

# Application of FLake on the Lake Balaton

Miklós Vörös



Hungarian Meteorological Service

St. Petersburg Workshop on Parameterization of Lakes in  
NWP and Climate Modelling 18-20. Sept. 2008

# Introduction

PhD work at the Eötvös Loránd University in Hungary

„Application and improvement of the AROME NWP  
model in Hungary”

Support from the Hungarian Meteorological Service

With the aid of  
Patrick Le Moigne, Joël Noilhan (Meteo France)  
Rui Salgado (University of Lisbon)



# Overview

- Introduction
- Lake Balaton
- Sources of data
- Off line simulations -  
Preliminary results
- Summary

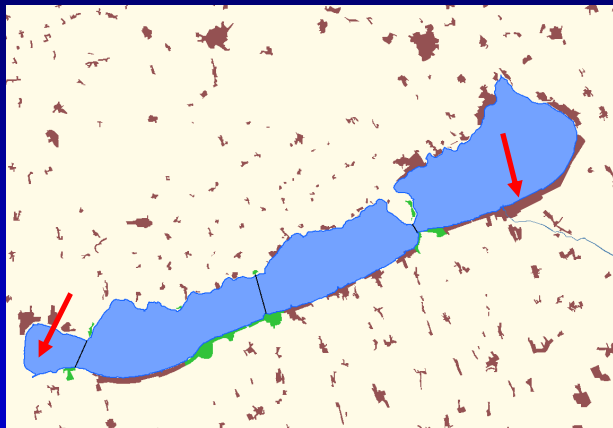
# Lake Balaton



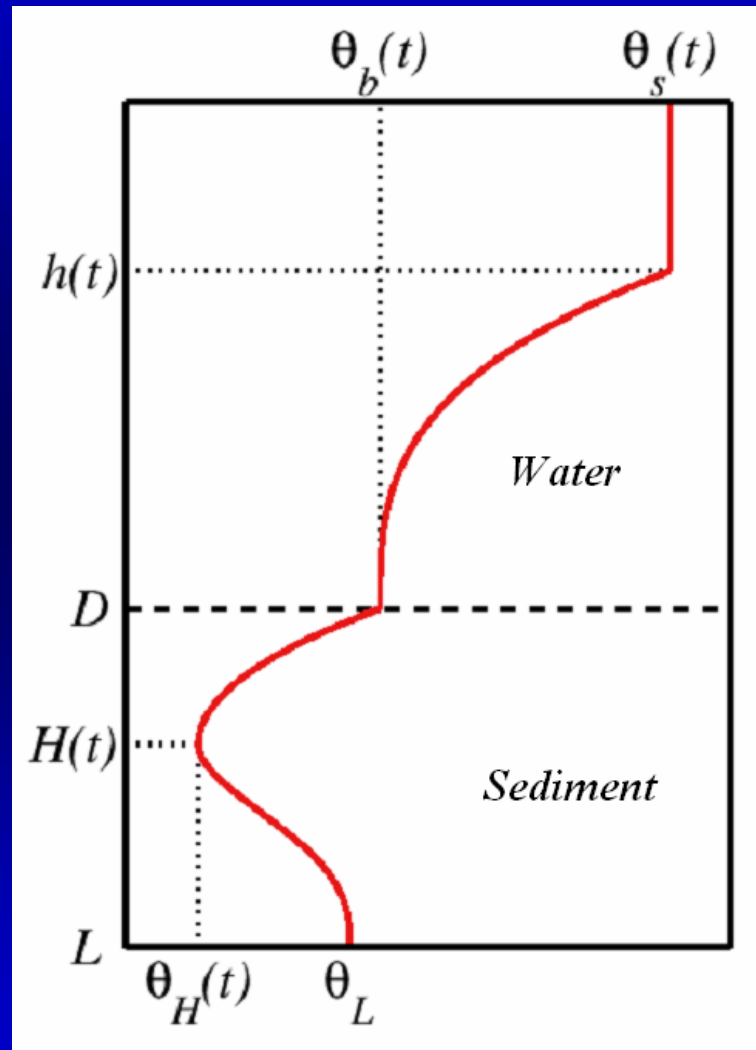
Source: NASA Blue Marble

# Lake Balaton

- Largest lake in CE
- Surface: 592 km<sup>2</sup>
- Mean depth: 3.3 m
- Max. depth: 12.2 m
- Lat: 46.83 deg
- Lon: 17.67 deg



