The impact of two deep convection schemes of a global atmospheric model on the mid-tropospheric circulation of NAWDEX IOP 6 cyclone

Meryl WIMMER[†] et Gwendal RIVIERE[*]

[†]*Centre National de Recherches Météorologiques, Toulouse*

[*]*Laboratoire de Météorologie Dynamique, Paris*

P. Arbogast, J.-M. Piriou, J. Delanoë, Q. Cazenave, J. Pelon, C. Labadie

Workshop NAWDEX, 09/03/2021

Deep convection scheme in ARPEGE-EPS

Bougeault, 1985 (B85)

- Mass-Flux scheme
- Closure in humidity

→ operational use

Piriou et al, 2007 (PCMT)

- Mass-flux scheme
- Closure in CAPE
- Linked to microphysic and transport scheme
- Strong entrainment

→ climate use

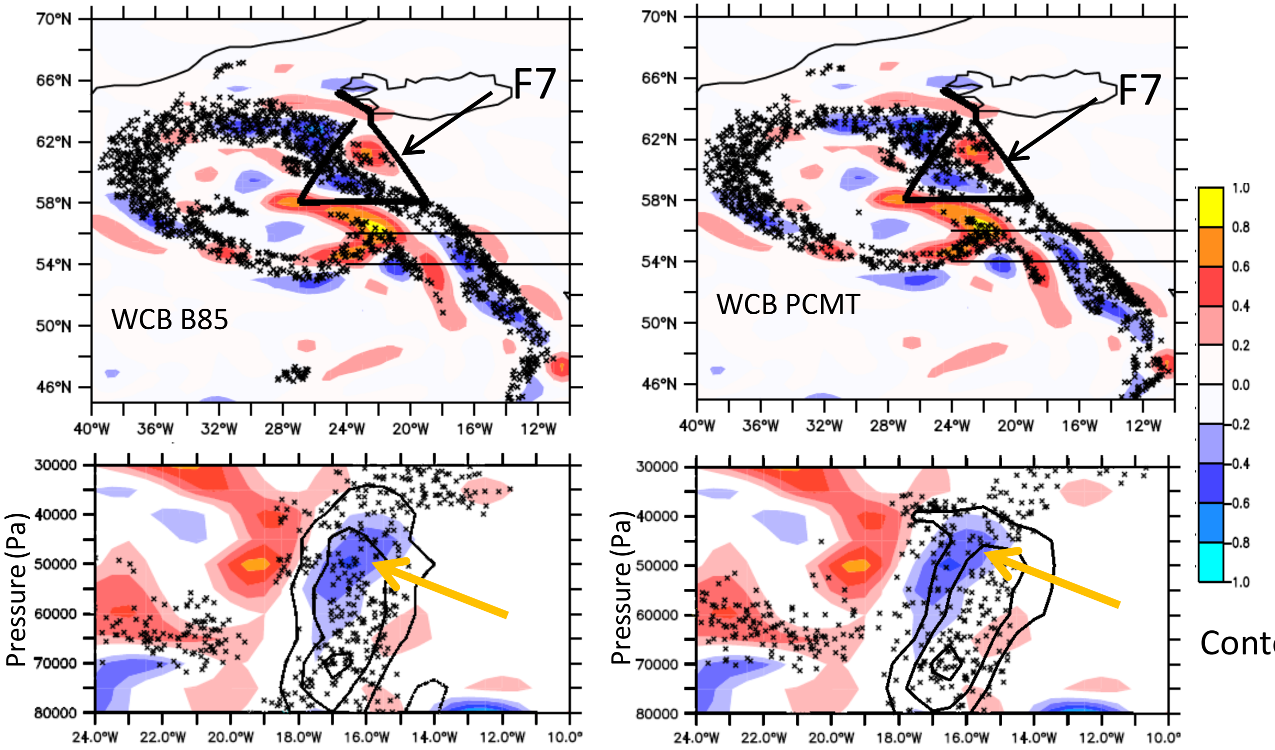
What are differences between the 2 deep convection schemes on wind and PV, along flight F7 (IOP6) which measured the ascending part of the Stalactite Cyclone WCB?

Can in-situ measures and analysis determinate which scheme better represent the dynamic?

Structure of PV anomaly in mid-troposphere at the time of flight F7

02/10/2016 at 15UTC (+27h)

PV(PCMT) - PV(B85) between 550 and 650 hPa

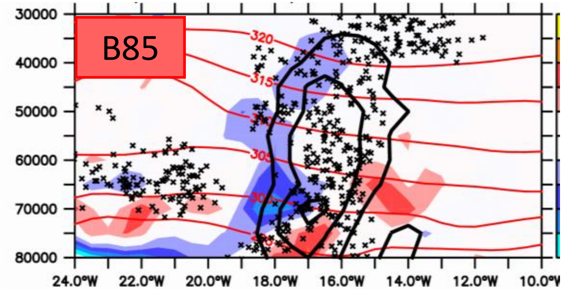


A tripole PV anomaly is formed along the cold front with mainly WCB inside the negative PV anomaly. This anomaly peaks in mid-troposphere

