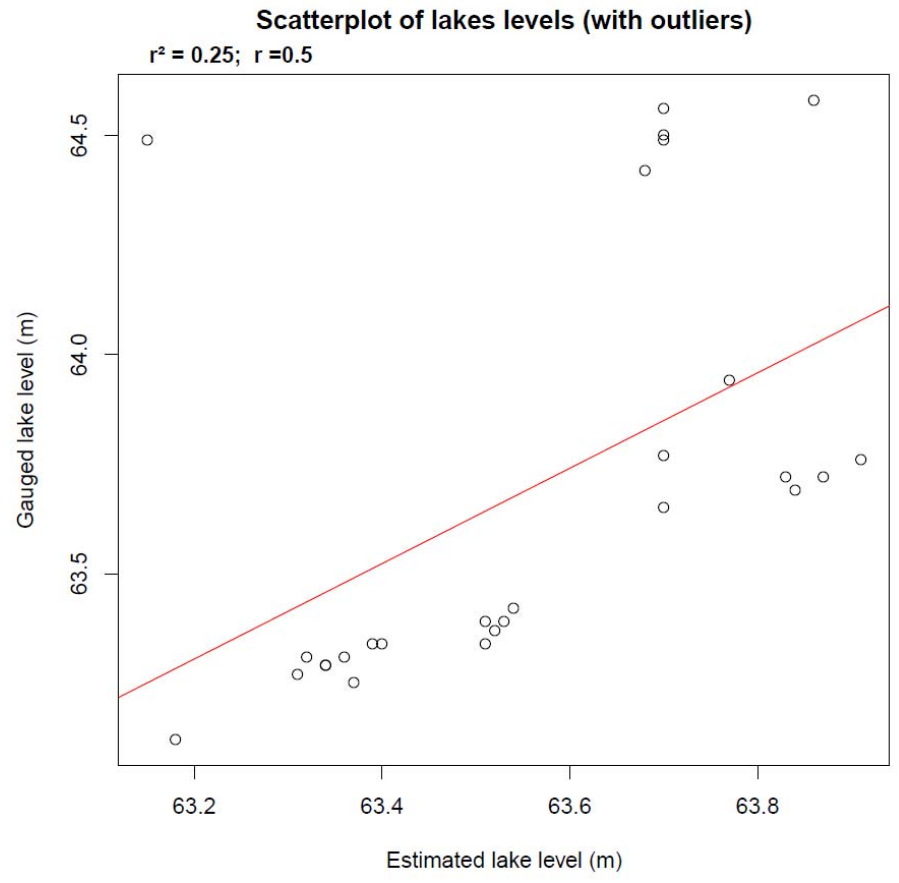
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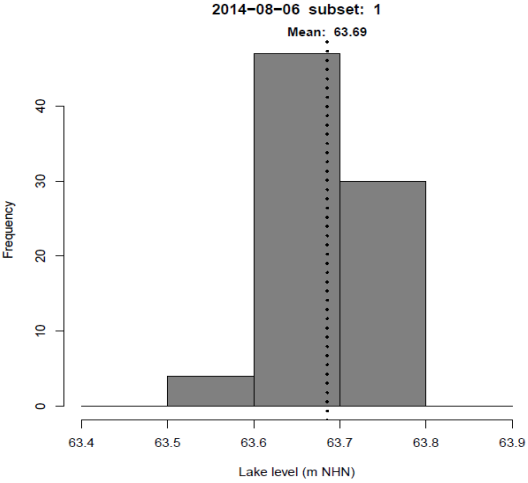
ed levels



Validation of estimated levels → outliers (subset 1, “mode”)