# FLake profile for the summer



Original intention:  
Start from observed profile  
Use observed forcing  
Compare with modelled profile  
See if outperforms the “const temp”  
Investigate its effect in on-line mode

Based on D. V. Mironov, Parameterization of  
Lakes in Numerical Weather Prediction, 2005



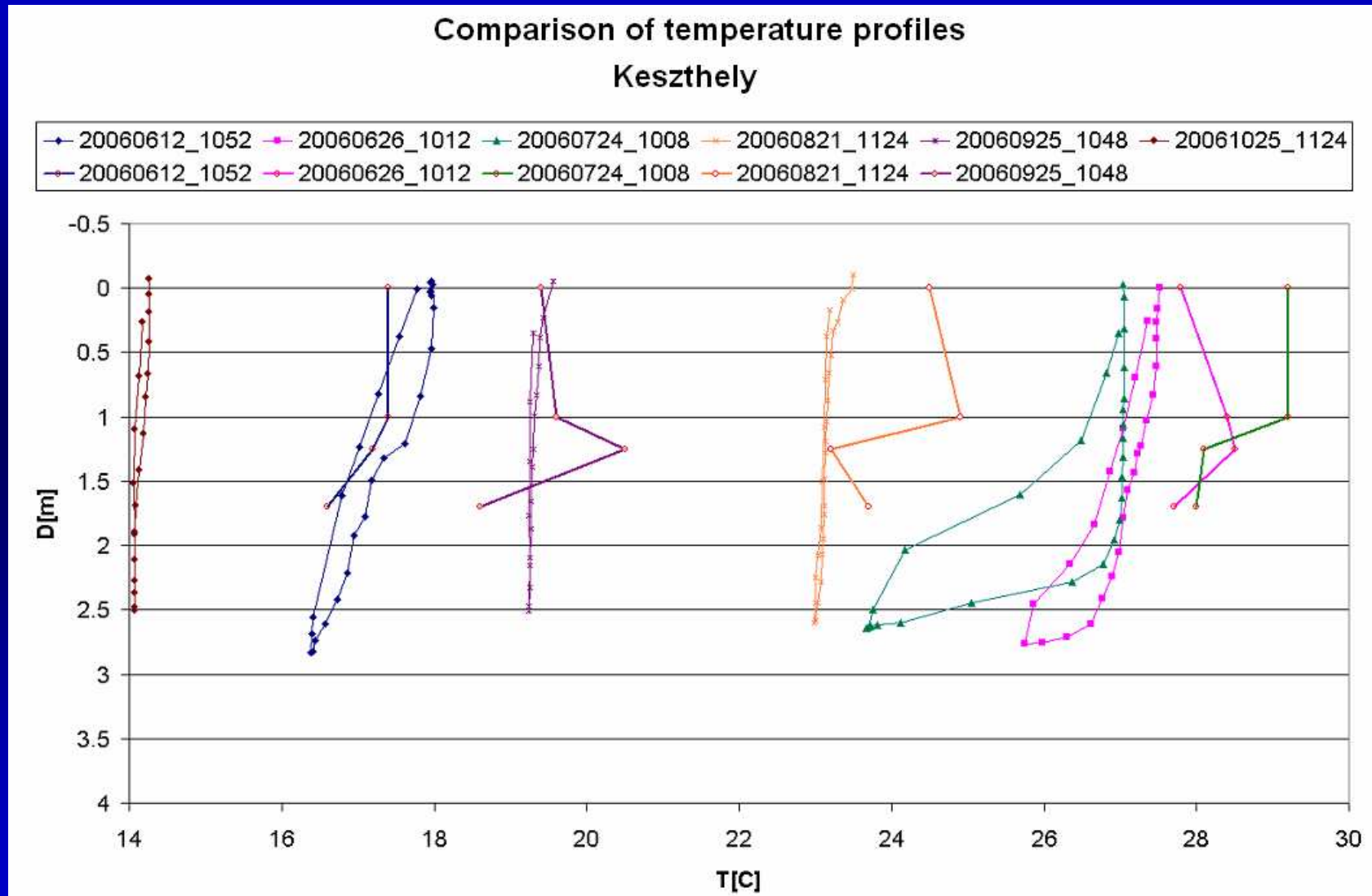
# Balaton – sources of data

Institute	Location	Depths	Time
OMSZ	Siófok	1 point	permanent 10 min
BLKI	variable	full profile	irregular
BUTE	Keszthely	4-8 points	permanent 15 min

