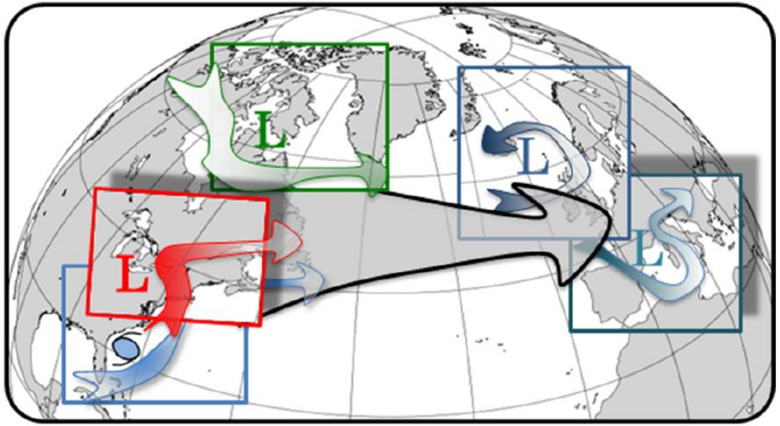
Première Analyse de la campagne NAWDEX

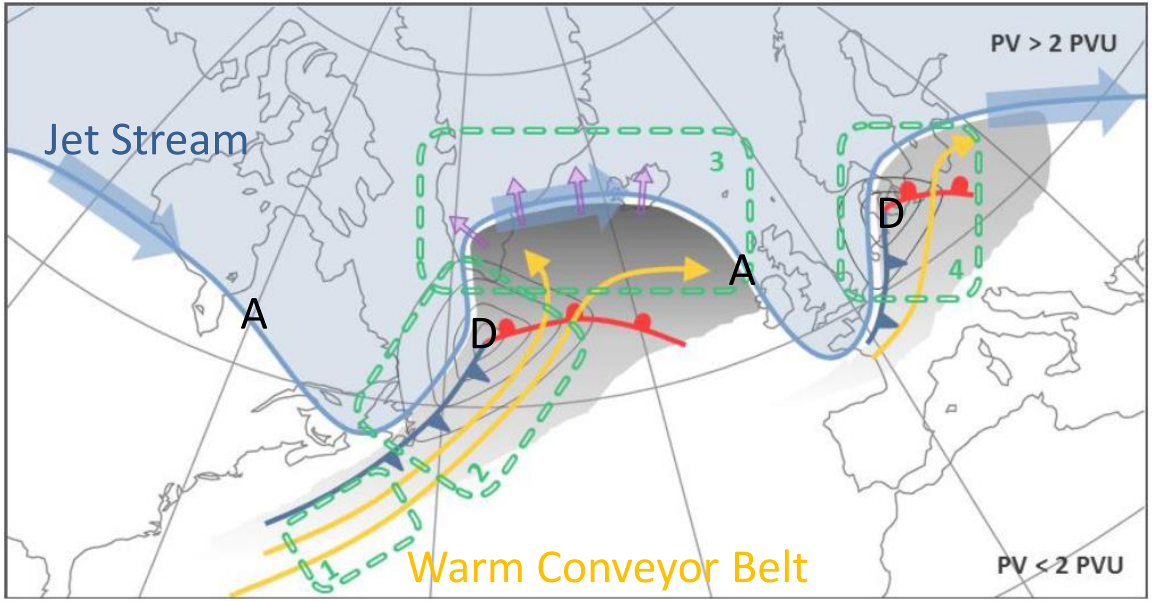
North Atlantic Waveguide Downstream Impact Experiment



Meryl WIMMER
M2 SOAC - DC

<u>Encadrants de stage :</u>
- Philippe ARBOGAST, CNRM
- Gwendal RIVIERE, LMD

Etude des Processus diabatiques



Schäfler et al, 2018

Processus diabatiques
- chaleur sensible,
- chaleur latente,
- rayonnement,
- turbulence

Etude des processus diabatiques dans la Warm Conveyor Belt
et l'effet sur le Jet Stream et les anticyclones d'altitude

NAWDEX

North Atlantic Waveguide Downstream Impact Experiment

- Initié par THORPEX
- Projet international
- Campagne de mesure en automne 2016
- Plateforme RASTA :

  lidar, radar et radiomètre

Falcon 20

Problématique

But du stage : Etudier l'effet des différents schémas de convection dans le modèle ARPEGE sur la WCB d'une dépression creuse

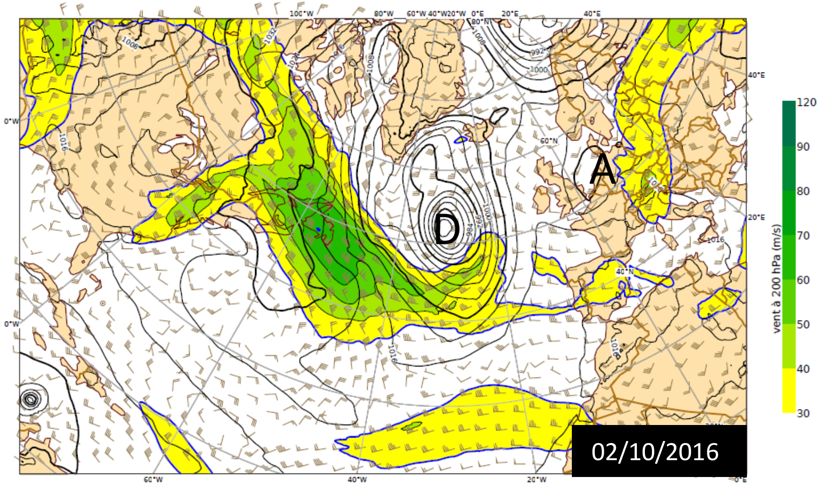
Etude des processus diabatiques dans la Warm Conveyor Belt

Cas d'une dépression creuse : 02/10/2016

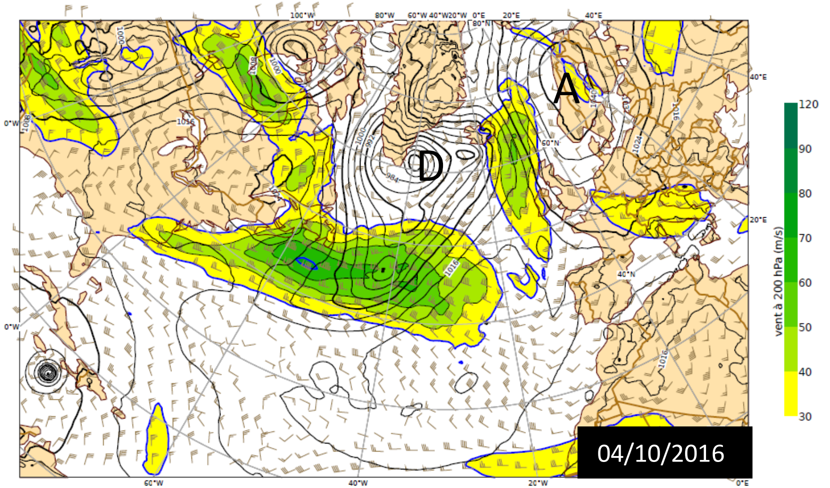
2 versions d'ARPEGE
- Version opérationnelle de 2016 : Run0
- Version avec schéma de convection PCMT : Run6

UNIVERSITÉ TOULOUSE III PAUL SABATIER

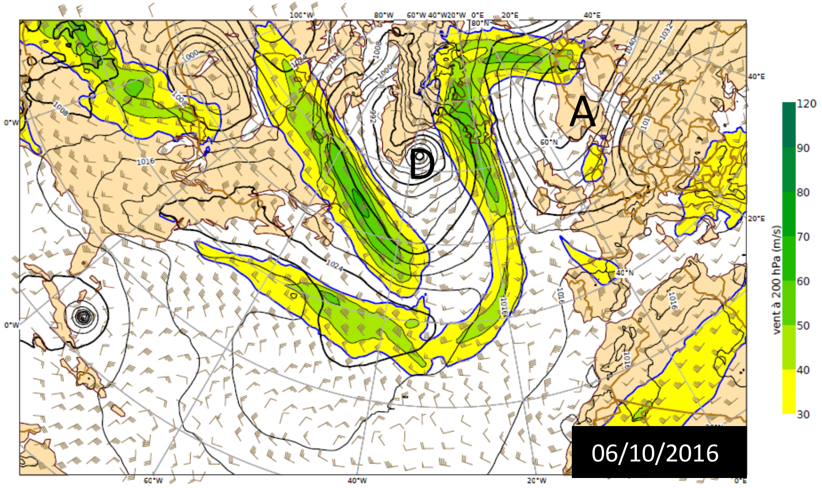
Dimanche 2 Octobre 2016 00UTC - Prevision Arpege t+0h: Dimanche 2 Octobre 2016 00UTC
Pression mer et Vent à 200 hPa



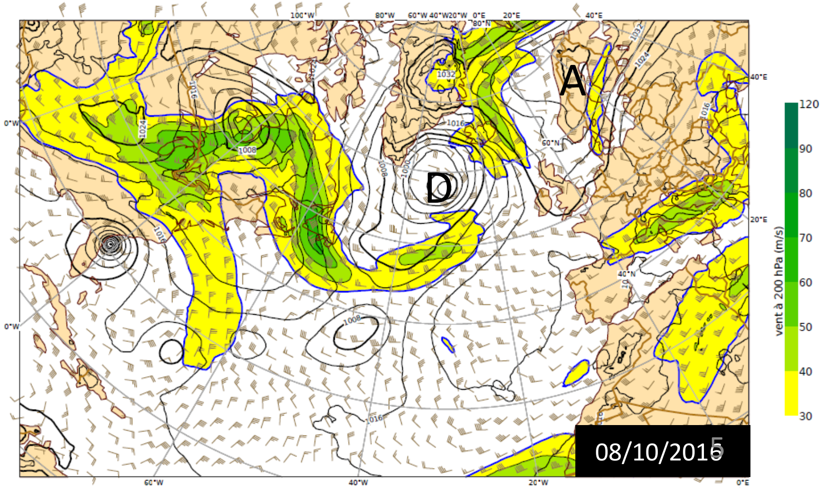
Mardi 4 Octobre 2016 00UTC - Prevision Arpege t+0h: Mardi 4 Octobre 2016 00UTC
Pression mer et Vent à 200 hPa



Jeudi 6 Octobre 2016 00UTC - Prevision Arpege t+0h: Jeudi 6 Octobre 2016 00UTC
Pression mer et Vent à 200 hPa

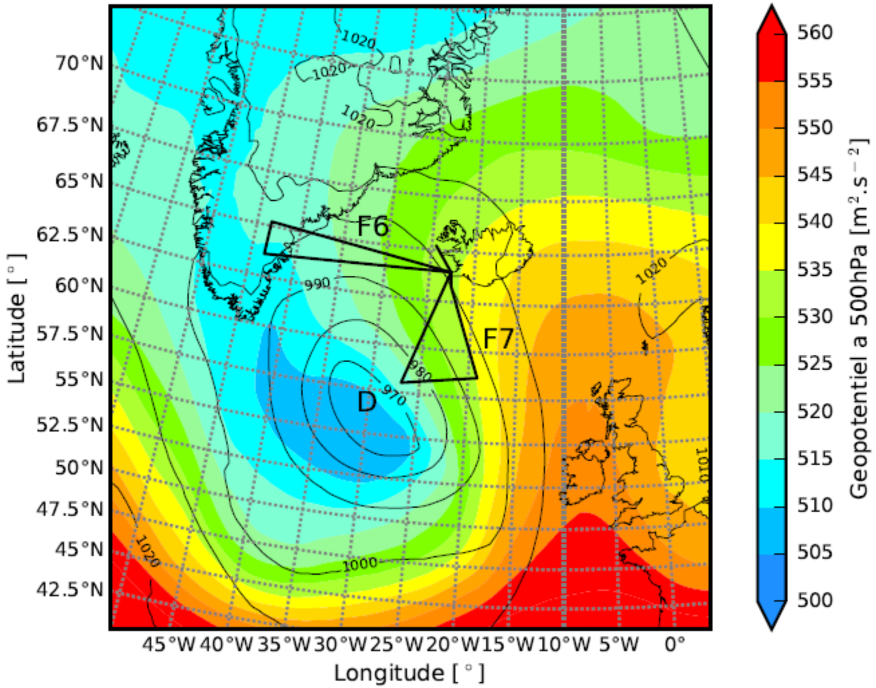


Samedi 8 Octobre 2016 00UTC - Prevision Arpege t+0h: Samedi 8 Octobre 2016 00UTC
Pression mer et Vent à 200 hPa

