Photography encouraged

EMS Annual Meeting
6-10 September 2021

Internal Boundary Layer Development over Lake Surface in Case of Very Young Waves

Gabriella Lükő[1] et al.[1,2,3,4]
[1]Budapest University of Technology and Economics
[2]Eötvös Loránd University
[3]University of Zagreb
[4]University of Debrecen

Motivation and Aims

Main driver of lake hydrodynamics:
- **friction velocity (u_*)**

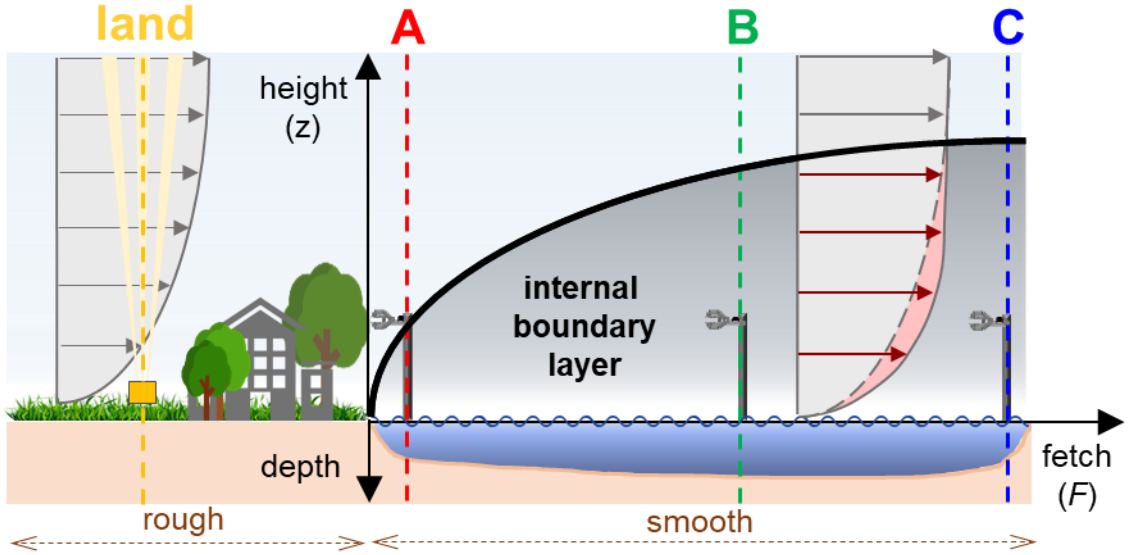
Estimate u_* considering IBL development
- routine weather data input
- spatial variablity of u_* along the fetch (F)

Internal Boundary Layer (IBL) Development

- **Rough to smooth transition:** land ($z_{0,l}$) and water ($z_{0,w}$)
- IBL height (Elliott 1958):

$$\delta(F) = \left(0.75 - 0.03 \ln\left(\frac{z_{0,w}}{z_{0,l}}\right)\right)\left(\frac{F}{z_{0,w}(F)}\right)^{0.85} z_{0,w}(F)$$

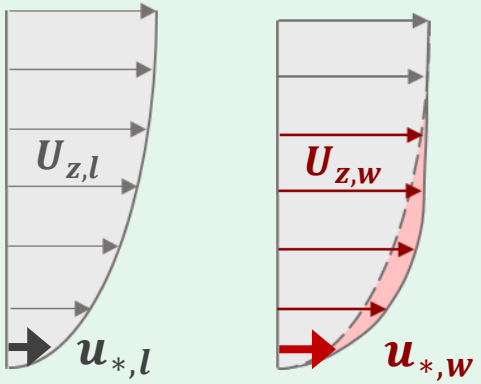
- Analytical, iterative IBL model

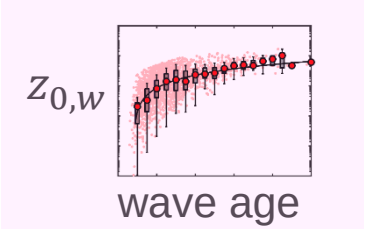


Logarithmic profiles:

$$U_l(z) = \frac{u_{*,l}}{\kappa} \cdot \ln\left(\frac{z}{z_{0,l}}\right)$$

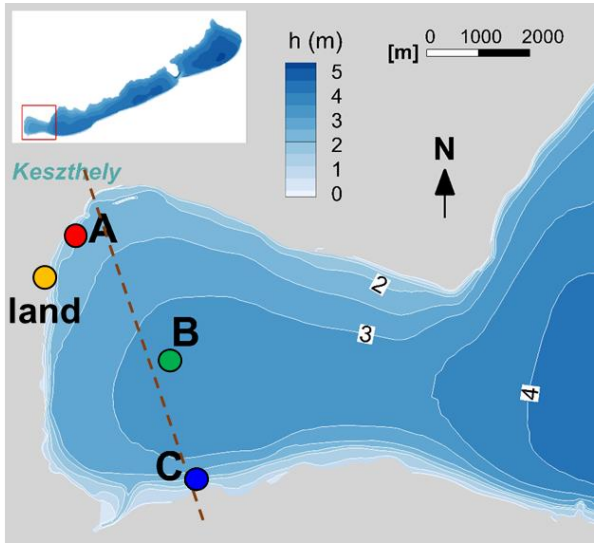
$$U_w(z) = \frac{u_{*,w}}{\kappa} \cdot \ln\left(\frac{z}{z_{0,w}}\right)$$

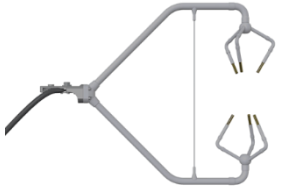


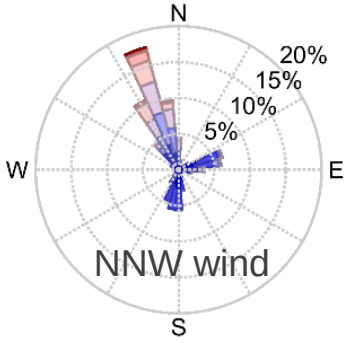


Lake Balaton measurements

- $u_{*,w}$ at **A**, **B**, **C** by eddy-covariance
- $U_l(z)$ in **land** by Sodar







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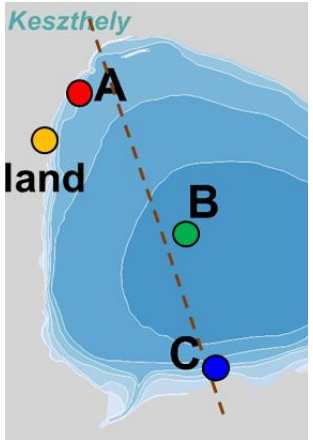

Estimations and measurements (land, A, B, C)

Conclusions

- Significant variability along the fetch
- Estimations at (offshore) station **B** are accurate
- Station **C** is in shallow zone: wave-breaking
- $u_{*,w}$ underestimation at **A**: wind sheltered zone by canopy