BLKI: Balaton Limnological Research Institute

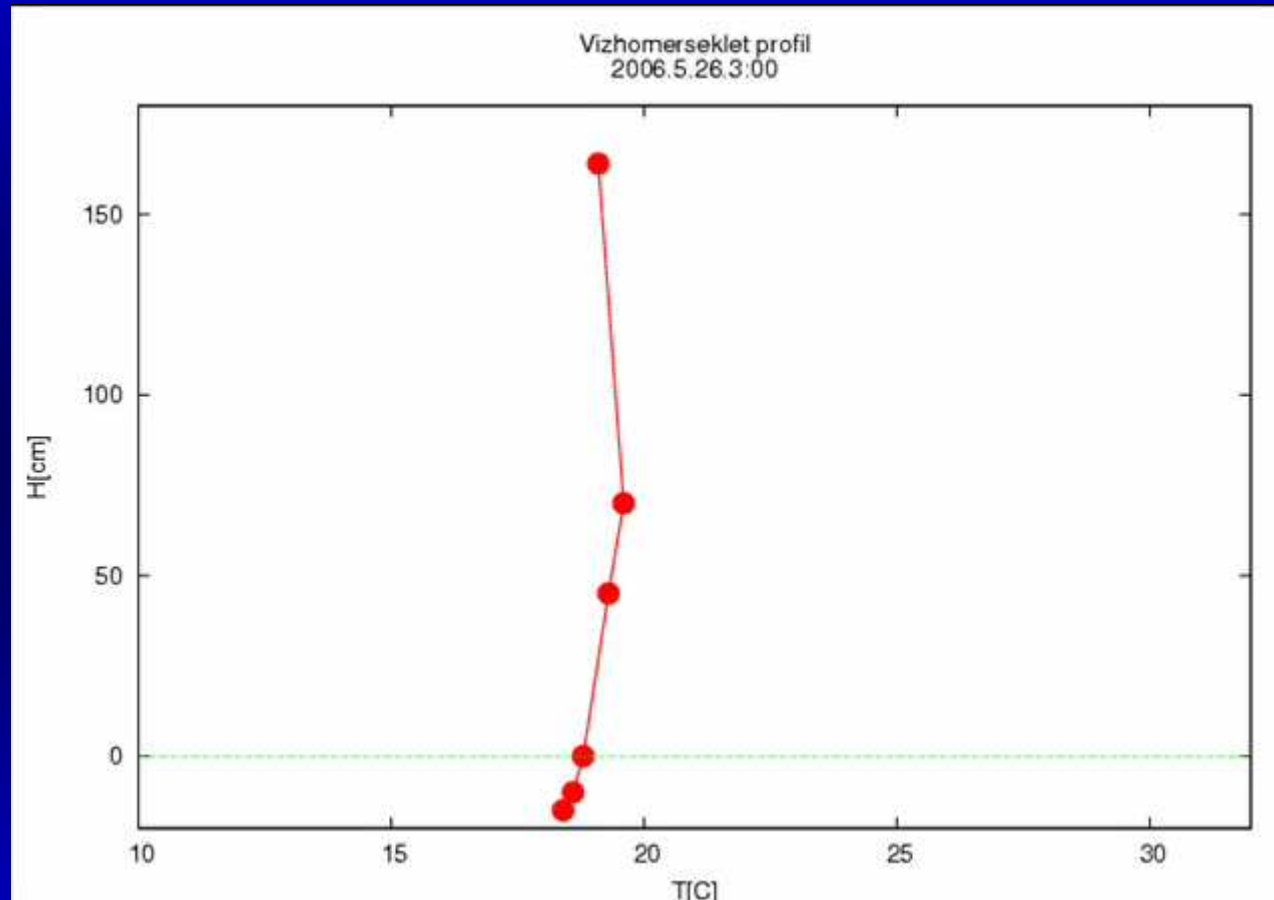
BUTE: Budapest University of Technology and Economy

