

SURFEX Steering committee
1st meeting: 6 October 2011, Toulouse

Participants:

ALADIN: Rafiq Hamdi, Piet Termonia*
HIRLAM: Ekaterina Kourzeneva, Patrick Samuelson*
Meso-NH: Jean-Pierre Chaboureau
GMGEC: Bertrand Decharme
GMAP: Jean-François Mahfouf
GMME: Aaron Boone
SURFEX team: Stéphanie Faroux*, Patrick Le Moigne*, Eric Martin

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Summary written by Eric Martin

Meeting agenda:

1. Introduction, SURFEX overview (present status and practical organisation of the code management. E. Martin)
2. Present use of SURFEX, plans and expectations (each member of the committee)
3. General discussion on needs and future actions :
 - scientific cooperation, need of additional submodel of parameterisation
 - optimisation of the code
 - maintenance aspects
 - practical management of the code
4. Conclusion

1. Introduction, SURFEX overview

E. Martin presents the status of SURFEX, the scientific models that are included and the main associated physiographic databases.

Concerning the practical organisation, the phasing is done by the SURFEX team (CNRM/GMME/MOSAYC), based on the contributions received. Until now, there are two coordination meetings per year at CNRM. Contributions outside CNRM are received via a local contact point. Coordination outside CNRM is made using the existing committees (ALADIN, HIRLAM, Meso-NH, SRNWP, ...).

Each version is tested using tests cases in offline mode and released as version « EXPORT » for offline users. Then, the version can be included in atmospheric cycles. In the near future, the plans are to consolidate the code management: more formal contributions and call for contributions, dedicated user's mailing list, use of svn for the code. With an increased number of users, additional resources for the phasing may be needed.

Short terms plans for optimisations concerns the suppression of global variables and optimisation of PREP/PGD, I/O optimisations, building a parallel offline driver. Some courses are organised (currently mostly for French users). A permanent special issue « The externalised surface model SURFEX » has been accepted by GMD and can accept papers related to SURFEX.

2. Present use of SURFEX, plans and expectations

ALADIN

ALADIN organised a SURFEX working week in 2011 (18-22 April), gathering 8 countries in order to conduct an extensive validation of SURFEX in various configurations (radiation and upper air physics). At present, SURFEX is not operationally used with the ALADIN/ALARO physical schemes. Several combinations were tested for instance using ALARO with the ACRANE scheme vs. the RRTM/FMR scheme (in exactly the same configuration as the E-suite of ALADIN in Meteo France). Improvements of the scores are noted under specific configurations, while degradations were noted in some cases (high elevation), but, overall, the results are very encouraging. Optimizations of the code were not considered during this week. Some problems were noted (implicit coupling not possible for some configurations, init of water surface temperature, surfex call at time 0, time in surfex outputs). One scientific paper is accepted on the impact of TEB in Belgium, another paper on the SURFEX working week results is in preparation. A priority for ALADIN

is to make SURFEX available with all the atmospheric models and physical parameterisations used in the consortium, including ALARO.

HIRLAM

HIRLAM uses SURFEX in its HARMONIE integrated DA/ forecasting system. Ongoing and planned R&D concerns:

- CANARY/OI_MAIN(VARASSIM)/SURFEX: testing of the analysis,
- Snow: Multiple Energy Balance scheme development (jointly with GMME), snow DA
- Sea and sea ice: DA, implementation of HIGHTSI
- Lakes: model, DA, lake database and climatology
- URBAN: testing
- Orography: radiation on sloping surfaces

HIRLAM prepared a list of suggestions for with regards to scientific and technical points for discussion during the meeting: ECOCLIMAP2, ice tile, version control system, integrated system for off-line 2D experiments, need for parallelization [for both off-line and in-line experiments (EKF)],*.lfi files to GRIB [needs of coordination to define GRIB code numbers], for compilation, more uniform make system, Wiki page and forum, code for downloading, system documentation for new coming developers

MESO-NH

MESO-NH is a research model that uses SURFEX since its creation. It is used for a wide range of applications, from synoptic scales to large eddy simulations. It has a large set of parameterizations. The code comprises one million of line of code and is still portable from PC to massively parallel computer (up to 130 000 cores). SURFEX is used as a « classical » surface code for heat and momentum fluxes and is also used in chemistry and aerosols studies for biogenic and anthropogenic emissions. Forest fire application requires a very fine description with a grid mesh of 5m. There is a need of readability of SURFEX, and the capability of SURFEX to run on more than 10^3 cores must be preserved in the future. Needs for MESO-NH are to develop calculation of anthropogenic emissions and improved fine resolution physiography datasets.

