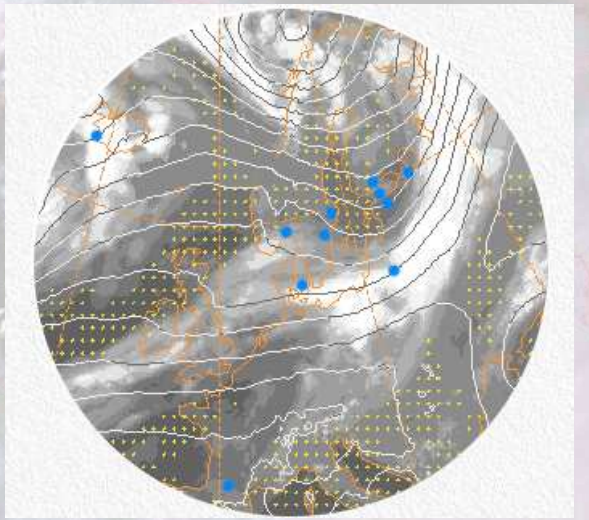


NetFAM

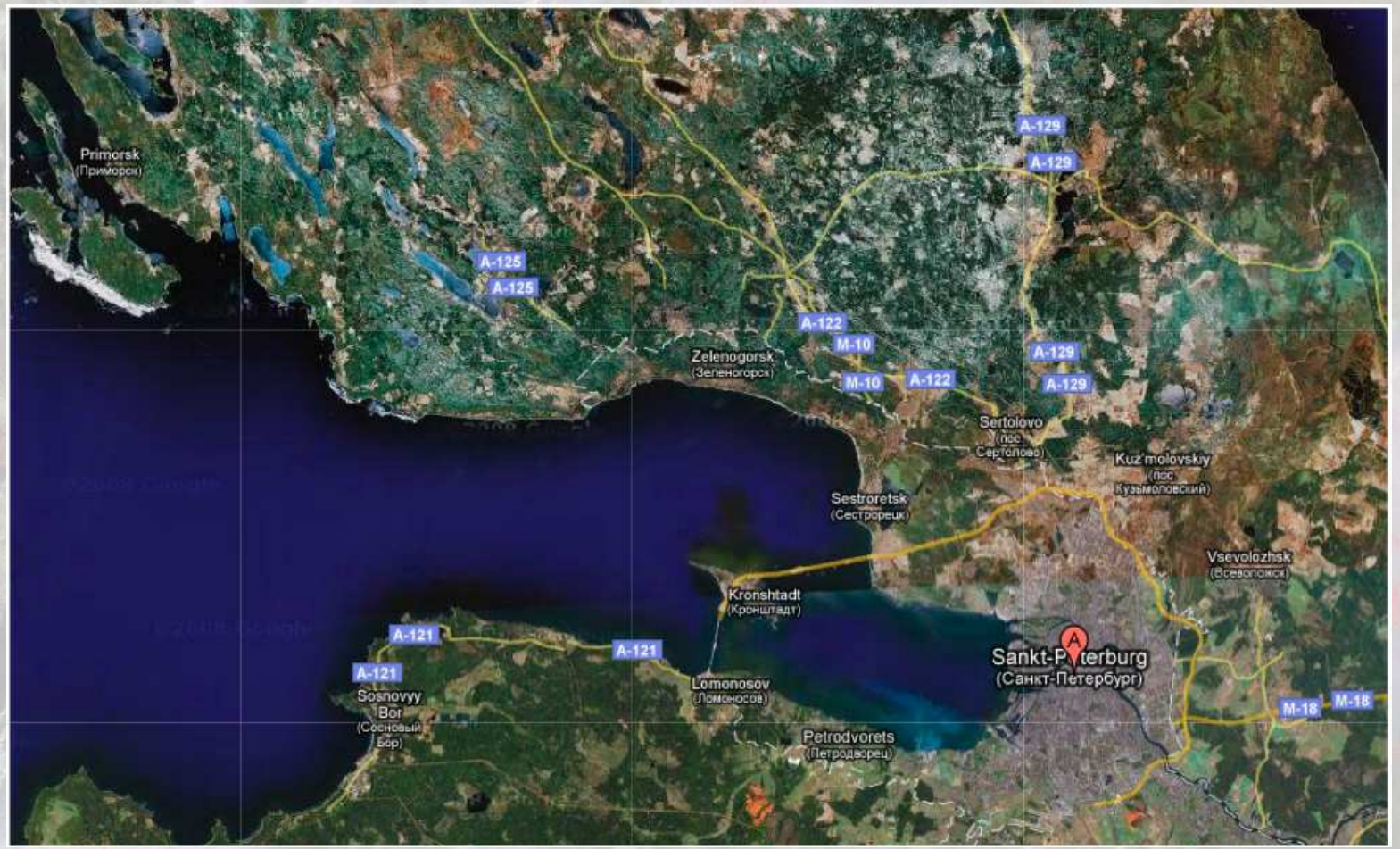
Report on Lake workshop

Sander Tijm

Slides used from: Peroud, Martynov, Rontu, Samuelsson

Introduction

- Workshop on lake modelling in Zelenogorsk, 18-20 november 2008


Primorsk
(Приморск)
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Zelenogorsk
(Зеленогорск)
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Sertolovo
(пос
Сертолово)
Kuz'molovskiy
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Кузьмоловский)
Sestroretsk
(Сестрорецк)
Vsevolozhsk
(Всеволожск)
Kronshtadt
(Кронштадт)
A-121
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Sosnovyy
Bor
(Сосновый
Бор)
Lomonosov
(Ломоносов)
Sankt-Peterburg
(Санкт-Петербург)
Petrodvorets
(Петродворец)
M-18
M-18