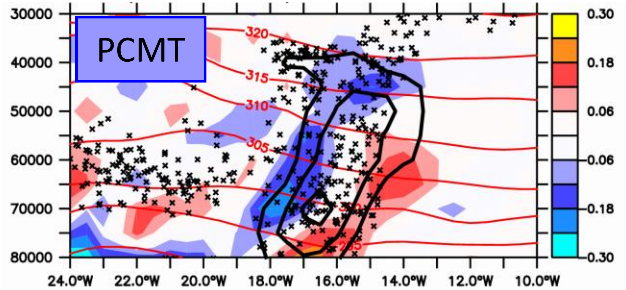
Contours : Heating

Interpretation of PV difference between the 2 runs above the cold front in terms of heating structure

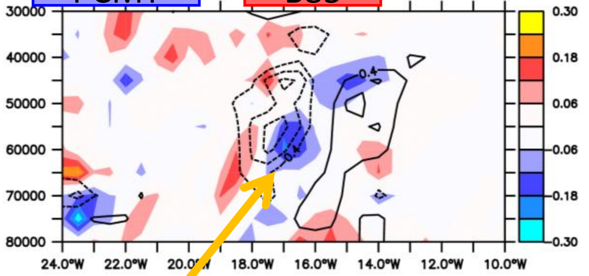
DPV/Dt – WCB B85



DPV/Dt – WCB PCMT

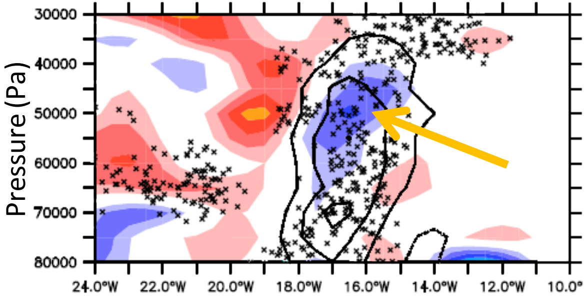


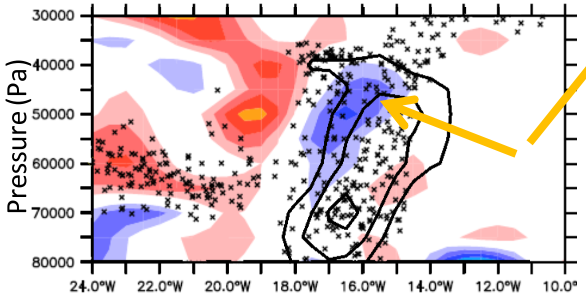
DPV/Dt PCMT - DP/Dt B85



02/10/2016 at 15UTC (+27h)

