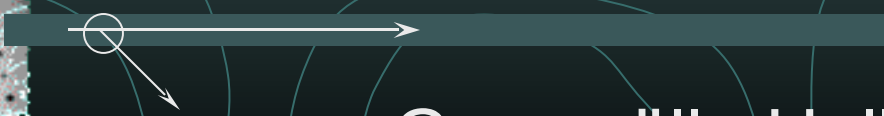# Technical aspects of the SURFEX implementation in ARPEGE/ALADIN/AROME (A^3)

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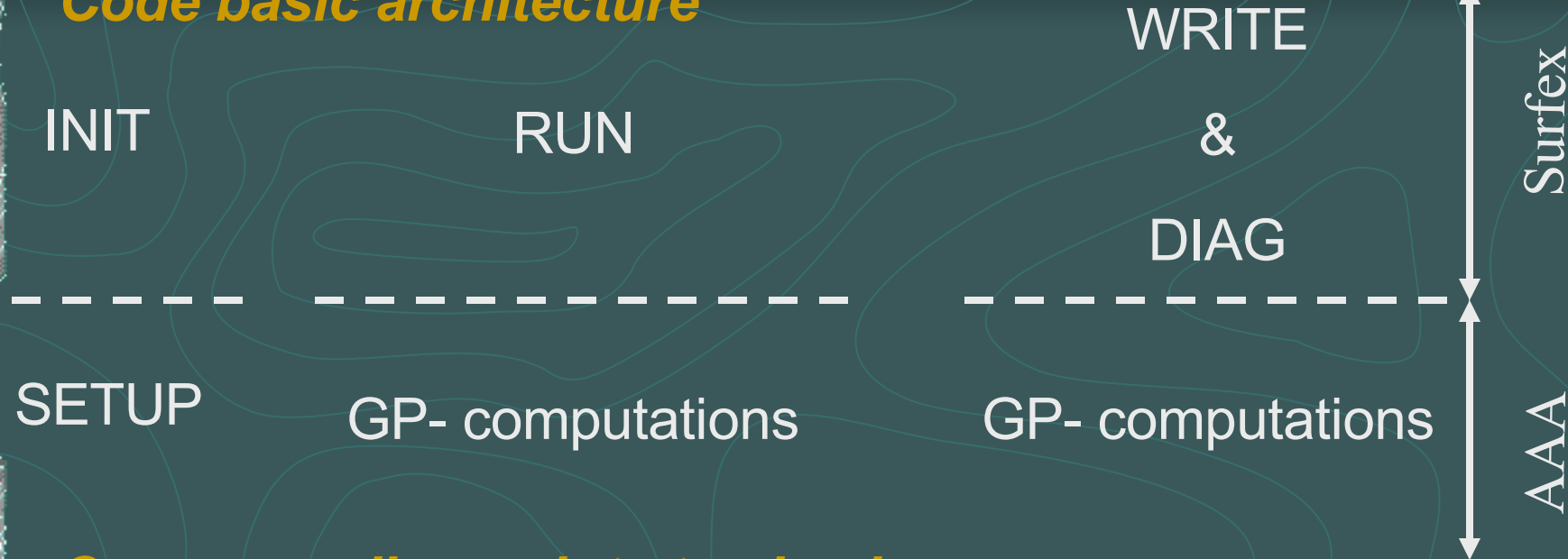
Main issues

- General overview of the problem
- Initialisation issues
- File issues
- Dynamical adaptation mode issues
- Assimilation mode issues

SURFEX – AAA interactions (no surface DA aspects)

Code basic architecture

INIT RUN WRITE & DIAG

Surfex

SETUP GP- computations GP- computations

AAA

Corresponding points to check

- Initialization procedure (including file preparation)

- Geometry

- File format

- Communication upper air-surface

- Code architecture compatibility

- File format

- Post-processing strategy (including assimilation ie screening)

Initialisation issues

- **Geometry**
  - LAM: no problem (to verify mercator rotated)
  - ARPEGE: Gaussian grid has to be added to the set of projection routines of surfex.

- **Initialisation**
  - straightforward init through ECOCLIMAP « cover » procedure ➔ AROME current case
  - Import external database: something is currently under development in order to read during the PGD computation (physiographic fields computation ~ conf 923 for surfex) an external database (aim = to reproduce current oper procedures) ➔ALADIN-ARPEGE issues
  - Then the prepsurfex procedure within 927 could be used ➔ AAA transversal

File issues (1)

- Current state :
  - One upper air file (« fa file ») *(Grib compression – low documentation)*
  - One surface file (« lfi file ») containing surface prognostic fields & surface diagnostic fields if requested (T2M, rain – AROME case) *(no compression – high documentation)*
  - Software has been developed for AROME to import fields from (lfi,fa) historical and/or fa coupling (or clim for constant fields) into the fa final file => allows to use the operational post-processing without any change and feeds the graphical procedure « promelange».
  - The above devs could also serve the AAA needs

