

Review of HIRLAM/HARMONIE SURFEX-related activities

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23 March, 2016



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Soil and vegetation, modeling and DA

Ongoing:

- SURFEX with 2 patches to run in HARMONIE:
 - tests without CANOPY
 - OI for 2 patches
- In HARMONIE cy40 branch ISBAv8 physics replaces ISBAv7.3 in SURFEX - to be opened for further developments
- IMPREX: Assimilation of satellite-based measurements of the hydrosphere - towards a combined meteorological-hydrological forecasting system:
 - problems with large values of Kalman gain in mountains, filtering could help. Cooperation with NILU.

Plans:

- SURFEX with ALARO

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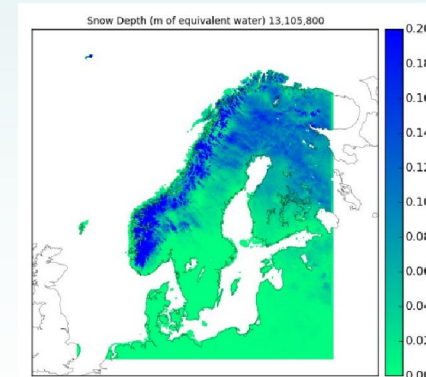
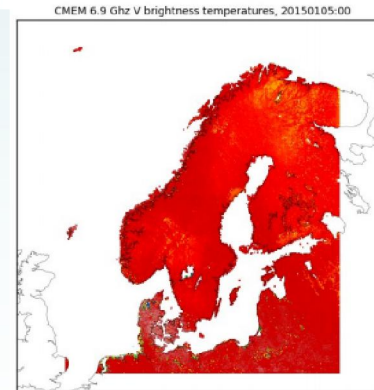
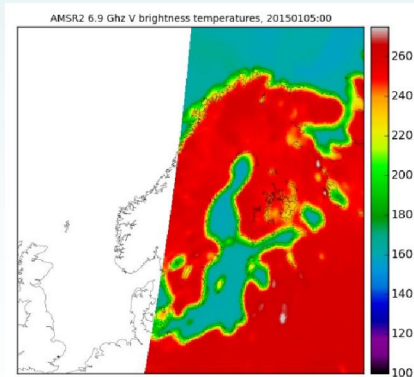
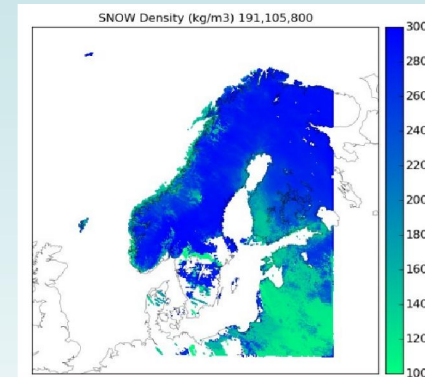
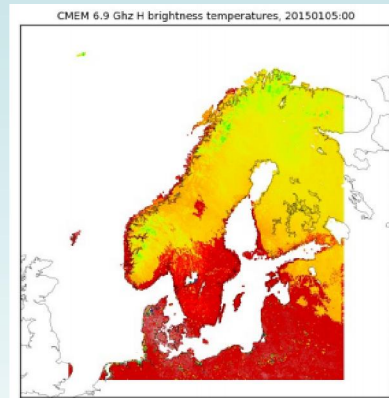
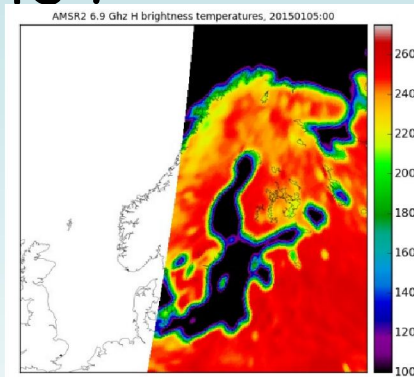


Snow modeling and DA

- Problems with permanent snow in Iceland - plans to fix
- SE from Land-SAF, or Globsnow, or MODIS, EKF for SWE - planned
- COST Action Harmosnow is running
- IMPREX: snow DA activities planned, Cooperation with NILU
- First steps towards assimilation of AMSR2 (microwave) brightness temperatures to get SWE

