

A Consortium for CONvection-scale modelling
Research and Development

Overview of ACCORRD surface activities

Patrick Samuelsson, 2026-04-15, All Staff Workshop, Marrakech, Morocco

ACCORD surface WW last May in Madrid



We were kindly invited by Samuel Viana and AEMET to enjoy a Working Week in Madrid, Spain.

It was a hybrid meeting with 10 participants on site and some 15 remote. [Link to wiki page here.](#)

The agenda included a number of presentations and some more deep discussions related to e.g. urban areas (invited local colleagues from Complutense University of Madrid), OSVAS, Analysed forcing, Multi-layer surface physics, ...



LACE ALARO-SURFEX WW last June in Prague



A Workshop was arranged in Prague last June devoted to the coupling of ALARO and SURFEX.

[Martina reported on the outcome of this Workshop](#) at the last EWGLAM/SRNWP meeting.

And progress since then will be presented in this session by Martina and Ján.

Autumn ACCORD Surface online Working Week last November

Eight sessions:

- [Surface data assimilation - current status and plans](#)
- [Tools for spinup and validation](#)
- [General SURFEX development](#)
- [Physiography](#)
- [Multi-layer surface physics](#)
- [Developments related to snow, sea and sea-ice, albedo](#)
- [Urban/TEB modelling](#)
- [Surface data assimilation - future plans](#)

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 CHMI in Prague in May



Czech Hydrometeorological Institute

Welcome to join the ACCORD Surface Working week at CHMI in Prague during the days May 18-22:

- **Plenum presentations in hybrid format.**
- **Working teams on different subjects with special focus on surface data assimilation.**

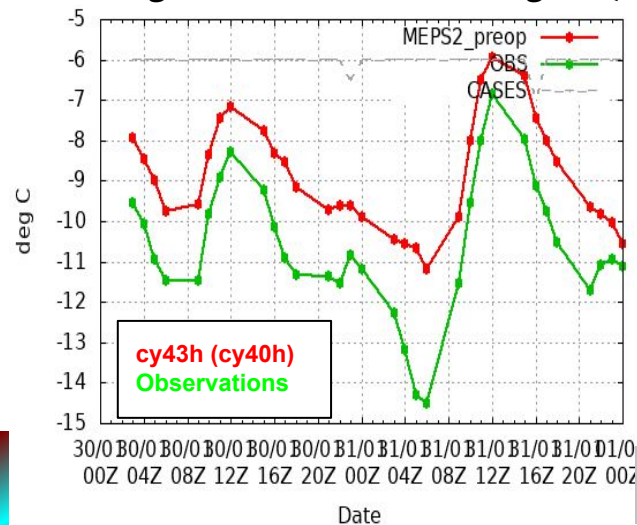
[See wiki for more information.](#)

Please sign up via the wiki.

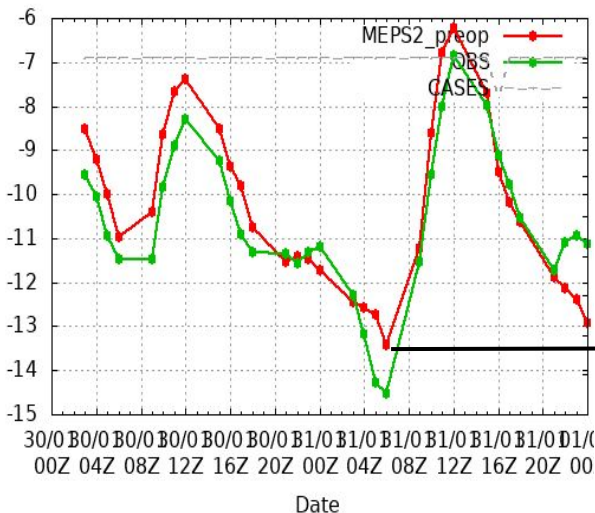
A case when T2m differs clearly between patches

A situation triggered by a combination of fluffy new snow, clear skies and low wind: SMHI forecasters complained on too warm HARMONIE-AROME T2m during January 30-31 2021. Time series of T2m (average of 18 stations) show a T2m_grid bias of 3 degC (locally up to 7 degC). Forecasters see T2m_grid! Okay, they can look into T2m_opl if they wish...