GMGEC

In the climate group, SURFEX has been implemented in the coupled atmosphere ocean global model CNRM-CM5 used to produce the IPCC runs. The impact on the model climatology is in general positive. SURFEX is also validated offline using discharge data and GRACE satellite gravimetric data. GMGEC is currently testing (or plan to test) new configuration of SURFEX (ISBA-MEB, multi-layer soil, carbon cycle, Canopy SBL, Flake, new surface albedo, development of global aquifers). In addition, the introduction of GELATO 1D is scheduled. GMGEC proposed a technical solution to avoid the repetition of fixed fields in the outputs. The next global coupled model will be based on a v7.x or v8 version of SURFEX.

GMME

The mesoscale group uses SURFEX in coupled mode with the atmosphere in AROME and MESO-NH at various scales, from LES to regional simulations. Research in hydrology and continental surfaces (inc. monitoring of vegetation and carbon cycle) are based on SURFEX and favor continuous improvements of the code. GMME is active in the improvement of most components of SURFEX: sea (improvement of the 1D ocean mixing layer), lakes (testing of Flake, in particular the Thaumex experiment), town (improvement of TEB: vegetation in the canyon, improvement of the building energetics and air conditioning/heating), ISBA (multilayer soil, multilayer snow models, photosynthesis and carbon options, explicit energy budget of the vegetation). SURFEX is coupled with various hydrological models from small basins to the continental scale. The current plans are to validate the most advanced versions of SURFEX under various configurations and replace the current standard options in the applications used by the group.

GMAP

AROME uses SURFEX since the beginning, with an operational surface assimilation since 2010. SURFEX is used ALADIN overseas since Sept 2010 and ALADIN France since Sept 2011 (soil analysis since Sept 2011 for both models), after various tests and comparisons with the original surface scheme. Current developments in AROME concerns the used of revised climatologies (ECOCLIMAP2 and new soil textures from HWSD). CY36T2_op2 is based on SURFEXv5_bf8, CY37T1 on SURFEX V6 (+optimisations), CY38T1 will be based on SURFEXv7.1 (or v7.2). Operational assimilation is based on the OI, and tests are done using the SEKF for the assimilation of ASCAT soil moisture (work done in cooperation with GMME, HIRLAM, ALADIN, NILU).

Developments to be undertaken concern:

- the optimisation of the code [reduce I/O volume, increase efficiency of PREP and PGD, consistency

- of geometry between surface and atmosphere],
- the coupling between SURFEX and ARPEGE (operational use planned in 2014)
 - and scientific aspects (lake database, mixed layer ocean, soil diffusion version [with impact on fog and data assimilation], separate energy budget for the vegetation).

3. General discussion

The discussion treated three main points:

- 1) Management issues, and how to enhance the communication around SURFEX and facilitates a collaborative work.
- 2) Scientific aspects, and the scientific priorities to improve the quality of the code
- 3) Technical aspects, in order to improve the capacity of SURFEX to run under various configurations.

A summary of conclusions for each of these aspects (with identified actions when relevant) is presented in Annexes 1, 2, 3.

In order to organise the work for 2012 and to plan a future version of SURFEX (in terms of content and timing), it has been decided to launch a « call for contribution » for SURFEX to all the steering committee members. The steering committee will examine the proposed contributions, verify that key actions are properly treated (in particular for technical points) and build a road map for the next SURFEX version and its insertion in atmospheric cycles.

Eric Martin will launch this call in November 2011, deadline mid January 2012.

4. Next meeting

The next meeting of the committee is planned at the end of January 2012. The objective will be the examination of the work plan for 2012. This meeting will be prepared by emails exchange and will be a conference call.

Annex 1

Summary of conclusions: Management of the code

Communication:

There is need to enhance the communication on the code, between developers and users. A SURFEX user's list has been recently created (contact Stéphanie Faroux to subscribe). The internet site must be developed, with all the documentation produced and archives of the mailing list. Some members suggest to add a wiki and a forum. HIRLAM has a very good experience with both wiki and forum.

Action: The SURFEX team will make proposals to improve the communication and will contact the local computer division for local technical solutions. A use of the HIRLAM wiki may be envisaged, but needs an agreement of HIRLAM first.

