Surface aspects in HIRLAM/HARMONIE

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EWGLAM/SRNWP meeting,
Antalya, 30 Sept.-4 Oct. 2013

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- Physiography

Operational status

- **HIRLAM v.7.4**

DA: span

in hor: OI for screen level temperature and relative humidity (anisotrophy due to land-sea and orography), SST and SWE

in ver: OI for deep soil temperature and soil moisture

obs: SYNOP, ECMWF SST (OSTIA), LST from SYKE

Operational status

- **HIRLAM v.7.4**

physiography: GLCC+CORINE+modifications, FAO soil map, GTOPO, lake depth database

surface layer fluxes: Louis formulation

surface schemes: 5 tiles – water(sea/lakes), sea ice, bare soil, low vegetation, high vegetation; land tiles may be covered by snow, ISBA 2L, newsnow scheme (1.5 layer in snow, snow on high vegetation), FLake, orographic radiation effects

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Operational status

- **HARMONIE-37**

DA: CANARI + OI_MAIN

in hor: OI for screen level temperature, relative humidity and SWE, bilinear interpolation for SST

in ver: OI for soil temperature and soil moisture

obs: SYNOP, OSTIA

Operational status

- **HARMONIE-37**

physiography: ECOCLIMAP-I, FAO soil map, GTOPO

surface layer fluxes: CANOPY

surface schemes: SURFEX6.1

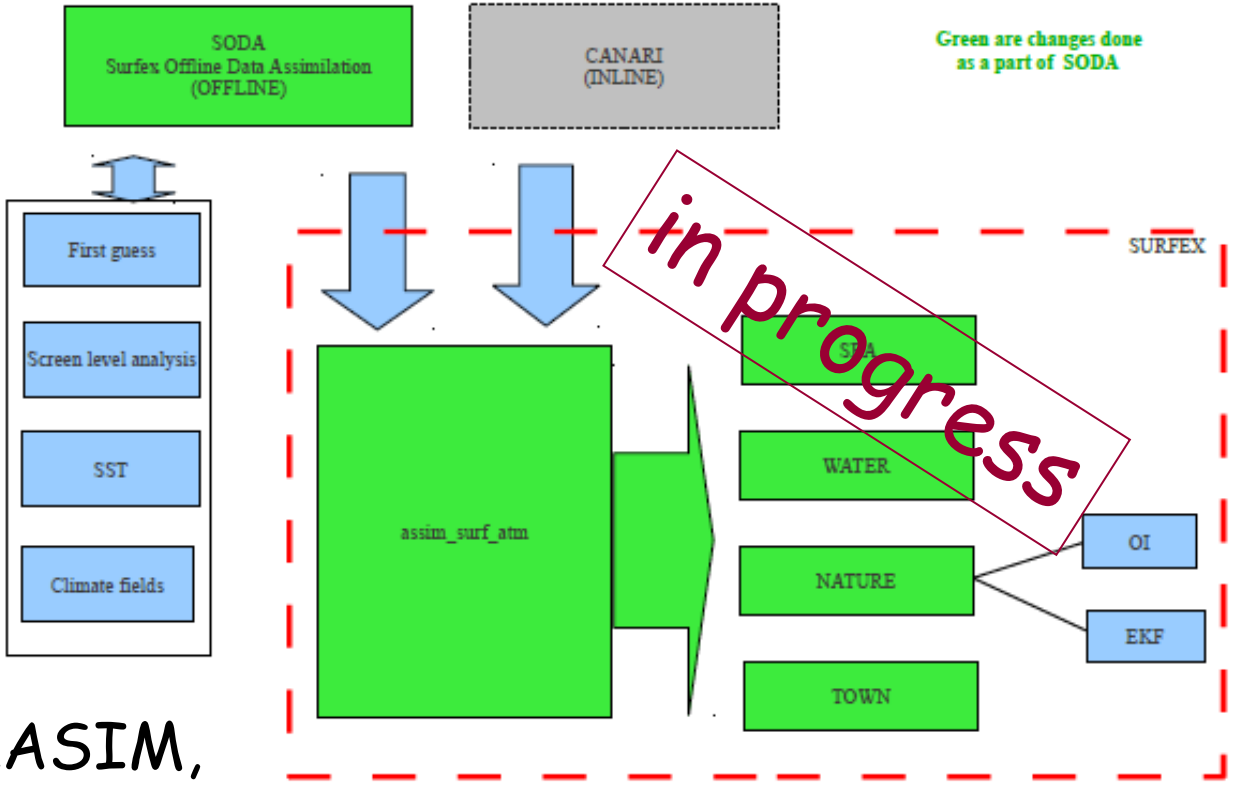
4 tiles – water and sea, urban, nature; nature tile may be covered by snow
ISBA 3L, 1 layer in snow

R&D: Technical

SODA:

SURFEX
Offline
Data
Assimilation

off-line
and in-line
parallel system
with CANARI
and SURFEX/VARASIM,
the default method in HARMONIE since 37h1.2,
huge reduction of running time for large domains

