

# LMDZ SCM

## Single Column Model

- + what is it ?
- + why is it interesting ?
- + List of 1D cases
- + how to install and run it ?

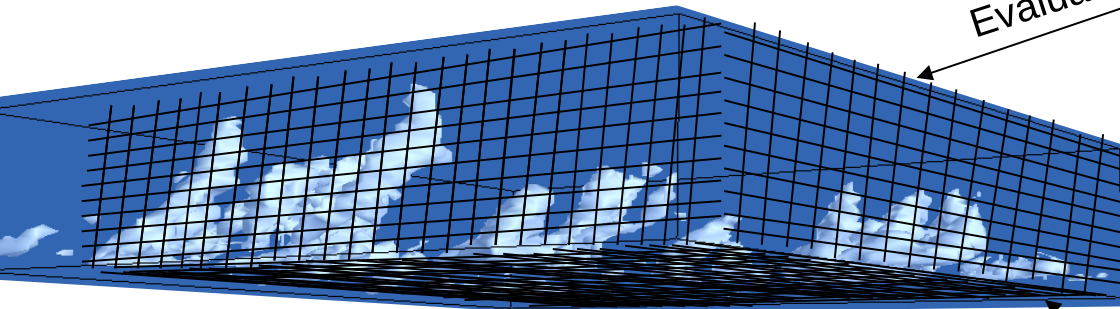
# Use of 1D cases



Observation



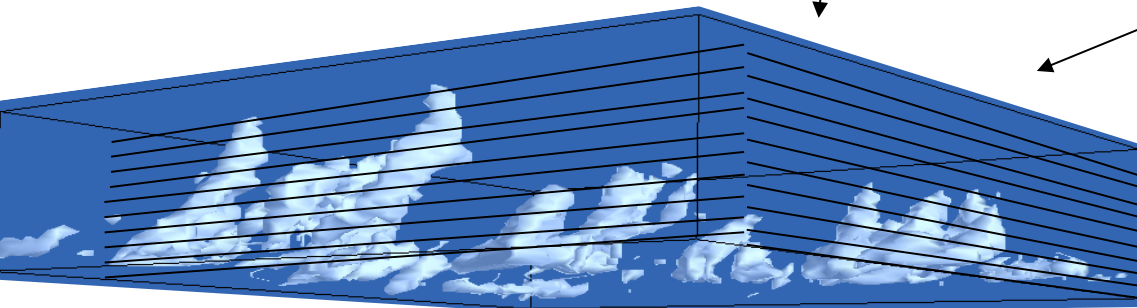
Evaluation



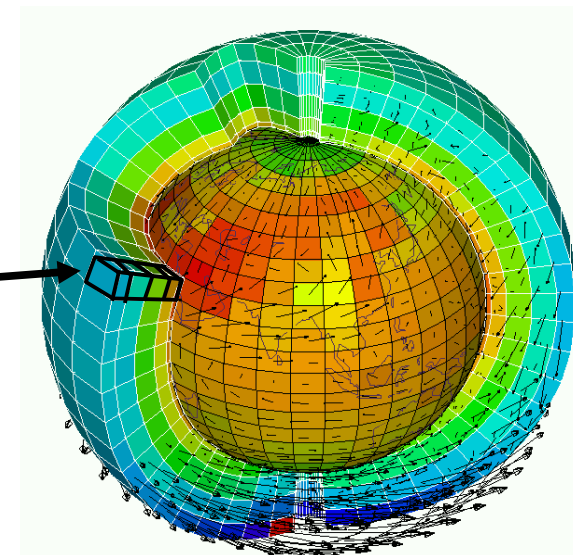
Explicit simulations, Grid cell, 20-100 m

Evaluation

« Large scale »  
conditions  
imposed



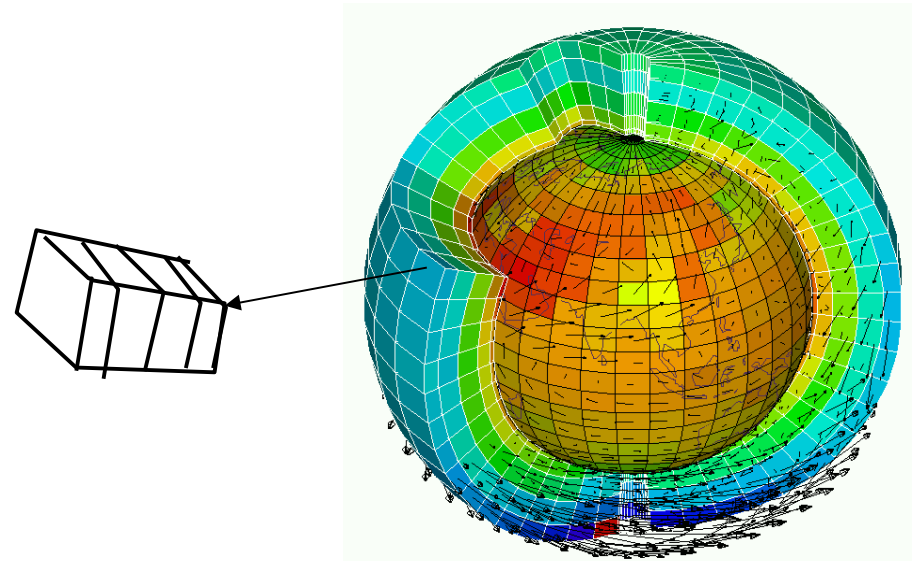
Climate model, parameterizations, « single-column » mode