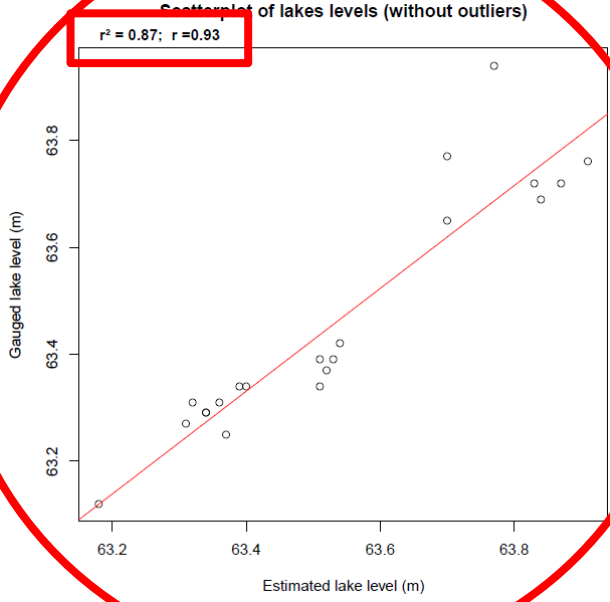
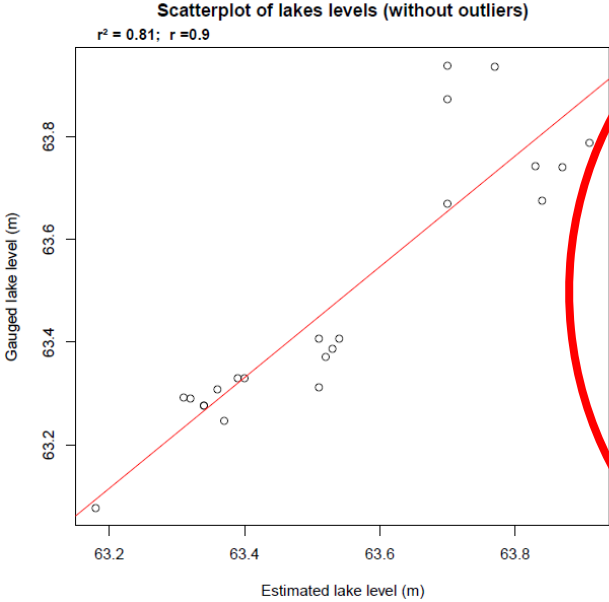
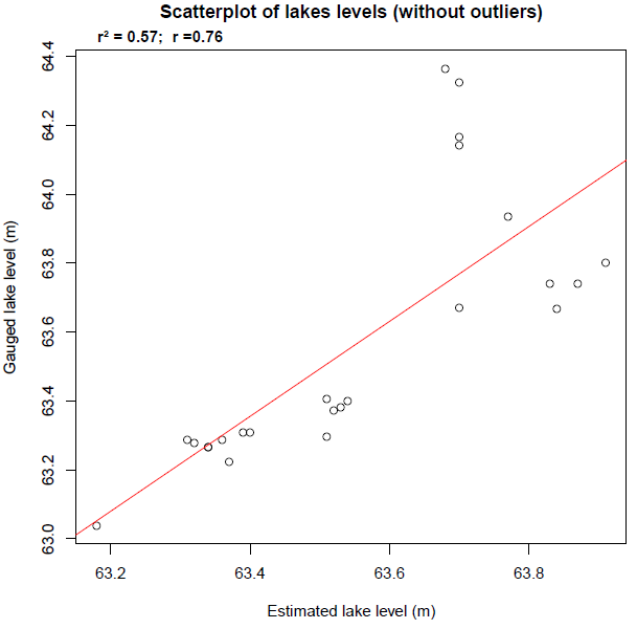
Histogram analysis (subset 1)



