Use of the high-resolution meteorological reanalysis UERRA to drive the lake model FLake over Europe

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Outline

- UERRA reanalysis
- FLake model experiment
- Preliminary results

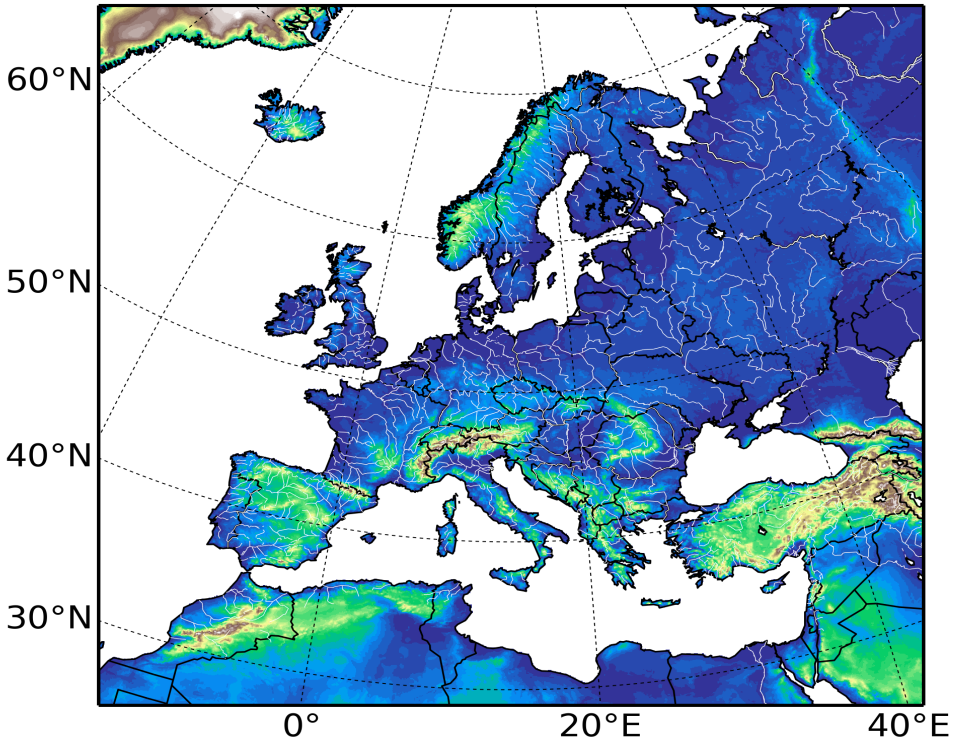
UERRA reanalysis

UERRA (***U**ncertainties in **E**nsembles of **R**egional **R**e**A**nalyses*)

