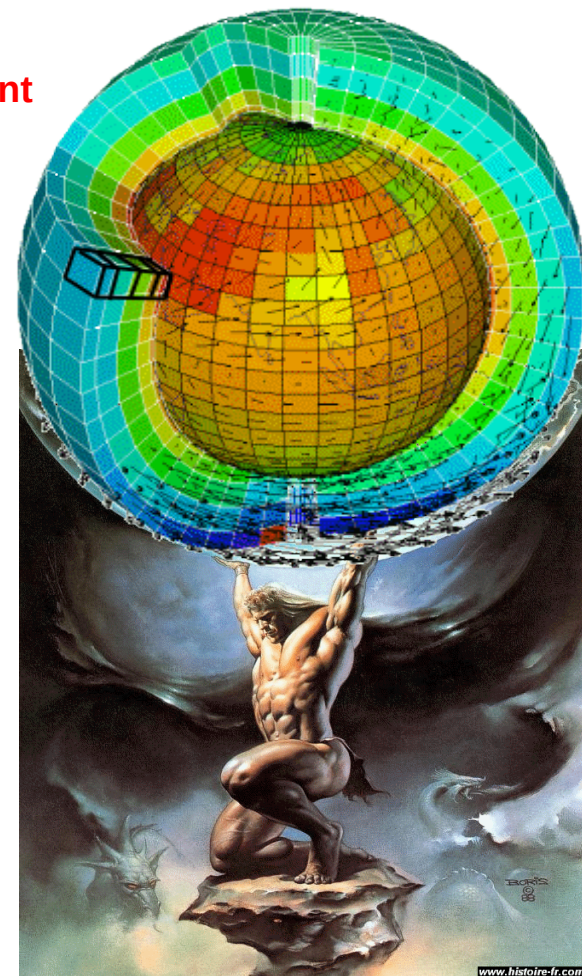


# Reduction of systematic errors in climate models : model improvement versus tuning of free parameters.

F. Hourdin, **C. Rio\***, I. Musat, F. Couvreur, D. Williamson and the LMDZ team.  
(LMD/IPSL, CNRM, Exeter Univ)

**\* awarded in 2016, WCRP/WWRP/WGNE International Prize for Model Development**

Coordinating the development of the IPSL-CM atmospheric component LMDZ for CMIP3, CMIP5 and CMIP6....



The way I probably dreamed my role as an Atlas of climate modeling at the beginning...

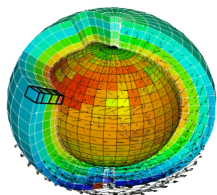
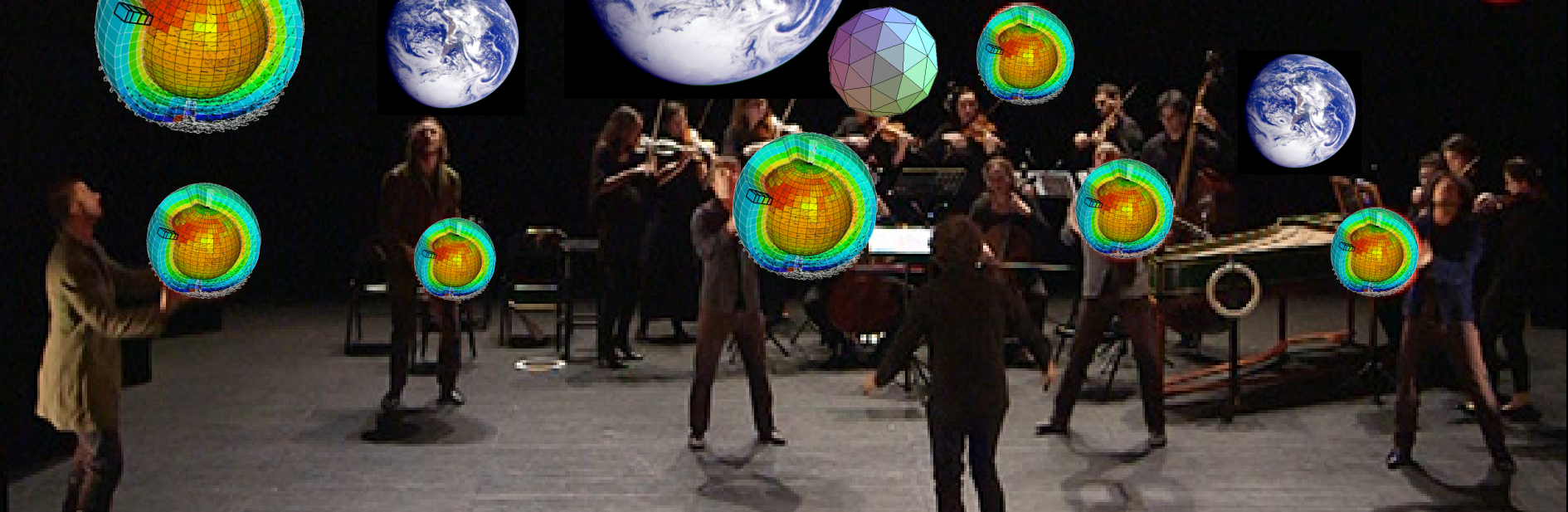


