Flake initial conditions and their influence on short-term modeling

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The relevance

Object of research: Alqueva lake

Aim:

Use FLake model through SURFEX in MesoNH to investigate lake impact on the atmosphere and the environment
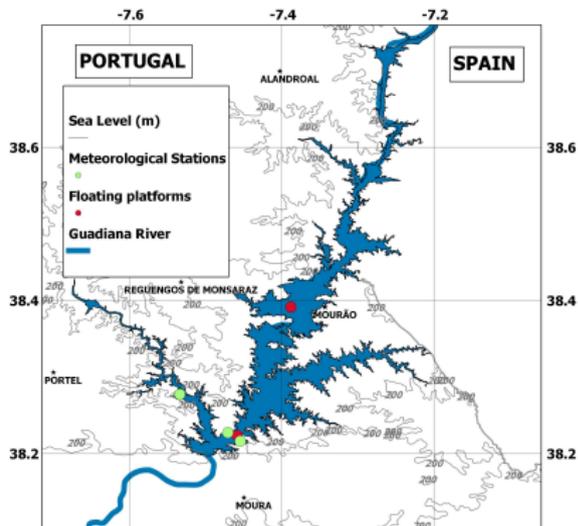
Basic info:

- Largest artificial lake in Western Europe (250 km^2)
- Up to 75 meter depth
- Fully filled in 2010
- Could affect local weather conditions and environment

MesoNH + FLake

In our studies we use MesoNH v 5.3.0 coupled with FLake model

MesoNH — is the **n**on-**h**ydrostatic **meso**scale atmospheric model

FLake model runs as a part of MesoNH simulation; MesoNH is able to provide FLake all necessary input data*

Meso-NH⇌FLake

Short-term simulations length: from **2-4 days** to **2-4 months**.

* this version of FLake can work stand-alone, separately from the MesoH

FLake input parameters

Constants:

- lake depth;
- water extinction coefficient;
- wind fetch, etc.

Input variables:

- air temperature;
- pressure;
- wind speed;
- LW and SW radiation;
- humidity.

Initial conditions:

- bottom temperature;
- mixing layer depth;
- temperature of mixing layer;
- termocline shape factor.

Dataset. ALEX2014 campaign

Duration: June-October 2014
Variety of meteorological data was collected including water temperature profiles

Montante platform

Sensors:
Campbell Scientific 107 probes (BetaTherm 100K6A1IA Thermistor)
Errors in working temperature range (10-30°C): ±0.25°C
9 Levels: surface, 0.5, 1, 2, 3, 6, 9, 18, 27 meters