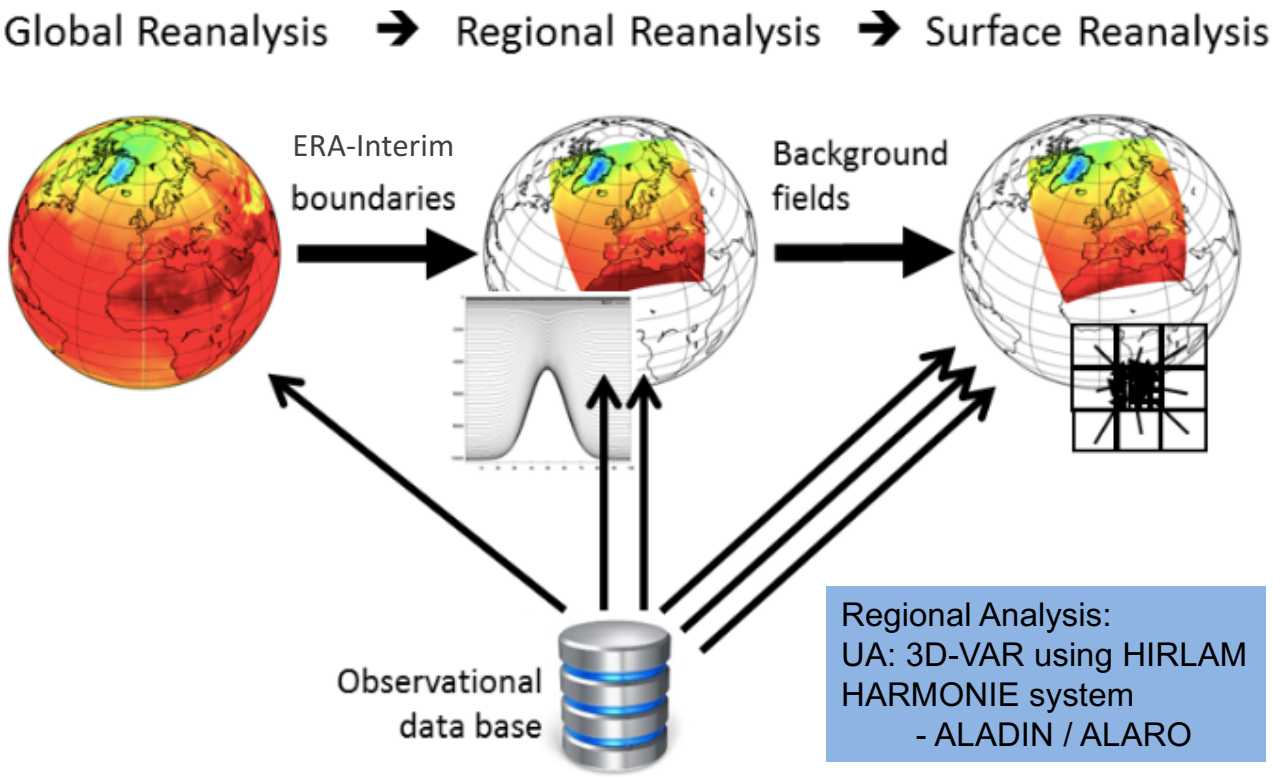
- Context
  - European FP7 project
  - Production and development of an ensemble system of regional reanalysis
  - Estimation of ECVs and their uncertainties
- Objectives
  - Design a 50-yr reanalysis covering the pan-European domain
  - Setup of a coupled hydro-meteorological modelling system
    - Climatology of land surface variables
    - Long time series of discharges over the main European rivers
  - Evaluation of the system (observations in situ)