illustration designed ~20 years, ago with my colleague Laurent Fairhead (UNIRAS graphical package)



# L'art et la science de l'ajustement des modèles de climat : de la théorie à la pratique

18 décembre 2025

Maëlle Coulon--Decorzens

Dirigée par Frédéric Hourdin & Najda Villefranque



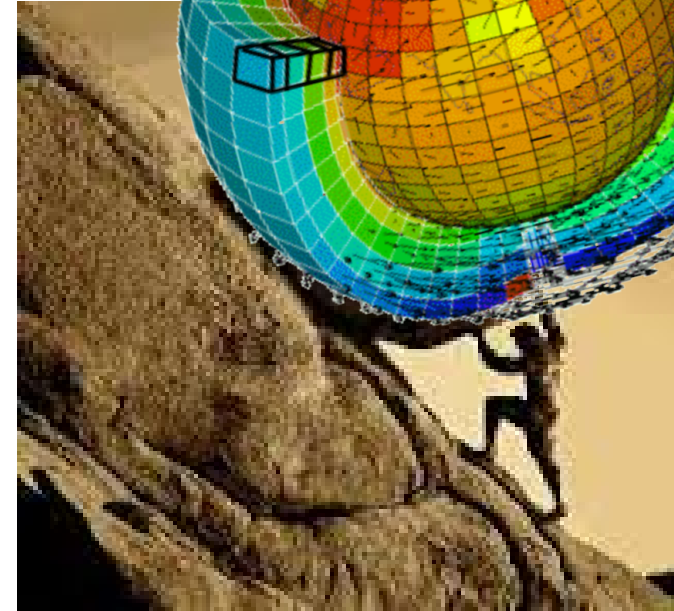
# IV. Evolution of model development and tuning strategy

## SCM/LES

New parameterizations  
Inspiration  
Developpement  
Assesment

**New for IPSL CM6 tuning**

**Systematic tests in 1D  
of new set of free  
parameters**



3D simulations nudged by  
ERA-Interim winds  
Test new parameterizations  
coupled to the continental  
surface and ocean without  
biases that come from large  
scale dynamics.  
Direct comparison with in situ  
observations  
Poster by Binta Diallo et al.

## 3D Atm. Imposed SST

Tuning of atmospheric balance  
Latitudinal variation of fluxes  
Mean rainfall  
Rainfall variability  
Eastern and Southern ocean flux  
biases  
Continental temperature  
...