Courtesy F.Hourdin

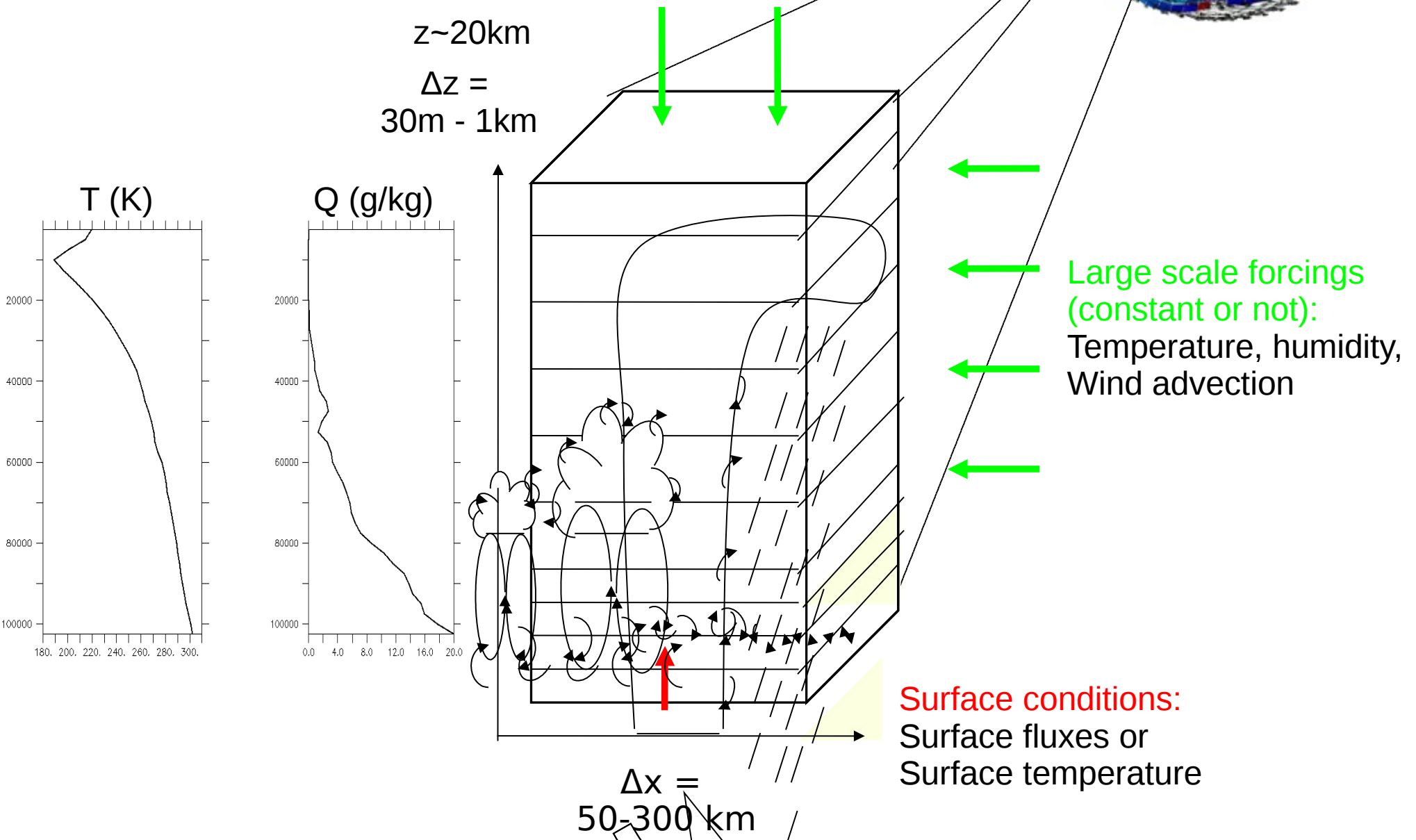
3D is a collection of many “single column models”, covering earth and interaction with each other through a set of rules known as “large scale dynamics”.

In a 1D model, there is no dynamics. We use observations or model output or idealized forcing to impose forcing at the boundaries of the column.



# LMDZ model in 1D mode

- We impose large scale conditions.
- Duration of the case varies from few hours to few months
- We study parameterizations in a given environment.



# Why use SCMs ?

- + **simplicity**: technical and understanding, usable on any labtop

- + it's a useful tool for **parameterization development**: shallow convection, deep convection, transition from stratocumulus to cumulus, stable boundary layer, radiation...

