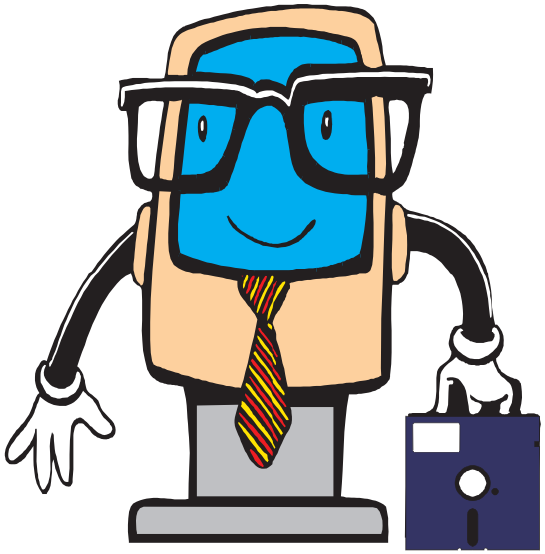
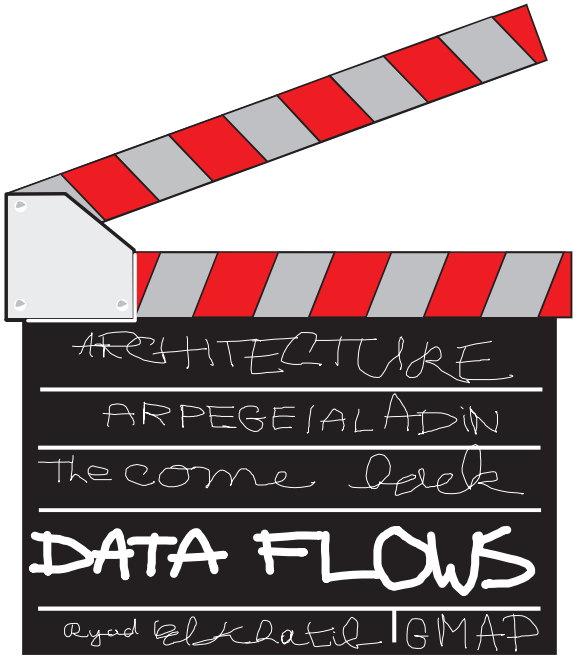
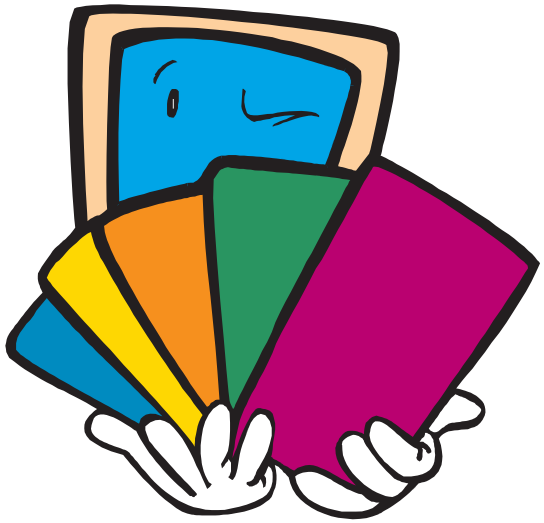
Page 1