Snow modeling and DA

- First steps towards assimilation of AMSR2 (microwave) brightness temperatures to get SWE
- Obs operator: emission model CMEM (ECMWF) based on HUT

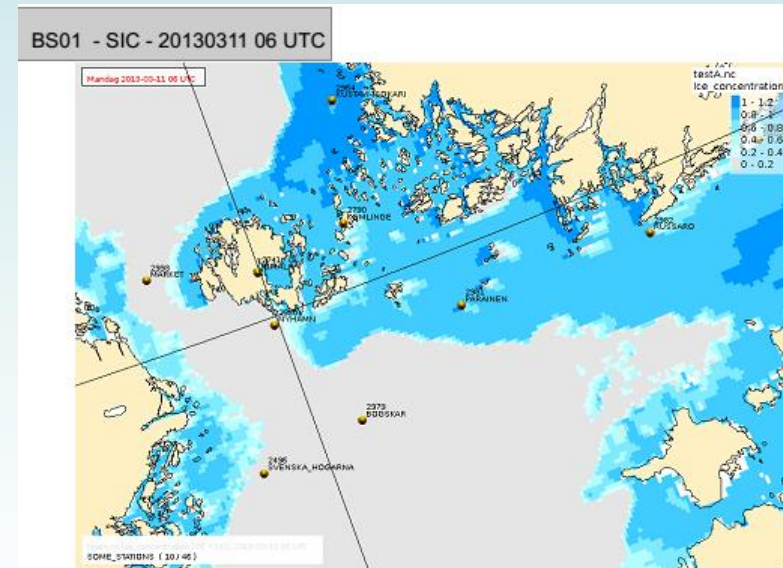
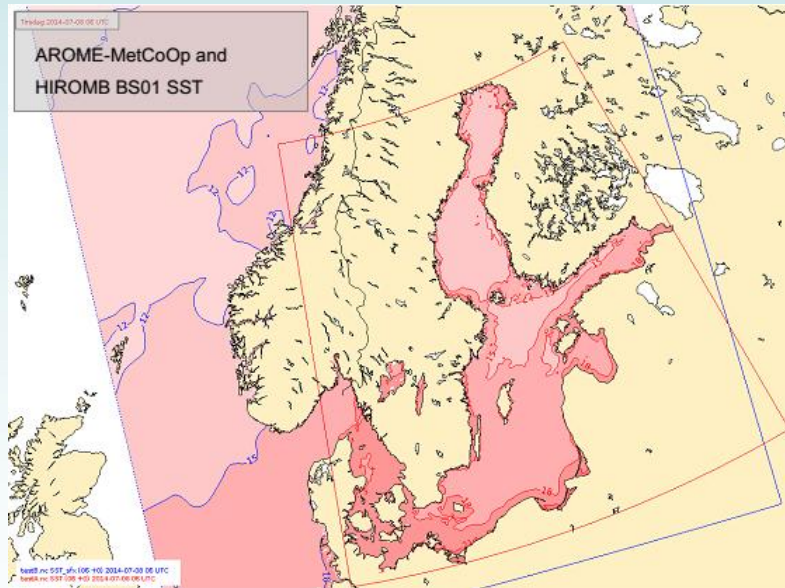


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SST and Sea ice

- SST and SIC from HIROMB for Baltic Sea - better resolution and quality than OSTIA, better scores for coastal stations