UERRA reanalysis

Euro-CORDEX domain



UERRA reanalysis



Regional and surface reanalysis

3D-VAR atmospheric analysis 11km/6h

DOWNSCALING 11km → 5.5km

T2M RH2M RAIN SNOW

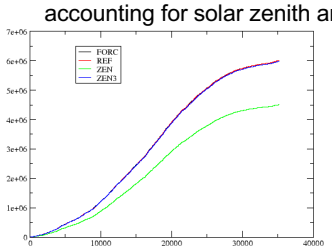
SWD LWD WIND PS

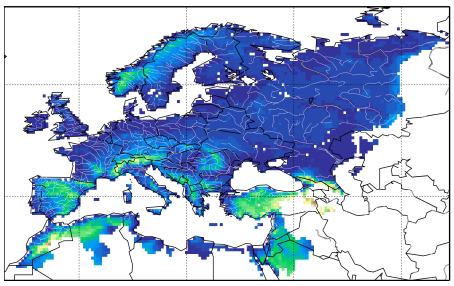
MESCAN surface analysis

OBS

T2M RH2M RR24

6h-SWD time interpolation accounting for solar zenith angle





Land Surface Model SURFEX

OASIS

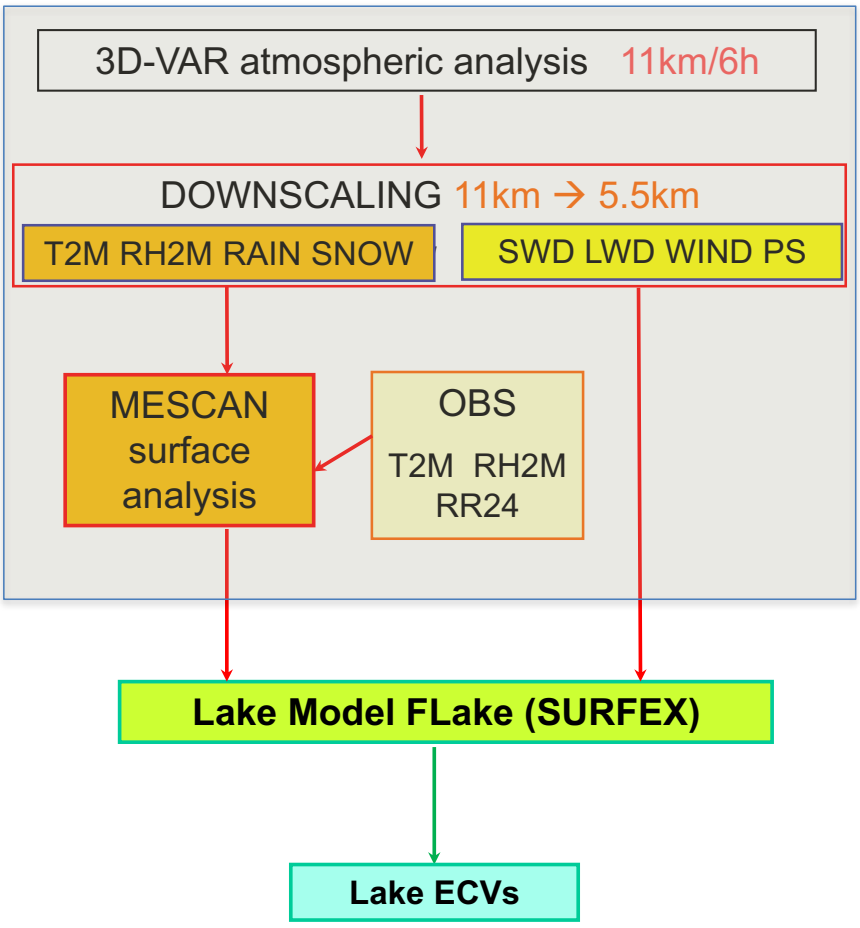
3-hr coupling

Hydrological Model TRIP

Surface ECVs

River discharge, watertable height

Is there any added-value of using UERRA reanalysis as forcing for FLake?



