

# Highlights and prospects for Numerical Astrophysics in France

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Lyon, October 8 - 11  
J. Blaizot

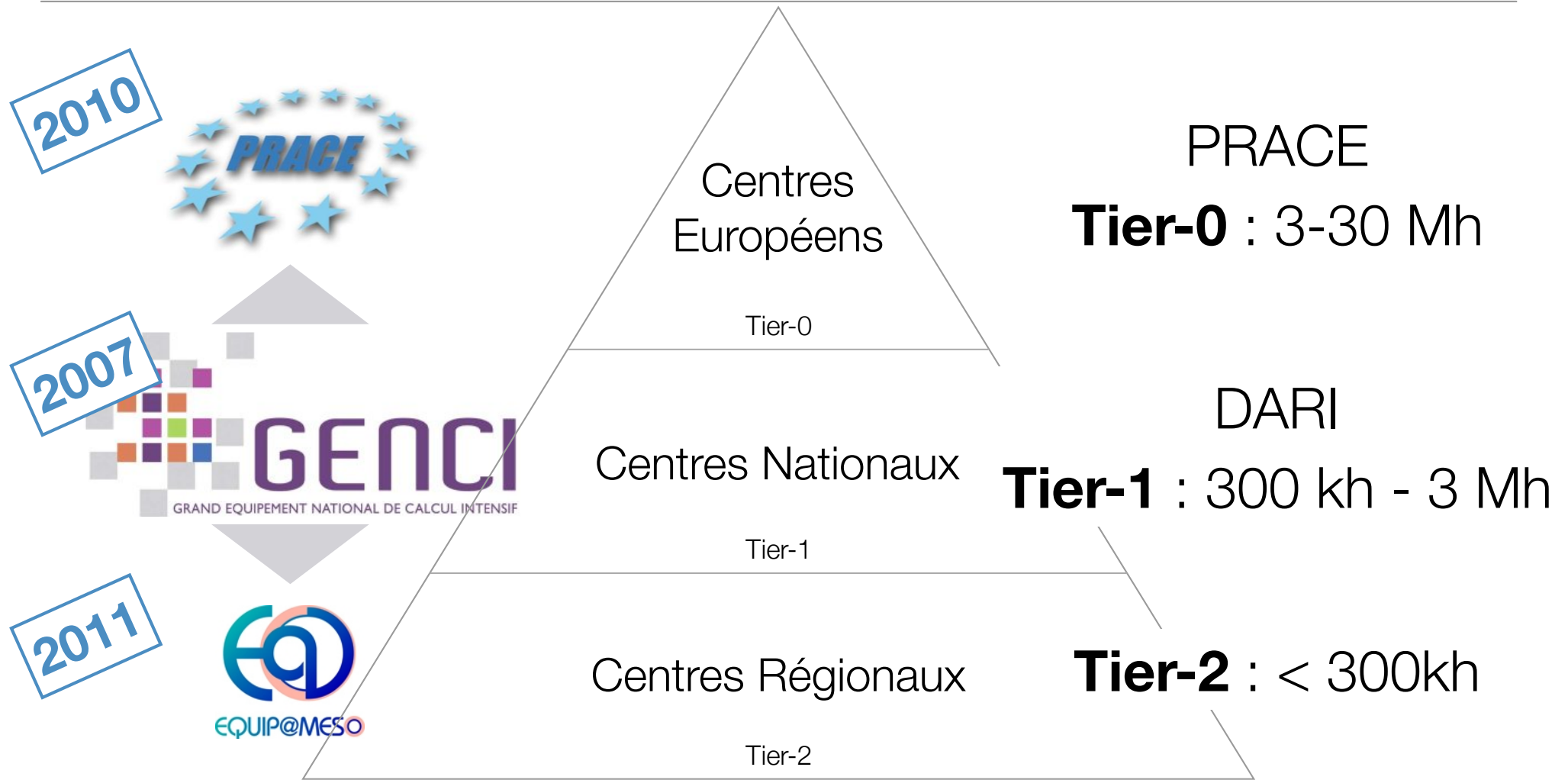
# Context

## INSU-AA's foresight exercises

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- Every ~5 years, INSU-AA organises a foresight exercise (“*exercice de prospective*”) where it defines scientific and instrumental priorities for the coming 5-10 years.
- These priorities are approved by the community and serve as a reference for funding/strategical decisions till the next exercise.
- The last exercise (2014) we (JB, B. Dintrans, & S. Fromang) issued 3 main recommendations concerning numerical simulations, which were then followed up by the CSAA ... and *this is how we're all here*.
- **The next foresight exercise begins and will end in Fall 2019.**

# HPC in France & Europe



The implementation of the HPC pyramid through GENCI is very successful, yet relatively new in France (~10 yr).

# Recommandations from 2014

(JB, B. Dintrans, S. Fromang)

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- The HPC infrastructure needs to be thought all the way down to Tier-3 (the lab, where the analysis/valorisation is typically done).
- Codes have become so complex that a researcher cannot master them from end to end anymore. Code development (both for production and analysis) require professional methods, collaborative development, and long-term support.
- The French numerical astrophysics community is in need of an entity that could represent its interests, e.g. an “Action Spécifique”

# Context

## CSAA's ad-hoc group for HPC & Big Data

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After 2014's foresight exercise, CSAA created a group to follow up on our recommendations with 2.5 missions:

1. Advise INSU-AA on strategies to address “Tier-3 crisis”
  2. Advise INSU-AA on ways to support numerical simulations (possibly through CNAP).
- 2.5 Lead structuring actions for the numerical community (schools, workshops).

Group composition : G. Aulanier, J. Blaizot (coord.), B. Dintrans, G. Dubus, S. Fromang, P. Hennebelle, F. Lepetit, A. Marchaudon.

Structuring actions for the numerical astrophysics community.

# Structuring actions

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- 2016: **workshop** during SF2A week (1 day, Lyon). (**S. Fromang** & JB)