Introduction to the data flow in ARPEGE/ALADIN cycle CY25T1

METEO FRANCE







SUMMARY

METEO FRANCE

1. Spectral arrays

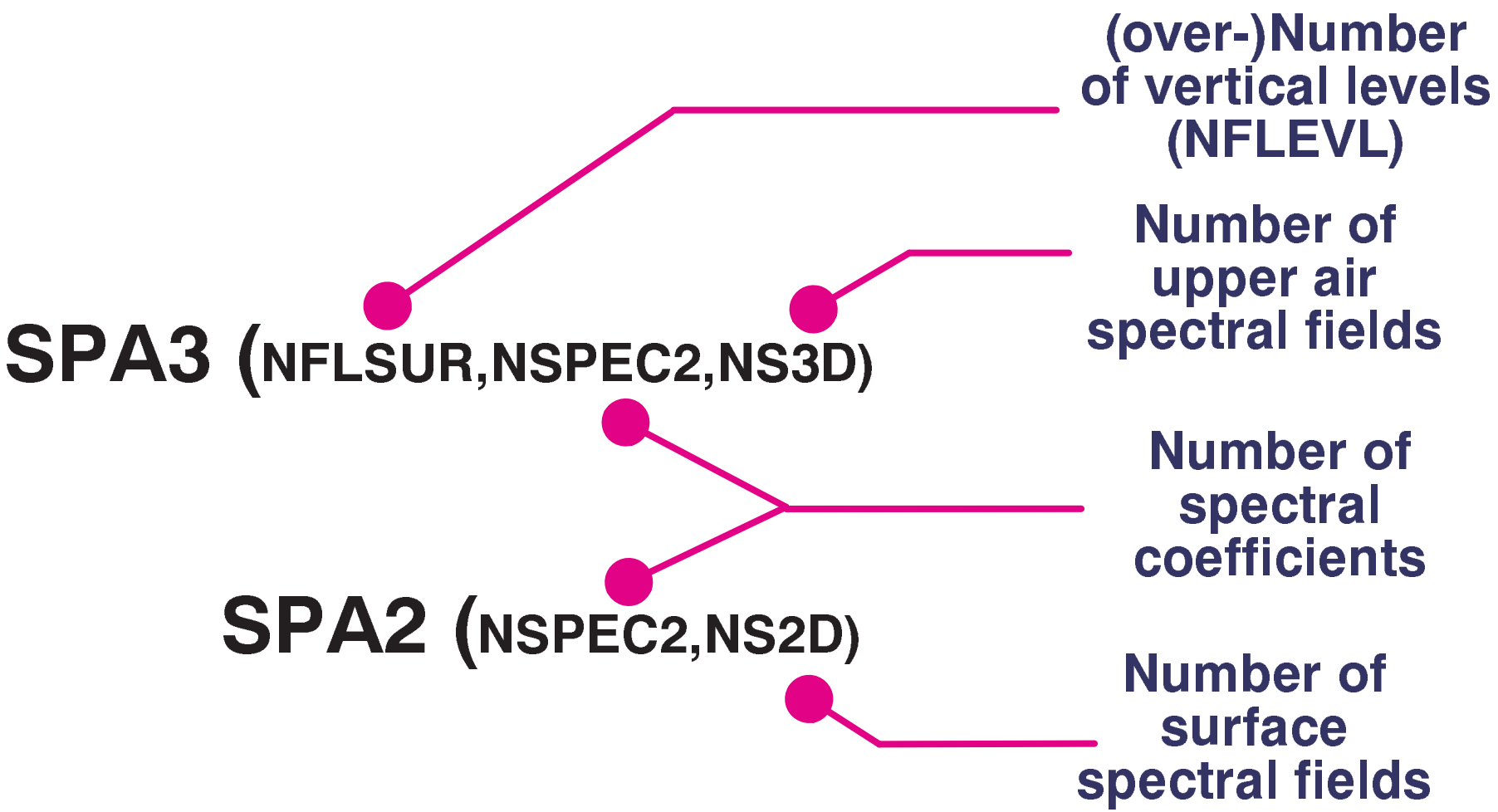
2. Gridpoint arrays/buffers

3. Data flow
   - Input
   - Output
   - Time step

4. "Semi-lagrangian" communications

Spectral (distributed) arrays

METEO FRANCE



Spectral arrays are split :

(target <= pointers)

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SPA3(: , : , 1) ⇐ SPVOR(: , :)	*Vorticity*
SPA3(: , : , 2) ⇐ SPDIV (: , :)	*Divergence*
SPA3(: , : , 3) ⇐ SPT (: , :)	*Temperature*
SPA3(: , : , 4) ⇐ SPQ (: , :)	*Specific moisture*
SPA2(: , 1) ⇐ SPSP (: , :)	*(Ln) Surface pressure*
SPA2(: , 2) ⇐ SPOR (: , :)	*Surface geopotential*

... And possibly :

SPA3(: , : , .) ⇐ SPW (: , :)	*Liquid water*
SPA3(: , : , .) ⇐ SPS (: , :)	*Ice*
SPA3(: , : , .) ⇐ SPSPD (: , :)	*(NH) Pressure departure*
SPA3(: , : , .) ⇐ SPSVD (: , :)	*(NH) Vertical divergence*
SPA3(: , : , .) ⇐ SPSV (: , : , :)	*Passive scalars*

Ordering of spectral coefficients

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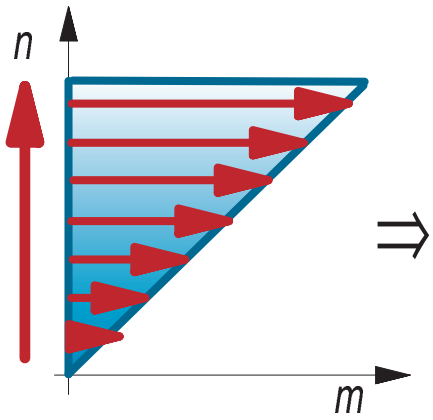
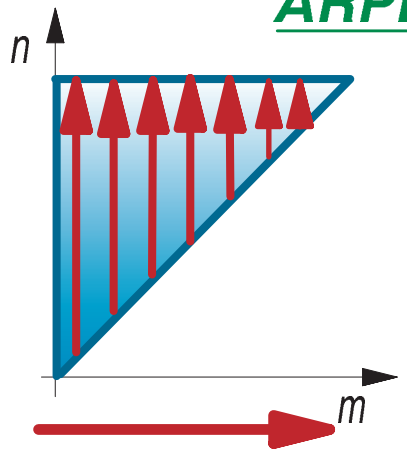
In file ARPEGE :

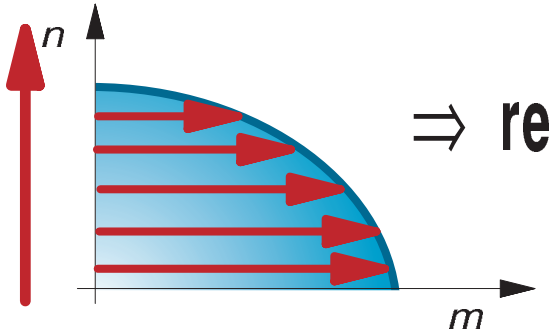


⇒ reordering ⇒

In model ARPEGE/IFS :

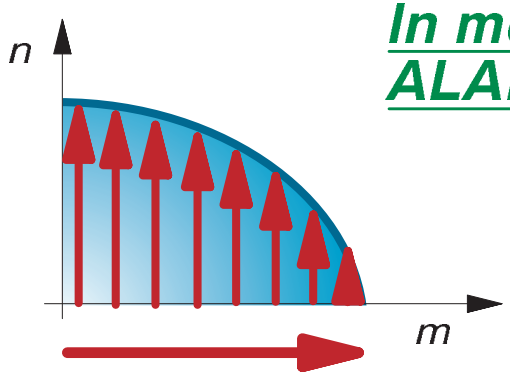


In file ALADIN :



⇒ reordering ⇒

In model ALADIN :



... Initial ordering has been modified in order to enable an easy distribution of data

GRIDPOINT BUFFERS

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type : "gridpoint_buffers"

*XXX*BUF(NGPTOT * KFIELDS)

Number of grid points

Number of fields

Example : Gridpoint surface fields for physiscs

GPPBUF(NGPTOT * NGP)

