SIMULATION OF LAKE GENEVA TEMPERATURE PROFILES UNDER OBSERVED AND FUTURE WARMER CLIMATE CONDITIONS WITH A SINGLE COLUMN LAKE MODEL

Presentation

Study site

Intercomparison of models

Impacts of Climate Change

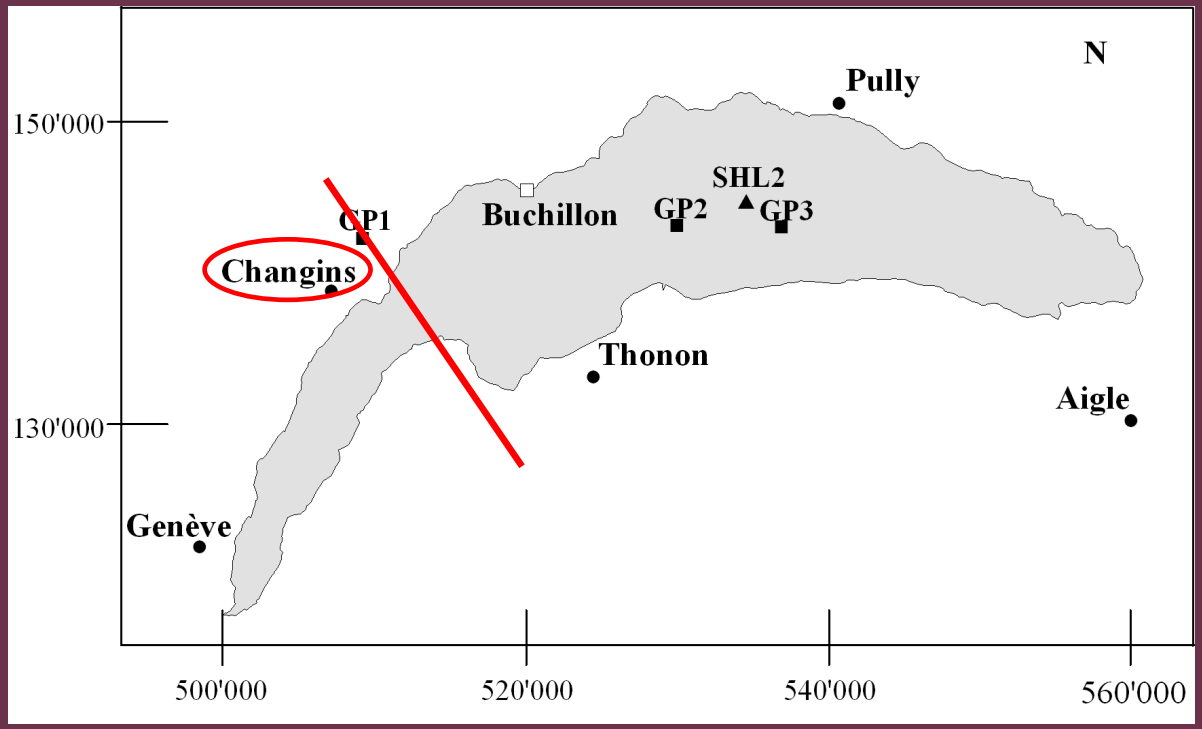
- One-way coupling method
- Two-way coupling method

Conclusions

Study site

Lake geneva characteristics

- 2 bassins: « Petit lac» and « Grand lac »
- Maximum depth: 309 m
- Axe length : 72.3 km
- Area: 580 km²
- Warm monomictic lake



Intercomparison of models

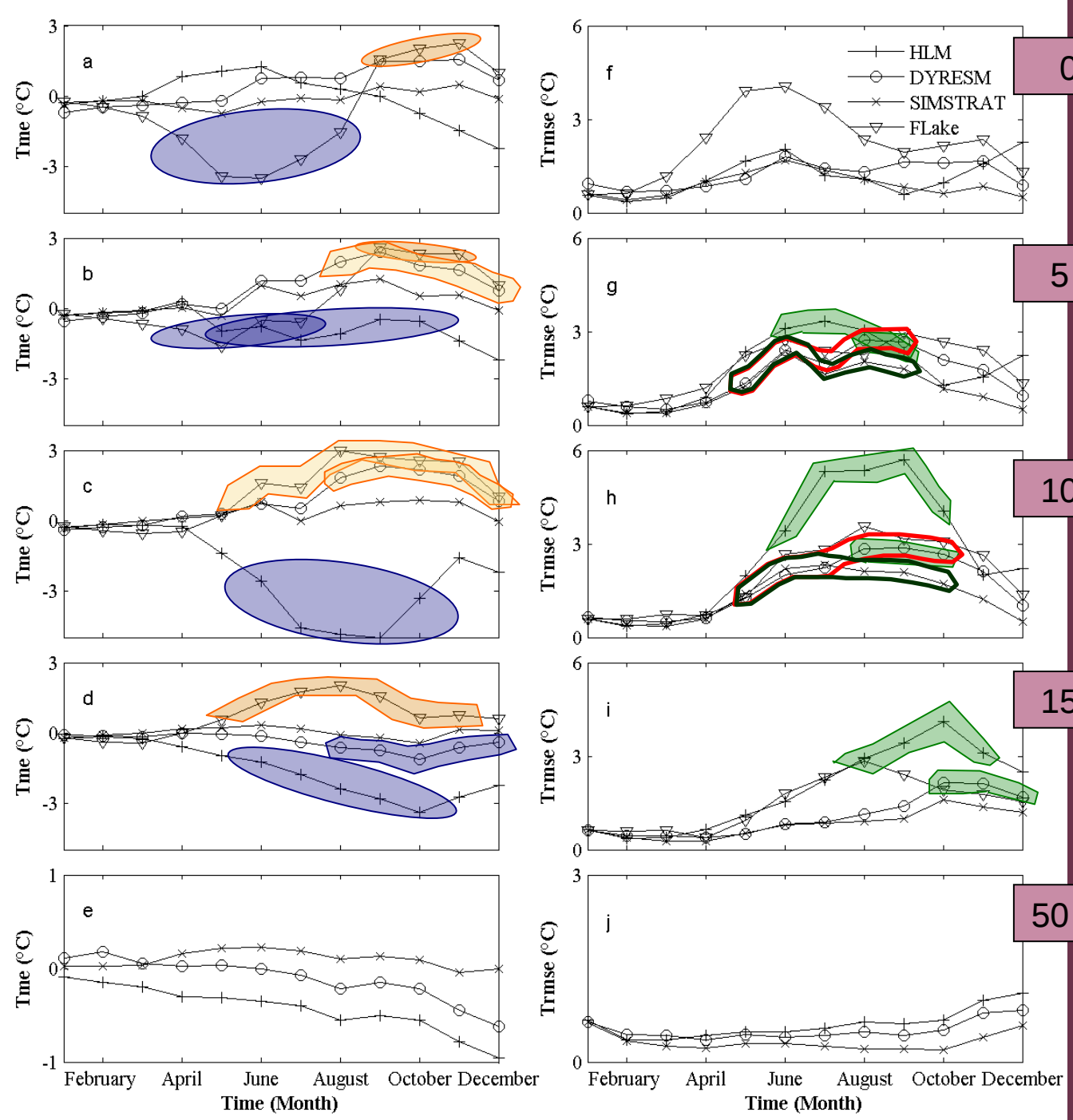
Models tested : The Hostetler model, DYRESM, Simstrat, FLake

