Yuqiao modelling

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The MyLake model (1D)

- Inputs
  - Lake morphometry
  - Atmospheric forcing
    - Temperature, pressure, wind speed, humidity, precipitation, irradiance
  - Water, inorganic particle, and total nutrient loading

ELSEVIER

available at www.sciencedirect.com

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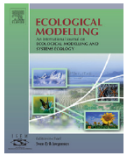
journal homepage: www.elsevier.com/locate/ecolmodel



MyLake—A multi-year lake simulation model code suitable for uncertainty and sensitivity analysis simulations

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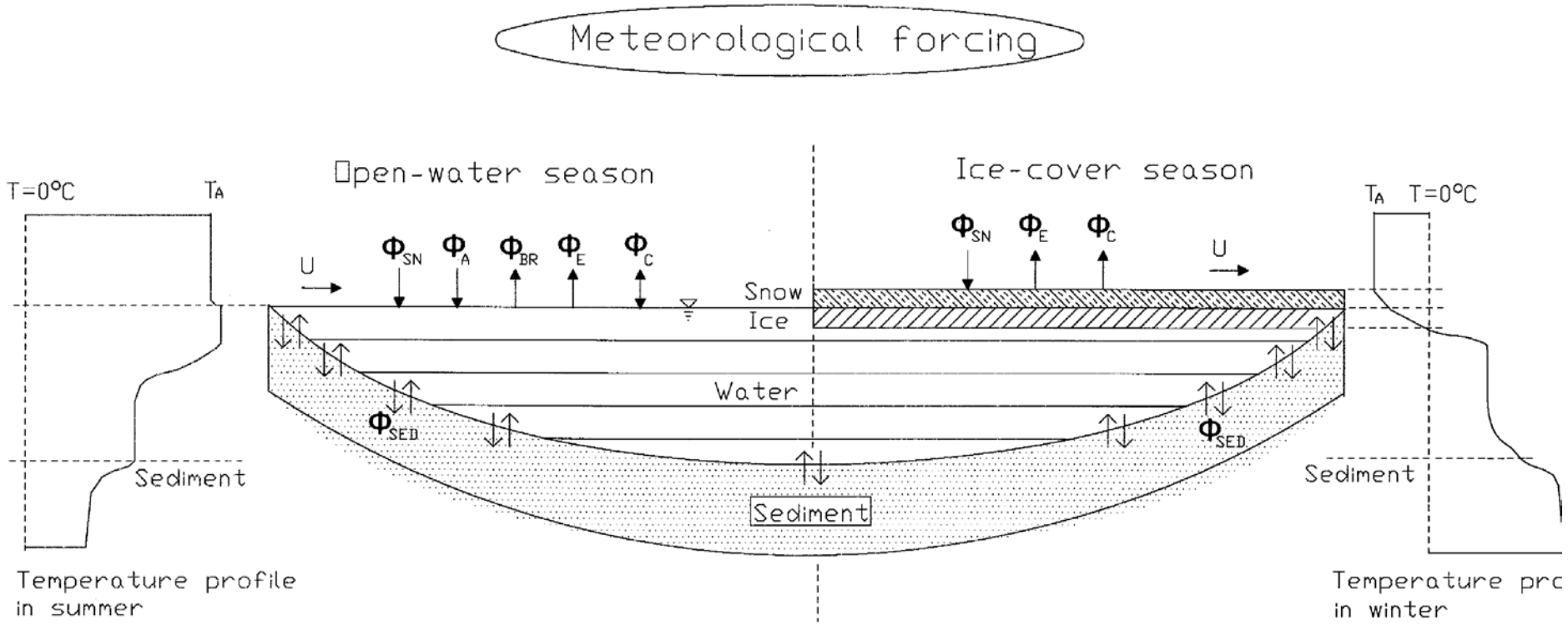
- Outputs
  - Temperature distribution
  - Snow/ice cover
  - Thermocline depth
  - Sediment heat exchange
  - Surface sediment P cycle
  - Simplified pelagic P cycle
  - Transport of suspended particles
  - Phase partitioning of P

