

SURFEX Steering committee
5th meeting: 2 April 2015
Toulouse/Brussels

Participants:

ALADIN: Rafiq Hamdi, Piet Termonia (ALADIN Program Manager)*
HIRLAM: Ekaterina Kourzeneva
Meso-NH: Jean-Pierre Chaboureau
GMGEC: Aurore Voltaire
GMAP: Jean-François Mahfouf
GMME: Aaron Boone
SURFEX team: Stéphanie Faroux, Patrick Le Moigne*, Eric Martin

(* = expert)

Summary written by Eric Martin

Meeting agenda:

- 1) Transversal subjects :
 - a. Status of V8
 - b. Status of code optimization
 - c. Status of assimilation in Surfex (SODA, OI_main, VARASSIM)
 - d. Physiography (HIRLAM initiative, ECOCLIMAP-SG status)
 - e. FA files
 - f. Needs for documentation and communication improvements
 - g. Fortran 2003 structures in surfex
 - h. Content of the next version and organisation of the development
- 2) Review of activities and plans

Meeting summary:

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

1. Transversal subjects

a. Status of V8

All new developments are now entered in the code and were validated by the developers using the automatic test database.

The entire code is currently modified (semi-)automatically by the CERFACS in order to remove the global variables. After this transformation, the code will be ready for tests in coupled mode, before official publication. Publication is expected in summer or early autumn. V8 will be open source. See annex for a summary of the main changes in V8.

b. Status of code optimization

The optimization discussed at the last SSC, and additional developments by Stéphanie Faroux are in V8 (monoprocessor). In the meantime, GMAP (Philippe Marguinaud) and the Surfex team (Stéphanie Faroux) worked on the parallelization of PREP and PGD. Meso-NH worked on the parallelization of PGD and PREP in the case of nested atmospheric models (prep_real_case, prep_pgd and prep_nest_pgd).

GMAP coupled FullPOS and PREP, taking advantage of the parallelization of FullPOS. The performance are compatible with the operational constraints. The main advantage is the coherency with the tools already used in NWP. Some problems appeared in case of land/sea mask or orography changes between the two domains. These improvements were tested over France and were satisfactory, but may be not general enough to cover all the needs.

The Surfex team developed a parallelization of PGD and PREP using MPI and open-mp locally. The routines developed to distribute the grid points for OFFLINE were re-used. The MPI commands were used to read the files and for horizontal interpolations. This new implementation was tested in one typical NWP case and one global climate case with significant improvements. It is planned to introduce these changes in a forthcoming Surfex version. The use of the external I/O server XIOS may be a solution to speed up the I/O. This solution will be tested later (the coupling with XIOS will be available in the V8).

The parallelization developed by Meso-NH uses the parallelization of the atmospheric component of the model and has been tested in few typical cases for this model.

The participation of people from the ALADIN consortium (already involved in the previous set of improvements) into this action for further testing and evaluating the performances of the new codes under various conditions are very welcome.

Piet Termonia will evaluate the interest and possibilities for the ALADIN consortium to put resources on the understanding and testing of the optimized PGD and PREP. Technical contact at MF are Stéphanie Faroux and Philippe Marguinaud.

c. Status of assimilation in Surfex (SODA, OI_main, VARASSIM)

Last year, the SSC agreed that SODA should be the target for assimilation in SURFEX, but a lack of manpower prevented the various teams to achieve this goal rapidly. In V8, SODA, OI_main and VARASSIM co-exist. Thanks to Stéphanie Faroux and Tygve Aspelien, 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 as soon as V8 is in an official atmospheric cycle.
- GMME agreed to move from VARASSIM to SODA once a current work on Ekf is completed.
- ALADIN already uses SODA (PhD thesis of Annelies Duerinckx) and plans to introduce the newly developed STAEKF in a forthcoming version of SURFEX.

d. Physiography/topography

HIRLAM/SRNWP initiative : a web meeting was held in December 2014 to discuss possible actions. In particular, a dedicated website and a reactivation of the SRNWP surface expert group are envisaged. In parallel, HIRLAM is improving the lake database (thesis of Margarita Choulga) and support is needed for the maintenance of this database after the completion of the thesis.