Mean

Median

Mode

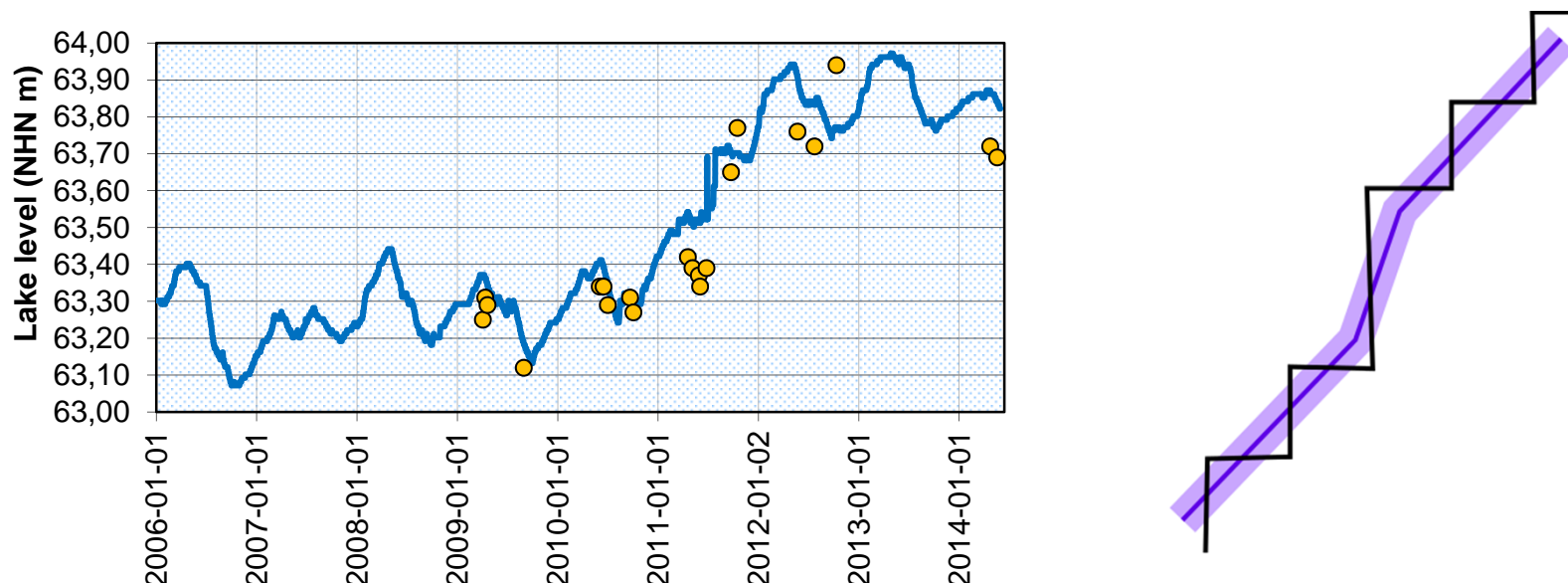


Lessons learned

- Level estimation needs accurate shoreline detection in RapidEye image and a shallow shoreline topography
- Range of estimated levels and “mode” correlates best with in situ gauged levels
- Critical point in level estimation is the accuracy of the shoreline detection: automatic classification of shoreline vs. probability of misclassifications

Open questions – next steps

- How to reduce misclassifications? NDWI vs. NIR?
- Improve accuracy through post-process the shoreline? Filtering, smoothing, buffer?
- Analysis of short-term level changes? More images? Additional data (TerraSAR-X)?
- Transferability?



