

Mapping the Lake Bed Topography and the Mud Layer of the Steppe Lake Neusiedl

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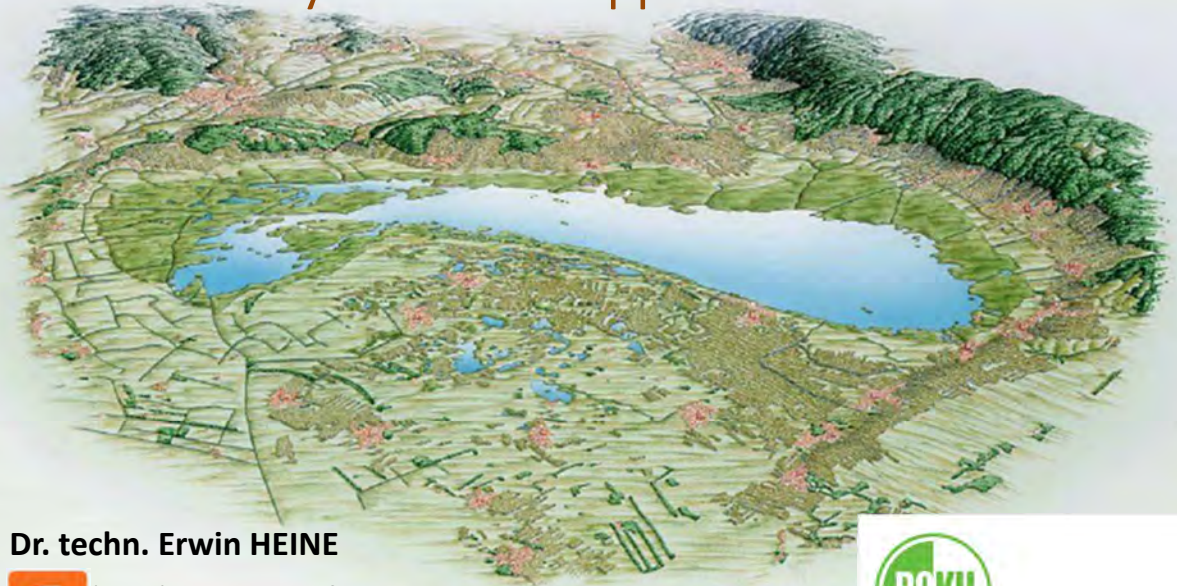
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Innomar workshop "Seabed Acoustics" 2015



Project "GENESEE"



New Geodetic Survey of the Lake Neusiedl – Hanság Channel System

supported by the

Trans border Cooperation Austria – Hungary

Duration: 2011 – 2015



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GENESEE project partners

- **Leadpartner**
 - University of Natural Resources and Life Sciences, Vienna - BOKU (AT)
 - Institute of Surveying, Remote Sensing and Land Information (IVFL)
 - Institute of Hydraulics and Rural Water Management (IHLW)
 - BOKU-Met – Administration
- **Partner 1**
 - Environment and Water management Directory North-Transdanubia, Győr (HU)
- **Partner 2**
 - Burgenland Administration, Dept. 9, Water- and Waste Management (AT)
- **Partner 3**
 - West Hungarian University Sopron, Dept. of Surveying and Remote Sensing (HU)
- **Other Partners**
 - Biological Station Neusiedler See, Illmitz
 - HafenCity University Hamburg (HCU)
 - Technical University Vienna, Institute for Photogrammetry and Remote Sensing (IPF)