ECOCLIMAP-SG initiative : 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).

e. FA files

Last year the SSC noted that the FA files implementation in SURFEX was not coherent with the FA files implementation in atmospheric models. Indeed, this situation is temporary. GMGEC and GMAP agreed to a unique implementation, based on the GMAP solution. The name of variables are now unified, the effective convergence will occur once GMGEC will update the climate model. Then the corresponding modifications will have to be reported in the SURFEX code for offline runs.

f. Needs 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 :

1. Create a new section of the website with namelist for typical configurations of the code, including comments.
2. Complete the documentation, by justifying the default values in the namelists, where appropriate.
3. Add a section with contact points for specific sub-models.
4. 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.

g. Fortran 2003 structure in Surfex

The SSC discussed the proposed implementation of a limited number of F2003 structures in Surfex, for new developments (point proposed by Ulf Andrae) and already agreed in a IFS-ARPEGE meeting for the atmospheric part.

Extract from the meeting minutes :

“EC, MF and Aladin/Hirlam to check the two new F2003 features promoted by Hirlam (Surfex code so far) and MF (pointers in functions). Disseminate the examples to all partners and check whether these features can be implemented (with a target for after CY42 ?). Note for Aladin: specific inquiry by the network coordinator (ACNA). => *there were two new sets of F2003 features proposed for acceptance: Pointer in Function (MF) and standard object-oriented statements (CLASSES etc.) (Hirlam). Both eventually have been found acceptable from CY43 onwards. **For the general object-oriented F03 statements, we have set the restriction that they should not be used to recode existing IFS-Arpege-LAM codes, but only for coding new features. Also, they should not be mixed up at the data assimilation / model control level with the OOPS C++ approach.*** Action closed.”

The SSC agrees the proposed used of F2003. The following remarks emerged from the discussion :

Meso-NH suggests to test the efficiency of the new pieces of code before implementation, to test the code on new compilers to increase portability and point out that the instruction “CONTIGOUS” from F2008 increases significantly code efficiency for array arguments in subroutines.

The question of the homogeneity and readability of the code as well as maintenance should be evaluated if the introduction of this new features occurs in large parts of the code.

h. Contents of the next version of the code and organisation of developments

The SSC has agreed to give priority to maintenance and technical issues for the next version. In the mean time, it appeared that the organisation used for the preparation of the V8 did not guaranteed a clear visibility of the main development branches to developers (multiple branches).

The SSC agrees to :

- Give priority to the code maintenance (removing of old options, checking the coherency of namelist options, ...) to allow an easier use of the code. This will be organized by setting up a group to check the different options and parameterizations in order to select the part that will be removed.
- Continue the same organization for the phasing of the developments. According to a HIRLAM suggestion, the main development branch will be the trunk to increase the visibility of the process for all developers (official versions will be tagged or consist of small branches that include the bug corrections).

A list of scientific and technical modifications will be made later. Below is a preliminary non exhaustive list :

- Simple ice scheme
- coupling with a wave model
- TOUCANS stability functions
- TEB hydrology
- land use changes
- STAEKF
- Parallel PGD/PREP

2) Review of activities and plans (see complete presentations in surfex-lab)

Surfex team :

- The V8 of SURFEX is almost finished, publication expected in summer or early autumn. The V8 will open-source.
- Plans are to move from svn to GIT soon after version 8.
- PGD/PREP have been parallelized. Additional tests are needed before introduction in an official version.
- Preliminary work on ECOCLIMAP-SG.