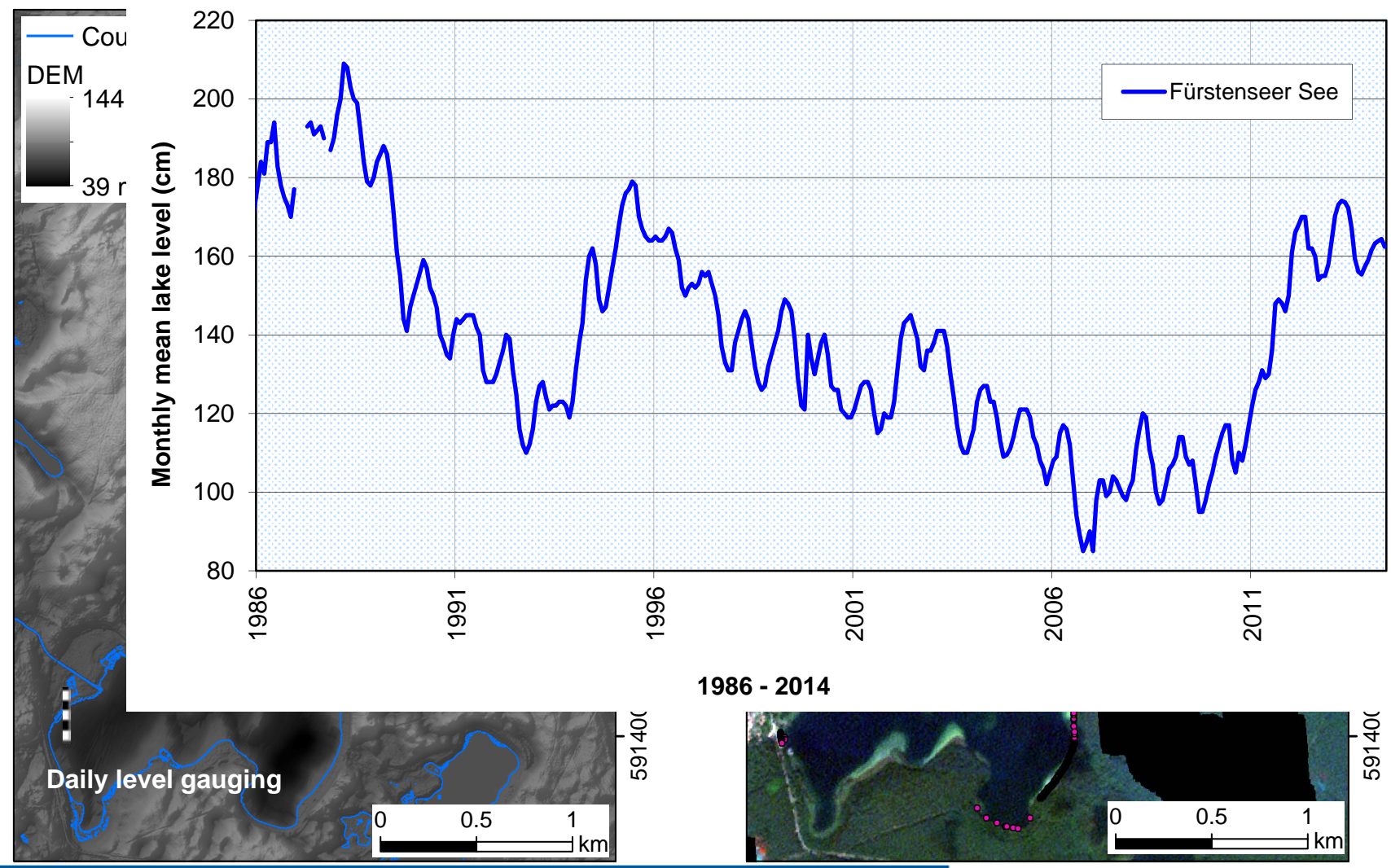
iris.heine@gfz-potsdam.de



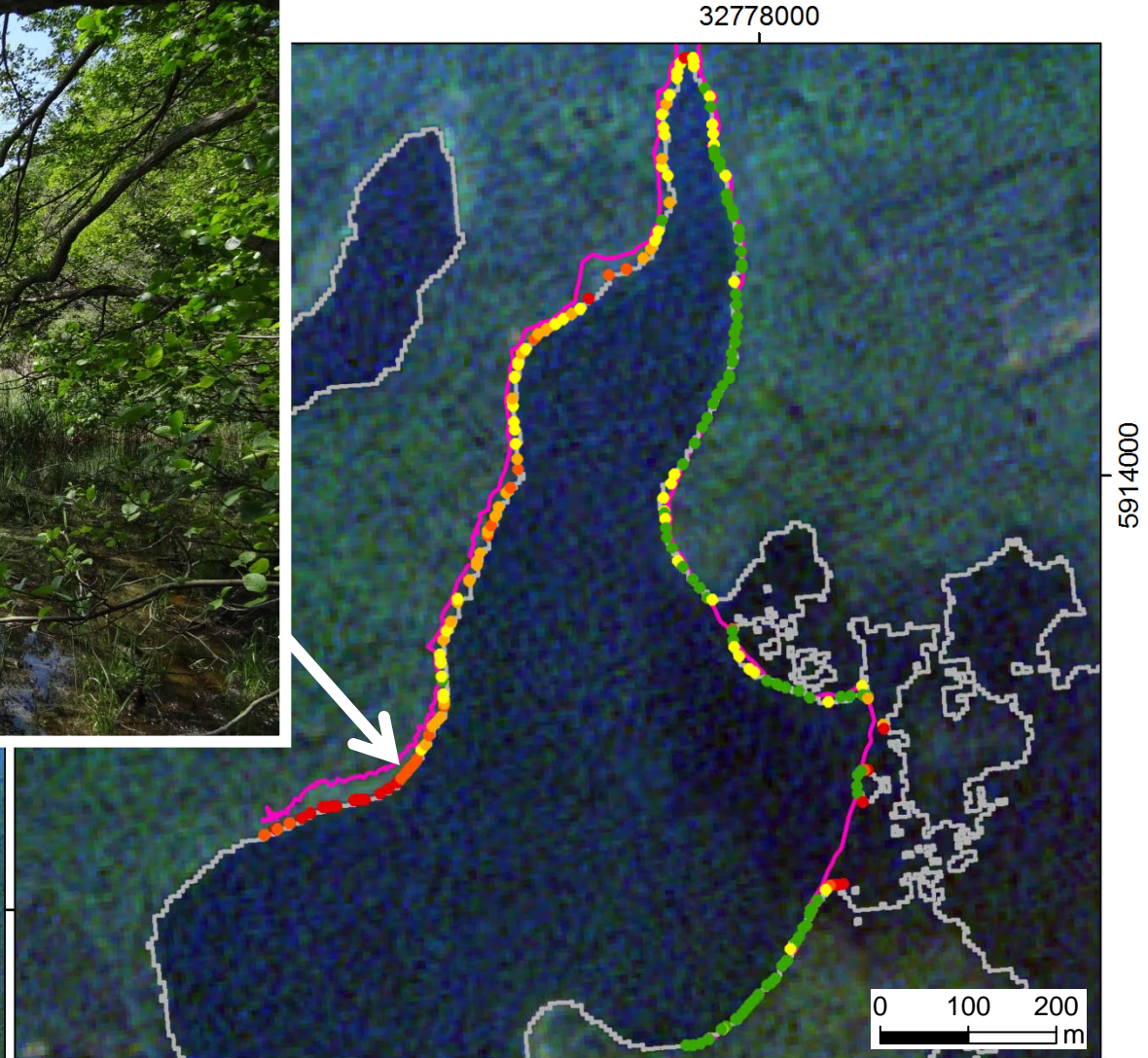
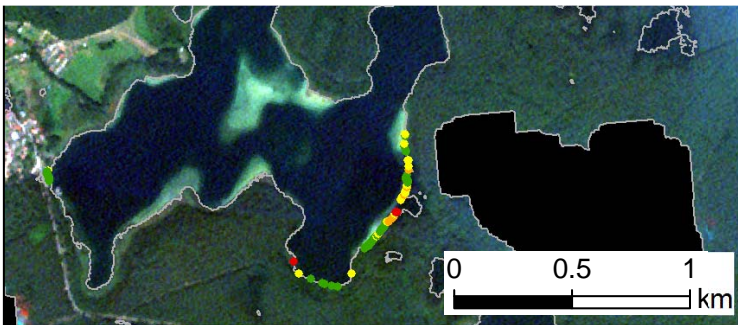
This study is a contribution to the Virtual Institute of Integrated Climate and Landscape Evolution Analysis –ICLEA– of the Helmholtz Association.

Lake level data are provided by "Staatliches Amt für Landwirtschaft und Umwelt Mecklenburgische Seenplatte". RapidEye images are provided by Blackbridge (RESA-ID A1274, ESA EO 14611). Digital terrain model is provided by "Landesamt für innere Verwaltung Mecklenburg-Vorpommern".