# Data sources - comparison





# Temperature profile - evolution



# Observation based experiment

Site: Keszthely

Measurement: water and sediment temperatures  
at various depths - V. Istvánovics, BUTE

Water depth: 1.6 m

Mean lake depth: 3.3 m

FLake

Homogenous initial water temperature profile : observed value

Off-line Forcing : observation data

Net radiation : empirical fit (based on sample B data)

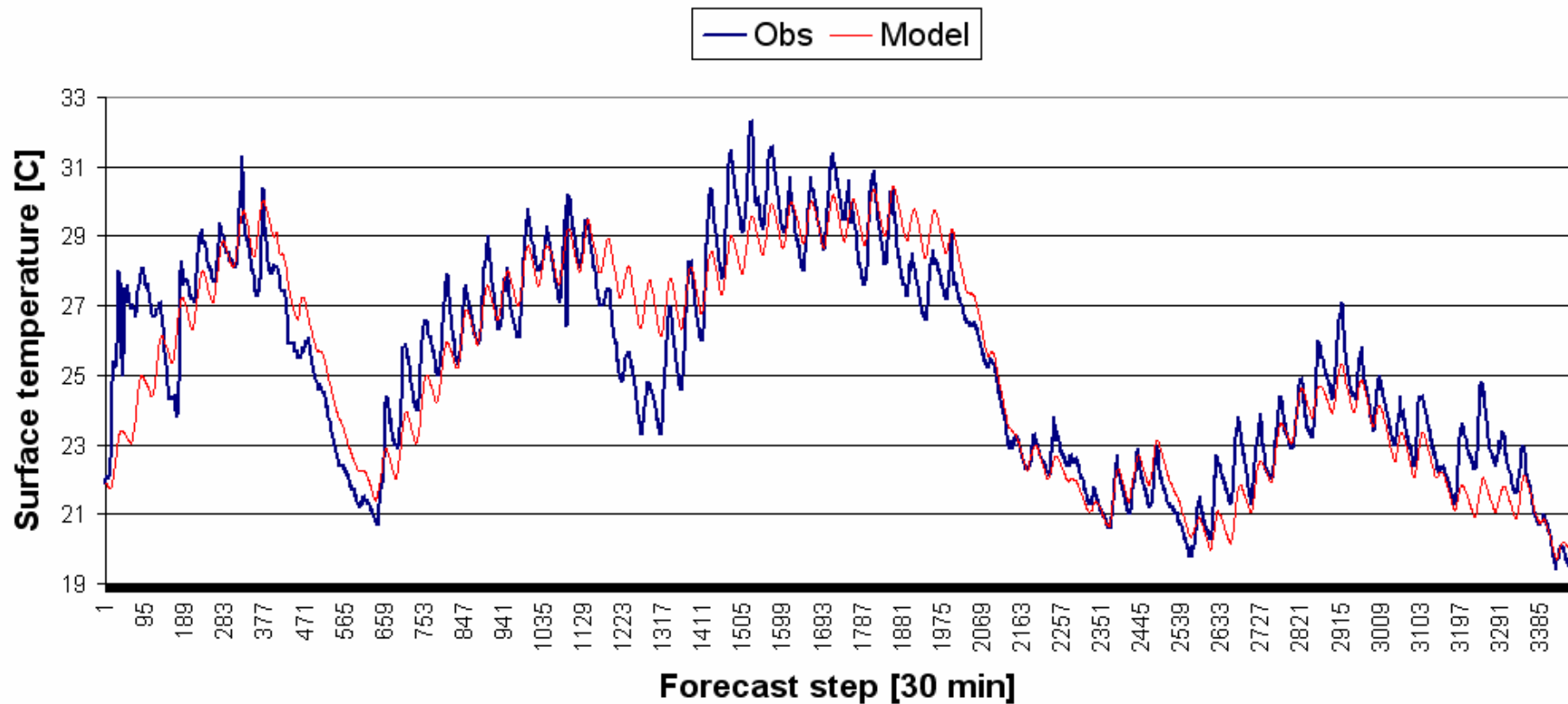