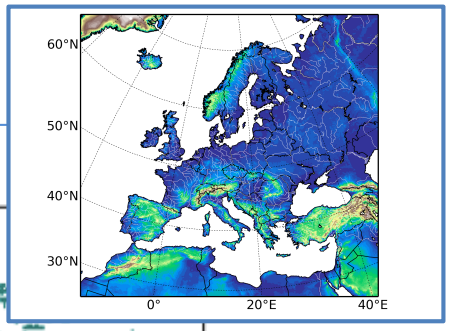
FLake experiments

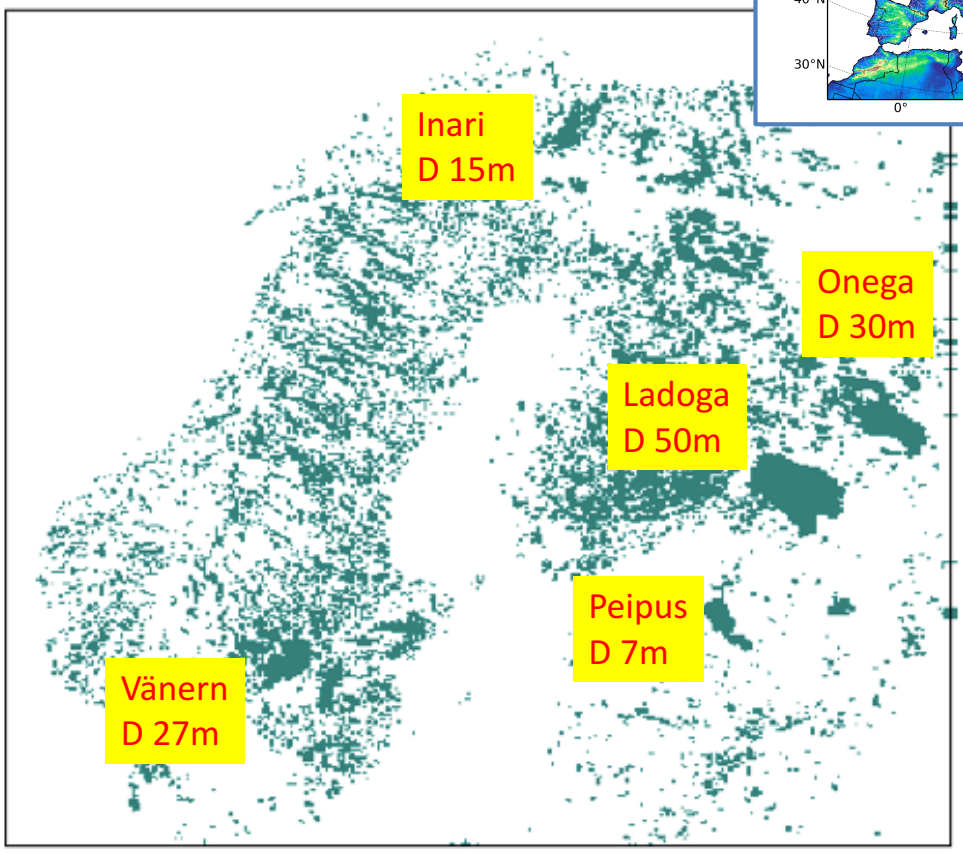
No feedback to the atmosphere

- Objective:
  - Study the impact of high resolution RRA on simulations with lakes
    - Energy balance, ice and snow thicknesses, surface temperature
  - Model configuration used is the same as in *Le Moigne et al., 2016* when FLake was coupled to CNRM-CM the MF climate model (used for CMIP6)
- Simulations
  - 5-yr Ensemble to assess the impact of various forcing
  - 28-yr Reanalysis to derive climatological trends