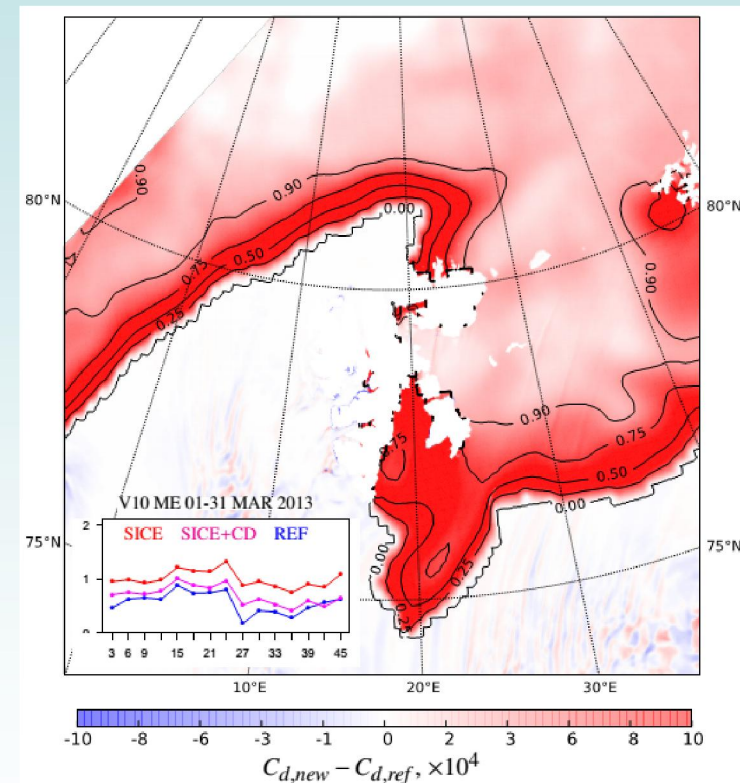
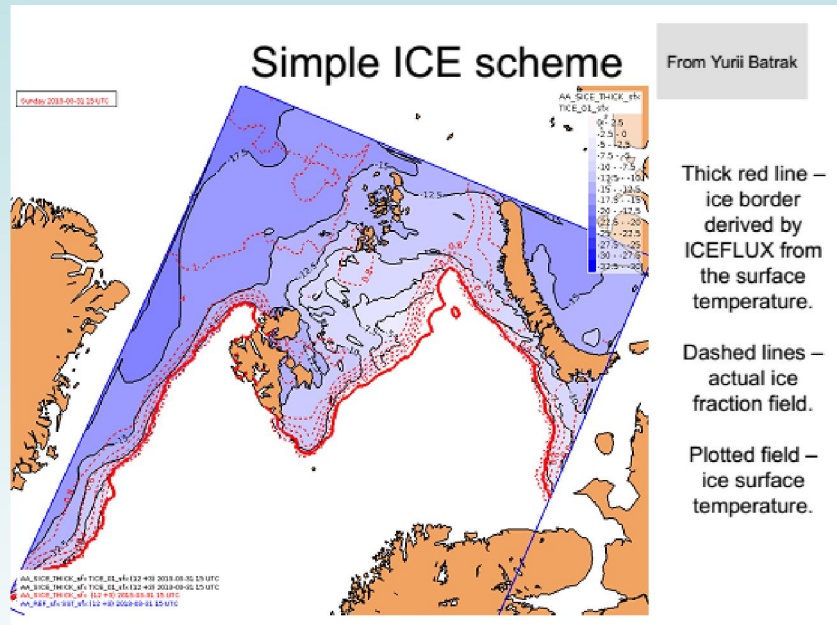


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SST and Sea ice

- SICE operational (MetCoOp), also Arctic
- Additional drag due to mixture of ice and open water



