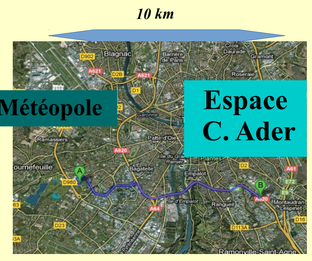
The NWP systems at Météo-France

New HPC at Meteo-France in 2020

2 twin HPC, 2 implementations

Centre National de Calcul
Météopole, Toulouse



Computer Belenos

Espace Clément Ader
Montaudran

Computer Taranis

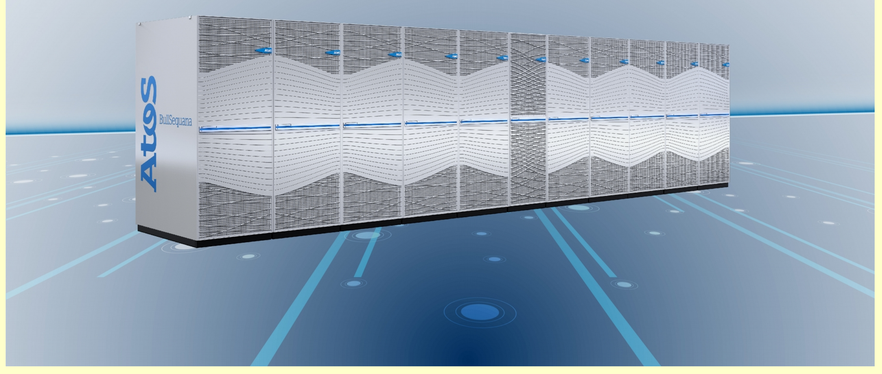
Belenos and Taranis HPC : **ATOS BULL Sequana XH2000**

10.39 PFlops peak performance
Node : **2 AMD Epyc Rome processors with 64 cores at 2.25 Ghz**
2292 computing nodes = 293376 computing cores
Dragonfly+ interconnection topology with **HDR100 infiniband** technology
"hot" water cooling (40°C → 48°C)
Lustre file system : **11.6 Po, 408 Go/s** (Belenos) & **8,2 Po, 288 Go/s** (Taranis)
Disk storage 200 To

from BULLX B710 DLC « Beaufix » and « Prolix »

Available : April 2020 (Belenos) Sept. 2020 (Taranis)

to ATOS BULL Sequana XH2000 «Belenos» and «Taranis»



***=> Five fold increase in performance** (ARPEGE and AROME-France benchmark runs)*

Météo-France Numerical Weather Prediction Systems

ARPEGE Ensemble Data Assimilation (ARPEGE-EDA)

MF global deterministic model : ARPEGE

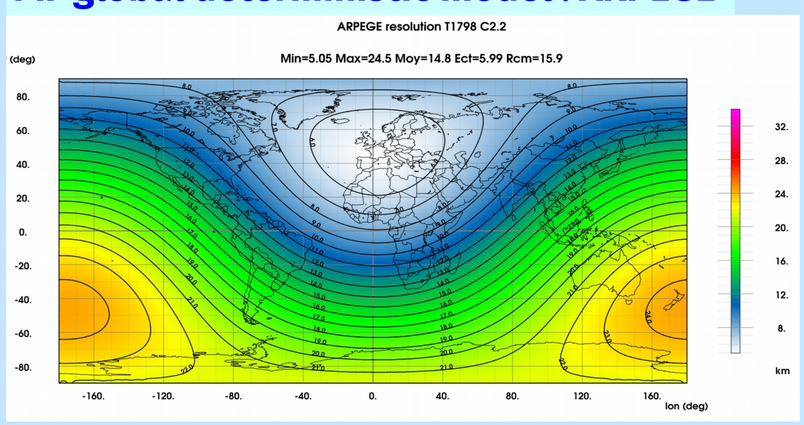


Figure 1: ARPEGE new resolution Tl1798c2.2 L105

MF global short-range E.P.S. : PEARP

Ref: Descamps L. et al., 2014. PEARP, the Météo-France short-range ensemble prediction system, QJRMS