Particularities

- common atmospheric data
- minor calibrations
- a correction factor to windspeed observed values
- variations of the aerodynamic drag coefficient, C_D

Analysis of the intercomparison

- Simulation over a ten-years period (1.1.1996 – 31.12.2005)
- Trmse and Tme averaged by depth intervals
- Strength of stratification (N2)
- Lower boundary of the metalimnion



0 – 5 m

5 – 10 m

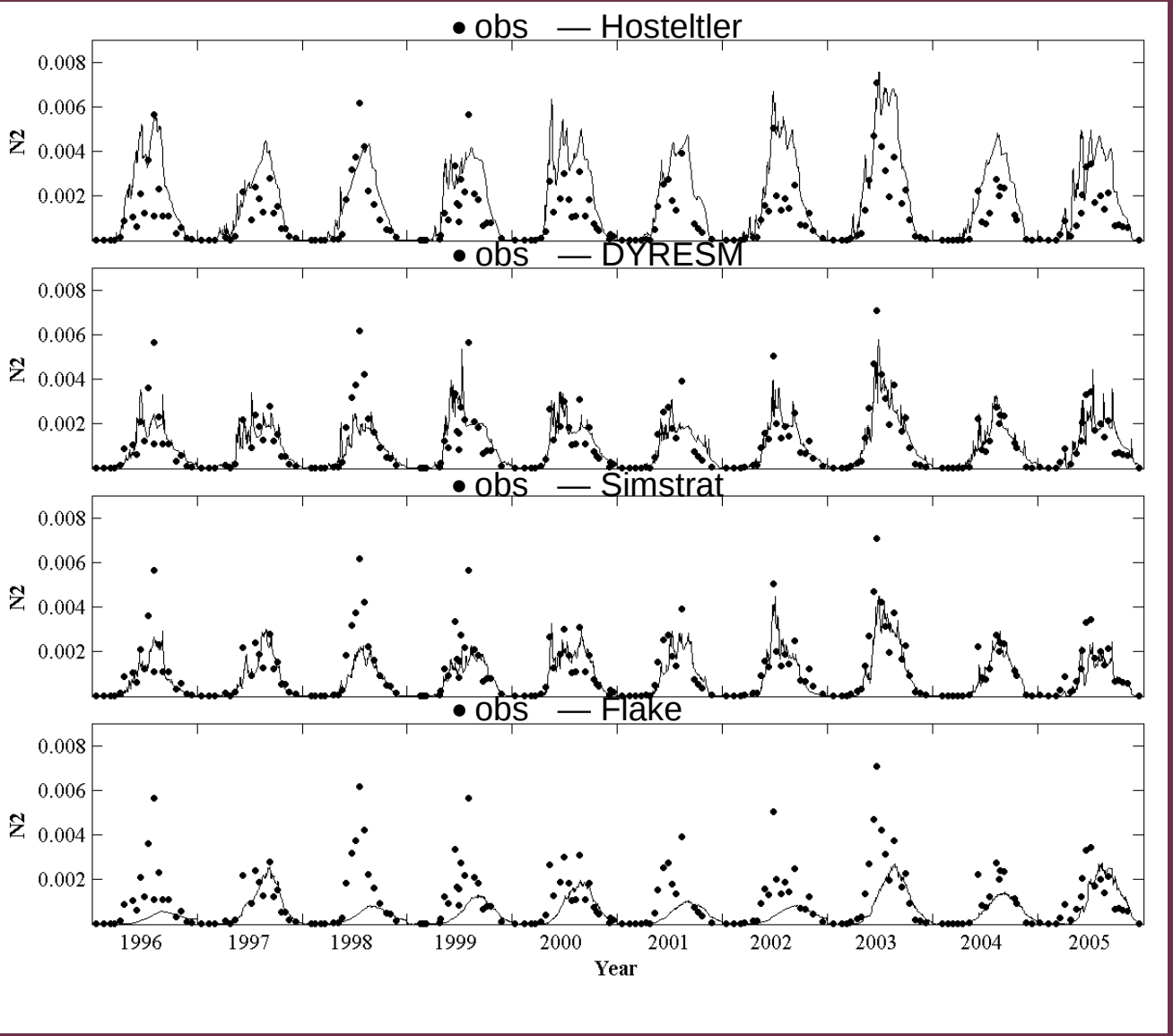
10 – 15 m

15 – 50 m

50 – 100 m

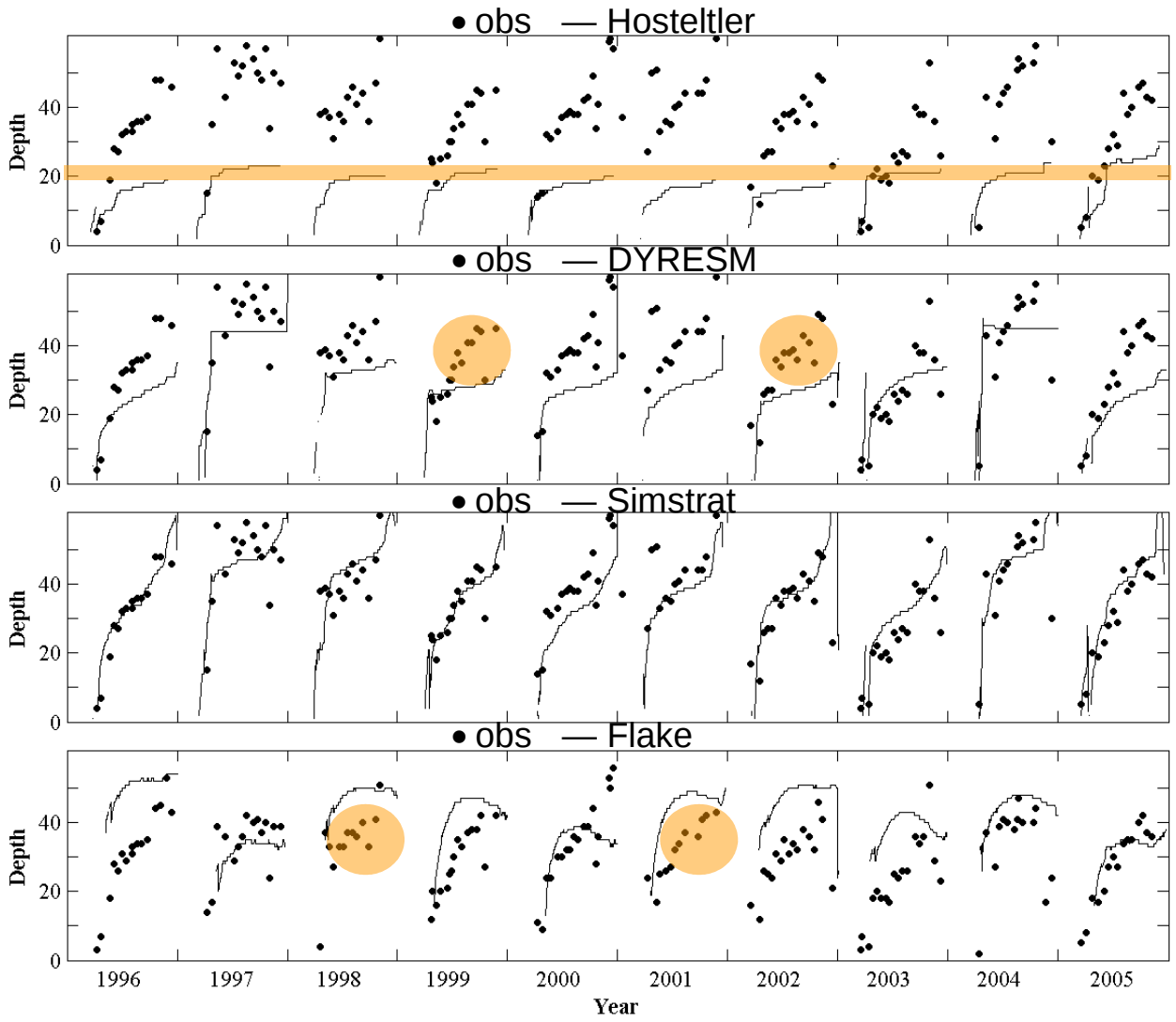
Statistical analysis

- Trmse
- Tme and σ



Strength of stratification

Brunt-Vaïsala frequency N2

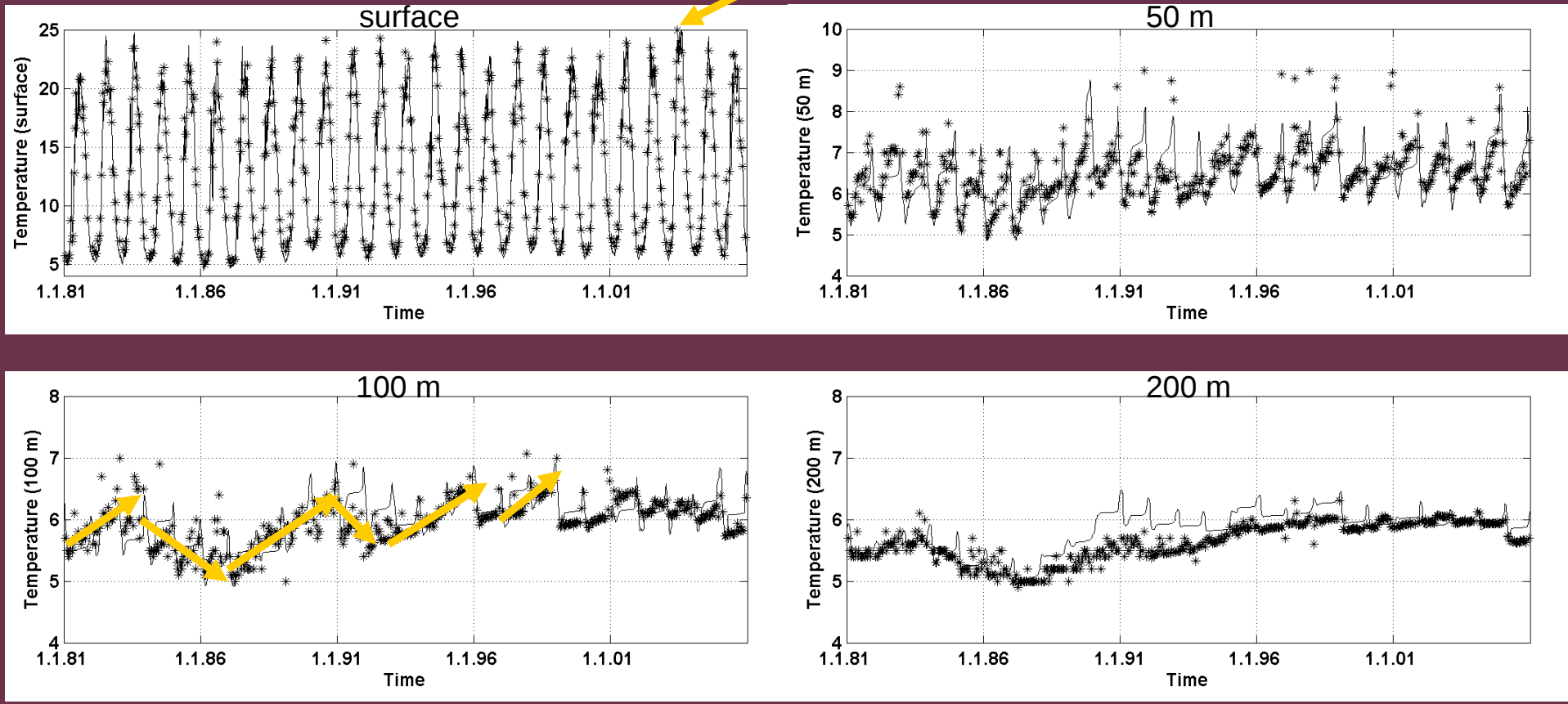