Time step: 30 min

Duration: 72 days

Output variable: surface water temperature

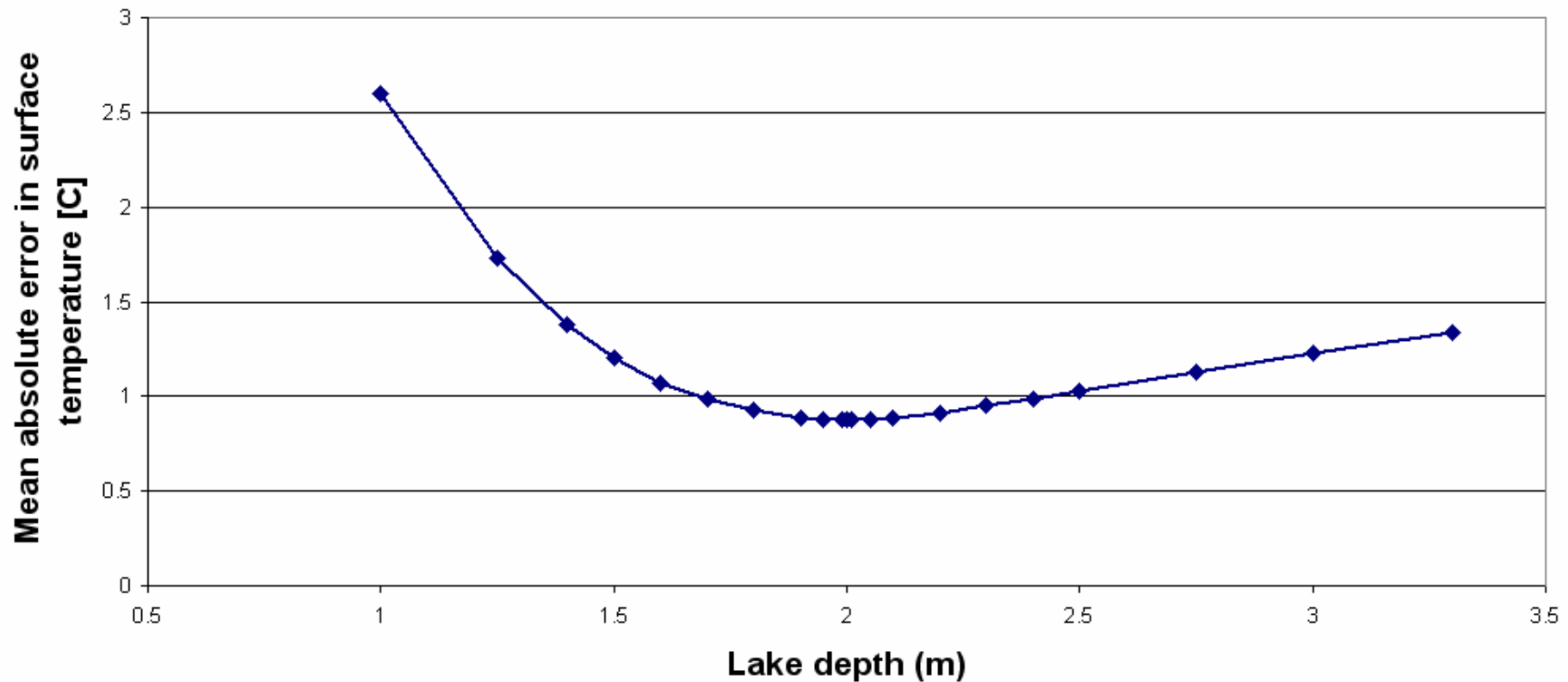
# Observation based experiment

**Forecasted and Observed Lake Temperatures**  
**Keszthely 2006/06/06 - 2006/08/31**  
**Avg. Lake Depth=3.3m, Meas. Depth=1.6m**



# Observation based experiment

Temperature Error vs. Depth Parameter  
Keszthely 2006/06/06 - 2006/08/31  
Avg. Lake Depth=3.3m, Meas. Depth=1.6m