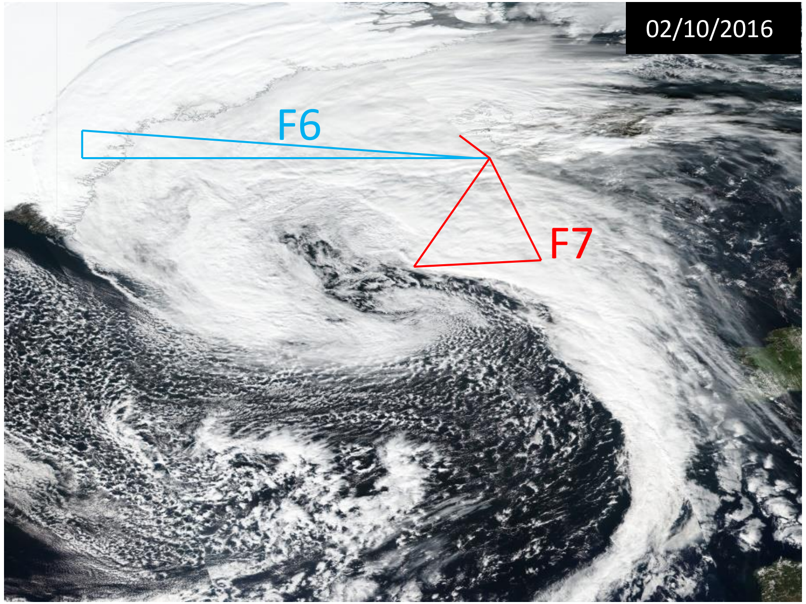


Situation météorologique

Carte de géopotentiel à 500 hPa et pression au niveau de la mer



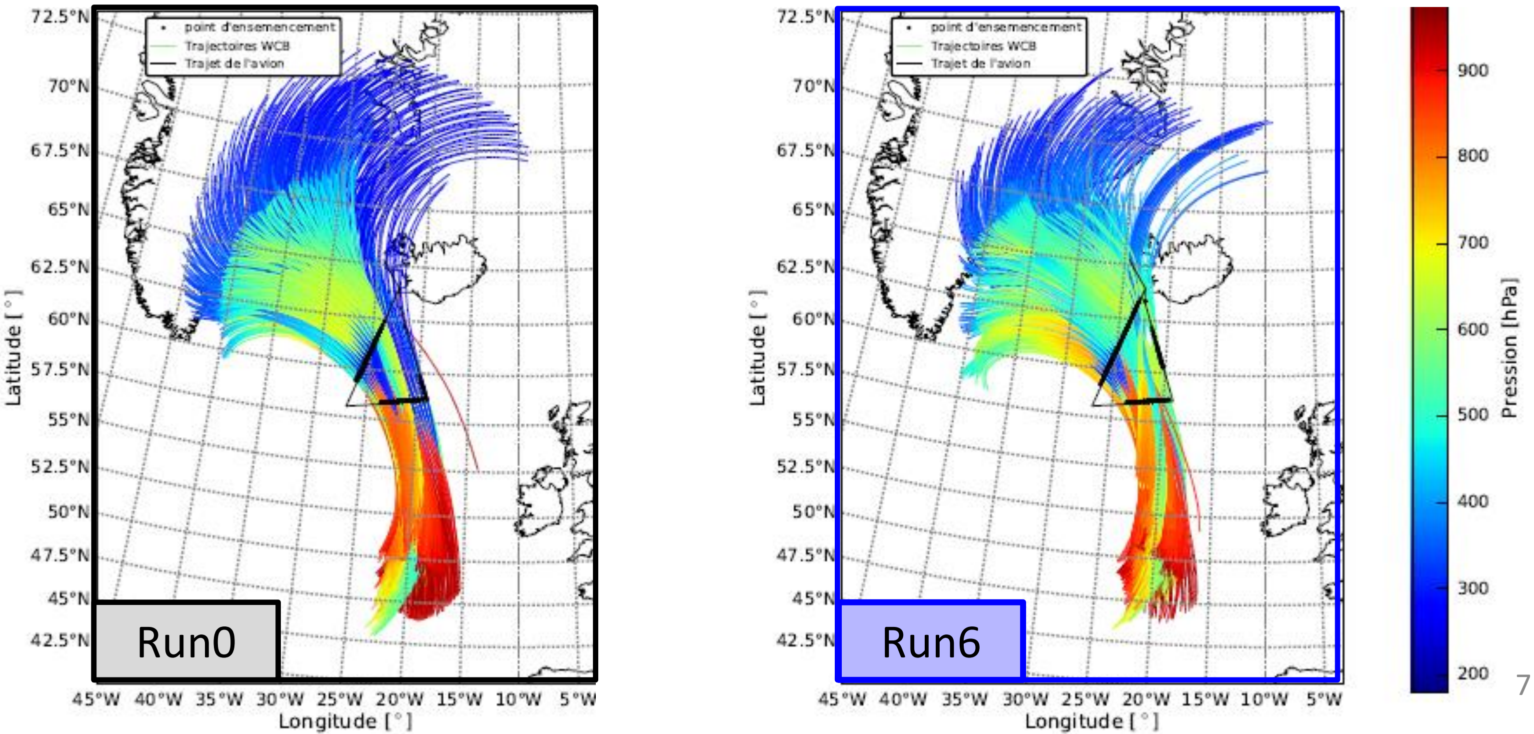
Analyse ARPEGE, du 02/10/2016 à 12h



MODIS, Nasa Worldview Application

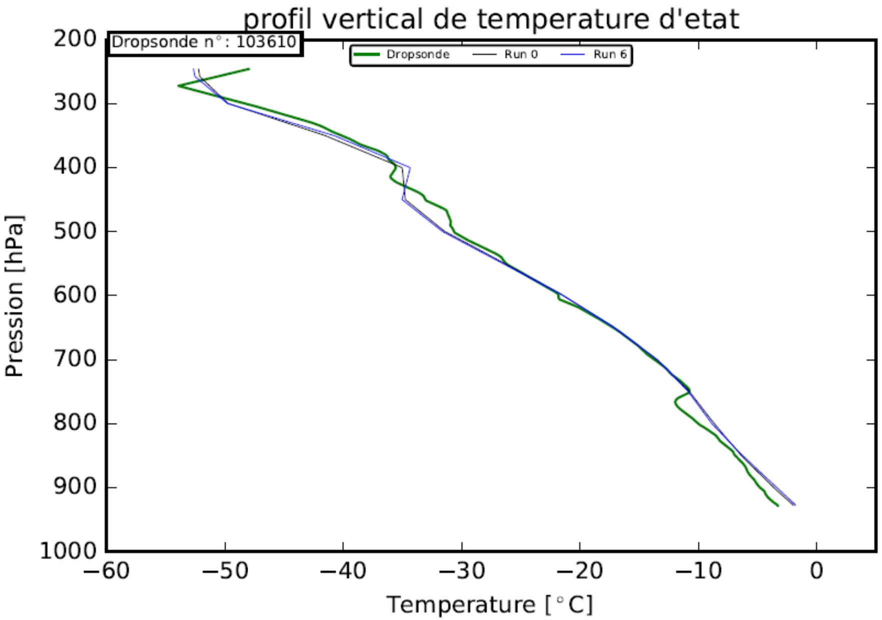
Warm Conveyor Belt – vol F7

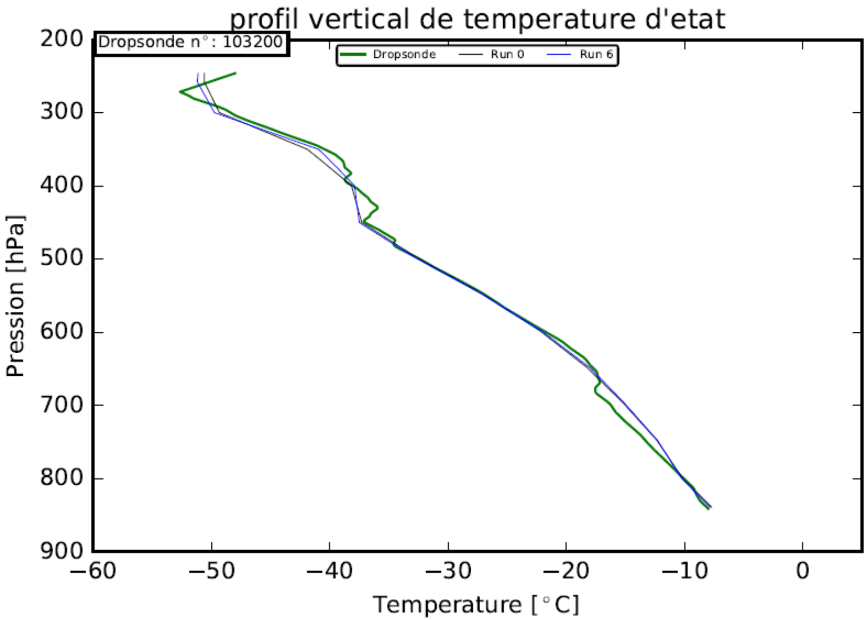
Critère : -300 hPa en 24h



CNRM

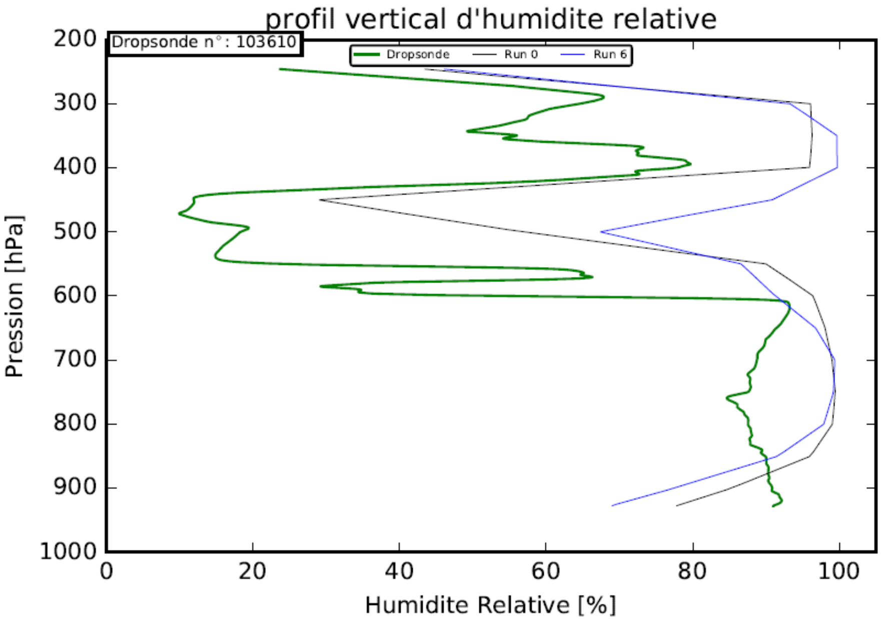
Dropsondes – vol F6

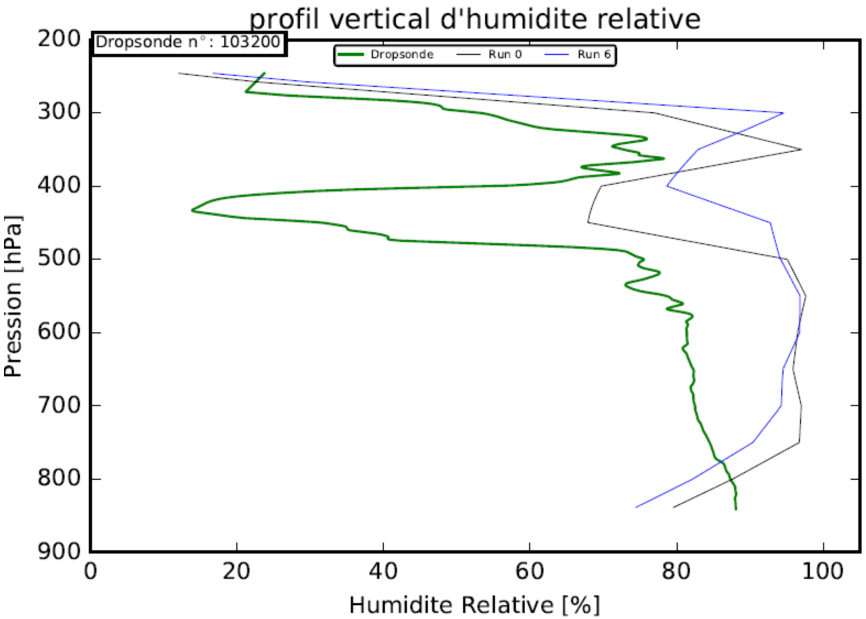




Mesures in situ Run0 Run6

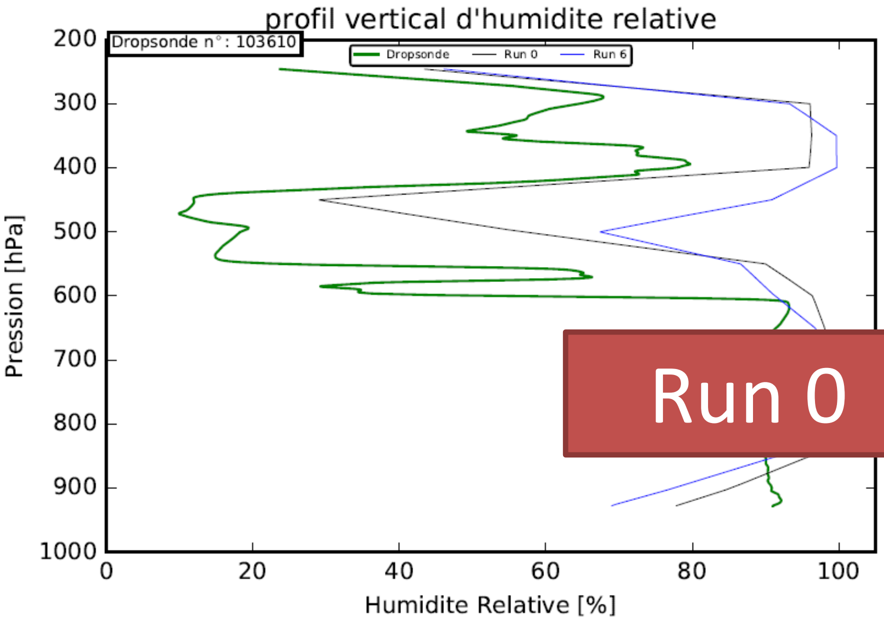
Dropsondes – vol F6

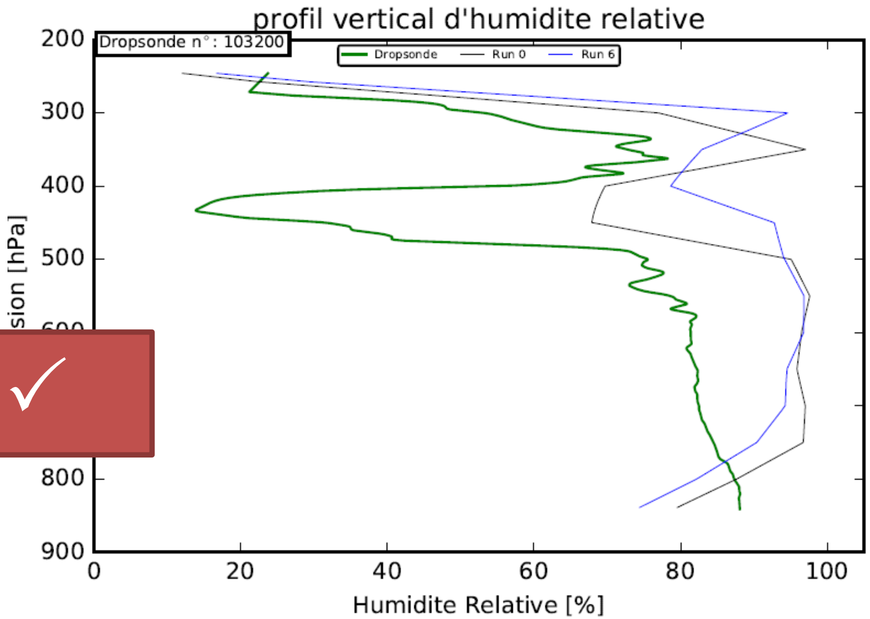




Mesures in situ Run0 Run6

Dropsondes – vol F6



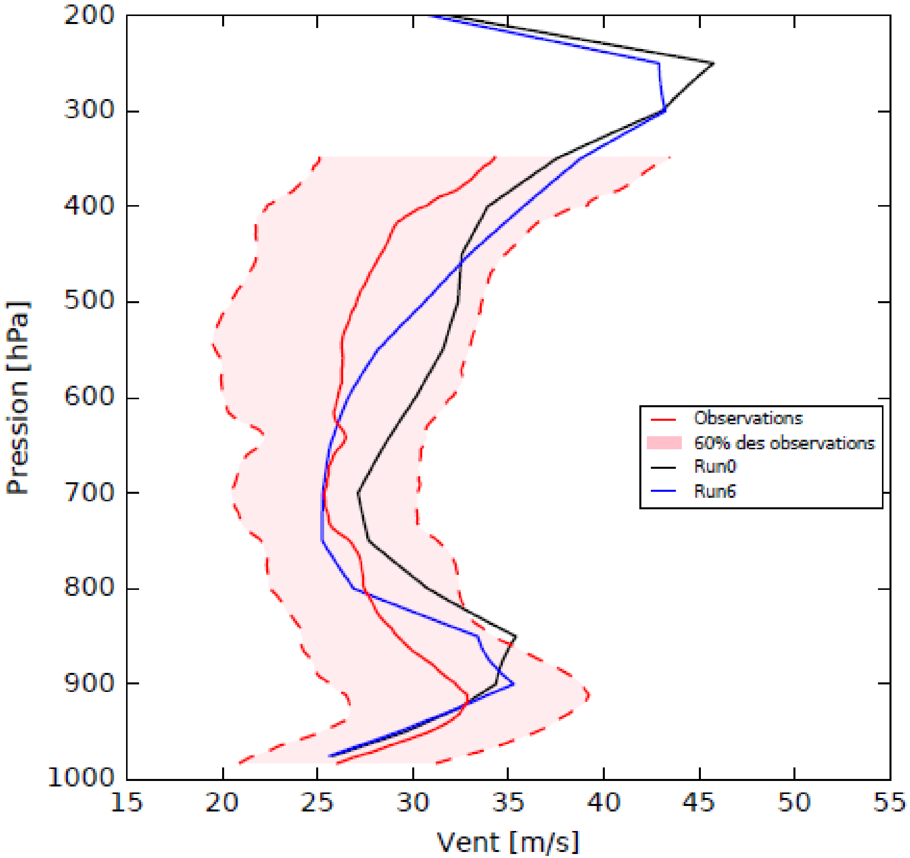


Run 0 ✓

Mesures in situ Run0 Run6

Radar – volF7

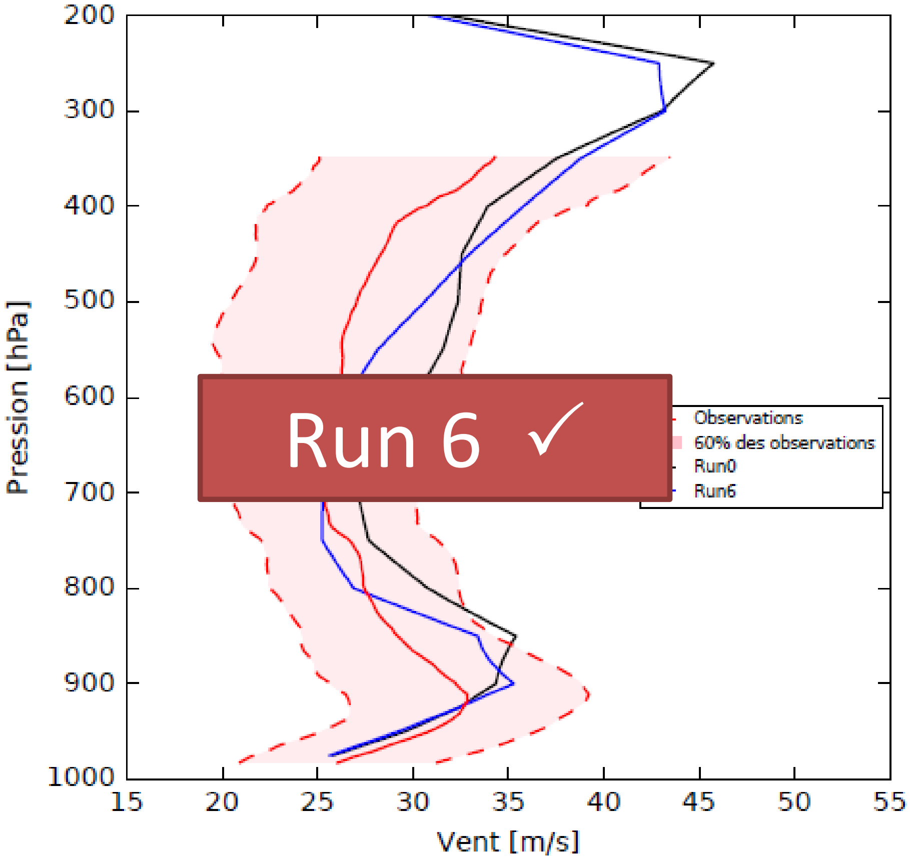
Vol F7



CNRM

Radar – volF7

Vol F7



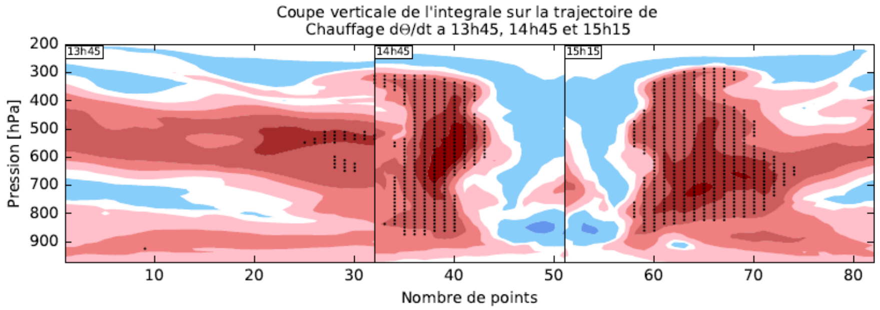
Run 6 ✓

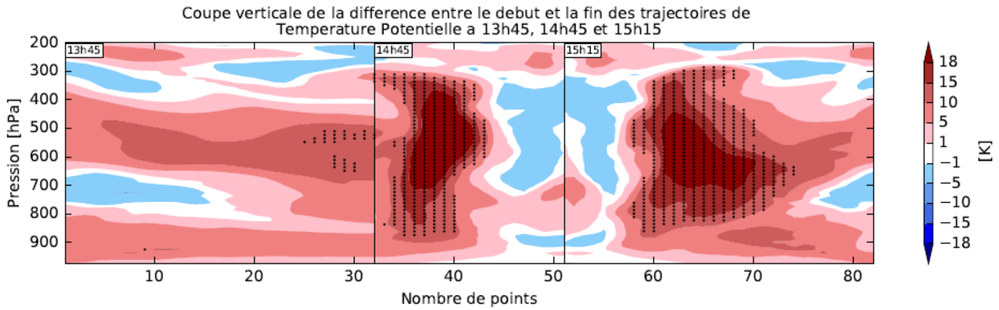
Validation du modèle de trajectoires : $\int \dot{\theta} dt \approx \Delta\theta$

