



# Highlights of the past year

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EWGLAM/SRNWP meeting, 27/9/2021

# Quite a few changes at HIRLAM management level

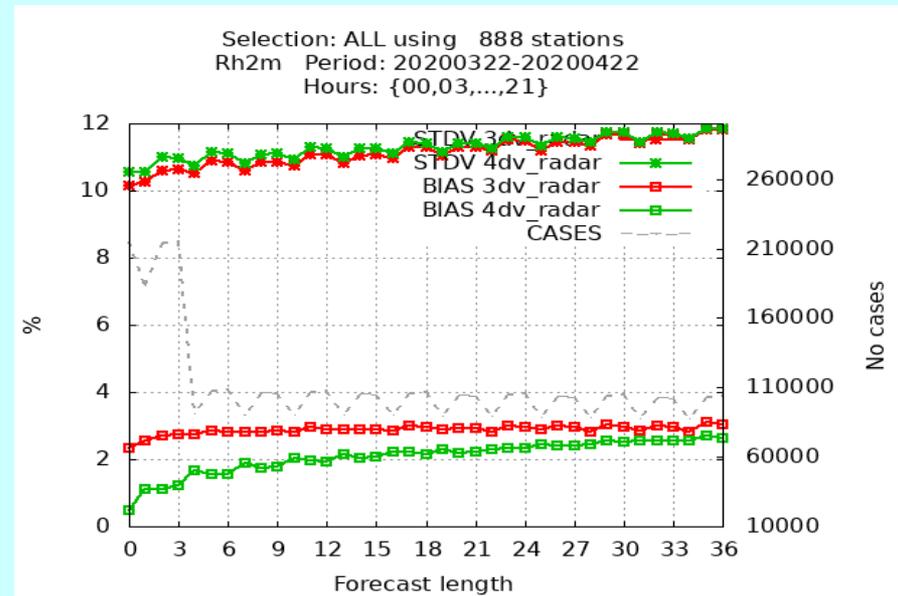
- Since January 2021, HIRLAM is part of the ACCORD consortium (see presentation Claude Fischer)
- The formation of the ACCORD MG and UWC-West MT led to several HIRLAM PL's changing position (Roger Randriamampianina, Patrick Samuelsson and Sander Tijm)
- New project leaders for HIRLAM:
  - \* Data assimilation: Magnus Lindskog
  - \* Physics parametrizations: Emily Gleeson
  - \* Surface analysis & modelling: Ekatherina Kurzeneva
- Project leader Bent Hansen Sass (Quality assurance) retiring at end 2021



# Developments in data assimilation algorithms and use of high-resolution observations

- 4D-Var readied for operations
- First setup for handling of cloudy radiances
- Intensifying work on better handling of observations (issues with bg statistics, VarBC, white/blacklisting experiences from re-analysis projects, supermodding, ...)
- Nowcasting: Preparing for sub-hourly cycling
- First Harmonie OOPS setup with 3D-Var, conv. obs. tested and working in pre-Cy46h
- Priority for coming year: creation of LAM OOPS and Harmonie DA tests, include 4DV and hybrid EnVar dev's in LAM OOPS.