$$C_{dn} = (1 - \alpha) C_{d,w} + \alpha \cdot C_{d,i} + C_{d,f}$$

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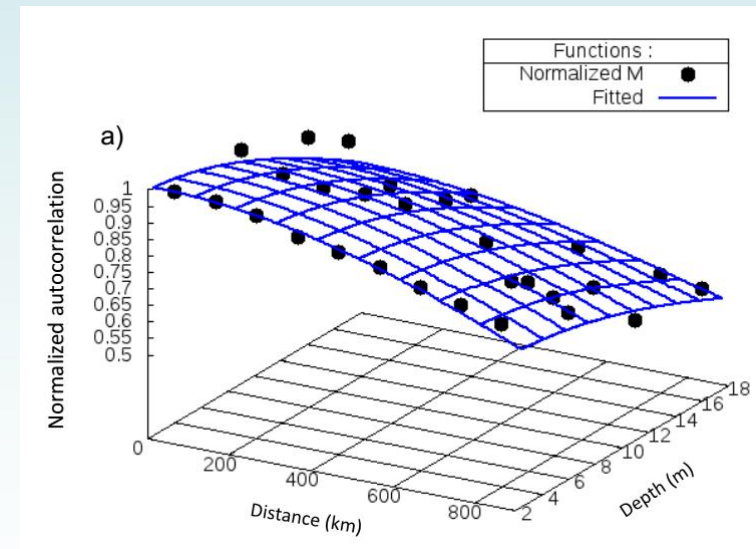
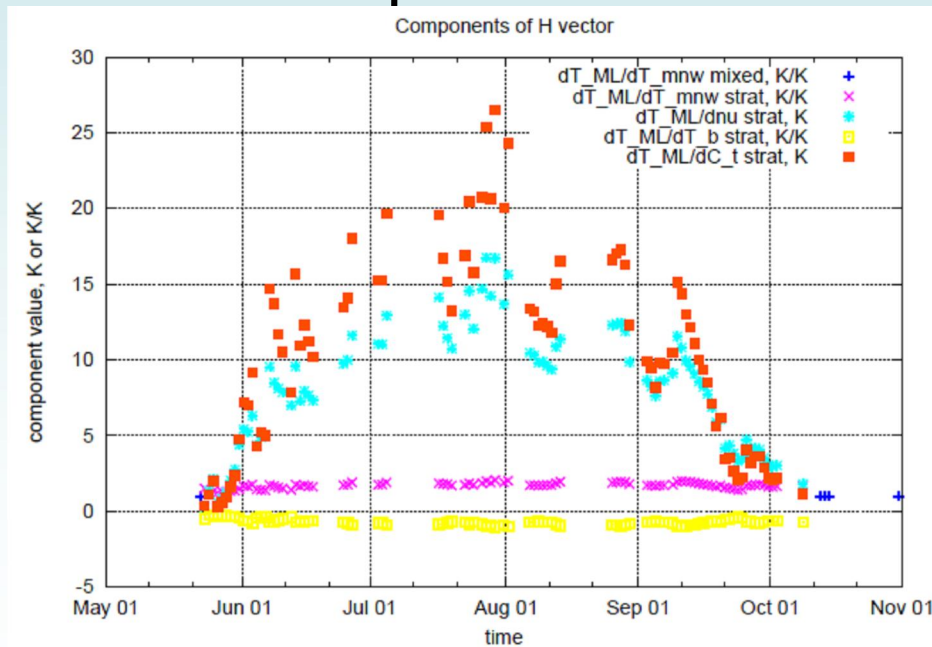


Ice modeling

- **SICE:**
 - problems with the initialization of temperature profiles of the newly appeared ice
 - snow on ice with snow 3L: stability problems for thin snow
 - different salinity for SICE in different regions (Baltics, Atlantics)
- Towards regular sea ice measurements and their DA: SIMBA bouys; at the moment - comparison with HIGHTSI
- **HIGHTSI** (but to rewrite the code) or to develop SICE further - ?

Lakes

- FLake in 2D, SURFEX7.3, HARMONIE cy40h -ongoing
- GLDBv3.1 included
- Tests in Antarctica
- Study of EKF Jacobians
- Structure functions for LST from obs (SYKE and MODIS), including dependency from the difference in the lake depth



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Lake Inarijärvi, 14.3 m



Urban modelling

- Comparison of flux meas. over Kumpula and Hotel Tornii, Helsinki with HARMONIE:
 - Radiation components are well modelled by HARMONIE, but troubles in snow periods
 - Winter turbulent fluxes hard to capture by HARMONIE
 - Initialisation: to be discussed
- To study also the potential of BEM over Stockholm - planned

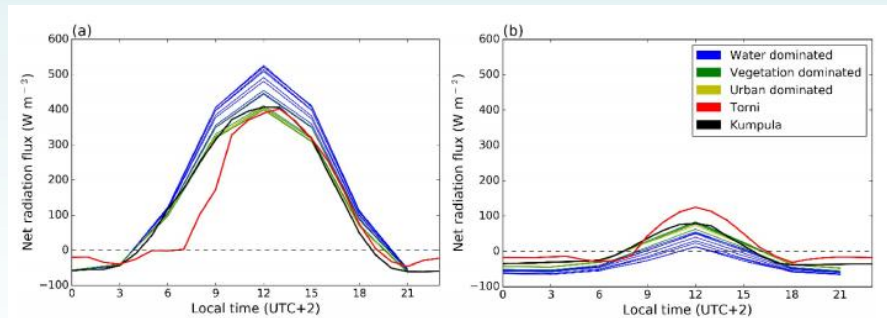


Figure 4. Mean diurnal cycles of modelled (3-hr averages) and observed (1-hr averages) net radiation (Q^*) for (a) summer and (b) winter. Blue, green and yellow lines indicate the 16 model grid boxes, which are water-, vegetation- and urban dominated, respectively.