Surface pronostic variables (NVSO*NCSS) +

Vegetation variables (NVEG*NCSV) +

Surface climatological variables (NVSF) + etc, etc

Gridpoint buffers are re-organized in DATA BLOCKS ARRAYS

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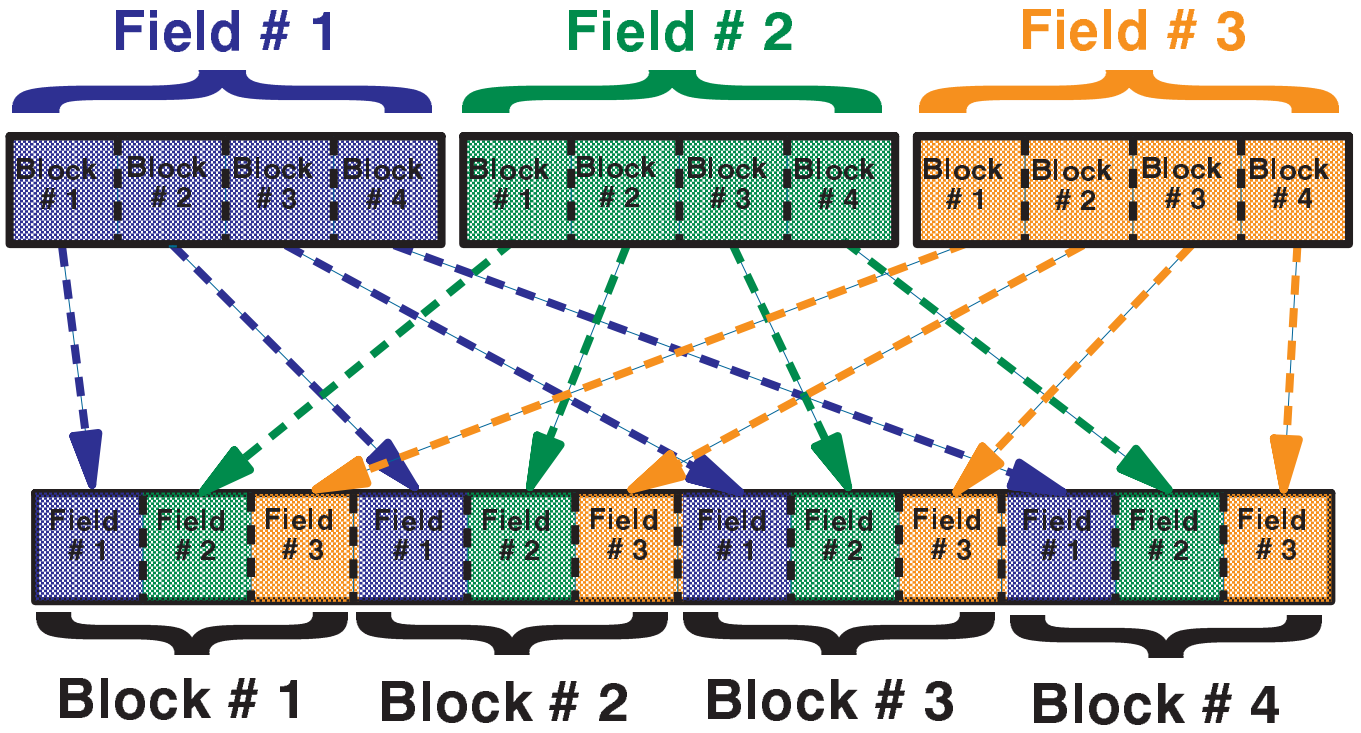
*XXX*BUF(NGPTOT * KFIELDS) → (NPROMA, KFIELDS, NGPBLKS)

NPROMA is in namelist

NGPTOT≤ NGPBLKS * NPROMA

***Example** : 3 fields and 4 blocks :*



Gridpoint blocks

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ZGPP (NPROMA , :)

Size of a packet

Number of fields

NPROMA = Any value between 1 and "NGPTOT" (total number of gridpoints in node)

* Smaller NPROMA saves memory (smaller working arrays)

* No use of n**2 prevents from memory bank conflicts

* Fits the machine architecture

Vector machine -> fit the size of the vector registers

Scalar machine -> fit the memory cache

* Each block to be potentially treated by a thread (OPEN_MP)