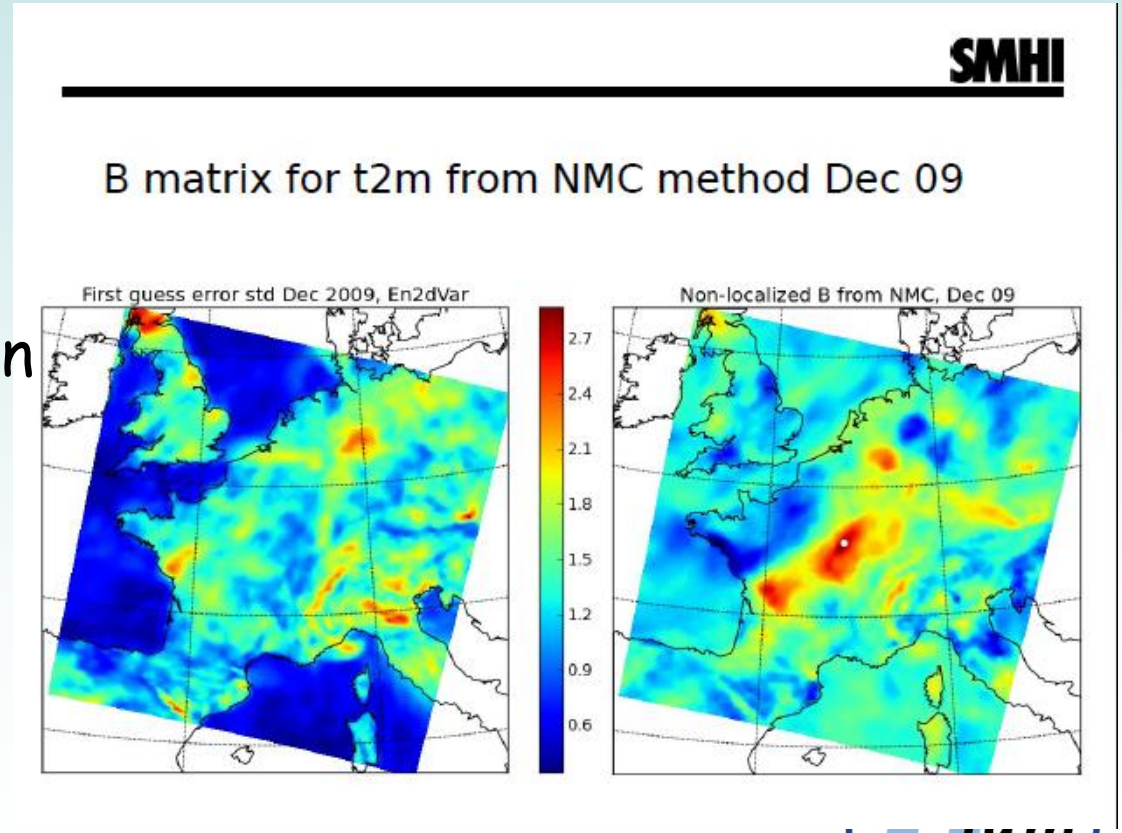


R&D: Soil and vegetation, DA

- **in ver:** Exp. with EKF, EnEKF, particle filter, ASCAT and SMOS data … - to be continued, but …

- **in hor:** EURO4M

Forcing from HIRLAM,
exp. with anisotropic structure functions in
CANARI
vs wavelets
vs Ens2DVar



R&D: Snow and ice modeling

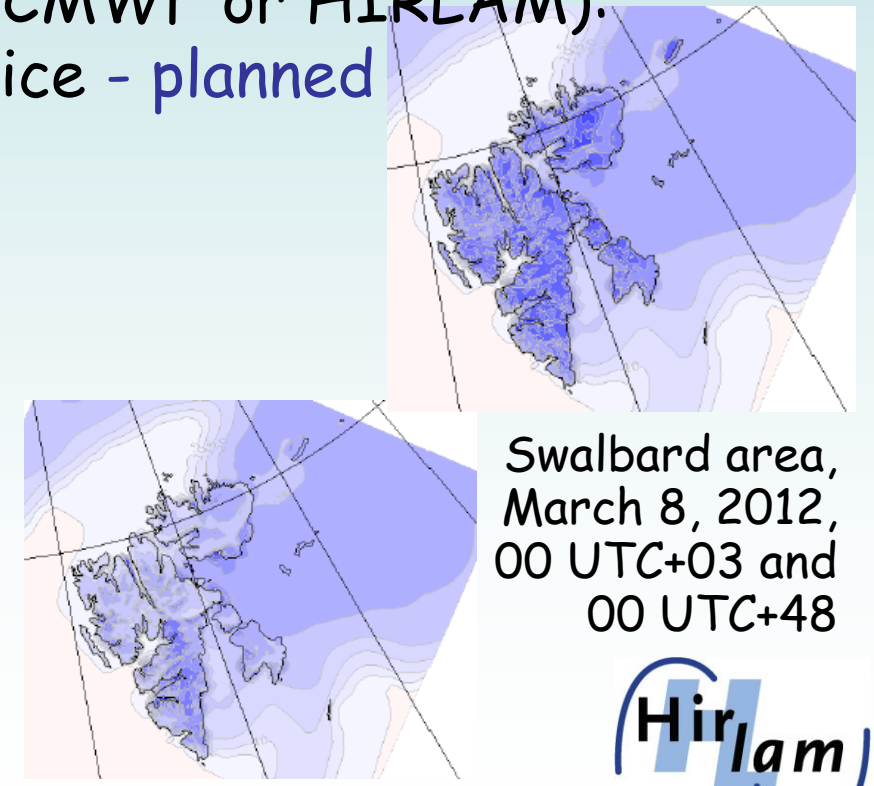
MEB: SURFEX 7.3 technical developments, testing – in progress, improvements of albedo – planned