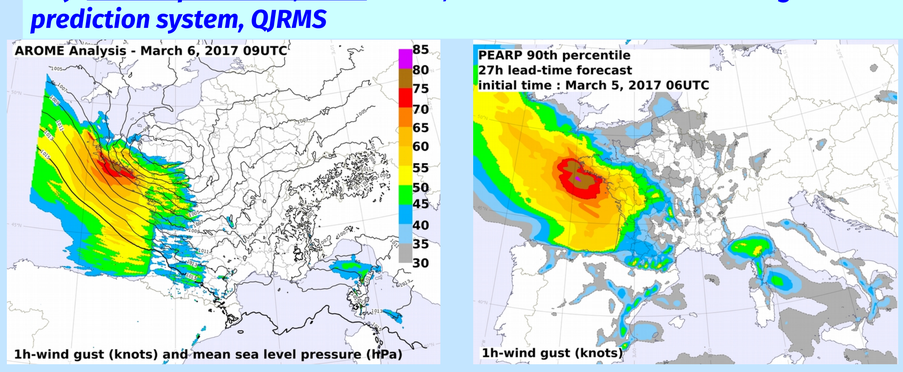


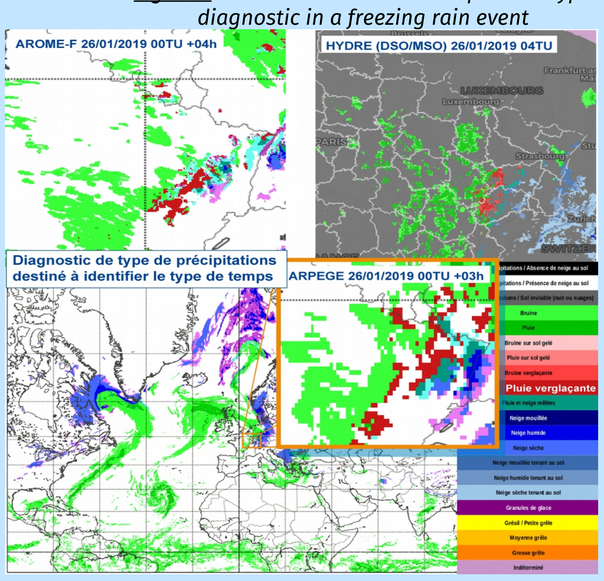
Figure 4 : An example of the ability of the global mesoscale hydrostatic ensemble system PEARP to capture an extreme storm event over France.

AROME-France Ensemble Data Assimilation (AROME-EDA)

operational since July 10th, 2018

AROME-France deterministic model

Figure 2 ARPEGE and AROME Precipitation type diagnostic in a freezing rain event



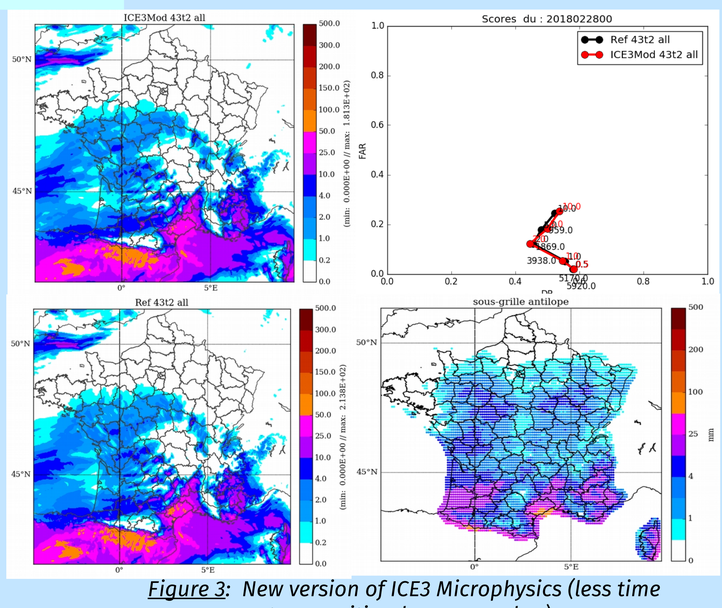


Figure 3: New version of ICE3 Microphysics (less time step sensitive, less graupels...)

