Global simulations at kilometric resolutions
Regional simulations at hectometric resolutions

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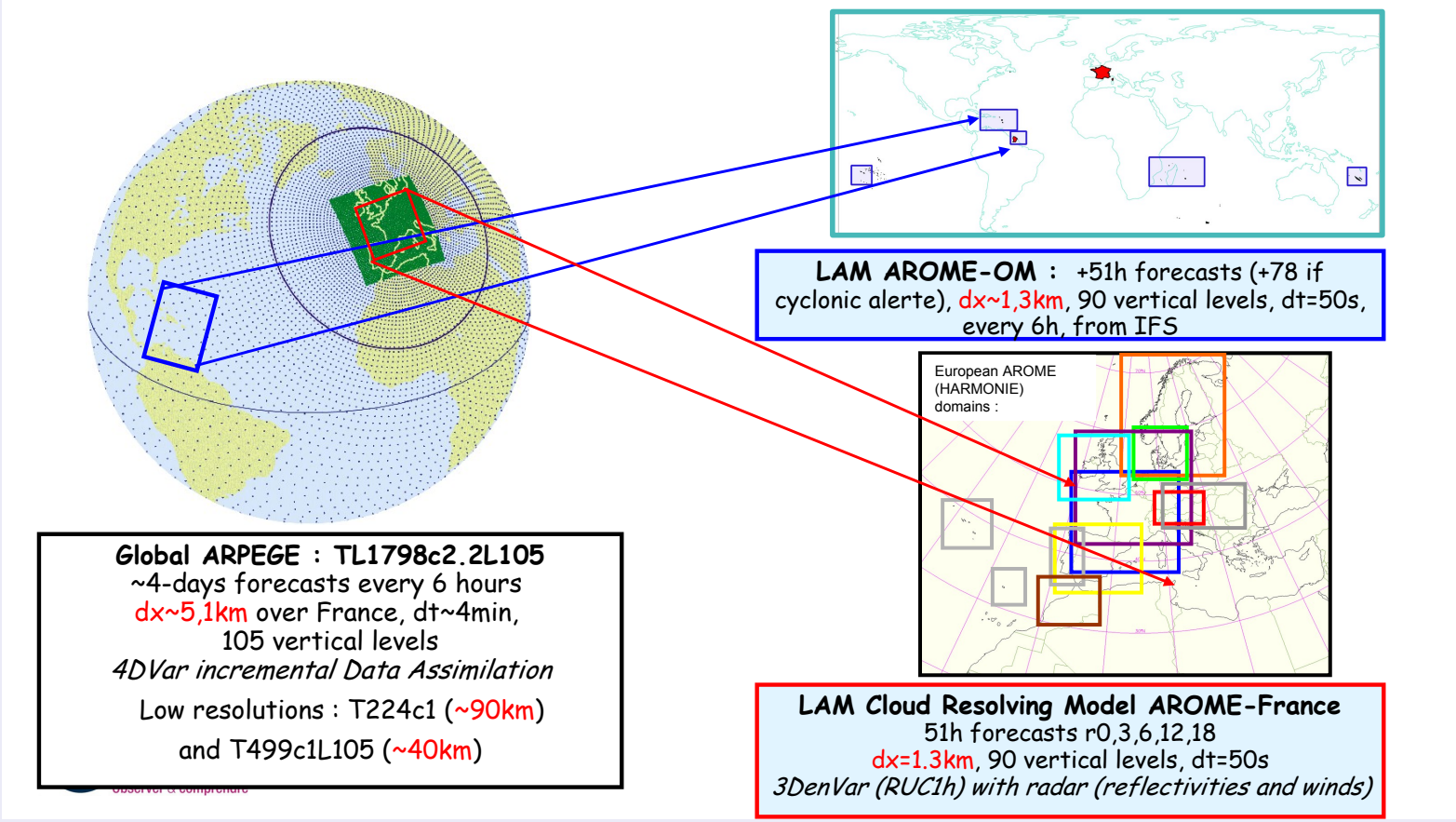
Météo-France/CNRM

Operational models at Météo-France in 2025



IFS, ARPEGE and ARPEGE-CLIMAT share the same dynamical core (spectral Semi-implicit Semi-Lagrangian) and AROME uses the LAM version of it. **But they use different physics.**

Global convection permitting configurations

- Dyamond intercomparison : TC3799 (2.5 km) c=1 L70, NH dyncore (the levels had been chosen to be close to sigma levels to insure stability of the NH), **AROME physics**.
- Current NWP tests : TC3799 L90 (AROME levels) or L105 (ARPEGE levels), dt=60s, H dyncore, **AROME physics**, starts from an ARPEGE or an IFS 4DVAR oper analysis.
- in parallel, test at TC3799 with ARPEGE physics.