# Dataset. ALEX2014 campaign — water temperature profiles
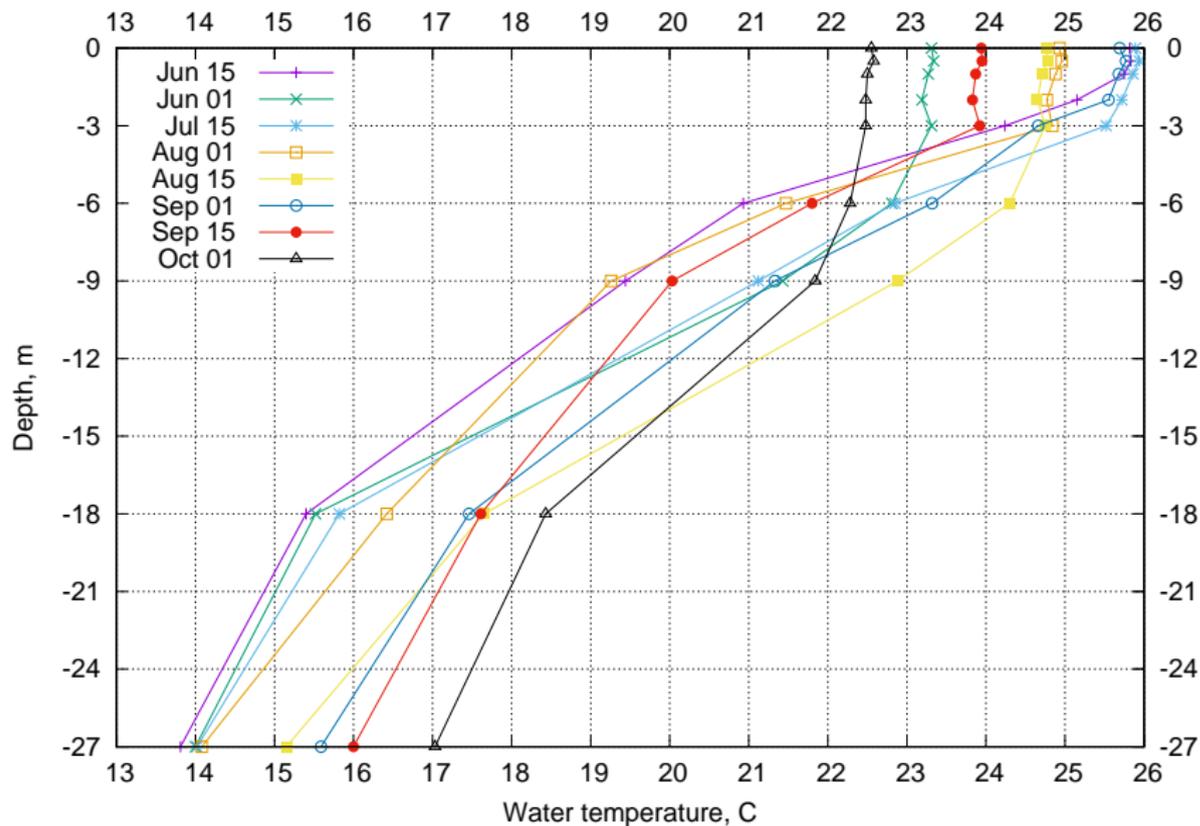
Midnight profiles

# FLake input parameters

## Midnight temperature profiles
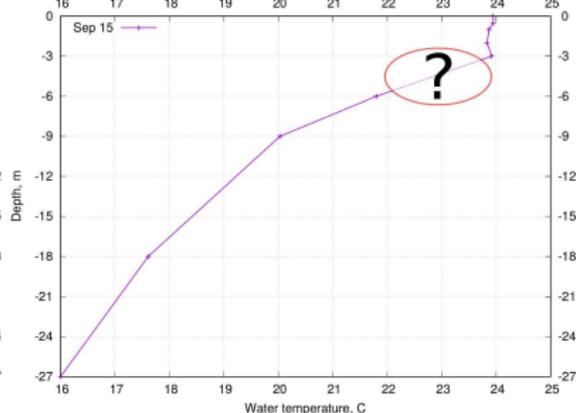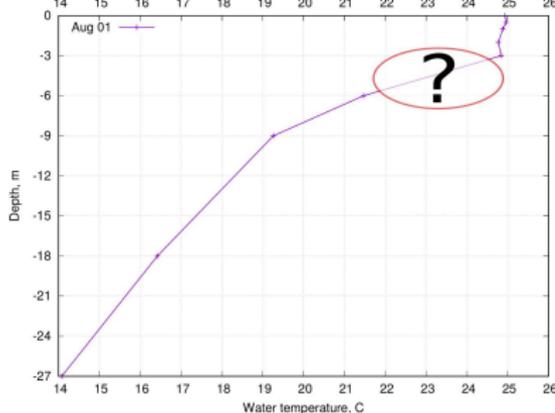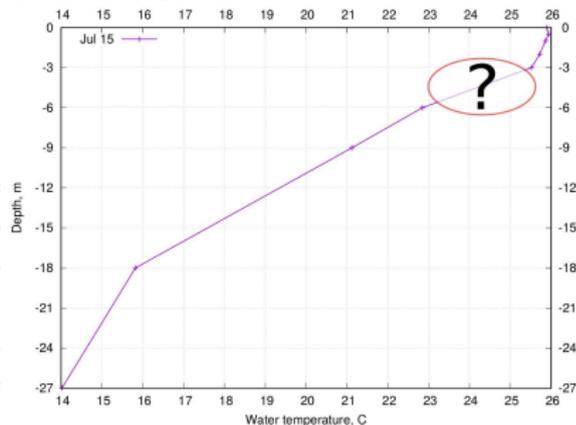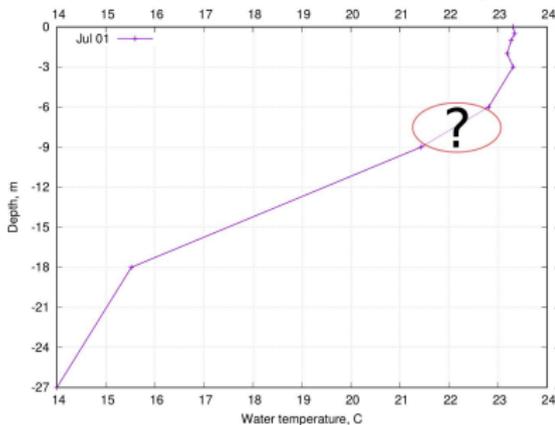