FLake experiments

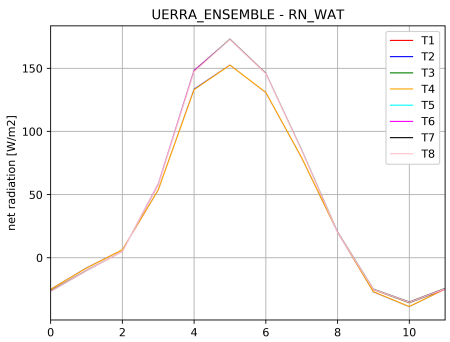
Domain of post-processing

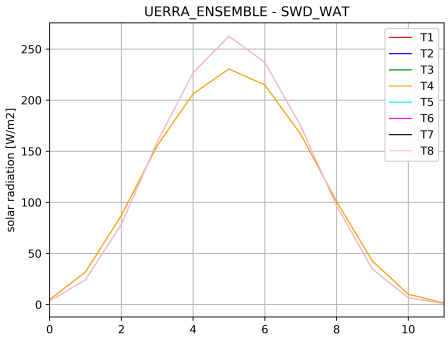


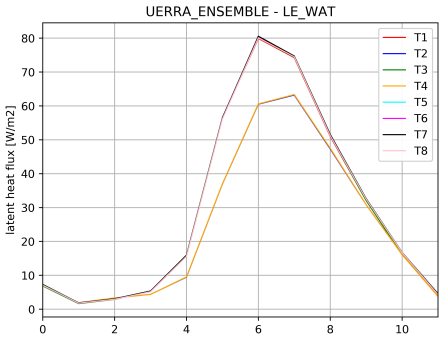


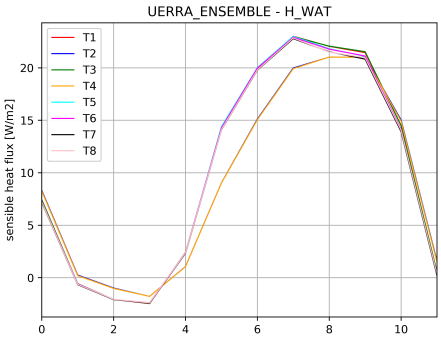
Preliminary results

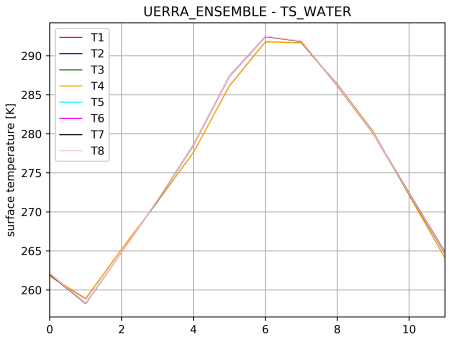
5-yr ensemble: 2006 – 2010







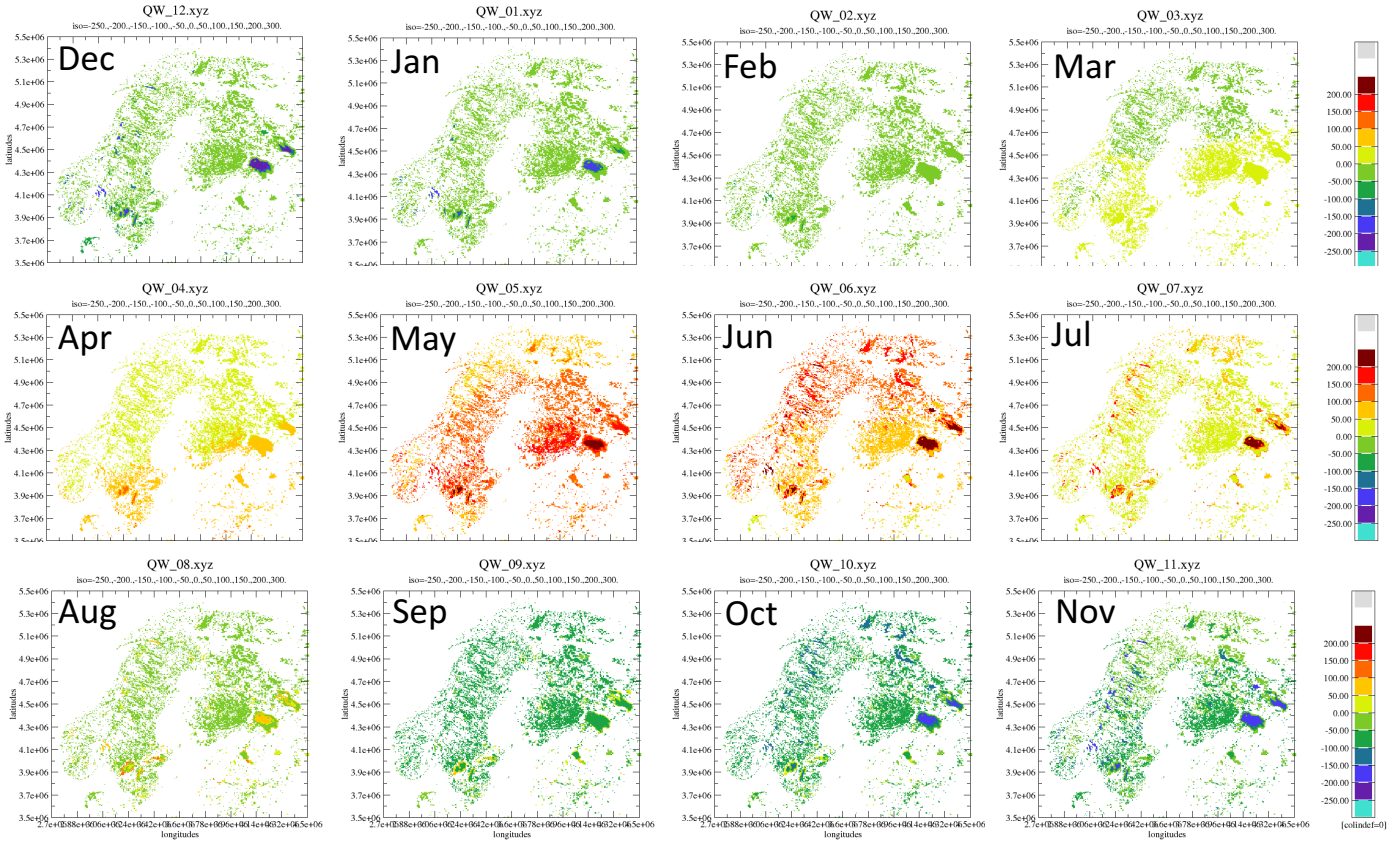




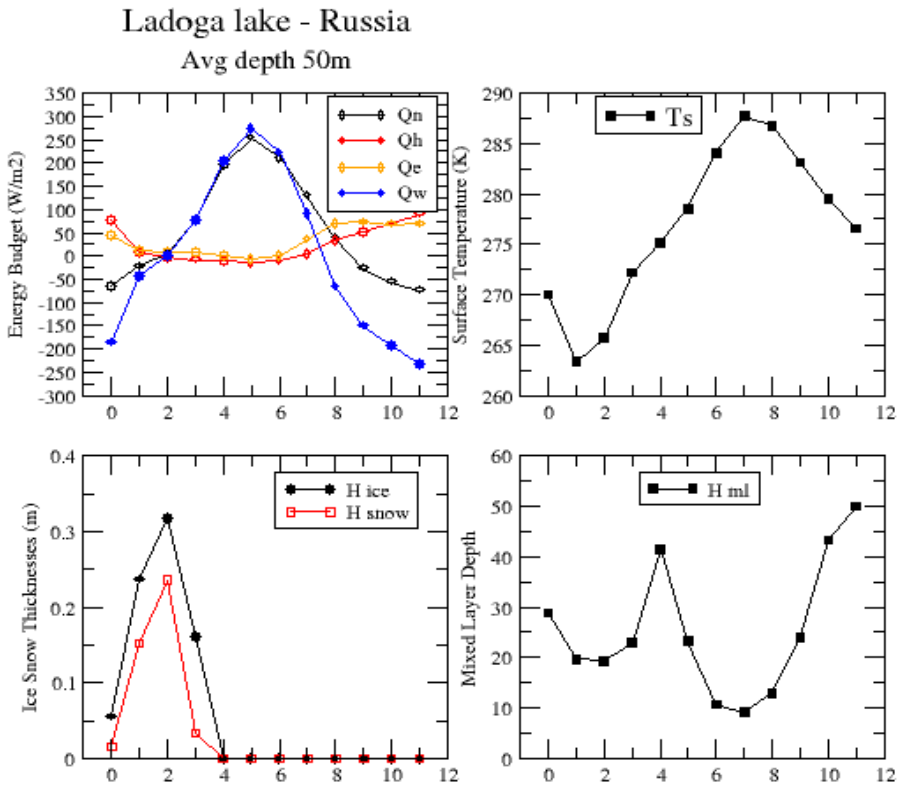
Small sensitivity to 2m air temperature and humidity. Main driver is radiation