PV PCMT - PV B85

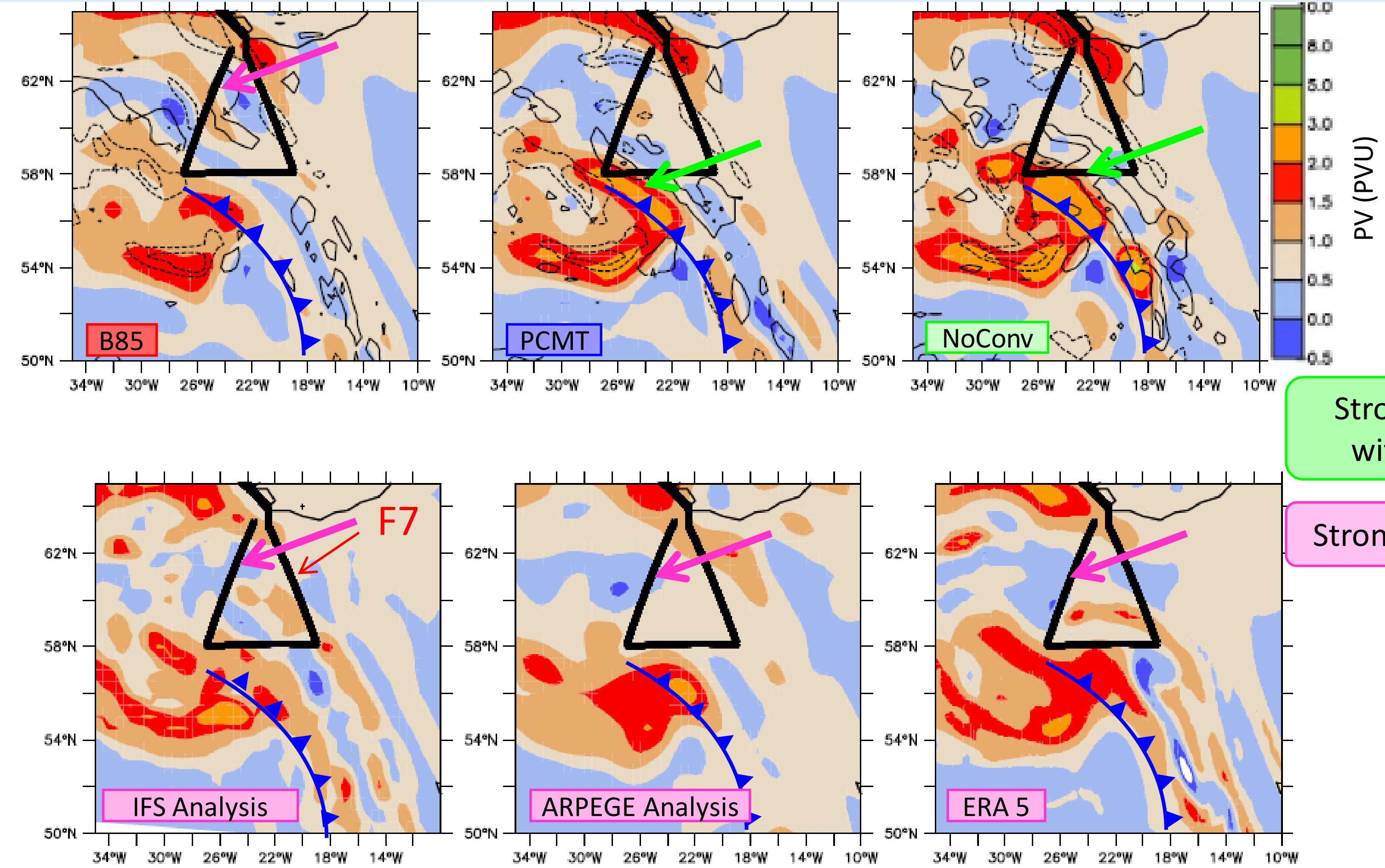




It shows that the negative PV anomaly in mid-troposphere is related to diabatic processes along WCBs and differences in the heating profiles

