

A Consortium for CONvection-scale modelling
Research and Development

Overview of ACCORRD surface activities

Patrick Samuelsson, 2025-04-02, All Staff Workshop, Zalakaros, Hungary

ACCORD surface WW last May in Kraków



We were kindly invited by Gabriel Stachura and IMGW to enjoy a Working Week in Kraków, Poland.

It was a hybrid meeting with 9 participants on site and some 10-20 remote. [Link to wiki page here.](#)

The agenda included a number of presentations and some more deep discussions related to e.g. the T2M/Q2M sandbox tool by Marvin, ML-based physiography, multi-layer surface physics, TEB, surface DA, SURFEXv9 contributions.

Autumn ACCORD Surface online Working Week last November

Seven sessions:

- Physiography and ECOCLIMAP
- Urban and TEB
- Surface data assimilation
- Climate modelling, snow aspects
- SURFEX code aspects
- Multi-layer surface physics
- Surface data assimilation continuous

All presentations are available as pdf:s or with links to them [at the wiki](#).

Also, Webex recordings are available.

Next ACCORD Surface Working week at AEMET in Madrid in May



Agencia Estatal de Meteorología

Welcome to join the ACCORD Surface Working week at AEMET in Madrid during the days May 19-23:

- **Plenum presentations in hybrid format.**
- **Working teams on different subjects with special focus on urban/TEB aspects at this WW.**

[See wiki for more information.](#)

Please sign up via the wiki.

ALARO-SURFEX Working week at CHMI in Prague in June

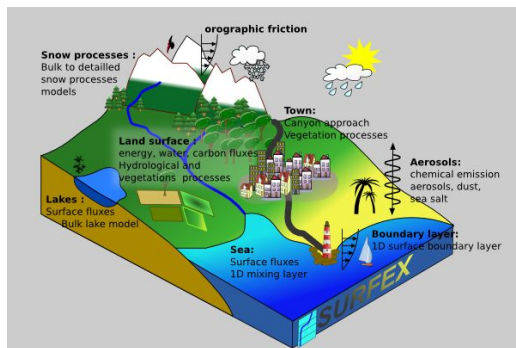


**Czech
Hydrometeorological
Institute**

**Welcome to join the LACE
ALARO-SURFEX Working week at CHMI
in Prague during the days June 2-6.**

SURFEX contributions from different NWP sources

SURFEXv8.1 code from different sub-consortia in ACCORD is, since cy49t, now in a common SURFEX code for NWP:



SURFEX team v8.1
Marie Minvielle

HIRLAM v8.1 in cy46h
Patrick Samuelsson

Météo-France v8.1_plus in cy48t
Adrien Napoly
Météo-France cy49t contributions
Patrick Samuelsson

LACE/ALARO1 v8.1
Ján Mašek

... but still in three separate repositories:

[cy49t GitHub repository](#)

These are synced

[SURFEX-NWP offline GitHub repository](#)

These are synced

[SURFEX team Git repository](#)

ACCORD SURFEX NWP contributions into SURFEXv9



In Kraków in May 2024 a team was formed (Adrien, Patrick, Andrea) to merge our ACCORD SURFEX NWP contributions into SURFEXv9. Andrea focused on the TEB-AROME-model-levels coupling.

After solving all the initial merging conflicts the work to test the merged code in the SURFEX team testing tool STRATO started last September. This process, including some code revisiting, is still ongoing and will continue a while more. Quite a few people are involved: Adrien, Patrick S., Marie M., Patrick LM, Katya, MetNorway colleagues (EKF, SICE).

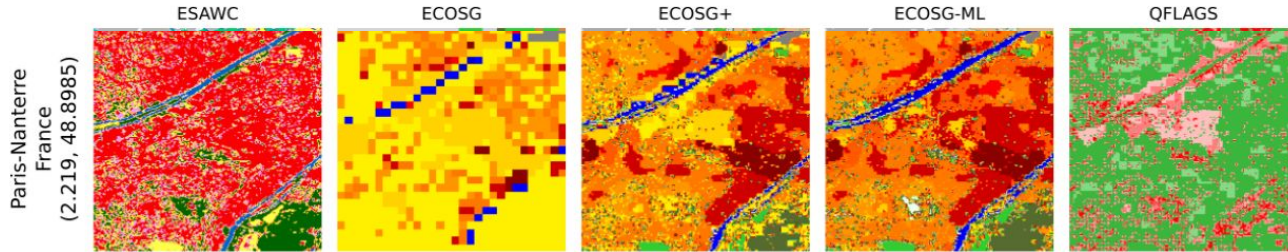
In parallel, documentation of new features and namelist settings is ongoing, i.e. contribution to SURFEX scientific and technical documentation.