Run0

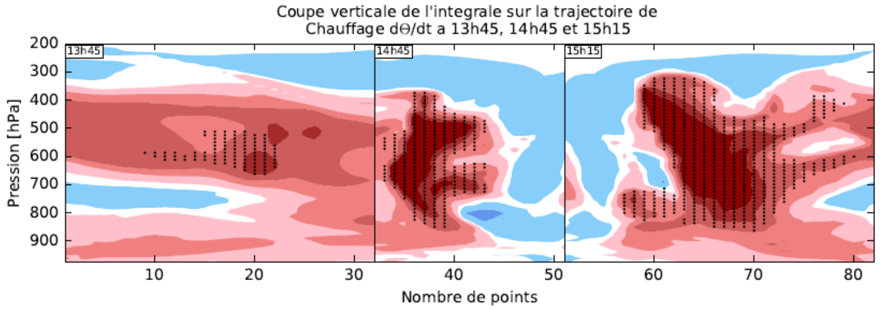
$\int \dot{\theta} dt$

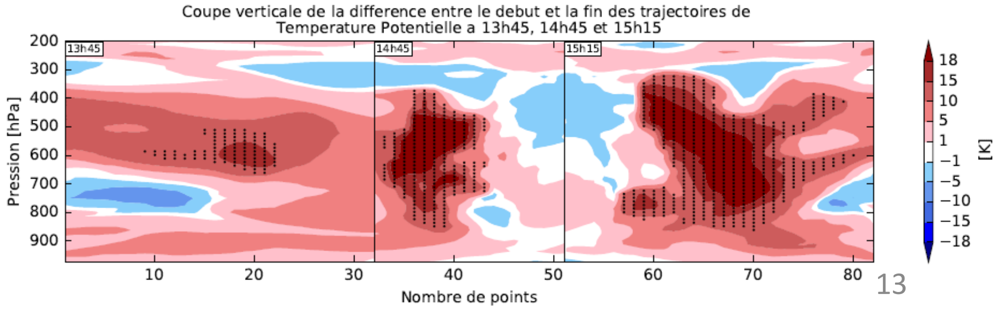
$\Delta\theta$





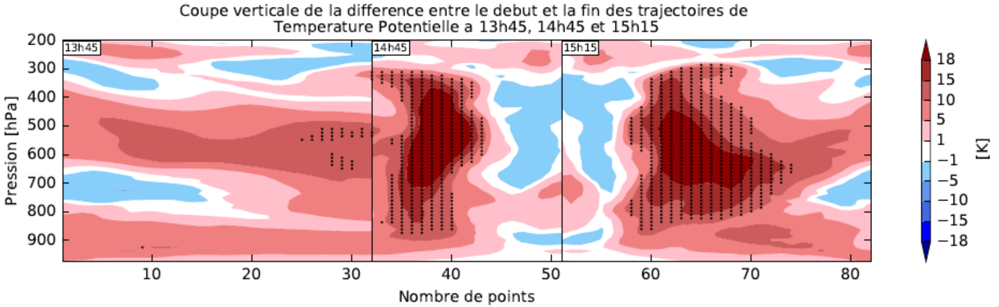
Run6

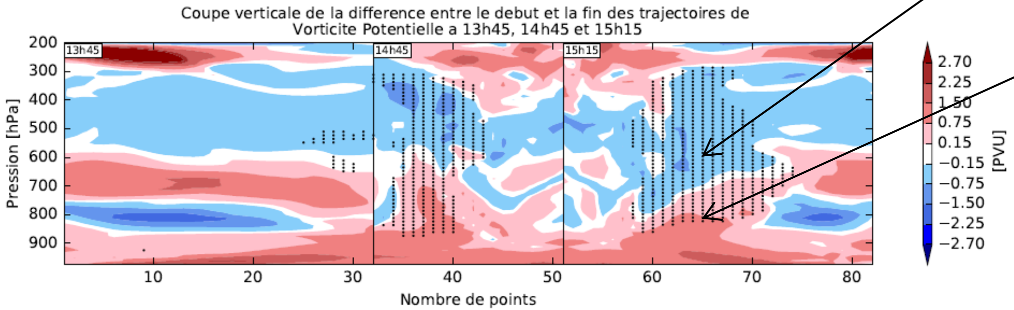


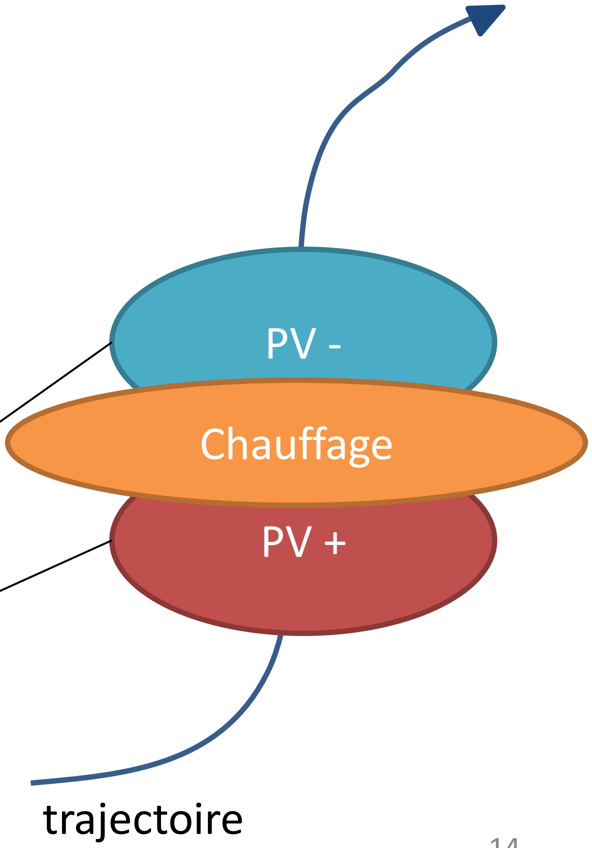


Lien chauffage-PV

Run0





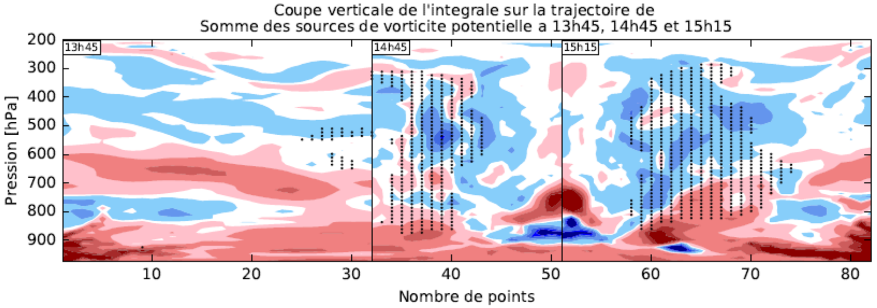


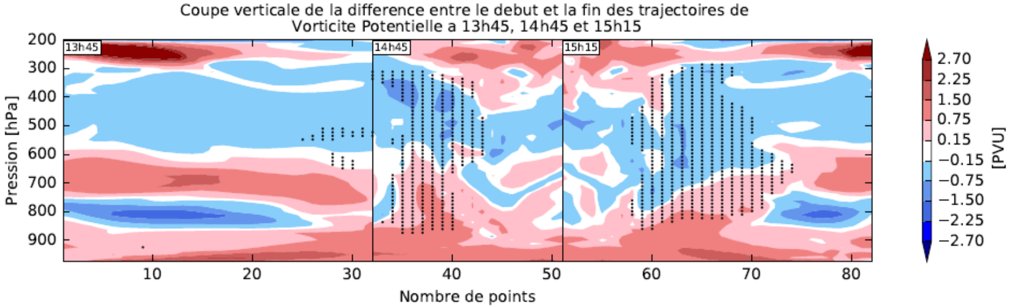
Validation du modèle de trajectoires : $\int \dot{PV}\,dt \approx \Delta PV$

$\int \dot{PV}\,dt$

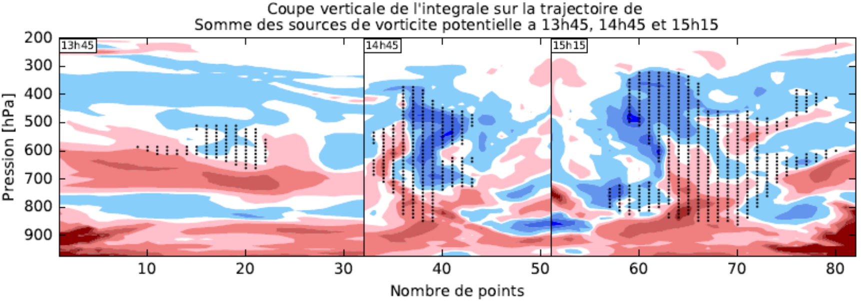
ΔPV

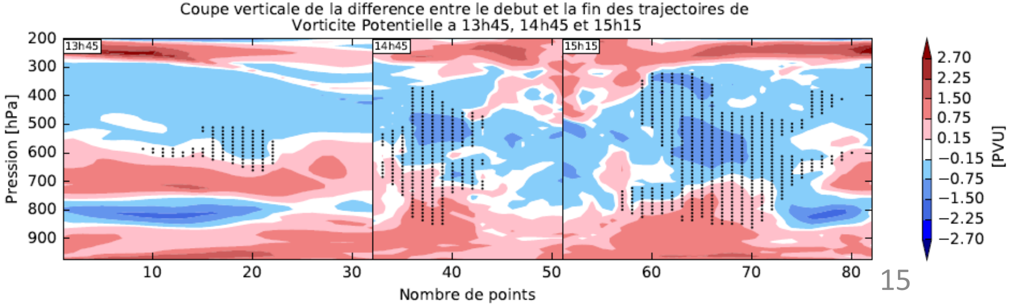
Run0





Run6



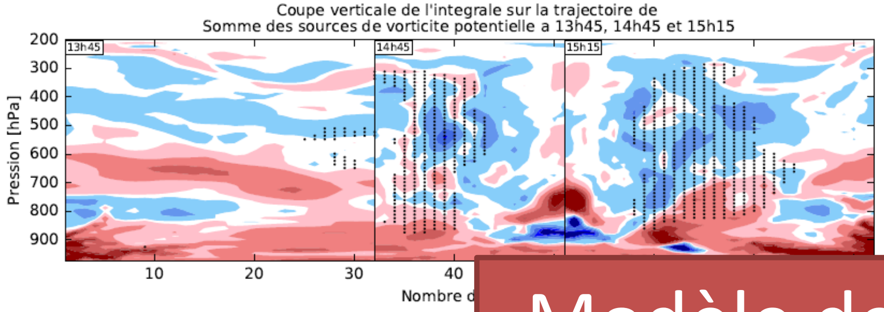


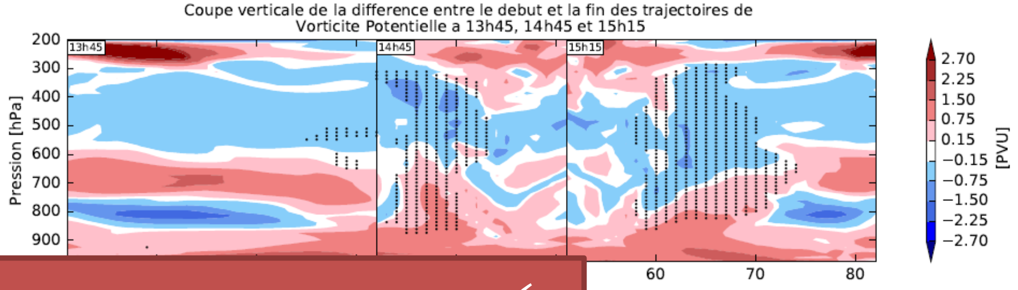
Validation du modèle de trajectoires : $\int \dot{PV}\,dt \approx \Delta PV$

$$\int \dot{PV}\,dt$$

$$\Delta PV$$

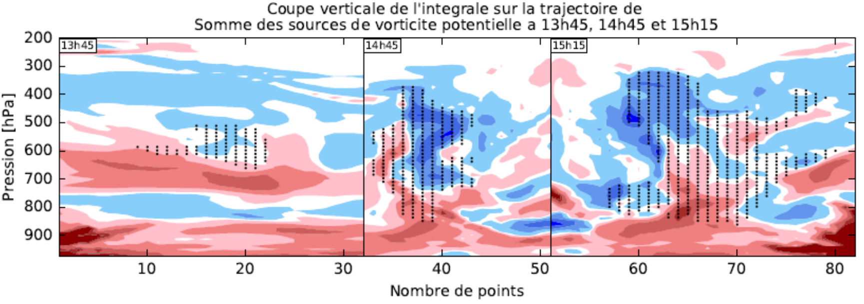
Run0

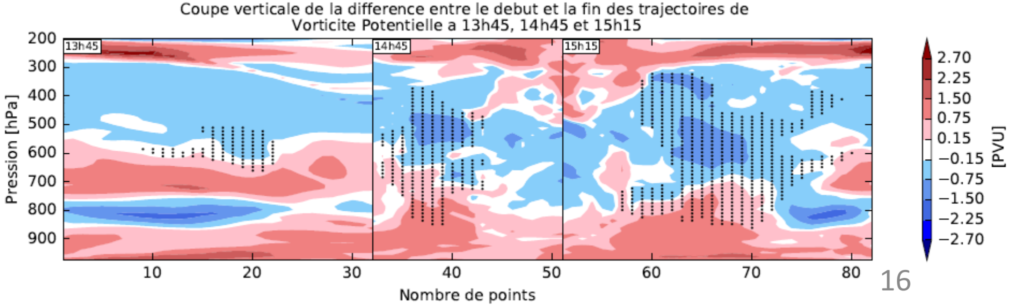




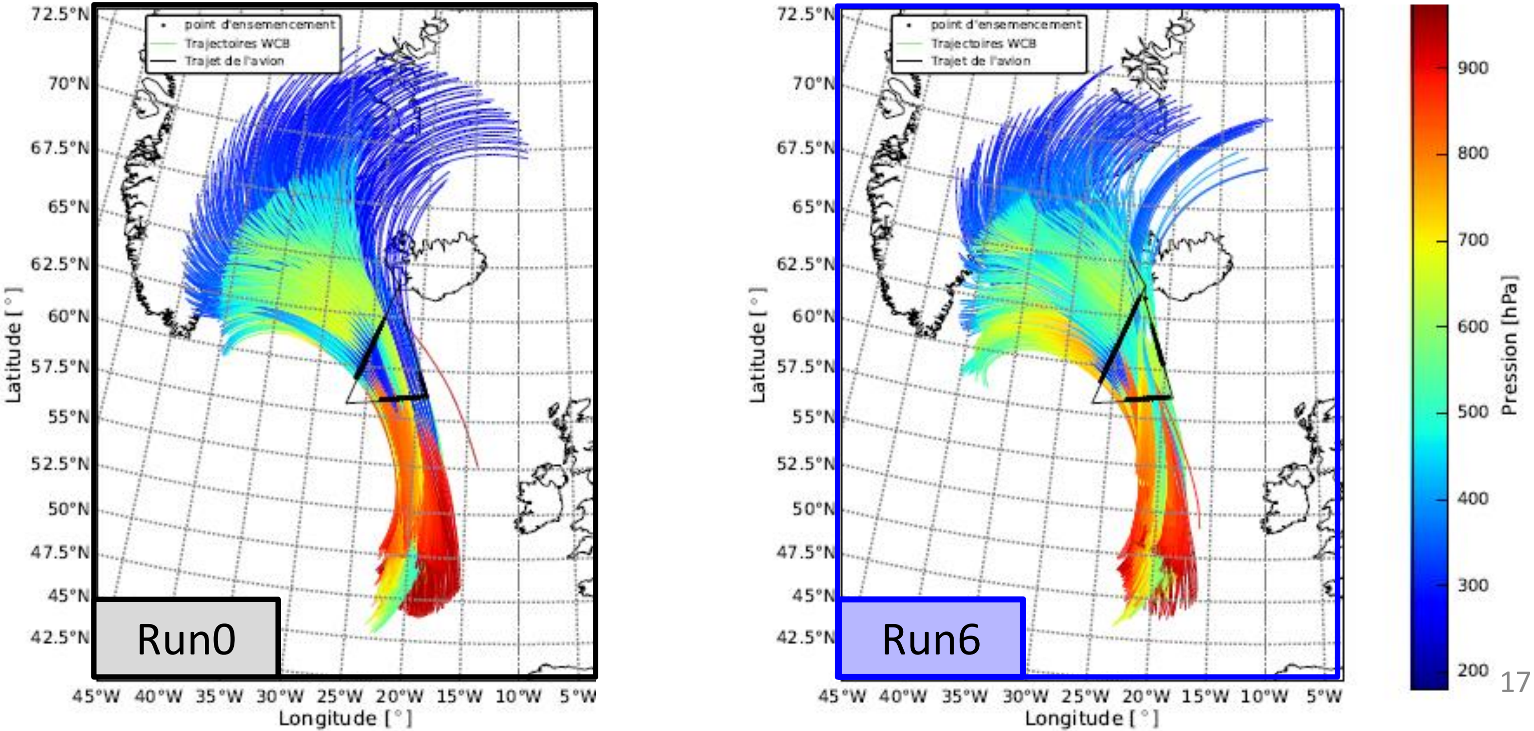
Modèle de trajectoire : ✓

Run6





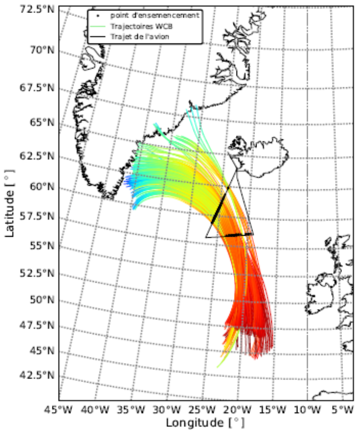
Etude des processus diabatiques

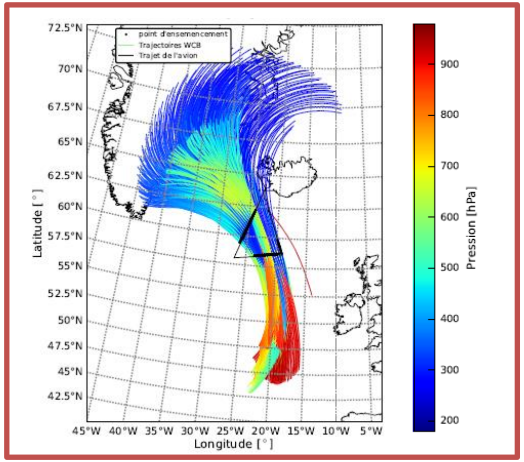


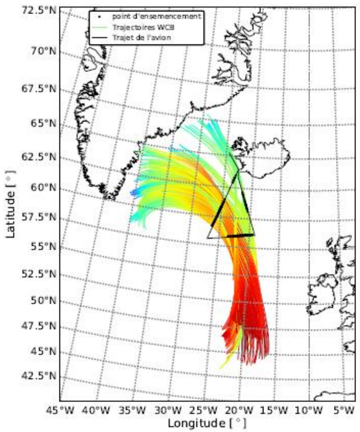
Trajectoires Cycloniques/Anticycloniques