Contours : Heating

PV at 600hPa– Comparison with analysis



Contour : difference with IFS

Strong PV along cold front with PCMT and NoConv

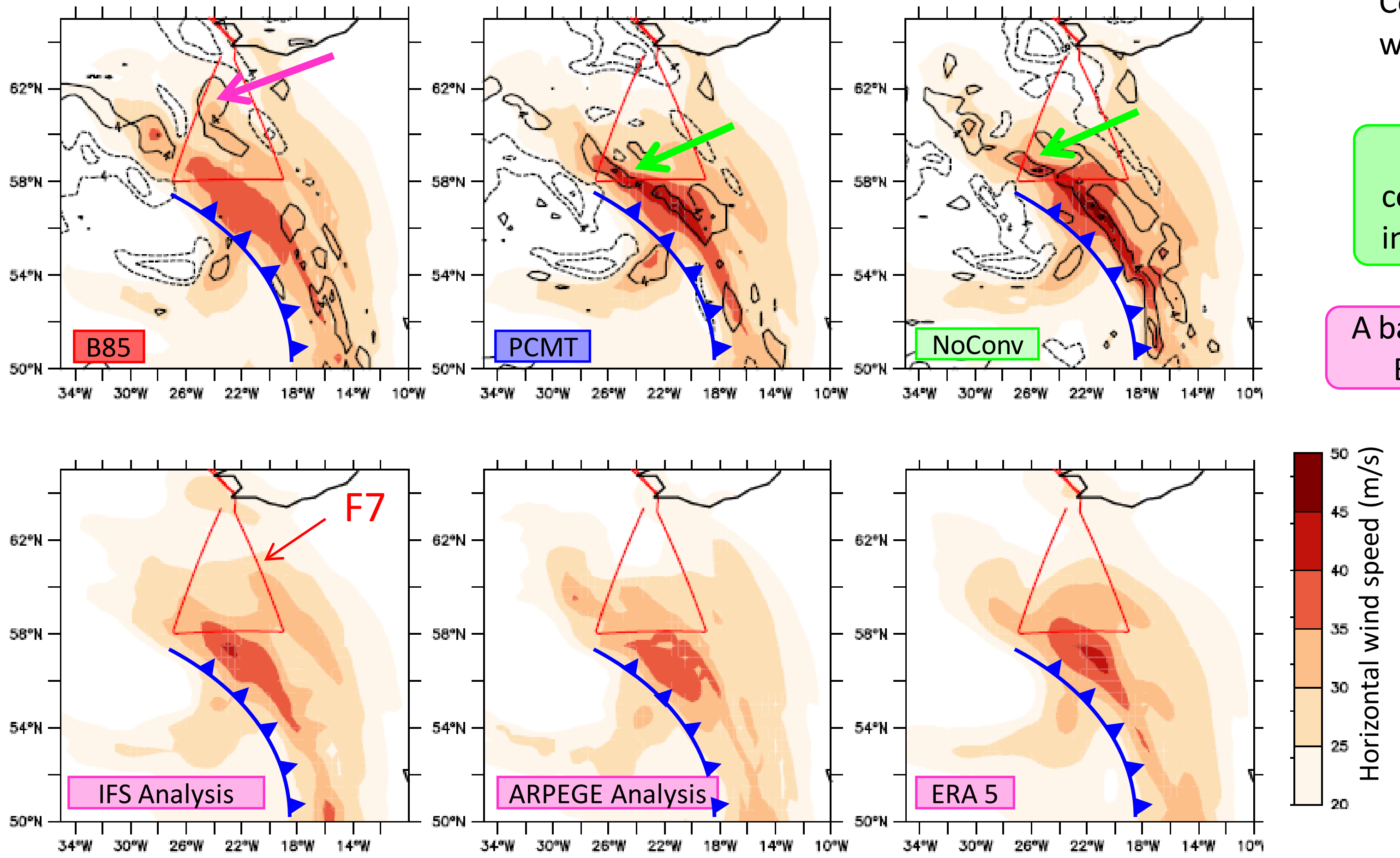
Strong PV crossing F7 in B85

Mid-tropospheric structure of the jet et – Comparaison with analysis

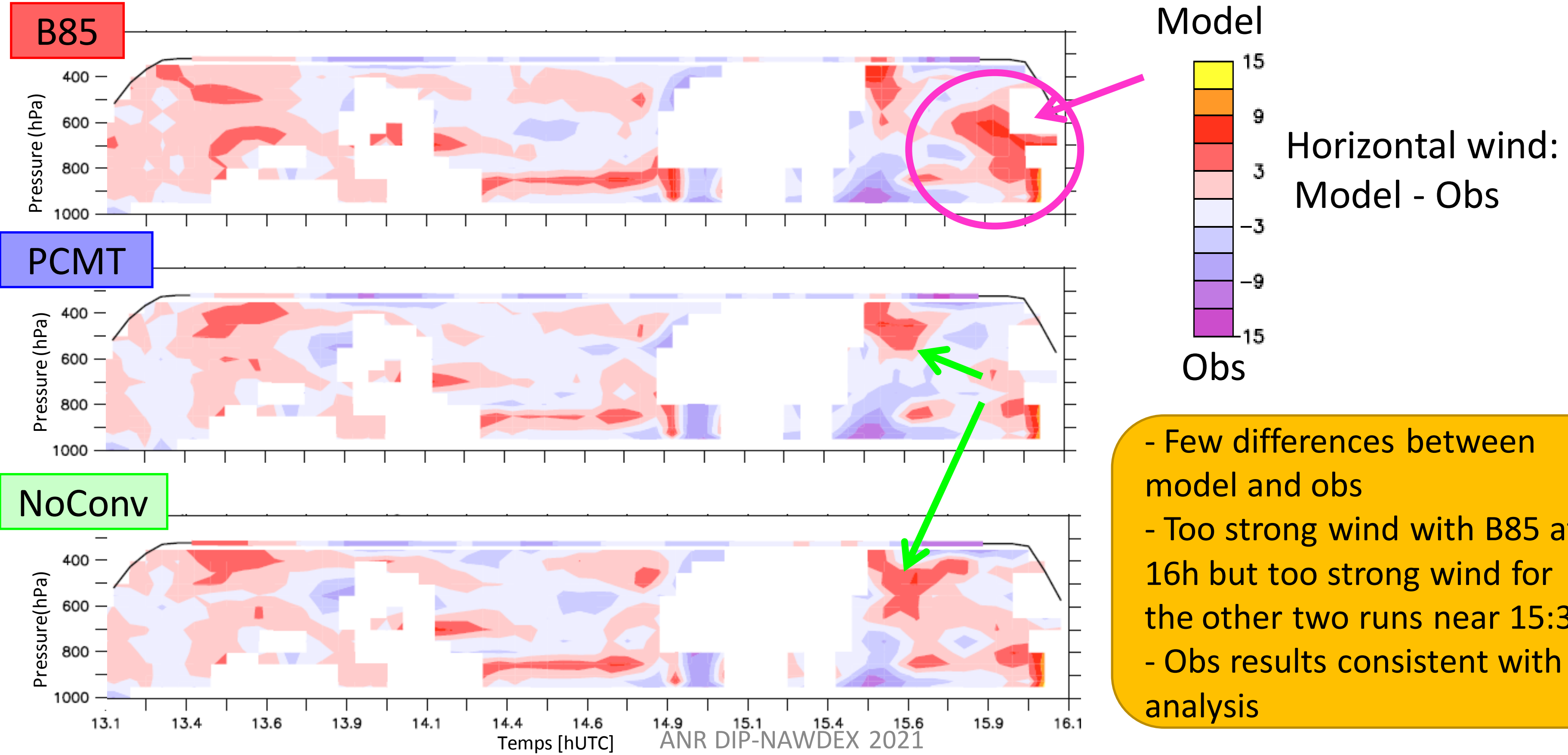
Contour : difference with IFS Analysis

Too strong wind compared to analysis in PCMT and NoConv