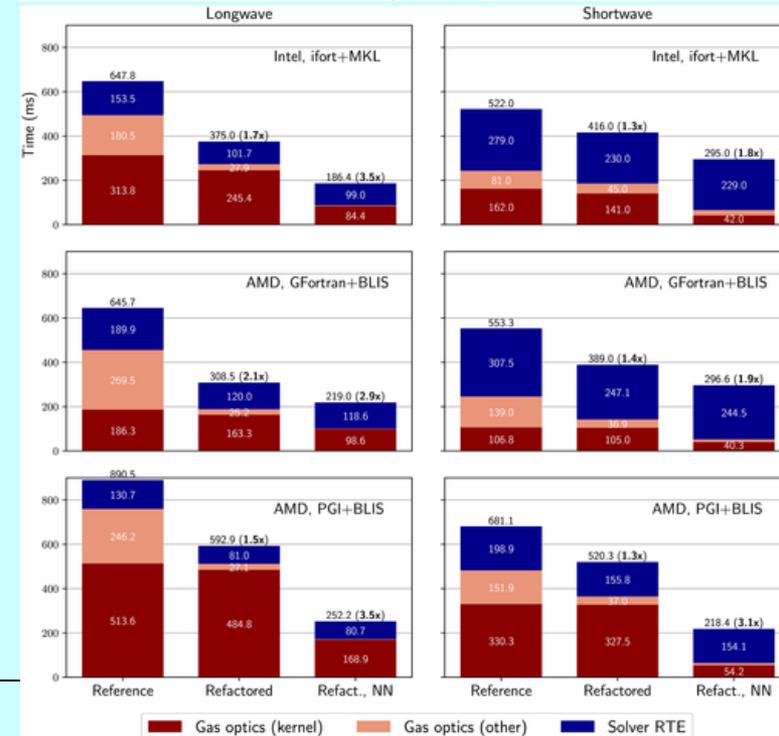
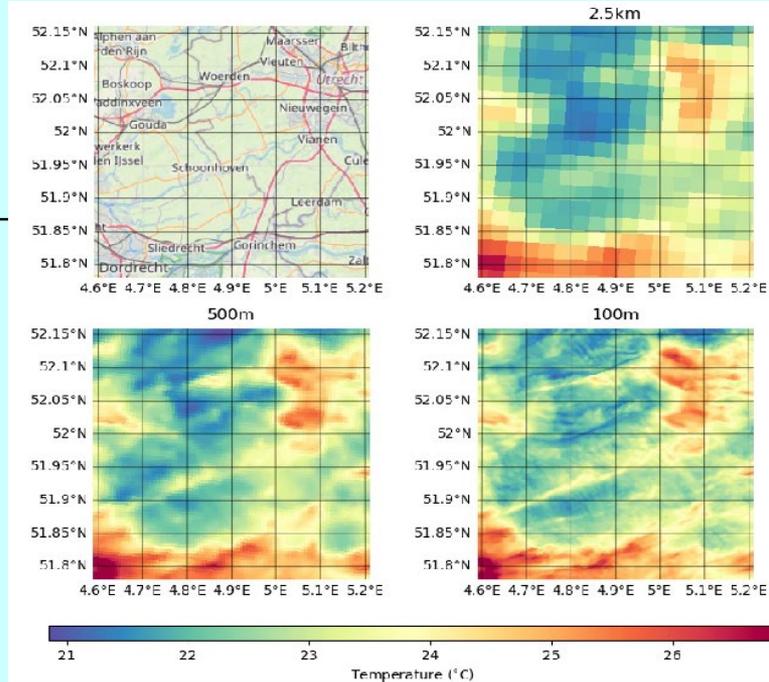
See presentations by Magnus Lindskog and Benedict Strajnar in the DA session



# Forecast model developments

- Implementation and testing of fog-related changes, use of NRT aerosol
  - Initialize with NRT aerosols from CAMS
  - CDNC profile in ICE3 microphysics and radiation
  - Activation parametrization
- Continued work to improve model representation of open cell convection
- Hectometric scale modelling
- First experiences with emulating part of physics scheme with machine learning

See presentations in Physics session and breakout session



# Surface analysis and modelling

- Testing SEKF + new many-layer surface physics, aim to include in Cy46h1: “still some kinks to be worked out...”
- Canopy roughness sublayer (RSL) model of Harman and Finnigan (2007) implemented
- Further machine learning work in MetEireann on surface characterization

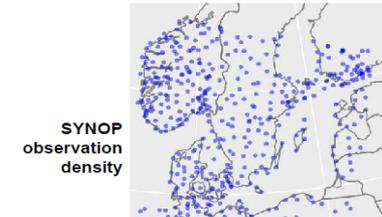
See presentations in Surface session and Surface and Machine learning breakout sessions

cy46h, based on pySURFEX, can now assimilate Netatmo crowd-source observations

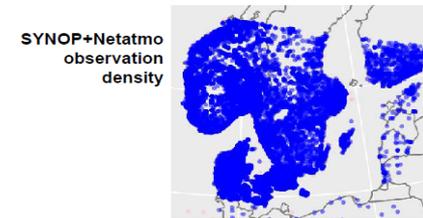
pySURFEX is a **stand-alone python(3) open-source** (<https://github.com/metno/pysurfex>) **interface to SURFEX/SODA**, developed by Trygve Aspelien (MetNorway), which enables e.g.