# 3 point fitting
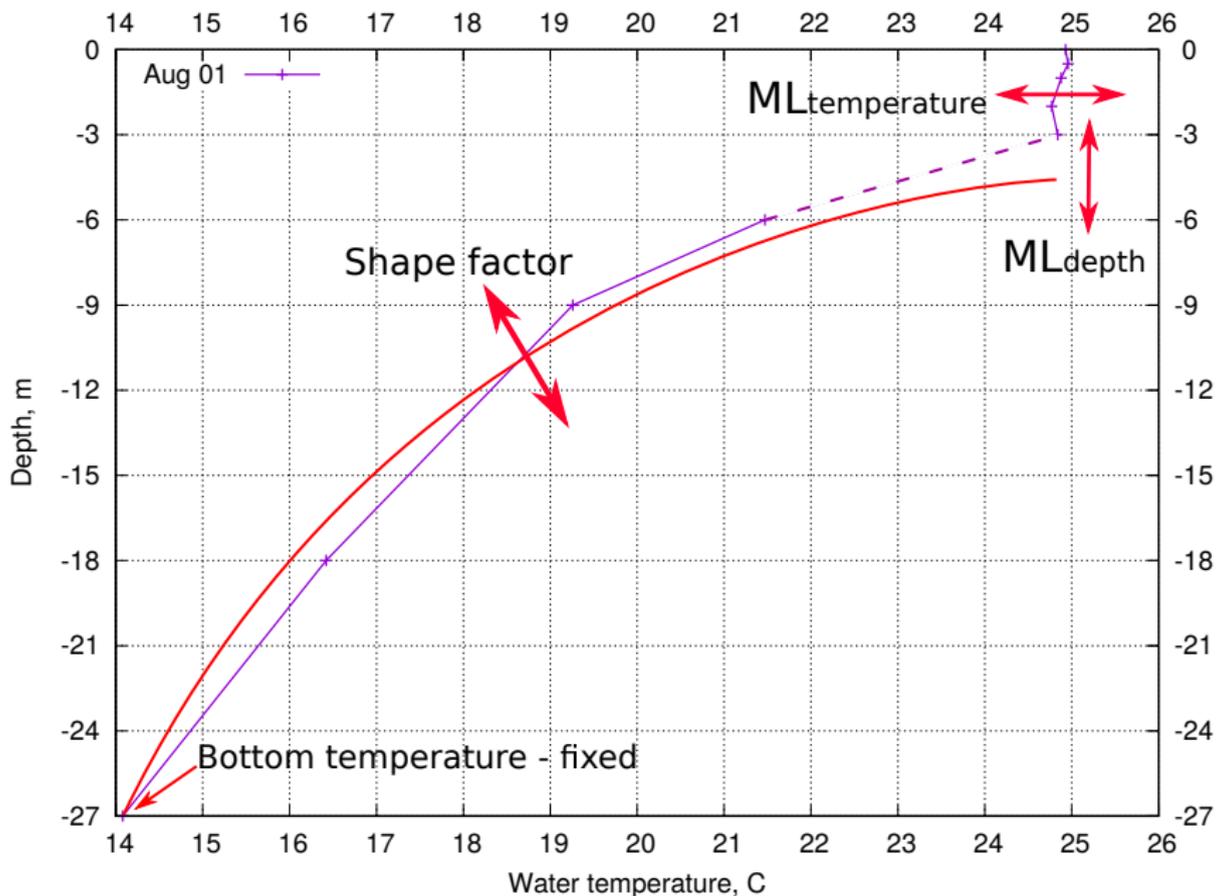
Initial parameters (midnight)
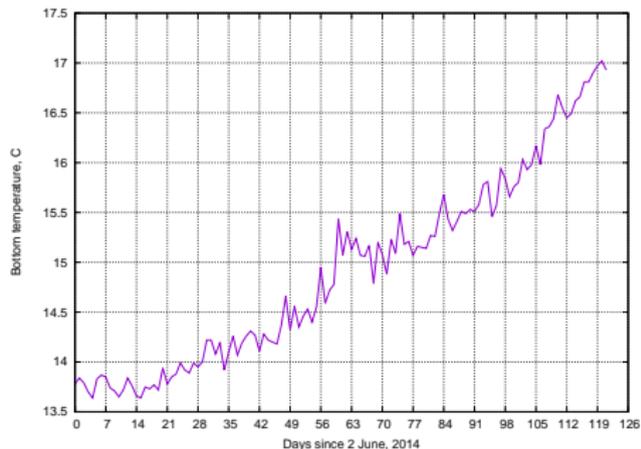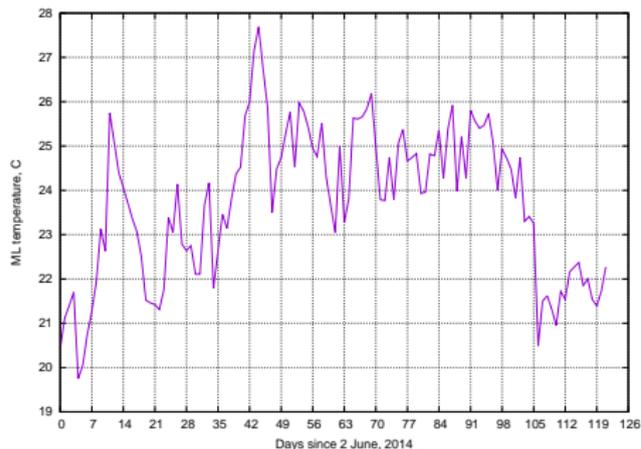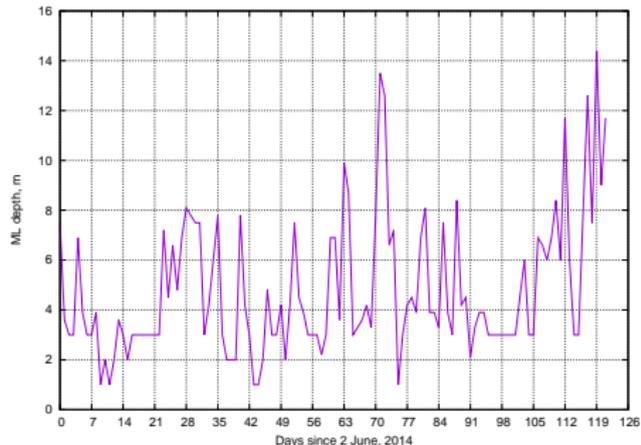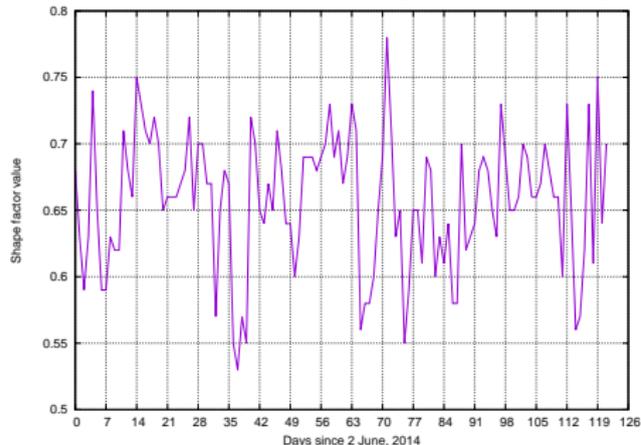
# Short time simulation