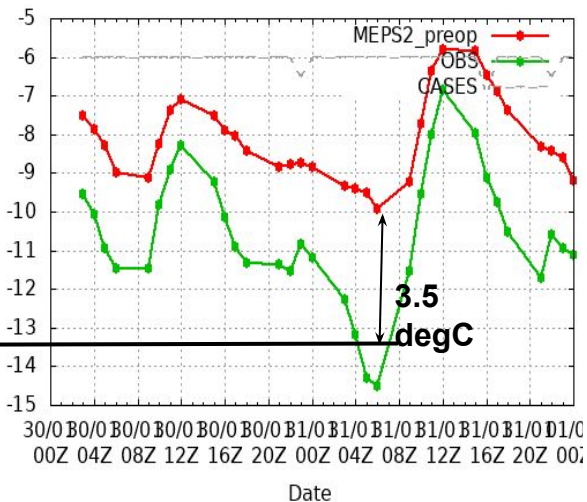
T2m grid (land) average
(seen by forecasters,
and goes into CANARI as first guess)



T2m open land (patch 1)




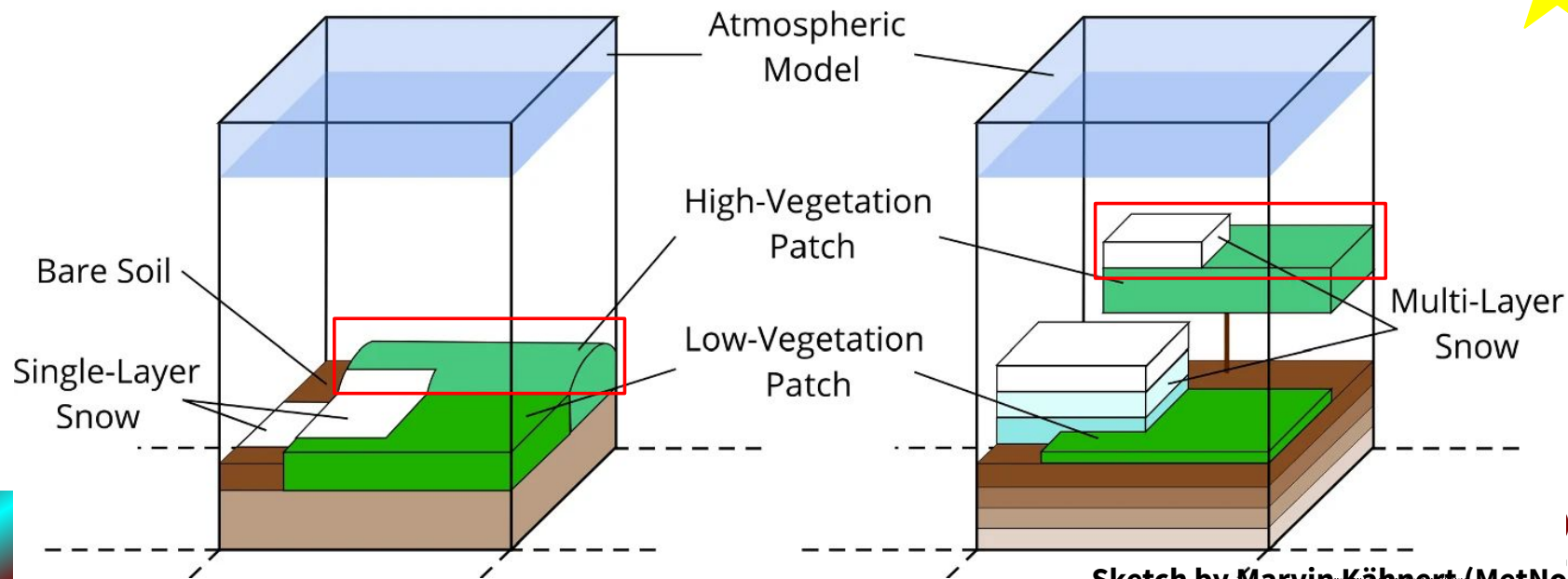
T2m forest (patch 2)



How the design of patches influences diagnostics

The described situation is represented by 2 patches and ForceRestore/D95 schemes.