# ALADIN experiment

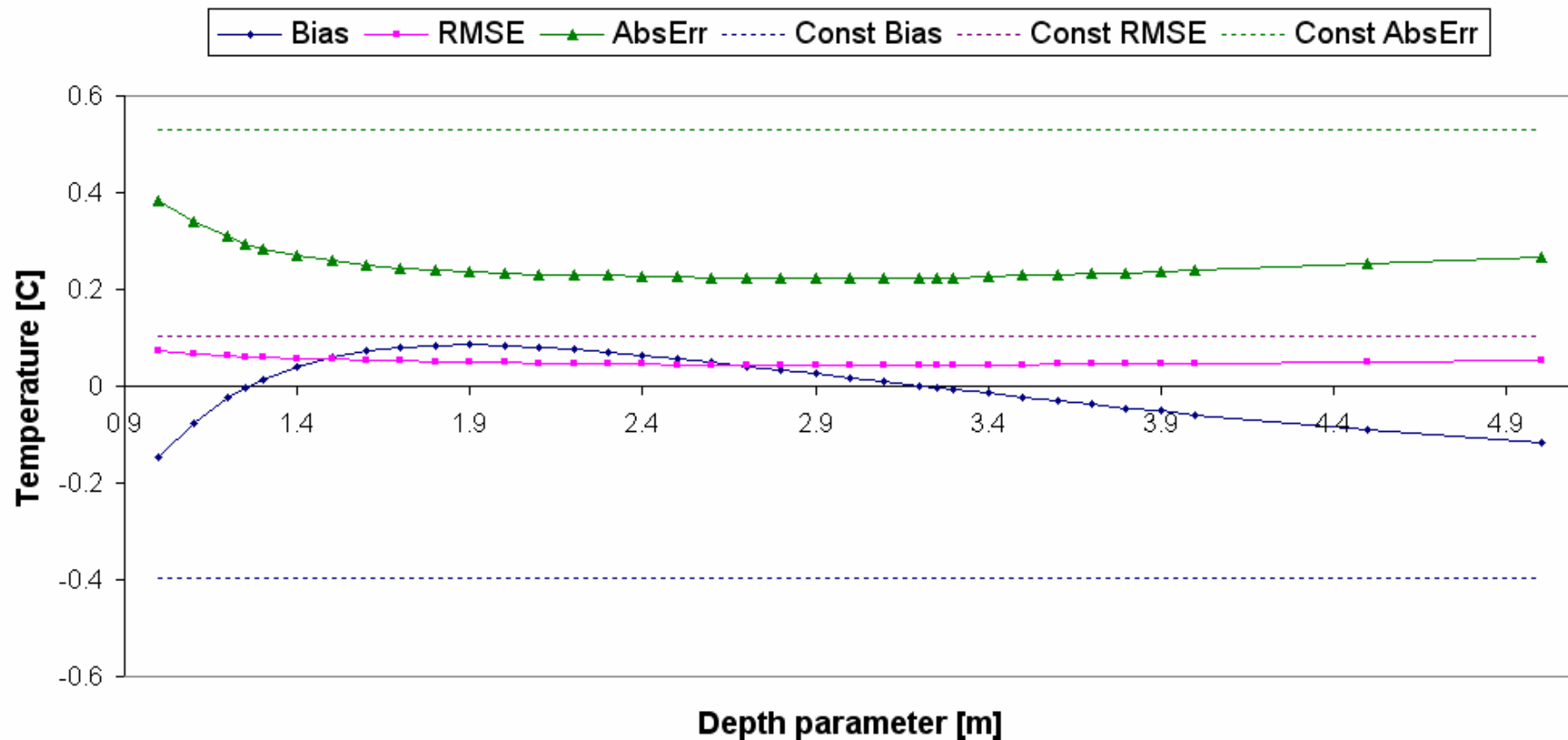
Site: Meteorological station in Siófok  
Measurement: water temperature at 1m depth  
Water depth: 1.2 m  
Mean lake depth: 3.3 m

## FLake

Homogenous initial water temperature profile : observed value  
Off-line Forcing : operative ALADIN forecast  
Net radiation : empirical fit (based on sample B data)  
Time step: 1 hour  
Duration: 36 hours  
Output variable: mean water temperature