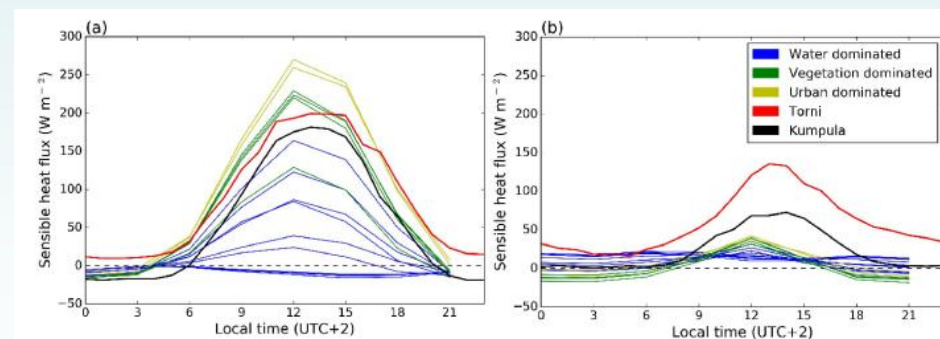


Figure 5. As Figure 4, but for the sensible heat flux H for summer (left) and winter (right).

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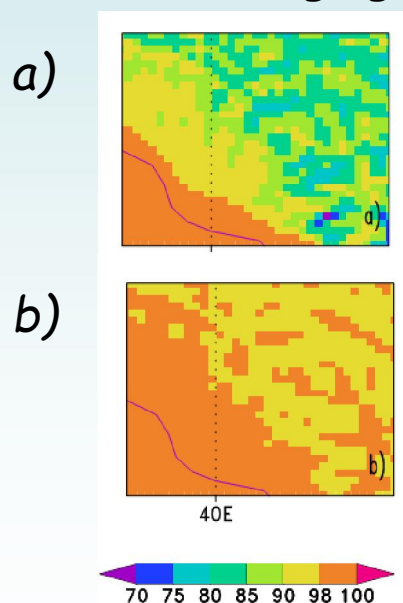
Thanks to Daan Koop!



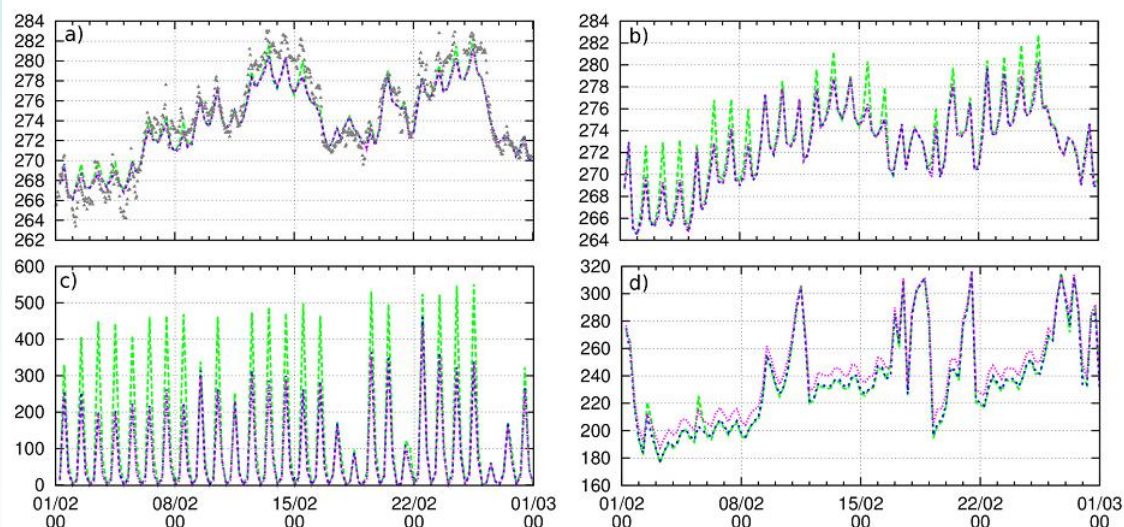
Orographic radiation

- Experiments over Caucasian mountains
- Experiments over Alps - planned

Sky view factor
without (a) and with (b)
distance averaging



a) T2m, b) T_surf, c) SWD, d) LWD
grey - obs, green - no ororad, magenta - with ororad