Lower boundary of the metalimnion

$DT_{T100max} = T_{100m} - T_D$

Choice of the model for predictive simulation

- Simstrat over 25 years



Impacts of Climate Change

Coupling at the lake-atmosphere interface

- one-way coupling method

  Model driven by meteorological data perturbed according to outputs produced by an RCM

- two-way coupling method

  Mutual exchanges between the lake surface and the atmosphere

  Coupling of Simstrat to FIZC

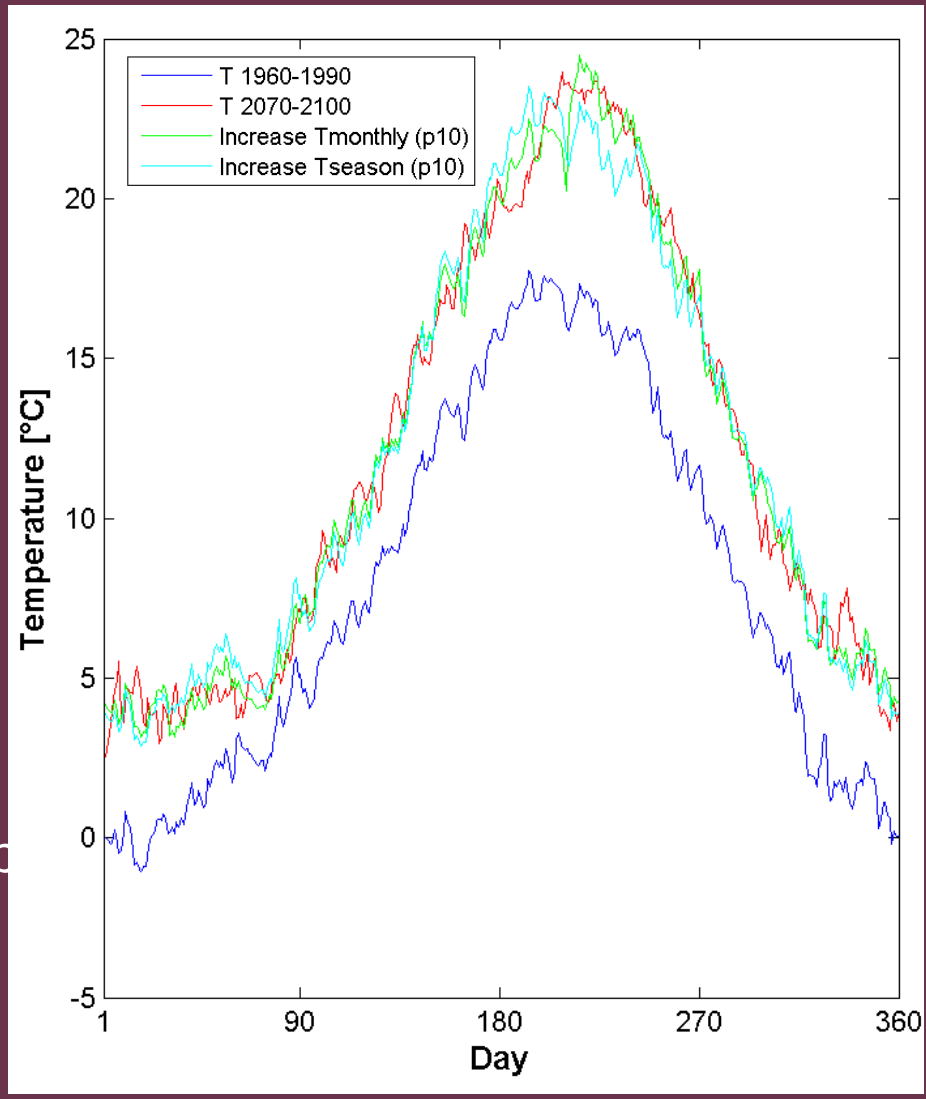
One-way coupling method

RCM dataset

- HIRHAM (IPCC A2 scenario)
- 2 sets of data:
  1960-1990 and 2070-2100
- Archival frequency : daily