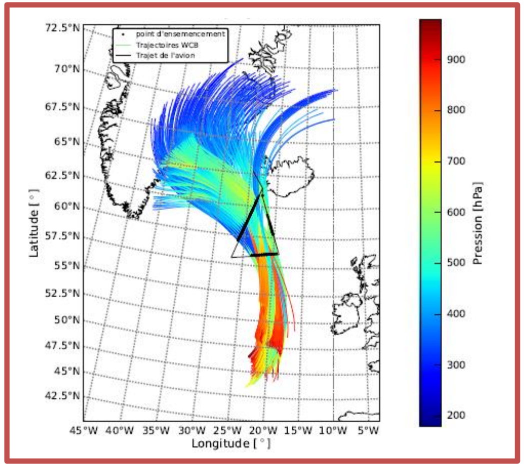
Run0

Run6

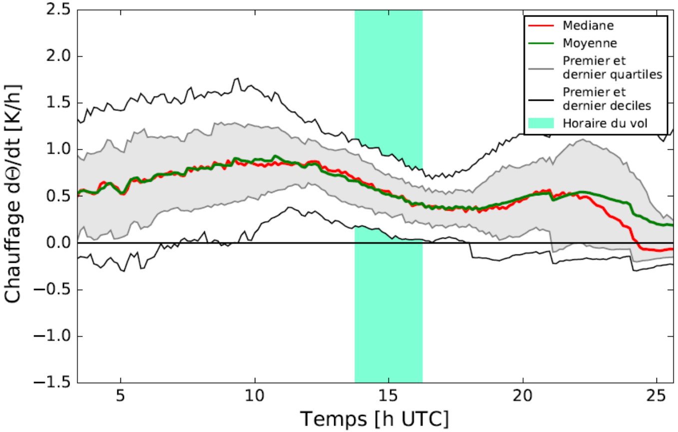


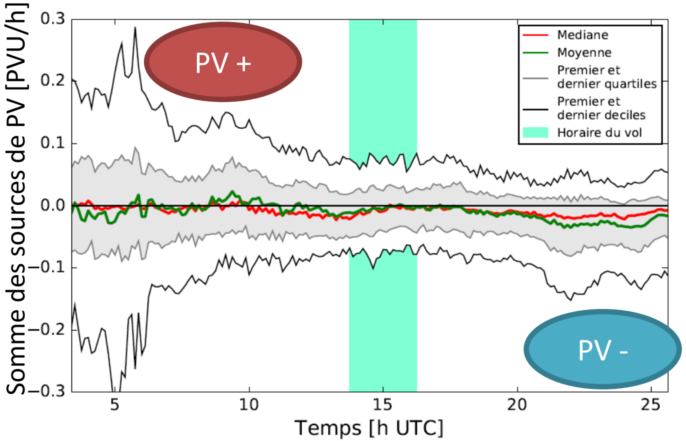




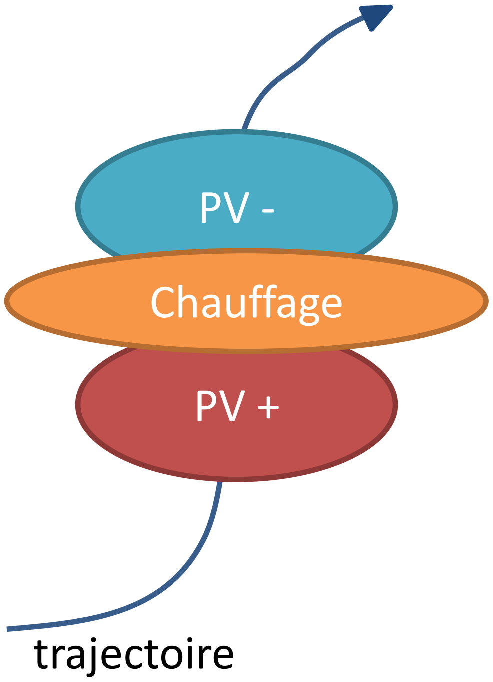


Effet du chauffage sur le PV

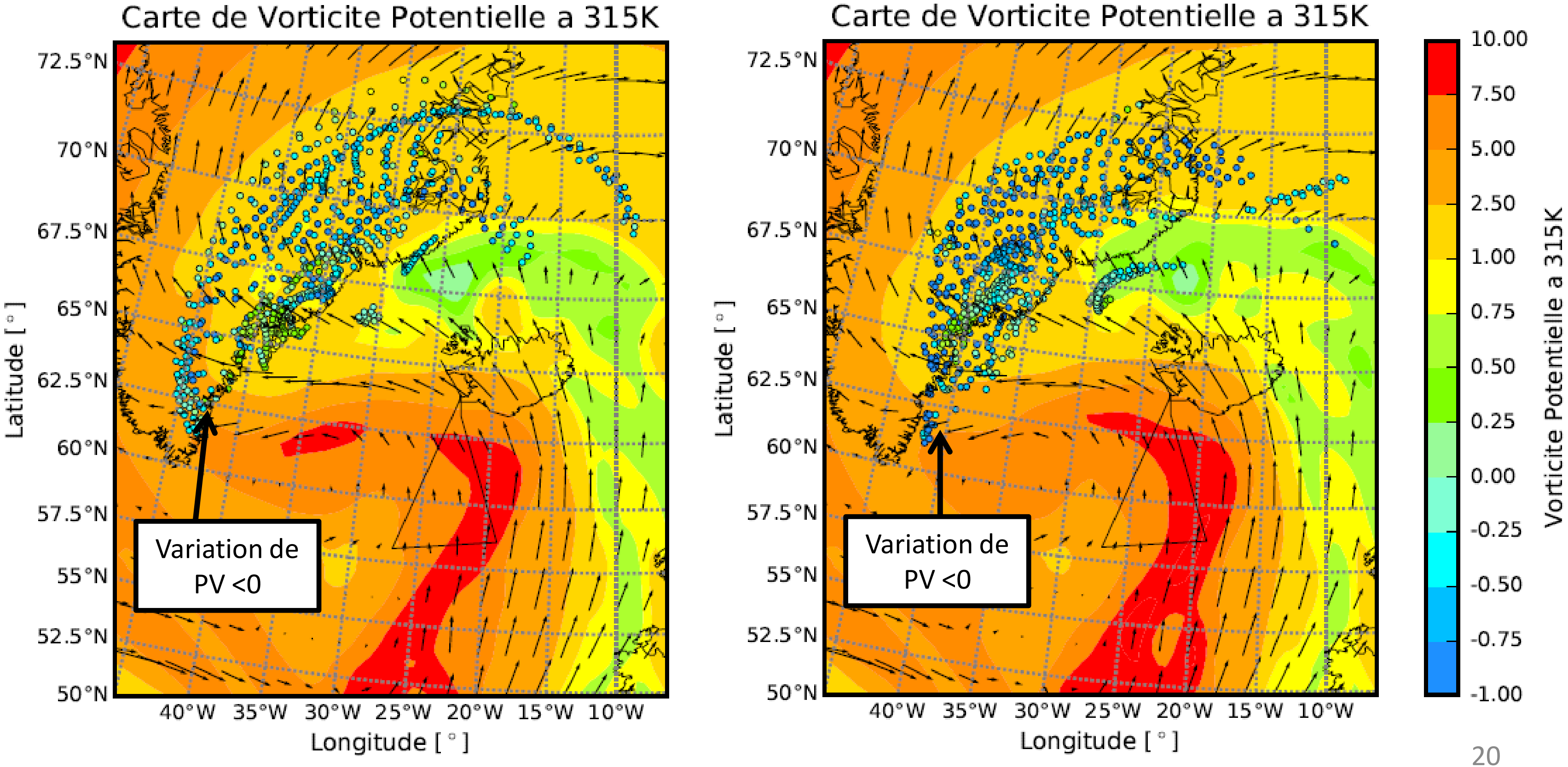




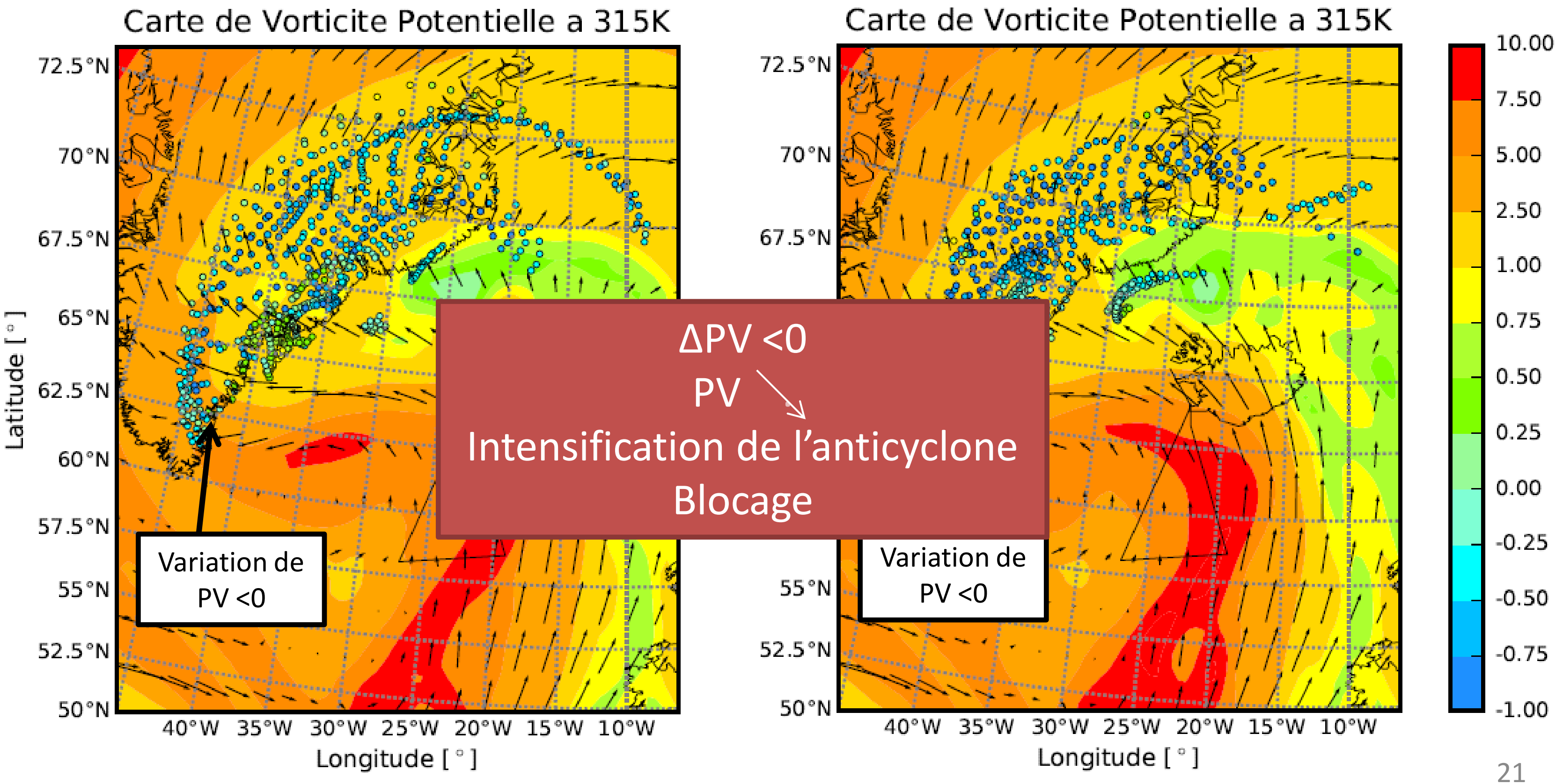
Run0



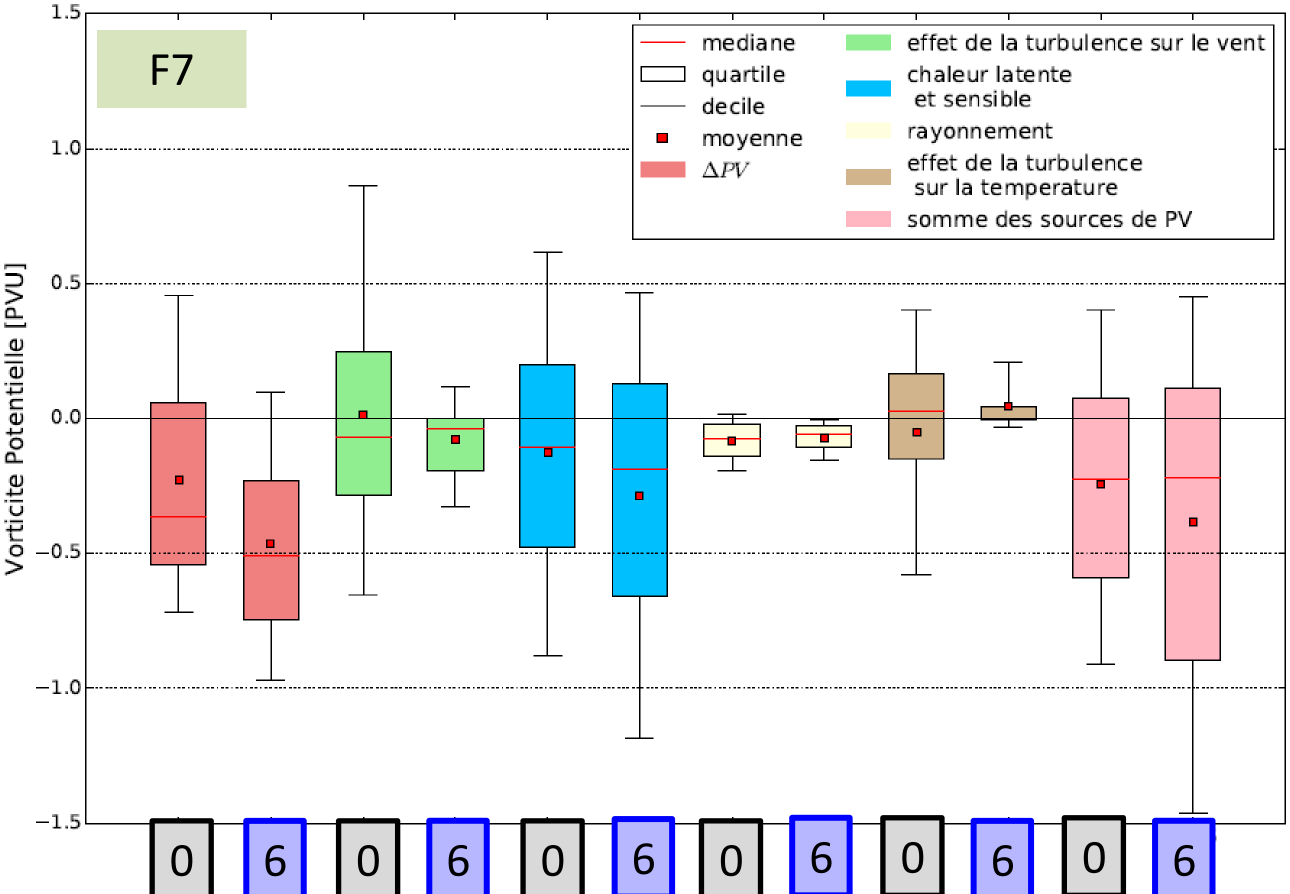
Variation de PV au bout de 24h



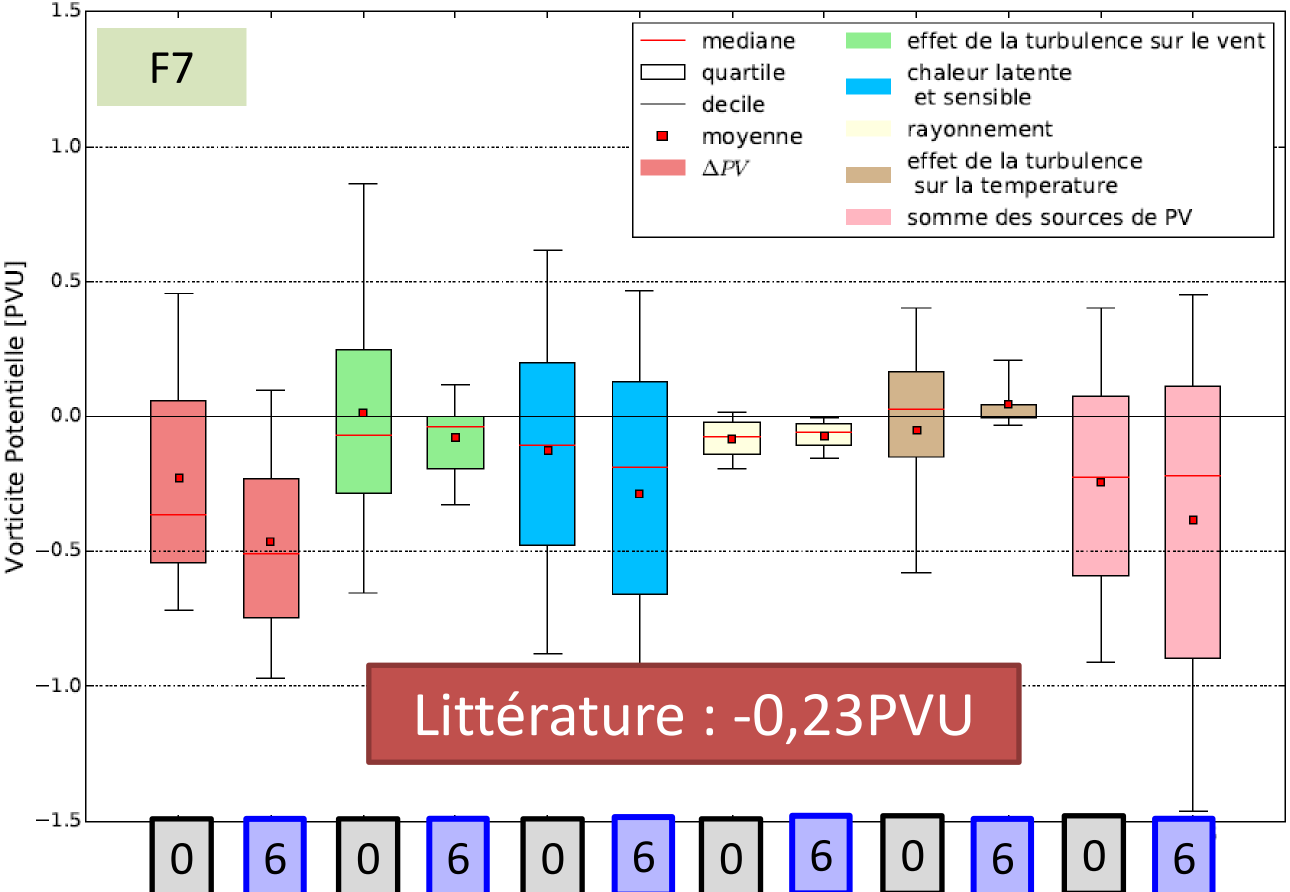
Variation de PV au bout de 24h



Distribution de PV

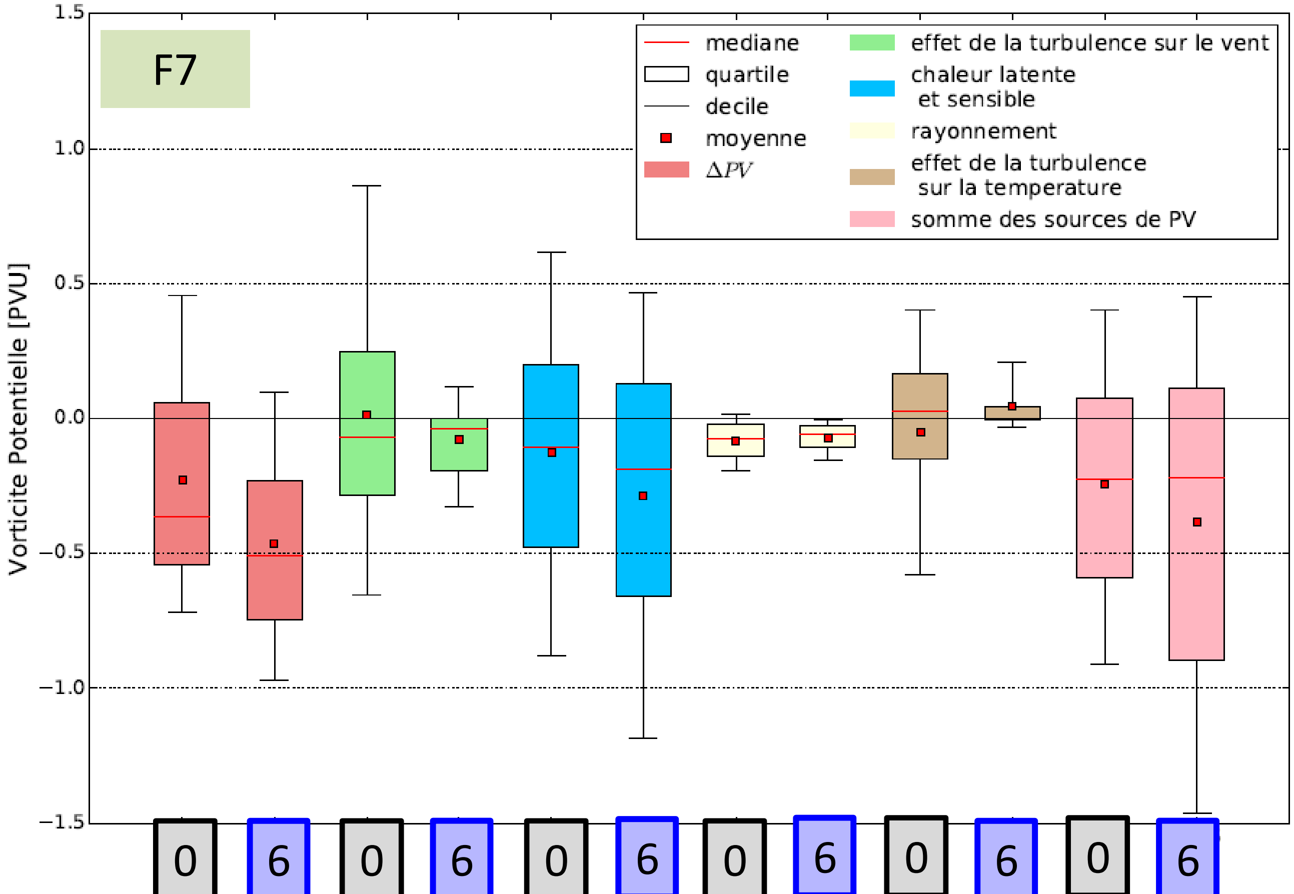


Distribution de PV

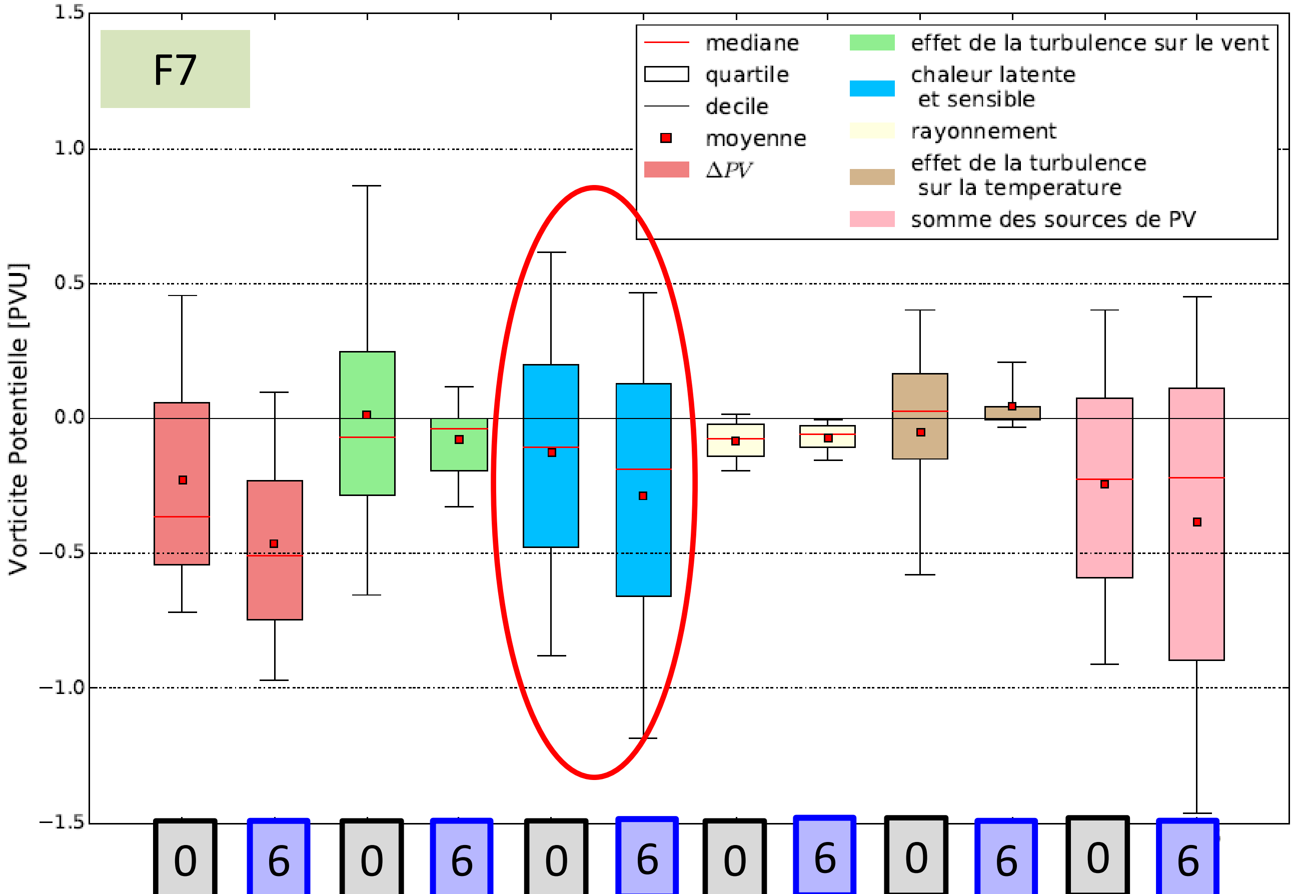


Littérature : -0,23PVU

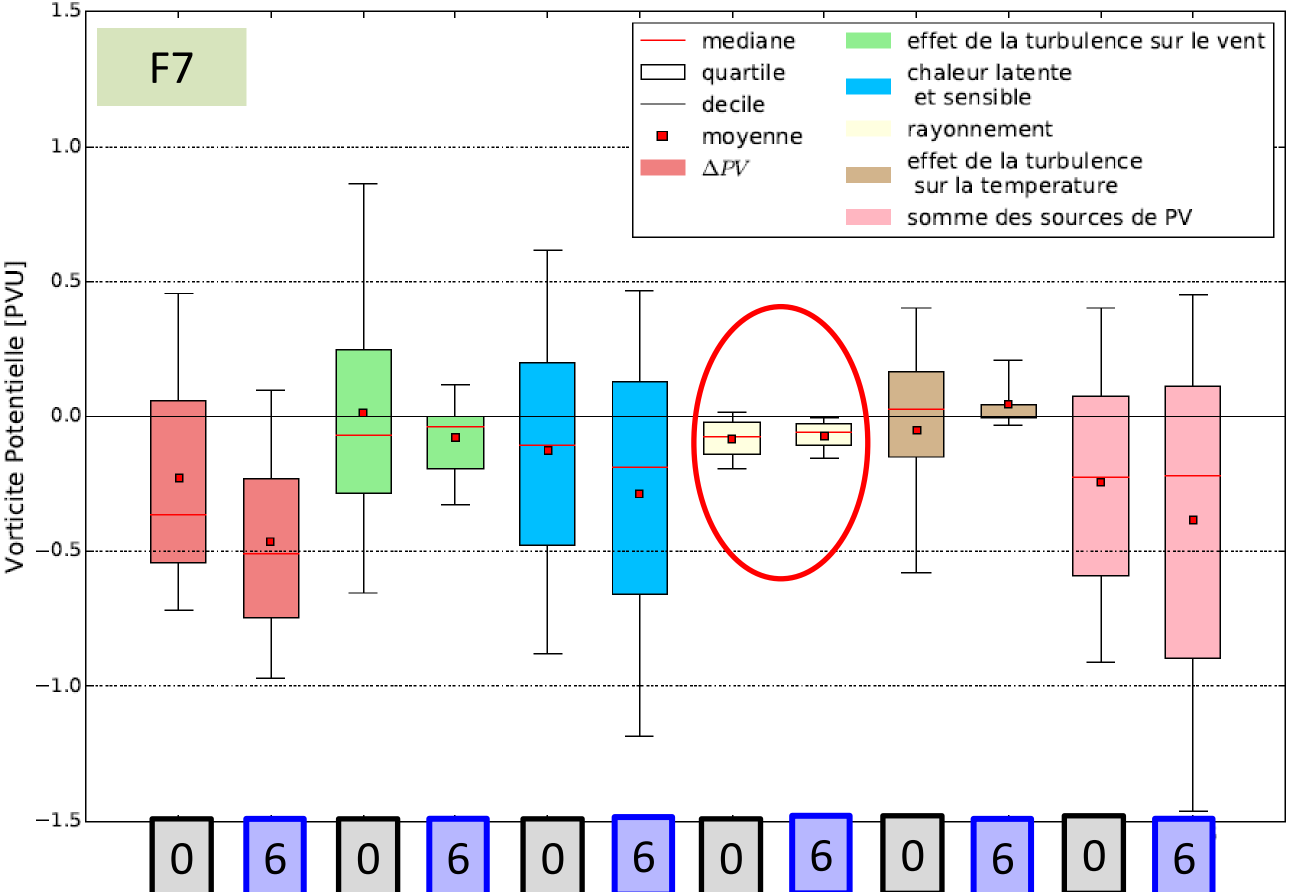
Distribution de PV