Ordering of gridpoint fields in file

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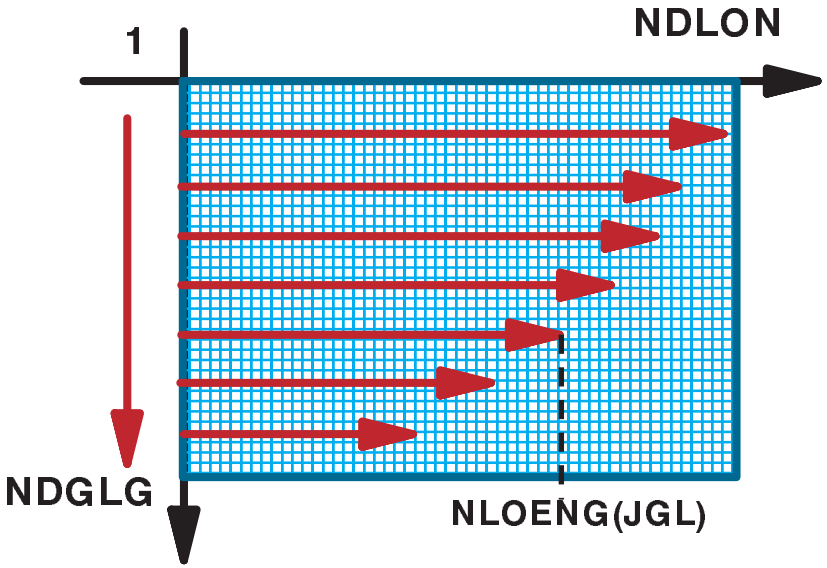
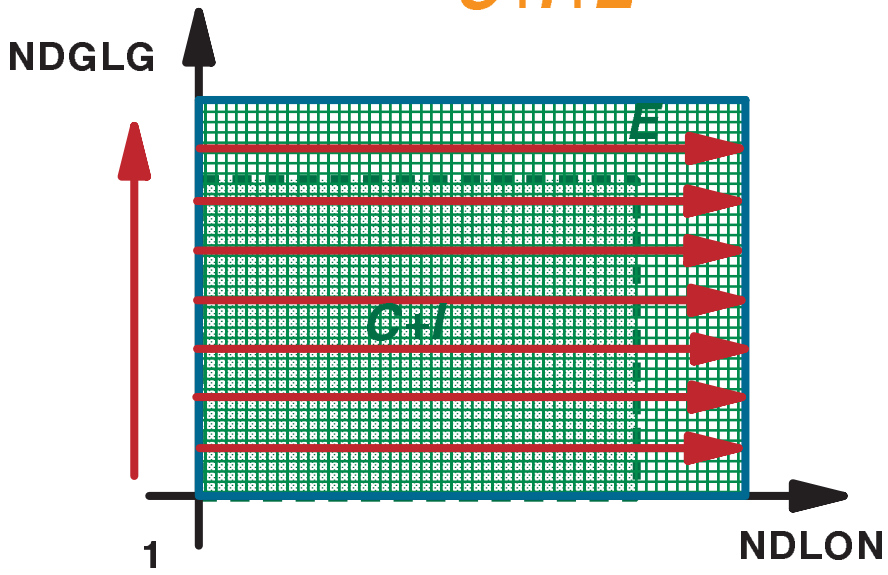
File *ARPEGE : Reduced grid*



From North Pole to South Pole,
from Greenwich,
toward the east to Greenwich

((X(JLON,JGL), JLON=1, NLOENG(JGL)), JGL=1,NDGLG)

File *ALADIN : "C+I+E"*



From South-West to North-East

((X(JLON,JGL), JLON=1, NLOENG(JGL)), JGL=1,NDGLG)

Points are always contigus (no "holes")

Gridpoint fields ordering in the model

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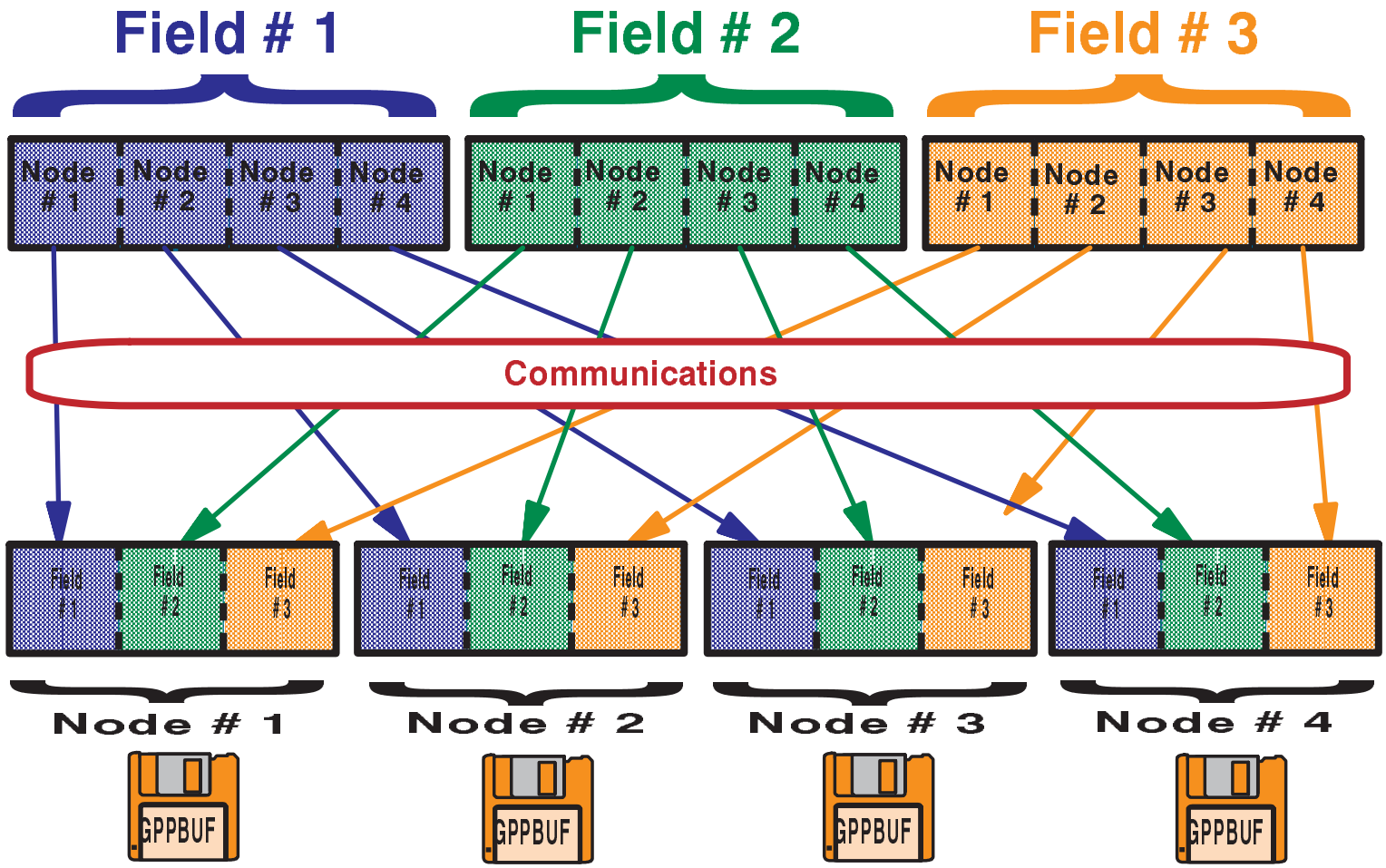
***Example* : 3 fields, 4 nodes, and 2 blocks per node :**