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Project Region



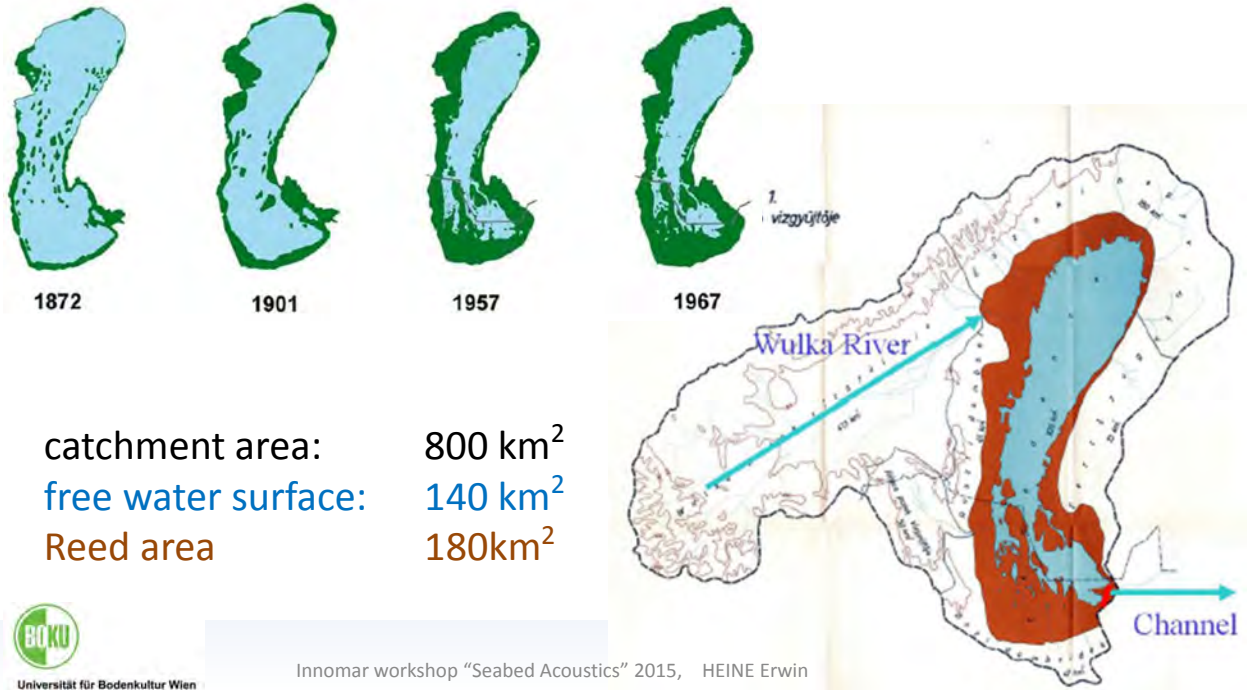
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Catchment and Lake Area

Genesis of the reed belt



Wetland of International Importance (Ramsar Convention; LWII ...)



Regional relevance for:

- Nature protection
- Fishery
- Tourism
- Water sports like sailing, surfing,...
- Recreation
- employment



water balance

water depth: < 2 m
mud thickness: up to 1 m

80% of the water gain originates from precipitation
90% of the water loss is due to evaporation

no natural outflow; artificial "Hansag" channel since 1870



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Aim of the Project



To ensure the various functions of the Lake,

a sound management of

- the water body
- the mud
- and the reed belt


is required.

Management needs concise data!

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GENESEE - hydrographic working packages

- echo sounding
- discrete point measurements with soil physical sensors in the lake area and i.e. in the reed belt area
Conducted by the BOKU Institute of Hydraulics and Rural Water Management (IHLW) 
- data processing for DTM calculations

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Echo Sounding Survey Setup (1)

Cross profiles:
– 100 m

Long profiles:
– 500 m

Water borders of
Islands and
reed belt

Total length:
> 2.000 km

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Echo Sounding Survey Setup (2)

- RTK-GNSS / IMU
- single Beam echo sounder:
 - 710 kHz
 - 100 kHz
- side scan sonar
- parametric sub bottom profiler
 - 10 kHz (low frequency)



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Coupled RTK-GNSS / IMU system - Positioning and Navigation

