

SURFEX Steering committee  
6<sup>th</sup> meeting: 10 March 2016  
Toulouse/Brussels

*Participants:*

ALADIN: Rafiq Hamdi  
HIRLAM: Ekaterina Kourzeneva, Patrick Samuelsson\*  
Meso-NH: Jean-Pierre Chaboureau  
GMGEC: Bertrand Decharme  
GMAP: Yves Bouteloup  
GMME: Aaron Boone  
SURFEX team: Stéphanie Faroux, Patrick Le Moigne

(\* = expert)

Summary written by Patrick Le Moigne

**Meeting summary:**

Preparatory documents and presentations are available on SSC web page :  
<http://www.cnrm.meteo.fr/surfex-lab/spip.php?article55>

The snow research center (CEN) has been invited to nominate a representative to serve on the Surfex Steering Committee due to its growing activity on SURFEX. Marie Dumont is the CEN representative at the SSC.

**A. Summary of discussions:**

- Difficulties for new users to understand the meaning of all options and how to select the right ones for an application. A need to document the default values for all namelist options is required: the SURFEX team proposes the following preliminary solution consisting in putting listings of operational configurations on surfex website, in which all options would be written out. This concerns AROME, CNRM-CM, SIM, S2M (from CEN), HIRLAM, ALADIN and LACE (for ALARO).
- A list of contact person for each model part would help partners from HIRLAM and ALADIN consortia: SURFEX team will propose a list of people.
- Phasing issues related to the evolution of SURFEX trunk and the developments entering an operational cycle (AROME or HIRLAM for example) based on an older SURFEX version. SSC agreed that there is a need to document the developments made for operational purposes and make them available for everyone: this is under the responsibility of people involved in operational applications.
- There is then a need to phase these developments with the future official SURFEX version. SURFEX team explained that there is no automatic transfer from operational SURFEX code to SURFEX repository, on the contrary, the correct way to do is first to go through SURFEX official release and if a development is made after then it has to be phased by the developer for the future official SURFEX version.
- This is typically the case for a specific treatment that has been introduced into operational AROME. The ORORAD module (shadowing, slope aspects due to orography) should be phased for next official SURFEX version. This work has to be coordinated with the solution proposed by CEN for the same treatment.
- How will the ongoing work on coupling ARPEGE with SURFEX impact the ALADIN applications which coupling files depend on ARPEGE model? GMAP ensured that the use of SURFEX won't affect the ALADIN partners, at least at the beginning: tools will be developed to make it transparent for partners.
- Sea-ice modelling was discussed. A simple ice model was developed in HIRLAM (SICE) and will be available in the next SURFEX release. HIRLAM would like to restart work on HIGHTSI (another ice

model developed at FMI) to implement it in SURFEX. It was proposed first to evaluate the performances of GELATO-1D already available and validated in SURFEX v8. Even if GELATO-1D offers the possibility to distinguish a lot of ice species and may seem complex at first look, it offers the possibility (via a configuration file) to be run in a simple way, ready to fulfil operational goals. SSC agreed that GELATO-1D would be studied in HARMONIE before thinking of the implementation of a new sea-ice model.

- HIRLAM wondered if any developments on glaciers were planned on the French side. Since such kind of developments are not identified, the SSC encouraged HIRLAM to promote development of such parametrizations.
- The work planned at GMME and consisting in adding a mass balance for lakes raised an interest also on HIRLAM side since SMHI hydrologists are also interested in working on lakes height: this could be another axis of collaboration.
- Some technical issues have been reported by ALADIN/ALARO or HIRLAM colleagues. Some are linked to the full coupled configuration like ALARO-1/SURFEX and some to more specific SURFEX issues like for example the problem of interpolation of Clay and Sand fields experienced by E. Kourzeneva. SURFEX team had already encountered the problem and will discuss solutions with E. Kourzeneva.
- In order to improve communication and collaborations on SURFEX activities, the SSC agreed that a 2-day international workshop (HIRLAM proposal) on SURFEX could be organized (every 2 years) in Europe. Such an organization relies on fundings that need to be found first.

## **B. Presentation of the SURFEX team report**

### **1. Status of v8**

All new developments that were presented during last SSC are now part of SURFEX v8. They were introduced incrementally by the developers and validated using the automatic test database. There's a need to reinforce this validation phase to ensure reproducibility of results from one version to another. For that purpose, and following the recommendations of the SSC, each modification will be more carefully looked at by SURFEX team and documented by the developers.