MyLake: Global energy balance



MyLake: Local energy balance

$$A\frac{\partial T}{\partial t} = \frac{\partial}{\partial z}\left[KA\frac{\partial T}{\partial z}\right] + A\frac{Q^*}{\rho_w C_p}$$

Temperature change

Diffusive flux

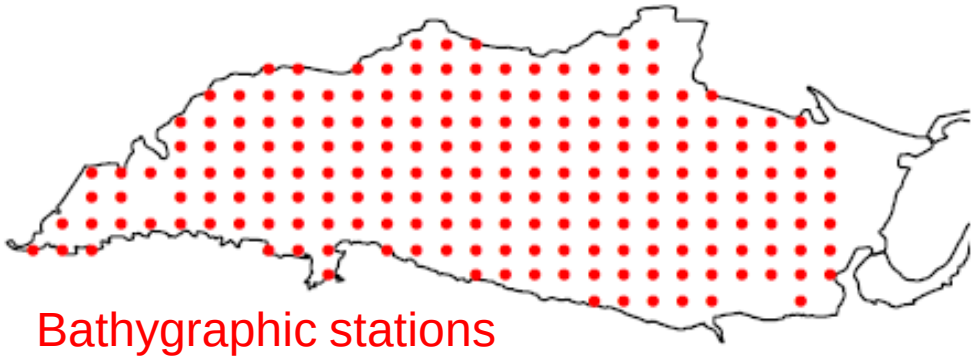
Heat flux

- 1-dimensional partial differential equation (PDE)
  - Implicit, finite-volume numerical solution scheme (daily time step)
- Boundary conditions: surface and sediment heat fluxes
  - Local weather station or WMO reanalysis data (daily averages)
- Freely available Matlab code
  - Distributed through active github community

Necessary inputs for MyLake

- Bathygraphic curve (area by depth)
  - Not available for Yuqiao
- Local weather data (daily)
  - Harder than expected to get
- Water inflow (Guo and Lin rivers)
  - Available only for Lin?
- Inflow water concentrations
  - Total / dissolved P, suspended inorganic solids
  - From WP1 + RCEES monitoring (YQ14-15)
- Physics calibration data
  - Water temperature (loggers), ice thickness + on/off
- Eutrophication calibration data
  - Chlorophyll, total & dissolved P (UiO + RCEES monitoring)