Snow 3L in HARMONIE: testing – in progress

Simple ice scheme (as in ECMWF or HIRLAM): H=1m, several (3?) layers in ice - planned

HIGHTSI: - planned

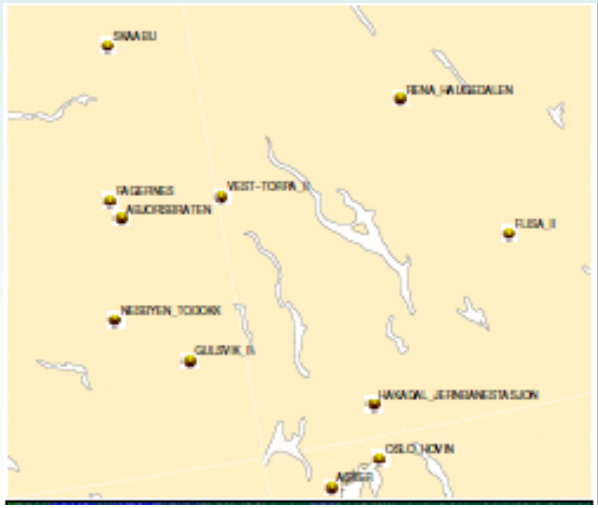
Now: Sea Ice Temperature (SIT) is taken from boundaries (ECMWF) and kept constant during a forecast, no diurnal cycle, large errors in Arctic

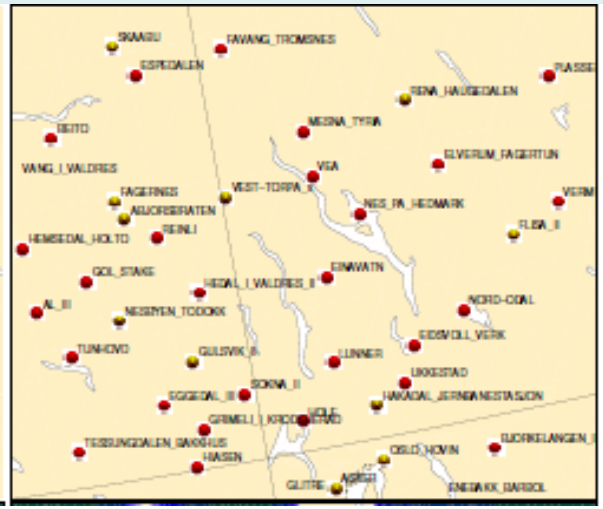


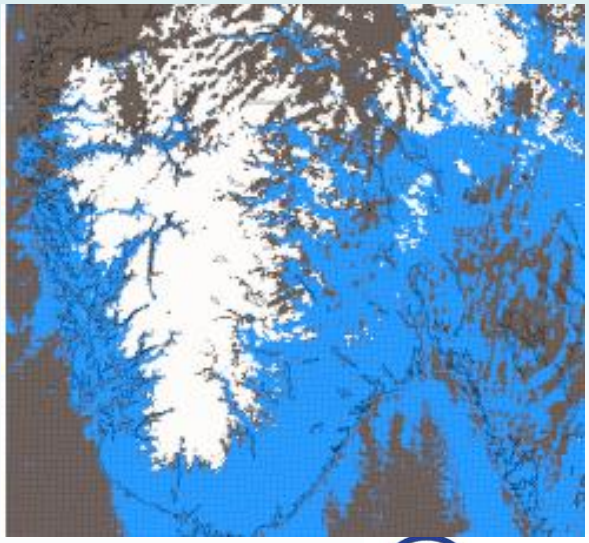
Swalbard area, March 8, 2012, 00 UTC+03 and 00 UTC+48

R&D: snow DA

- **in hor:** Exp. to assimilate data from **precipitation stations (snow depth)** and **CryoRisk product (snow extent)** for Norway. Reduced bias in T2m in spring!
- Planned: to assimilate **snow extent** obs from NESDIS (but too smooth for HARMONIE) or Land-SAF, or new SE from Globsnow, or MODIS (positive experience in Iceland)







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Data from 'climate' and 'precipitation' stations for Sweden and Norway are now available via BUFR/GTS and at ECMWF

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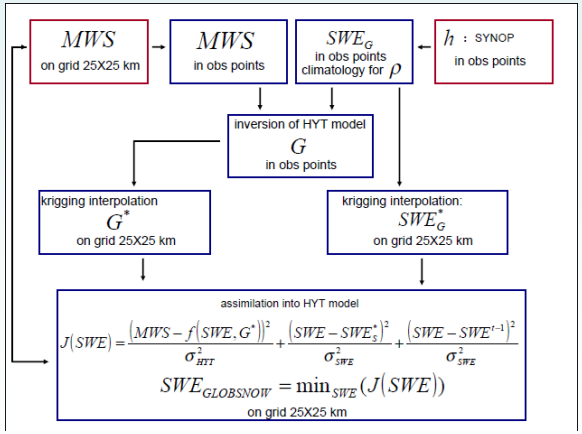
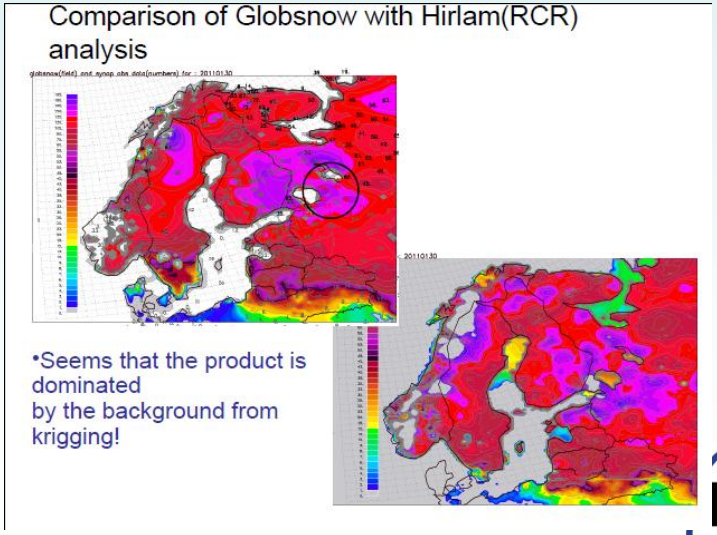
R&D: snow DA