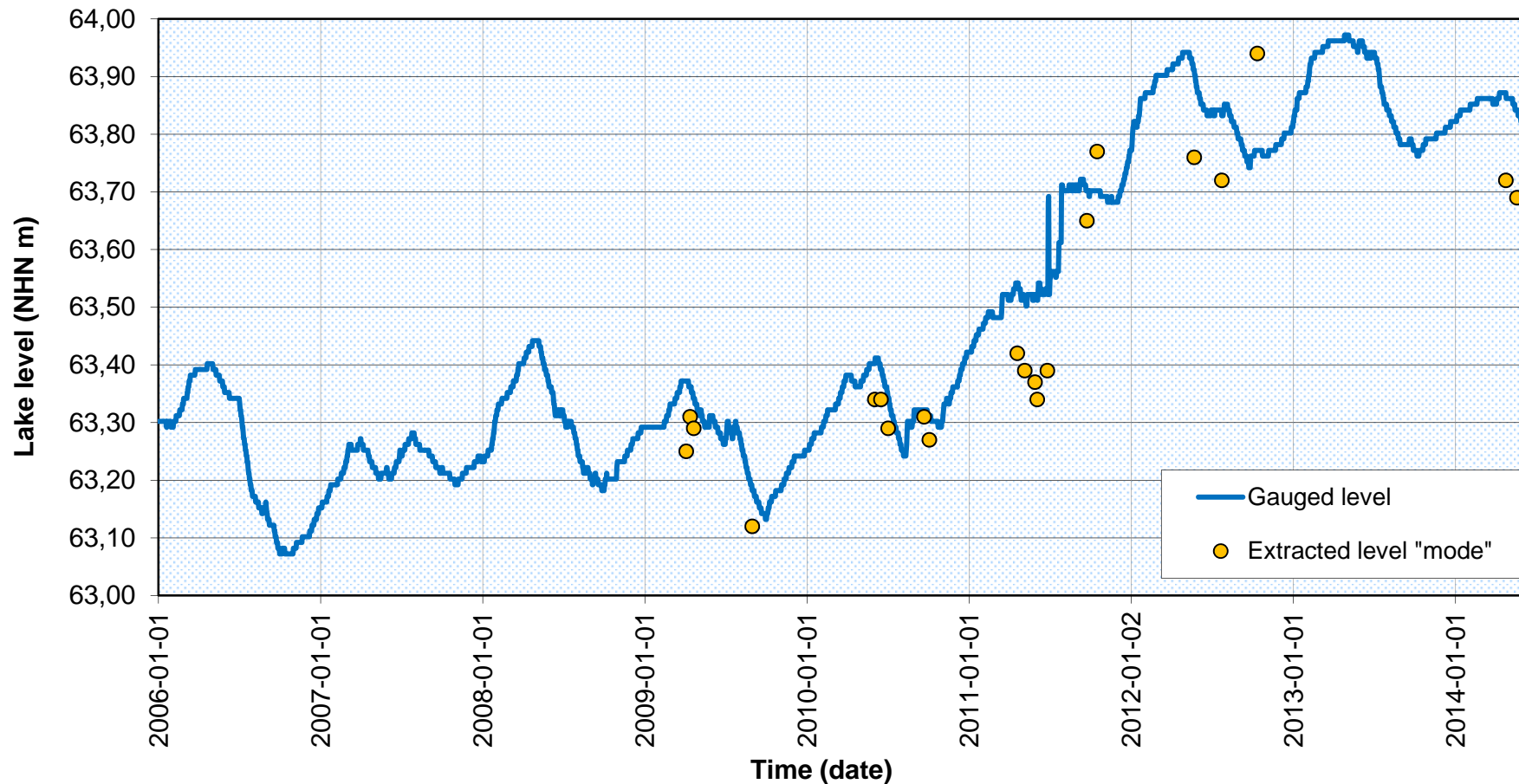
Test area “Großer Fürstenseer See”