A band of too strong wind in B85 more to the north

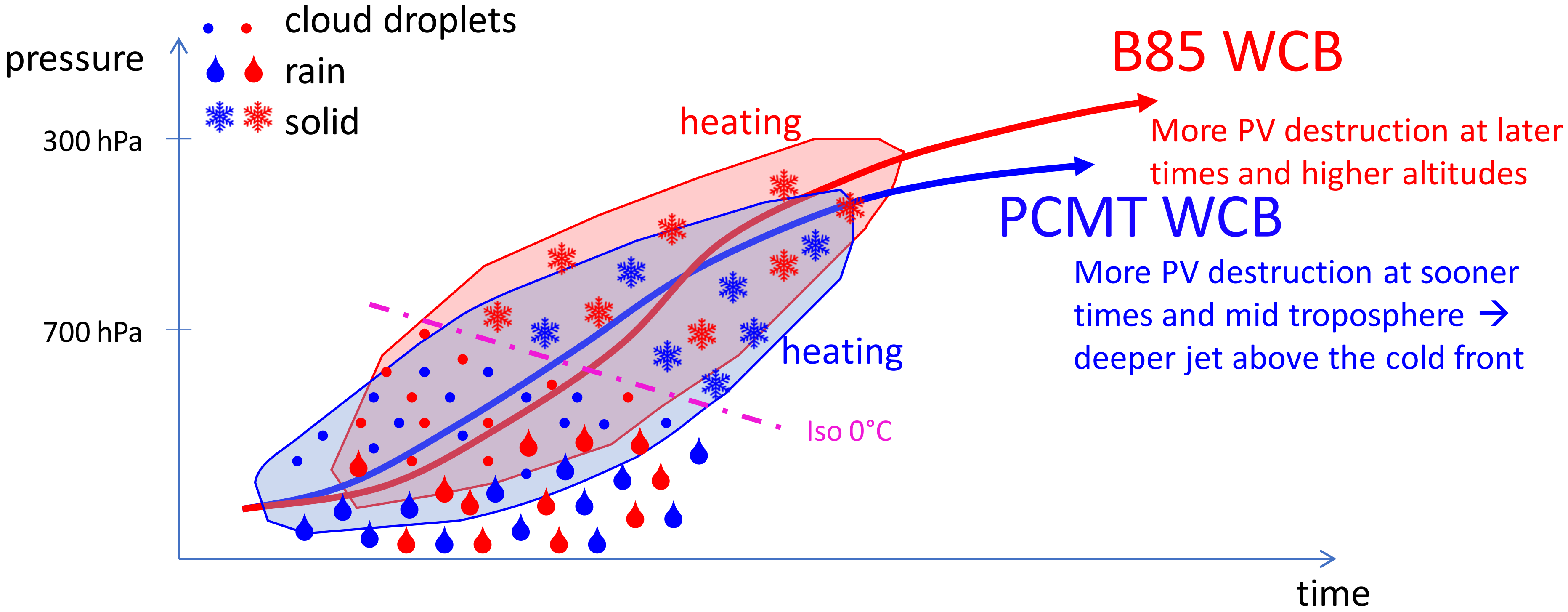


Comparison with radar wind retrieval



- Few differences between model and obs
- Too strong wind with B85 at 16h but too strong wind for the other two runs near 15:30
- Obs results consistent with analysis

Conclusion



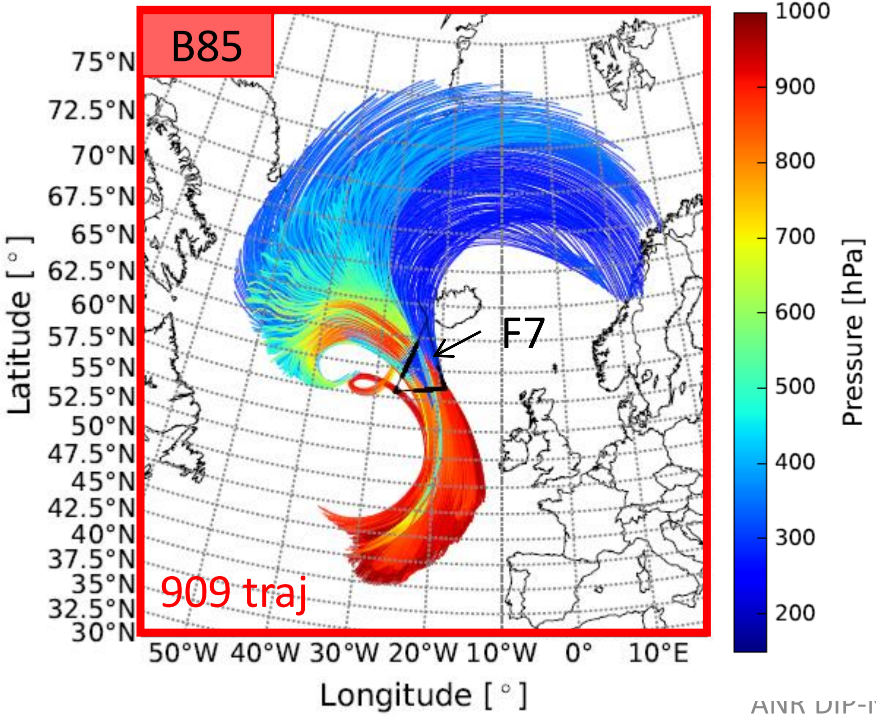
Results are consistent with the fact that PCMT is known to create more destabilization at low levels.