- **GLOBSNOW data on SWE:** artifacts, small variability in meso-scale <= weaknesses in algorithm
- Planned: to assimilate retrievals using HUT model as obs operator? EUMETSAT fellowship application: a roadmap
- **in ver:** EKF for SWE (exp. of R. Essery with JULES) - planned





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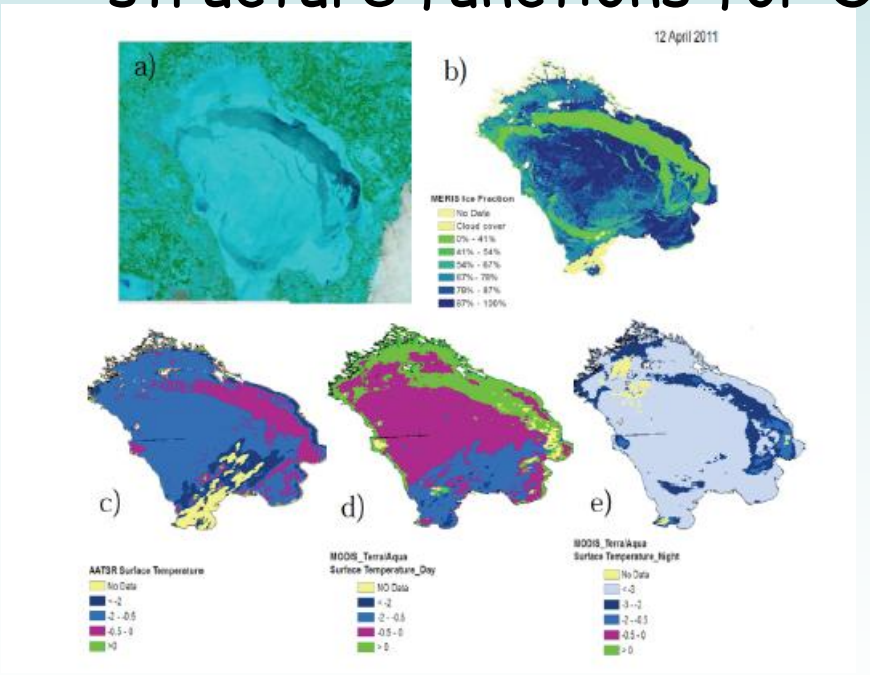
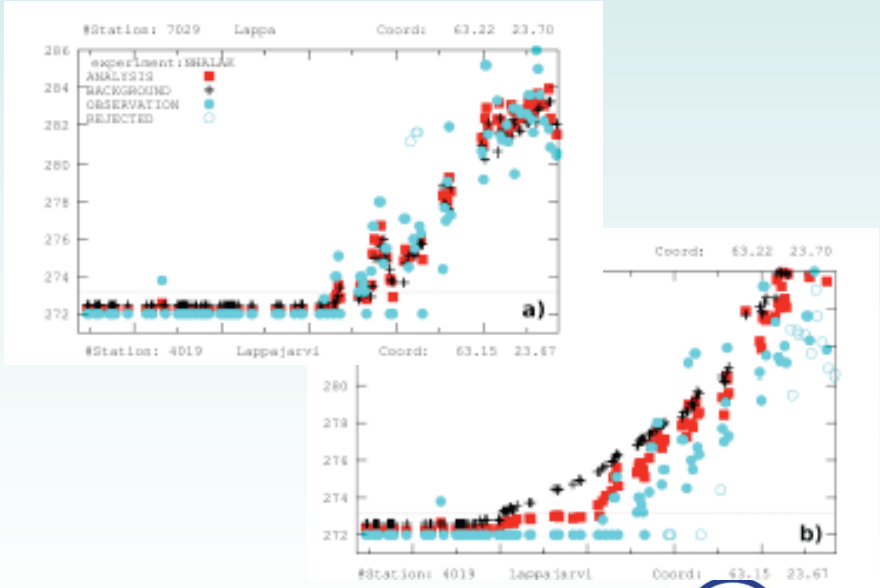
R&D: Lake modeling

- to test FLake in HARMONIE – planned
- to include new lake database into SURFEX and HARMONIE – planned
- to include improved lake climatology into SURFEX and HARMONIE - planned

R&D: Lake DA

- **In hor:** exp. with MODIS obs: **probleam of quality control**!
- Planned: quality control of satellite data, new structure functions for OI (others than for SST)