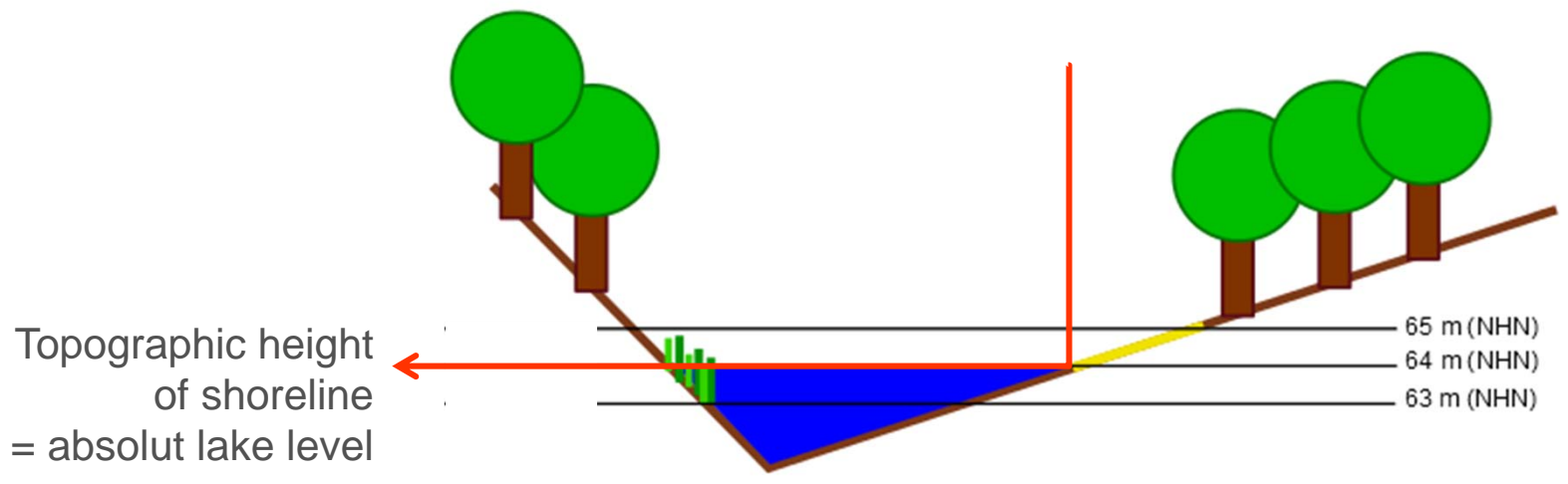
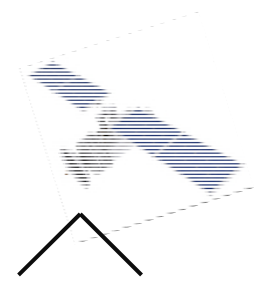
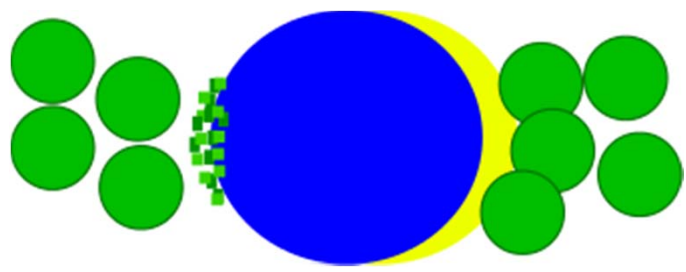
Shoreline validation