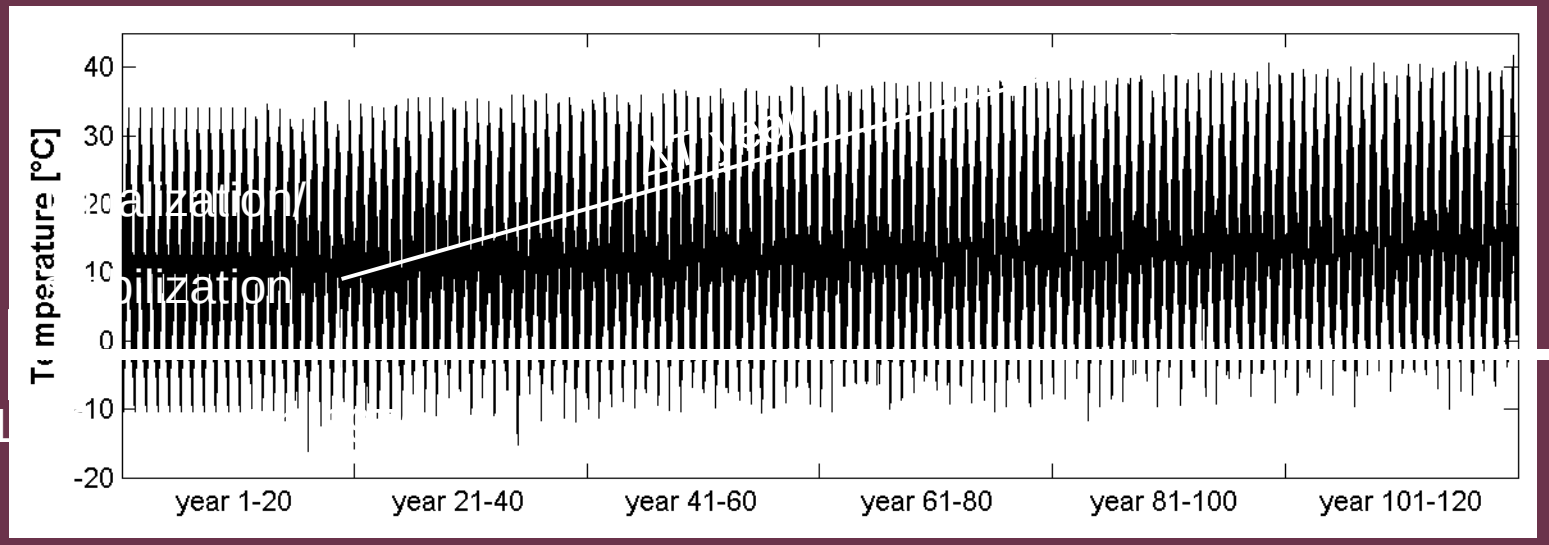
Data perturbation

- Percentiles method
  - temperature and dew point temp
  - classes of percentiles
  -random meteorological
  data generator

