



Parametric Sub Bottom Profiler measurements of the subaquatic portion of the debris fan of Gschlifgraben in Lake Traunsee, Austria


Brian Kreis & Sebastian Riegler (students)
Erwin Heine

supported by INNOMAR's Student Project 2013

BOKU University of Natural Resources and Life Sciences, Vienna

Background: study site



Source: BEV


20.05.2015 2



Background: debris fan of the landslide



20.05.2015 3



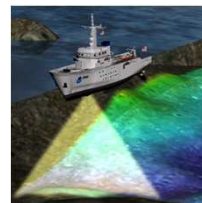
Background: facts

- Winter 2007/2008: landslide of 22 ha & 4 million m³ of mud
- from the mountain ridge towards the lake (max. veloc.: 4.7 m/day)
- 45 houses were endangered
- the debris fan continuous in the lake up to 140 m of depth
- Mitigation measures: installation of drainages and trenches, removal of material, construction of wells,...
- monitoring and an early-warning system has been established:
 - ➔ **need of accurate bathymetry and sediment layer information**

20.05.2015 4

Methods

- 4 different **measuring systems**:
 - Sub-bottom profiler
 - Side-scan sonar
 - Single beam echo sounder
 - Multi-beam echo sounder



20.05.2015

5


Objectives of the student project

Main tasks of the parametric sub bottom profiler (SBP) application:


- ➔ Acquisition of **highly accurate bathymetry and sediment data**
- ➔ Discovery of **critical zones**
- ➔ **Assessment** of Innomar's measuring system with respect to **future monitoring purposes**

20.05.2015

6



Data acquisition: survey vessel (outside)



- GPS rover
- Additional GPS antennas
- MRU-Z
- EA 400 transducer
- SES-2000 light plus transducer

20.05.2015 7



Data acquisition: survey vessel (interior)



20.05.2015 8



Survey procedure (1)

- Raster-based measurements (QUINSy):
 - 60 lines perpendicular to the coast line
 - 5 lines parallel to the coast line
 - 3 side scans along the coast
- Daily recording of sound velocity profiles