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Physiography

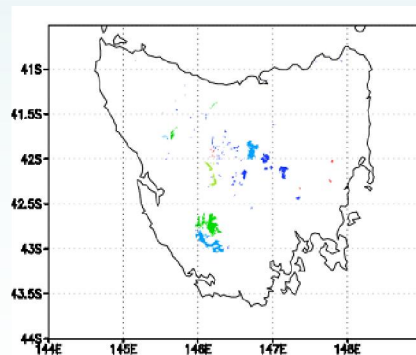
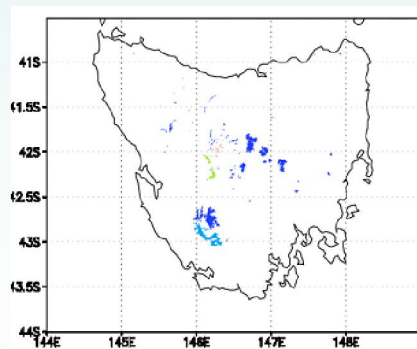
GLDB

- GLDBv3 released: indirect estimates of the mean lake depth for the Southern Hemisphere
- first steps towards fine resolution, Globcover (prototype over Germany)
- GLDBv3.1 - bathymetry for 1 419 Finnish lakes (thanks to Charlotte Moissette!)

ECOCLIMAP

to include local fine res. data over cities?

Tasmania



GLDBv2 and GLDBv3



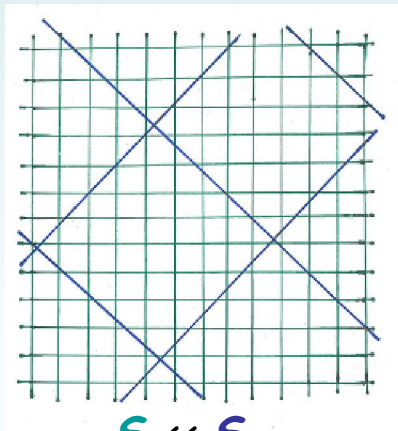
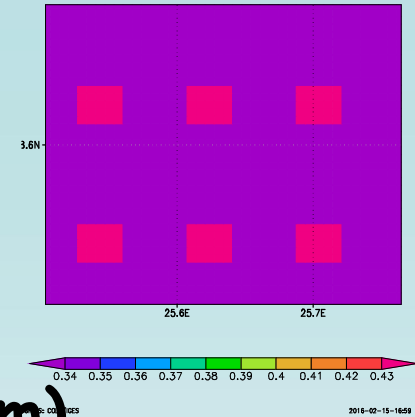
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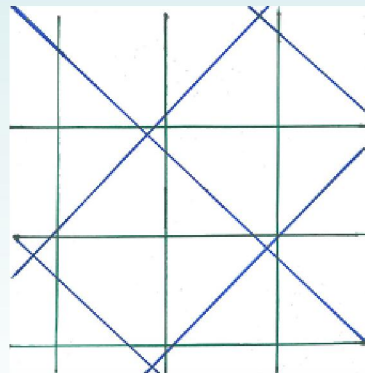
Physiography

- Physiography for very fine scale: from aggregation to interpolation
- Resolution of atm model: **2.5 km**
of surface data: **1.0 km (5.0 km)**
- In PGD, coded so that provides consistency (for the price of accuracy), but some problems for clay, sand and lakes existed - fixed for v7.3.