28-yr reanalysis: 1961 – 1988

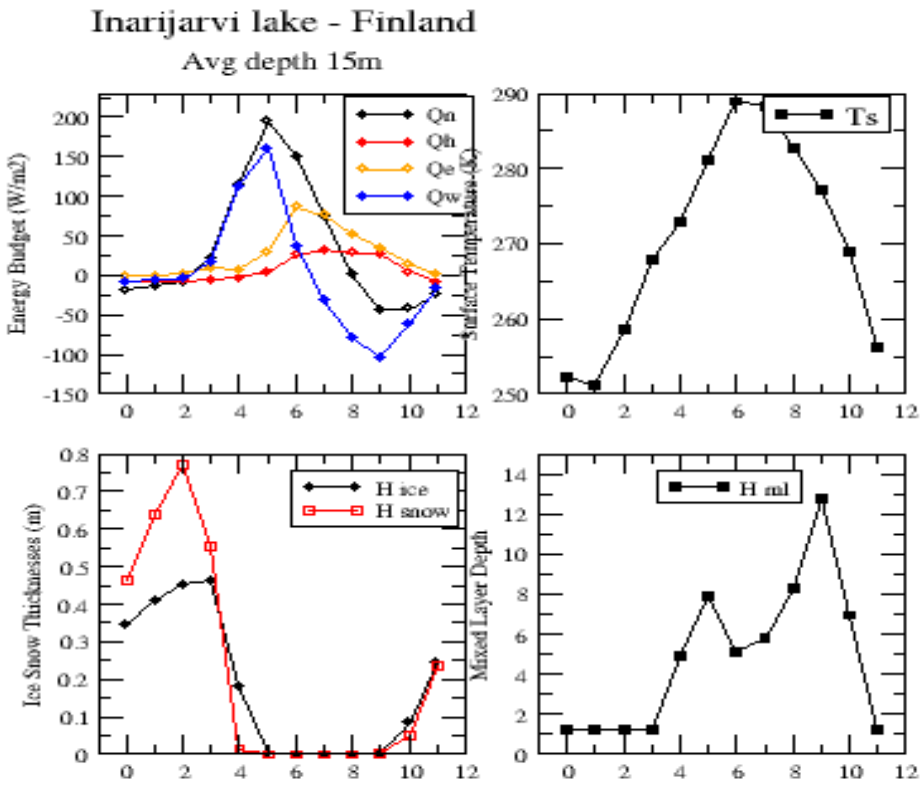
Heat water budget: QW = QN – (QH – QE) – QB – I(D)