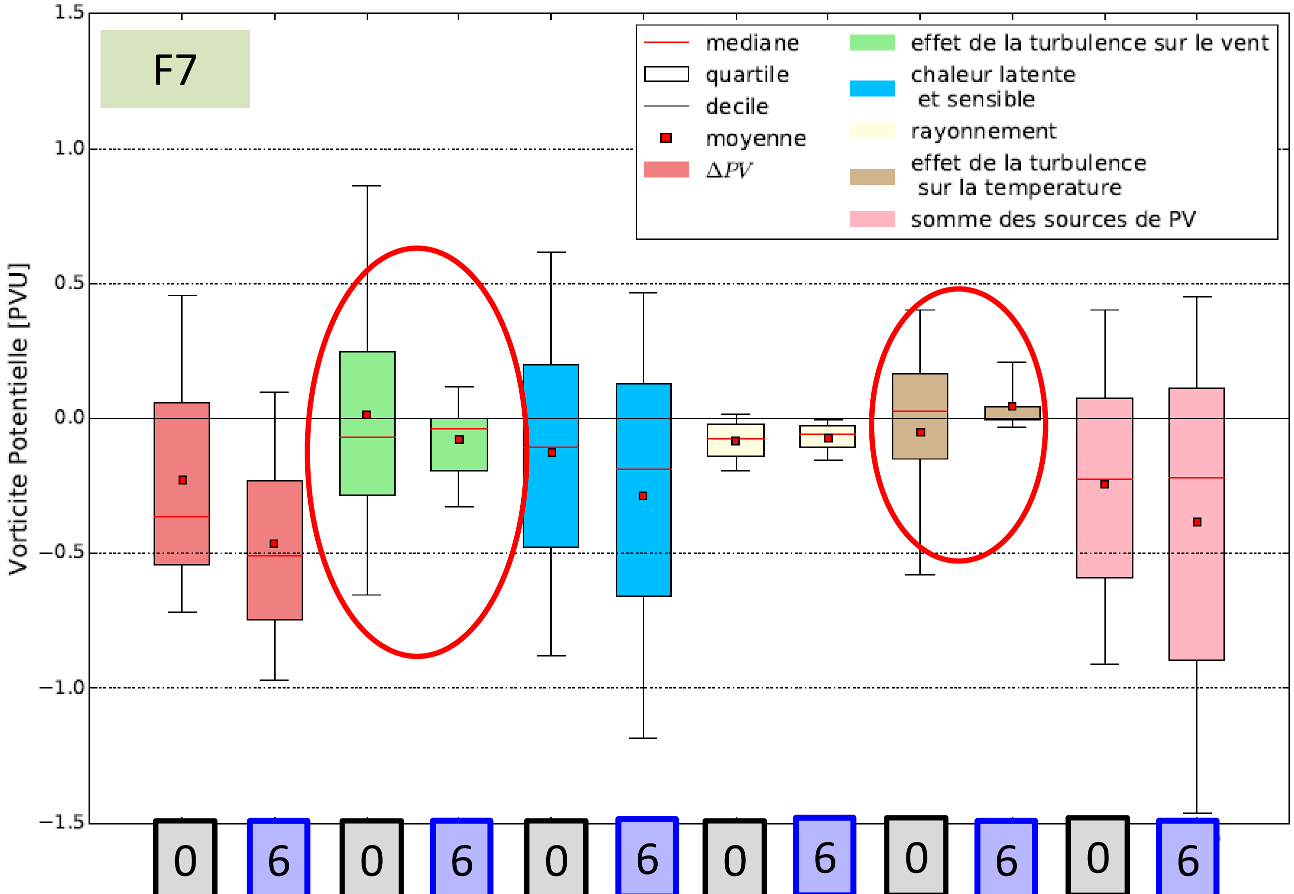
Distribution de PV



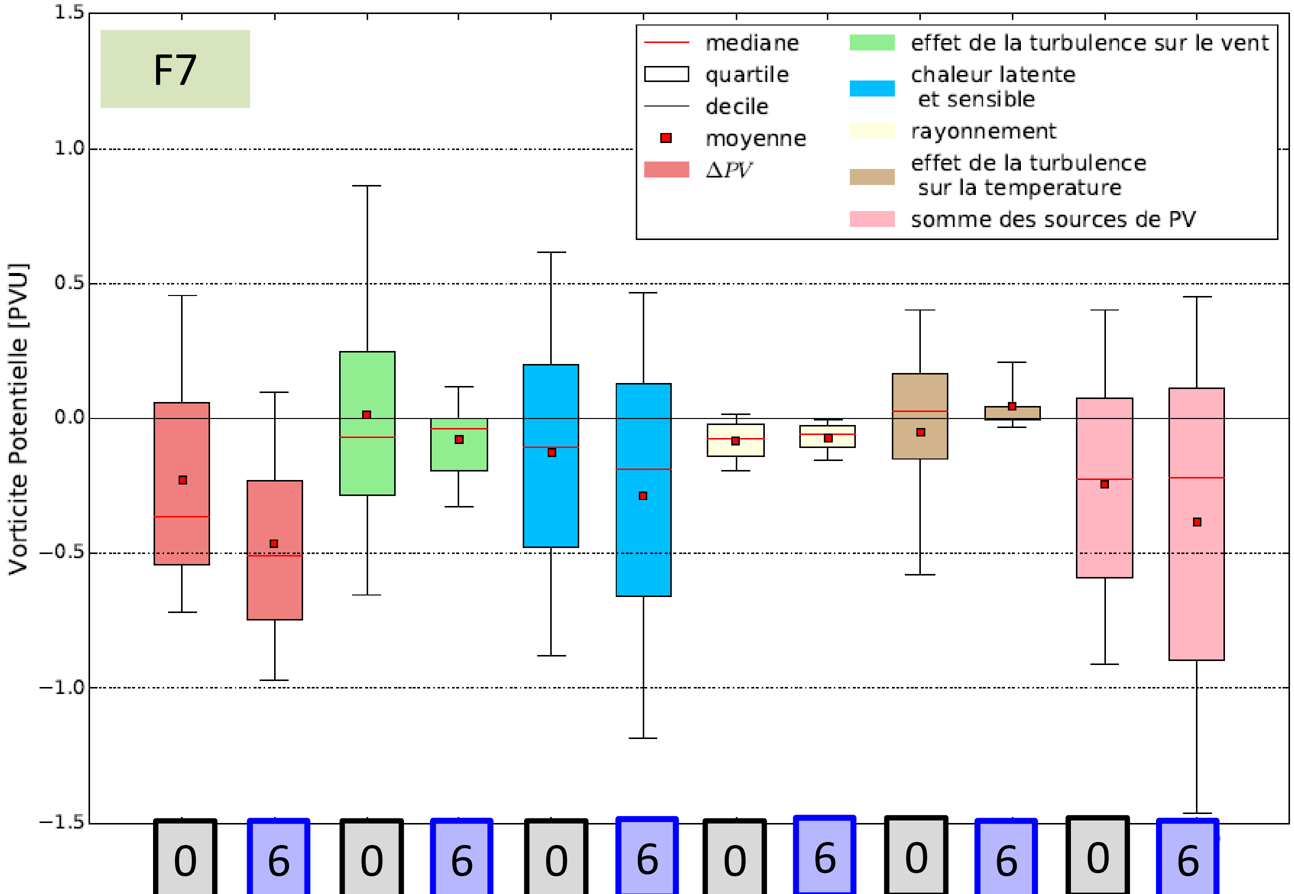
Distribution de PV



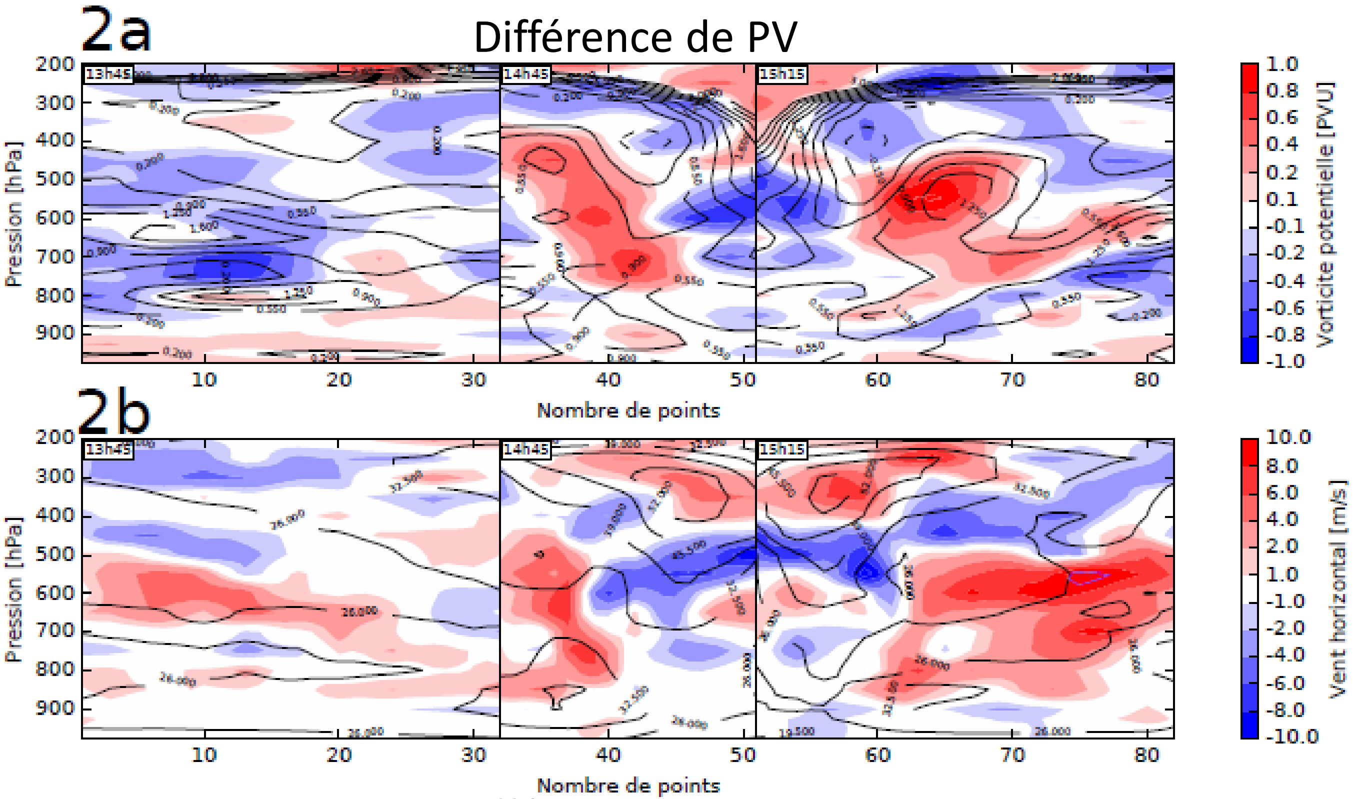
Distribution de PV



Distribution de PV



Différence de PV négatif



Différence de vent

Run0 – Run6

Run0 > Run6

Run6 > Run0

$$PV \propto \text{grad } vent$$

Conclusion

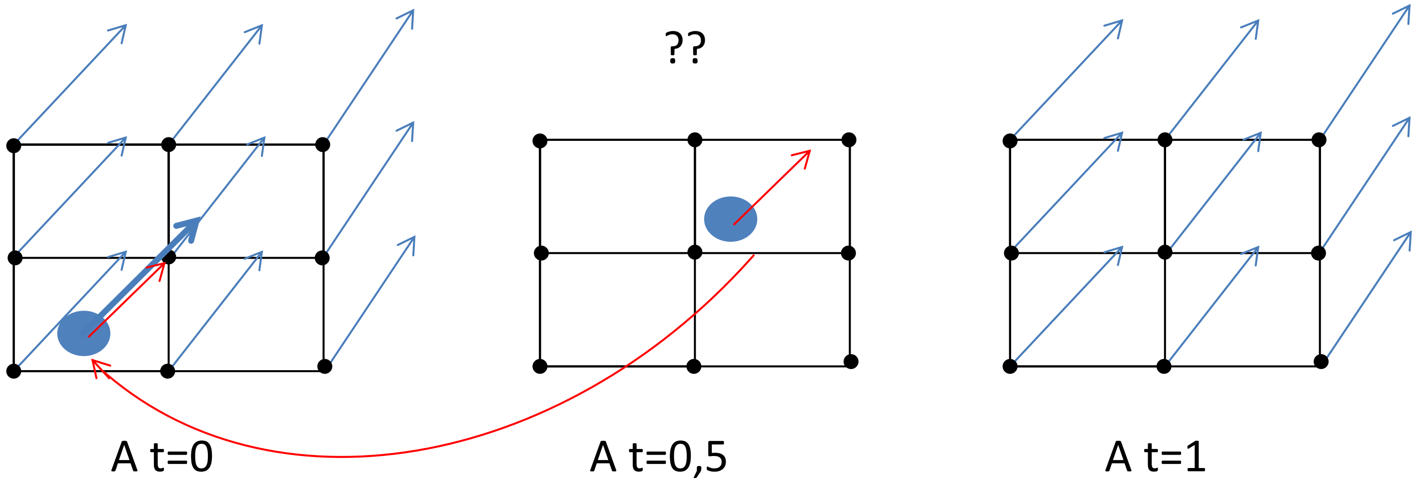
- Variation de PV < 0 → intensification de l’anticyclone
- Cohérence entre les deux modèles
- Chaleur latente et sensible : Impact principal
- Rayonnement : Impact plus faible
- Différence dans la distribution verticale de PV négatif
  - Run0 : haute altitude
  - Run6 : milieu de troposphère