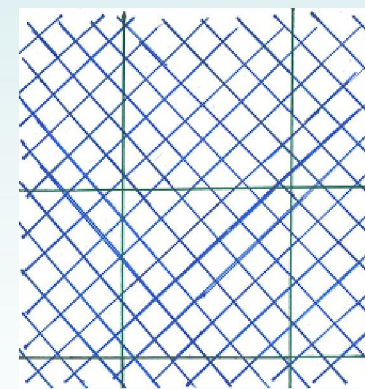
% of sand



$S \ll S$
aggregation



$S \approx S$
weighted average



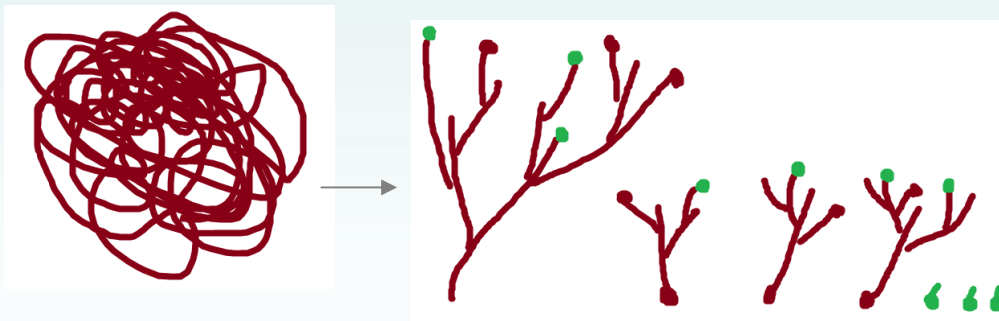
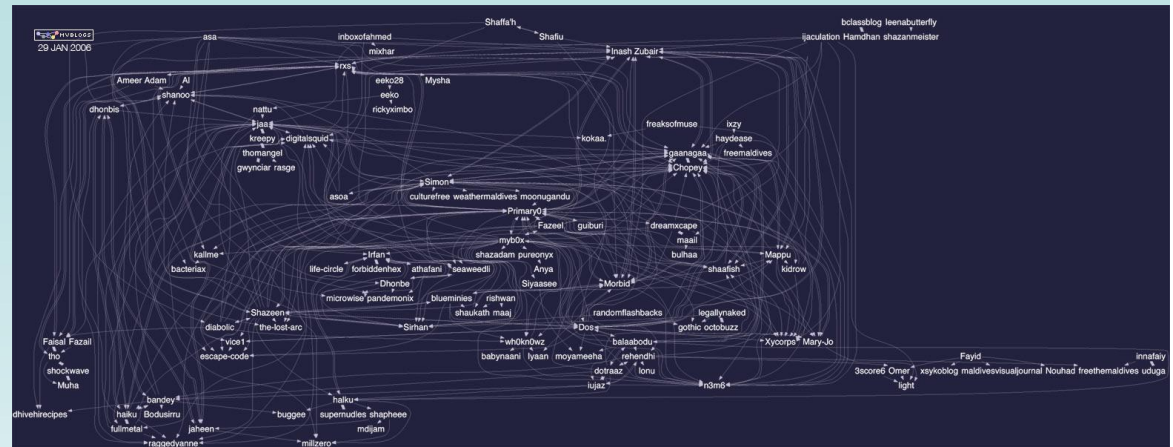
$S \gg S$
interpolation

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R&D: Documentation

- How to see the code structure?
- DOXYGEN: lists, a graph ...
- to unravel the graph: make several graphs of one plain routines, utils, blocks - ongoing



```

PREP
ALLOC_SURFEX
GET_LUOUT
OPEN_NAMELIST
POSNAM
CLOSE_NAMELIST
READ_ALL_NAMELISTS
GOTO_SURFEX
GOTO_TRIP
IO_BUFF_CLEAN_n
INIT_PGD_SURF_ATM
INIT_SURF_ATM_n
PREP_SURF_ATM
SURF_VERSION
PREP_SEA
PREP_SEAFLUX
GET_LUOUT
PREP_OUTPUT_CRID
    
```

```

INIT_SURF_ATM_n
ABOR1_SFX
SURF_VERSION
GET_LUOUT
DEFAULT_SSO
DEFAULT_CH_SURF_ATM
DEFAULT_DIAG_SURF_ATM
READ_DEFAULT_SURF_ATM_n
READ_SURF_ATM_CONF_n
WRITE_COVER_TEX_START
PREP_CTRL_SURF_ATM
READ_NAM_PREP_SURF_n
READ_SURF_ATM_DATE
READ_PRE_SURF_ATM_DATE
    
```

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Thank you!



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