Short-time simulations
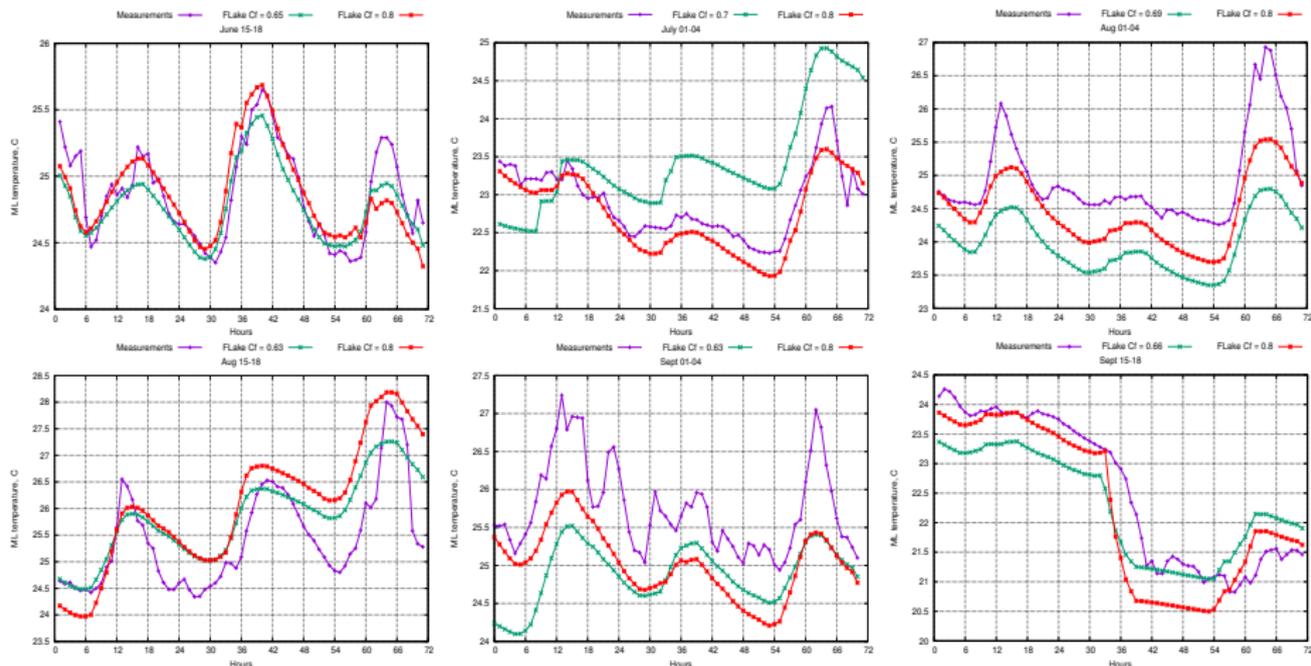
Green line — initial parameters were obtained by the fitting;
Red line — shape factor is always 0.8, no fitting.