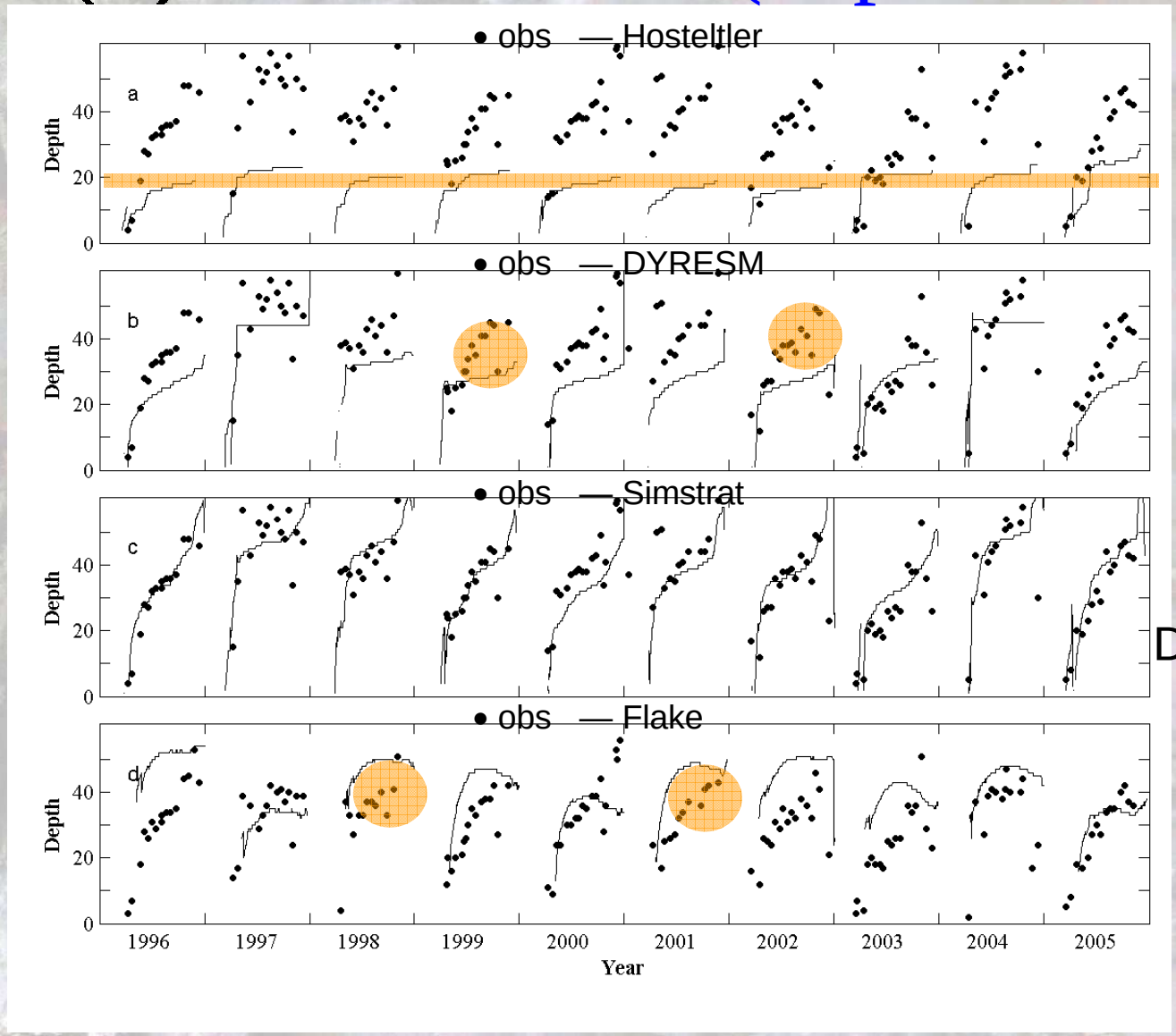
Introduction

- Workshop on lake modelling in Zelenogorsk, 18-20 november 2008
- Subjects: Lake modeling, surface scheme developments, data-assimilation, lake data bases, observations
- Good overview of lake modeling
- Supposed to be first surface expert team meeting.

Different lake models

- Different models around:
  - FLake
  - Hostetler
  - DYRESM
  - Simstrat
  - K-ε model
- Ranging from 2-layer to many-layer 1D models, resolution up to 75 cm!