20.05.2015

9

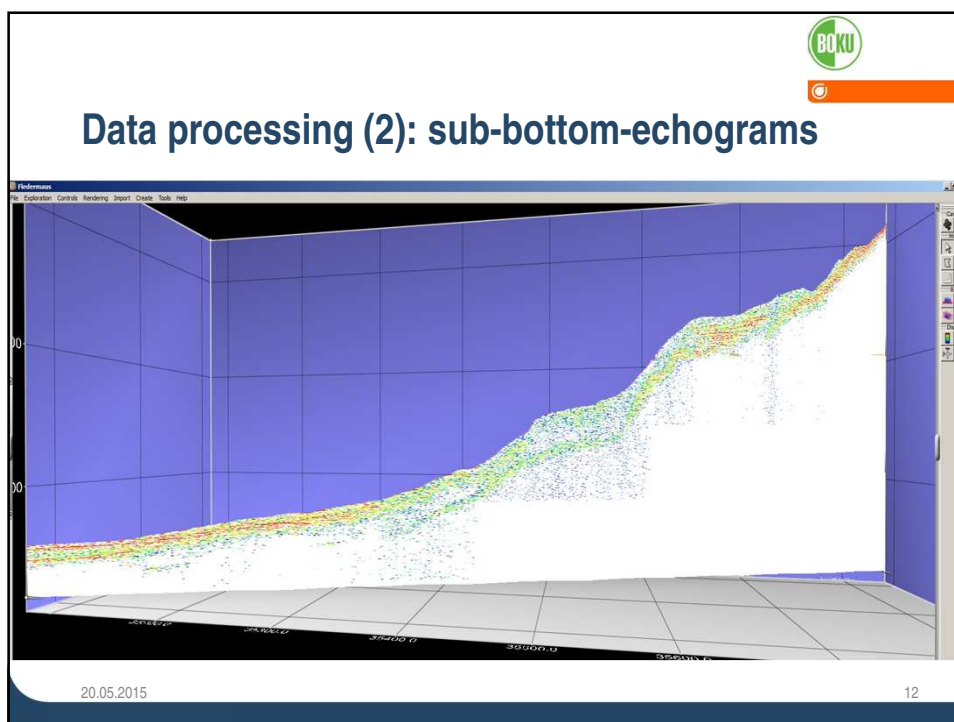
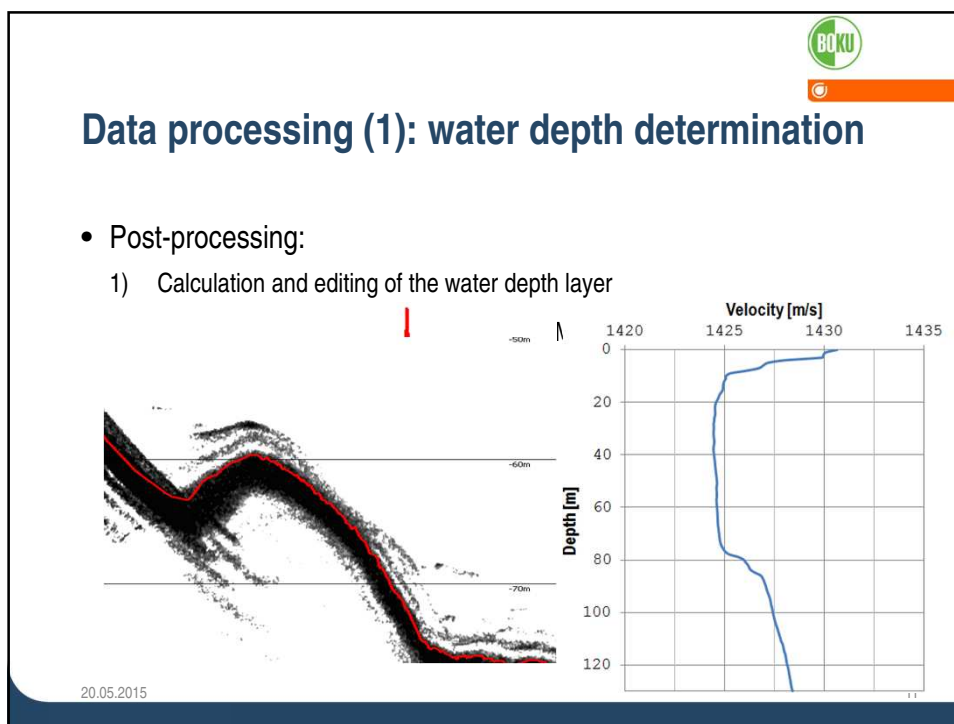



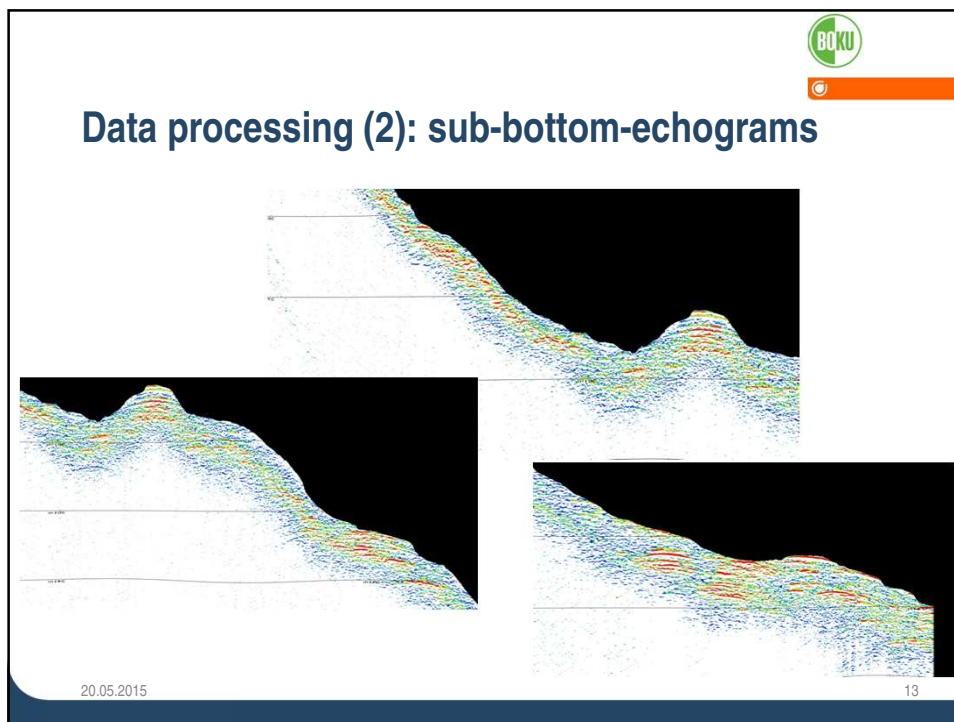
Survey procedure (2)