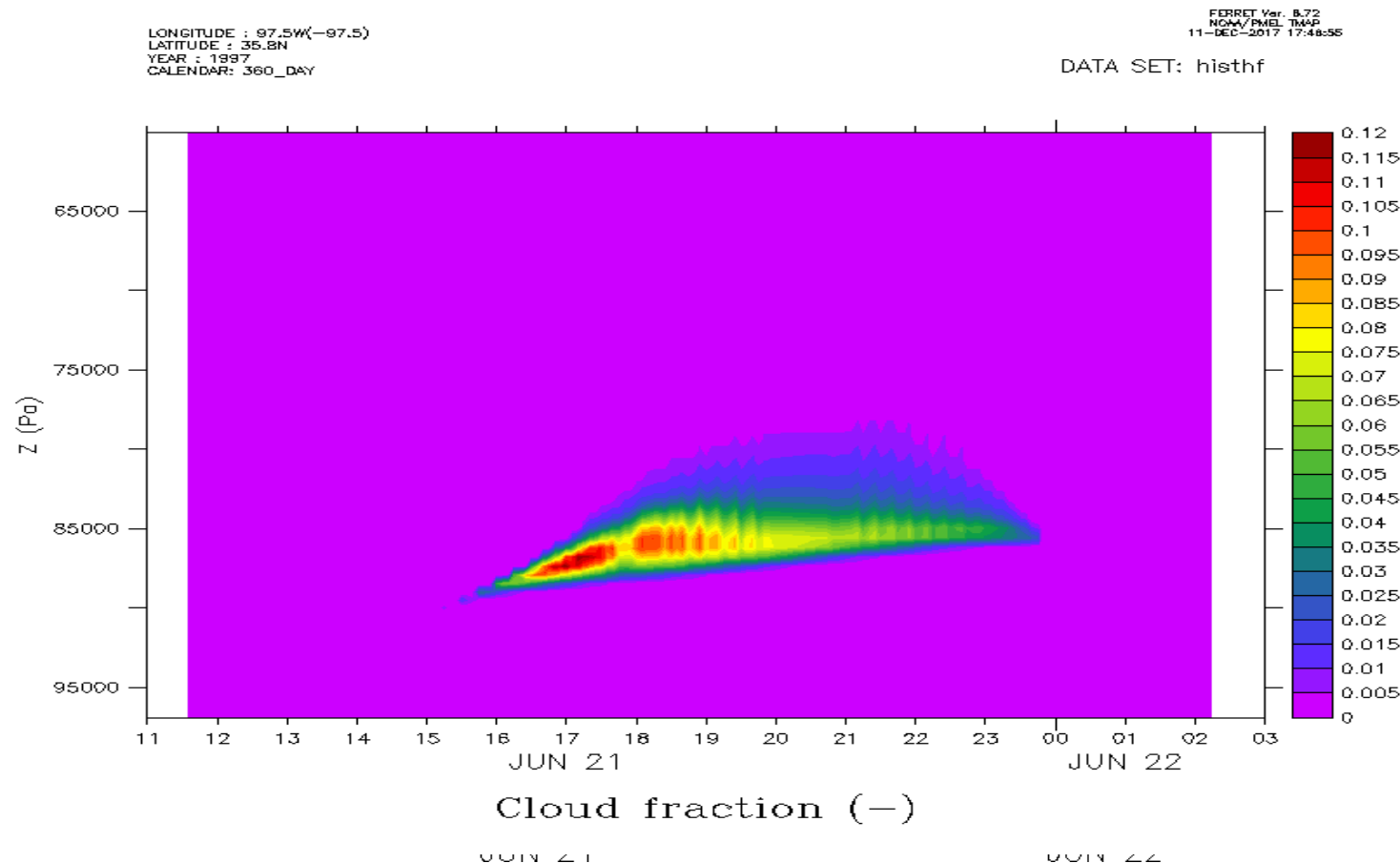
- + we can **compare results to observations or to explicit simulations** (CRM, LES)

- + then we go back to GCM and test new parameterizations ...

- + hierarchy of models: SCM, LAM, AGCM, GCM ...

# Dry and shallow convection

- **Arm\_cu** (diurnal cycle of shallow cumulus over land)
- **Rico** (Rain In Cumulus over Ocean, shallow precipitating cumulus over sea)
- **Ayotte** (convective boundary layer, sky clear )



Arm\_cu case - Cloud fraction (%)

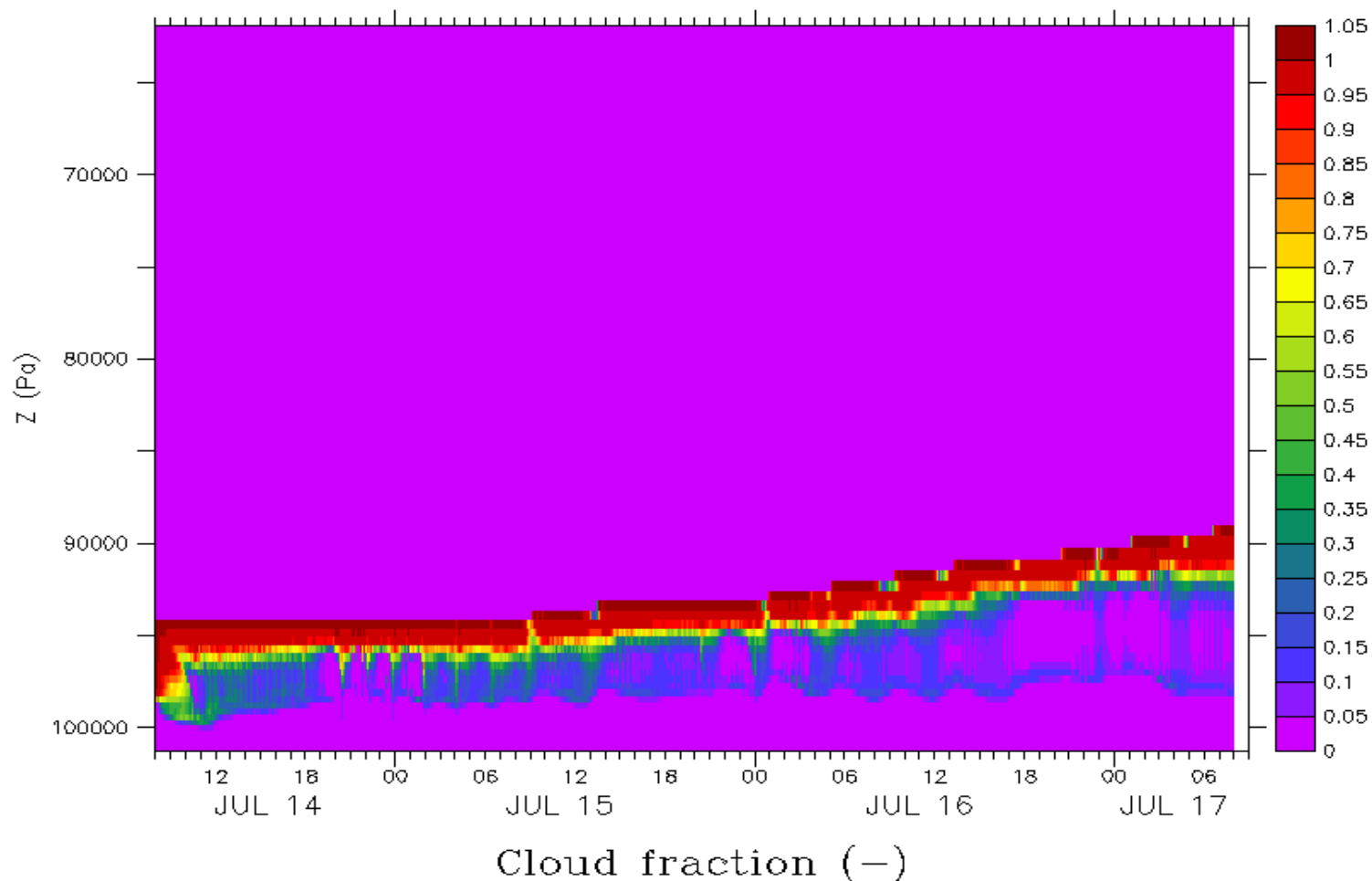
# Stratocumulus and transition to cumulus