Lake Geneva (depth > 300m)

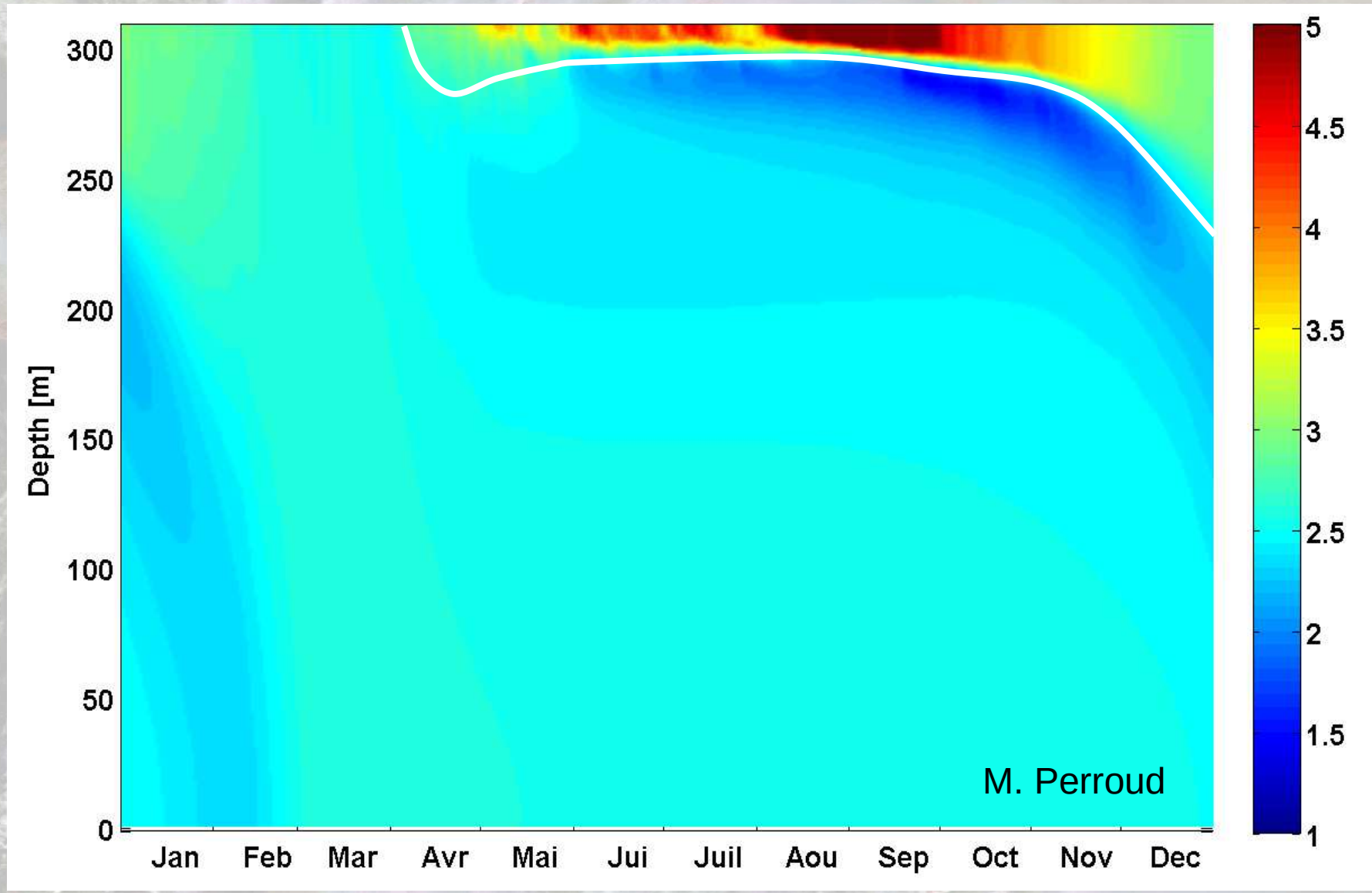


Lower boundary of the metalimnion

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

M. Perroud

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



Use of lake models

- Different lake models, choice dependent on use
- Flux and LST important, models like FLake can be used
- Temperature profile important, more sophisticated model necessary (use for water quality, algea blooms, fishing)
- Use of FLake for rivers also possible. Use shallow lake, possible because strong mixing