**For the “happy Sisyphus”:  
Makes the synthesis more  
difficult !**

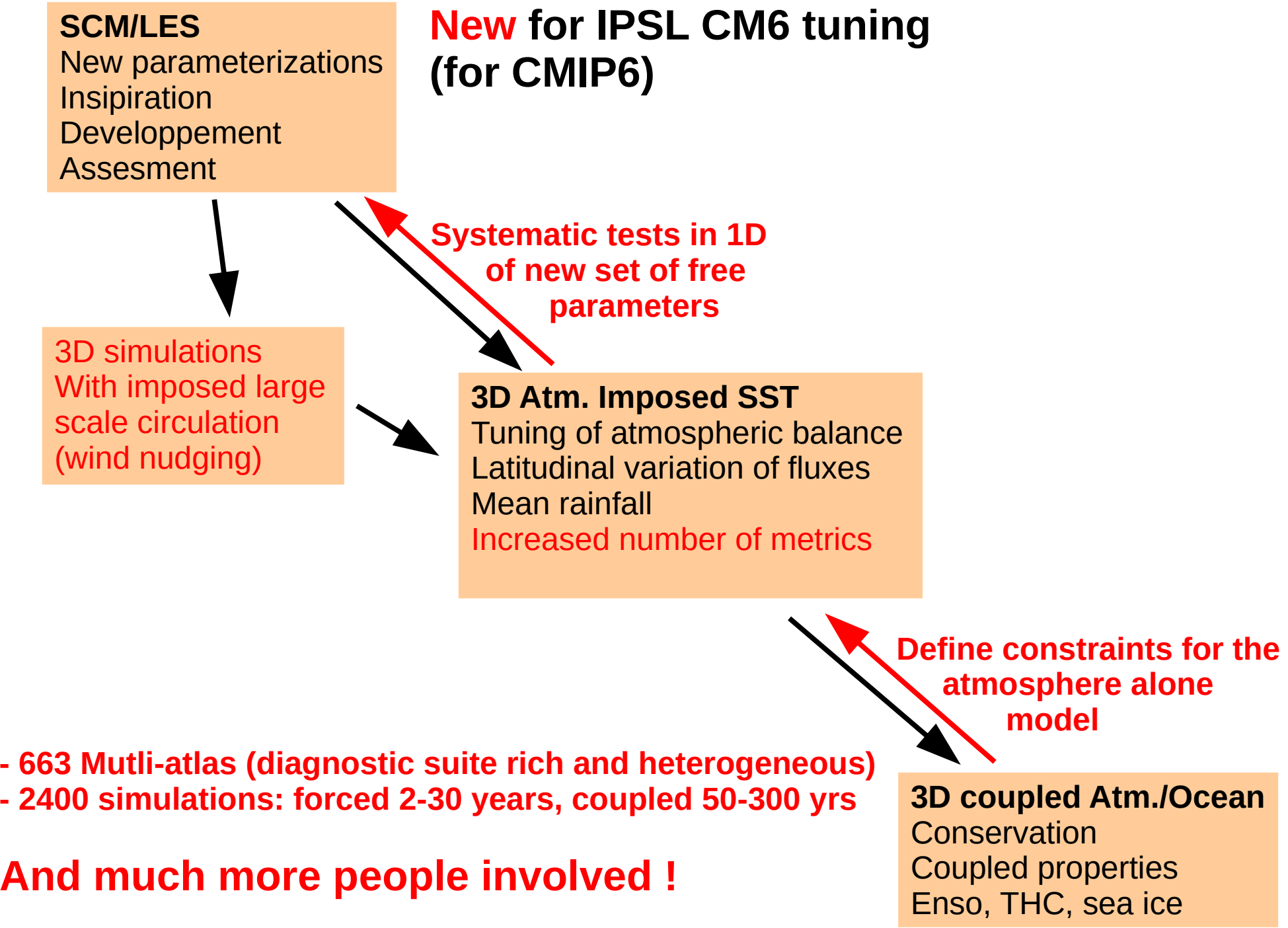
**Define constraints for  
the atmosphere alone  
model**

**And much more  
people involved !**

## 3D coupled Atm./Ocean

Conservation  
Coupled properties  
Enso, THC, sea ice

### III. Tuning of free parameters : evolving strategy



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3D simulations  
With imposed large  
scale circulation  
(wind nudging)