- Frequencies used for sub-bottom profiling:
 - Penetration of lake bed: 10 kHz
 - Water depth calculation: 100 kHz
- Frequencies of the side scan measurements
 - 400kHz
 - 600kHz

20.05.2015

10



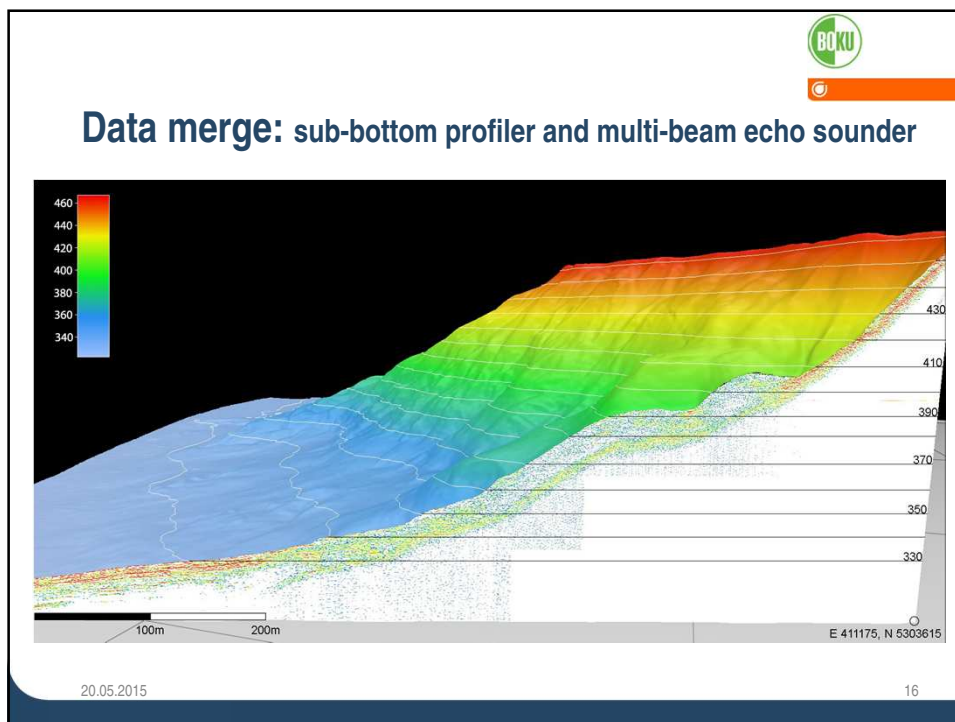
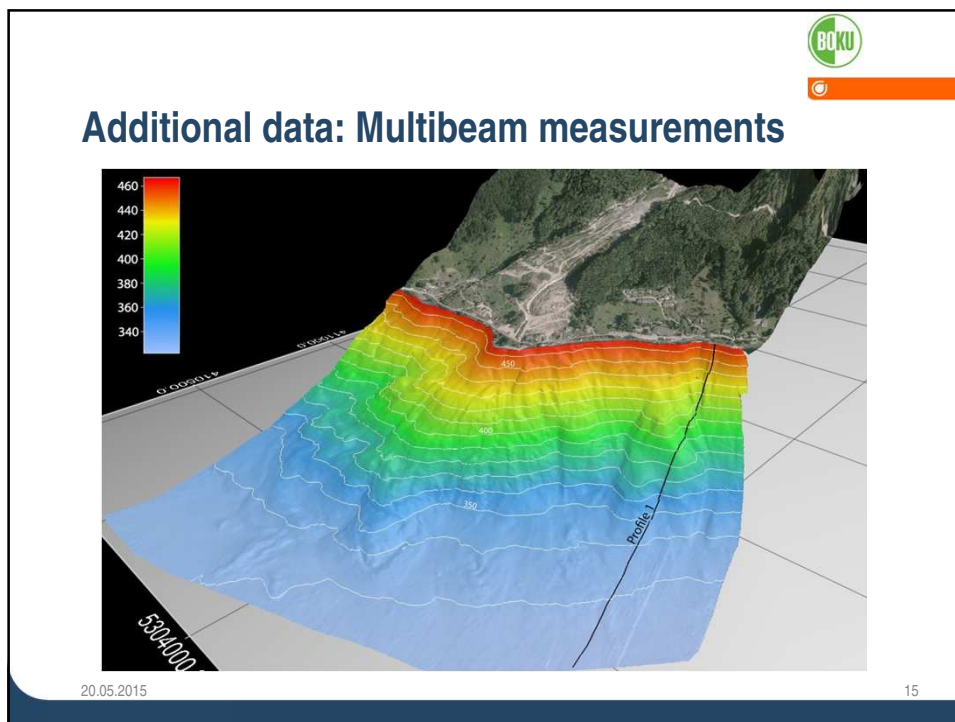