Comparison of extracted and gauged lake levels

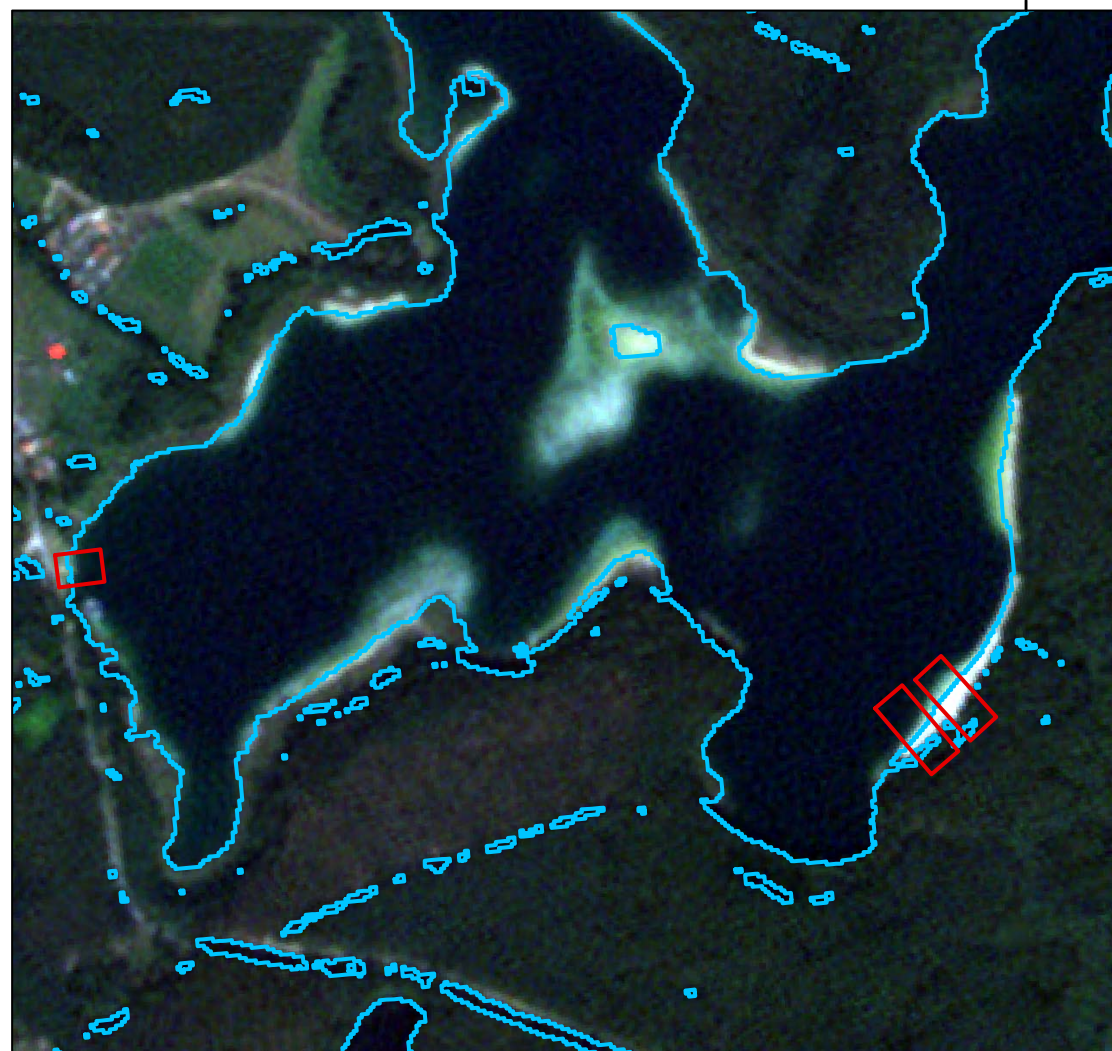


Principles of the reconstruction of lake levels



2009-09-20

32778000



- FS_level_subet2
- 2009-09-20 (NIR otsu)
- RapdiEye (2009-09-20), RGB**
- RGB**
- Red: Band 3 (657.0 Nanomete
- Green: Band 2 (555.0 Nanomete
- Blue: Band 1 (475.0 Nanomete
- DEM**
- 144 m
- 39 m

5914000

0 100 200
m

Processing chain

Preprocessing of RapidEye images

1. Radiometric correction (TOA reflectance)
2. Geometric correction
3. Cloud masking

Preprocessing of digital elevation model (DEM)

1. Shoreline estimation
2. Interpolation of bathymetric data
3. Merging of bathymetry and digital terrain model

Water classification

1. Two methods: NIR and NDWI otsu thresholds
2. Validation based on DGPS measurements

Lake level estimation

1. Shoreline extraction (filter + smoothing + buffer)
2. Combination of shoreline and DEM
3. Statistical analysis of shoreline values (subsets)
4. Validation based on daily gauged lake levels