In File :



In model :

HANDLING GRIDPOINT FIELDS

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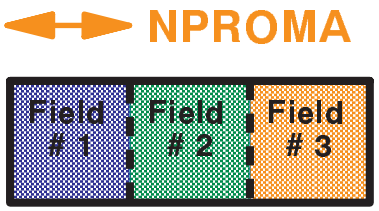
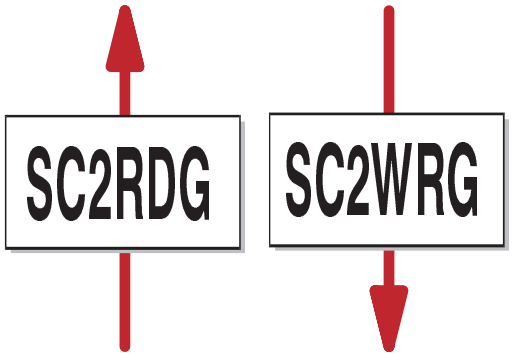
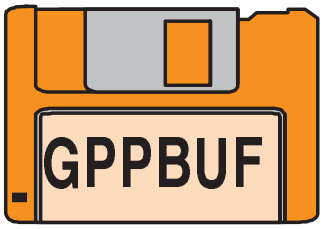
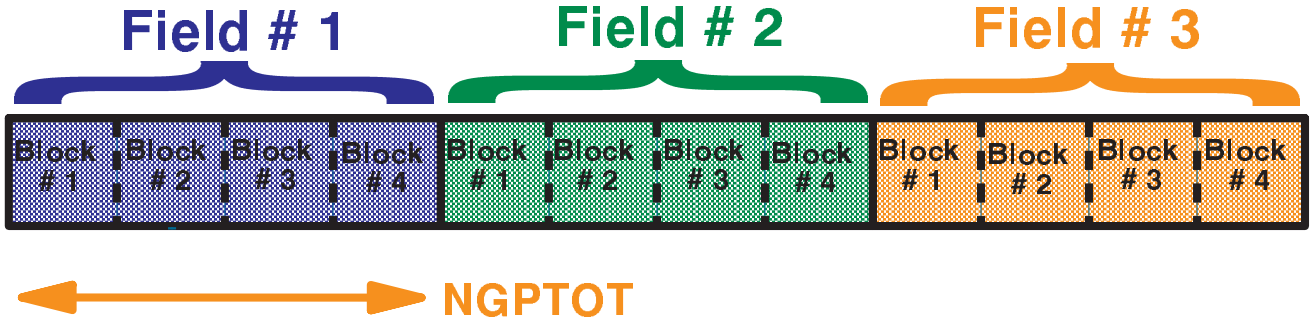
Each node loops on the
NGPBLKS
NPROMA-sized blocks



Use of dedicated
interface subroutines
to get in/out a given block
from the gridpoint buffer







The most famous gridpoint buffers/arrays below STEPO and SCAN2MDM

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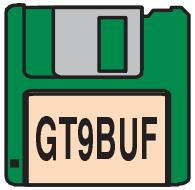
* *BUF : Gridpoint buffer*



Dynamic fields at time t-Δt ("9") : Input-Output

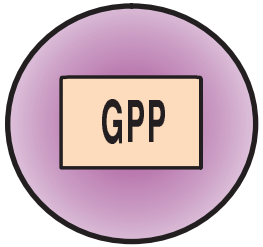
Physical surface fields : Input-output

Cumulated fluxes

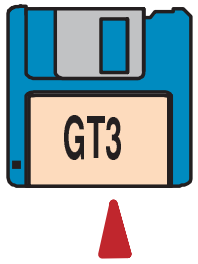
Instantaneous fluxes

* PP : data blocks array

Spectral arrays



Dynamic fields at time t ("0") and t+Δt ("1") : input-output



Dynamic coupling fields (Aladin only)