Coupled mode runs are now performed to finalize the v8 validation. The v8 was satisfactorily tested in AROME and Meso-NH model. There are however remaining issues for some CNRM-CM configurations, which are a prerequisite for an official publication of the version. Publication as Open Source is expected before summer.

An effort of documentation is asked to developers. Indeed, the scientific documentation should be ready for Open Source publication. The topics to be documented include features from **ISBA** (parametrization of organic matter and permafrost, multi energy budget (MEB), new diffusion scheme ISBA-DIF, snow scheme ISBA-ES, new vegetation radiative transfer module – new ISBA-Ags settings), **SODA**: data assimilation, **TEB** (Building Energy Model, irrigation of gardens in town, solar panels on roofs, module of comfort indices in town, ventilation in buildings), **CROCUS** (New snow metamorphism scheme and new radiative transfer model (TARTES)), **GELATO-1D**: sea-ice model

The contributions are expected to be sent by 15<sup>th</sup> June 2016 and the documentation to be ready for this summer.

### **2. Status of SODA: assimilation in SURFEX**

The SSC agreed previously that SODA should be the target for assimilation in SURFEX. GMME has abandoned VARASSIM and is now using SODA and V8 for surface and soil analyses purposes. SODA and OI\_MAIN still co-exist and there doesn't seem to be room in the GMAPs calendar to. SODA contains now all the functionalities of OI\_MAIN and SODA, but these functionalities and the efficiency of the code remain to be tested.

The plans for the future are :

- GMAP agreed to test SODA instead of OI\_MAIN after V8 is in an official atmospheric cycle.

But GMAP is currently involved in using ARPEGE coupled to SURFEX, and there doesn't seem to be room to test SODA within the operational environment. The operational OI\_MAIN (named OI\_CONTROL btw) has already evolved at GMAP. On the HIRLAM side Trygve Aspelien modified CANARI (2m temperature increments for open-land in HIRLAM system): this is an ongoing development that will be evaluated in pre-operational mode.

The OI\_MAIN part of SODA won't be maintained anymore in future SURFEX releases.

A need of a contact point for SODA was identified by the SSC: C. Albergel (GMME/VEGEO) will be proposed to be the contact point and to participate to next SSC as expert on assimilation.

### 3. Next SURFEX releases

After v8 official publication, a cleaning cycle v8.1 will be prepared where only technical aspects will enter. These technical developments concern the optimization and parallelization of PGD and PREP made by Stéphanie Faroux. The implementation of a GMAP's solution to optimize PREP based on FULLPOS will also enter even if it will be abandoned later on. It will also account for developments from LA for Meso-NH model.

The XIOS IO server was phased and validated on v8 (GMGEC) will be part of the v8.1.

A cleaning of options, following recommendations of SSC5, will be done. A group composed of S. Faroux, Y. Seity, B. Decharme and P. Le Moigne will take care of this action.

OpenMP will be removed from the off-line driver.

The use of TYPE as argument will be extended to the whole code by S. Faroux, in order to improve readability of the source code.

### 4. Databases

ECOCLIMAP-SG: in order to replace ECOCLIMAP, Météo-France is developing a strategy to build a new database relying on operational products (mainly COPERNICUS). Hence it is envisaged to base this new map on the ESA-CCI land cover map ( <http://maps.elie.ucl.ac.be/CCI/viewer/index.php> ) and automatic transformations to easily update the map when ESA-CCI updates are published. The use of ESA-CCI corrects some errors in the position of rivers. In order to strengthen the product, co-operations within the SURFEX community will be searched (it is anticipated that the completion of this task will take 3 years).

Lake database: a new version GLDB3 is available (thesis of Margarita Choulga) and support is needed for the maintenance of this database after the completion of the thesis. Probably SRNWP will support this action for one more year.

### 5. Need for communication and documentation improvements

The present state of the documentation may be sometimes confusing for new users, as some options can be present in the documentation, but are not tested in all configurations (offline /coupled, ...). In addition, the defaults values need more explanations (is the value realistic or not?) Several ways of improvement were discussed and the conclusions are summarized below :

- Create a new section of the website with namelist for typical configurations of the code, including comments.
- Complete the documentation, by justifying the default values in the namelists, where appropriate.
- Add a section with contact points for specific sub-models.
- Add information on the code structure (HIRLAM is developing a tool that can be used for that purpose). Consider a dedicated course on code structure and development within SURFEX.

## C. Review of activities and plans (see complete presentations in surfex-lab)

### SURFEX team

- The v8 of SURFEX is almost finished, publication expected in summer.
- The v8 will be open-source.
- Scientific documentation needs to be updated
- Plans are to move from svn to GIT after version 8.
- The next v8.1 has already started.