As for AROME, the orography is derived from GMTED2010 (resolution about 200 m) instead of GTOPO30 (ARPEGE, resolution about 800 m).

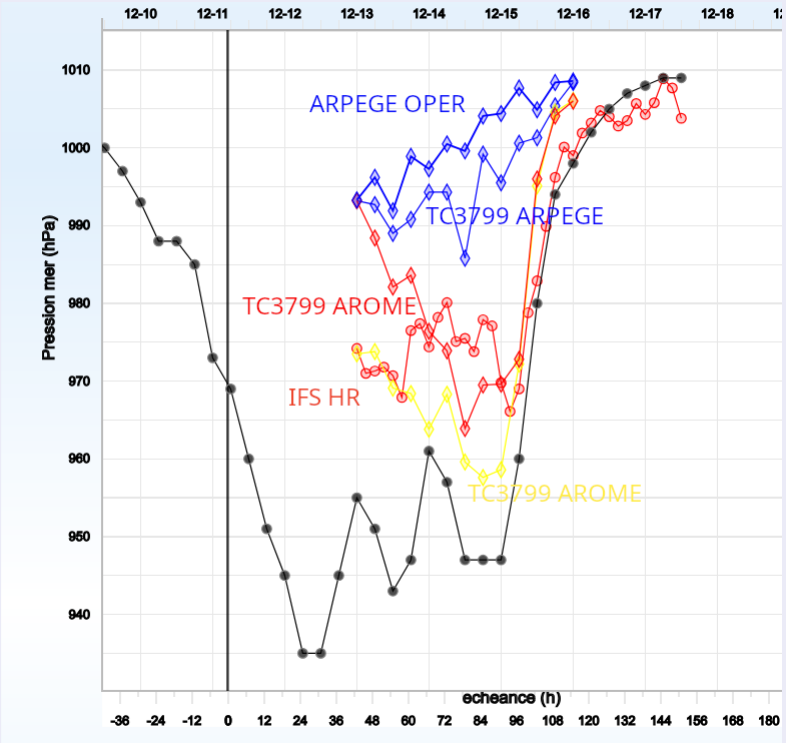
Very preliminary results

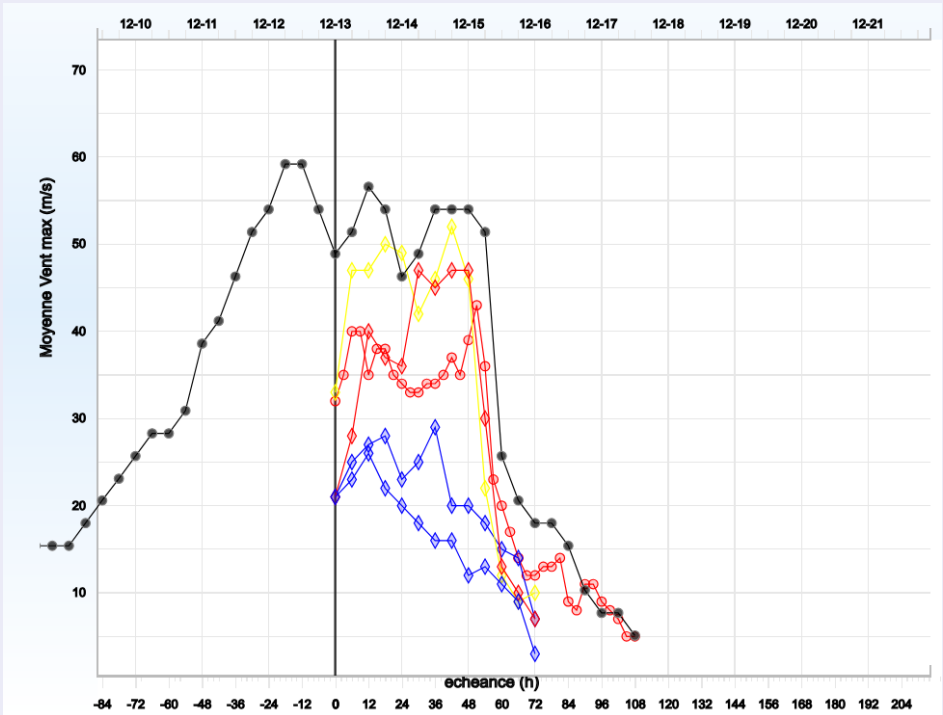
A lot of teething problems!