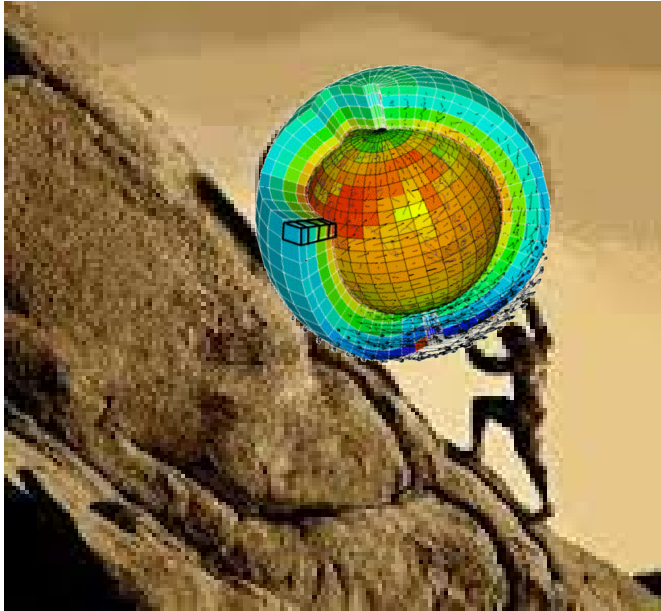
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Latitudinal variation of fluxes  
Mean rainfall  
Increased number of metrics

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- 663 Mutli-atlas (diagnostic suite rich and heterogeneous)
- 2400 simulations: forced 2-30 years, coupled 50-300 yrs

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Coordintate successive  
versions of CMIP atm.  
models like Sysiphus  
("We must imagine happy  
sisyphus", A. Camus)

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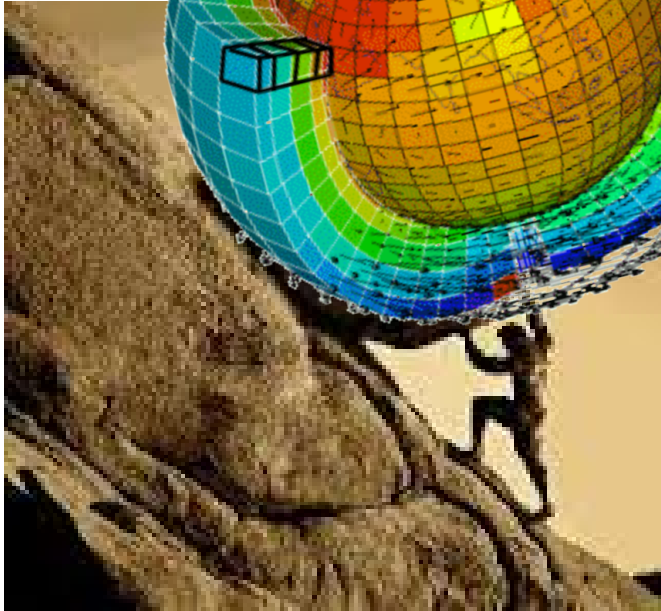
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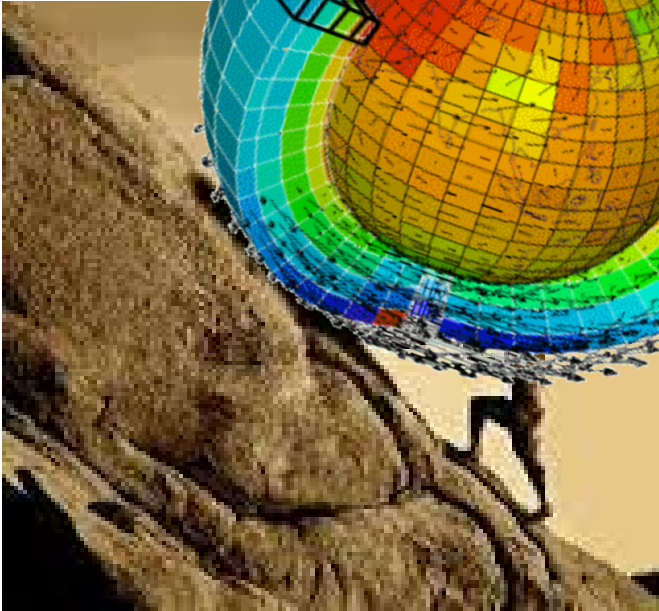