4 months simulation
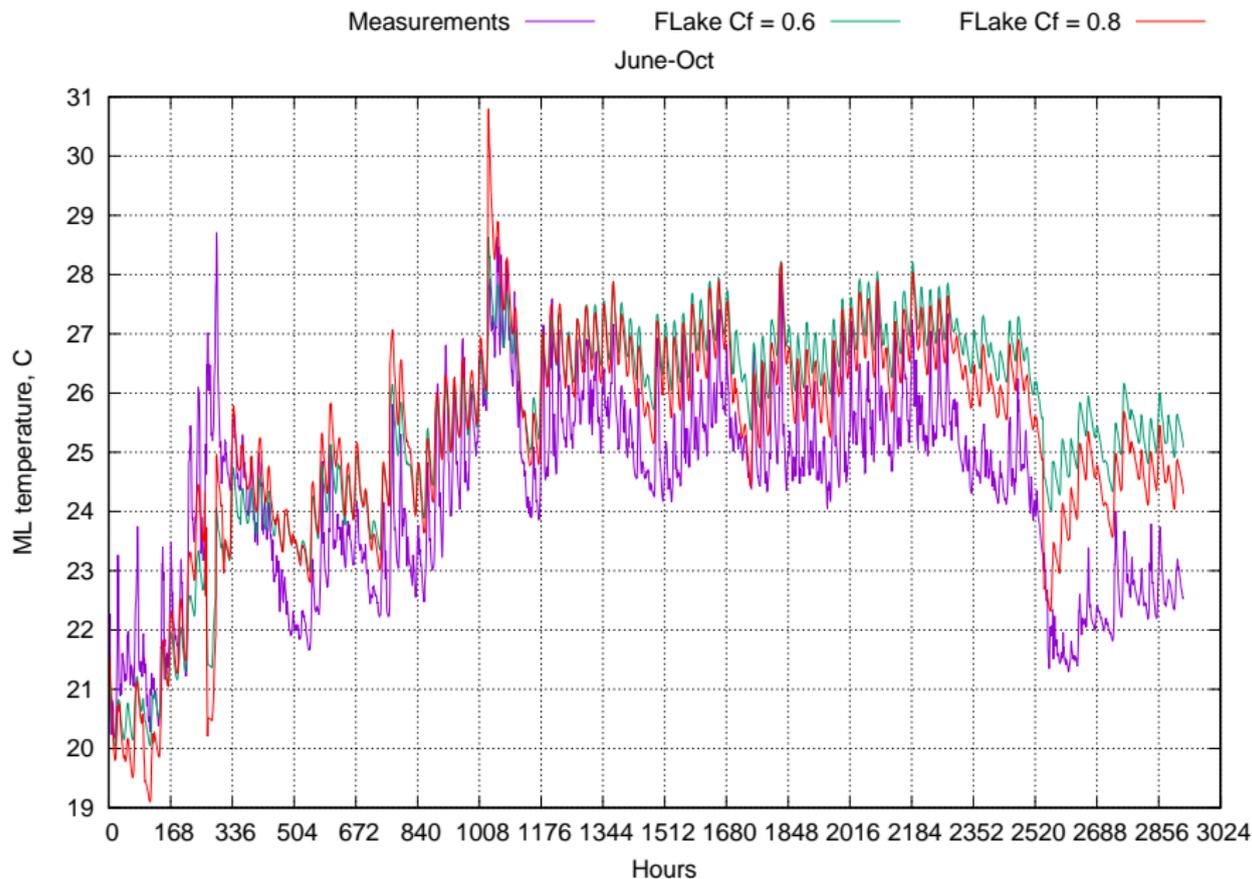
4 months simulation
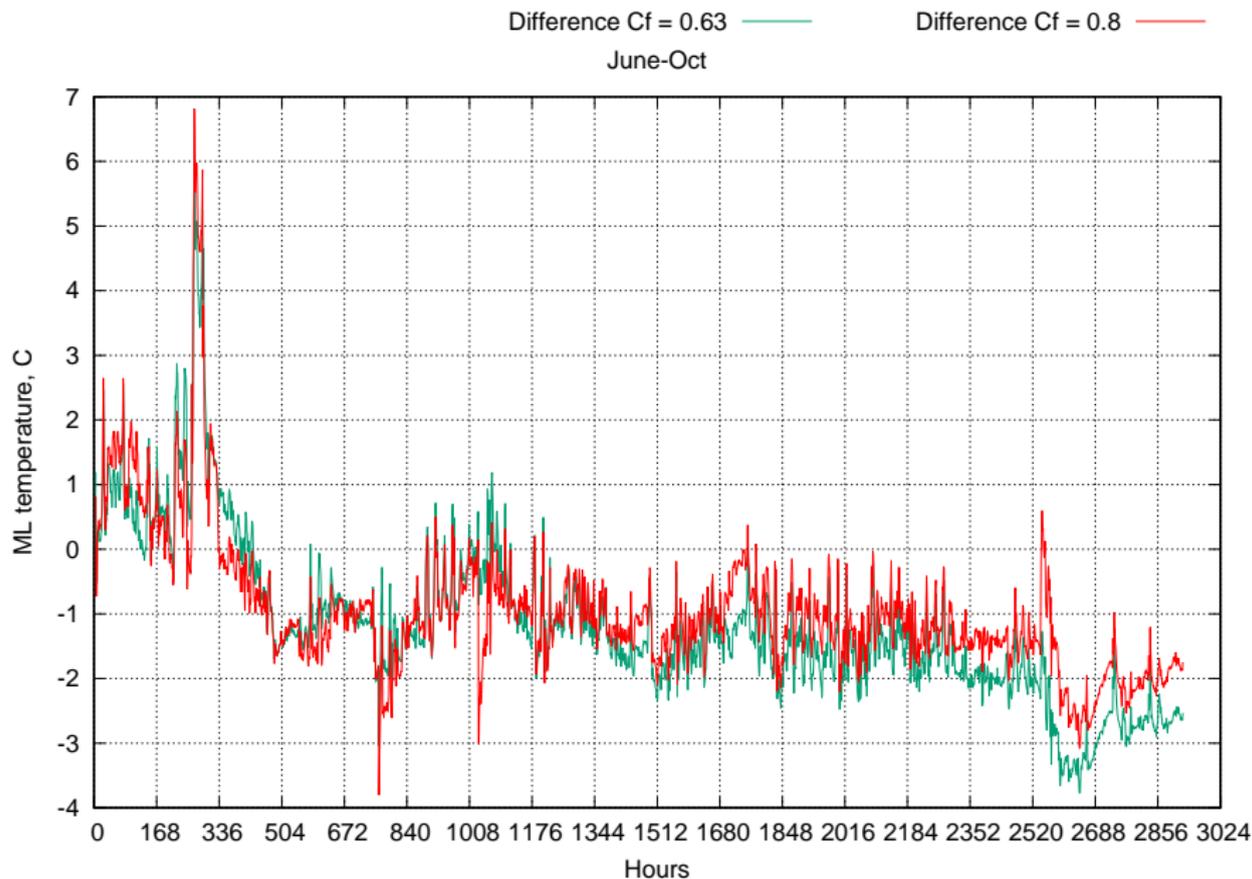
New dataset: ALOP 2017 campaign