As has been announced by Alexandre, to ease this process, the ACCORD SURFEX version has been frozen since cy49t. How to continue is currently under discussion.

How do we proceed with surface activities in ACCORD:

- **Physiography**
- **Physical processes**
- **Observations and data assimilation**

Next generation of physiography data is based on Machine Learning



Two ECOSG ML-based land covers are produced:

- ECOSG+: a multitude of input data is used through a decision tree, resulting in a map with different levels of quality.
- ECOSG-ML: a convolutional ML model is trained on the high-quality areas, and the trained model is used to fill the low quality areas.

The result is a ECOSG-like ML-based physiography at **60 m resolution**.

In the figure, physiography generated by these two methods are compared to ESA CCI landcover Word Cover map (ESAWC) and ECOSG, accompanied by a quality flag (QFLAGS). Links to documentation:

- Geoffrey Bessardon et al. (2024, [10.20944/preprints202409.0953.v1](https://doi.org/10.20944/preprints202409.0953.v1))
- Thomas Rieutord et al. (2024, [10.20944/preprints202409.0942.v1](https://doi.org/10.20944/preprints202409.0942.v1))

Next steps include a further evaluation of the ECOSG-ML map and to connect the ECOSG-ML map to parameter data of LAI and albedo.

Technically ECOSG-ML can be used by the SURFEX PGD step but the quality of the output is currently investigated.

[The work is going on at FMI and Met Éireann.](#)

This ECOSG-ML development will be presented in Bonn next week.

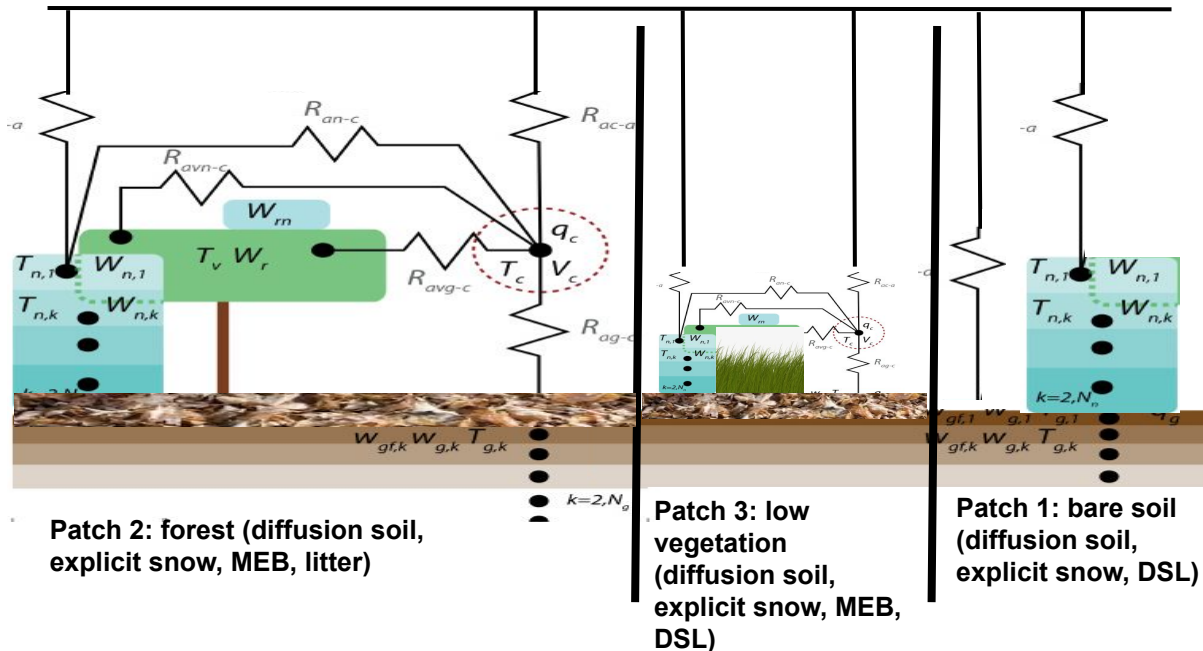
Multi-layer surface physics progress

ACCORD WW on multi-layer surface physics
at RMI in Brussels, December 2024



Adrien Napoly (GMAP, Météo-France)
Aaron Boone (SURFEX team, Météo-France)
Jan de Pue (RMI)
Samuel Viana (AEMET)
Patrick Samuelsson (SMHI)

We now go for 3 patches and MEB also for low vegetation...