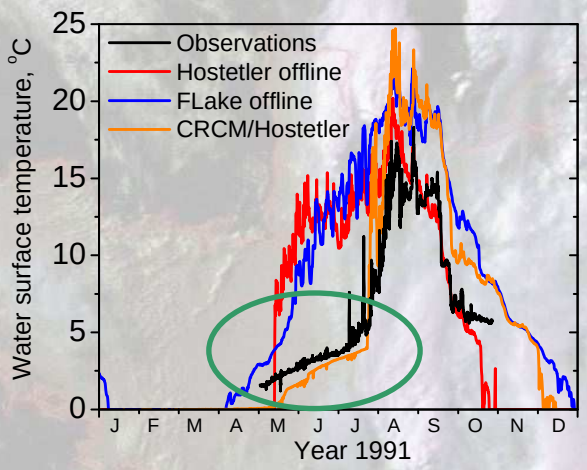
How to test models

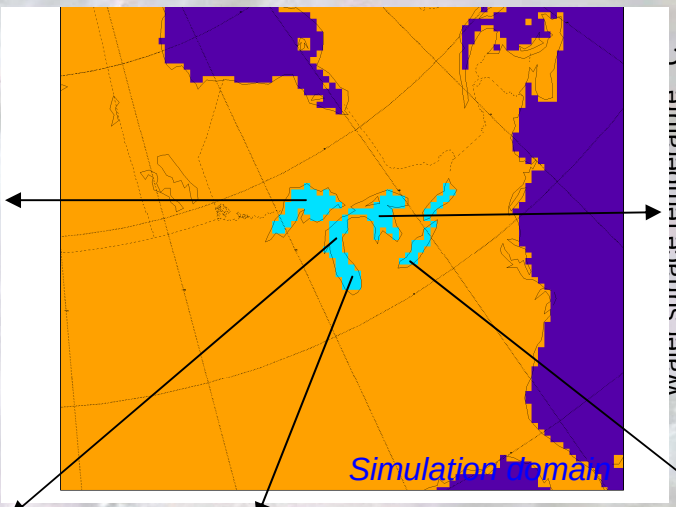
- Testing of models:
  - Results depend on way of coupling
  - Offline: no feedback of lake on meteorology, weather (clouds), near surface profiles (fluxes). Comparison with observations can be tricky
  - Online: more expensive, fluxes better and results can be compared with observations

Coupling with lake models

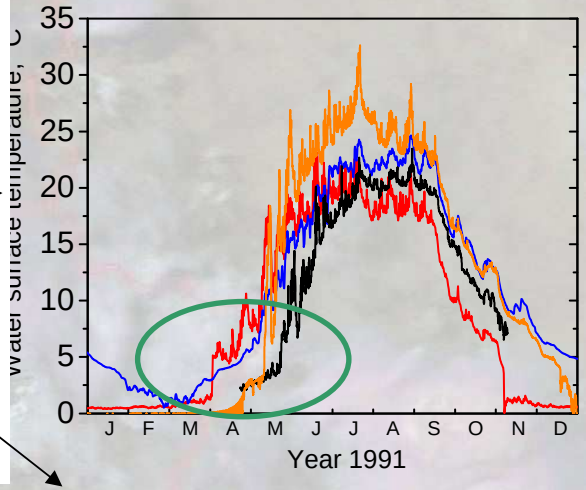
First coupled simulation: year 1991, LAKE=2 (Hostetler), driven at the boundaries by the NCEP/NCAR reanalysis
Grid: 80×90, horizontal resolution: 45 km. Lakes: only the Great Lakes (other lakes are masked out)

Lake Superior, NDBC buoy 45001, depth: 261.6 m

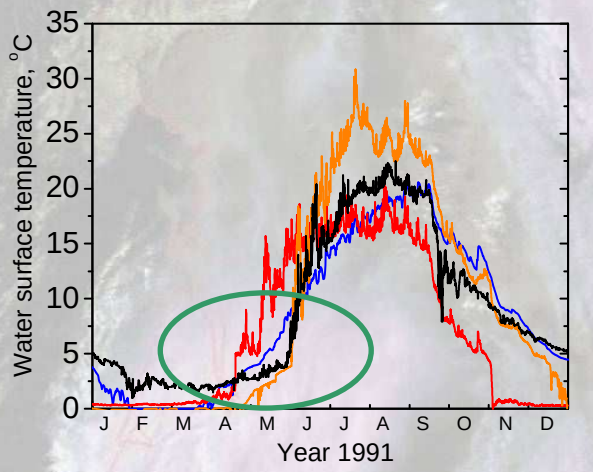




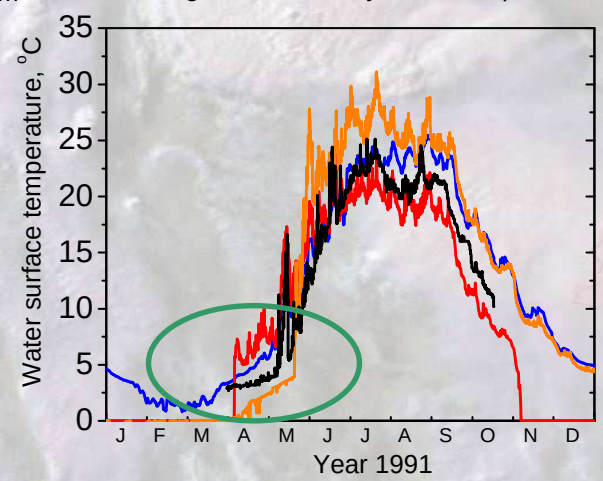
Lake Huron, NDBC buoy 45008, depth: 54.3 m