#### **ALADIN**

- Austria: currently working on SURFEX within CY40T1. Need of SODA contact point.
- Portugal: run AROME with ECOCLIMAP including lake Alqueva.
- Hungary: evaluation of ALARO coupled SURFEX on 2m-temperature using different SBL parametrizations.
- Belgium: PhD of A. Duerinckx (EKF and 3dVar assimilation in ALARO). SODA with CY38 works technically but not the Offline. STAEKF introduced in CY36T1 (remaining bugs). Ongoing work on ALARO-1 with Toucans: to be introduced after v8.1 of SURFEX.
- ALARO1-SURFEX was worked on during the HIRLAM/ALADIN/LACE System working week in Bratislava 11/2015

#### **HIRLAM**

- Soil and vegetation: use of 2 patches for HARMONIE. The ISBA part of SURFEX v8 is implemented in a development version of CY40h. Will be used for tests and development of soil DIF and snow 3-L options in combination with EKF. Issues related to permanent snow/LAI/clay/sand/albedo over Iceland in ECOCLIMAP/PGD are worked on by Icelandic Met Organisation.
- Work on snow modelling and DA – COST Harmosnow action – DA coop with NILU – Assimilation of AMSR2 brightness temperature to derive SWE
- SST and sea-ice: use HIROMB instead of OSTIA over the MetCoOp domain – The simple SICE model is running operational over the MetCoOp domain since cy38h – HIGHTSI modules will be considered for SICE
- Lakes: new lake database GLDBv3.1 – DA over lakes ongoing
- Urban modelling: flux compares well but problem during snow events where snow in TEB has too high albedos. Test of BEM in HARMONIE setup over Stockholm is considered
- Physiography: orographic radiation – Use of finer resolution input data in ECOCLIMAP – Interpolation for clay, sand and lakes can occur (depending on resolution of target grid)
- Documentation tool being developed

#### **MESO-NH**

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#### **GMGEC**

- SURFEX v8 in CNRM-CM6 contains FLake, ECUMEv6, GELATO-1D, ISBA-DIF-ES, ISBA-Ags-CC, coupling with OASIS3-MCT, TRIPv2
- In progress: XIOS server, land-use, fire forest model, nudging for superficial soil moisture and snow mass
- future plans: evaluation of MEB at a global scale, etc.

#### **GMME**

- Hydrological processes: new SIM chain with SURFEX v8 – flash flood prediction (TOPODYN): development of a probabilistic version (perturbed initial soil moisture conditions and parameters)
- Soil vegetation processes: MesoNH works with ISBA-DIF – SURFEX v8 soon available in official MesoNH version. – MEB available in SURFEX v8, validated over forests. – ECOCLIMAP-SG based on ESA-CCI where COVERS will be replaced by vegetation types.
- Lakes: coupling with ISBA-ES – add prognostic mass for lakes.
- Urban processes: urban hydrology – trees along roads – BEM (Building Energy Model)
- SODA works with ISBA-DIF – assimilation of satellite-based surface albedo
- offline reanalysis: LDAS-France being recoded in preparation of LDAS-Monde global application – fine scale runs over Europe (UERRA project) including ISBA-TRIP routing model – global offline runs in the frame of GSWP3

#### **GMAP**

- Operational systems in March 2016 : CY41T1\_op1 with SURFEX V7.3+. Next operational suite beginning 2017 with CY42\_op1 with SURFEX V7.3+. Plans to use CY43T1 with SURFEX V8.
- Work on PREP/FULLPOS will enter SURFEX v8.1
- 4D-VAR with SURFEX is being validated.
- Coupling files for LAMs using ISBA will have the same format when ARPEGE will be coupled to SURFEX (need to develop converting tool)
- Remaining issue: how to produce a surface file for a LAM using a SURFEX v(n-1) or older from a global surface file produced by ARPEGE/SURFEX v(n) ?

## **CEN**

- SYTRON snow transportation by wind scheme
- MEB-Crocus coupling
- New snow netcdf outputs and diagnostics with snow layer dimension
- Multi-physical simulations for Crocus
- Implementation of the radiative transfert scheme ATMOTARTES for the atmosphere and prognostic snow impurity content (no scavenging)
- Crocus-resort : include grooming effect and artificial snow production
- Adaptation of Crocus to Dome C snow conditions
- Implementation of Richard equation for liquid water percolation in Crocus
- Implementation of new sets of physical properties for falling snow -
- Implementation of a numerical representation of icing events in Crocus
- Implementation of the snow mechanical stability analysis scheme MEPRA in SURFEX