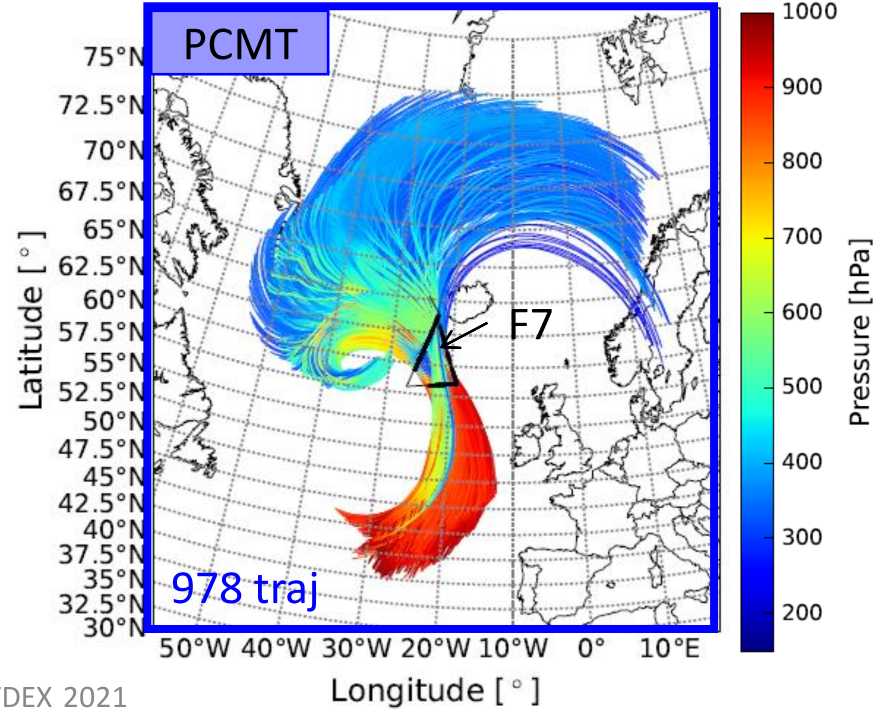
Thank you for your attention

Warm Conveyor Belt accross F7

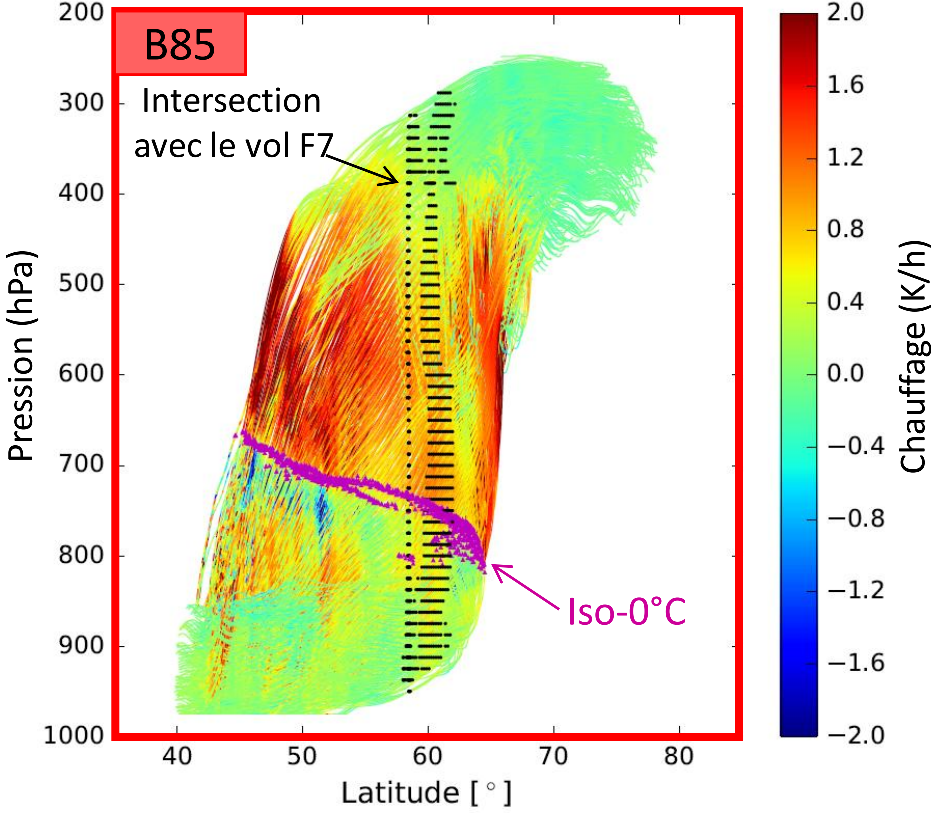
Trajectories : -24h / +24h

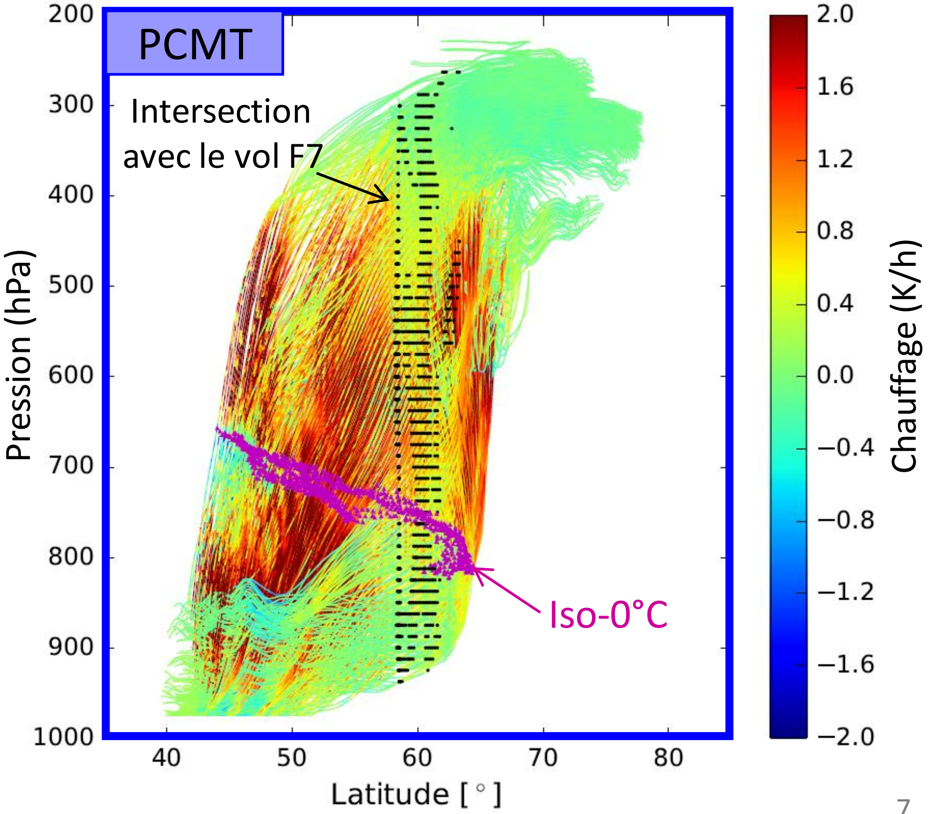
WCB : -300hPa in 24h + P_0>850hPa