Multi-layer surface physics progress

The conclusions from the Brussels WW is that we should aim for three patches with the following configurations:

- **All three patches**
 - [14-layer diffusion soil scheme](#) and [12-layer Explicit snow scheme](#).
 - We adjust the top 1 m soil thermal and moisture characteristics based on external [Soil Organic Carbon \(SOC\) fields](#).
- **Patch 1, bare soil, rocks and permanent snow**
 - We reduce the bare-soil evaporation by applying the Dry Soil Layer (DSL) parameterization.
- **Patch 2, forest**
 - We apply [explicit canopy \(MEB\)](#) in combination with a “lid” at the first floor ([the Litter parameterization](#)).
- **Patch 3, low vegetation (grass and crops)**
 - We apply [explicit canopy \(MEB\)](#) in combination with DSL (as for bare soil).

In addition a modification of the top most soil layers, utilizing the SOC concept, is under testing (see next slide).

This whole setup is under evaluation in ACCORD and by Deode. Earlier versions (2 patches) is used in CARRA2 pan-Arctic reanalysis and by MetNorway for their AROME-Arctic operational system.

Please note that the current cy49t2 code does not allow activation of MEB for non-forested patches. A PR to allow for this has been merged into [cy49t2h](#) and Deode code. Also, cy49t2 does not include the DSL scheme yet.

Multi-layer surface physics progress

The top most layers of the diffusion soil scheme has been identified to be too mineral-soil-like. Here we utilize the SOC parameterization to investigate the sensitivity. 1 out of 120 stations forced offline by Arpege near-surface data for August 2024:

SOC (default)

FracSOC*3 if FracSOC>15% for layers 1-2

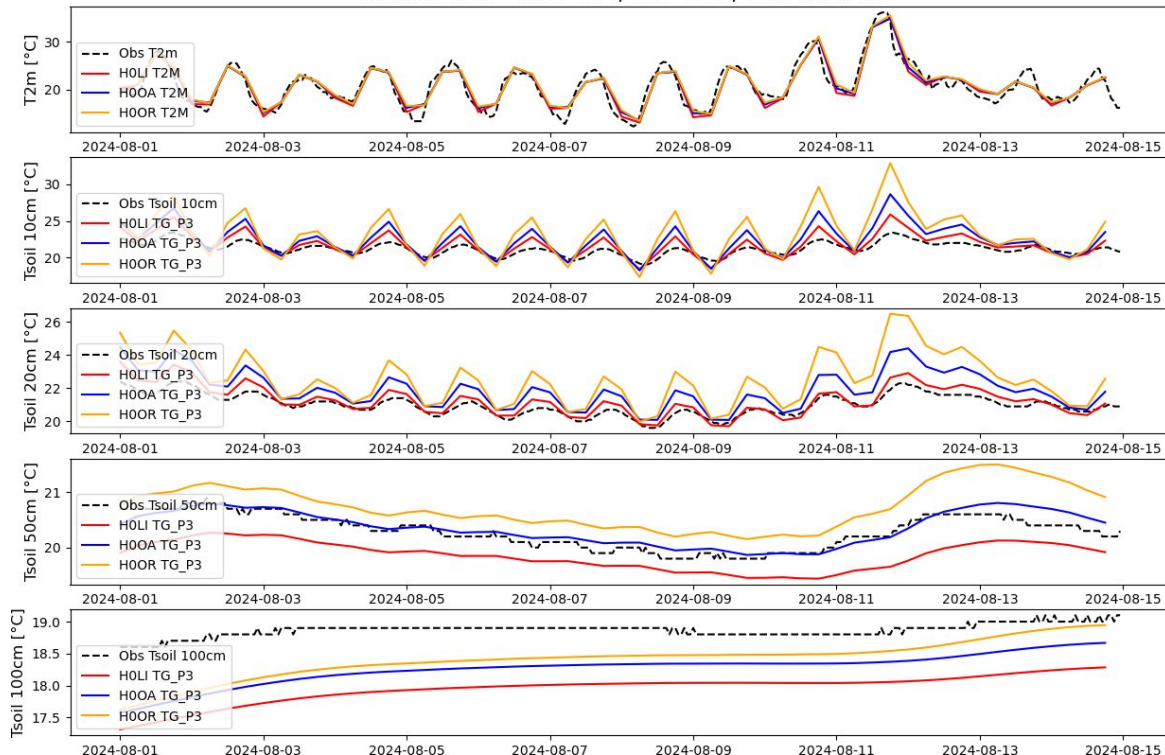
FracSOC=1 if FracSOC>15% for layers 1-2

Observed soil temperature

Note: no MEB used here yet.

