Overview of Météo-France NWP systems

2 twin HPC, 2 implementations

Centre National de Calcul Météopole, Toulouse

Computer Belenos

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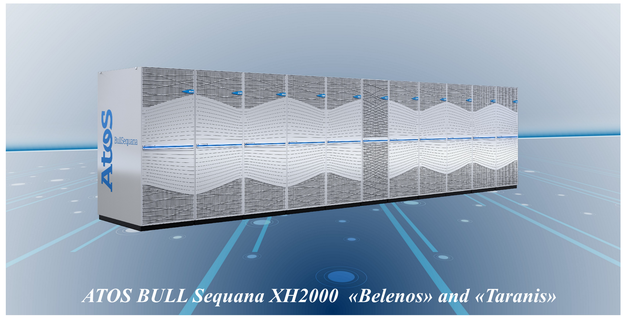
Computer Taranis



ATOS BULL Sequana XH2000 «Belenos» and «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 (39°C → 46°C)
Lustre file system : **11.6 Po, 408 Go/s** (Belenos) & **8,2 Po, 288 Go/s** (Taranis)
Disk storage 200 To

=> Five fold increase in performance than the previous HPC
(ARPEGE and AROME-France benchmark runs)

In operations since February 2021

No upgrade during the 4 year contract

Regional operational NWP systems based on AROME

AROME-France *Deterministic*
- *1.3km (1536 x 1440 pts)*
- *L90: from 5m to 10hPa*
- *3DVar (1h cycle)*
- *5 forecasts per day up to 48h*

AROME Overseas *(5 domains)*
- *2.5km L90 – Dynamical adaptation of IFS (altitude) and Arpege (surface)*
- *4 forecasts per day up to 48h*
- *Ref: ALADIN-HIRLAM Newsletter n°10 Jan.2018, Forecasting the tropical cyclones IRMA and Maria with AROME-Antilles, G. Faure & C. Fischer*

AROME-France Nowcasting
- *1.3km (1536 x 1440 pts)*
- *L90: from 5m to 10hPa*
- *3DVar (no cycling – 10' cut-off)*
- *24 forecasts per day up to 6h*
- *Ref: ALADIN-HIRLAM Newsletter n°9 Sep.2017, AROME for Nowcasting, N. Merlet et al*

AROME-EPS (PEARO)
- *2.5km L90*
- *16 members*
- *Four times per day up to 51h*
- *Initial and boundary conditions from PEARP*
- *Ref: ALADIN-HIRLAM Newsletter n°8 Jan.2017, AROME-France EPS, F. Bouttier et al*

Figure 3: operational AROME-France domain

Figure 4: operational AROME overseas domains

AROME-EDA (AEARO)
- *3.25km L90*
- *25 members*
- *3DVar (3h cycle)*

AROME-IFS
- *2.5km L90– Dynamical adaptation of IFS (altitude) and Arome-Fr (surface)*
- *2 forecasts per day up to 48h*

Global operational NWP systems based on ARPEGE

ARPEGE *Deterministic*
- *Tl1798c2.2 L105 (5km on W Europe)*
- *4DVar (6h cycle): Tl224c1L105 & Tl499c1L105*
- *5 forecasts per day up to 114h*

ARPEGE-EDA (AEARP)
- *Tl499c1 L105 ; 50 members*
- *4D-Var (6h cycle): Tl224c1 L105*
- *Background covariances averaged on 12h and updated every 6h*

ARPEGE-EPS (PEARP)
- *Tl1198c2.2 L90 (7.5km on W Europe)*
- *35 members ; four times per day up to 108h*
- *Using 35 EDA members and singular vectors*
- *10 physical packages*
- *Ref: Descamps L. et al., 2014. PEARP, the Météo-France short-range ensemble prediction system, QJRMS*

Figure 1: Horizontal resolution ARPEGE
Min 5km – Mean 11km – Max 24km

Figure 2: Horizontal resolution PEARP
Min 7,5km – Mean 17km – Max 37km

Current e-suite : cy46t1_op1

Calendar
- Real-time e-suite for all systems by the end of September 2021
- In operations by Q2 2022

Few highlights
(among many others)

- **EPS systems reach the same resolutions than their deterministic counterpart #arpege #arome**
- **Changes in physics**
  # arpege: Tiedke deep convection scheme, use of SRTM for solar radiation
  #arpege&arome: Ecume v6 air/sea flux parametrisation
- **Coupling with 1d sea-ice model #arpege**
- **All-sky assimilation of microwave data from MHS and ATMS #arpege**
- **Snow analysis #arpege**
- **Change of Arome dynamics to improve moist convection:**
- **Upgrade of horizontal resolution of the Arome-Overseas models**