- **Sandu** (transition case with 3 options according to variation of SST)
- **Fire** (diurnal cycle of stratocumulus)

LONGITUDE : 119.5W(-119.5)  
LATITUDE : 33.2N  
YEAR : 1987  
CALENDAR: 360\_DAY

FERRET Ver. 8.72  
NCAR/PMEL TMAP  
11-DEC-2017 17:48:20

DATA SET: histhf



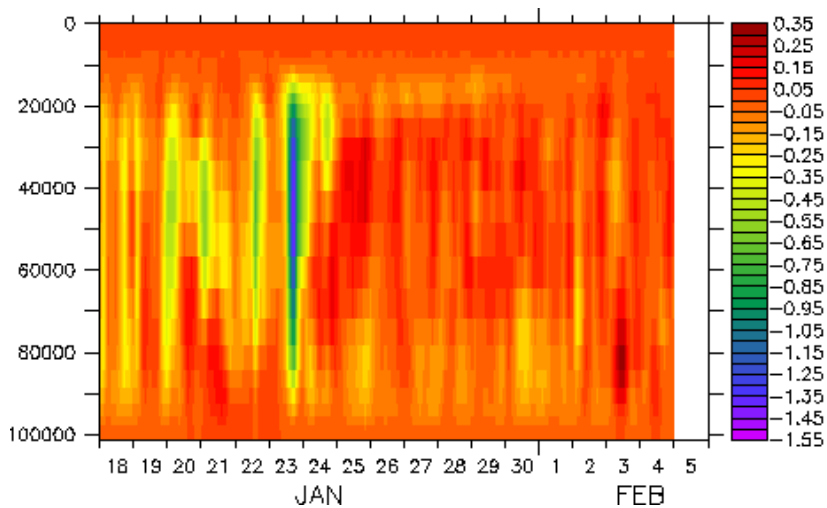
Fire case:  
Cloud fraction (0-1)  
NPv6.0.12splitL95

## Deep convection:

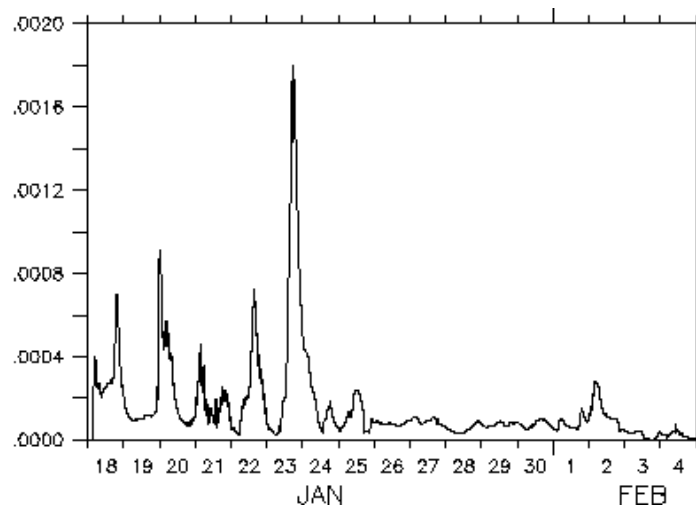
### Over ocean:

- **Toga**
- **case\_e** (part of Toga)
- **TWPICE** : off the coast of Darwin
- **Cindy Dynamo** : MJO study