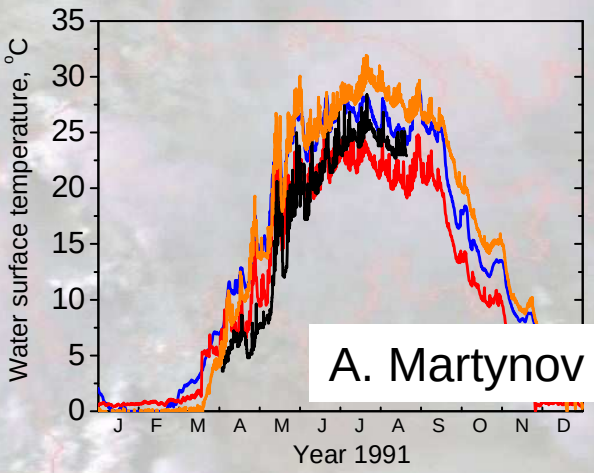
Lake Michigan, NDBC buoy 45002, depth: 181.1 m



Lake Michigan, NDBC buoy 45007, depth: 160 m



Lake Erie, NDBC buoy 45005, depth: 12.6 m



A. Martynov

This coupled simulation reproduces much better the observed temperature patterns, than offline ones.
Long spring water warming from 0°C to 4°C in deep lakes is reproduced in coupled simulations. Why?
Too high water temperature in summertime: air/lake interactions need to be adjusted.

FLake

- FLake is (being) implemented in all European models
- Impact dependent on surface scheme (tiling approach or not)
- Model needs characteristic values for every lake (one effective depth, turbidity, size) from lake database
- At this moment model does not take changing depth into account, important for ice cover

