The NWP systems at Météo-France

Météo-France Numerical Weather Prediction Systems

New HPC at Meteo-France in 2020

2 twin HPC, 2 implementations

Centre National de Calcul Météopole, Toulouse

Espace Clément Ader Montaudran

10 km

Research or Operational

Météopole

Espace C. Ader

Operational or Research

Computer Belenos

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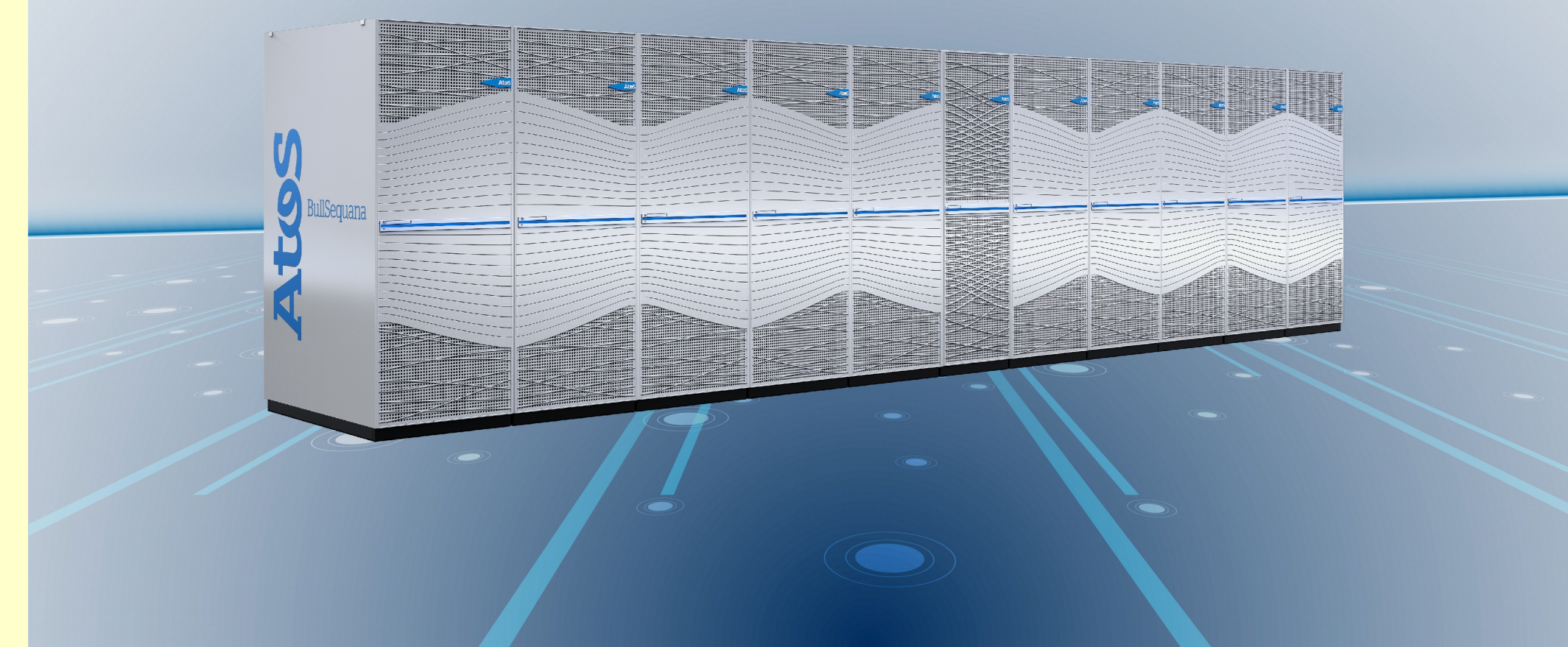**Disk storage 200 To**

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

TOP 500 The List. *Belenos enters the TOP500 and is ranked 29 on the list published in June 2020*

from BULLX B710 DLC « Beaufix » and « Prolix »

Available :   June 2020 (Belenos)   October 2020 (Taranis)