Data processing (3): geodetic datum transformation

To compare the results of the bathymetry of 2013 with those from previous measurements:

- the height provided by GNSS system (ETRS89) → the national reference sea level
- horizontal coordinate system (UTM 33N) → Austrian coordinate system GK M31.

20.05.2015 14





Results (1)

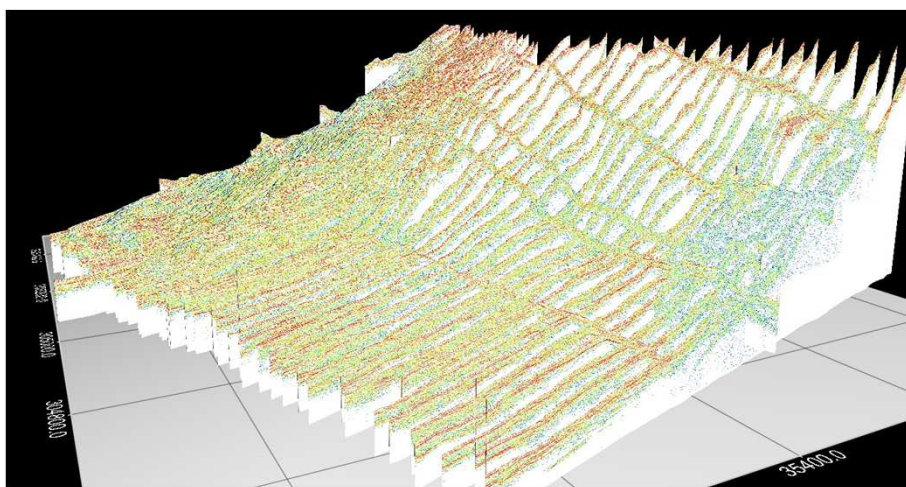
- Identification of **three different zones**:
 - The **upper part** (from water level to ca. 60 m) consisting of **highly reflective material** with a layer thickness of up to 5 m.
 - The **middle part** (from ca. 60 m to ca. 130 m), which is made up of **less reflective material** characterized by morphological distortions in which layers of sediments could be found in basins.
 - The **lower part** with **stratified sediment layers** in which the signal could penetrate the bottom up to 15 m.

20.05.2015

17




Results (2)



20.05.2015


18



Results (2)

- Identification of **three different zones**:
 - The **upper part** (from water level to ca. 60 m) consisting of **highly reflective material** with a layer thickness of up to 5 m.
 - The **middle part** (from ca. 60 m to ca. 130 m), which is made up of **less reflective material** characterized by morphological distortions in which layers of sediments could be found in basins.
 - The **lower part** with **stratified sediment layers** in which the signal could penetrate the bottom up to 15 m.

20.05.2015 19



Conclusions

In the course of this Student Project, it was possible to

- ➔ Acquire **highly accurate bathymetry and sediment data**
- ➔ Discover **critical zones**
- ➔ **parametric sub bottom profiler** is able to provide **useful information for further morphological investigations** of the subaquatic portion of the debris fan

20.05.2015 20

