ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

SRNWP at FMI

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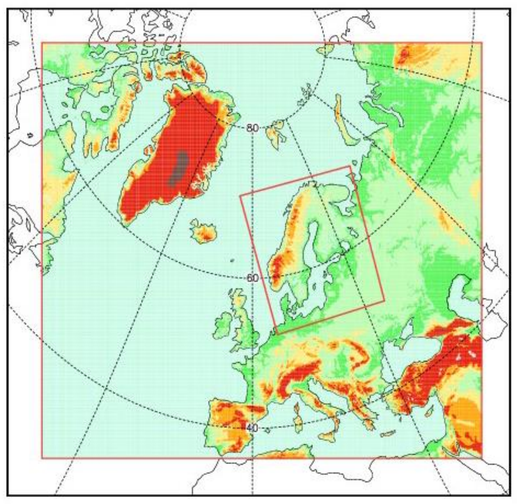
Operational

SRNWP SUITES	HIRLAM v7.4 "RCR"	HARMONIE Cy38h12 "AROME"
Mesh size	7.5 km	2.5 km
Number of grid points	1036 * 816	720 * 800
Number of levels	65	65
Initial times	00/06/12/18 UTC	00/03/06/09/12/15/18/21 UTC
Range	+54 h	+54 h
Upper air analysis	4D-var	3D-var
Surface analysis	Optimal interpolation	Optimal interpolation
Nestor forecast	ECMWF IFS, hh - 6 h	ECMWF IFS, hh – 6-9 h
LBC frequency	3 h	3 h

COMPUTING RESOURCES
Cray XC30: 2 identical clusters, each with 3420 cores, 10.7 TB memory
Peak performance ca 70 Tflop/s for each cluster, ca 140 Tflop/s total

HIRLAM v74 / HARMONIE aro38h12



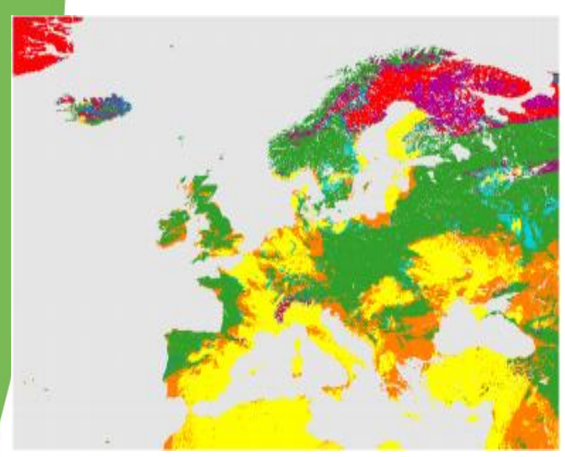
DOWNSTREAM & RELATED APPLICATIONS		
SILAM dispersion and chemical transp. model -POLLEN -FAS -DMAT	Particle dispersion, jointly with the Radiation and Nuclear Safety Authority STUK	Nuclear emergency preparedness Forest fires Volcanic ash Long-range pollen transport
	Chemical transport modelling	SO_2, NO, O_3, CO, PM_{10}, $PM_{2.5}$, concentrations and deposition
HILATAR	Eulerian regional transport	SO_x, NO_x, NH_x, toxic metals, dust
Road model	State of road surfaces and pedestrian pavements Intelligent traffic applications	
Marine models	Baltic wave forecasts	WAM
	Sea level at Finnish coast	OAAS, WETEHINEN 2D
	Baltic ice	HELMI
	Baltic water circulation	HBM
Hydrological models	Managed by Finland's environmental administration SYKE	
LAPS	Hourly analyses of surface and upper air variables	

Snow observations from different sources from a DA perspective

- **Objective:** to evaluate data on Snow Extent (SE) and Snow Water Equivalent (SWE) from remote-sensing observations and in-situ observations comparing them between each other and with HARMONIE snow analyses.
- **Data** (Oct. 2015 – May, 2916):
  1) SE satellite product METOP (polar orbiting, visual band)
  2) SE satellite product MSG (geostationary, visual band)
  3) Snow depth in-situ observations from SYNOP stations
  4) HARMONIE analyses: SWE and snow fraction
  5) + SWE satellite product GLOBSNOW (microwave band)

METOP vs MSG:

METOP has more data in the North, but MSG has fewer pixels with undefined values. With better spatial resolution, METOP brings much information in spring. Use both MSG and METOP for DA.



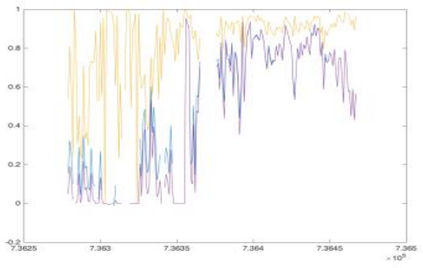
Snow classification METOP vs. MSG, Jan 14:

METOP model \ METEOSAT model	Snow	No snow	Undefined
Snow	Red	White	Pink
No snow	Brown	Yellow	Cyan
Undefined	Blue	Orange	Green

Contingency table METOP vs. MSG (METEOSAT) for January, 14. Number of pixels with snow (S), no snow (NS) and undefined (ND)

		ANALYSE	METEOSAT	
####		S	NS	ND
ANALYSE	S	2869.00	295.00	2729.00
METOP	NS	374.00	117572.00	5409.00
####	ND	18891.00	51453.00	251749.00

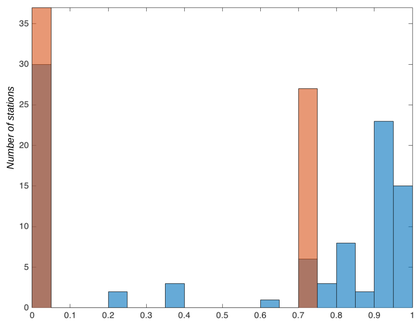
HARMONIE vs METOP and MSG: Good agreement where data are available. HARMONIE analyses has artifacts.