Management of the atmospheric and SURFEX cycles

It is needed to improve the coherence between SURFEX and atmospheric cycles in order to avoid delays between the submission of a modification in SURFEX and its use in atmospheric model.

Action: the SURFEX team and members of the SSC must try to improve the coordination between SURFEX and atmospheric cycles for the next versions of SURFEX.

Code repository:

The SSC support the project of the SURFEX team to use svn on an internet site. HIRLAM has a very good experience with svn and can offer advices.

Action: the SURFEX team continue the implementation of svn. HIRLAM provides a contact in order to finalize the implementation and associated teaching and user's guide, based on the experience gained by HIRLAM.

Organisation of the preparation of future SURFEX versions

The next SURFEX version (v7.2) will be available for cycle 38t1. It is necessary to anticipate contribution for the next version of SURFEX, to be prepared during 2012.

Action: The SURFEX team will launch in November a « call for contributions » to all the steering committee members. The proposed contributions will be examined by the SSC in January 2012 (mail exchanges or conference call).

Annex 2

Summary of conclusions: Scientific aspects

General:

Coherency between surface and atmosphere drag coefficient for ptkc must be treated. ALADIN will make a proposal.

Coupling and Scientific testing of SURFEX with all the ALARO configurations must be undertaken. ALADIN will organise this work

Action: ALADIN will organise this work and solicit the SURFEX team when needed

Sea:

Sea-ice model: A sea-ice model is needed in SURFEX. GMGEC plans to introduce GELATO, the 1D version of the sea-ice model used in the coupled climate model to ensure coherency between coupled and atmospheric runs. Developments will begin during the second half of 2012. HIRLAM plans to introduce the HIGHTSI model. Both actions were already discussed in the past and were delayed. Due to the preparation already undertaken in both groups, the SSC agrees that both models can be introduced in SURFEX. The SSC ask that both models have the same interface for atmospheric variables and initialisation. A direct coordination between HIRLAM and GMGEC is needed.

Sea-ice tiles: the main SURFEX tiles are fixed. The sea-ice part can be treated as a variable subtile, in a similar manner of the snow proportion in ISBA.

ISBA:

Scientific tests of ISBA-MEB will be continued in 2012, in order to include it in the next official version (HIRLAM+GMME)

Assimilation:

HIRLAM plan to develop an assimilation for lakes and sea surface temperature (missing in SURFEX)

Concerning the Kalman filter, several institutes are using this code and improved it. Coordination is needed, to identify (among others) the improvements that must be introduced in SURFEX.

Action: GMAP organises a concertation between the SEKF developers in order to propose consolidated improvements that must be included in SURFEX.

ECOCLIMAP2

HIRLAM propose to validate ECOCLIMAP2 with national databases. The best is to compare the distribution of cover with existing national databases (contact Stéphanie Faroux).

Annex 3

Summary of conclusions

Technical points:

Compilation :

Difficulties are reported for the compilation of SURFEX in some cases.

Action: Each member of the committee collects the identified problems (and ideas for solutions if appropriate) and transmits them to the SURFEX team.

Geometry:

Some geometry are missing in SURFEX (this point has not been treated in the meeting, to be treated in a next meeting)

***lfi to grib:**

Coordination needed for the definition of codes (this point has not been treated in the meeting, to be treated in a next meeting)

Optimisations needs already identified by the CNRM in May 2011:

Several needs for optimisation were already identified by the CNRM:

- Suppression of global variables (easier maintenance for Open-MP). This action is scheduled for 2012 (CERFACS, Surfex team, GMAP)
- Memory : limit the use of ALLOCATE instructions (done, GMAP+Surfex Team)
- I/O : reduce file sizes, suppress fixed fields, use of FA, compact fields, optimise I/O (in progress, GMAP, GMGEC, Surfex team)
- Optimize PGD/PREP: to be instructed in 2012, (GMAP, Surfex Team) (need of additional manpower?)
- Parallel offline driver : to be developed in 2012/2013 (Surfex Team)

Assimilation

Concerning the OI, the present version is not optimized as it needs a lot of I/O. After discussion, it seems that the best solution is to couple in a more closely manner OI_MAIN (and possibility the SEKF) and CANARI in order to exchange data with arguments, instead of files. The option would avoid developing interfaces within SURFEX with observation data bases (e.g. ODB) when satellite products are considered for assimilation.

Action: GMAP will propose a strategy to the committee for the optimisation of the OI.