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R&D: Lake DA

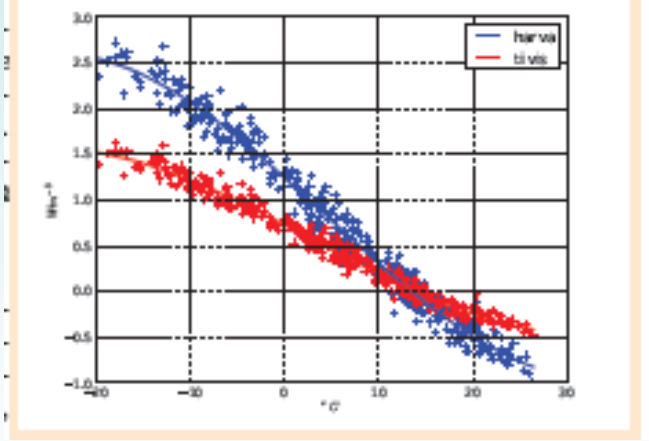
- **In ver:** EKF exp. with in-situ+MODIS obs: role of obs in early spring! Cross-validation.
- Planned: continue testing, include into SURFEX and HARMONIE

Lake	Bias		RMS	
	REF	EKF	REF	EKF
Inari (14 m)	-2.0	-2.0	5.0	1.3
Saimaa (11m)	-1.1	-1.1	3.7	1.7
Tuusula (3m)	0.8	0.8	2.9	1.9
Lappa (7m)	1.2	1.2	2.9	2.0

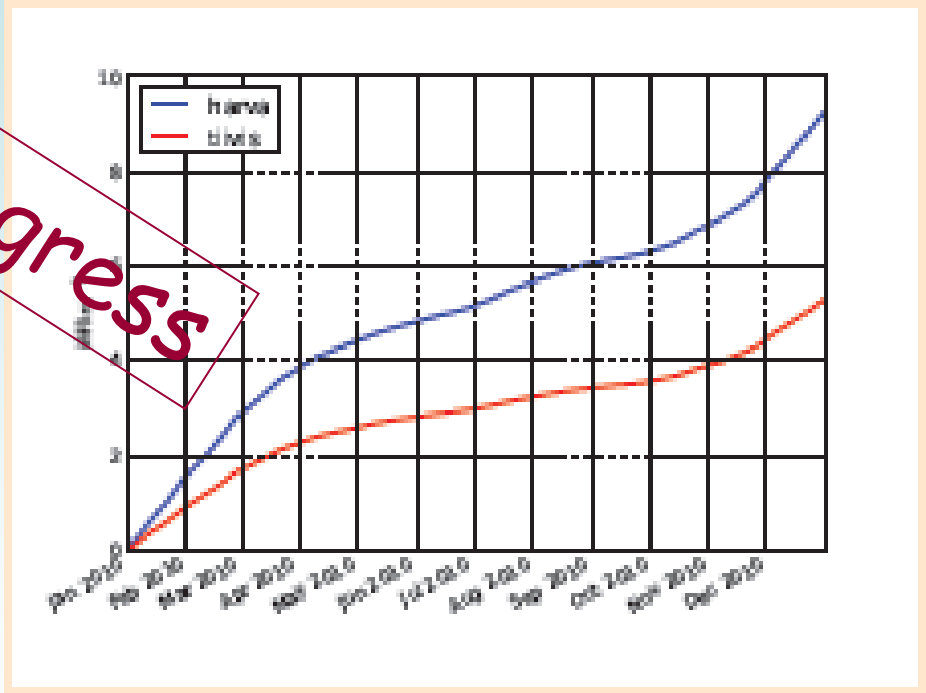
R&D: Urban modelling

- **TEB:** sensitivity tests - continued

kaavoitus	korkeus	peittävyys	seinäpintasuhde
harva	10 m	28 %	28 %
tiivis	30 m	45 %	90 %



in progress



Helsinki, 2010

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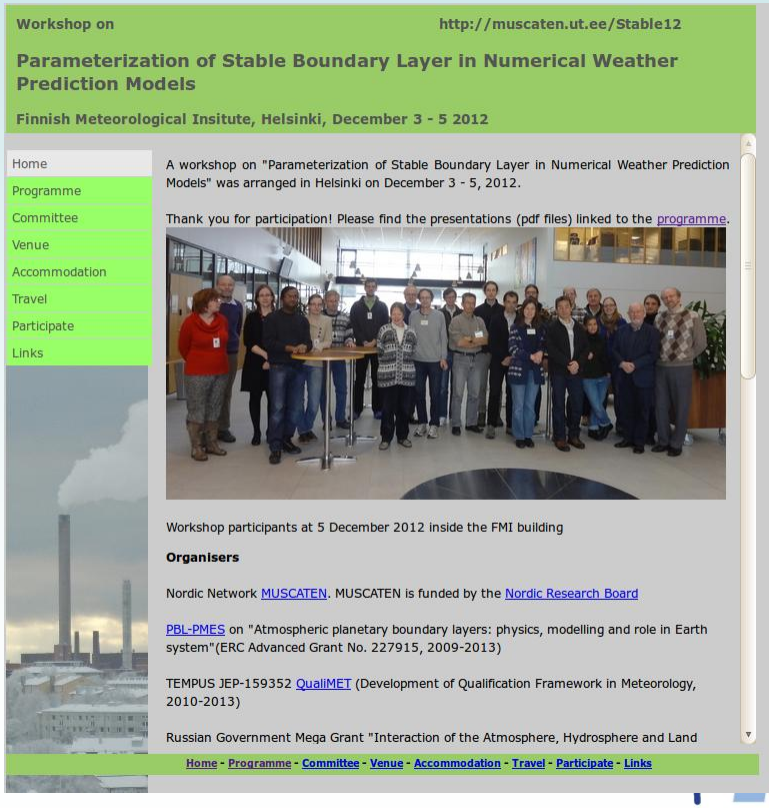
R&D: Surface layer

