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Lakes in winter-time HIRLAM

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Hirlam



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Introduction: Winter 2009-2010 Performance of HIRLAM over lakes Lake data assimilation issues





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15th of December, 2009





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2nd of January, 2010



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1st of April, 2010





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10th of June, 2010



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Where is ice? Operational comparison at 31th March







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30th of March 2010, Swedish lakes started to melt already









1st of April 2010, Baltic sea is melting, but lakes are still mostly frozen





Experiment with new HIRLAM: water and ice the 31th of March, 2010





Trying Freshwater Lake parametrizations instead



NB! FLake only provides the first guess for WST \Rightarrow ice analysis, which works independently

Or another attempt without Flake?



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Left: fraction of water, right: fraction of ice new HIRLAM with modified ice analysis only, experiment started 28 of October 2009 difference: relaxed quality control, successive corrections instead of optimal interpolation

Does it matter? Lake Inari, December 2009







Verification in Scandinavia, December 2009

Left: Two-metre temperature, right: two-metre dewpoint temperature Upper curves: RMS, lower curves: bias



Less impact on other predicted variables; influences remain local.

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Where does the WST and ice input come from?

(Global) water surface climatology

ECMWF analysis

Local observations and climatology

FLake parametrizations instead or with data assimilation



Climatology of water surface temperature (left) and fraction of ice (right) From HIRLAM climate files interpolated to the 31th of March



ECMWF analysis of sea/lake ice 15 December 2009



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Fraction of ice. Left: original, right: interpolated



Sea and lake temperatures as pseudo observations



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Haukivesi was ice-covered between 3 December, 2009 and 25 April, 2010



Inari was ice-covered between 15 October, 2009 and 15 May, 2010

Freezing of lakes Inari and Haukivesi

Assimilation of observations on lake surface state

Phase 0. Observations alone or FLake alone

Phase 1. Peaceful coexistence of LST/ICE analysis and FLake

Phase 2. Assimilation of prognostic lake variables of FLake

Phase 3. Unified method for lake data assimilation within a NWP model



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(Hirlam)



PEACEFUL COEXISTENCE OF SURFACE DATA ASSIMILATION AND FLAKE





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Data assimilation questions within the peaceful coexistence

Observations and model

- Availability and combination of different observations and "observations"
- Specific questions of handling ECMWF (satellite) input
- **Interpolation methods**
- Method of interpolation: successive corrections or optimum interpolation?
- Interpolation between different lakes, lakes and sea?
- Relation between the ice cover and surface temperature analysis
- Quality control of observations: first guess/neighbours
- The role of model background (first guess) and climatic information
- Towards lake data assimilation
- From diagnostics and interpolation towards assimilation









Thank you!











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Freezing and melting dates with comments

Lake	FEI obs	Finlake clim	FLake (OI)	Flake (SC)
				and the second
Haukivesi	3 Dec - 25 Apr	1 Dec - 4 May	5 Dec - 10 May	5 Dec - 1 May
Inari	15 Oct - 15 May	31 Oct - 2 Jun	26 Nov - 23 May	20 Nov - 6 Jun

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- Inari was frozen already when the FLake experiments started but HIRLAM did not necessarily know that
- In Flake-1 with optimal interpolation FLake dominated
- In Flake-2 with successive corrections and relaxed quality control, Finlake climatology influenced more
- A recent HIRLAM version with OI interpolation but without FLake (not shown in table) more or less handled Haukivesi according to Finlake climatology and Inari with ocean climatology