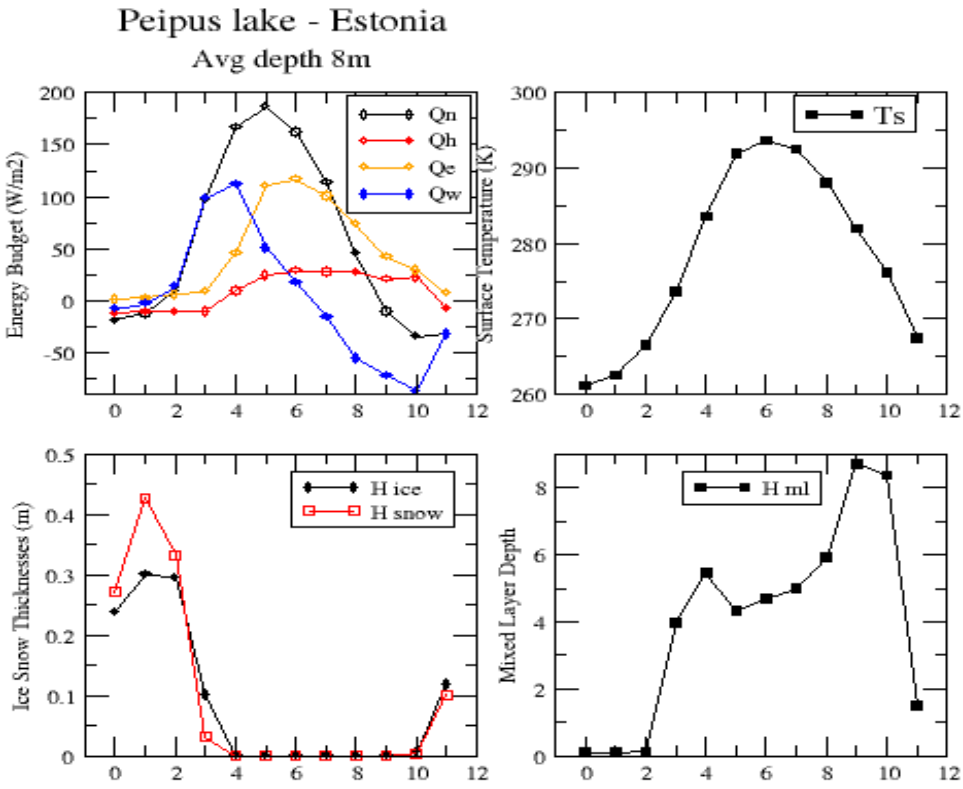
Ladoga lake: 1961 – 1988



Inari: 1961 – 1988

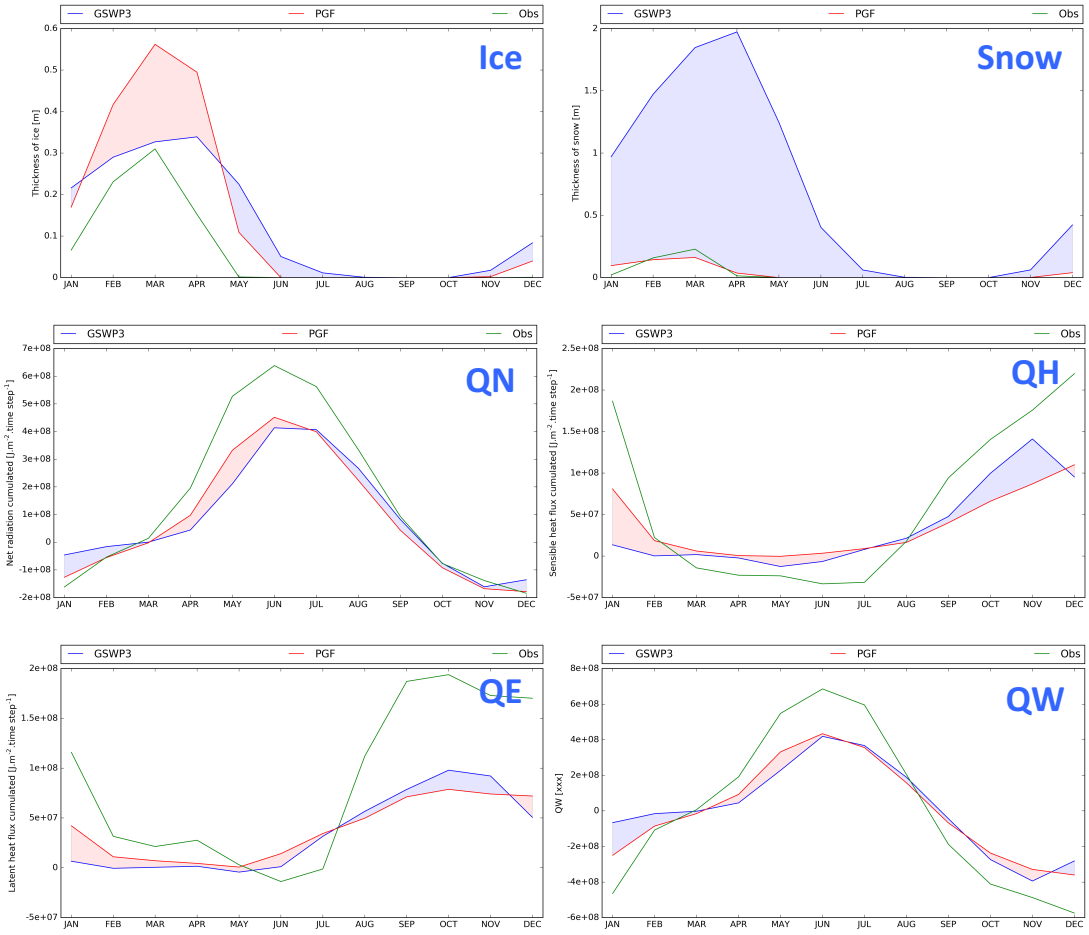


Peipus: 1961 – 1988



Ladoga lake: sensitivity to atmospheric forcing

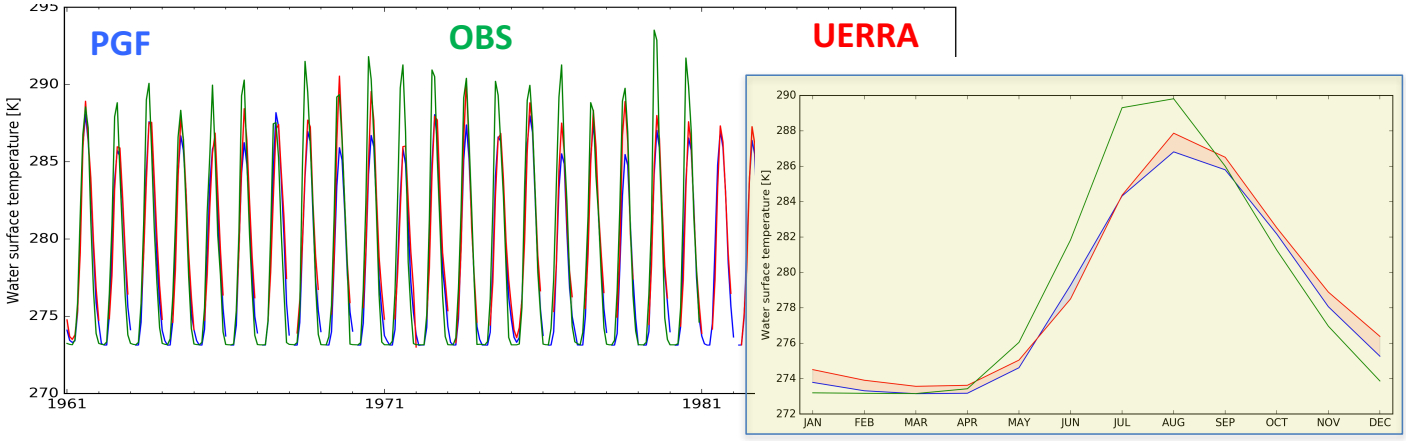
GSWP3
PGF
UERRA

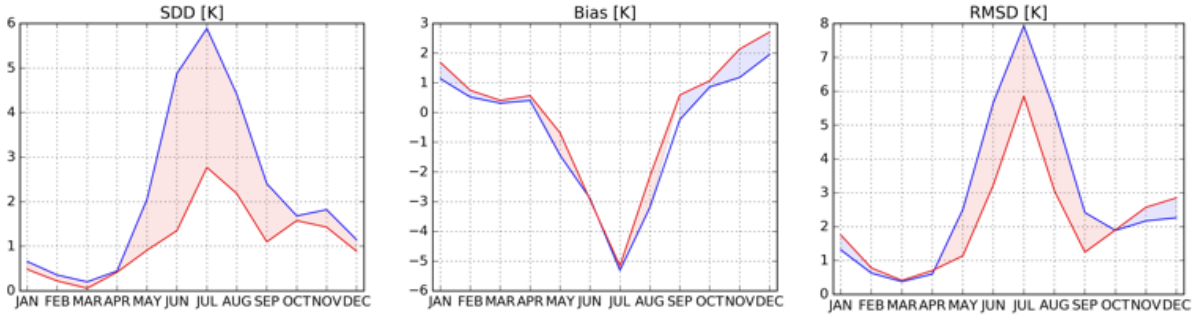


METEO FRANCE

cnrs

Evaluation of Ladoga LWST against Arc-LAKE data





Significant reduction of the error during the warm season.

Conclusion

- Use UERRA reanalysis to drive FLake model
- Added-value of high resolution forcing
- Climatology of lake variables at high resolution

What's next?

- 50-yr simulations, statistics
- Continue evaluation of model performance with other dataset (MODIS)
- Compare with existing climatology