- Scores compared to OPER: ARPEGE and AROME (technically not obvious, two different worlds that need merging...)
- Specific diagnostics : TC tracking, rain histograms

Tropical cyclone CHIDO (Mayotte - North of Madagascar)

Pmin/Vmax compared to Best Track

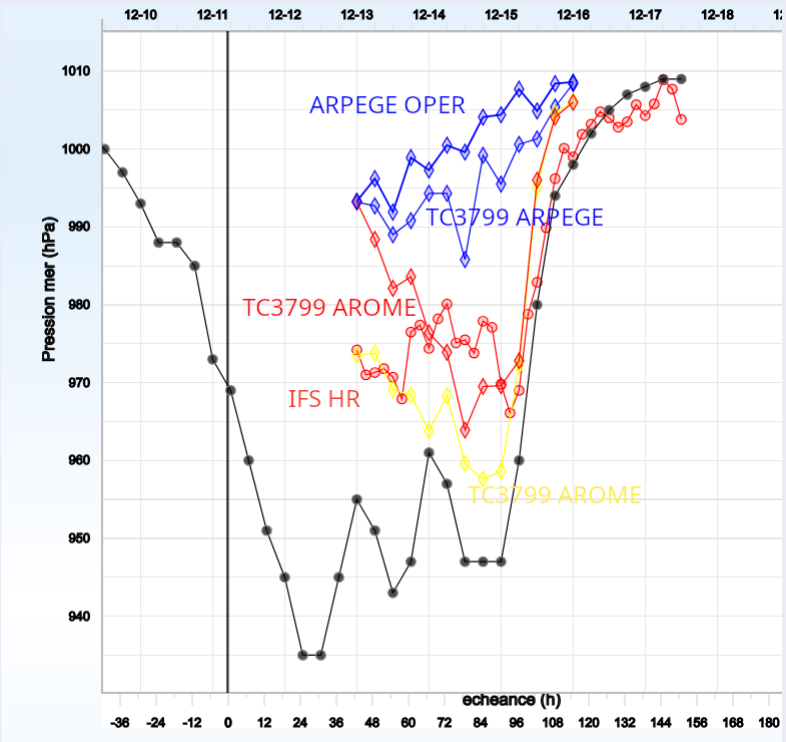


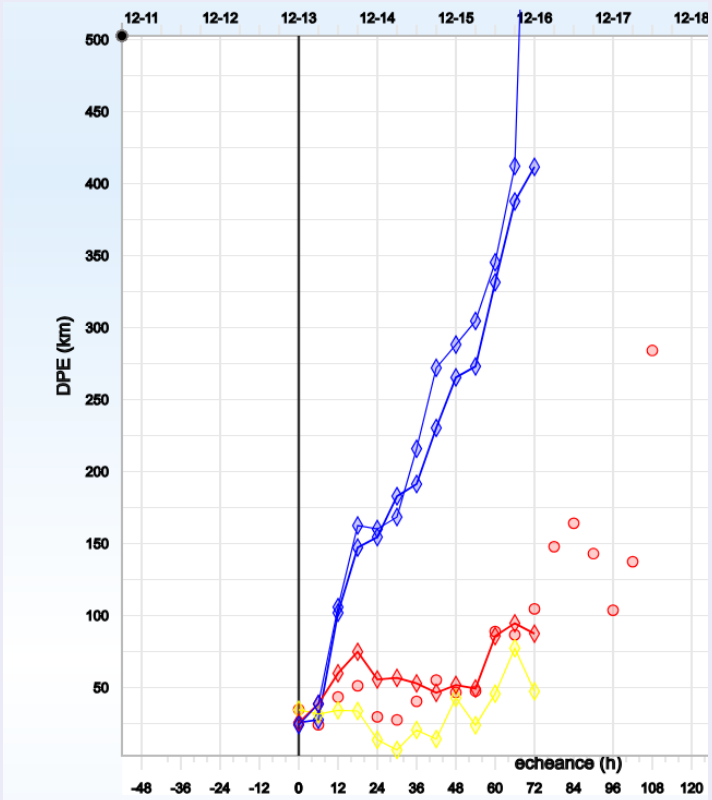


Black : Best Track, Blue: ARPEGE physics (OPER or TC3799), starts from ARPEGE, Red diamonds: AROME physics, starts from ARPEGE, Red circles: IFS HR, yellow: AROME physics, starts from IFS.