- 2017: **summer school** at CBP (2 weeks, Lyon). (**B. Commerçon** & **P. Hennebelle**)
- 2018: **this workshop** (4 days, Lyon) (J.B. & **B. Commerçon**)
- 2019: **summer school** at CINES (2 weeks, Montpellier). (**B. Dintrans**, & JB)
- 2020: **Volunteers** to host the next **workshop** ?
- 2021: **Volunteers** to host the next **summer school** ?

NB for the foresight exercise : An *action spécifique* would be a natural framework to keep these activities going in the long run, with both a secured budget and a structured board. (Other reasons later).

## Survey of resources (hardware, and HR) in astrophysics departments.

In order to advise INSU-AA on strategies relative to the “Tier-3 crisis” and HR issues, we need to assess the current situation in detail.



# Infrastructure

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We find 3 types of departments :

**1. Departments with heavy infrastructure** (e.g. CEA/SAP, CRAL, IAP, ...). These typically have >1000 cores for parallel computing, and > 1PB workspace. These facilities are funded by LABEX, ERC, ANRs, Univ., Regions, etc.

**2. Departments with a strong link to a local Tier-2** (e.g. IPAG, IRAP, LATMOS, ObsPM, OCA, ...). These typically have a few 100 cores in-house, ~ 100TB of storage, and privileged access to the Tier-2 next-door.

**3. Departments which don't do much simulations.** Typically they have a few nodes with dozens of cores and some RAM. Less than 100TB of storage.

# Human Resources

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1. **The median lab counts ~20 researchers** (staff, postdocs, PhD) running or using numerical simulations, and some engineer support for infrastructure and administration.
2. In general there is **no engineer support for HPC development or dissemination of simulated data**, except interesting exceptions (CRAL, LUTH, OCA, IAP, IRAP, CEA)
3. **Wherever there is local support for HPC development (e.g. through internal calls) researchers find the experience extremely positive.** Engineers in astrophysics departments are a useful relay between researchers and interdisciplinary experts.
4. Expertise offered by interdisciplinary centres (e.g. MdS) is still not very implanted in our community. The national landscape is very diverse here.