- Tests with CANOPY scheme in HARMONIE – tuning the of canopy drag and Ri_max
- GABLS4 – GEWEX Atmosheric Boundary Layer Study
- The Workshop on Stable Boundary Layer parameterization in NWP

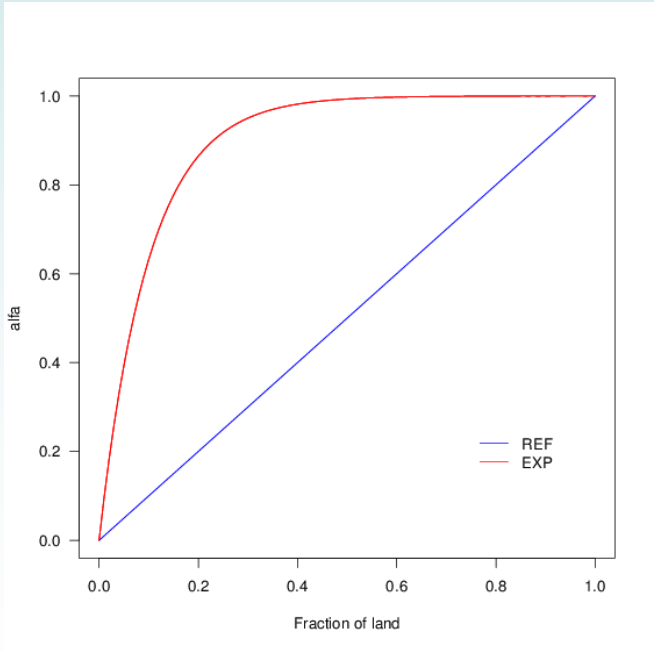


R&D: Averaging, interaction between tiles

- Idea: to "import" drag coefficients from an "upstream" tile when calculating tile fluxes – planned, but …
- Modified weights in averaging T2m in coastal regions (Norway) to give more weight to land. Increased T2m scores.

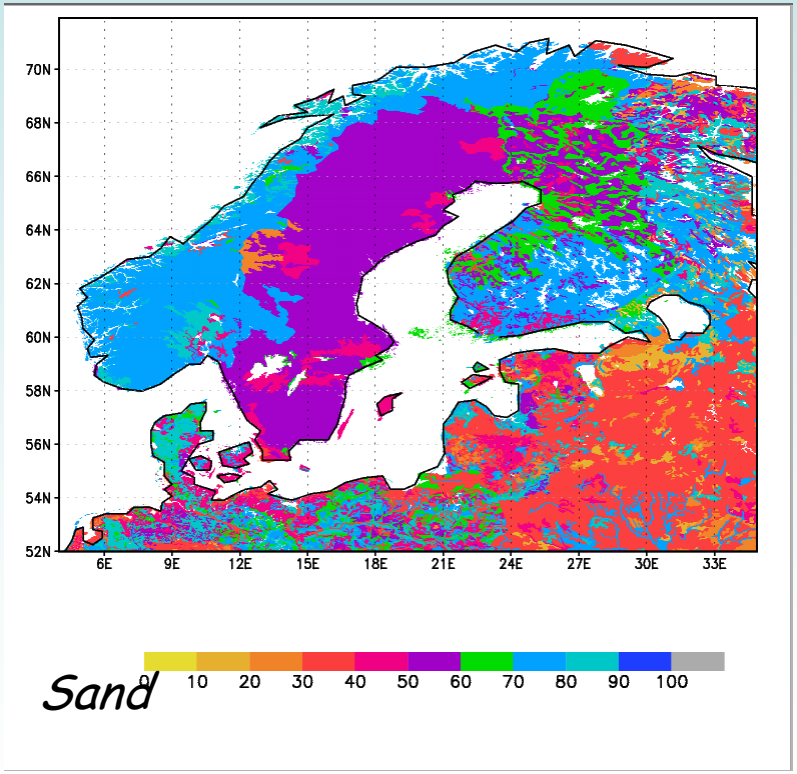
$$\mathbf{T}_{2\mathbf{m},\mathrm{mod}} = \alpha(\mathbf{FRL}) * \mathbf{T}_{2\mathbf{m},\mathbf{land}} + (1-\alpha(\mathbf{FRL})) * \mathbf{T}_{2\mathbf{m},\mathbf{sea}}$$