File issues (2)

- 2 options :
  - 1 file , 1 format (fa) *difficult if compression of fields-from lfi is required*
  - 2 files, 2 formats (fa – lfi) ➔ current situation
- So what will be done (with some guess here):
  - Develop the possibility to write surface fields into the fa file as they are (using unchanged low level FA routines)
  - But, there would be no optimisation, compacting, … due to the nature of the surface fields (logicals, no plain arrays but segments of data, ..). If this part is needed, then something has to be developed
  - We need here requirements from the end-users (operation people & Aladin partners)

Initialisation issues - summary

PGD - creation

- Gaussian geometry to be developed

- Use of an external database developed but to be tested

- Cleaning of 923 to be evaluated at a later stage

Surfex-initfile creation « prepsurfex »

Prepsurfex ongoing dev :

- LSM question (use of surfex LSM in 927 for interpolation of SST) to be done

- Multi proc capability to be coded

- Use for global model to be evaluated

- Interaction with screening procedure (sometimes missing surface fields …) to be evaluated

AROME generalisation to AAA

To generalise the code that was previously written for Arome (partly done in CY31T1; to be continued)

Run : Dynamical adaptation mode (1)

- Implicit coupling :
  - Performed in 1D, without significant differences. 3D development currently in progress (should enter CY32)
  - Development of the inquiry routines to pass information to the atmospheric model (Qs, Snow fraction, …) (CY31T1)

* Last year requirements:

Only one set of A and B for wind	Surfex uses Au = Av $\sqrt{Bu + Bv}$
S v/s Cpθ	Surfex uses θ (A_θ, B_θ)
Evaporation term	Not yet
Cp(q), L(t)	Cp(q) : yes, L(t) not yet
Antifibrillation	Partial solution (lowest atmospheric level): 1D tests show robustness of the solution

Dynamical adaptation mode (3)

- The nproma problem
  - One solution has been coded (should appear in CY31T1).
  - It is now possible to call surfex inside the nproma loop (aplpar-apl_arome).
  - The solution has also been tested on IBM (portability) with no noticeable increase of computing and memory consumption but this aspect will be kept under survey

  This allows now to perform Aladin 3D tests

Dynamical adaptation mode (4)

- Writeout & Diagnostics:
    - More surface diagnostics needed from surfex (in progress; some part in CY31T1)
    - Code architecture : separate write (iopack) & diag (cpg_diag) in order to stick to AAA architecture (in progress in CY31T1 or CY32), more generality (from AROME- thinking to AAA thinking in progress)
    - Post-processing strategy (including surface obs operators) : *are computations done by surfex or by fullpos ?*

        No clear strategy there: a case-by-case development.
        - AROME case: by fullpos when possible, by surfex when fields needed from surface part are missing.
        - For the other AA models: Not at this stage yet,they will benefit from AROME dev.

Run, summary

coupling

- Code compatibility – NPROMA blocking point (solved in CY31T1)

- 3D tests to be done (Ald-Arp)

- Some missing points to code or evaluate

Write-diag

- File format ?

- Adapt to AAA code architecture part in CY31T1

- More diag in CY31T1

- Fullpos or surfex ?

- Portability issues : Some tests still to be performed

- Code readability :The generalisation of what was previously coded for Arome to be done (naming convention …): partly in CY31T1

Assimilation mode issues (1)

- **Obs operators** (screening – minim configuration, post-processing strategy)

The difficulty: some obs operators are using surface fields as input (surface obs operators, also sat obs operators (rttov). Thus, the interaction surfex-AAA concerns also screening and minimisation configurations

- AROME current state :

  - The needed surface fields are imported from Aladin coupling files

  - Ts vs Tsrad ?

  - To be evaluated : use Surfex diag to compute « obs operators » when possible (ex T2M, …) is in progress

  - Other AAA models not yet at this stage

Assimilation mode issues (2)

1. **Surface assimilation**

   The question: *what to do for surface assimilation ?*

AROME several trials :

- First Nothing ➔ restart of surface fields at each cycle (it works)

- Second ➔ use Canari + prepsurfex (interpolated from Arpège) when it exists (every 6 hours) and no refreshment in between (in case of RUC)

- Next : develop a specific surface assimilation (only plans at this stage, combining the adaptation of OI/Canari to LAM + specific modules inside surfex + specific Canari/Surfex interface)

CONCLUSION AAA strategy for the implementation of SURFEX

- AROME: solving problems one-by-one.
    - Dynamical adaptation mode: time for cleaning, optimization & generalization to AAA-thinking
    - Assimilation mode: try to find the best configuration considering several, different constraints
- ALADIN-ARPEGE:
    - The idea is to have a raw configuration working in dynamical adaptation mode for CY32 in ALADIN, in ARPEGE later on.
    - The strategy implicitly chosen for the time being is: first SURFEX, then ECOCLIMAP