Duration: April 2017 - nowdays

More sensors profiles.
14 levels: surface, 0.25, 0.5, 1.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 15.0, 20.0, 30.0, 60.0 m

# Dataset. ALOP2017 campaign - water temperature profiles

Midnight profiles
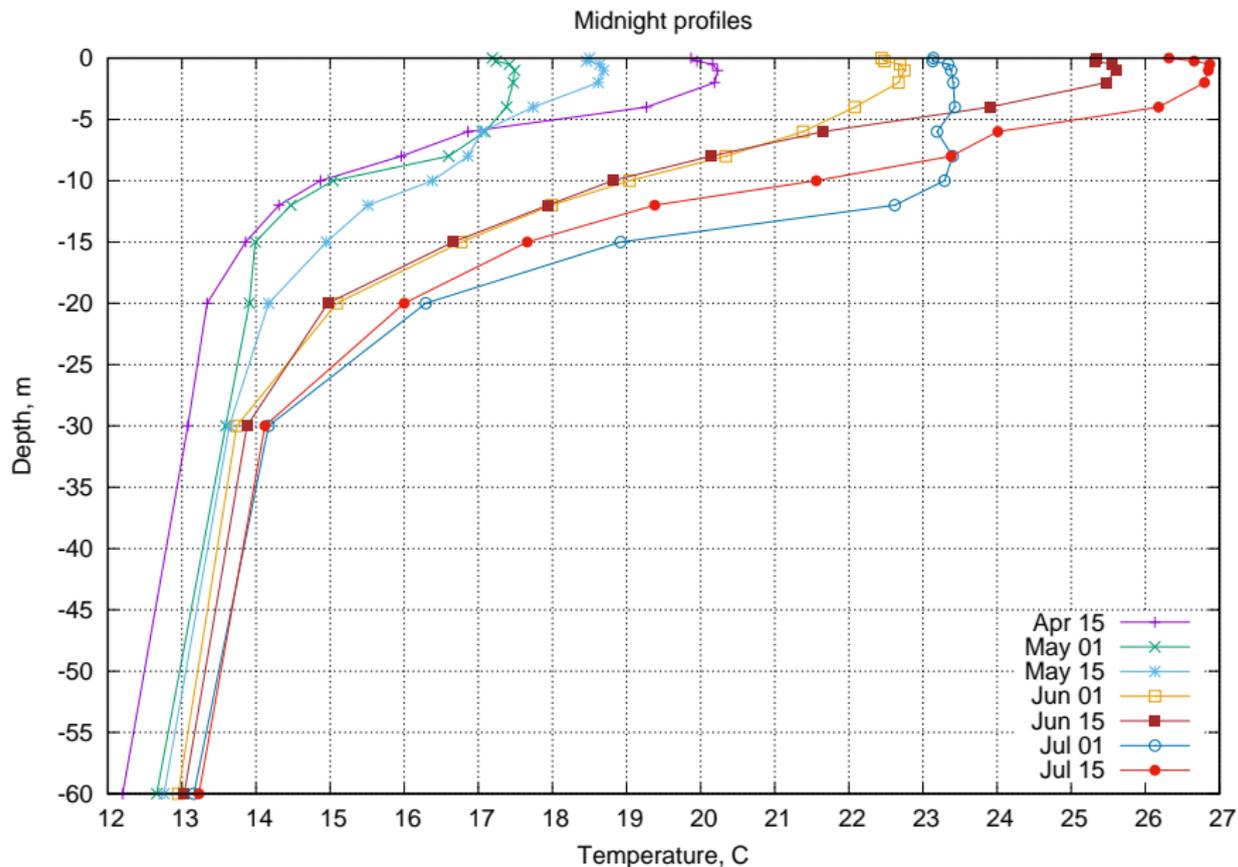
Dataset. ALOP2017 campaign.