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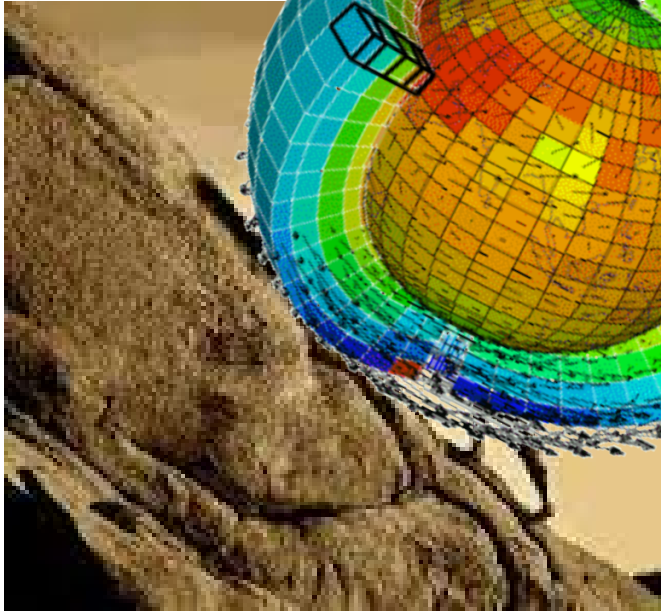
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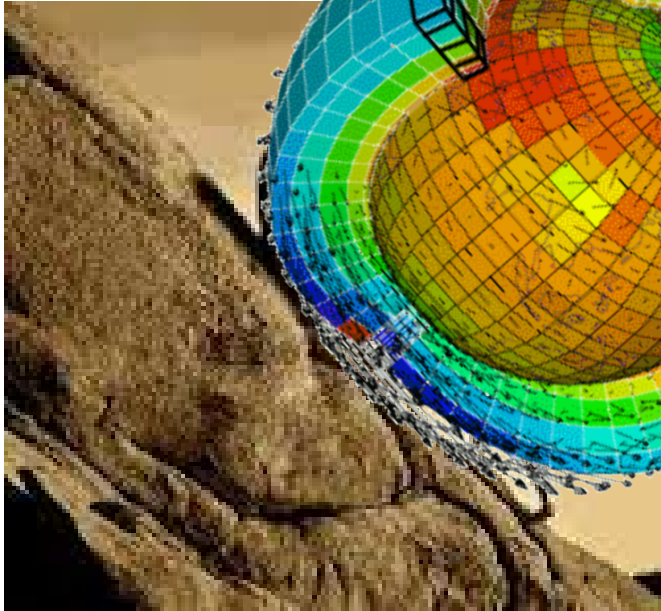
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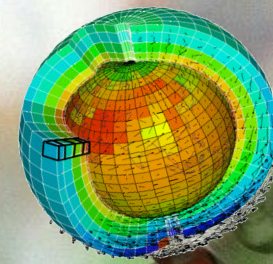
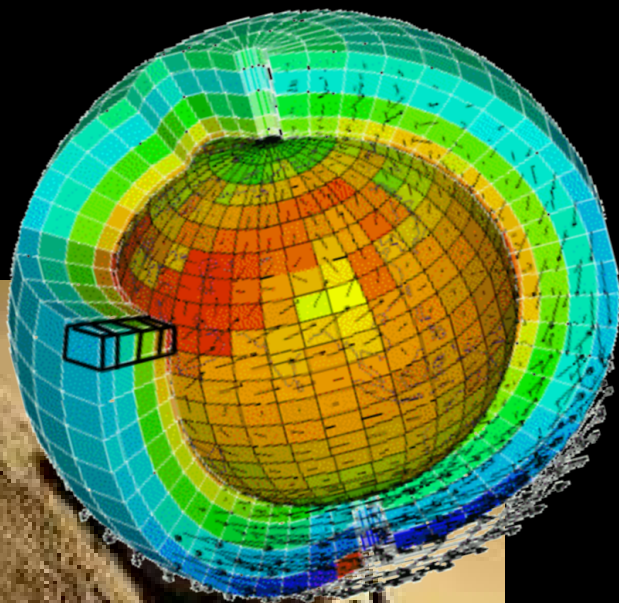