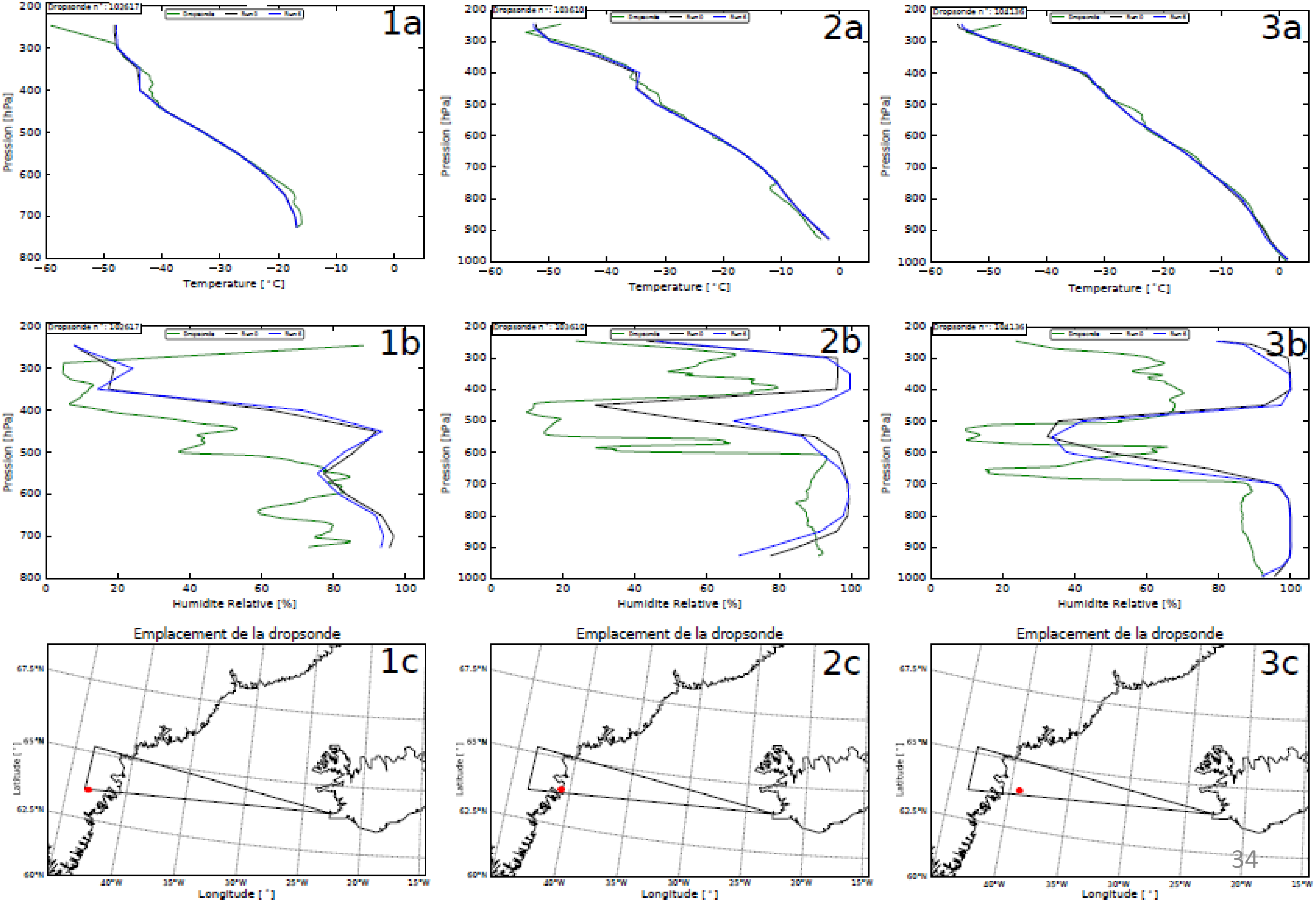
Perspectives

- Modification du critère des trajectoires WCB
- Amélioration du modèle de trajectographie :
  - Augmentation du degré d'interpolation
- Etendre l'approche à d'autres cas de la campagne :
  - Etude des dépressions du 04 et 05 octobre 2016
- Autres schémas de convection : PCMT amélioré, Tiedtke,…

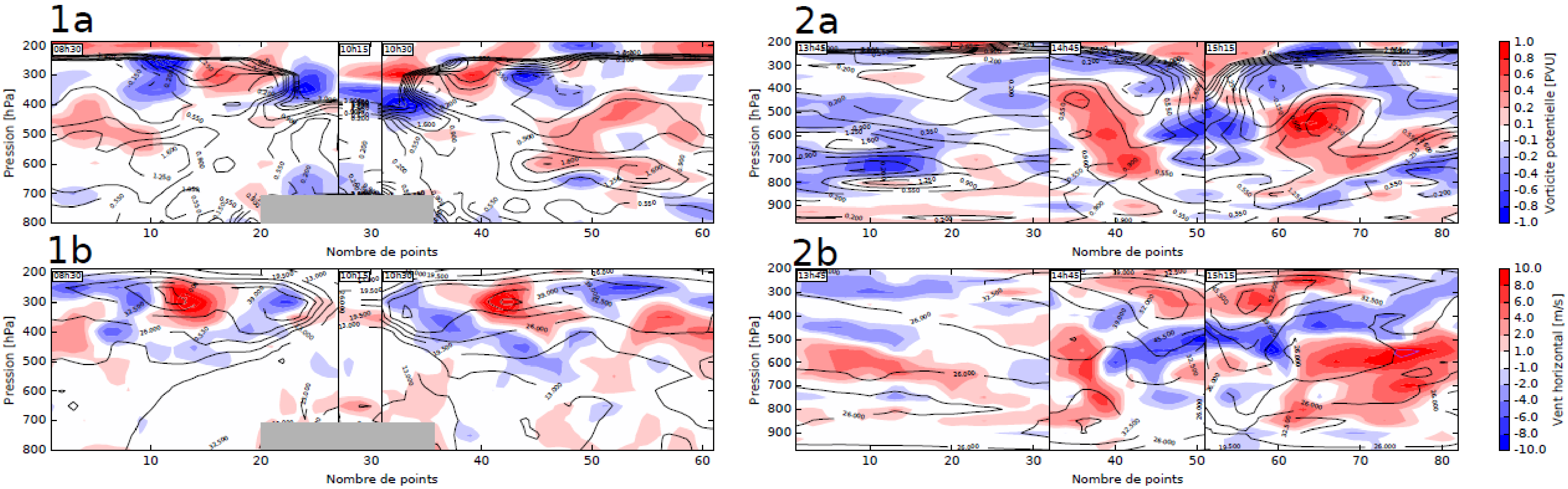
Merci pour votre attention

Modèle de trajectoires

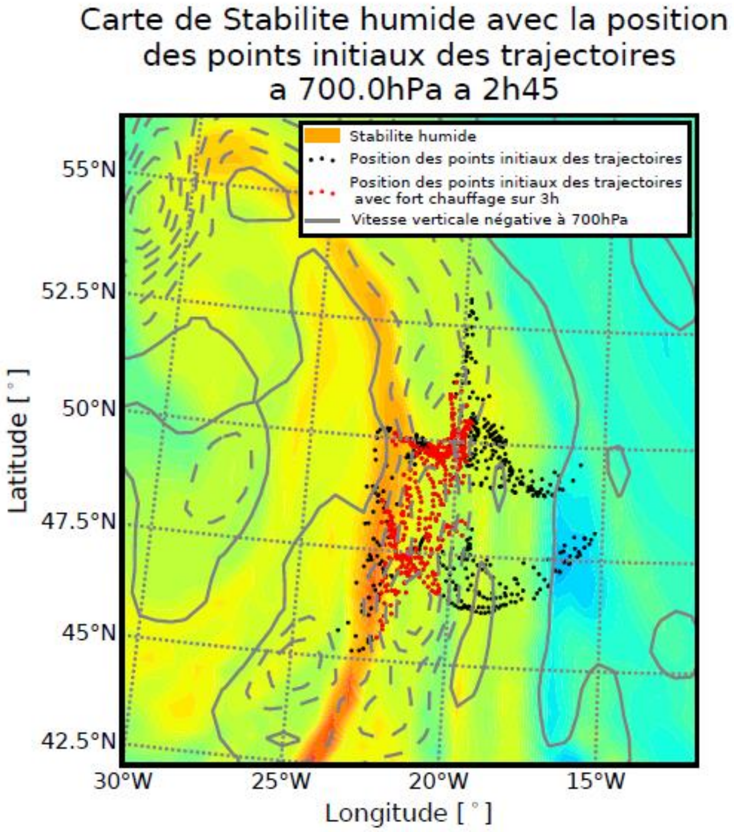


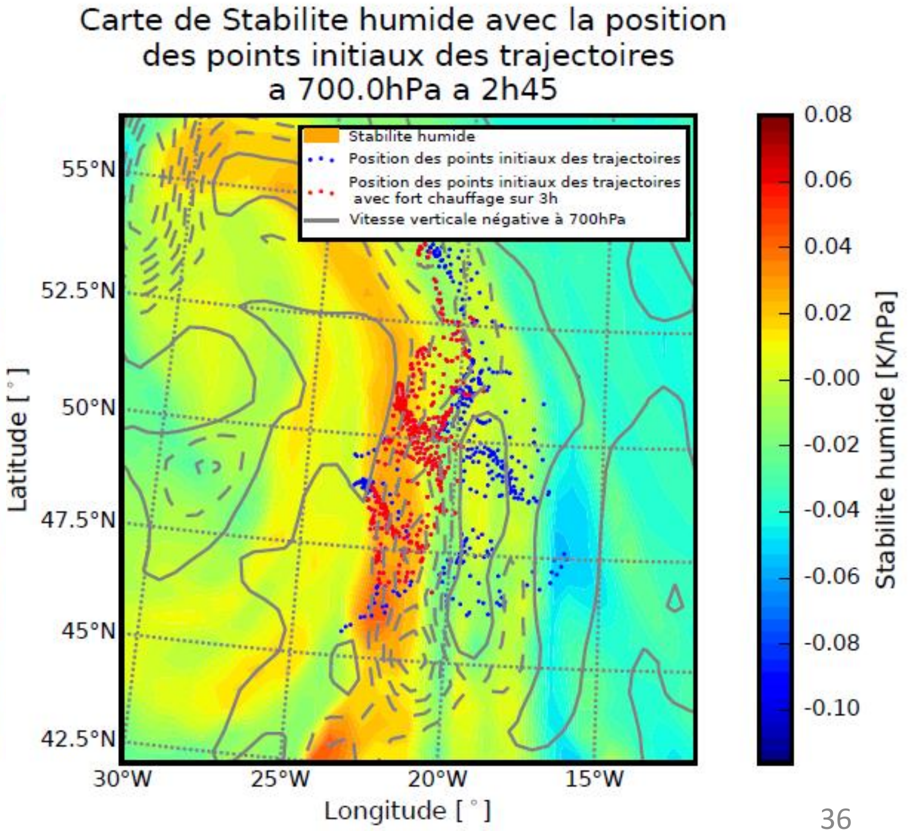


1a
Pression [hPa]
Temperature [°C]
2a
Pression [hPa]
Temperature [°C]
3a
Pression [hPa]
Temperature [°C]
1b
Pression [hPa]
Humidite Relative [%]
2b
Pression [hPa]
Humidite Relative [%]
3b
Pression [hPa]
Humidite Relative [%]
Emplacement de la dropsonde
1c
Latitude [°]
Longitude [°]
Emplacement de la dropsonde
2c
Latitude [°]
Longitude [°]
Emplacement de la dropsonde
3c
Latitude [°]
Longitude [°]

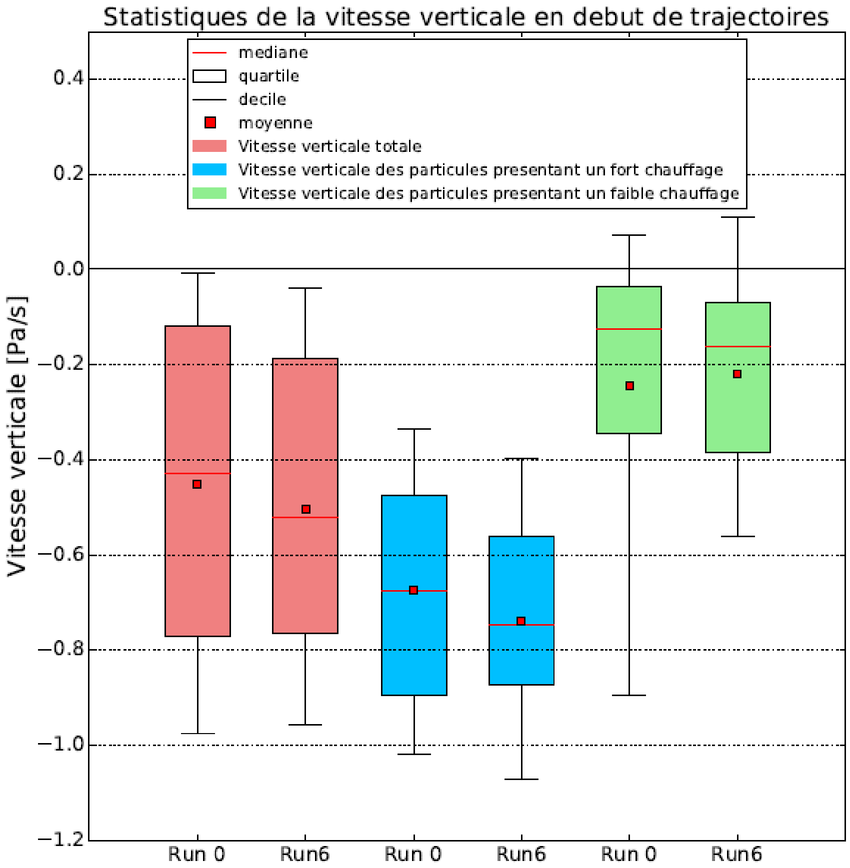

1a
1b
2a
2b
08h30
10h15
10h30
13h45
14h45
15h15
Pression [hPa]
Nombre de points
200
300
400
500
600
700
800
900
10
20
30
40
50
60
70
80
Vorticite potentielle [PVU]
1.0
0.8
0.6
0.4
0.2
0.1
-0.1
-0.2
-0.4
-0.6
-0.8
-1.0
Vent horizontal [m/s]
10.0
8.0
6.0
4.0
2.0
1.0
-1.0
-2.0
-4.0
-6.0
-8.0
-10.0