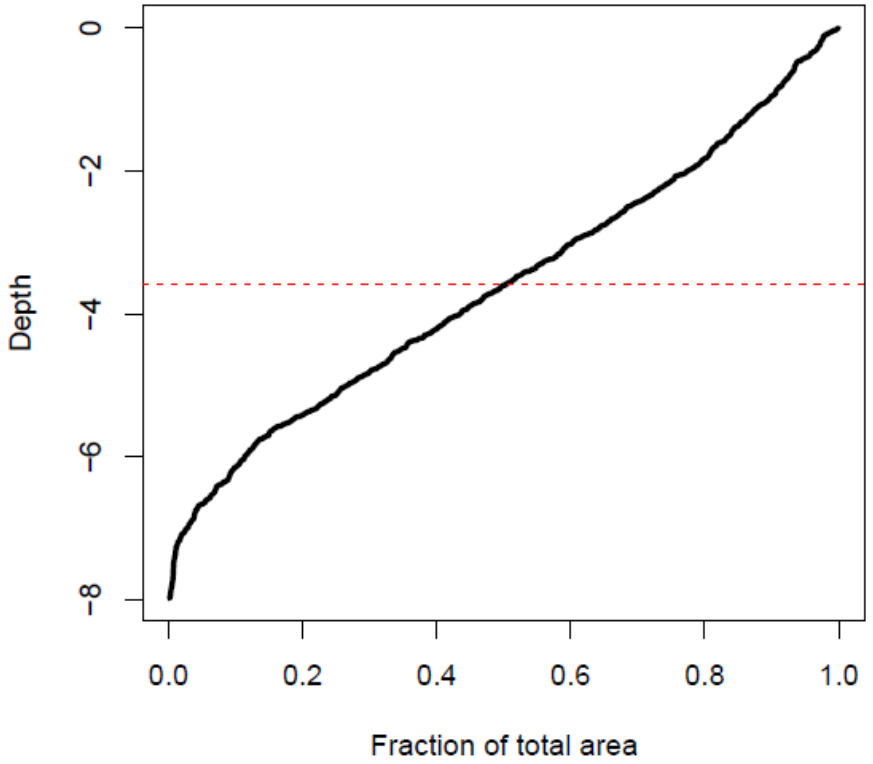
Bathygraphic data



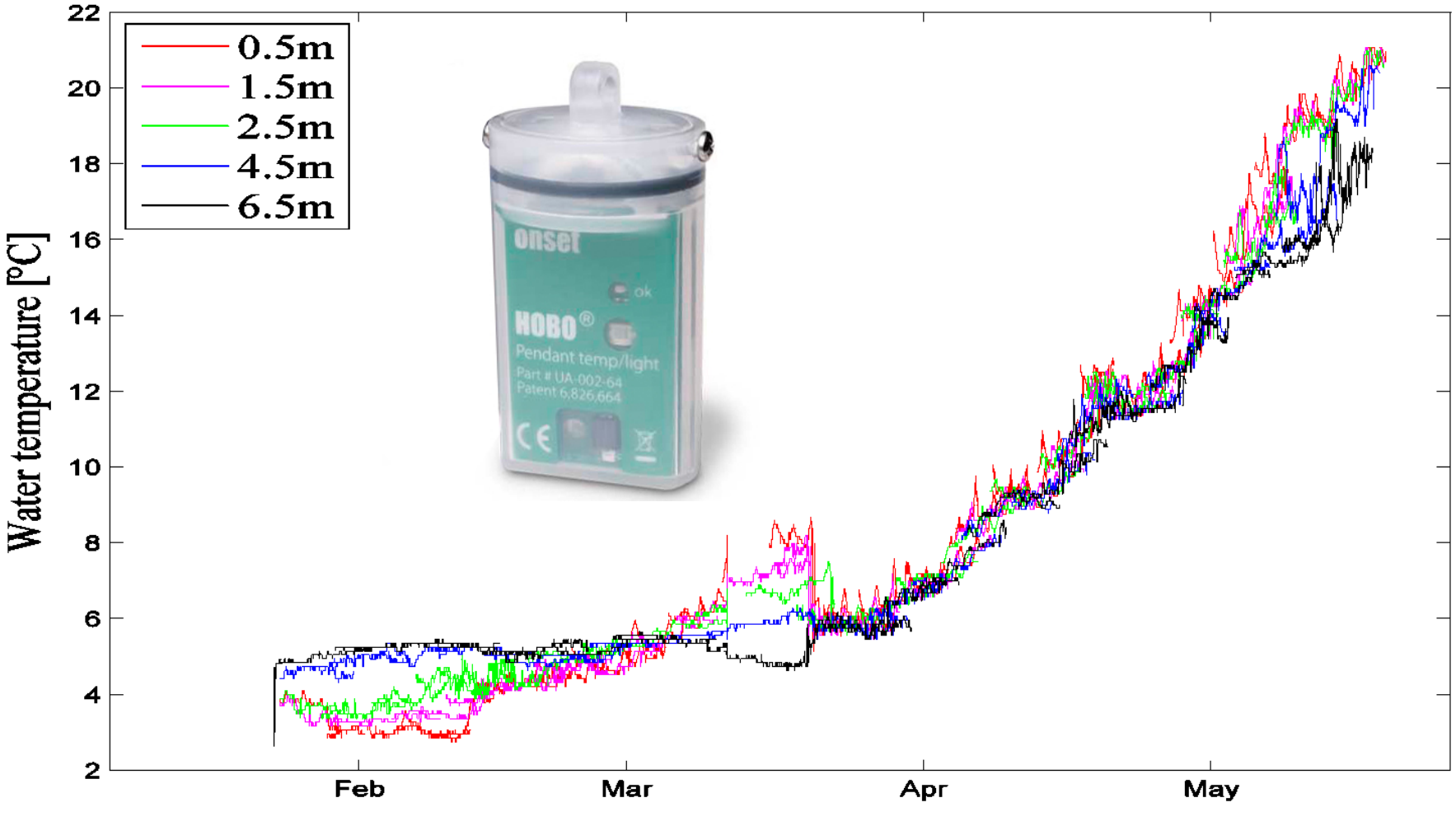
Bathygraphic stations

Depth contours

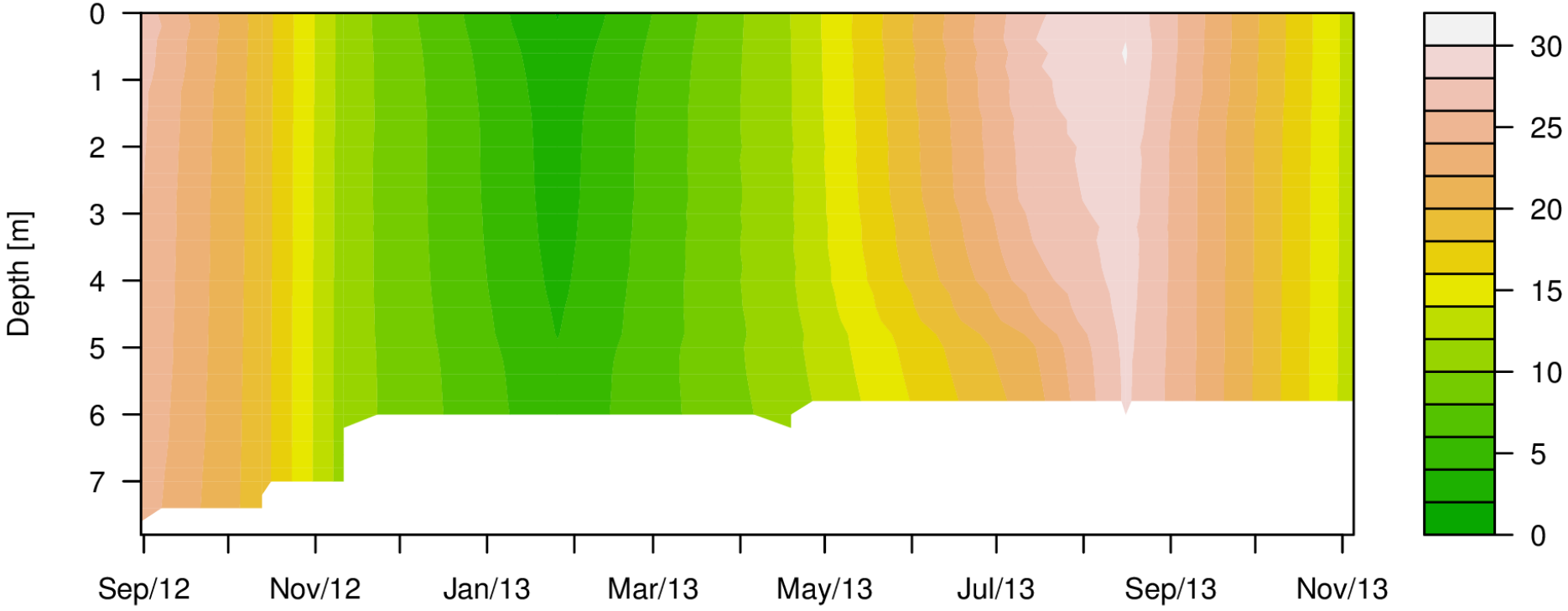
Bathygraphic curve



Temperature logging