## **TWPICE Case (2 weeks)**

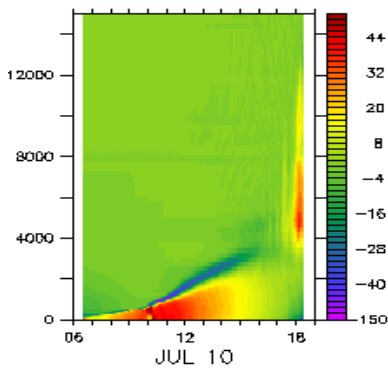


Vertical speed (m/s)

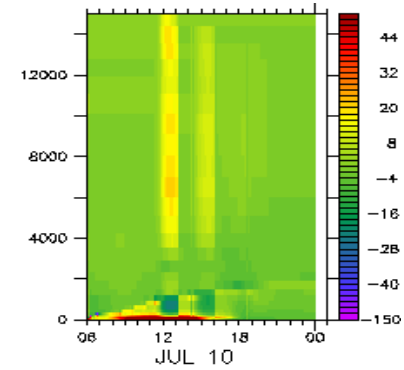


Precipitation (mm/j)





LES from 6h **to 18h**



LMDZ\_AR4\_L39  
From 6h **to 00h**

AMMA case (10h july 2006):  
Thetal tendencies due to all schemes (K/j)

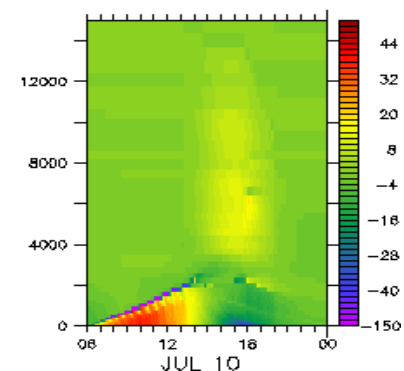
## Deep convection:

### Over land:

- **Hapex**
- **AMMA**

### Idealized case:

- **eq\_rad\_conv** (RCE) : radiative and convection scheme active



LMDZ\_NP\_L70 from 6h **to 00h**

## Stable boundary layer:

- Dice
- GABLS4

We can run these cases with  
atmosphere forced or coupled with  
Orchidee model

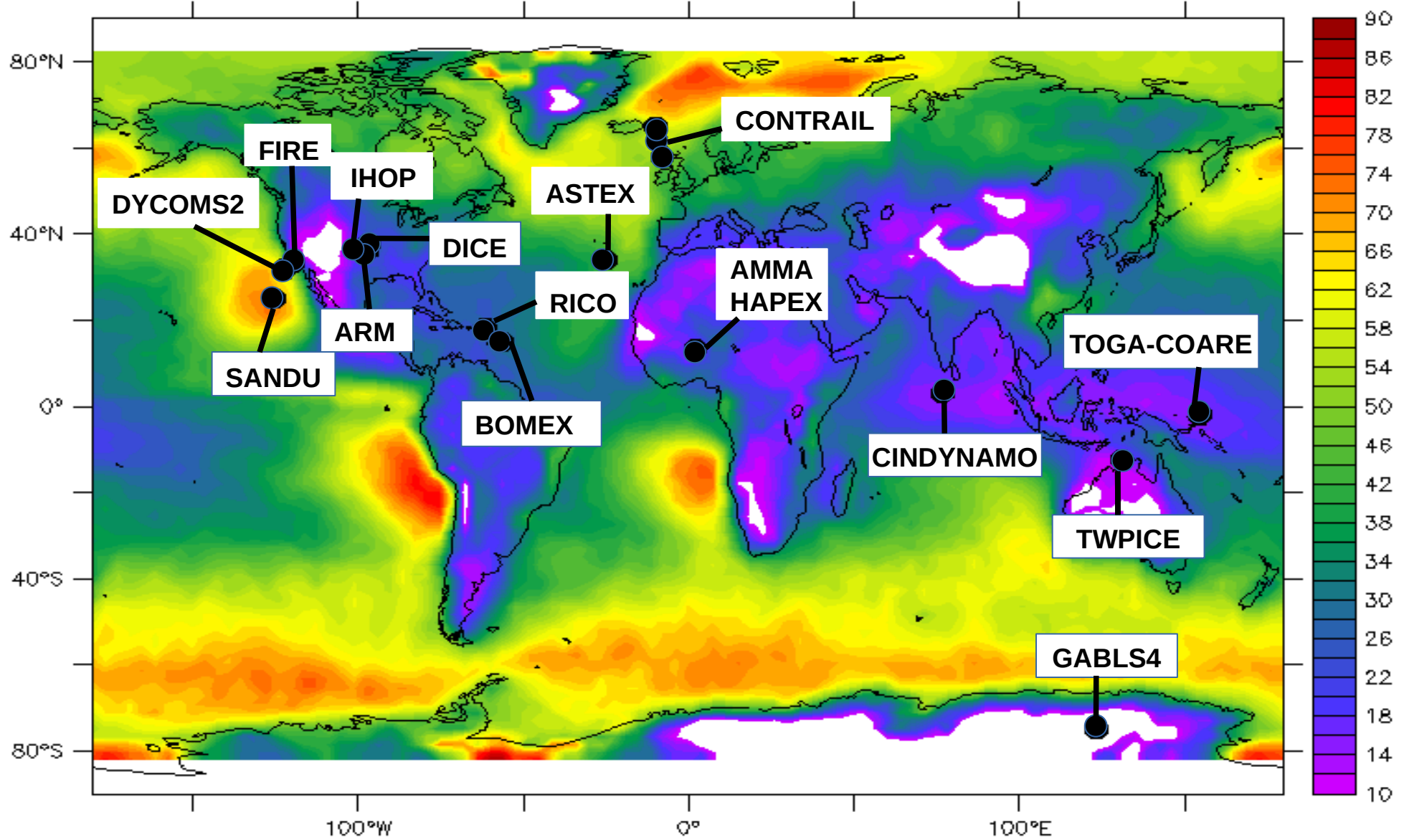


**DICE** case : characterize boundary layer  
In the site of SGP during 3 days/night



**GABLS4** case : interaction of a very  
stable boundary layer with a snow  
surface