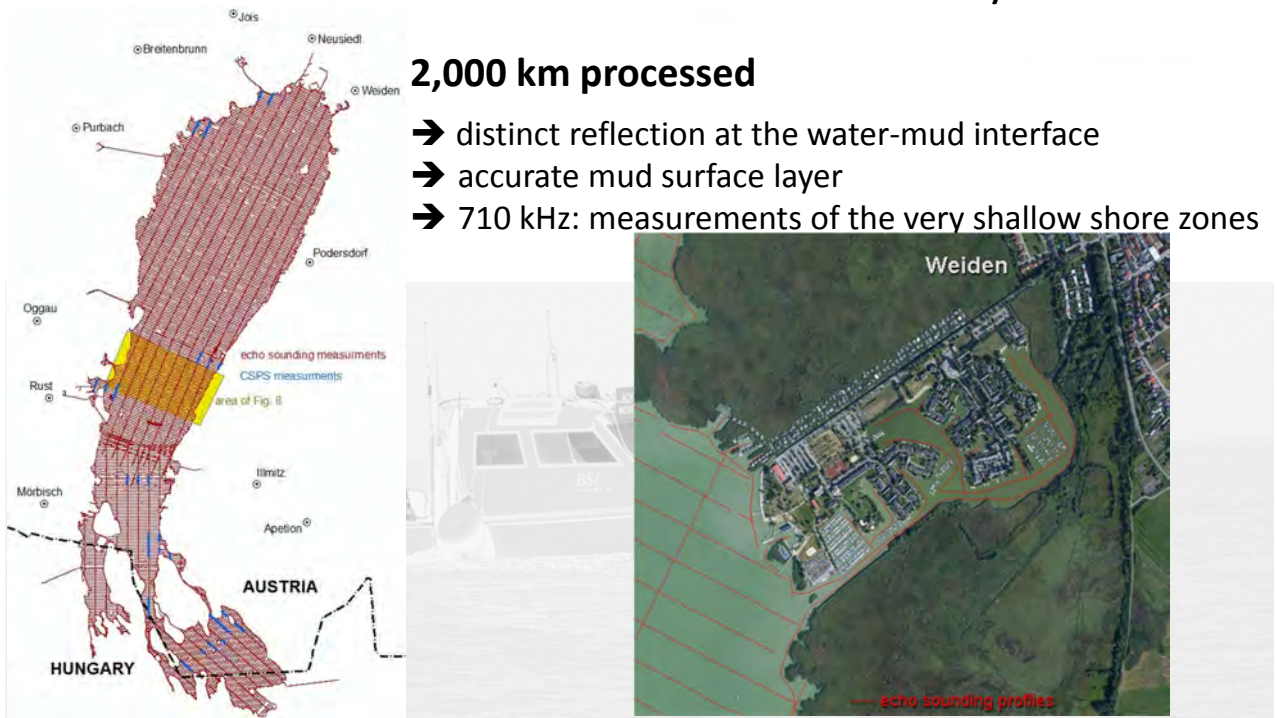
3 GNSS reference stations
UHF-Transmission



- 4 eccentric transducer positions
- roll and pitch: flatwater boat
 - very windy area
 - wind tide
 - high frequent waves



High frequency Single Beam Echo Sounders (SBES) - Determination of the mud surface layer

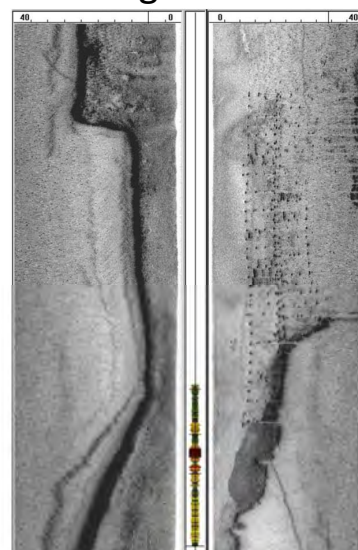
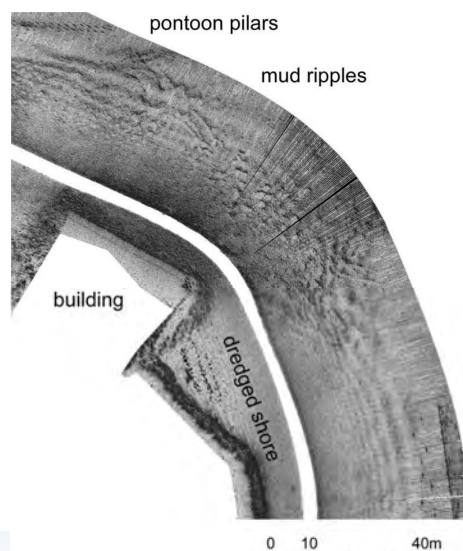