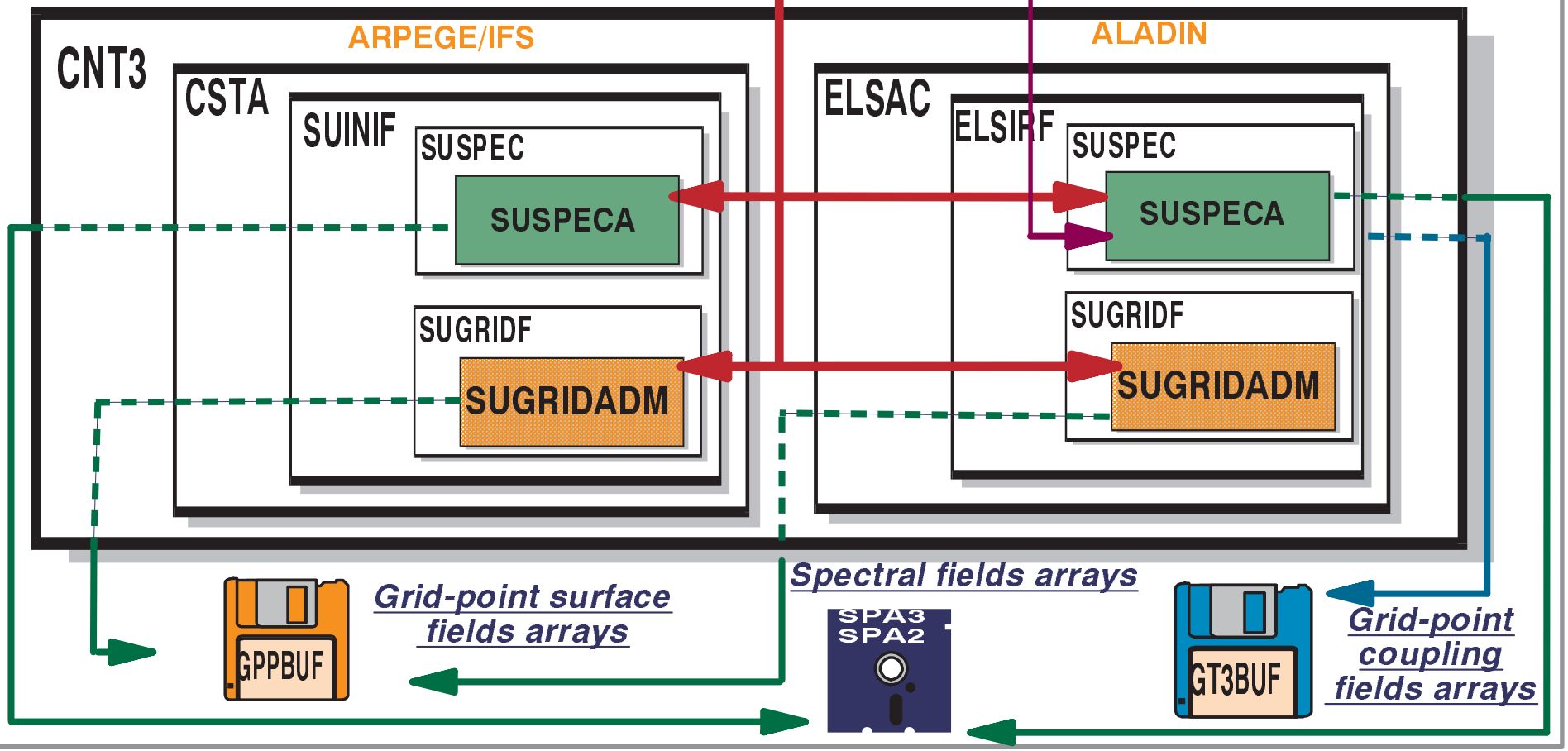
The shape of this array has a specific flavour !

Input data flow (setup)

METEO FRANCE

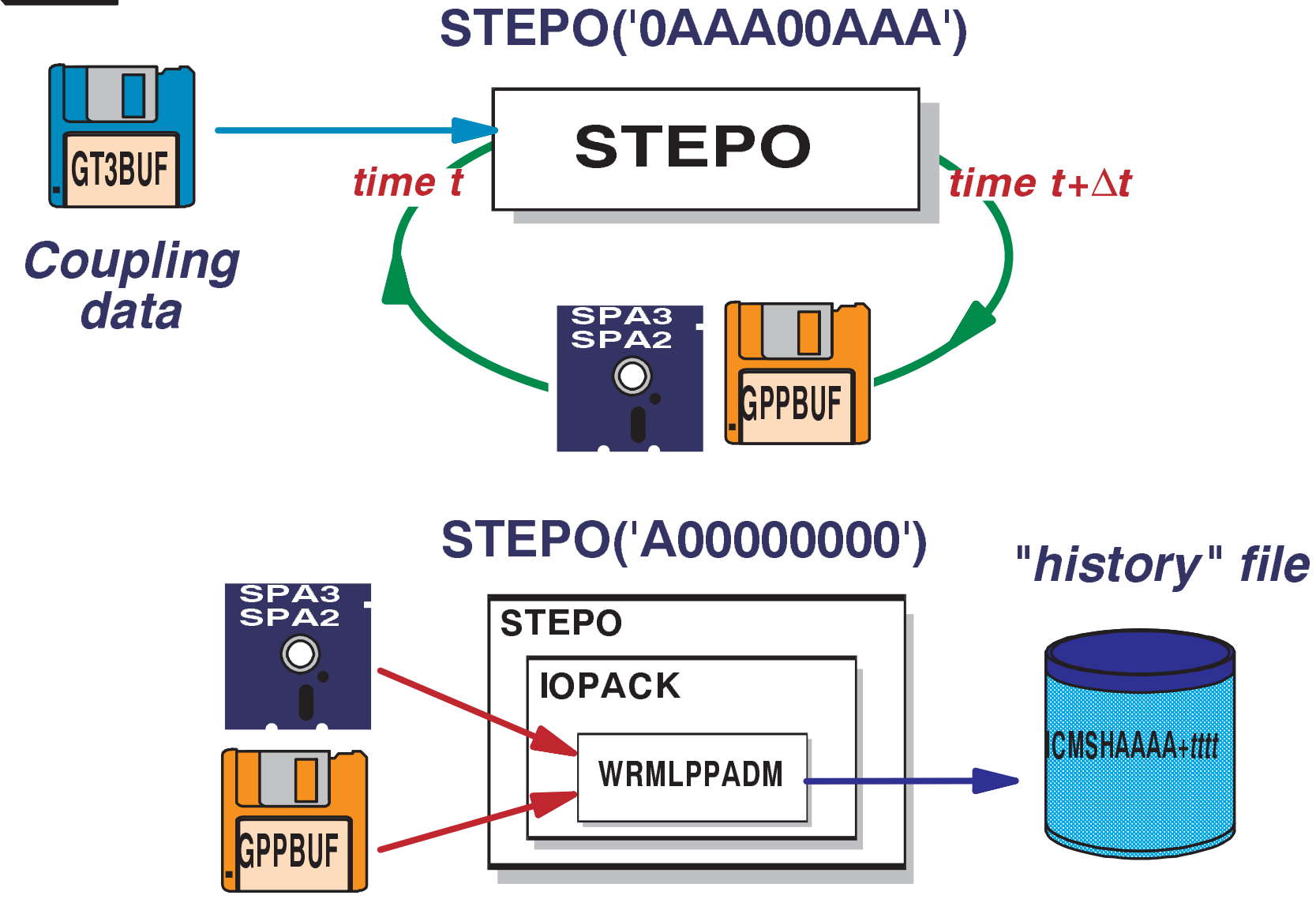
Initial conditions file :