Stabilité humide

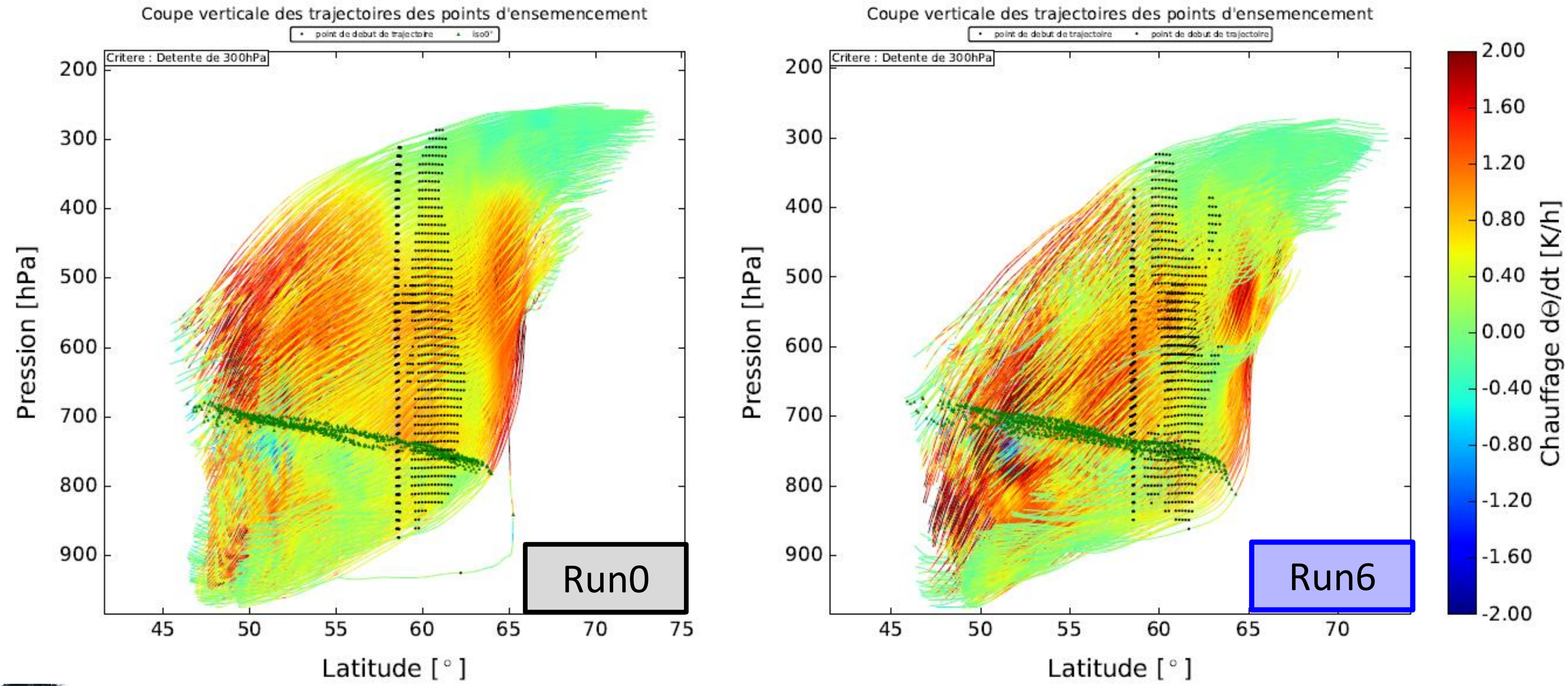




Vitesse verticale

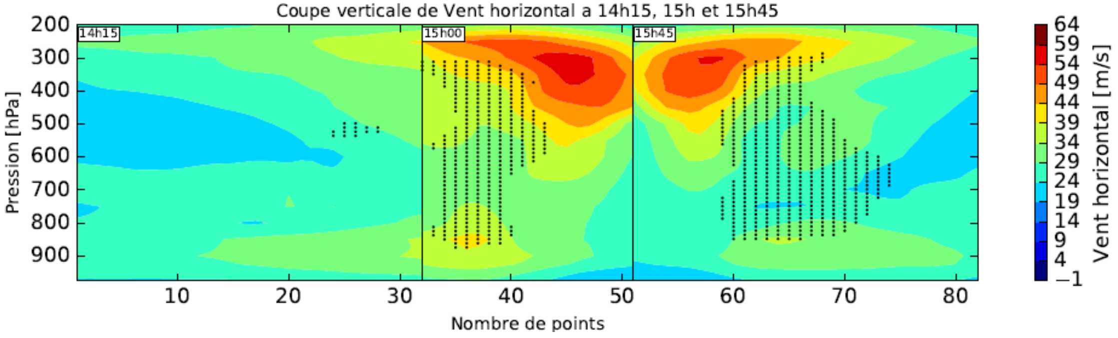


Chauffage total

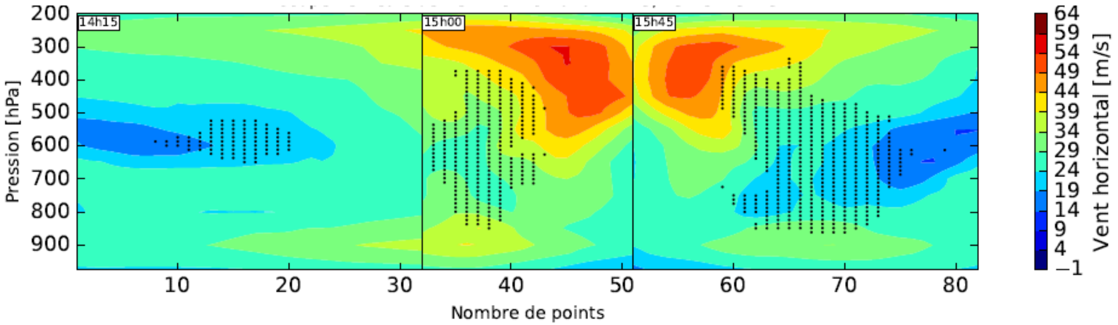


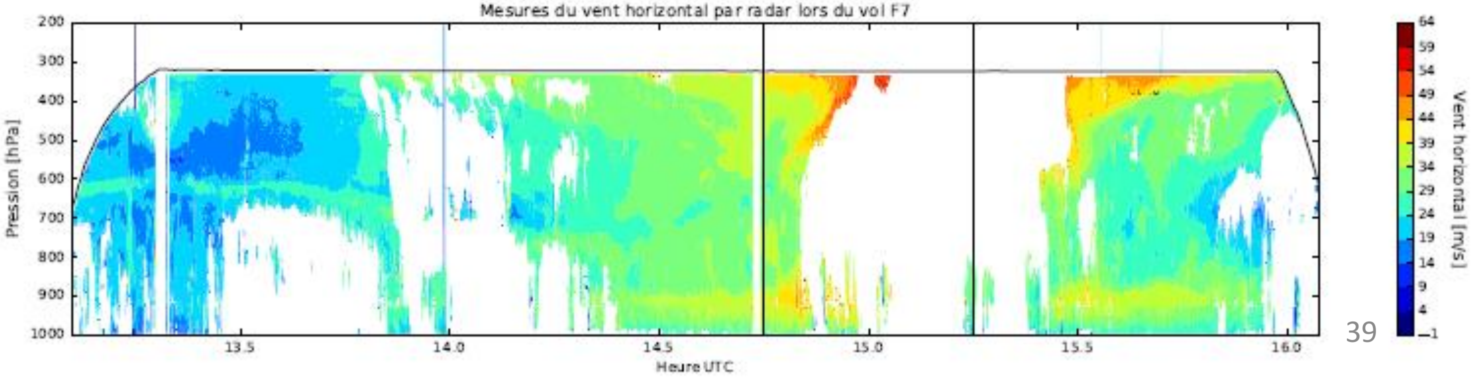
Vol F7

Run0



Run6

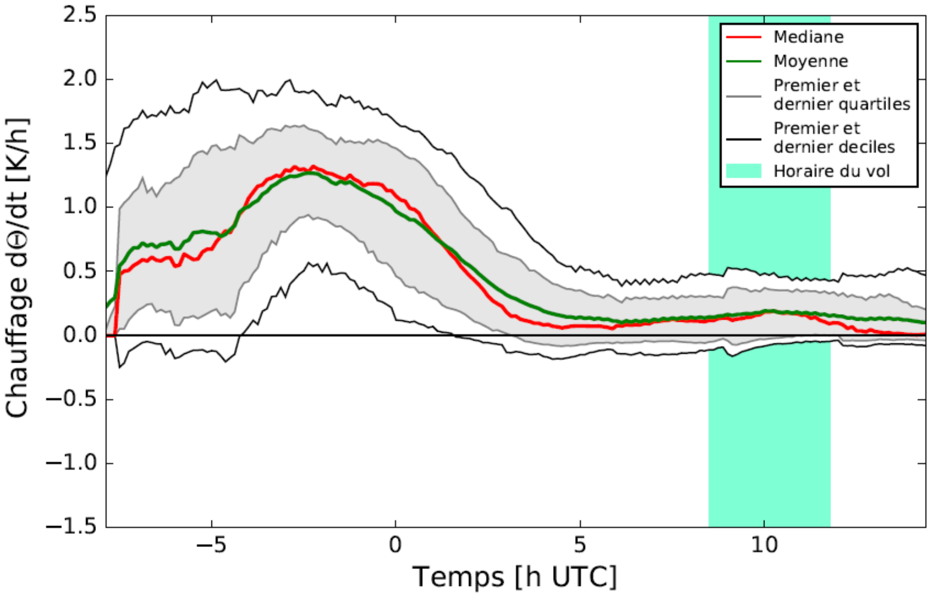


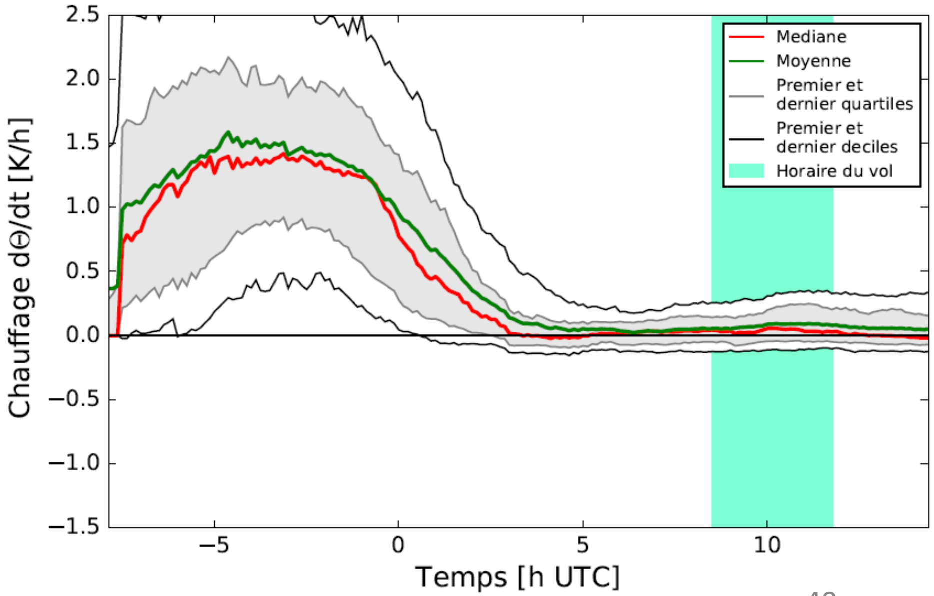


Chauffage

Run0

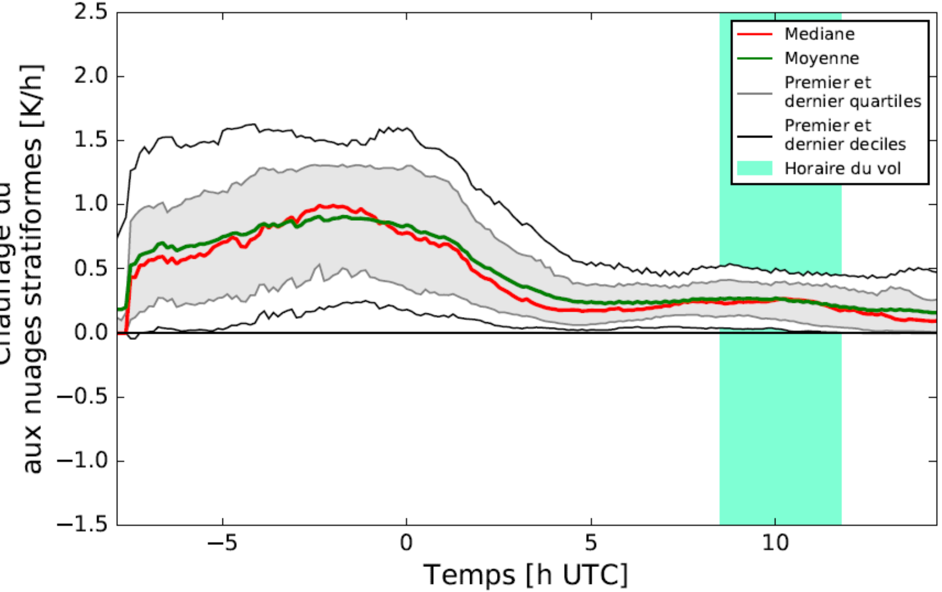
Run6



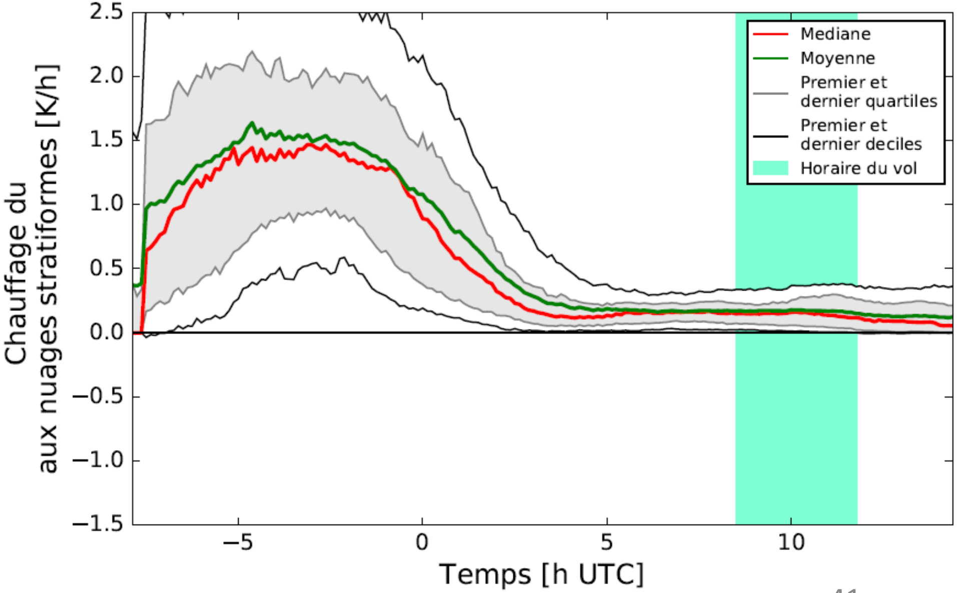


Chauffage stratiforme

Run0



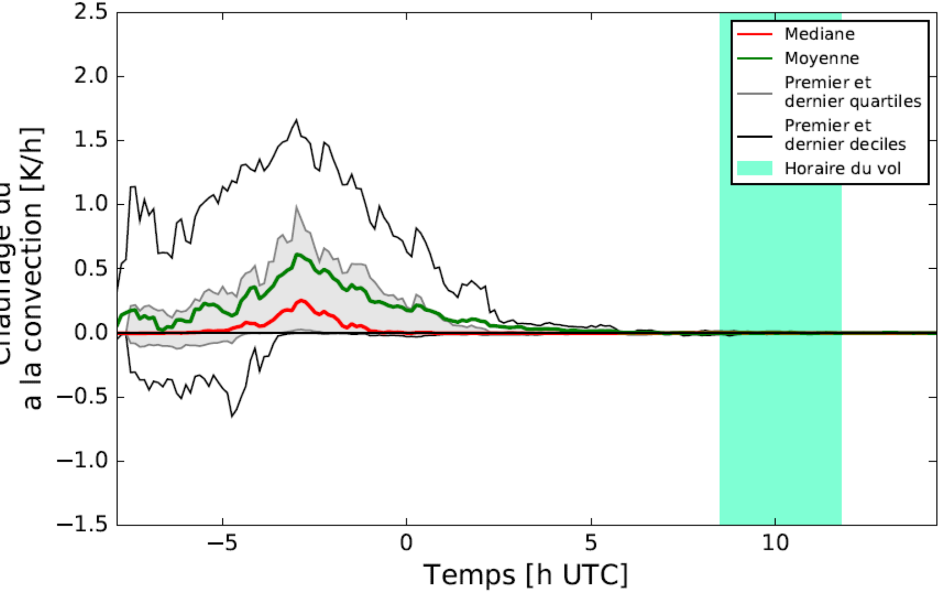
Run6

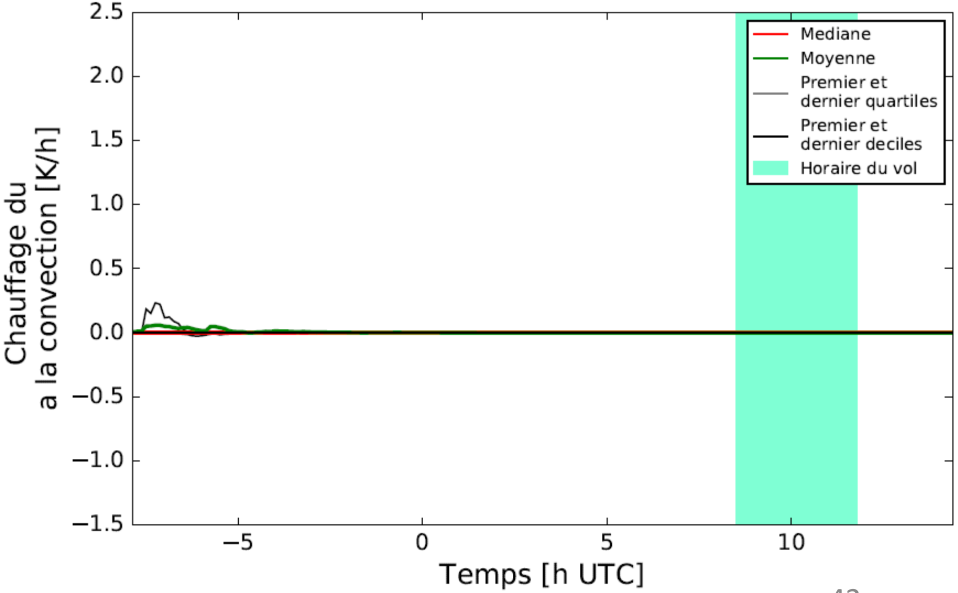


Chauffage convectif

Run0

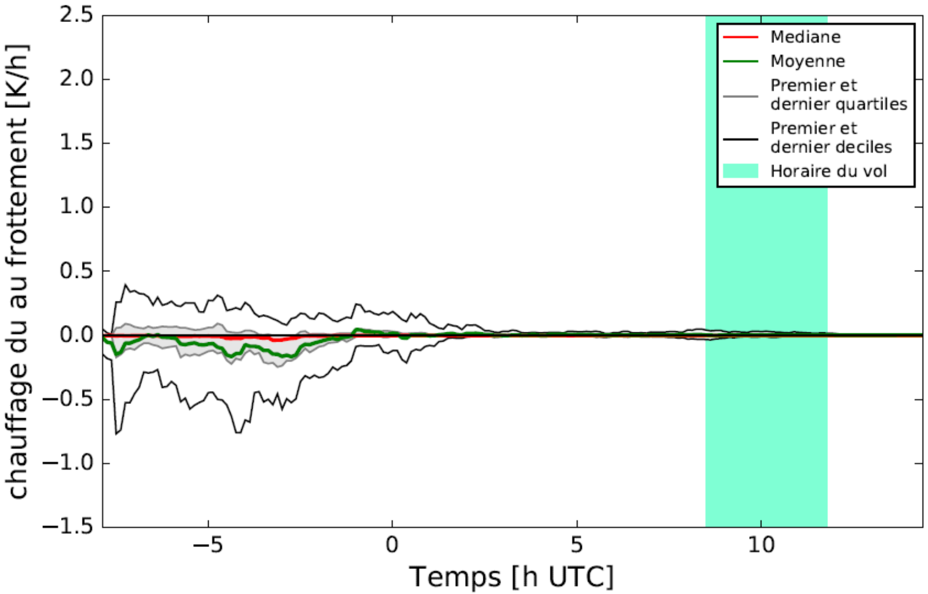
Run6



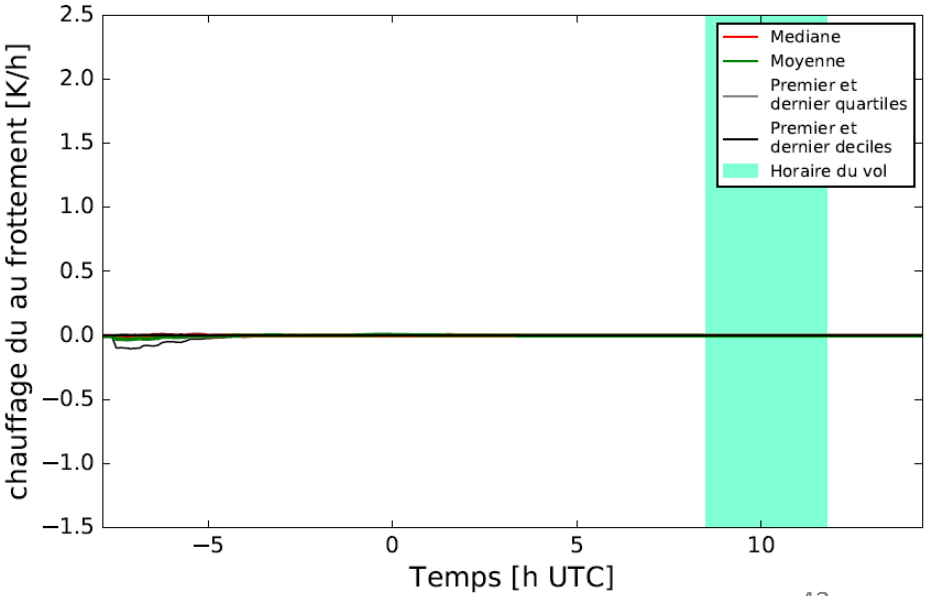


Turbulence

Run0



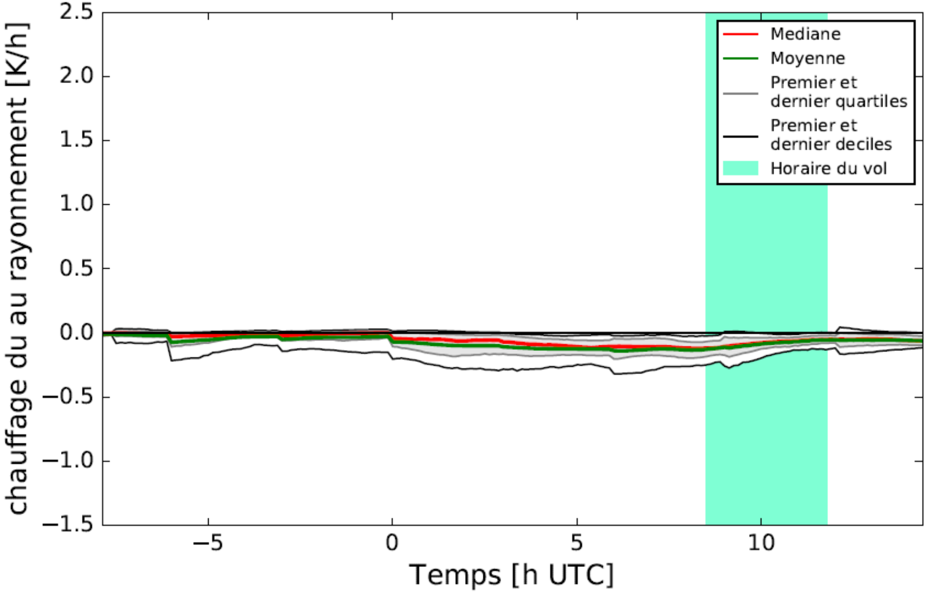
Run6

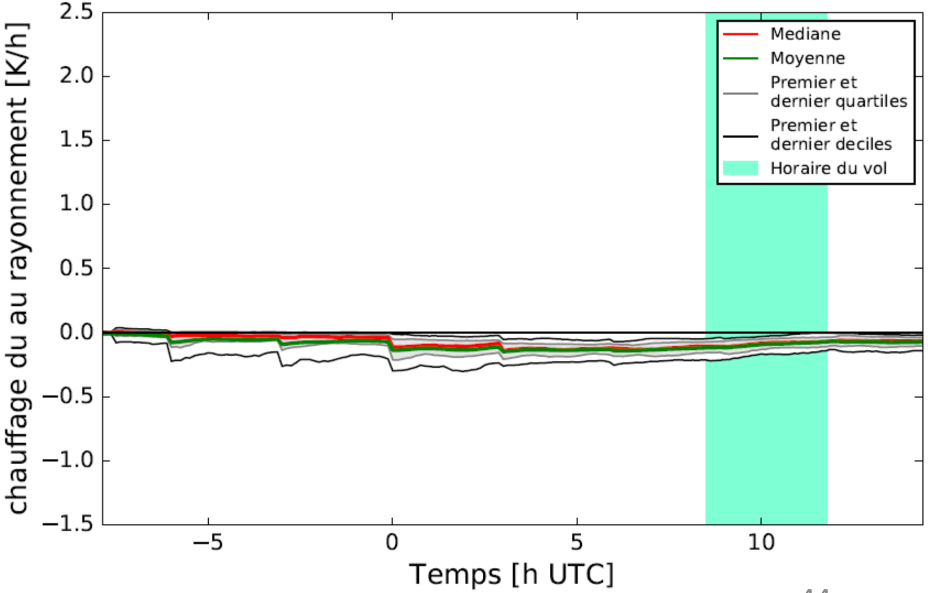


Rayonnement

Run0

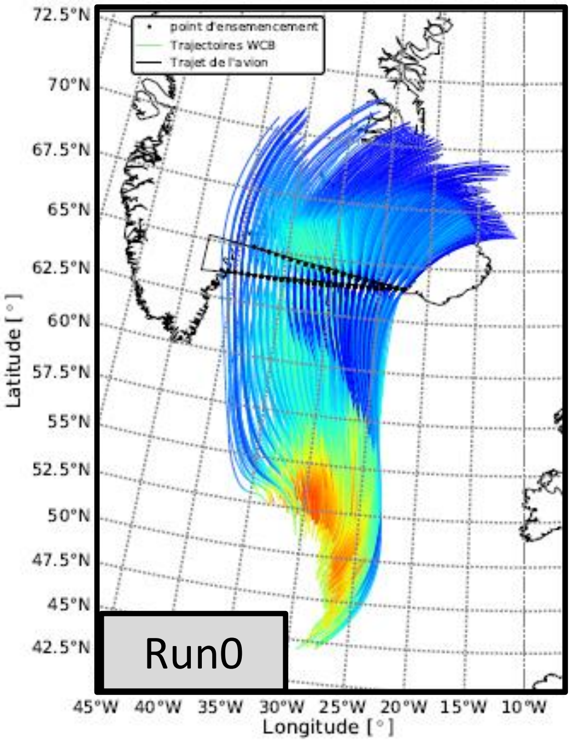