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Side Scan Sonar (SSS) – lake bottom information

- medium water depth of 1.5 m ➔ suitable sonar image strip width of 30 – 40 m
- about 4'000 side scan sonar images were georeferenced



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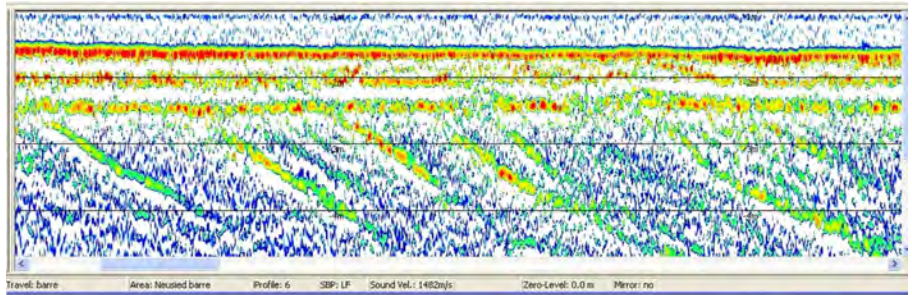
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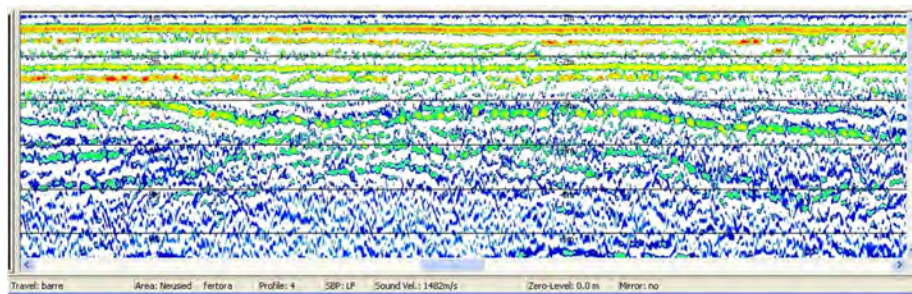
Parametric Sub Bottom Profiler (SBP) – Mud layer and sediment structure information (1)

Innomar SES 2000:
LF: 10 kHz

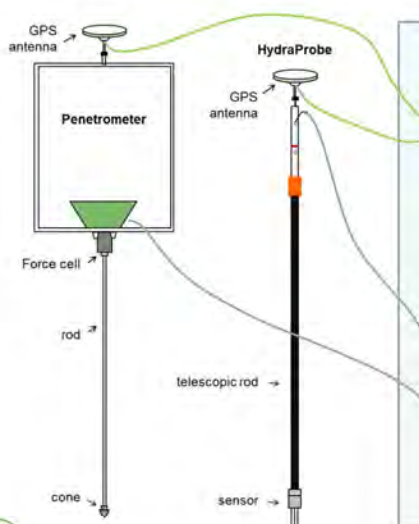
sediment layers and significant reflections of layers deeper in the subsoil