Time series of Proportion Correct (yellow), kappa (blue) and Heidke Skill Score (mauve) coefficients for MSG vs HARMONIE

SYNOP vs METOP and MSG:

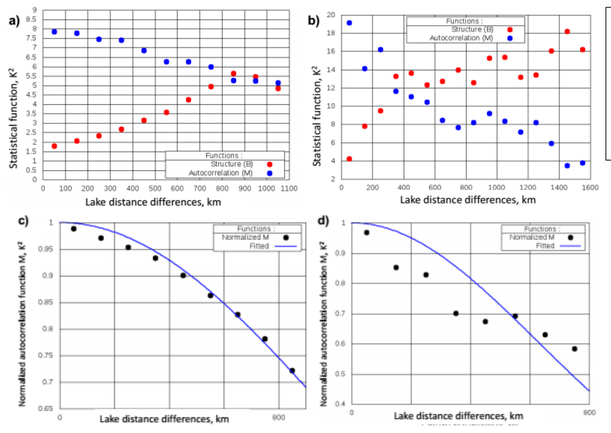
Good agreement where data are available. However both METOP and MSG overestimate snow. Also, SYNOP data contain representativeness errors.



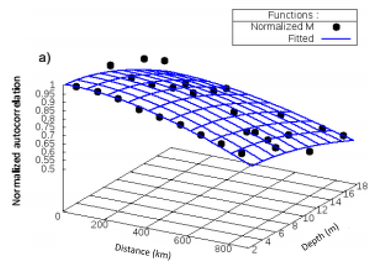
MSG vs SYNOP for April, 28,
Blue: SYNOP stations in MSG snow area.
Orange: SYNOP in MSG no-snow area.
Blue or brown colour in the first gradation is overestimation of snow by MSG. Orange or brown colour in other gradations mainly reflect representativeness errors of SYNOPs.

New structure functions for lake water surface temperature (LWST) from observations

- **Objective:** new structure functions of LWST dependent on the distance and on the difference in lake depth in the frame of Gandin (1965)
- **Observations**: in-situ for 27 Finnish lakes by the Finnish Environmental Institute (SYKE). From MODIS for 71 pixels in Fennoscandia.
- June-July-August 2010-2014

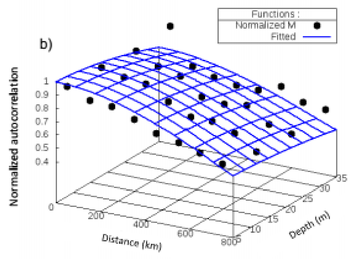


a,c: from SYKE
b,d: from MODIS
Obs. error: 0.9 °C for SYKE
1.2 °C for MODIS



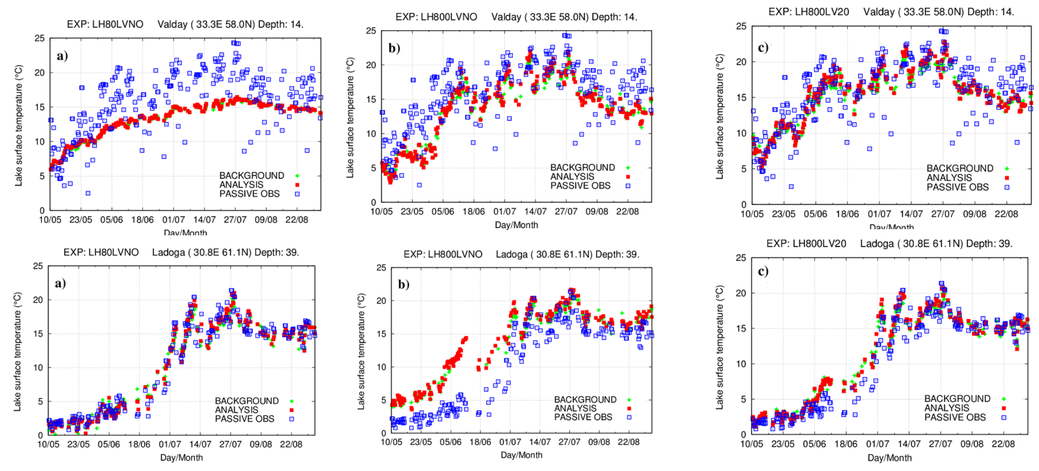
a) from SYKE
L_H=1050 km *L_H=1100 km* *L_V=20 m*
$\mu(\rho) = e^{-\left(\frac{\rho^2}{2L_H^2}\right)}$

b) from MODIS
L_H=630 km *L_H=740 km* *L_V=50 m*
$\mu(\rho,\partial) = e^{-\left(\frac{\rho^2}{2L_H^2}+\frac{\partial^2}{2L_V^2}\right)}$



Old functions (for SST):
L_H=80 km

Experiments (HIRLAM): a) *L_H=80 km* (old functions)
b) *L_H=800 km*
c) *L_H=800 km, L_V=20 m*



Conclusions:

- Usage of *L_H=800 km* allows to introduce more observations, for lakes located far from their neighbours
- Usage of the depth difference dependency improves the analysis prevailing the influence of observations from shallow lakes on deep lakes, and vice versa