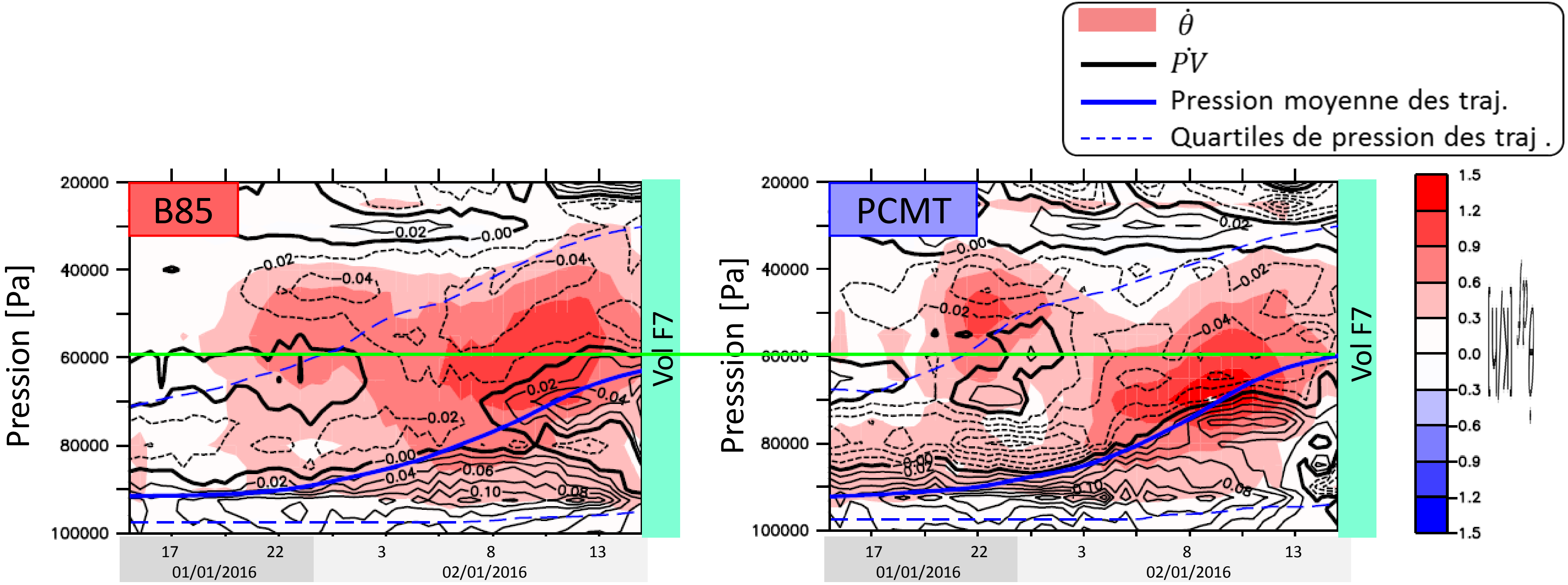


Difference de chauffage en phase liquide





Profil vertical de $\dot{\theta}$ et de $\dot{PV}$, moyennés sur toutes les trajectoires WCB, pendant les 24h **avant le vol F7**