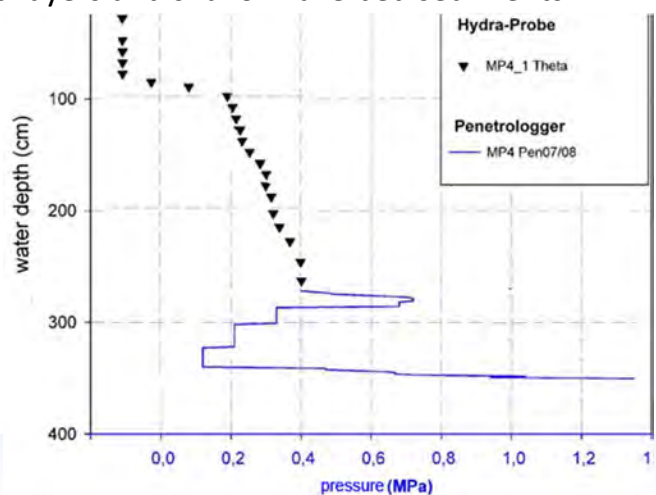
??? sound velocity for the mud layer



Combined Soil Physical Sensors (CSPS) – Mud layer and sediment structure information



a capacitive sensor (Hydra Probe):
to determine the water content in soft mud
cone penetrometer:
to measure penetration resistance in compact mud layers and shallow lake bed sediments



Mud cores

- collected at zones of different mud accumulation
- analysed qualitative (colour, roots) and quantitative (particle size distribution, ...) for the calibration of the CSPS sensors

	Höhe / müA		p[S] / %	p[U] / %	p[C] / %
P047	113,40	113,56	5,6	54,6	39,8
	113,56	113,64	1,6	45,1	53,3
P111	113,64	113,72	2,2	41,9	55,9
	114,19	114,23	1,4	47,1	51,5
	114,23	114,28	4,1	44,5	51,4

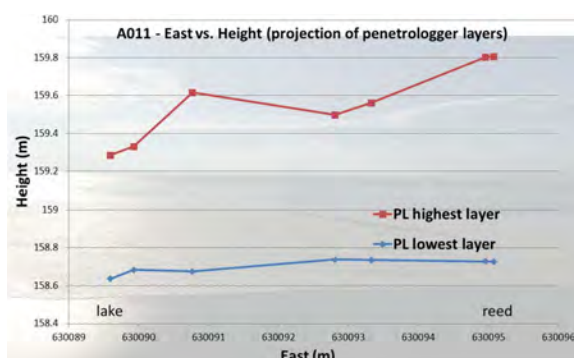
Core size distribution of core samples at the reference points P47 and P111: sand fraction S, silt fraction U, and clay fraction C

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4100 CSPS measurements

- at the shore zone and the reed belt areas
- at the open water area for referencing echo sounding, i.e. SBP results

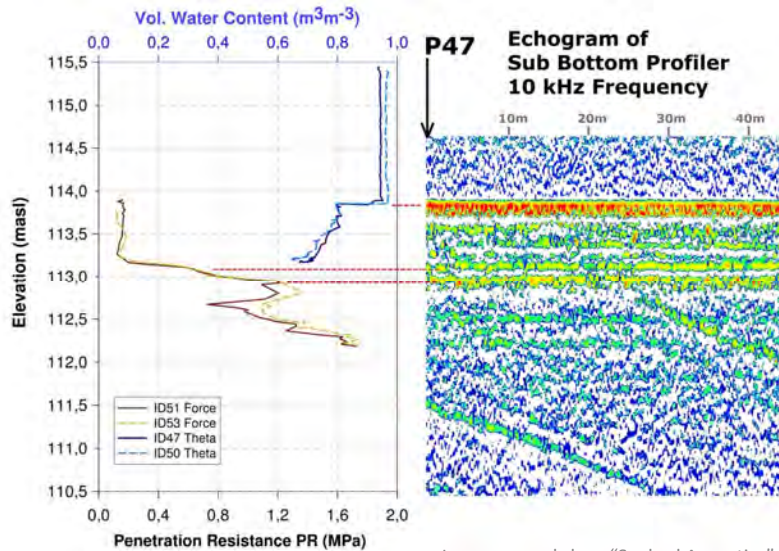


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CSPS data and 10 kHz Sub Bottom Profiler Data for mud thickness determination

- 61 reference points at the open water area
- distortion factors for low frequency SBP readings by comparing the mud layer thickness of CSPS and SBP