More data — more problems



Temperature evolution in one week of April
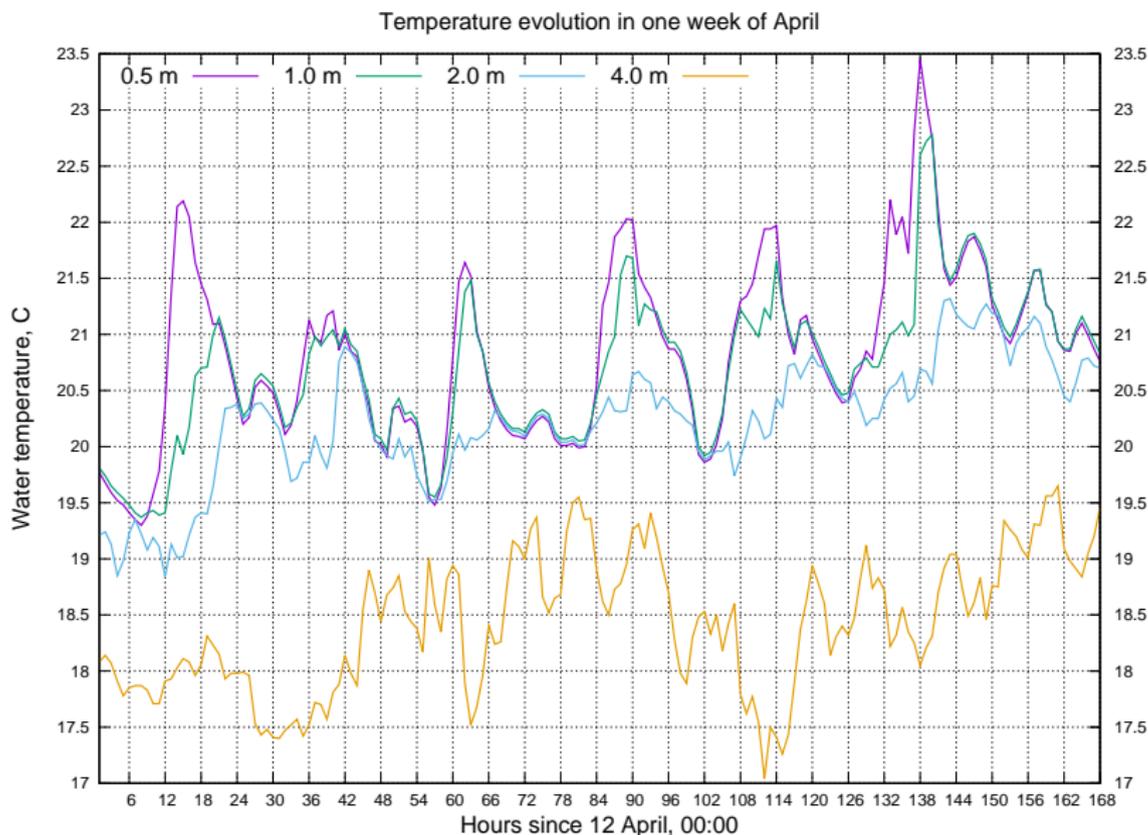
Initial parameters (midnight)
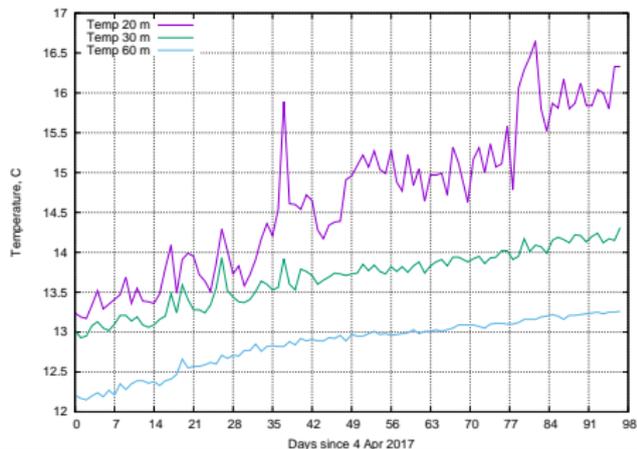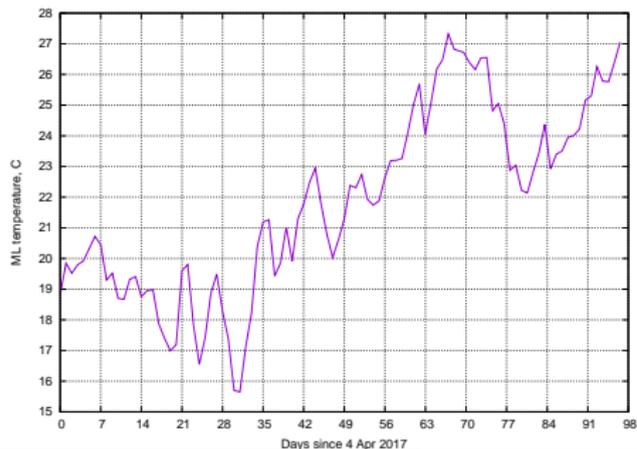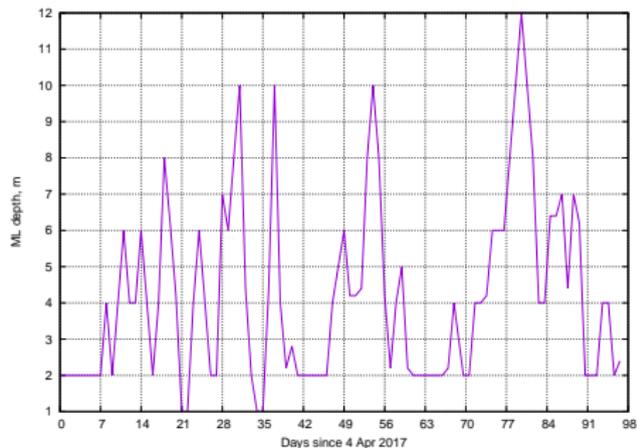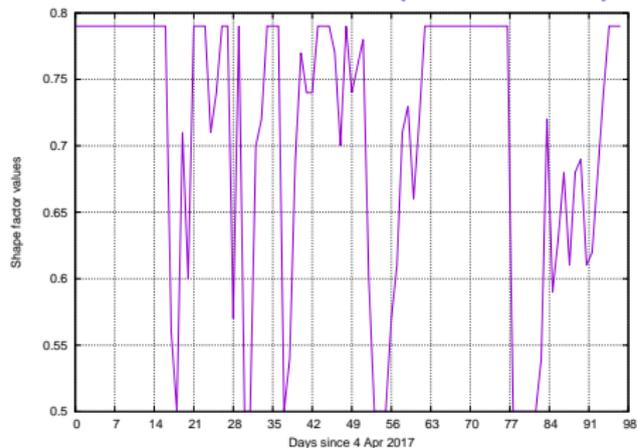
Short time simulation

Short time simulations
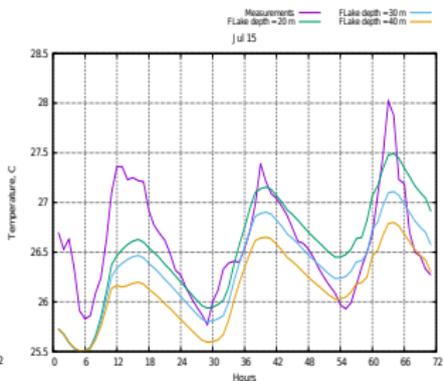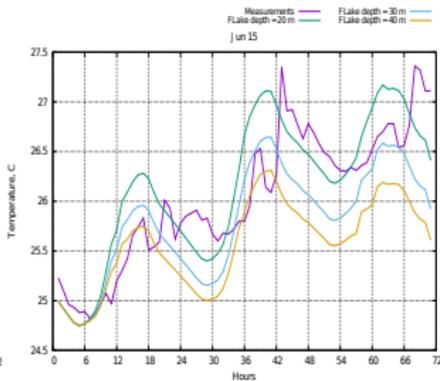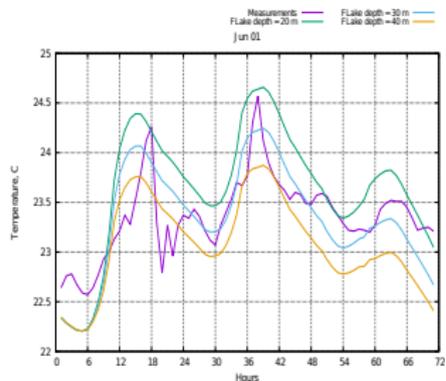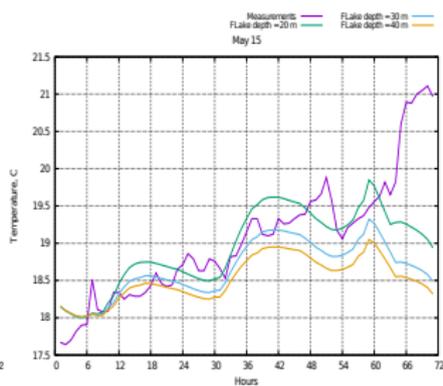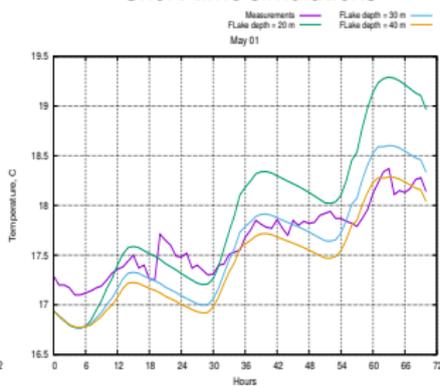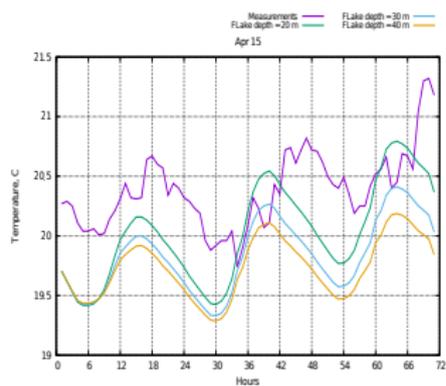
3 month simulation