Boundary files (ALADIN)



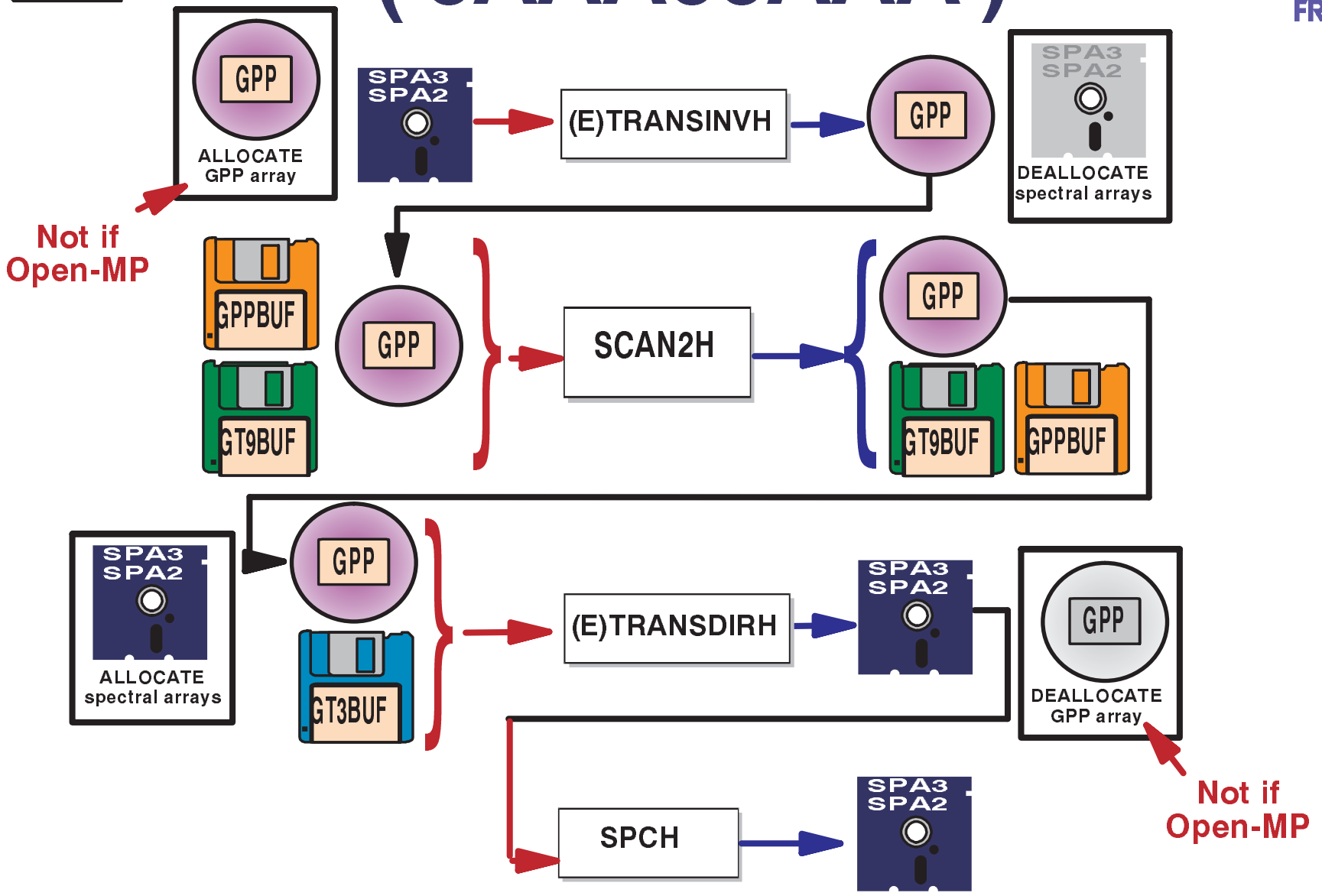
Output data flow (iopack)