In the case of 3 patches and MEB for forest and low vegetation the contrasts can be even larger. We should understand better how it affects surface DA and how we utilize/communicate diagnostics. 



Since CY50T2, SURFEX contributions are welcomed!

- Until recently, and since the release of CY49T1, SURFEX was frozen in IAL.
- By the release of CY50T2, SURFEX is externalised from IAL and is now placed in a separate repository: <https://github.com/ACCORD-NWP/SURFEX>
- This action is coordinated with the move of the official SURFEX team repository to GitHub.
- **And now, Pull Requests (PRs) to the NWP branch of SURFEXv8.1 [50T2](#) [develop](#) are welcomed!**



- **Adrien Napoly (Météo-France/GMAP) is new ACCORD coordinator of SURFEX NWP contributions. Any new PRs will be checked and merged by Adrien. Contributors are encouraged to suggest reviewers.**
- **The active SURFEX version used in your IAL experiment is defined in [bundle/bundle.yml](#)**
- **See this [presentation](#)/video by Adrien for more information.**

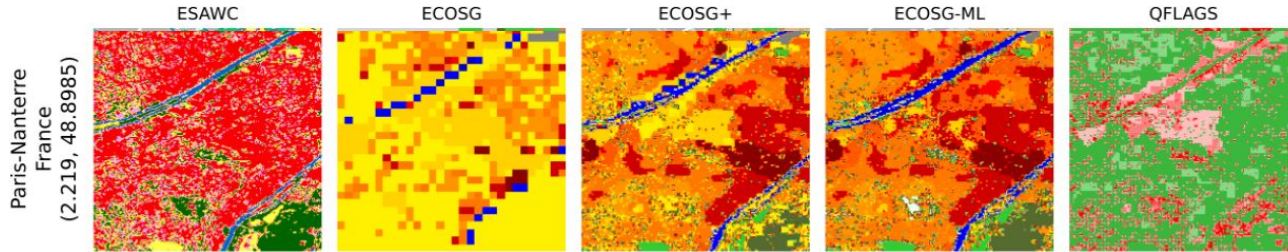
ACCORD SURFEX NWP contributions into SURFEXv9

- **Since May 2024, when initiated at the Kraków surface WW, the efforts to merge our ACCORD SURFEX NWP contributions into SURFEXv9 have been going on.**
- **A team of mainly Adrien Napoly, Patrick Samuelsson and Marie Minvielle have been active in the process.**
- **Current status is that >97% of the tests in the SURFEX testing tool STRATO are satisfactory and a release of SURFEXv9.2, including our NWP contributions, is quite near.**
- **However, quite some work and tests remain to finally couple SURFEXv9.2 to IAL:**
 - **Davai tests**
 - **ECOCLIMAP Second Generation**
 - **NWP mods of SODA surface data assimilation**
- **In parallel documentataion of our contributions is ongoing.**

How do we proceed with surface activities in ACCORD:

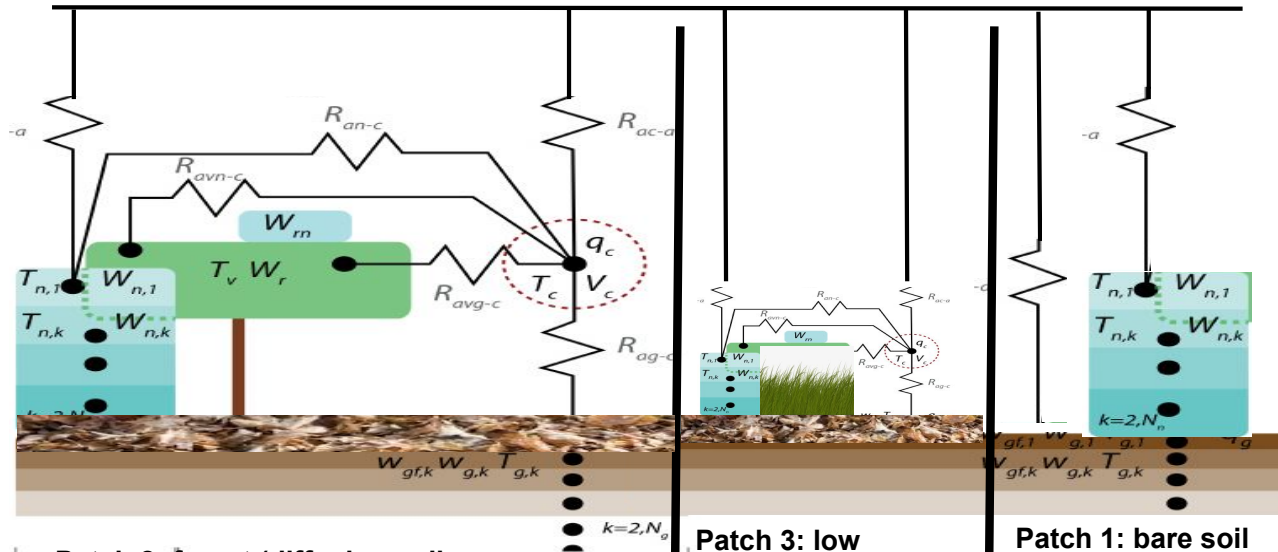
- **Physiography**
- **Physical processes**
- **Observations and data assimilation**

Next generation of physiography data is based on Machine Learning



- The ECOSG-like ML-based physiography at **60 m resolution** can now be applied in the Deode framework.
- New LAI, Albedo and Tree Height maps, collocated with the ECOSG-ML cover maps have been produced.
- An updated version of the ECOSG-ML has been published, produced with a re-trained deep learning model. [See publication here.](#)
- [For more info please refer to the autumn WW presentation by Panu Maalampi, Ekaterina Kurzeneva, Olli Saranko, Rudolf Mård \(FMI\) and Emily Gleeson \(Met Éireann\)](#)

Multi-layer surface physics progress



Patch 2: forest (diffusion soil, explicit snow, MEB, litter)

Patch 3: low vegetation (diffusion soil, explicit snow, MEB, DSL)

Patch 1: bare soil (diffusion soil, explicit snow, DSL)

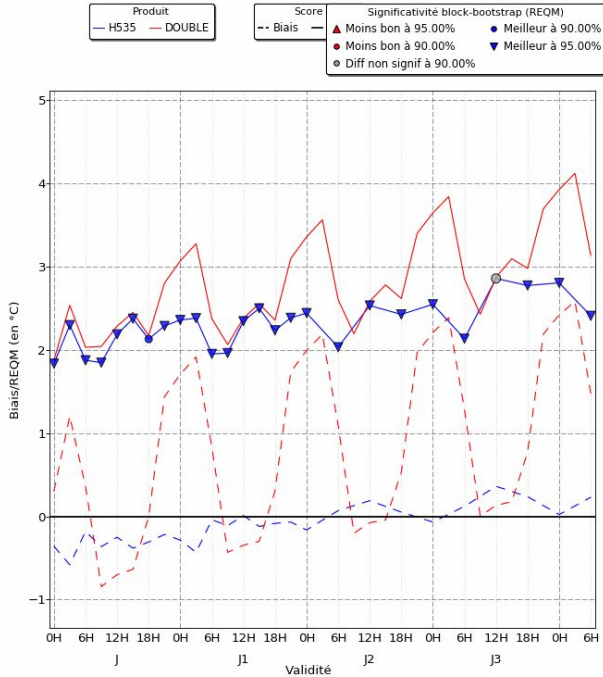
Slightly different versions of the multi-layer surface physics setup have been evaluated over quite some time now...