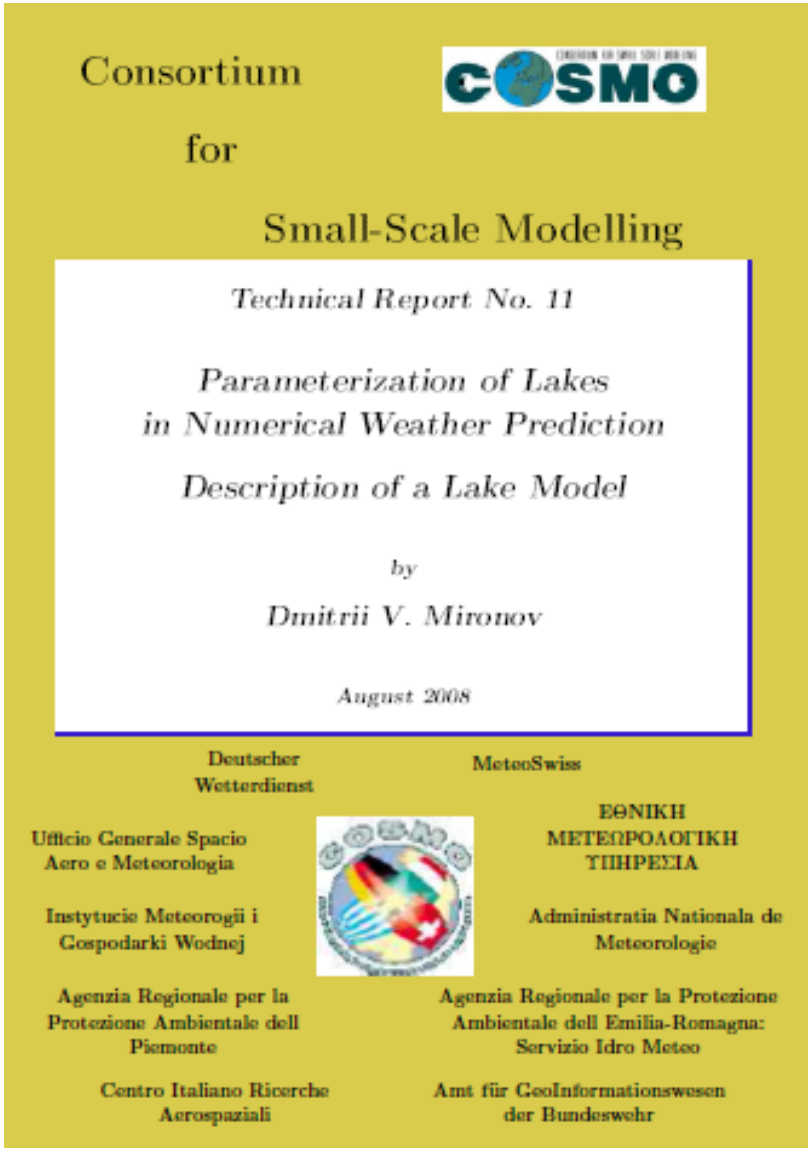
Monitoring temperature profiles



Physics input situation

- Bathygraphic curve
  - Not referred to absolute water surface altitude
- 10 years of weather data
  - No climate scenario data (CORDEX)
  - No on-lake weather station deployed
- Incomplete water balance data
  - No hydrology data from Ji county
- Temperature, light, and water level logging aborted
  - Temperature profiles from monitoring (1 year)

The Flake model (0.5D)