Tropical cyclone CHIDO (Mayotte - North of Madagascar)

Pmin/Total Trajectory Error





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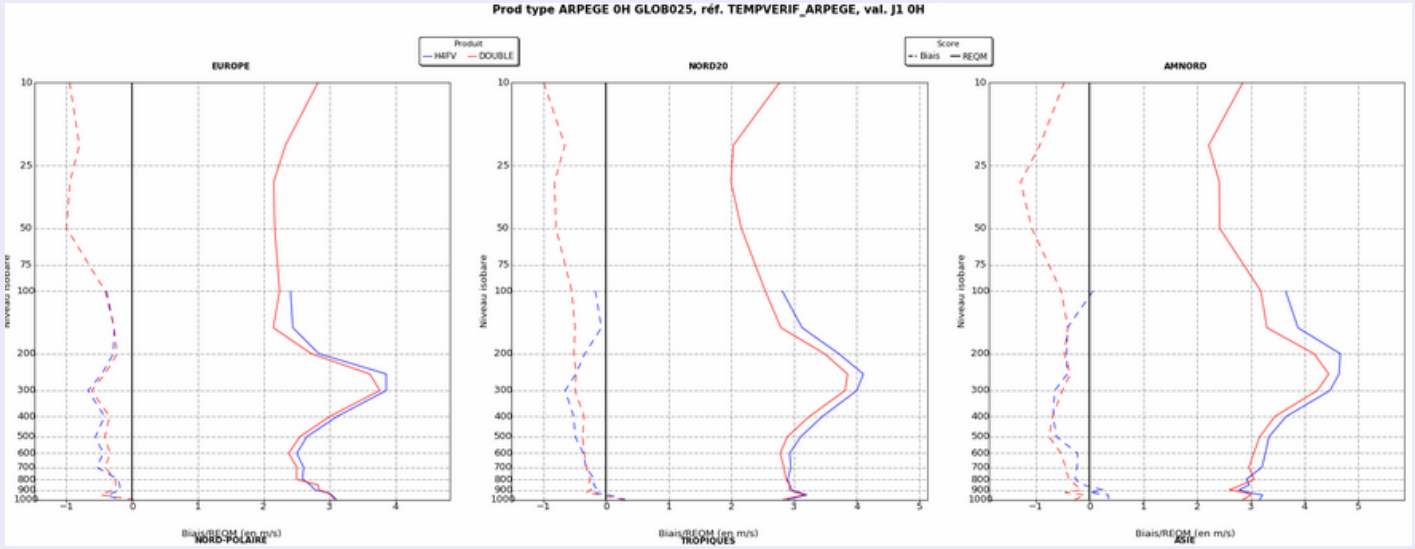
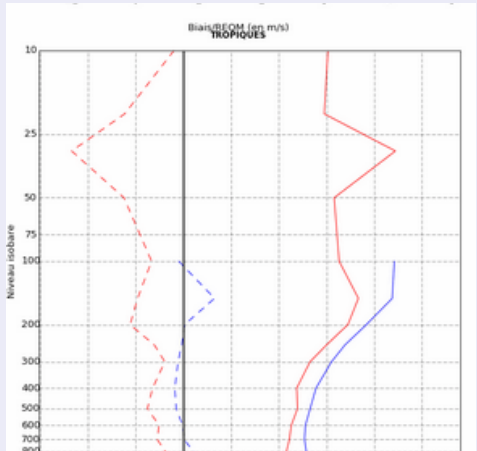
Global scores (FF compared to RS)