## Where are located all these cases ?



*Background : low cloud cover from Calipso (Chepfer et al. 2008)*

# How to proceed ?

- + install LMDZ 3D with **install\_lmdz.sh**

- + to install LMDZ 1D :

  - \* `wget http://www.lmd.jussieu.fr/~lmdz/pub/1D/1D.tar.gz`

  - \* `uncompress 1D.tar.gz`

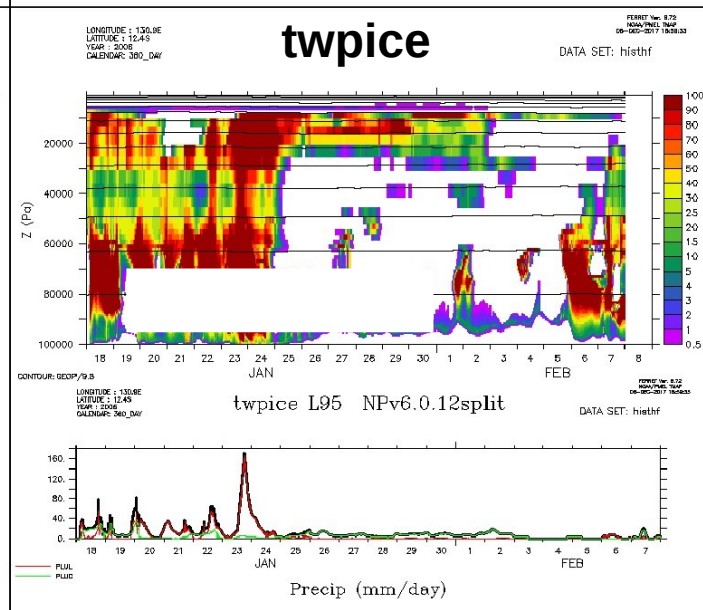
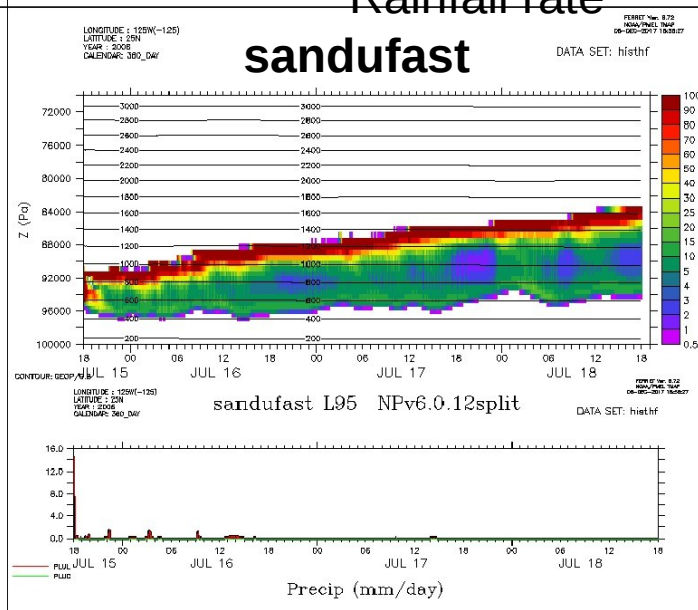
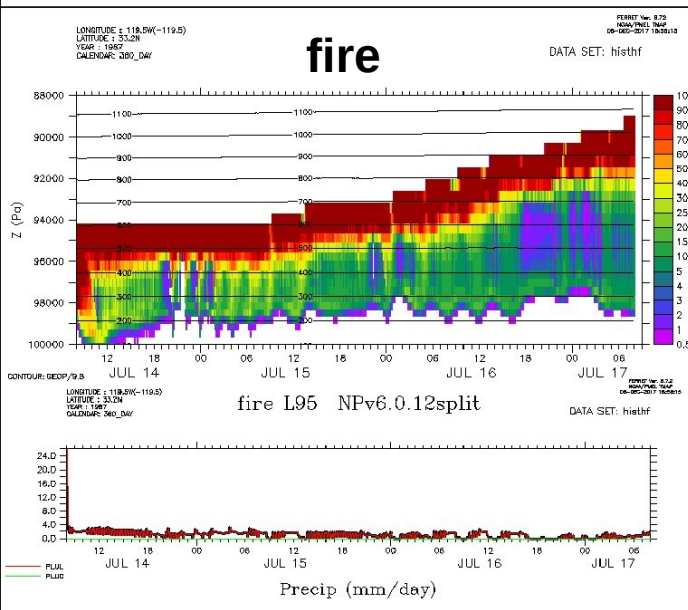
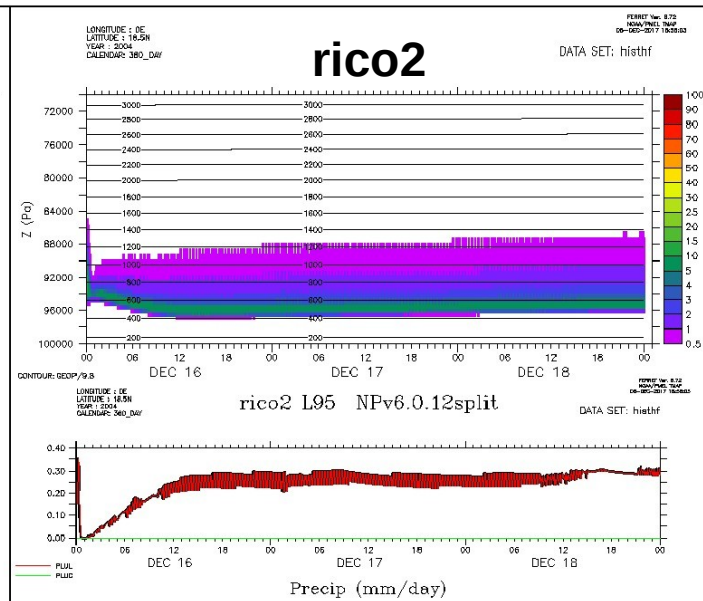
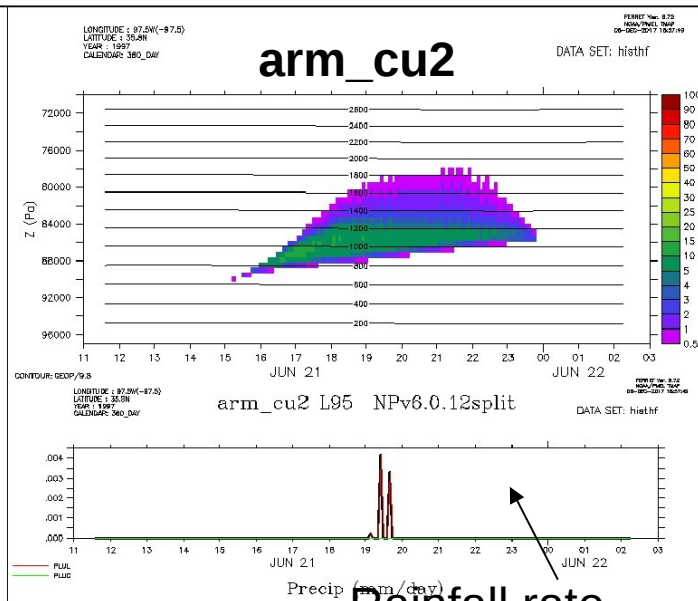
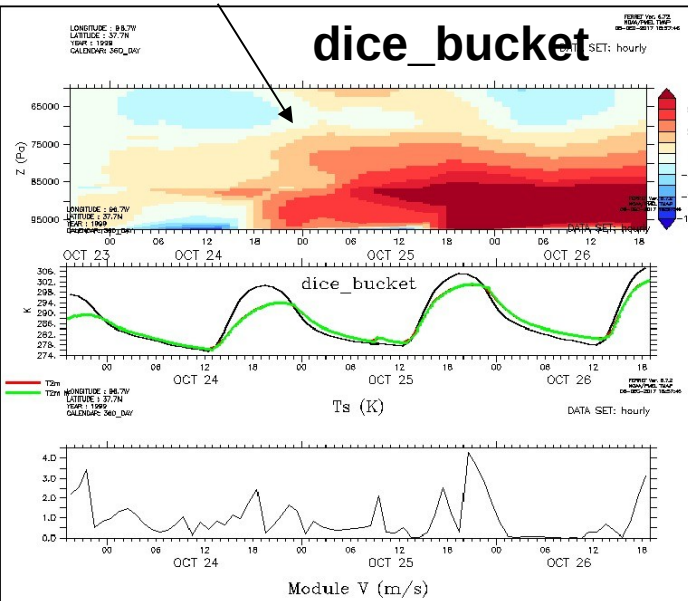
  - \* `./run.sh`