Consortium

for

Small-Scale Modelling

Technical Report No. 11

Parameterization of Lakes in Numerical Weather Prediction

Description of a Lake Model

by

Dmitrii V. Mironov

August 2008

Deutscher Wetterdienst

MeteoSwiss

Ufficio Generale Spacio Aero e Meteorologia

ΕΘΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΚΗ ΥΠΗΡΕΣΙΑ

Instytucie Meteorogii i Gospodarki Wodnej

Administratia Nationala de Meteorologie

Agenzia Regionale per la Protezione Ambientale dell Piemonte

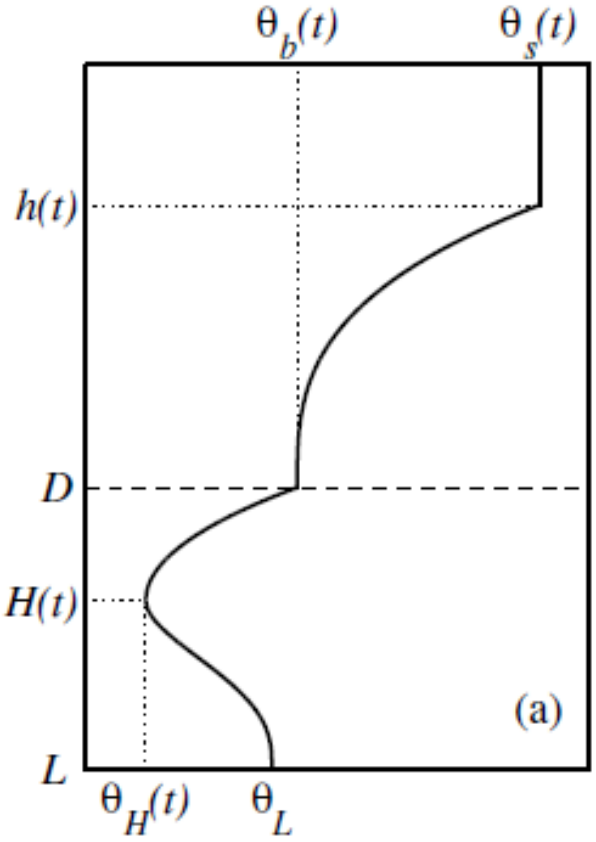
Agenzia Regionale per la Protezione Ambientale dell Emilia-Romagna: Servizio Idro Meteo

Centro Italiano Ricerche Aerospaziali

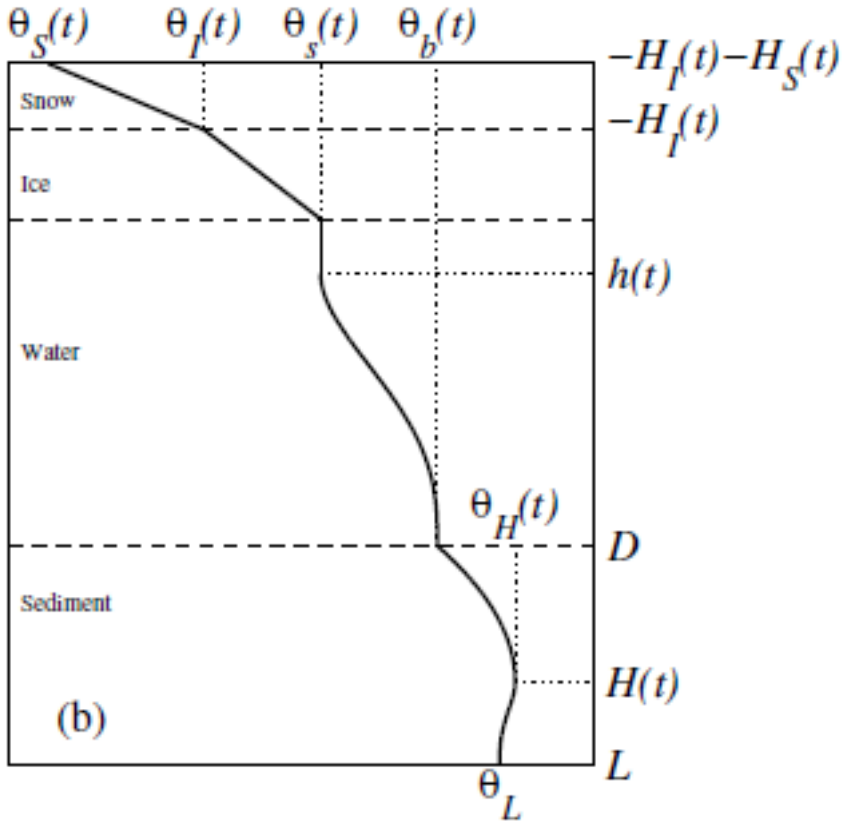
Amt für GeoInformationswesen der Bundeswehr