METEO FRANCE

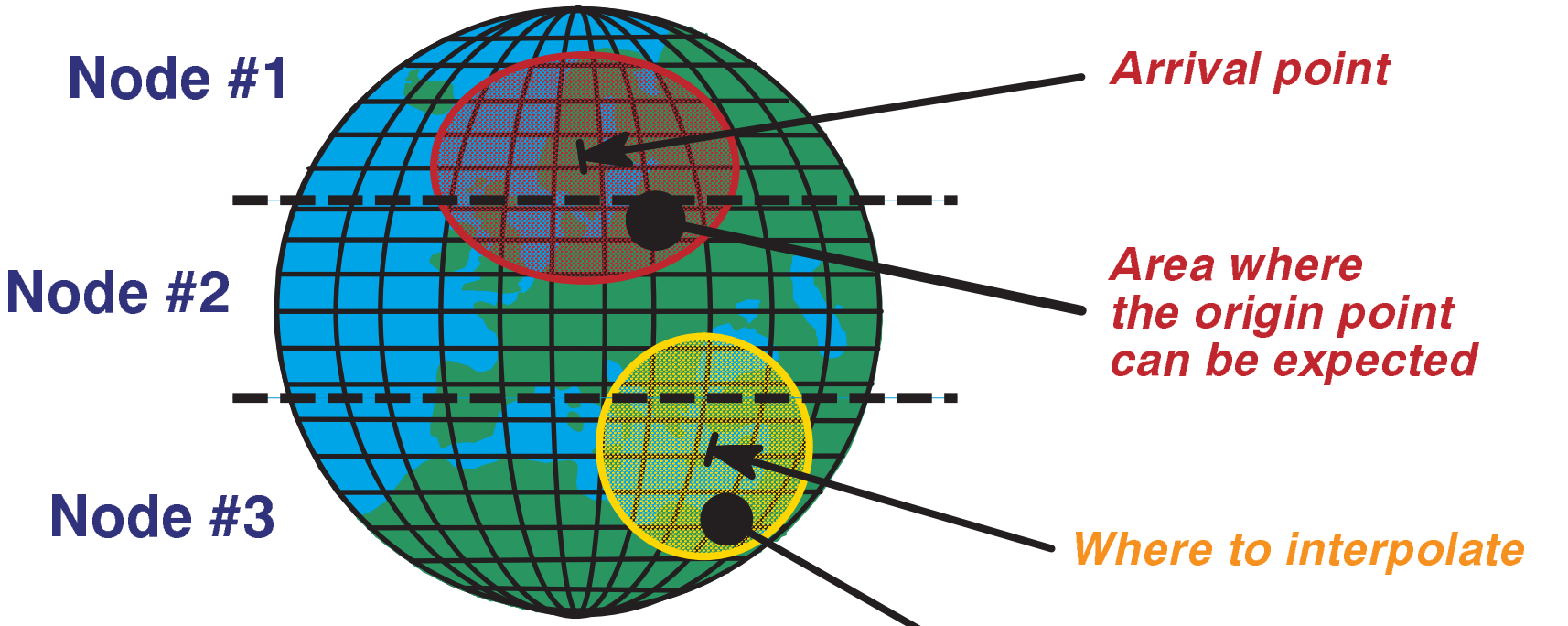


Data flow in stepo ('0AAA00AAA')

METEO FRANCE



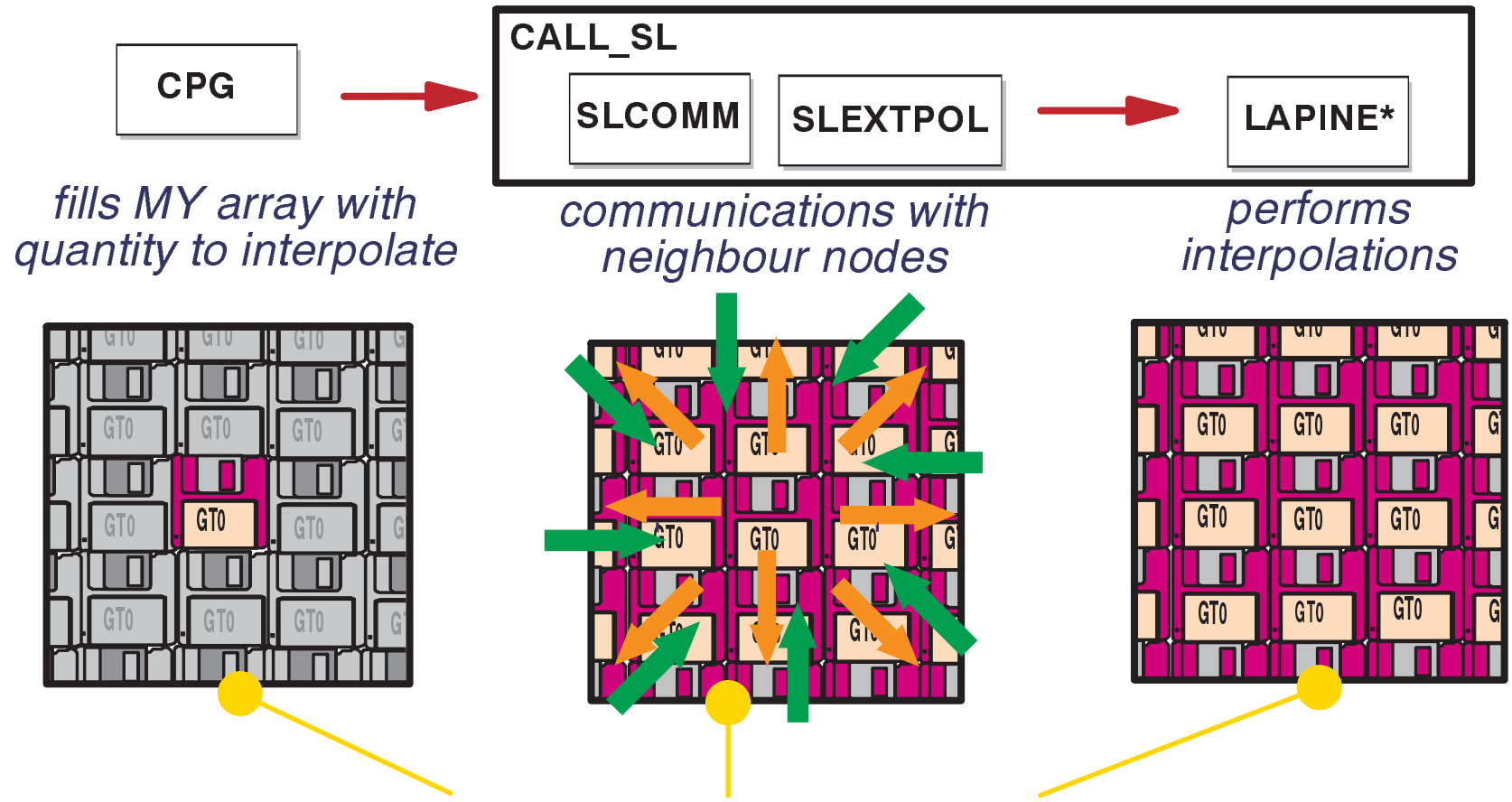
"Semi-lagrangian" communications for horizontal interpolations



- *semi-lagrangian scheme,*
- *analysis,*
- *post-processing*

The "halo" around the point where to interpolate may contain points belonging to another processor than mine => communications

"Semi-lagrangian" communications

METEO FRANCE

Each node does :