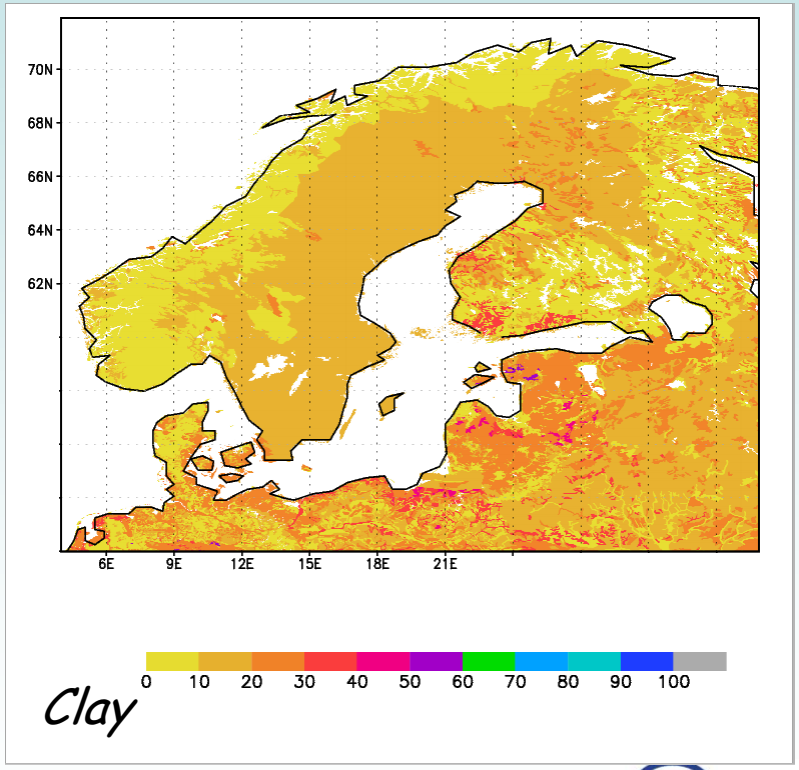
where $\alpha(\mathbf{FRL}) = 1 - \exp(-10 * \mathbf{FRL})$



R&D: Physiography

- Evaluation of new **soil maps** for Nordic region: too smooth data in Sweden and Norway. Due to difference in classification?





R&D: Physiography

- Exp. with **ECOCLIMAP I**: sharp gradients in the land use type along Finnish-Russian border, false lakes in Bielorussia => bias in V10m up to 3 m/s in HARMONIE
- **ECOCLIMAP II** in HARMONIE: testing for Norway
- **GLDBv2**: indirect estimates of the mean lake depth for the Sourthern Hemisphere – continued, but ..., to include into SURFEX, HARMONIE - planned

R&D: Physiography

- Evaluation of **ECOCLIMAP II** against local data:
  Maanmittauslaitos karttapaikka, Finland, coastline
  also
  CORINE Finland, CORINE Europe, GlobCover,
  GSHHS (global coastline)

Types of errors:

- Shift – in ECOCLIMAP II!
- Inland seas (sea => lake)
- Missing small lakes/islands

How pressing is the problem?

		ECOCLIMAP		
	%	Land	Lake	Sea
CLC Finland	Land	75.193	3.374	0.666
	Lake	3.108	5.290	0.004
	Sea	0.281	0.026	12.057

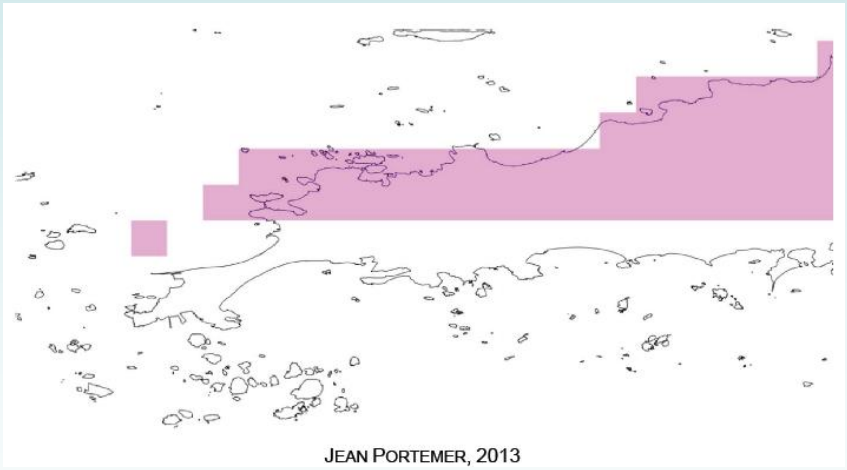
JEAN PORTEMER, 2013

Gross errors:

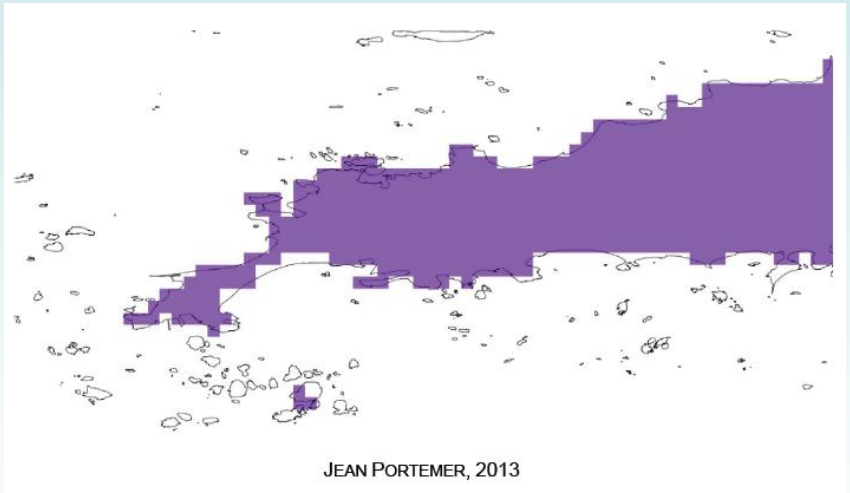
the Curonian lagoon is 40% land (reported from Lithuania)

R&D: Physiography

- **Shift** in ECOCLIMAP II
- GlobCover – 5.008% of wrong pixels
  ECOCLIMAP II – 7.460% of wrong pixels