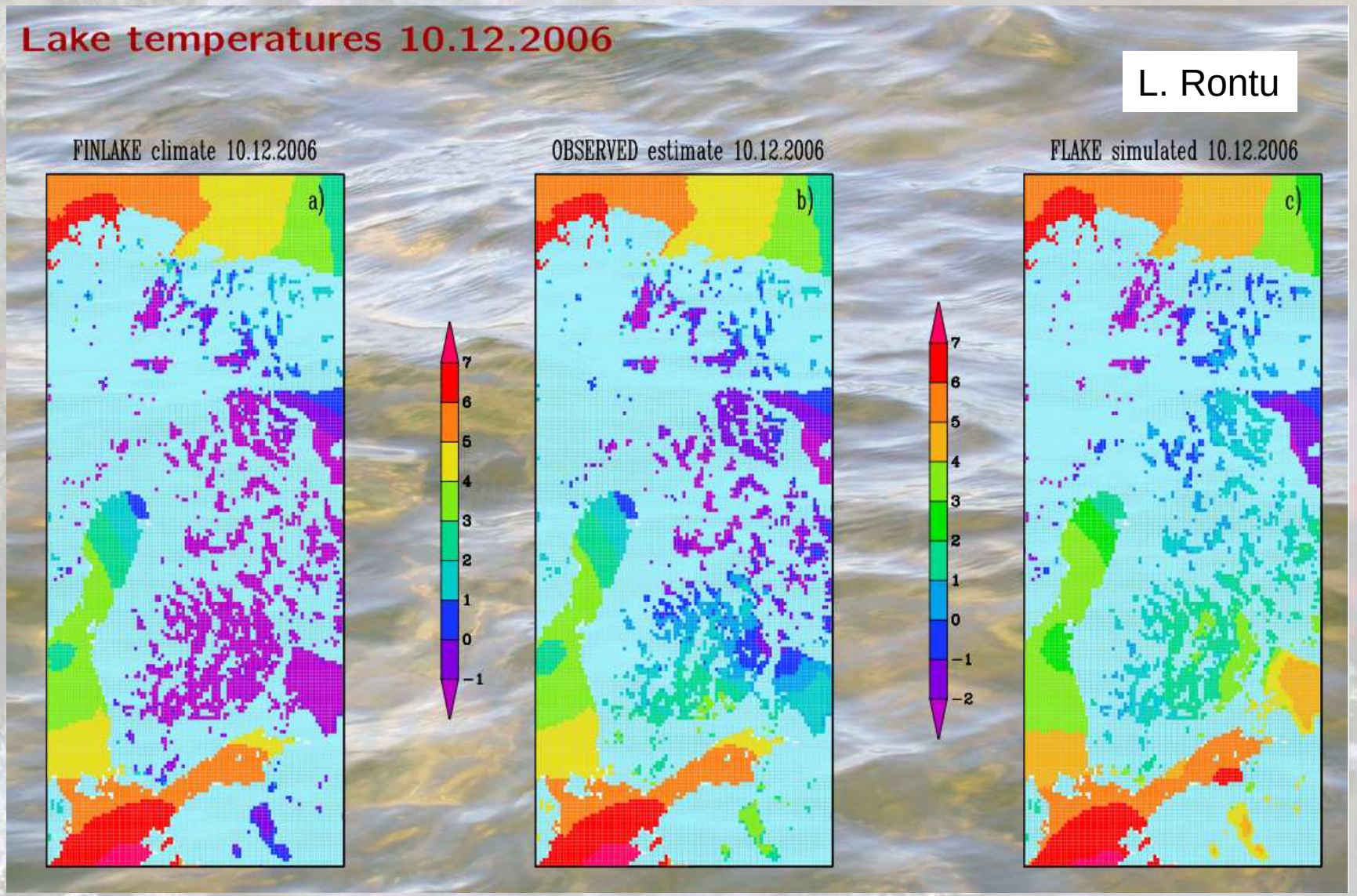
Optimal parameters FLake

- Lake model results strongly dependent on characteristic values of model
- Values in database may not be optimal for NWP model
- Use variational technique to find best fit of yearly temperature cycle per lake
- Ice cover period second parameter to fit, FLake produces too much ice, snow has to be taken into account

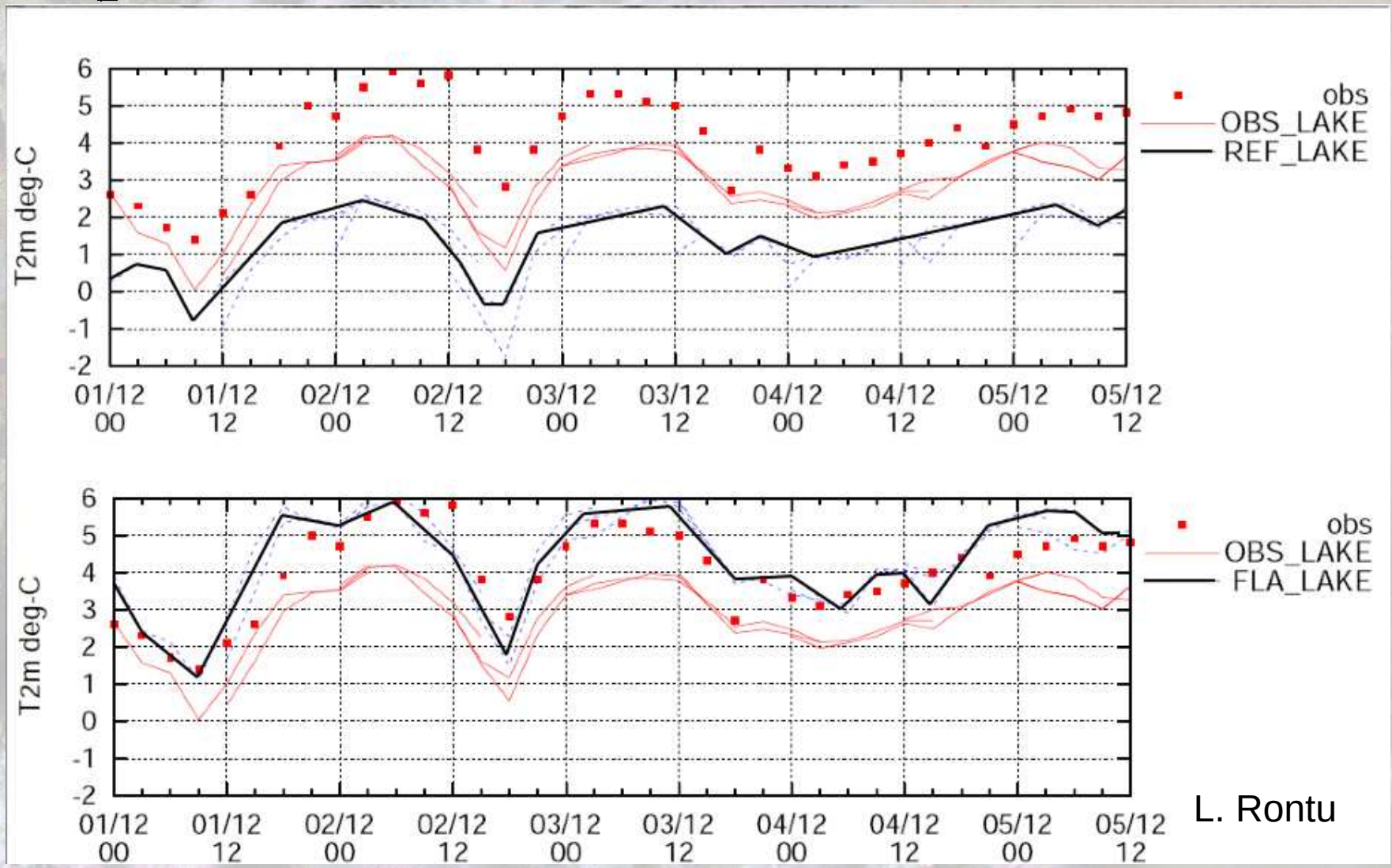
Underlying data

- Data base important, needs to be extended for all of Europe, rest of world
- FLake website, quick check of impact of changes in parameters
- **FLake Page** http://lakemodel.net (also http://nwpi.krc.karelia.ru/flake)