# ALADIN experiment

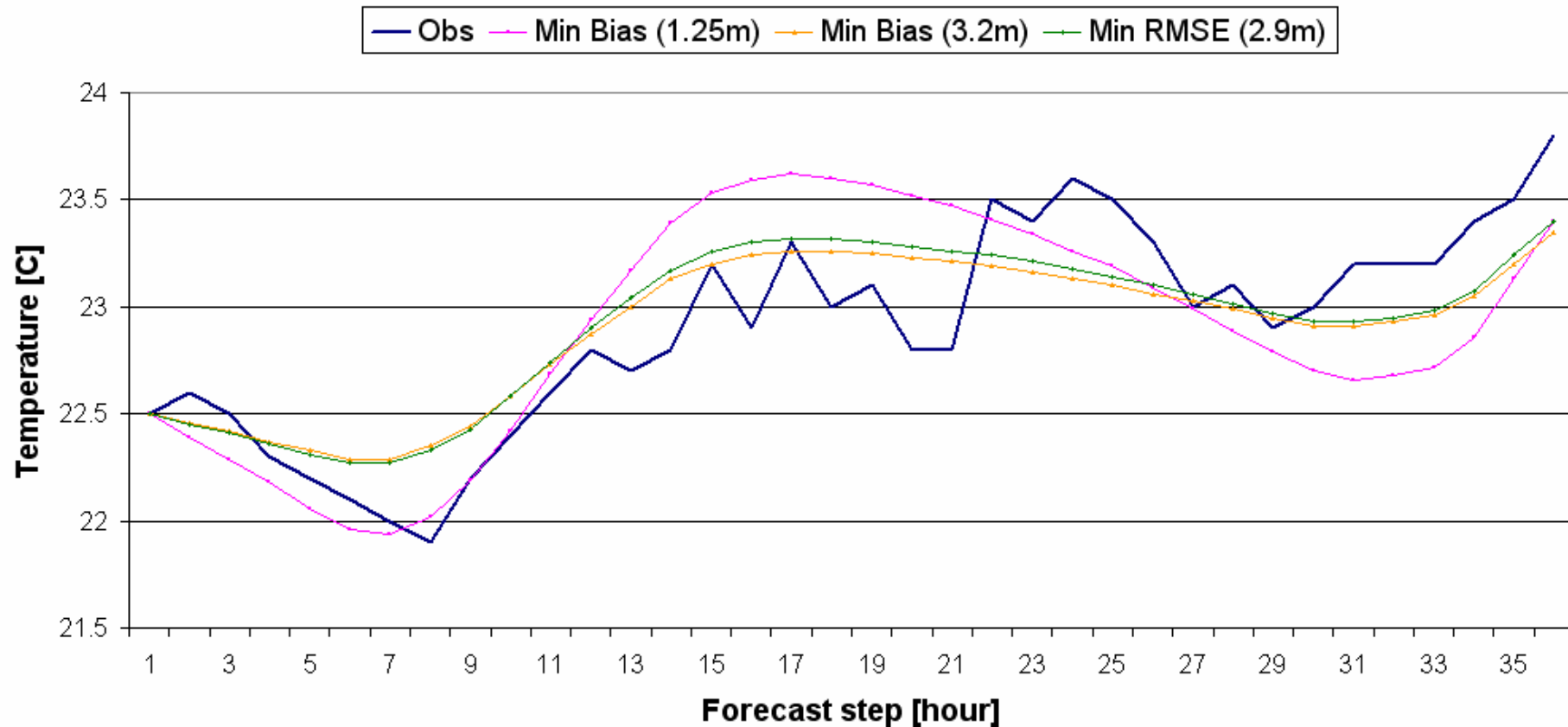
Temperature Bias, RMSE, MeanAbsError  
Short-range Forecast for Siófok, Lake Balaton  
2008/08/28 00UTC





# ALADIN experiment

**Observed and Forecasted Mean Water Temperatures  
Short-range Forecast for Siófok, Lake Balaton  
2008/08/28 00UTC**



# Summary

- PhD work for the local application and improvement of AROME
- Importance of Lake Balaton for Hungarian forecasters
- Lake Balaton: Large shallow lake to the extremes
- Preliminary results show promising performance of FLake
- Meet the challenges
  - complete and reliable dataset
  - winter profile
  - on-line performance
  - identify potential improvements



Thank you for your attention!

And also to

András Horányi, László Kullmann, Gergely Bölöni,  
Tamás Weidinger, Patrick Le Moigne, Joël Noilhan,  
Rui Salgado, Ekaterina Kourzeneva for their help;

Vera Istvánovics, Lajos Vörös for their data