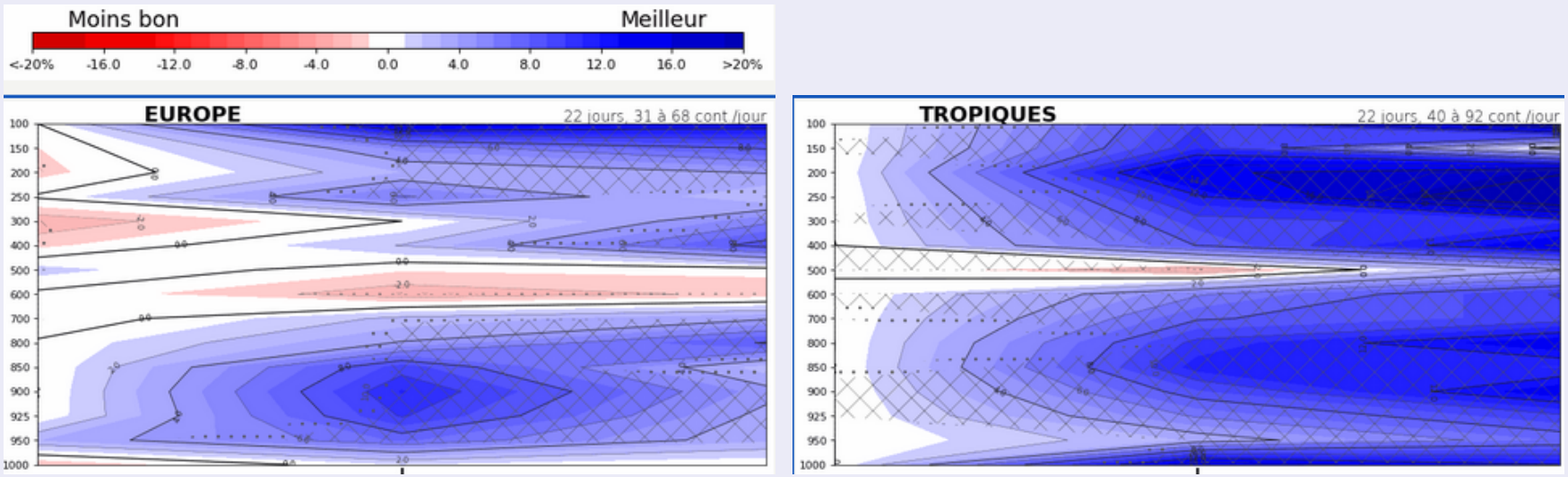
TC3799 c=1 AROME physics versus TL1798 c=2.2 ARPEGE e-suite : Global model with AROME physics is generally worse for global large scale scores





Global scores (model temperature compared to RS)