- Forcing file creation from AROME output (GRIB2NetCDF, FA2NetCDF if Epygram is available) Used in cy46h with SEKF for SURFEX offline perturbation runs needed by SODA
- GRIB, BUFR reading via Eccodes
- Observation quality control by open-source titanlib (<https://github.com/metno/titanlib>) Applied in cy46h on SYNOP and Netatmo observations
- Surface analysis by open-source gridpp (<https://github.com/metno/gridpp>) Used in cy46h for the OI surface analysis of T2m, Rh2m, snow depth needed by SODA

pySURFEX (and Netatmo) is currently used in MetCoop HARMONIE-AROME nowcasting setup



compared to



## Introduction of roughness sublayer in SURFEX

Currently in SURFEX the roughness length over forest is simply

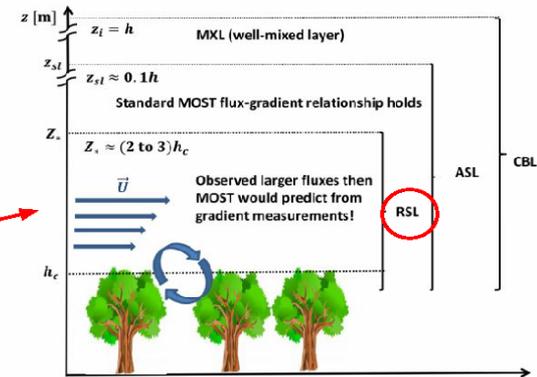
$$Z0_{for} = 0.13 * h_c$$

where  $h_c$  is height of trees. This gives e.g.  $z0=3$  m for  $h_c=23$  which **underestimates U10m over forest areas!** Currently in HARMONIE-AROME we tune tree height and limit  $z0$  do deal with this situation.

So, there is **no dependence of  $Z0$  on e.g. displacement height, LAI or stability...**

The characters of energy exchange above tall vegetation, in the **roughness sublayer (RSL)**, are extensively investigated and better formulations for roughness length and energy exchange do exist.

Currently Meto (SMHI) and Samuel (AEMET) are **implementing and testing the Harman & Finnigan (2007) RSL model in SURFEX**. More realistic roughness and energy exchange are expected.



# Ensemble forecasting

- Model perturbations: SPPT abandoned, focus fully on SPP. Paper under review. Work started on handling of correlated parameters, testing alternative pdf's
- Drying of perturbed members wrt control due to perturbations of soil moisture and their cycling => perturb in SWI space rather than WG directly.
- Start investigation of impact that ensemble generation techniques have on DA: sampling of climatological as well as error-of-the-day covariances.
- SP vs DP testing in EPS

See presentation by Inger-Lise Frogner in the EPS session

$$F2 = (WG2 - WILT) / (FC - WILT)$$
$$Rs = (Rsmin / LAI) * (F1 F2 F3 F4)^{-1}$$

Transpiration  $\sim 1/Rs$

Thus, low WG2, gives low F2, gives high Rs, gives low transpiration

Soil Wetness Index (SWI) has same formulation as F2. But  $0 < F2 < 1$ , while SWI can be negative or be more than 1.

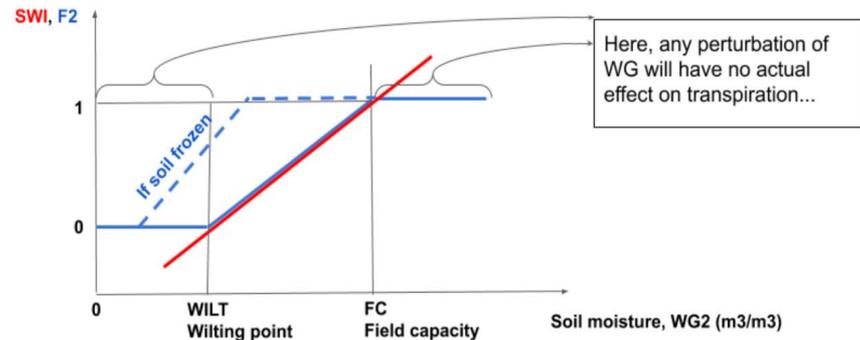


Figure: Patrick Samuelsson

# Harmonie Reference System developments

## Releases:

- \* February 2021: Cy43h2.1.1 (low clouds/fog improvements)
- \* Fall 2021: Cy43h2.2 (4D-Var; fog/radiation/precip improvements)
- \* July 2021: Cy46h-beta1.  
New components to be introduced in Cy46h:  
new surface modules and SEKF, changes related to use of NRT aerosol

## Other developments:

- \* Move to github repository, related tools
- \* Working on more continuous, distributed code integration and testing process in ACCORD
- \* Testing of single and mixed precision
- \* BSC assessment of Harmonie computational performance



# Towards joint operational production in United Weather Centers context



- UWC-West (Dk, Ic, Ir, NI): Preparing for take-off
- Joint NWP production on common machine in Iceland to start in Jan 2023
  - Contract for new HPC close to signature
  - UWC-West management team has started preparations for operational setup/procedures

UWC-East=MetCoOp:

First common hardware procurement for archiving

How to integrate into UWC: strategy discussions in coming year

Thank you for your attention!



Any questions?