Run6

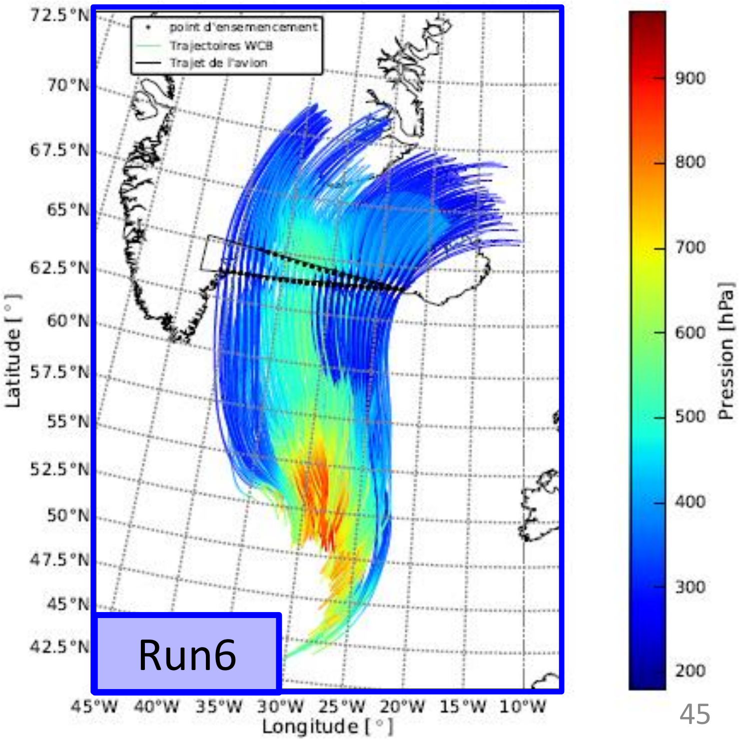




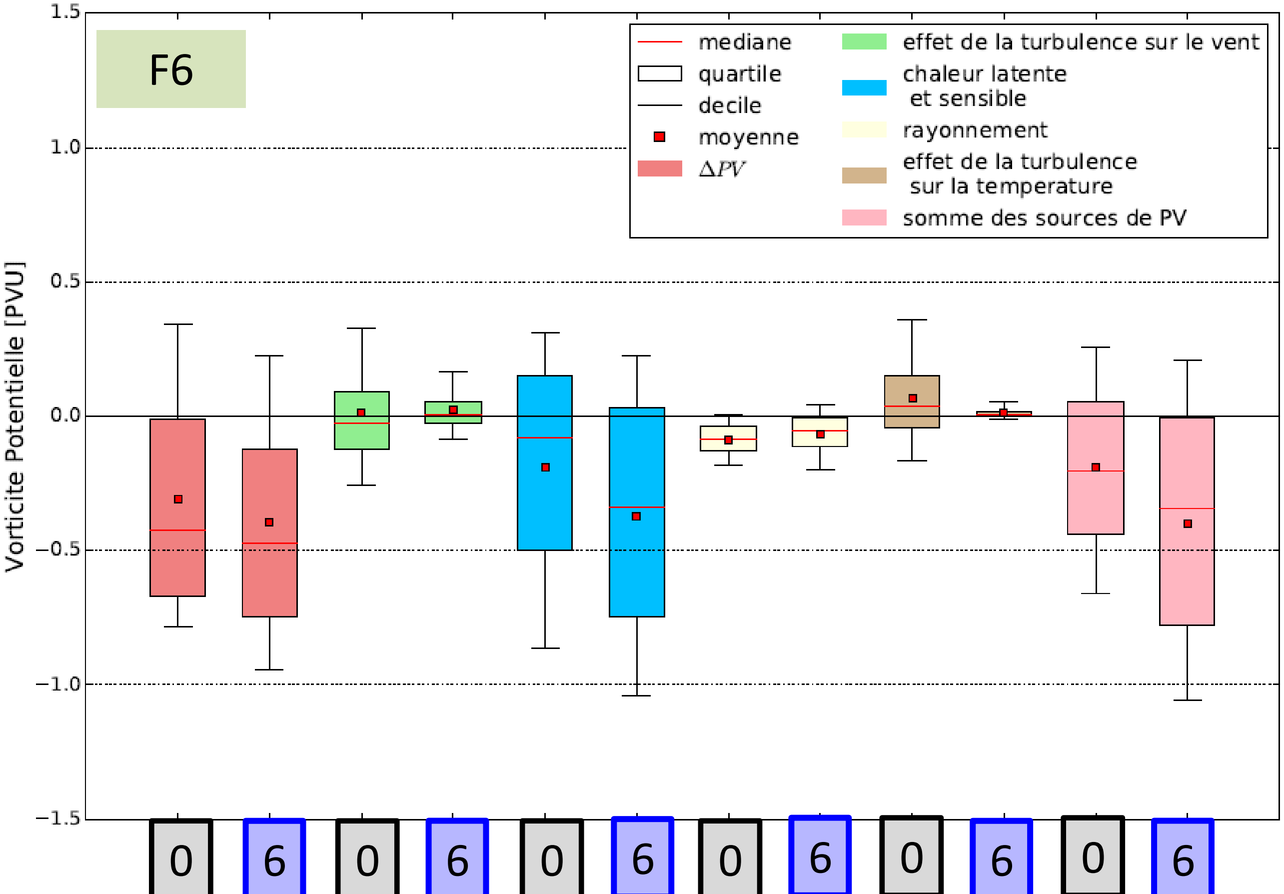
Warm Conveyor Belt – vol F6

Critère : -300 hPa en 24h

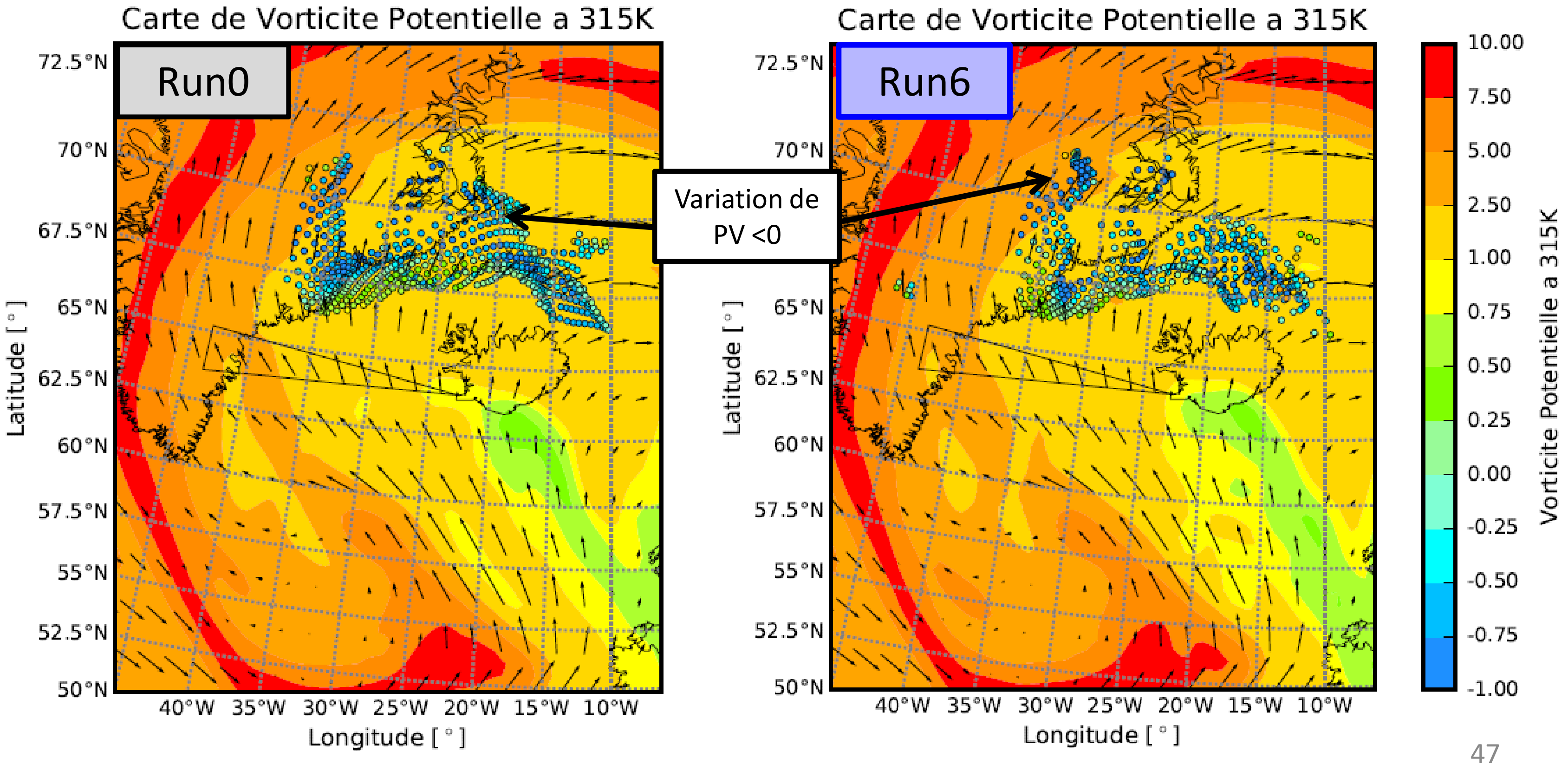




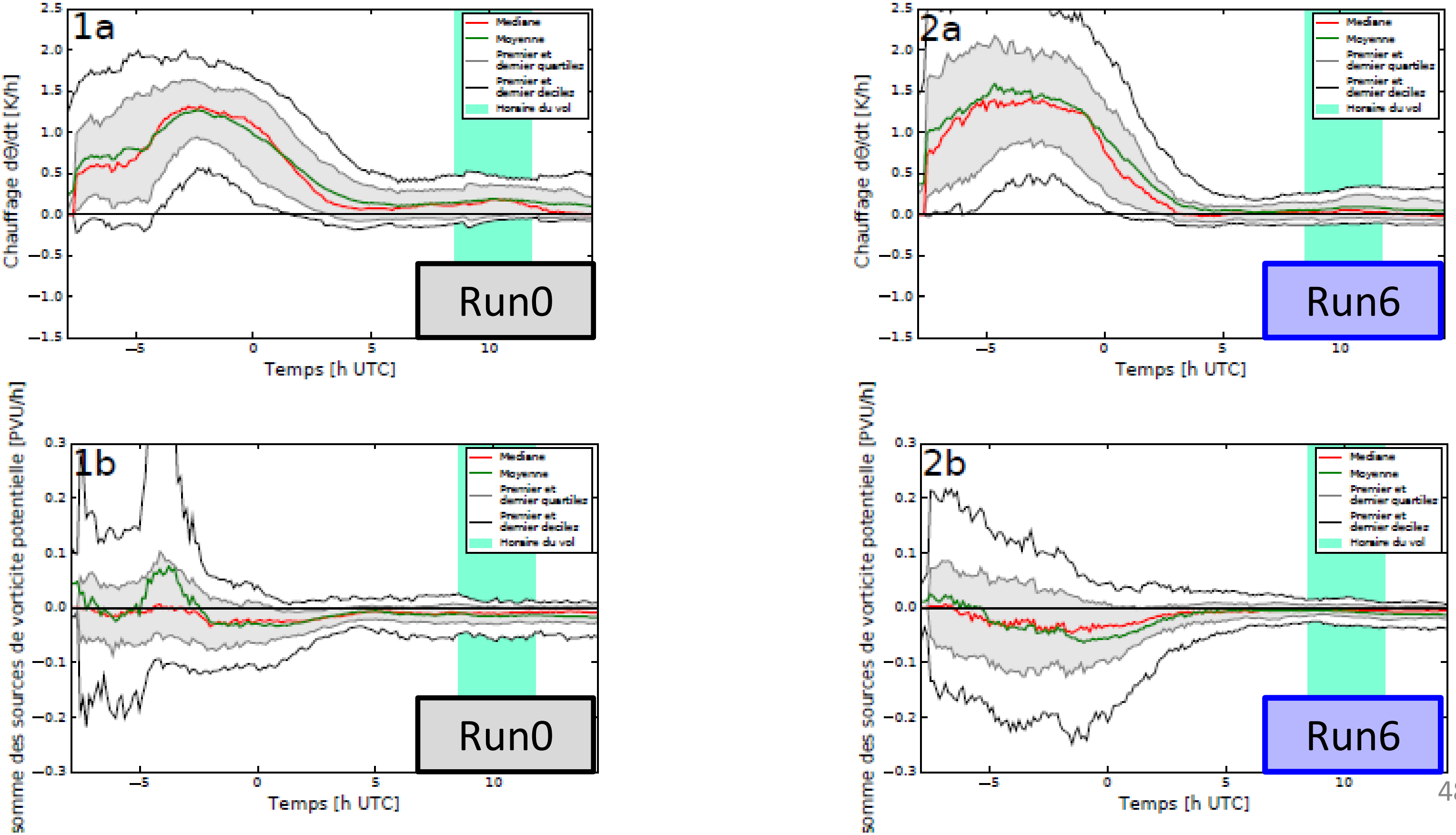
Distribution de PV



Variation de PV au bout de 24h



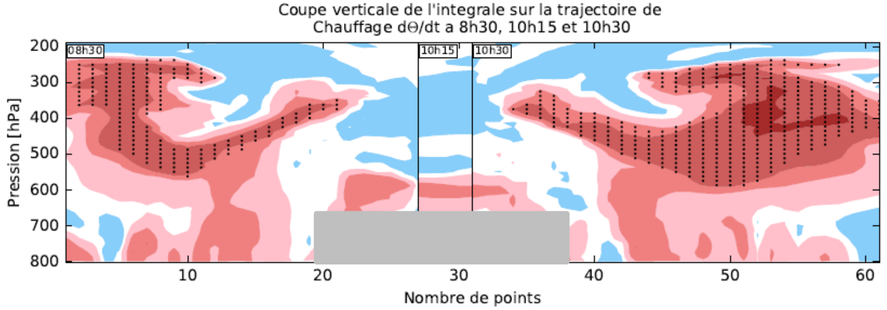
Effet du chauffage sur le PV

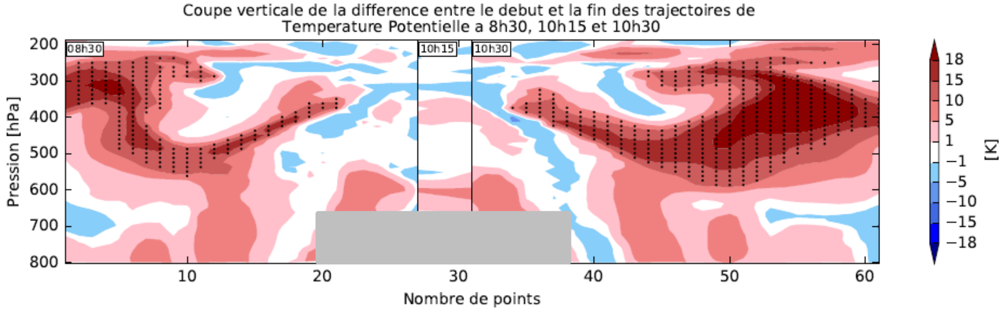


Validation du modèle de trajectoires : $\int \dot{\theta} dt \approx \Delta\theta$

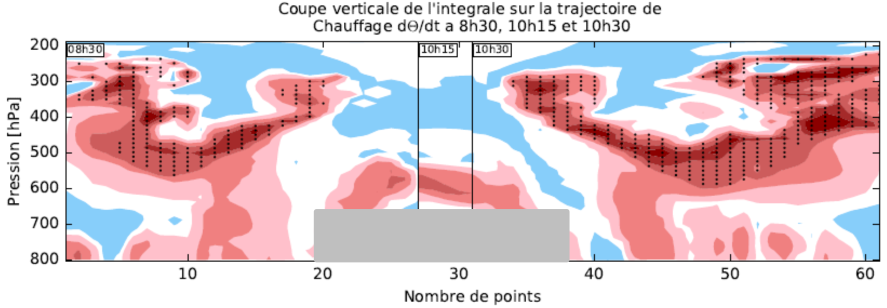
Run0

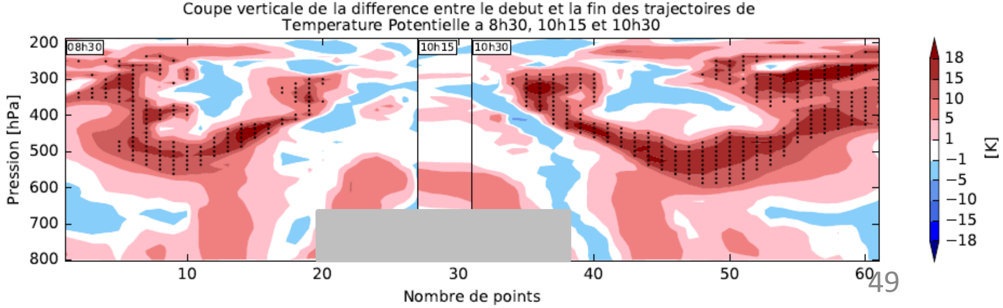
$\int \dot{\theta} dt$ $\Delta\theta$





Run6



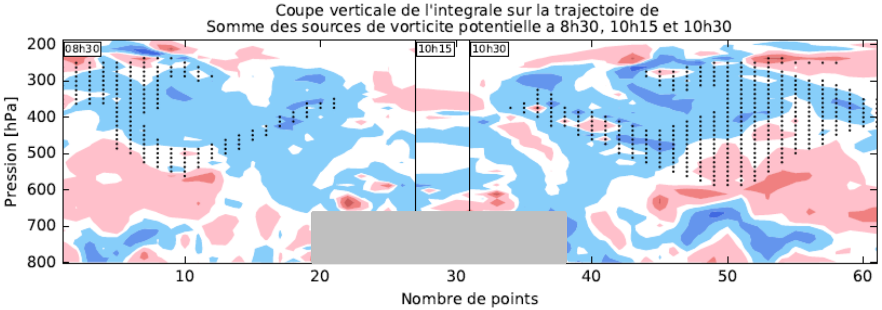


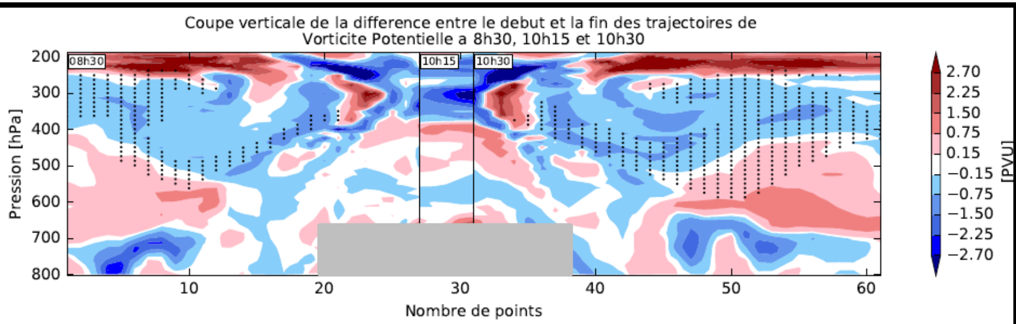
Validation du modèle de trajectoires : $\int \dot{PV}\,dt \approx \Delta PV$

$\int \dot{PV}\,dt$

ΔPV

Run0





Run6