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Research and Development

ACCORD contributions to SURFEX

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2022-04-12, SURFEX Steering Committee, Hybrid

ACCORD

A NWP community in Europe, and beyond, gathering 26 countries…

ALADIN
LACE
HIRLAM

http://www.accord-nwp.org/

Three NWP model configurations (CSCs):
AROME-France (t), HARMONIE-AROME (h), ALARO (t)

Status of SURFEX used:
cy43t: v8.0   cy43h: v8.1(HIRLAM)
cy46t: v8.0   cy46h: v8.1(HIRLAM)
cy48t: v8.1 (GMAP)   cy48h (common v8.1(?))
      ct49t/h: v8.1 (common v8.1)

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Common ACCORD NWP SURFEX repository in GitHub

A common ACCORD SURFEX code based on SURFEXv8.1 is available **since last week** under the ACCORD GitHub environment for the purpose to be a common SURFEX environment for ACCORD SURFEX applications and developers:

https://github.com/ACCORD-NWP/SURFEX-NWP/tree/ACCORD_NWP_v81

Acknowledgements to Daniel Santos (ACCORD System AL) and Alexandre Mary (ACCORD Integration leader) for the establishment of the ACCORD GitHub setup!

Acknowledgements to Klaus Zimmermann (SMHI) for help finding the **filter-repo** package used to clean the SURFEX git history (to **get rid of big files in the git history** which otherwise would prevent GitHub to accept a push).

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This **first version** is based on a **merge** between the **HARMONIE-AROME version of SFXv8.1** (branch SURFEX_NWP in the SURFEX repository used in cy43h) and the **AROME-France, GMAP, version of SFX8.1** (branch NWP_81plus in the SURFEX repository used in cy48t). The intention is that cy49t will be based on this common version.

Acknowledgements to Alexandre Mary and Adrien Naoply for the merging initiative. And to Adrien and Yurii Batrak for assistance in taking us through the merging process.

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Please note that **this repository follows the SURFEX offline directory structure** which is different from the ACCORD NWP structure. Thus, the integration of this offline structure and the NWP code structure is yet another challenge. ACCORD Integration leader Alexandre Mary and System Area leader Daniel Santos are working on the ECMWF bundle tool to build a cycle from different repositories.

Please note that the setup of this branch under the ACCORD GitHub environment is a **temporary solution** to allow for a smooth development environment for NWP colleagues. When the official SURFEX repository has later moved to GitHub this NWP offline SURFEX branch will be integrated there. In the meantime some careful synchronisation is needed between repositories.

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Current status:

- **The branch compiles and runs in the SURFEX offline environment.**
- **Applying the branch in HARMONIE-AROME cy43h environment reproduce both summer and winter performance compared to default cy43h setup (based on MetCoOp domain Monitor validation).**
- **In cy48t environment and AROME configuration: Goes through PGD and PREP steps but crashes in Forecast step (MASTERODB) for still unknown reasons. Need to be tested in ARPEGE too.**

Next steps:

- **Create a development methodology workflow in the ACCORD GitHub environment.**
- **Merge in SFXv8.1 development done by others (and also NWP development in older SURFEX versions that we wish to bring in) and later development in t- and h-cycles.**
- **To be used in the upcoming NWP SURFEX training week in Budapest/Hybrid in May.**

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The current content of the common NWP SURFEX version, in addition to the original SURFEX8.1 code, is e.g.:

- **ORORAD - Orographic influence on radiation processes.** *Submitted to V9DEV*
- **Toucans - Surface layer exchange processes related to the Toucans turbulence scheme.** *Submitted to V9DEV*
- **Sea ice schemes SICE (operational in HARMONIE-AROME) and modified Gelato routines to use openmp parallelisation (used in Arpege).** *See next slides*
- **OROTUR - Orographic induced drag (an additional CROUGH option).**
- **Improved FLake implementation and compatibility to latest Lake Depth Database.**
- **Open-land roughness adjustments needed for ECOSG activation.** *Published in ACCORD newsletter*
- **Corrected Rh2m diagnostics for below 0degC conditions.** *See next slides*
- **SODA adjustments to allow for NPATCH>1 and both D95 and ExplicitSnow snow assimilation.**
- **Single precision adjustments.**

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Sea ice code structure (both SICE and GELATO)

Now in object oriented format

abstract_ice.F90
ABSTRACT INTERFACE
  SUBROUTINE IINIT(THIS,
  SUBROUTINE IPREP(THIS,

seaice_gelato1d.F90
CONTAINS
  SUBROUTINE INIT(THIS,
  SUBROUTINE PREP(THIS,

seaice_sice.F90
CONTAINS
  SUBROUTINE INIT(THIS,
  SUBROUTINE PREP(THIS,

This structure is initialized and called as e.g.

