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

- Trmse and Tme averaged by depth intervals
- Strength of stratification (N2)
- Lower boundary of the metalimnion
Statistical analysis

- Trmse
- Tme and σ
Strength of stratification

Brunt-Vaïsala frequency N2
Lower boundary of the metalimnion

\[ DT_{T_{100max}} = T_{100m} - T_D \]
Choice of the model for predictive simulation

- Simstrat over 25 years

Year 2003

- Surface (50 m)
- 100 m
- 200 m
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 temperature
  - classes of percentiles
- Random meteorological data generator
Application of the percentiles method

- Generation of 120 years of hourly data
- Increase of $\Delta T$/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 $v$, $K\downarrow$, Cloudiness
• $dT$ following CO2 concentration
• comparison with the 2-way coupling method
Thanks for your attention!
• Hostetler model

a. 0-5m, b. 5-10m, c. 10-15m, d. 15-50m, e. 50-100m
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• Simstrat
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Daily means for years 1976-1986

Daily means for years 2076-2086