Results and slide by Adrien Napoly and plot made by Junior Ngandjou (Météo-France/CNRM)

Station 153 - lon: -1.4, lat: 46.7, alti: 88.0 m



Surface data assimilation - overview

Operationally, **OI surface assimilation** is still our working horse in most setups with assimilation.

Circumstances decide how short-medium term solutions beyond OI look in our consortia:

Ensemble NWP system:
OI for soil with EPS-coeff.

Ensemble NWP system:
EnKF-based solution

Deterministic and Ensemble NWP system:
(S)EKF-based solution

Crowd-sourced focus:
TITAN/gridPP spatialisation

Less weakly coupled atm-surface assimilation

Two flavours of EnKF:

- the Ensemble Square Root Filter (EnSRF) by Abhishek
- the Local Ensemble Transform Kalman Filter (LETKF) by Åsmund.

Both in connection to multi-layer surface physics.

Methungary
by Helga Toth

2D-Var
2D-EnVar

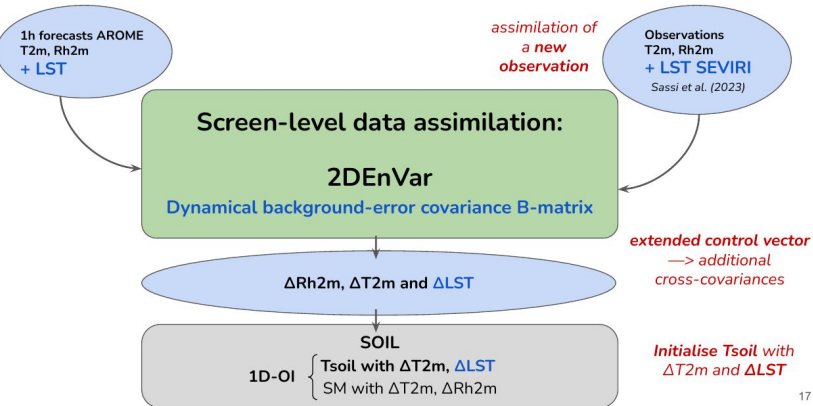
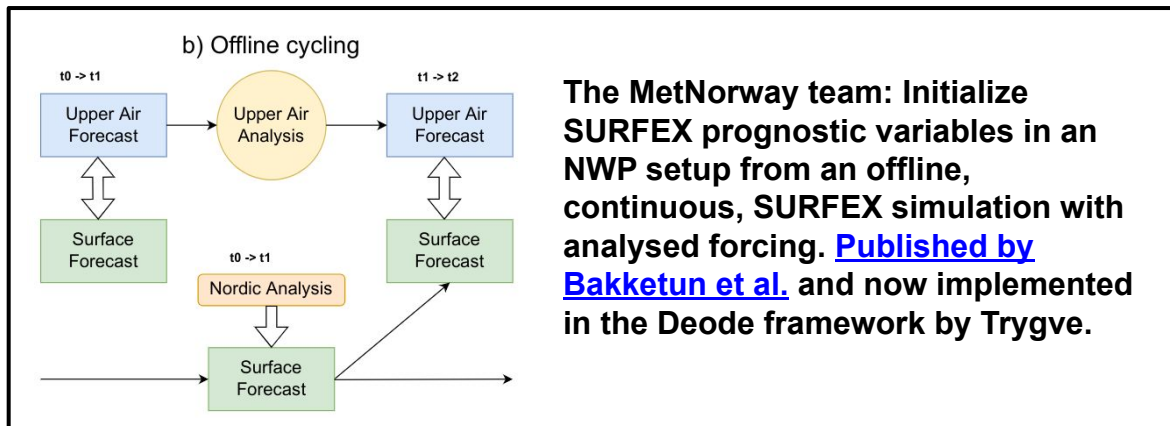
Météo-France
by Sophie Marimbordes et al.

Create a good initial state for the surface (before any additional surface DA) by forcing SURFEX by optimized/analysed forcing variables. By Trygve and Åsmund.

Surface data assimilation - autumn WW reports



Helga Tóth (HungaroMet) shows how ASCAT soil moisture product is assimilated by SEKF into their cy43t2-system with ForceRestore.



The Météo-France team: Further development of the [2D-EnVar system for surface analysis](#) (replaces CANARI) by inclusion of SEVIRI LST observations.

Sophie reports: Neutral to positive impact on forecasts with 2D-EnVar-LST compared to 2D-EnVar due to the cross-covariances allowed by 2D-EnVar.



THANKS!