ECOCLIMAP II

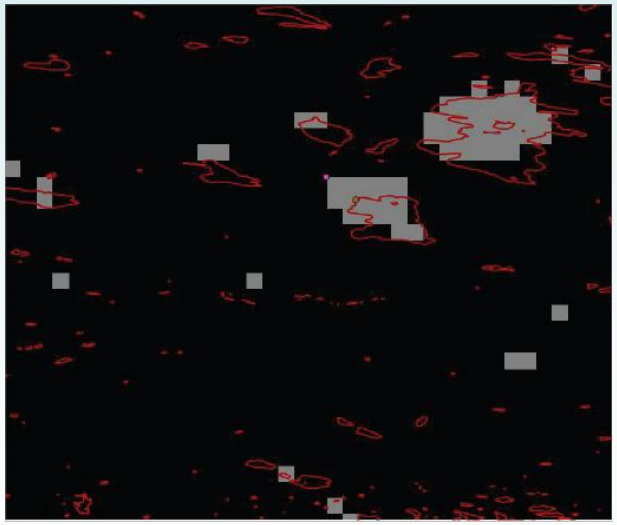


GlobCover

R&D: Physiography

- To correct the shift with an affinity transformation?

$$\begin{pmatrix} i_{shifted} \\ j_{shifted} \end{pmatrix} = f\begin{pmatrix} i \\ j \end{pmatrix} = \begin{pmatrix} a & b \\ d & e \end{pmatrix} * \begin{pmatrix} i \\ j \end{pmatrix} + \begin{pmatrix} c \\ f \end{pmatrix}$$



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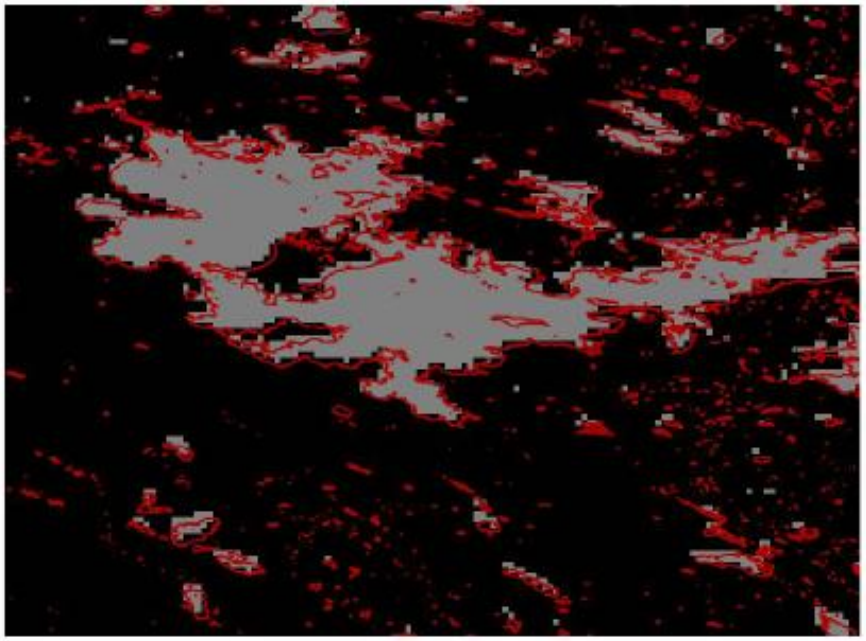
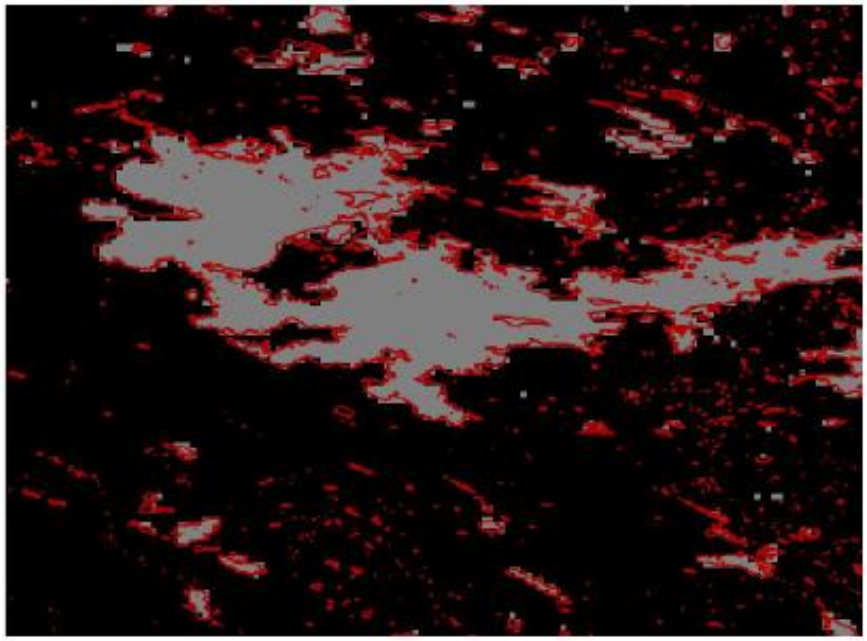
R&D: Physiography

ECOCLIMAP II orig.



ECOCLIMAP II corrected



ECOCLIMAP II orig. – 7.460% of wrong pixels

ECOCLIMAP II corrected – 6, 663% of wrong pixels

GlobCover – 5.008% of wrong pixels

Candidate for the new physiography?

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Thank you!

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