April-July
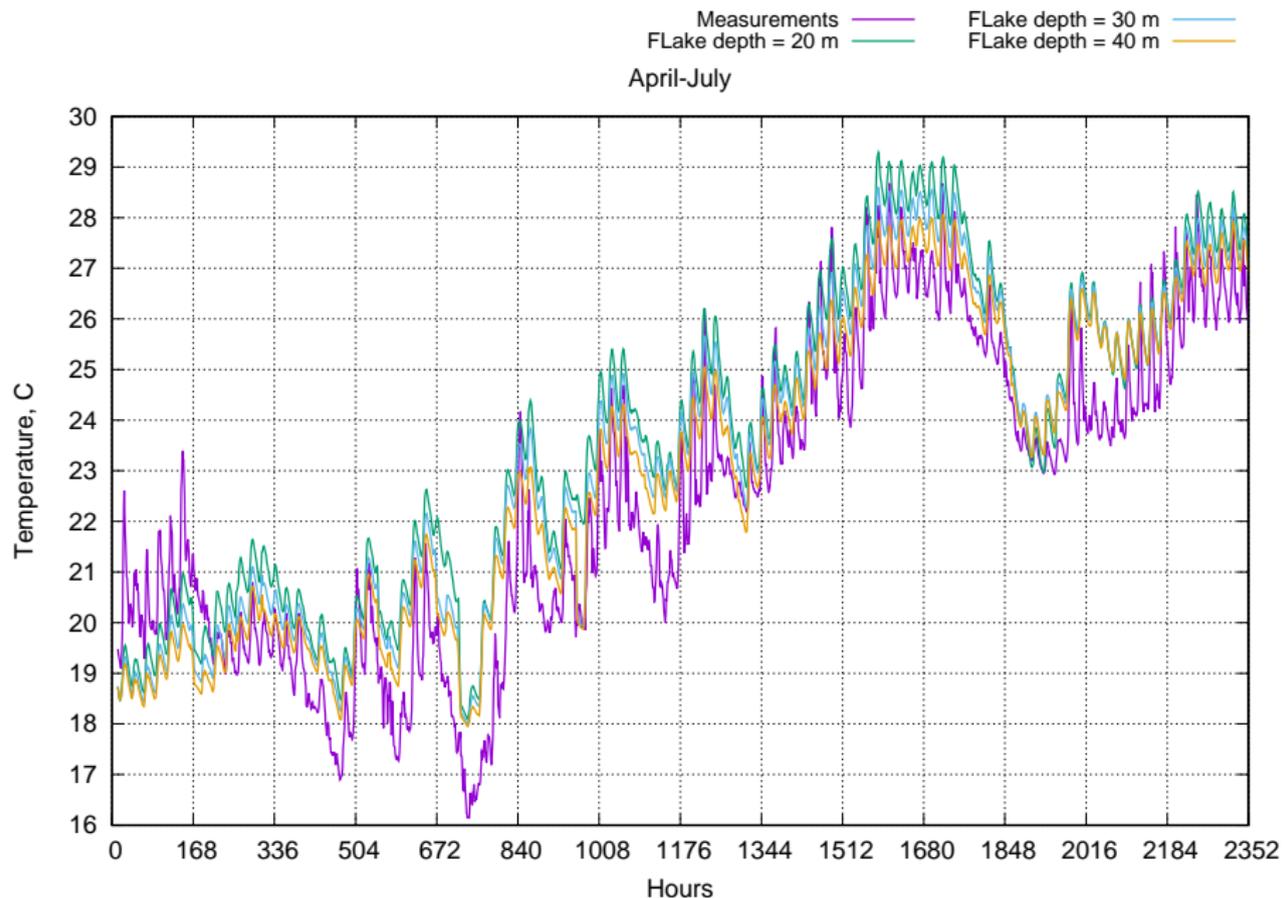
Conclusion

- Initial parameters, even the shape factor, could affect the results even at 4 month simulations;
- for the simulation of the ML temperature shape factor of 0.8 is the best value;
- a fitting approach, presented here, could be used to define initial parameters (more detailed profiles are better);
- (not a conclusion) extinction coefficient to be defined as input variable.

Acknowledgements

THANK YOU FOR ATTENTION