... and are also in use for a couple of high-latitude setups: CARRA2 pan-Arctic reanalysis and **MetNorway** **AROME-Arctic**, where it is operational since **September 2025** ([see presentation by Jostein Blyverket](#)).

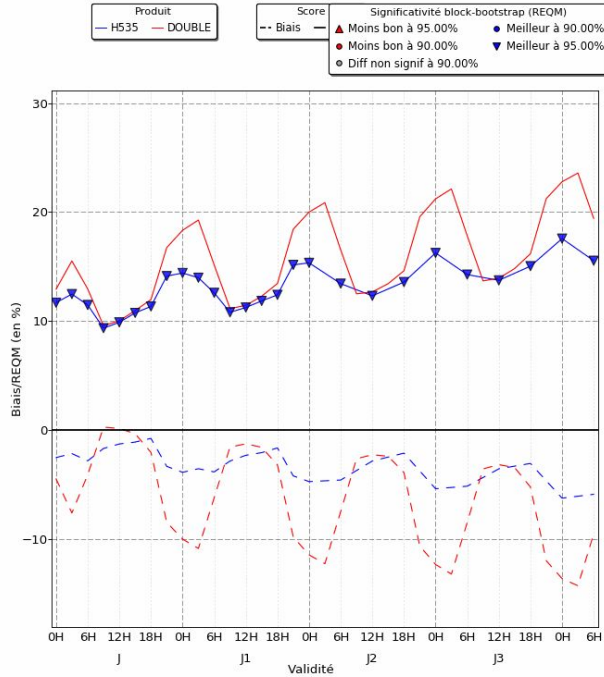
Multi-layer surface physics progress

T2M/HU2M bias (dashed) and RMSE (solid) over France JJA

Biais/REQM T2m -- du 03 juin 2025 au 31 août 2025 (89 jours)
Prod type ARPEGE 0H EURAT1520, réf. BDCLIM, contr. FRANXL



Biais/REQM Hu2m -- du 03 juin 2025 au 31 août 2025 (89 jours)
Prod type ARPEGE 0H EURAT1520, réf. BDCLIM, contr. FRANXL



Almost 1 year of Arpege-4DVar system (May 2025 to today):

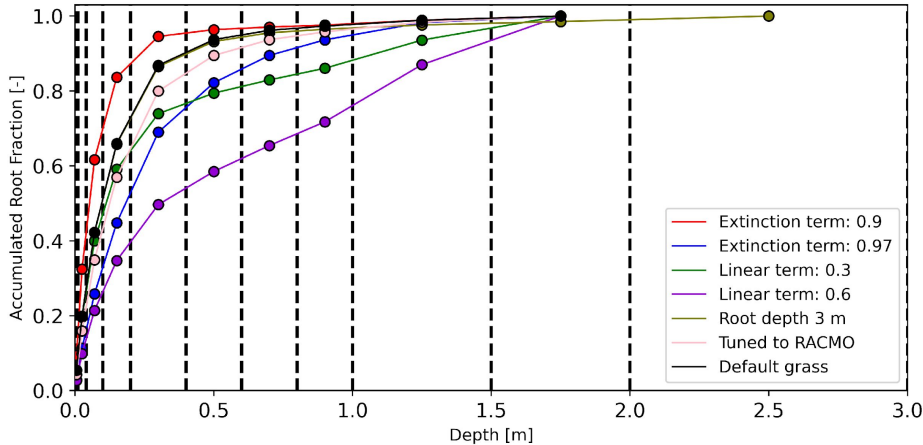
The figures show good results for the multi-layer surface physics in blue compared to the operational system (ForceRestore/D95) in red.