- Inputs
  - Mean depth (only)
    - Bathtub-shaped basin
  - Weather
    - Observed or generated
  - Water turbidity
- Outputs
  - Mixed-layer temperature
  - Thermocline depth
  - Bottom temperature
  - Snow/ice cover
  - Very light-weight
  - Only physics

FLake structure

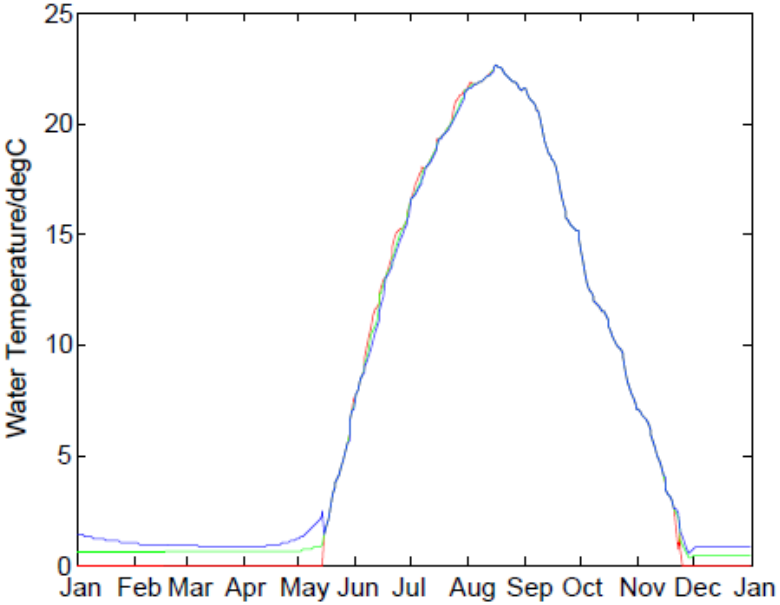


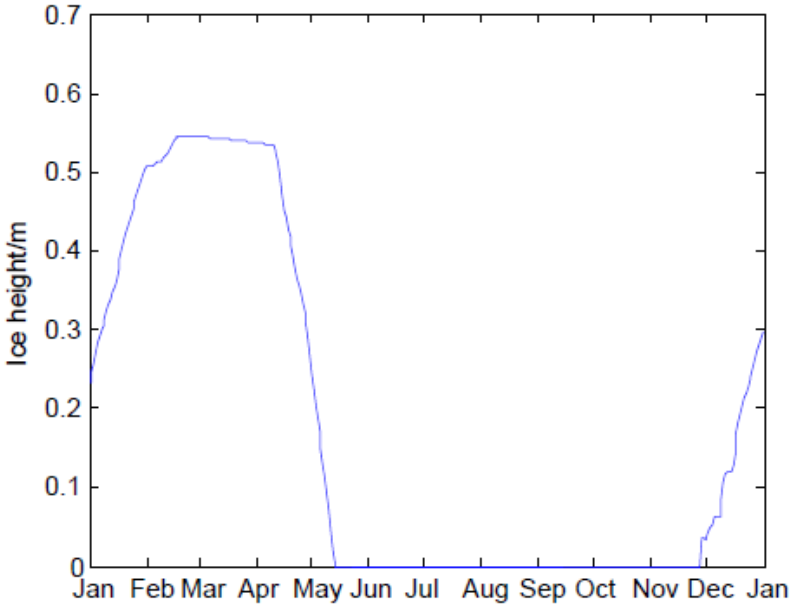
Summer



Winter

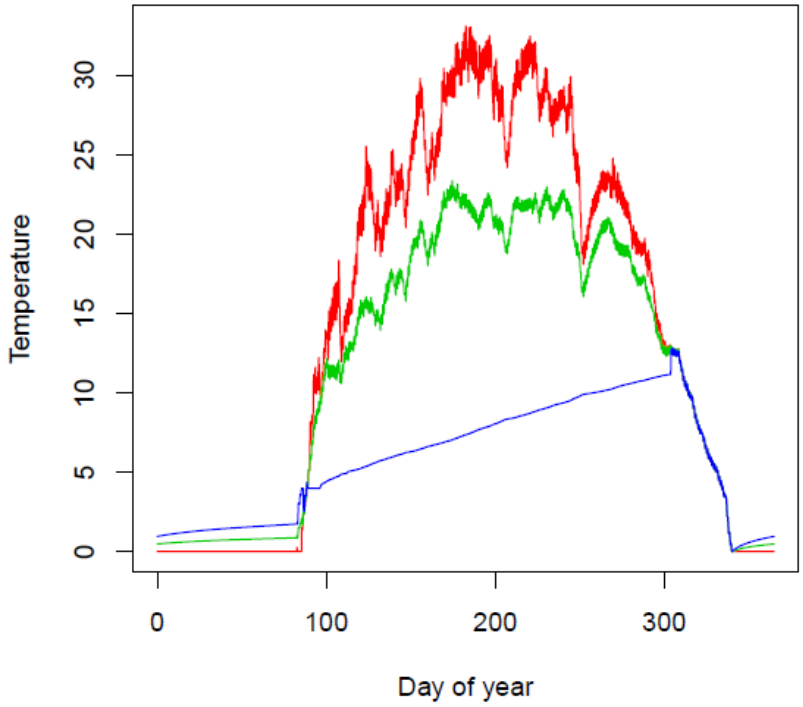
Uncalibrated MyLake

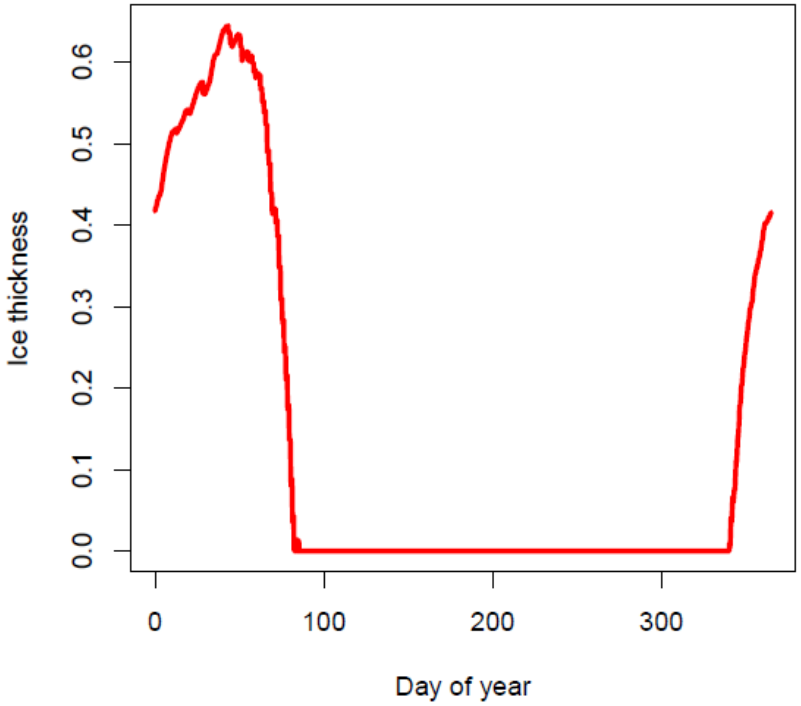




Run with10 years of local weather (2001-2011; showing 2011)

Uncalibrated FLake





Run with 1 year of generic weather (from reanalysis)

MyLake vs. FLake

- FLake predicts stratification in summer
  - Contrary to observations
- FLake predicts ice-off in March
  - In accordance with observations

- MyLake predictics no summer stratification
  - In accordance with obeservations
- MyLake predicts ice-off in May
  - Contrary to observations

- FLake’s summer temperature predictions are closer to observations than MyLake’s