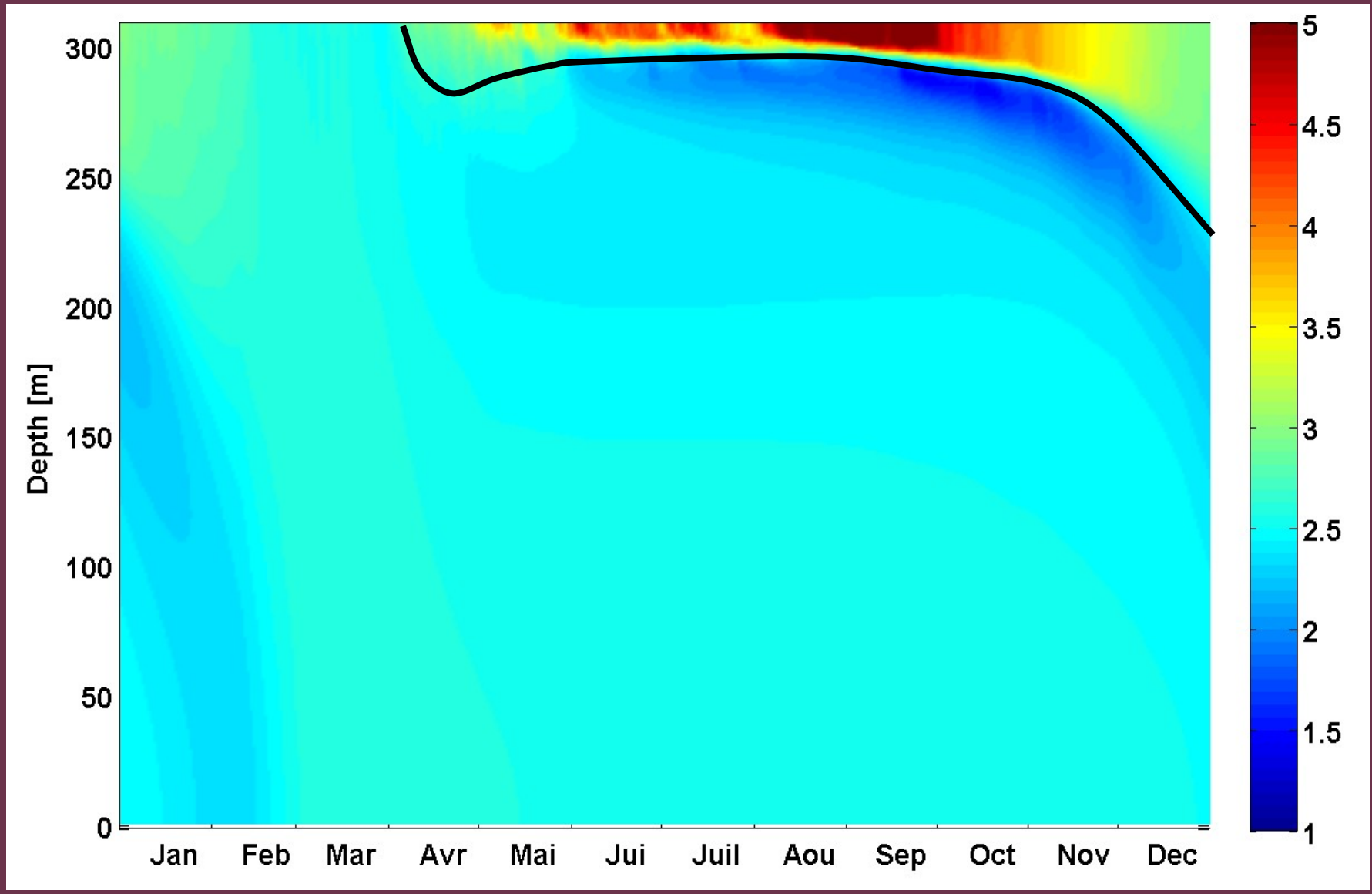


Application of the percentiles method

- Generation of 120 years of hourly data
- Increase of ΔT/year



Difference between daily means for years 1976-1986 and 2076-2086



Conclusion

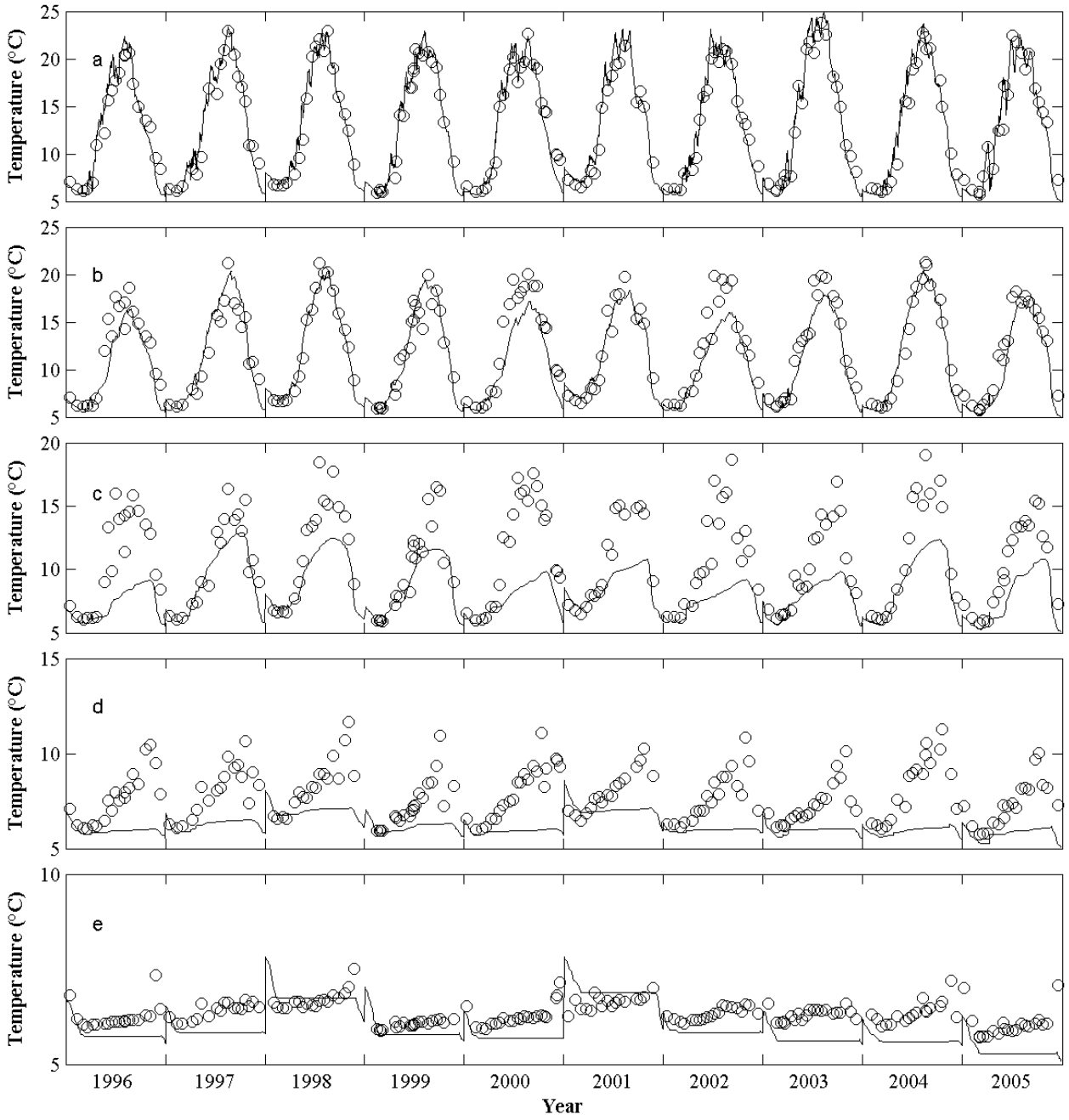