But there are also less good results, e.g. a cold nighttime bias in T2M over France during October - March. Over tropical regions some degradation compared to radiosoundings is observed.

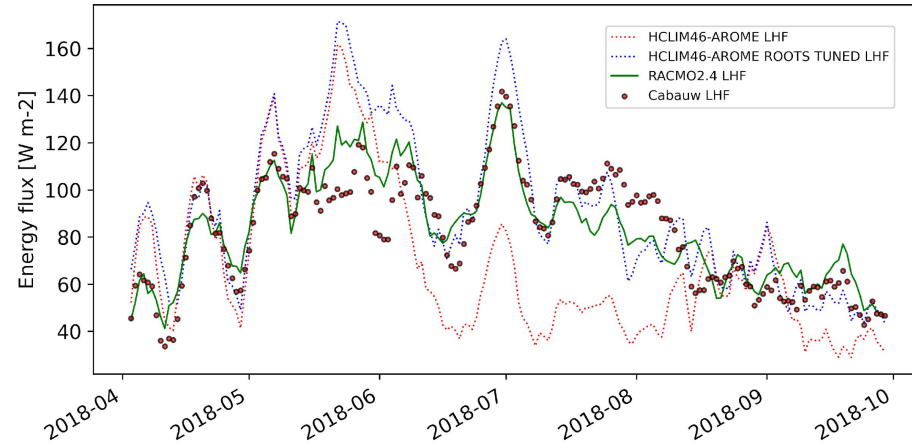
Results by Adrien Napoly

Multi-layer surface physics progress

Christiaan van Dalum et. al (KNMI) has investigated the role of root distribution. Here the default distribution of grass (black) is compared to a more linear distribution (green).



Compared to observed latent heat flux in the Cabauw tower (black dots), the default distribution of grass creates a more biased latent heat flux in HCLIM (red dotted) than the more linear distribution (blue dotted). Unfortunately, just adjusting the root distribution does not give the final solution...



Surface data assimilation

Sophie Marimbordes (Météo-France) successfully defended her thesis last year and here are two articles related to her work:

2DEnVar DA system (T2m, Rh2m)

Article published in the QJRMS DOI: <https://doi.org/10.1002/qj.4867>

“Towards a 2DEnVar surface data assimilation approach within the convective scale numerical weather prediction model AROME-France” Marimbordes et al. (2024)

2DEnVar gives equivalent results compared to OI, with even more details

2DEnVar DA system with the assimilation of the LST from SEVIRI + the extension of the control vector with LST

Article published in the QJRMS DOI: <http://doi.org/10.1002/qj.5021>

“Assimilation of land-surface temperature observations in a 2DEnVar surface data assimilation system with AROME-France” Marimbordes et al. (2025)

Positive impact on forecasts with 2DEnVar-LST compared to 2DEnVar due to the cross-covariances allowed by 2DEnVar

Surface data assimilation - future steps

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.

OSVAS - Offline SURFEX Validation System

OSVAS Steps:

1. Retrieve ICOS data & create the forcing files ([jupyter notebook](#))
2. Retrieve ICOS observations for validation ([jupyter notebook](#))
3. Run SURFEX OFFLINE (PGD, PREP, OFFLINE) ([SURFEX binaries](#))
4. Extract variables to validate from the model output ([nc2sqlite.py](#))
5. Run verification / validation tools (currently HARP) ([oper-harp-verif](#))
6. Visualize results (HARP's shiny apps) ([shiny web apps](#))

Good progress was made during the Helsinki WW last December.

Since then validation of the system has continued and Samuel Viana has now a student involved in future development.

A wide-angle landscape photograph showing a lush green valley filled with a mix of deciduous and coniferous trees. In the distance, a range of blue-toned mountains stretches across the horizon under a sky filled with large, white, fluffy clouds. A small body of water is visible on the left side of the valley. The overall scene is bright and vibrant, suggesting a summer day.

THANKS!