AROME Overseas (AROME-OM)

in operation since Feb. 11, 2016, upgrade in Dec. 2017

ALADIN-HIRLAM Newsletter n°10 Jan.2018, Forecasting the tropical cyclones IRMA and Maria with AROME-Antilles, G. Faure & C. Fischer

AROME-NWC: high resolution model for nowcasting

operational since December 8, 2015

Ref: ALADIN-HIRLAM Newsletter n°9 Sep.2017, AROME for Nowcasting, N. Merlet et al

AROME-France E.P.S. : PEARO

operational production since October 2016

Ref: ALADIN-HIRLAM Newsletter n°8, Jan.2017, AROME-France EPS, F. Bouttier et al

Version CY43T2 of the ARPEGE/IFS code operational since 2 July 2019

Simultaneous switch of all systems to CY43T2 on 2 July 2019

- technical changes (GRIB2, VORTEX), version 8 of the external surface scheme SURFEX
- **new model output diagnostics** : visibility, type of precipitations

ARPEGE :

- **increase of horizontal resolution (7.5→5.1 km over France), time step 360→240s**,
- new tuning of the convection scheme and changes in data assimilation

AEARP : increase of horizontal resolution (42→40 km), 25 → 50 members, increased resolution also for the 4D-VAR analysis increments

PEARP : increase of horizontal resolution (10→7.5 km over France), time step 514→360s, initialisation with 35 members from AEARP

AROME : new version of ICE3 microphysics schema, MESCAN surface analysis, changes in radar assimilation

PEARO : increase of horizontal resolution

Coupling files for ALADIN Partners

Impact (scores over 6 month e-suite period)

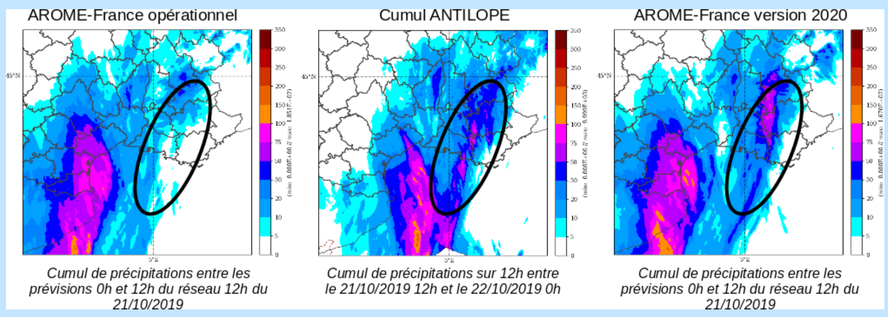
- Significant improvement of ARPEGE synoptic forecasts for all parameters, all levels, all ranges and domains (improvement higher over Europe),
- Neutral impact on AROME objective scores, with improvement of precipitation and surface humidity subjective scores

Upgrade of CY43T2 (op3) on 15 January 2020

ARPEGE & AEARP : assimilation of ASCAT-C sea-surface winds

AROME :

- Implementation of a snow analysis scheme in AROME-France: better representation of the snow melt over plains (see ALADIN-HIRLAM Newsletter n°12, Jan. 2019, C. Birman)
- Assimilation of OPERA radars data with 31 French radars and 62 radars from neighbouring countries (Fig.5) : positive impact on precipitation scores (Fig. 6)



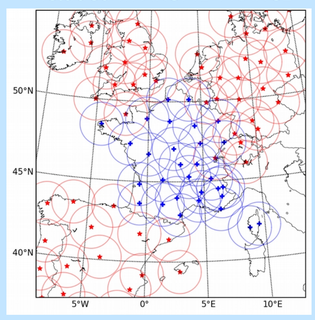
Cumul de précipitations entre les prévisions 0h et 12h du réseau 12h du 21/10/2019

Cumul de précipitations sur 12h entre le 21/10/2019 12h et le 22/10/2019 0h

Cumul de précipitations entre les prévisions 0h et 12h du réseau 12h du 21/10/2019

Figure 6 : An example of the improvement of the AROME-France 12h precipitation forecast with assimilation of OPERA radars (right), compared with the operational version (left) and the ANTILOPE rainfall analysis (centre)

Figure 5: OPERA radars (blue) and French radars (red) included in AROME-FRANCE



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