Simstrat

- application to other (large) lakes
- computational efficiency

Percentiles method

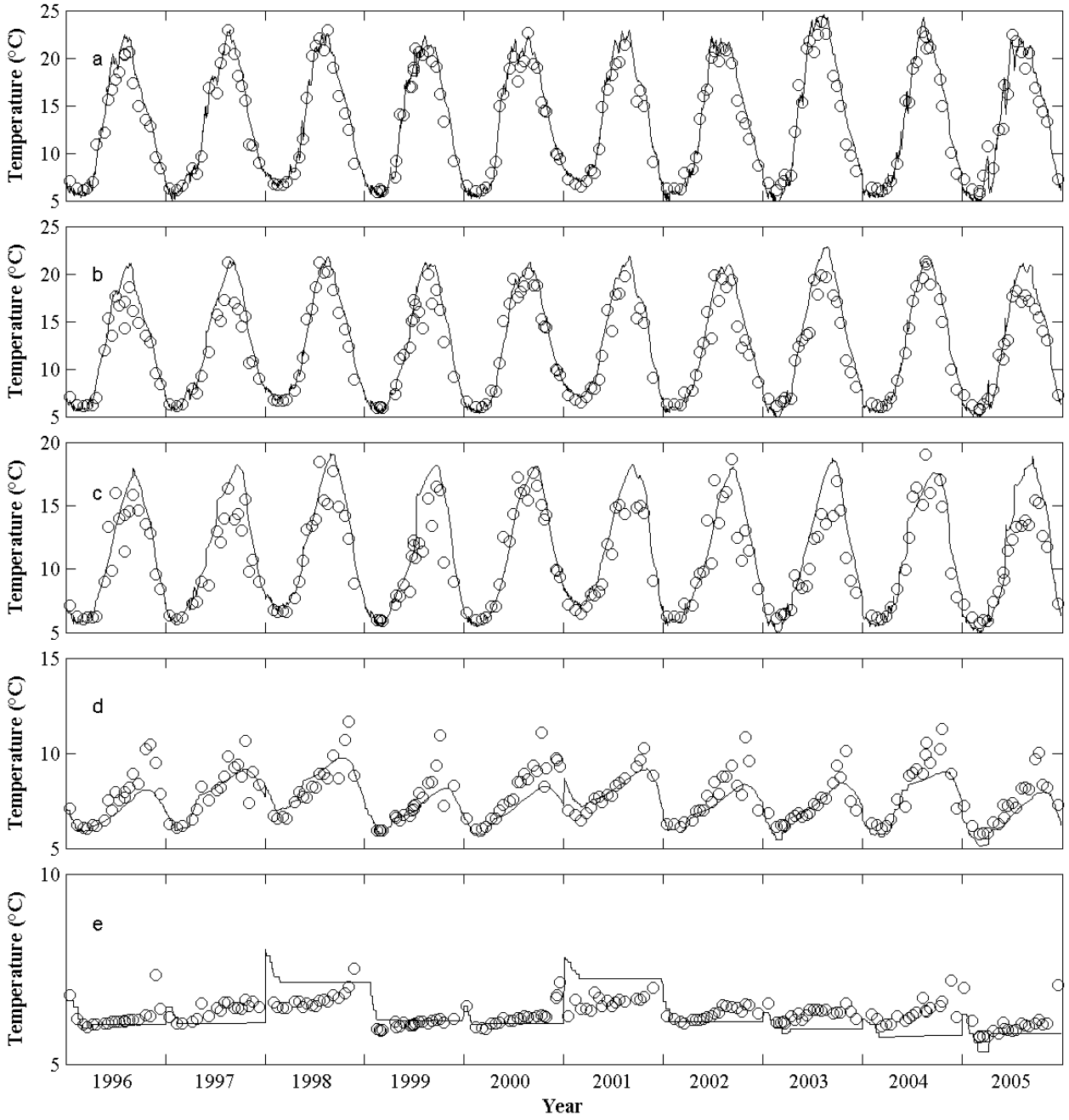
- applied to v, K↓, Cloudiness
- dT following CO2 concentration
- comparison with the 2-way coupling method