init_seafluxn.F90
SM%S%CSEAICE_SCHEME = CSEAICE_SCHEME
SELECT CASE(SM%S%CSEAICE_SCHEME)
  CASE('GELATO')
    ALLOCATE(GELATO_t :: SM%S%ICE)
  CASE('SICE ')
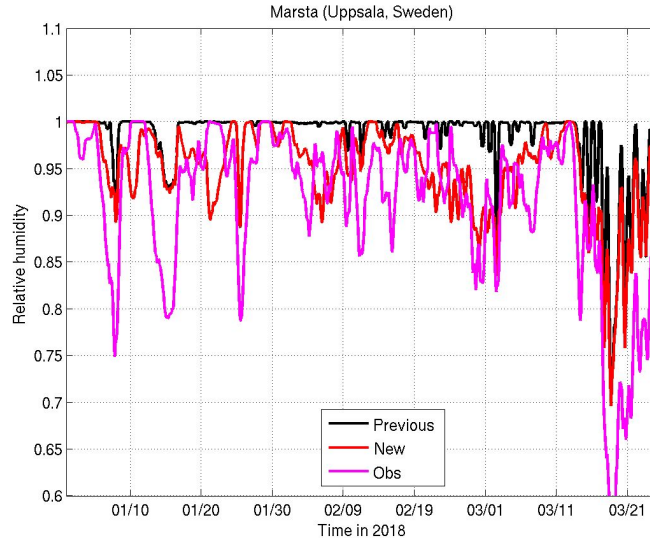   ALLOCATE(SICE_t :: SM%S%ICE)

CALL SM%S%ICE%INIT(HPROGRAM)

prep_seaice.F90
TYPE(SEAFLUX_t), INTENT(INOUT) :: S
CALL S%ICE%PREP

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Corrected Rh2m diagnostics

In SURFEX7.3 calculations of fluxes are wrongly all related to saturation humidity over water even if surface temperature is below zero. This has been corrected for in SURFEX8.1 but this correction also wrongly affected the diagnostic output of Rh2m (HU2M). With the change, HU2M became with respect to ice (for surface temperature below 0deC) while observations of HU2M are always with respect to water (WMO standard). Patrick has made a correction for this in cy43h/SURFEX8.1

Here is a test of the new HU2M formulation in offline SURFEX for the Marsta site north of Uppsala, Sweden. Observed tower data at 29 m has been used to force SURFEX. Simulated HU2M with old formulation (black), **new formulation (red)** and **observed HU2m (magenta)** is shown for the beginning of 2018. New formulation fits better with observations although still overestimated.

Marsta (Uppsala, Sweden)

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Ongoing NWP SURFEX developments

- **Roughness sublayer (Samuel and Meto)**
- **SURFEX on its way into ALARO (report by Bogdan Bochenek, LACE physics AL):**
  - **Investigation of the roughness length treatment in SURFEX revealed several inconsistencies between original ISBA implementation and SURFEX, as well as some bugs on the SURFEX side.**
  - **It also turned out that some tunable ISBA parameters, important for NWP, are hard-coded in SURFEX.**
  - **A modset correcting these drawbacks was prepared and partially validated.**
  - **There are still some issues to be addressed; the modset is intended for NWP commit.**
- **SODA/SEKF/Snow/LAI assimilation development (Åsmund, Helga, Stefan, Trygve, Balazs)**
- **SODA/EnKF assimilation development (Jostein)**
- **Reaching consistency of fractions in the CANARI/SURFEX/SODA framework (Katya)**
- **Connecting SURFEX/SODA to the pySurfex environment (Trygve)**
- **Implementation of 1-D ocean model GOTM into SURFEX (Yurii)**
- **Drip-irrigation using mulch plastic (Rafiq, paper under review)**
- **Complement of ECOSG parameters (albedo, LAI) at high latitudes (Bolli)**

Many testing efforts!

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What we miss now and hope to have in future:

- **Improved representation of glaciers**

- **Parameterization of wetlands: being developed at COSMO and ECMWF**

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A high-resolution version of ECOCLIMAP-SG

At last week's ACCORD All Staff Workshop Geoffrey Bessardon gave the presentation "**Plan for the production of a high-resolution version of ECOCLIMAP-SG**" and described the steps how this might be achieved. He suggests applying of different sources of information and ML.

Wish to emphasize: Geoffrey welcomes anyone who wishes to join him in this effort!

- **Software package development**
- **Share any national physiography datasets that you are aware of**

Please don't hesitate to contact Geoffrey.

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Projects on physiography supported by SRNWP

Sandro Oswald is working on corrections of ESA CCI dataset

Work on fine resolution Global Lake Database is ongoing

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Questions and comments

We need to continuously test the contributions to the common SURFEX NWP branch! Should probably be a combination of STRATO and NWP 3D tests… How to proceed? Should we build on STRATO? The testing procedure should be clearly documented for the developers. Also some automatic testing procedure of the branch should probably the there (as used in our NWP environment).

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ACCORD NWP SURFEX training in Budapest in May

We are kindly invited by OMSZ to enjoy a May week (9-13) in Budapest for our NWP SURFEX training. It is a hybrid meeting. **Link to wiki page here**.

The agenda includes a number of lectures, training activities and discussions on how to proceed with SURFEX for our NWP needs.

At the moment some 30 participants have signed up (10 on site). There is room for more participants, on site and virtual. Please sign up via the wiki page.

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