ALADIN

- Austria is currently working on Surfex within CY38t1.
- Assimilation : a paper was published on the EKF for soil analysis in SURFEX/V5 (GMD), a paper on SURFEX EKF and 3dVar atmospheric assimilation is scheduled in QJ.
- SURFEX has been successfully coupled with ALARO-1 and the TOUCANS stability functions are introduced in SURFEX V7.2 (and available for future SURFEX versions). Differences between ALARO with and without SURFEX can be seen over mountains and snow covered areas (a check with GMAP-Yann Seity- is suggested to verify that the drag options are correct)
- Work on the interaction between radiation and orography (importing ororad features in SURFEX, cooperation Austria, MF, HIRLAM).
- Surfex offline and SBL are currently used for urban climate simulations.

HIRLAM

- HARMONIE climatology (HCLIM) includes now SURFEX V7.3 (ISBA-DF/ES-3L) and a prognostic sea ice.
- Plans for NWP are to run advanced snow models (FR+ES+MEB) and develop surface assimilation (COST-ES1404 has now started).
- The sea-ice model is tested over the AROME Arctic domain.
- GLDBv2 is included into SURFEX, work on data assimilation for lakes is on going.
- On going comparison of urban models : TEB, SUEWS, CLM-U.
- Work on the interaction between radiation and orography (importing ororad features in SURFEX, cooperation Austria, MF, HIRLAM).
- Work on ISBA-MEB development (cooperation with GMME).

MESO-NH

- The version 5.2 of the model is planned for November and will include SURFEX V8.
- PREP was parallelized in the case of nested models (prep_real_case)
- PGD will be soon parallelized in the case of nested models (prep_pgd and prep_nest_pgd)
- Work on the coupling between SURFEX and an ocean model.

GMGEC

- Development of the coupling between SURFEX and XIOS
- The climate model in preparation will use SURFEX V8.
- Introduction of GELATO-1D in Surfex V8.
- Plans to use ISBA-A-gs coupled with MEB.

GMME

- Hydrology : The future hydrometeorological chain over France will use SURFEX V8. The coupling between SURFEX and TopModel is available for ISBA-DIF
- Soil-vegetation processes : ISBA : ISBA-DIF is currently tested in coupled mode within Meso-NH, an improved vegetation canopy radiative transfer scheme is available, MEB is in Surfex V8 (cooperation with HIRLAM).
- Lakes : separation of rivers and lakes. Model changes to allow consistency with other schemes. Plan to couple FLake with ISBA-ES.

- Urban : introduction of solar panels and development of an urban climate generator. Plan to include a better hydrology and coupling with MEB
- Re-analysis : LDAS-France is being recoded for further extension of the LDAS over the globe. The re-analysis scheduled in the UERRA project over Europe will start in September. SURFEX V8 will participate in the GEWEX-supported GSWP-3 project.

GMAP

- Operational systems in April 2015 : CY40_op2 with SURFEX V7.2+
- Improvement of PREP (coupling with FullPOS)
- 4D-Var ARPEGE with SURFEX by the end of 2015 (in a research environment). Operational implementation is foreseen for the end of 2016
- Work on the interaction between radiation and orography (importing ororad features in SURFEX, cooperation Austria, MF, HIRLAM).
- Evaluation of SODA to replace OI_CONTROL for surface assimilation in NWP models when SURFEX V8 is available in an atmospheric cycle (end of 2015).

Annex :
Main changes in V8 :

PGD :
Various optimizations
Altitude/slopes can be provided by external files

PREP :
Improved patch averaging and various optimizations

I/O and code design :
Improved portability for compilations
netCDF format for PREP and PGD

Assimilation :
New VARASSIM program
SODA optimized and contains both OI_MAIN and VARASSIM

Scientific models :

ISBA :
Introduction of perturbations for AROME ensemble prediction
coupling ISBA-TOP with ISBA-DIF
Introduction of MEB
Implementation of 19 patches
Bug corrections and improvements in ISBA-DF-ES
CROCUS : new radiative transfer in snow, new metamorphism scheme
Coupling with a hydrological model with OASIS

TEB :
Irrigation, solar panels

SEA :
New sea-ice model GELATO
ECUME V6
Coupling with a sea model with OASIS

LAKES :
Minor changes in FLake