Thanks for
your attention!



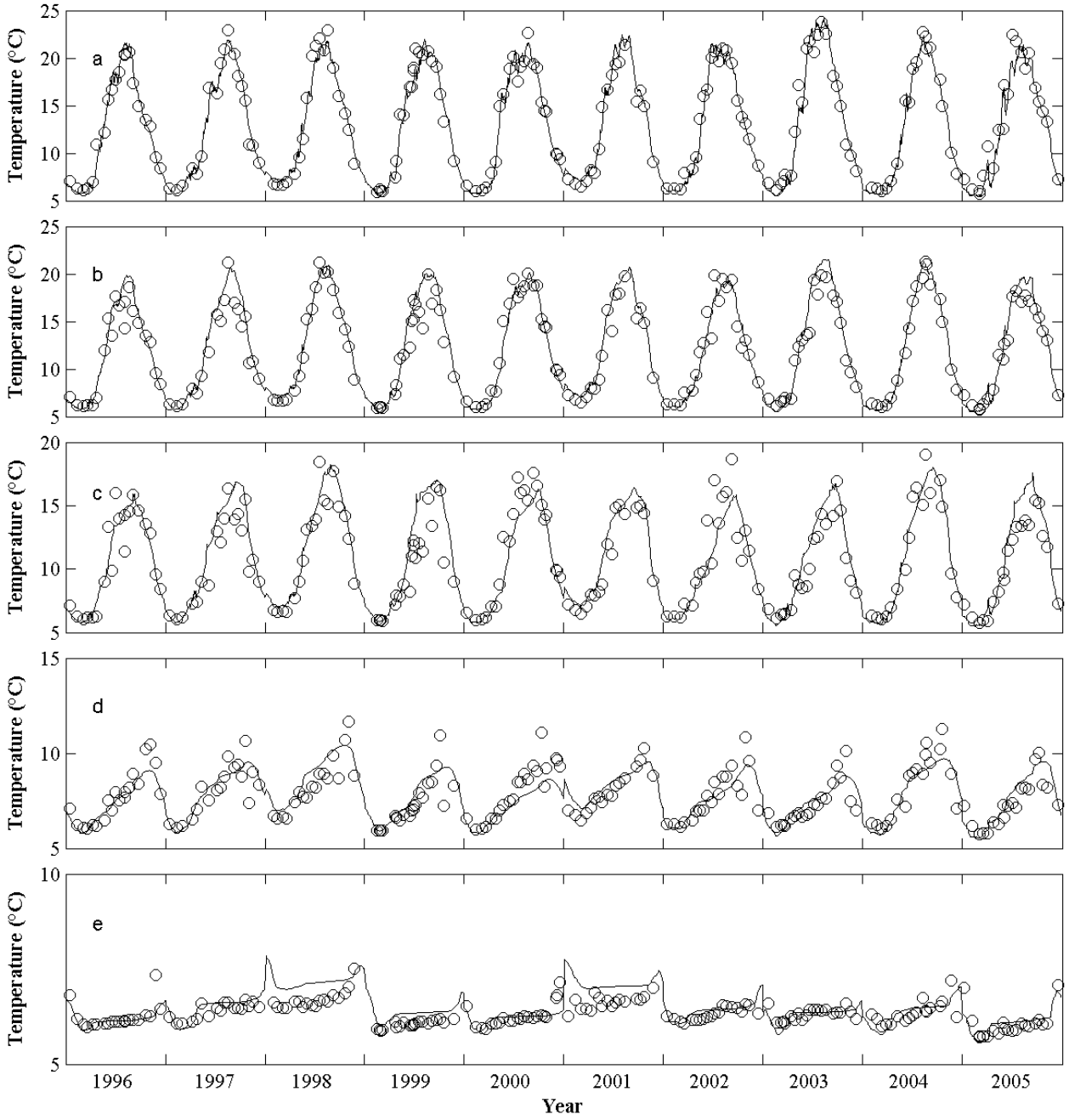
a. 0-5m, b. 5-10m, c. 10-15m, d. 15-50m, e. 50-100m