  - \* runs 6 cases ( `dice_bucket` `arm_cu2` `rico2` `fire` `sandufast` `twpice`) with 1 physical package

  - \* shows cloud cover + precipitation plot

# NPv6.0.12split 95 levels

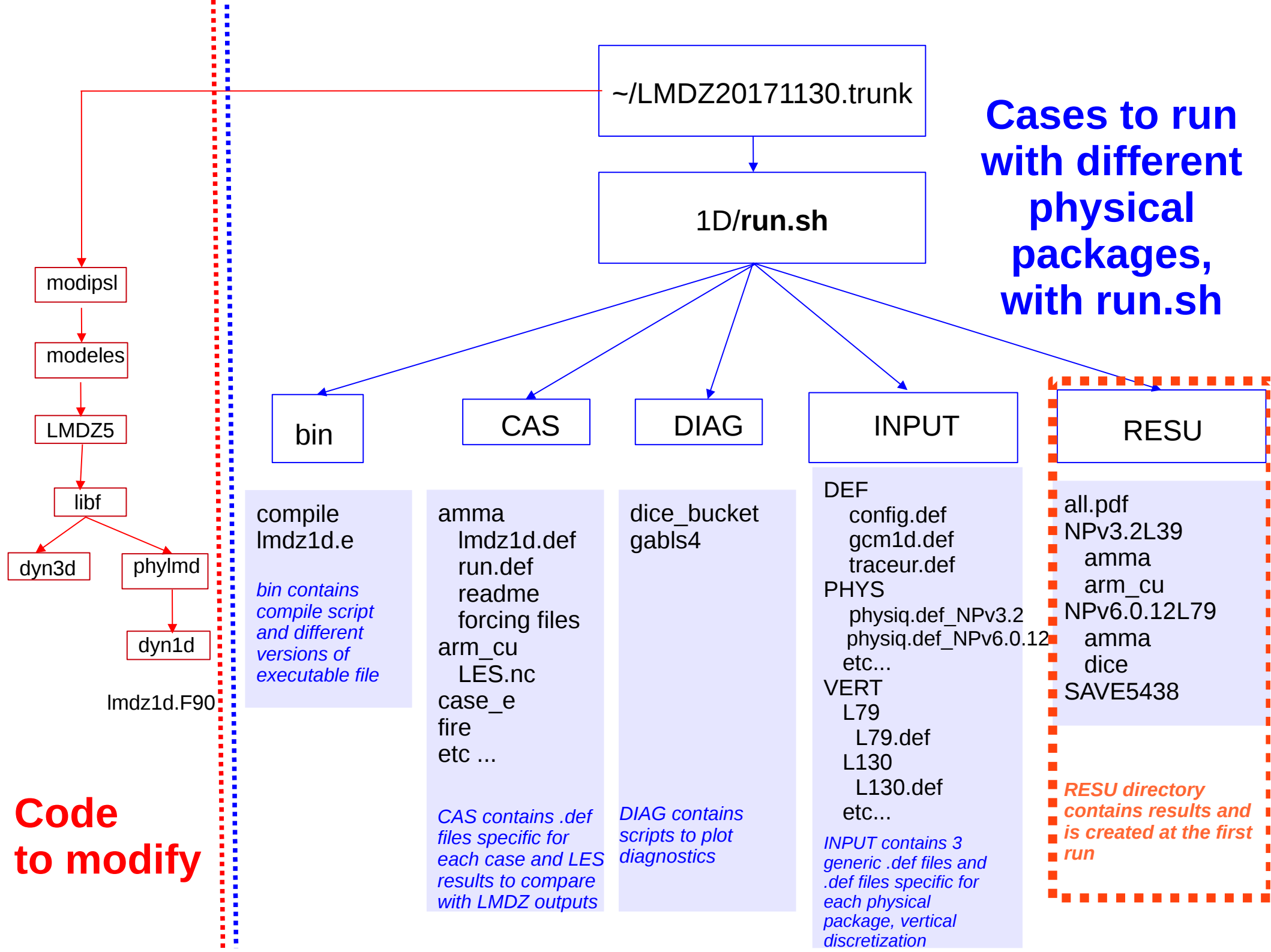
Cloud cover



What can you do in each case directory ?

- + **compile & run** with run.sh: choose case, physical package and level number
- + Look at **initial profiles and forcings** (ascii files or netcdf files)
- + Modify \*.def files
- + Read readme file
- + **get results** in netcdf files (hist\*.nc)
- + **compare** to LES results if available





There are two ways to run the model :

- Either in « **operationnal mode** » with run.sh (several cases and physical packages)
- Or « **by hand** » with ~bin/compile then lmdz1d.e



# How to run a case or compile after modifications : With run.sh

## Which case(s) ?

```
listecas="dice ihop arm_cu rico sandufast sanduref sanduslow fire  
toga ayotte twpice case_e amma " # testes
```

```
listecas="arm_cu rico sandufast fire twpice amma"
```

```
listecas="amma"
```

## Which physics ?

```
listedef="SP NPv3.1 NPv3.2 NPv4.12 NPv5.00 NPv5.10"
```

```
listedef="NPv5.00 "
```

```
listedef="NPv6.0.12split "
```

## Number of levels ?

```
case $DEF in  
  SP|NPV3.1|NPv3.2) L=39 ;;  
  NPv4.12) L=59 ;;  
  *) L=79  
esac
```

# Where are the results ?

In LMDZtesting/1D/RESU/NPv6.0.12splitL95/amma

lrwxrwxrwx	1	...	36	3 déc.	11:38	amma.nc	← forcings
-rw-r--r--	1	...	285452	3 déc.	11:38	histhf.nc	↗ Result files
-rw-r--r--	1	...	279088	3 déc.	11:38	hourly.nc	↘
-rw-r--r--	1	...	15292	3 déc.	11:38	limit.nc	
-rw-r--r--	1	...	652	3 déc.	11:38	lmdz1d.def	
-rw-r--r--	1	...	4247	3 déc.	11:38	config.def	*def files
-rw-r--r--	1	...	85	3 déc.	11:38	gcm.def	
-rw-r-----	1	...	3765	3 déc.	11:38	physiq.def	
-rwxr-xr--	1	...	692	3 déc.	11:38	run.def	
-rw-r--r--	1	...	42	3 déc.	11:38	traceur.def	
-rw-r--r--	1	...	7728	3 déc.	11:38	paramLMDZ_phy.nc	
-rw-r--r--	1	...	16532	3 déc.	11:38	startphy.nc	
-rwxr--r--	1	...	16532	3 déc.	11:38	lmdz.e	

## CAUTION !

You can modify \*def files in ~LMDZtesting/1D/RESU and quickly rerun the model because lmdz1d.e is in this directory. **BUT BE CAREFULL**

The « original » files are either under ~LMDZtesting/CAS or ~LMDZtesting/INPUT  
And will be replaced at each run of run.sh

Thank you !