Application Flake HIRLAM

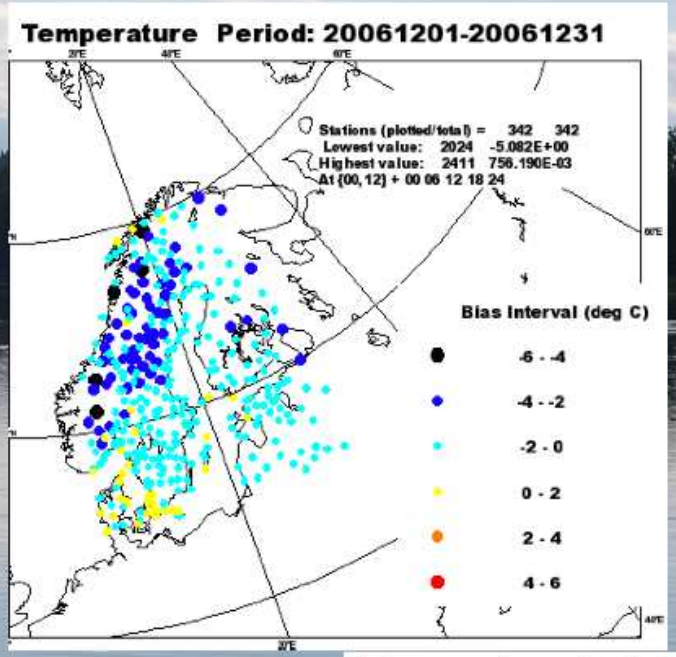


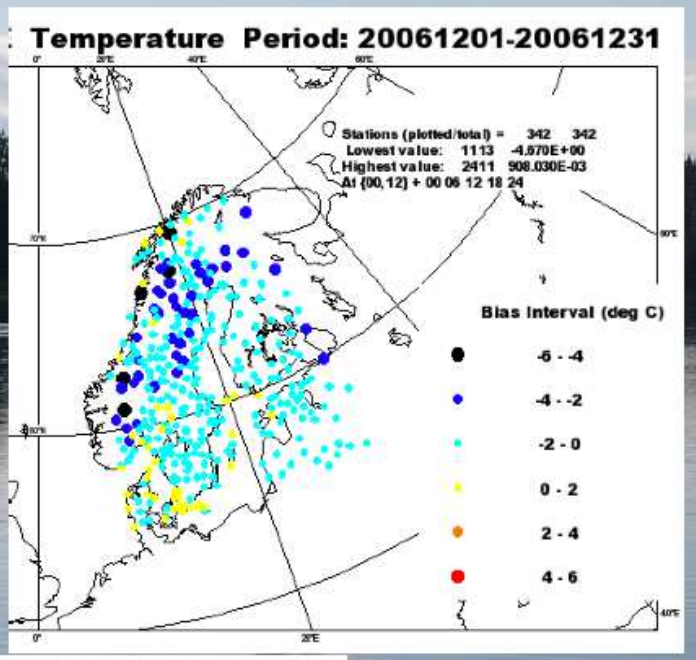
Lake station T2m

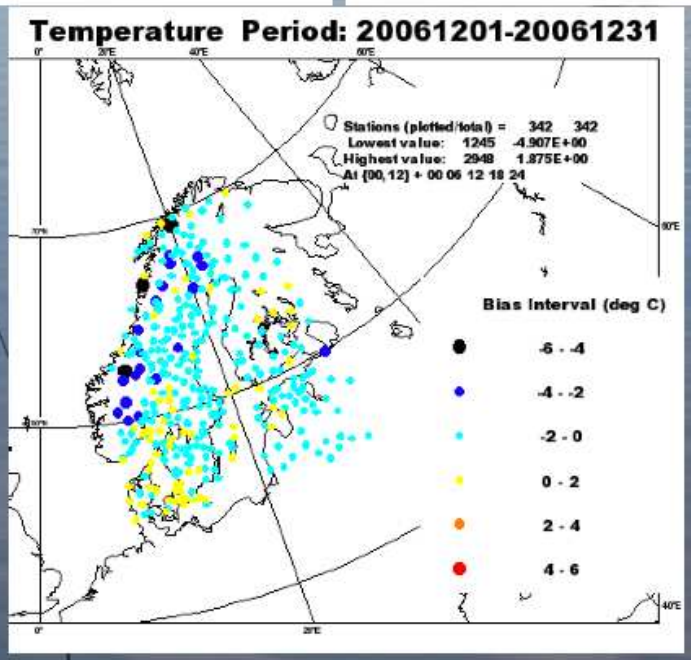


L. Rontu

Statistical verification in December 2006







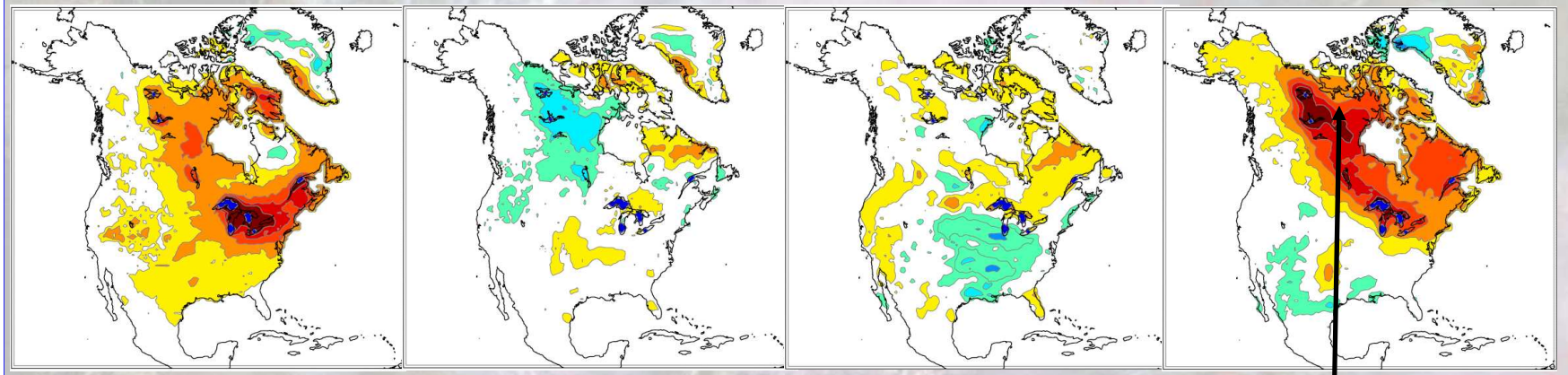
L. Rontu

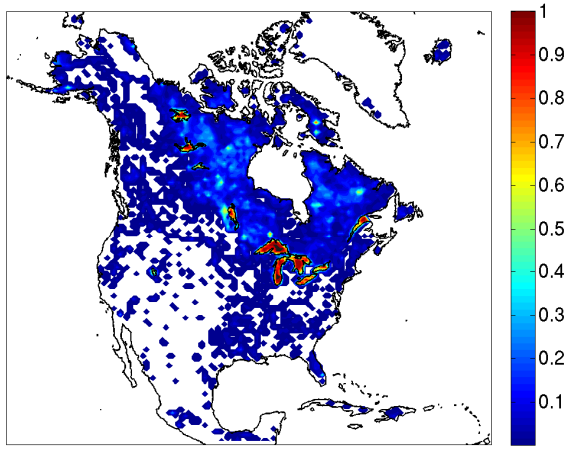
Lake influence on 2m-temperature

North America 1985-1989

Open land 2m-air-temperature for (lake version) – (no lake version):

winter **spring** **summer** **autumn**





Lake fraction

Too deep lakes in this area can contribute to a warm bias we experience (also the case in Siberia).

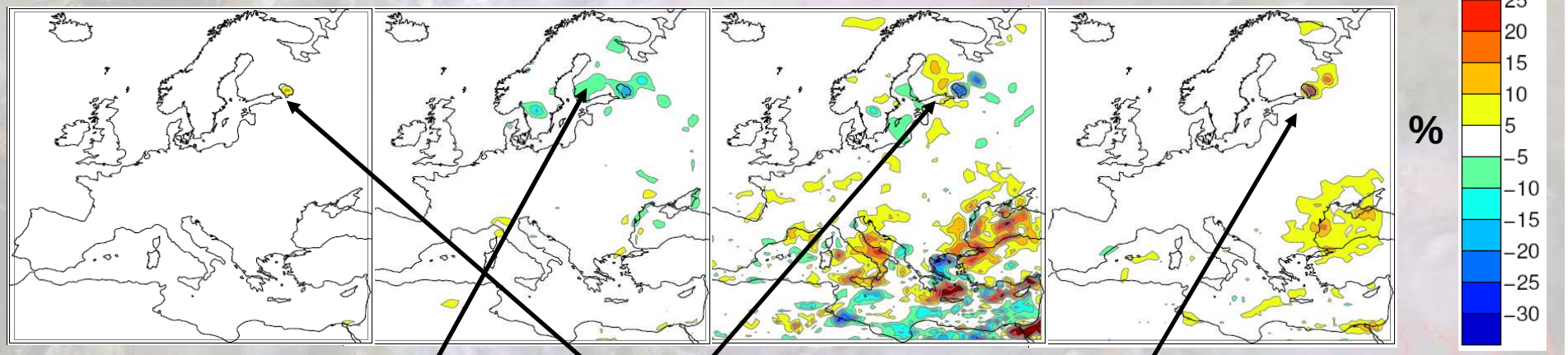
P. Samuelsson

Signatur

Lake influence on precipitation

winter spring summer autumn

Total precipitation for ((lake version) – (no lake version))/(no lake):



Less prec over lakes in spring

More prec over big/deep lakes in autumn-winter

More prec over small/shallow lakes

P. Samuelsson

Remaining issues

- Extension of database, search for funds
- Extension of FLake with snow on ice, for better ice cover period
- Extension to 2D, changing depth for large lakes. T and %ice depend strongly on depth.
- Flow of ice for large lakes
- Intercomparison of lake models (LakeMIP)
- Role of SRNWP in organization of workshop in 2 years time