# Lobbying

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- At the CSAA level : we have (co-)funded equipment for numerical projects (e.g. IAP, Meudon, IPAG). Synergies with local Tier-2 have been encouraged.
- CSAA is also about long-term lobbying. The community (non-numerical) is more and more aware of our needs.
- Outside CSAA: we have reported to INSU and CNRS directly, outlining the diverse needs of our community. The changes of direction there have somewhat reduced our impact ... to be continued.
- We have started discussing about “*Labelisation*” (i.e. CNAP)

# Community codes & Services d'observations

## **AO-S03 : CODES NUMERIQUES COMMUNAUTAIRES**

**III-1 : CODE NUMERIQUE MESO-NH (Modélisation à moyenne échelle de l'atmosphère)**

**III-2: Code numérique ES-OPA (Modélisation de l'océan global)**

**III-3 : CODE NUMERIQUE CHIMERE (Modélisation de la pollution atmosphérique)**

**III-4 : CODE NUMERIQUE SIROCCO (Simulation réaliste de l'océan côtier)**


Océan,  
Atmosphère et  
Climat

# Community codes

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- There very strong analogies between numerical simulations and observations, from the development of public codes to the planification and execution of large simulation campaigns. The SNO's are a natural framework to support all these aspects.
- In INSU-OA, 4 community codes are labeled. The duties are mostly related to community management (distribution and maintenance of the code, organisation of yearly schools and workshops).
- RAMSES has reached a maturity which makes it a strong candidate for receiving INSU's label. Probably other codes/communities too ?
- **Next call for *labellisation* : likely announced end of 2018, with deadline for submission around Feb 2019. We (the HPC group) are here to help. It is important to get started before the next foresight event.**

# Discussions



**ASTRO  
SIM** **Highlights and prospects for numerical astrophysics in France**  
*8-11 Oct 2018 Lyon (France)*

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**MAIN MENU**

- Home
- News

**Discussions**

Please edit and comment the [google-doc at this link](#) to prepare the discussion sessions.

**Rational**

**News**

Meeting open  
October 8th,  
Amphitheatre

## **Discussion #1 : Moyens matériels**

*Les moyens de calcul offerts à la communauté sont considérables. Répondent-ils aux besoins de l'astrophysique ?*

- Est-ce que les centres nationaux et européens offrent assez de temps ?
- Est-ce que les plateformes (et leurs évolutions) répondent aux besoins de nos codes ?
- Les moyens locaux sont-ils suffisant ?
- Quelles sont les ressources qui financent ces moyens locaux ? et comment sont-ils administrés ?
- Est-ce que le stockage (pérenne) pose problème ?
- ...

## **Discussion #2 : Moyens humains**

*Qui peut faire les développements de code dont nous avons besoin pour le passage à l'exascale ?*

- Quels partenariats établir avec les centres d'expertises (e.g. MdS, ...)
- Ces partenariats suffisent-ils ?
- Peut-on recruter des “instrumentistes” numériques ?
- Comment maintenir des codes dans la durée ?
- Faut-il un support IR dans les labos ?
- ...



## **Discussion #3 : Codes communautaires**

*Comment accompagner l'évolution profonde des codes phares de notre domaine ?*

- Quels codes communautaires identifie-t-on en astro (en France) ?
- Ces codes sont-ils prêts pour l'exascale (i.e. peuvent-ils exploiter  $>100,000$  coeurs avec  $\sim 1$ Go de RAM/coeur efficacement) ?
- Ces codes sont-ils maintenus ?
- Quelle stratégie mettre en place pour assurer la pérennité de ces codes ?
- Des formations longue durée (1-2 mois) des utilisateurs (étudiants, postdocs, chercheurs) sur des codes communautaires bien ciblés peuvent-ils être envisagés ?
- ...