**Promote more objective  
and « agile » methods  
Collective work**

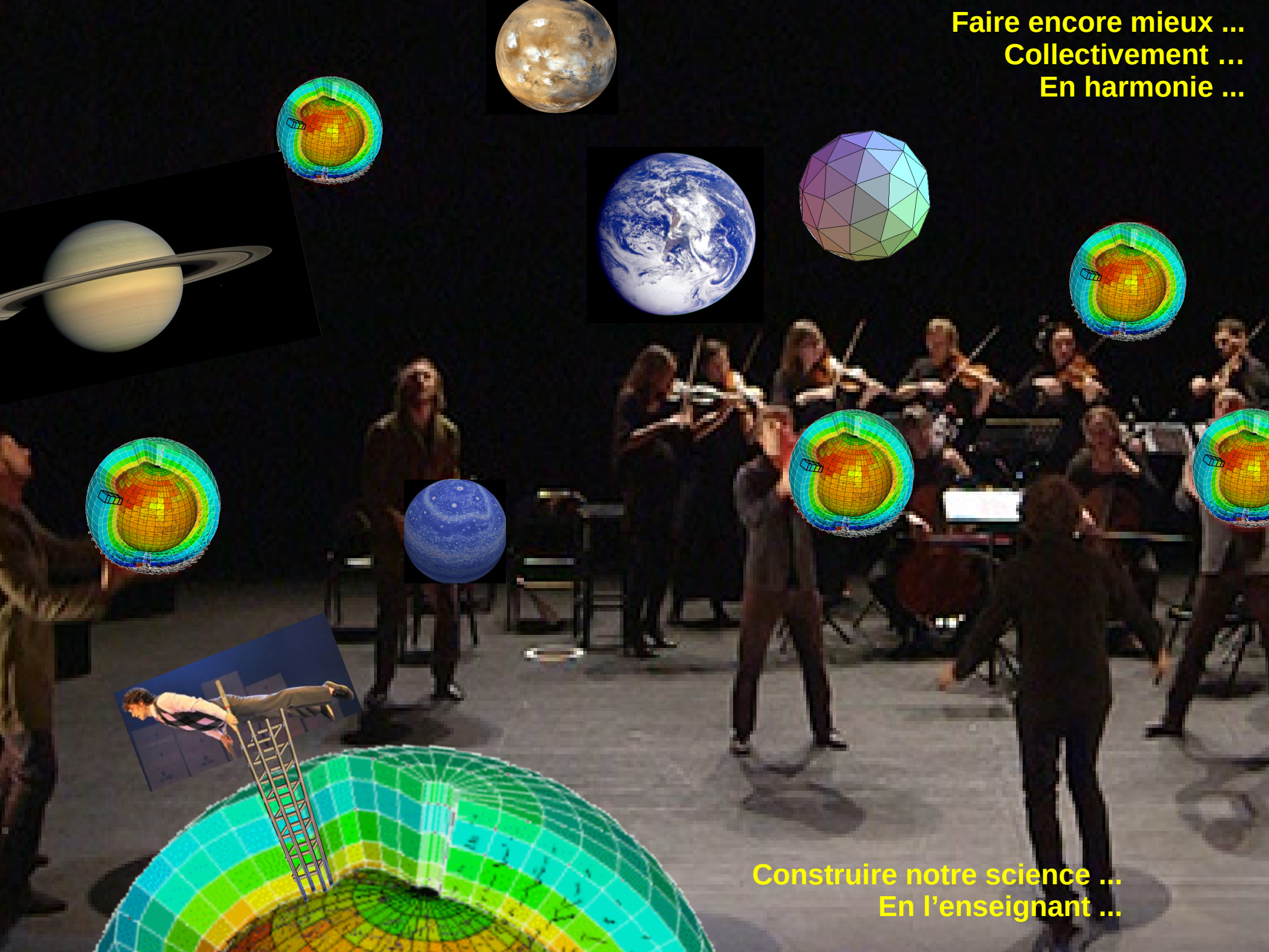
**Disponibilité de configurations multiples  
mise en œuvre en enseignement**

**Automatisation des post-traitements  
Tuning automatique (émulateurs)**





Faire encore mieux ...  
Collectivement ...  
En harmonie ...



Construire notre science ...  
En l'enseignant ...