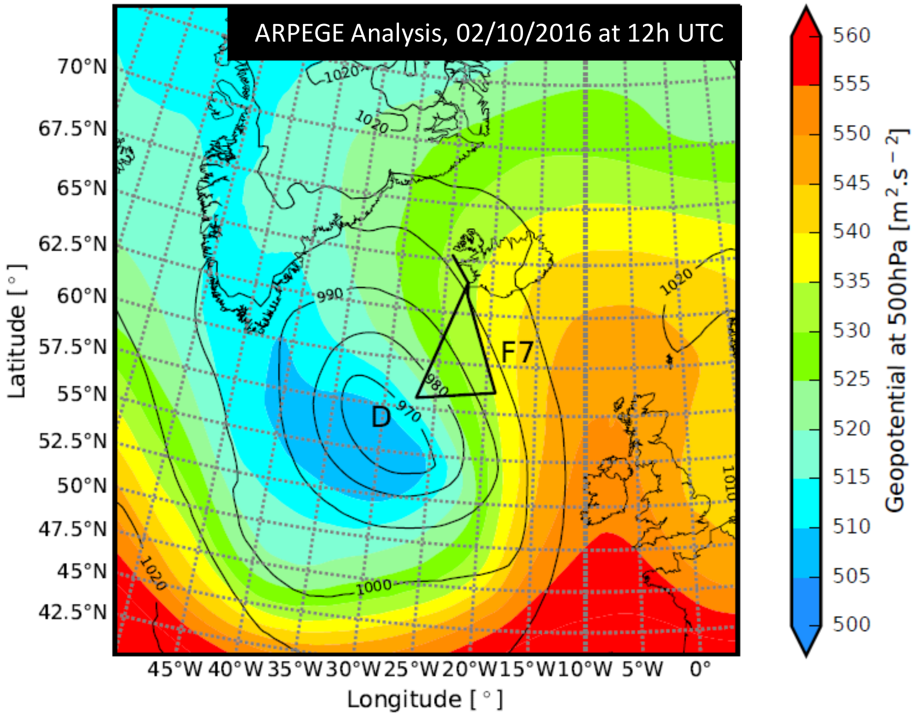


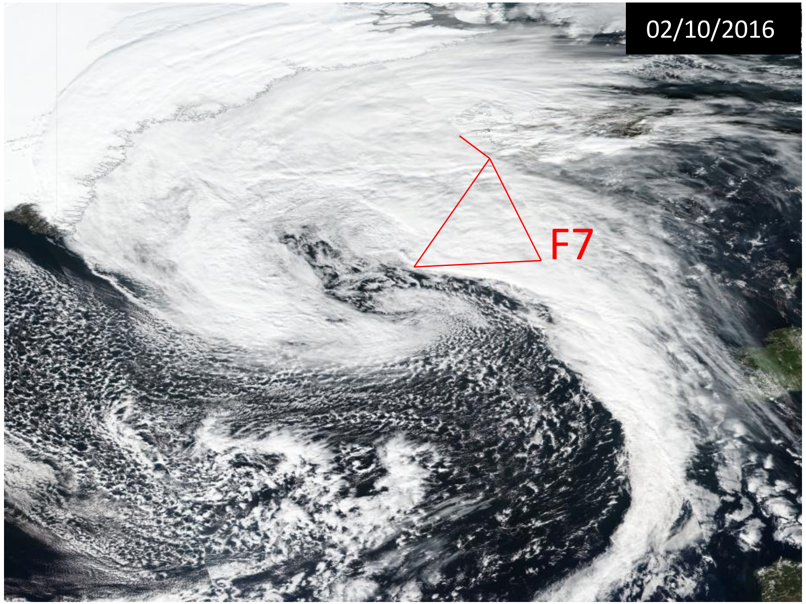
Chauffage plus haut

Chauffage plus bas

Stalactite Cyclone / IOP6

Geopotential at 500 hPa (shading)
et mean sea level pressure (contour)





MODIS, Nasa Worldview Application