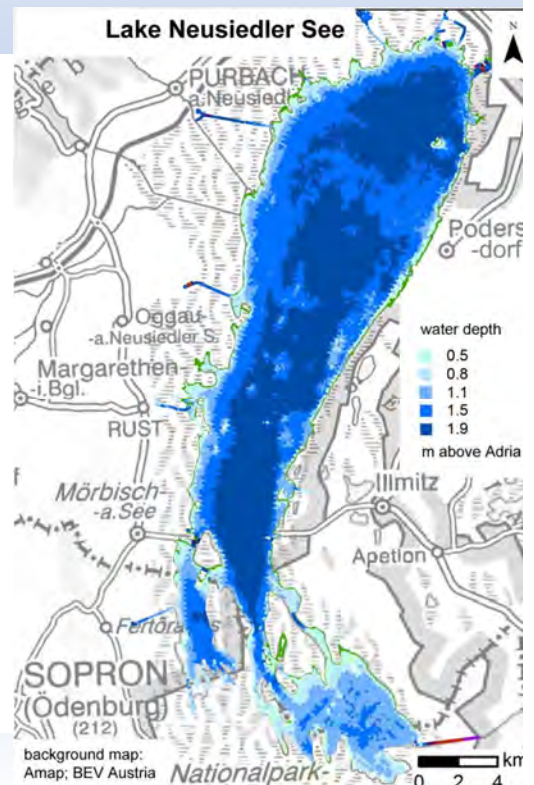
→ accurate SBP lake bottom height

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DTM of lake area

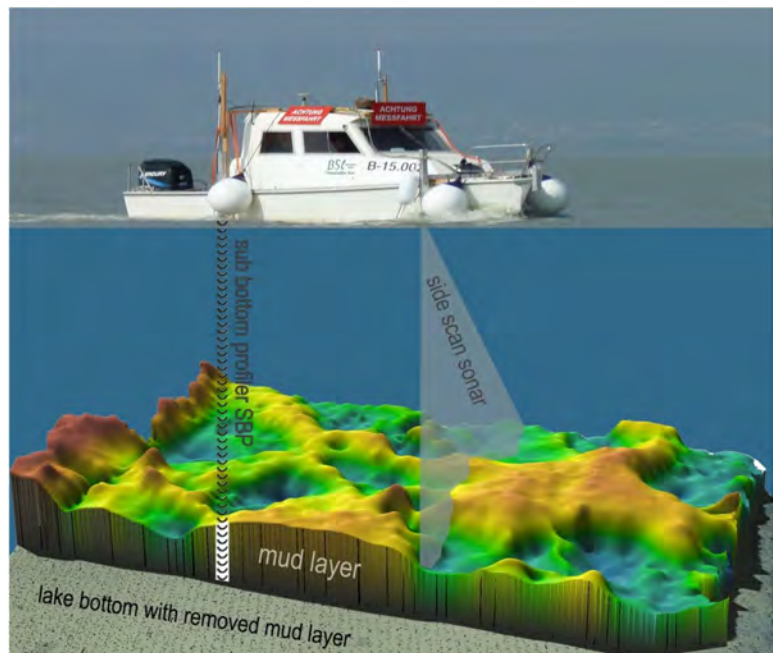
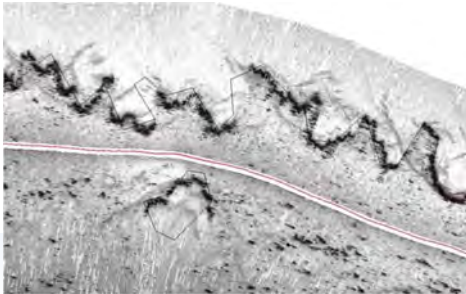
- lake bed: based on echo sounding
- Reed zone: based on CSPS data
- Surrounding area: ALS-data



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Resulting mud layer of the lake area

For further investigations:
Applying **Side scan images**
➔ additional information for
the sedimentation and reed
expansion process



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