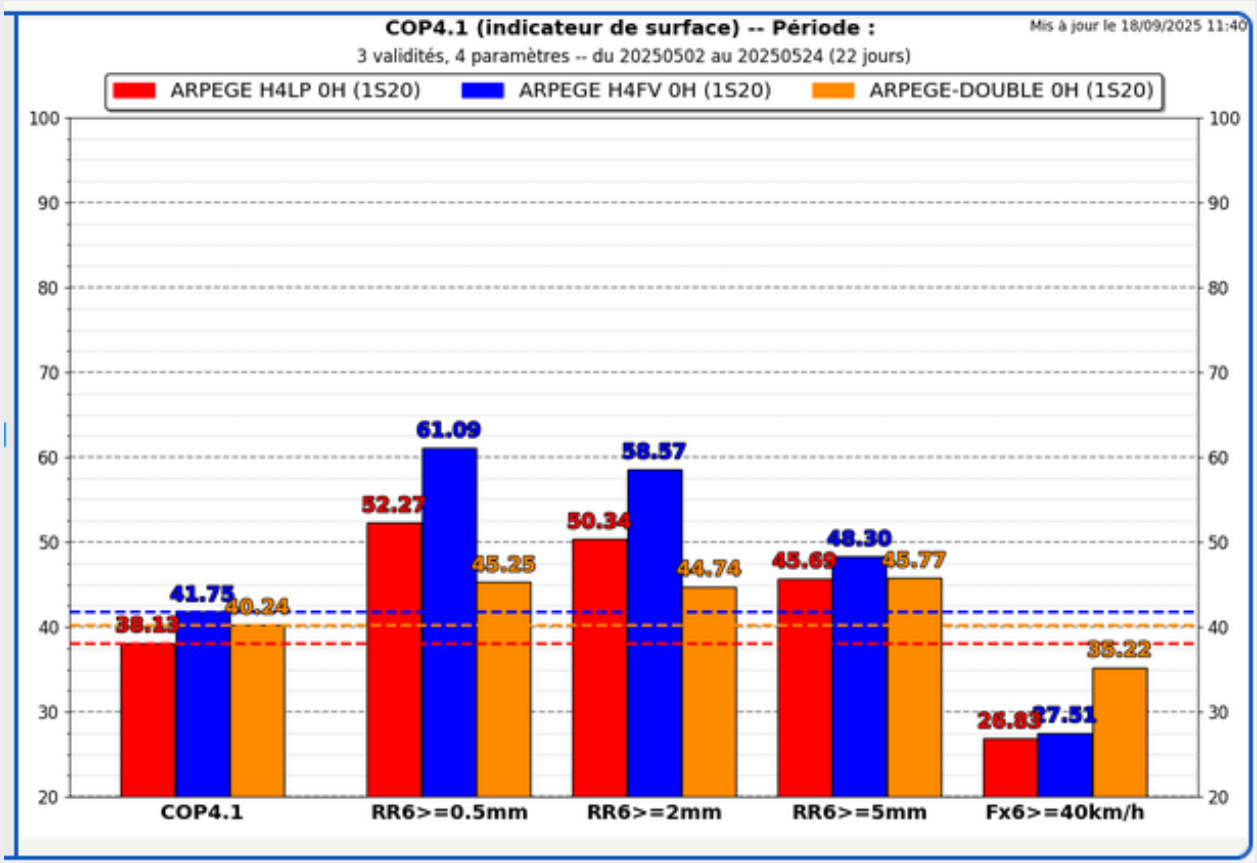
TC3799: RMSE ARPEGE versus AROME physics : AROME physics is generally worse for global large scale scores



Blue : ARPEGE physics better than AROME physics at TC3799

Regional surface scores

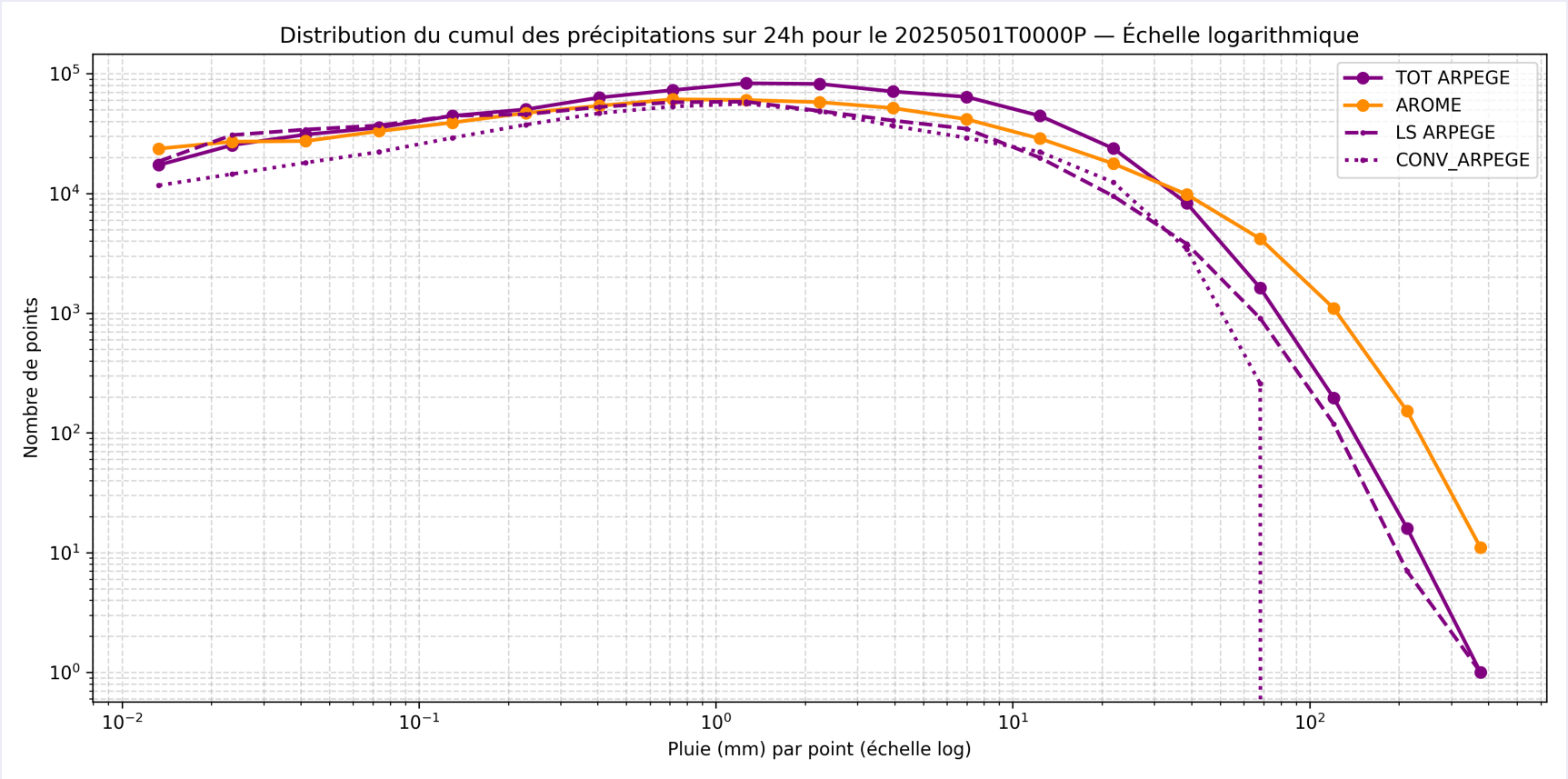
Combined score index for RR and gusts over France