- Hostetler model



a. 0-5m, b. 5-10m, c. 10-15m, d. 15-50m, e. 50-100m

- DYRESM



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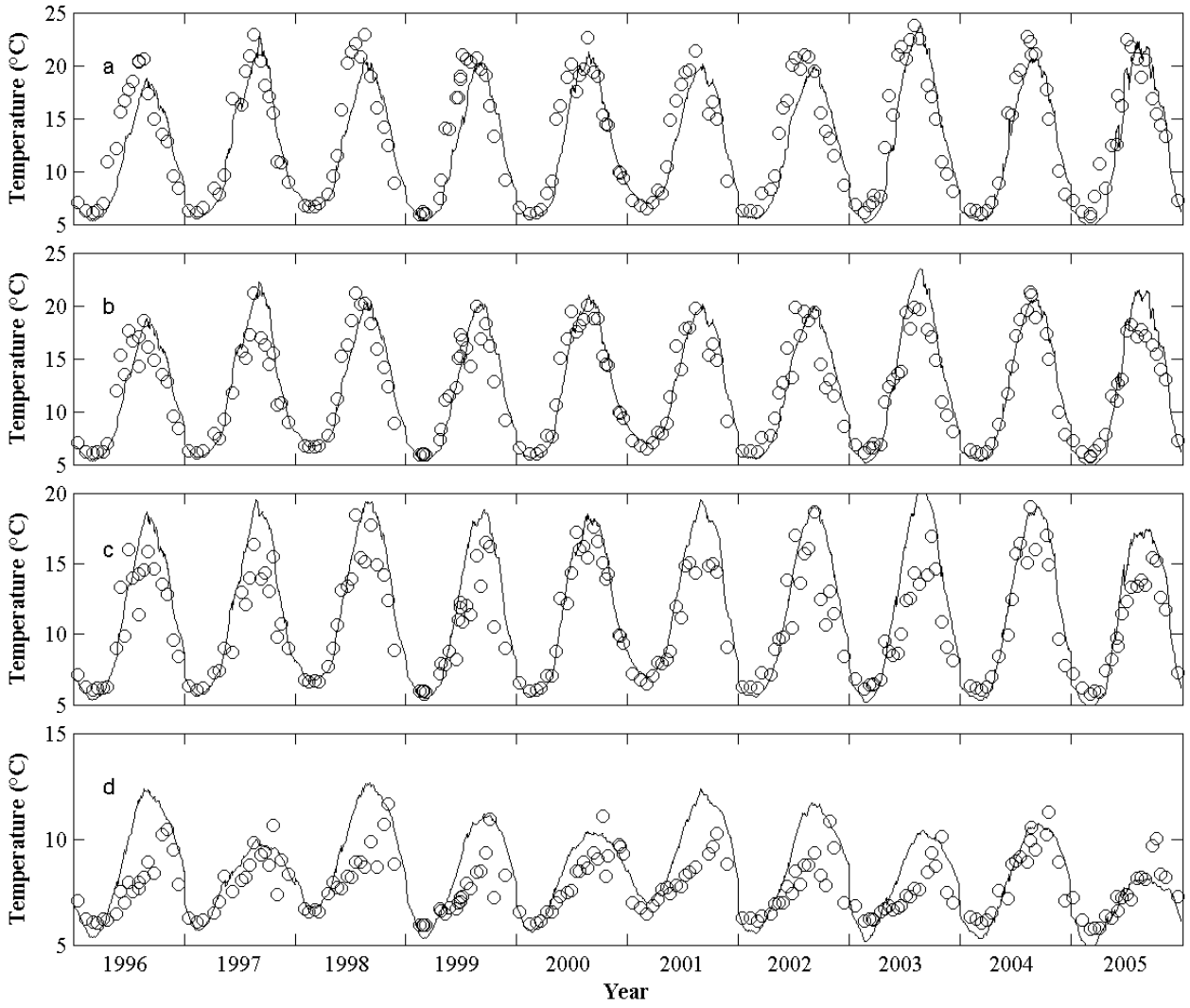
- Simstrat

- FLake



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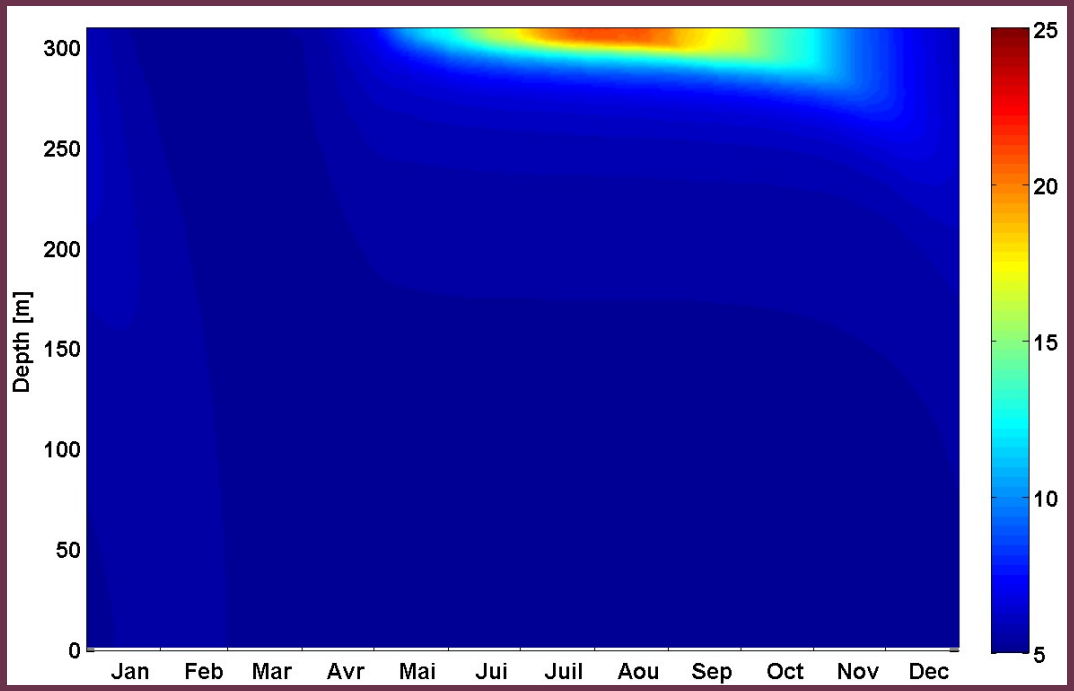

Daily means for years 1976-1986

Daily means for years 2076-2086