Blue : TC3799 with AROME physics, Red: TC3799 with ARPEGE physics, Orange: ARPEGE e-suite (TL1798 c=2.2: 5km over France)

Precipitation histograms (+24 h)

TC3799 c=1 : AROME versus ARPEGE physics



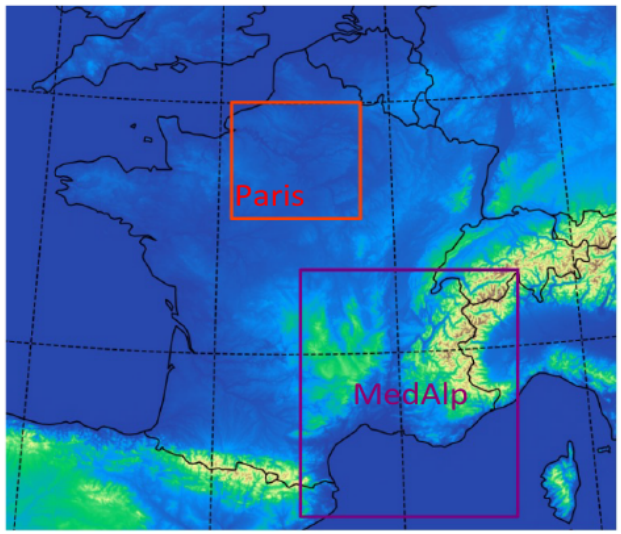
Short term plans for the HR global configuration:

- work on the remaining technical problems
- tests with ARPEGE physics without Deep Conv and/or GWD
- tests with AROME physics + deep conv. scheme (Tiedtke)(+GWD?)
- also tests at TL7598 (same grid, but twice more wavenumbers), quadratic orography : historical AROME config
- more specific diagnostics

Regional hectometric configurations of AROME

AROME $\Delta x = 500$ m, L120, dt=20s

- 2 domains: Paris and Alps/Mediterranean
- New surface data base (ECOCLIMAP-SG)
- 1 year evaluation by the forecasters + scores
- $\Rightarrow$ Little benefit compared to the 1.3 km operational configuration



Do we need a better physics? Different dynamics?
Are we in a grey zone of one of the parametrisation?
Do we need data assimilation, in particular for the surface?

Regional hectometric configurations of AROME

AROME $\Delta x = 200$ m, L120, dt=10s — Under development

(also part of the European DEODE project : Destination Earth's on-demand extremes digital twin)

- improve the stability of the spectral semi-implicit semi-Lagrangian DynCore
- improve the computer efficiency of AROME (GPU),
- development of a pseudo-3D turbulent TKE scheme (Göger, 2018, Leonard, 1997)
- include the height of the buildings in the topography

By adding the building height to the input orography data