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

AtoS

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*

Figure 3: operational AROME-France domain

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*

Figure 4: operational AROME overseas domains

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

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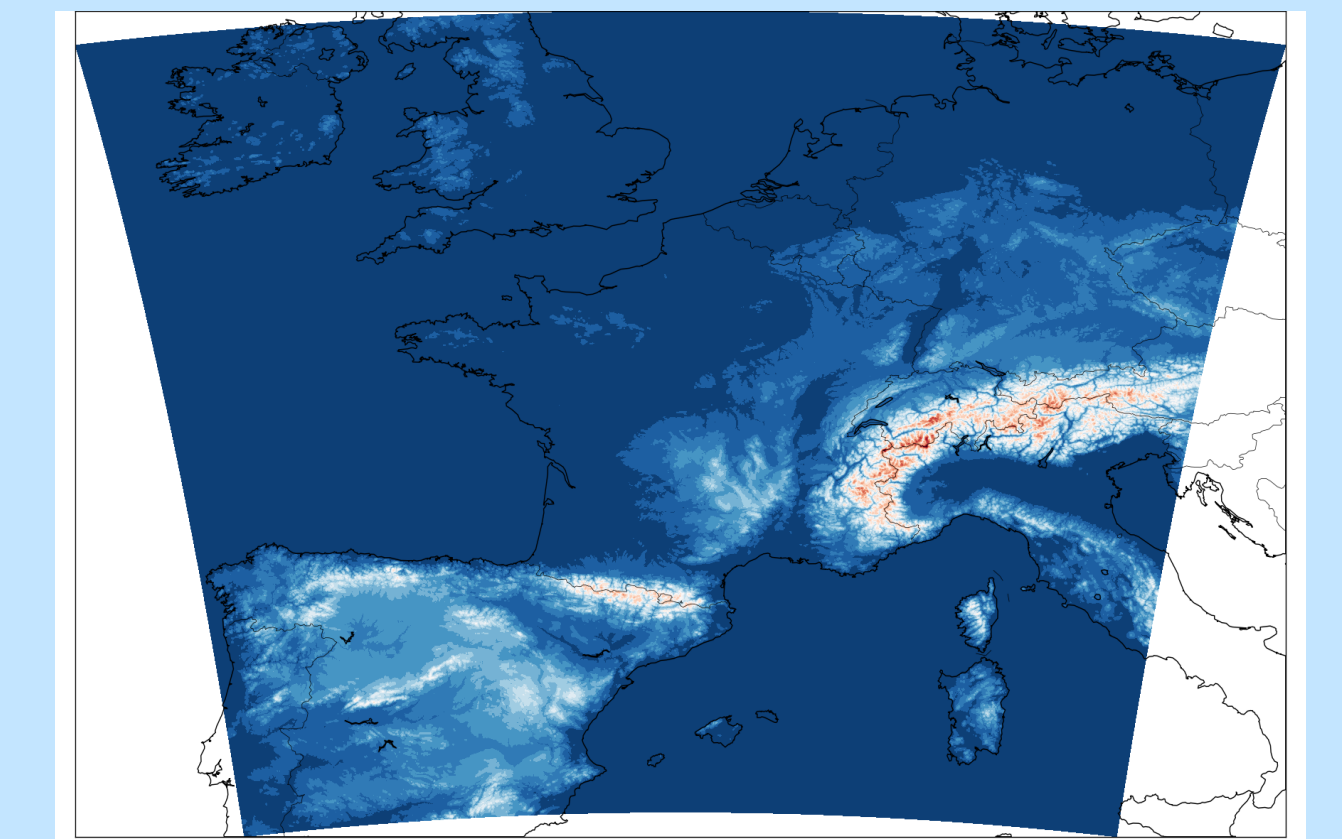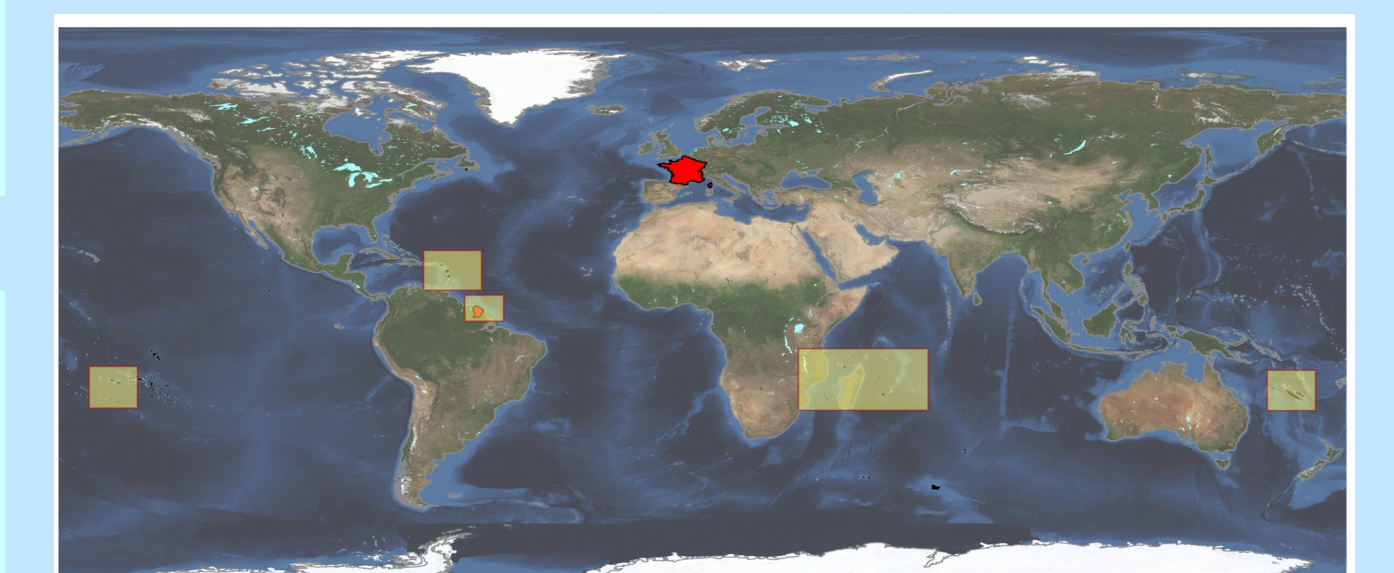• *Ref: ALADIN-HIRLAM Newsletter n°8 Jan.2017, AROME-France EPS, F. Bouttier et al*

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*
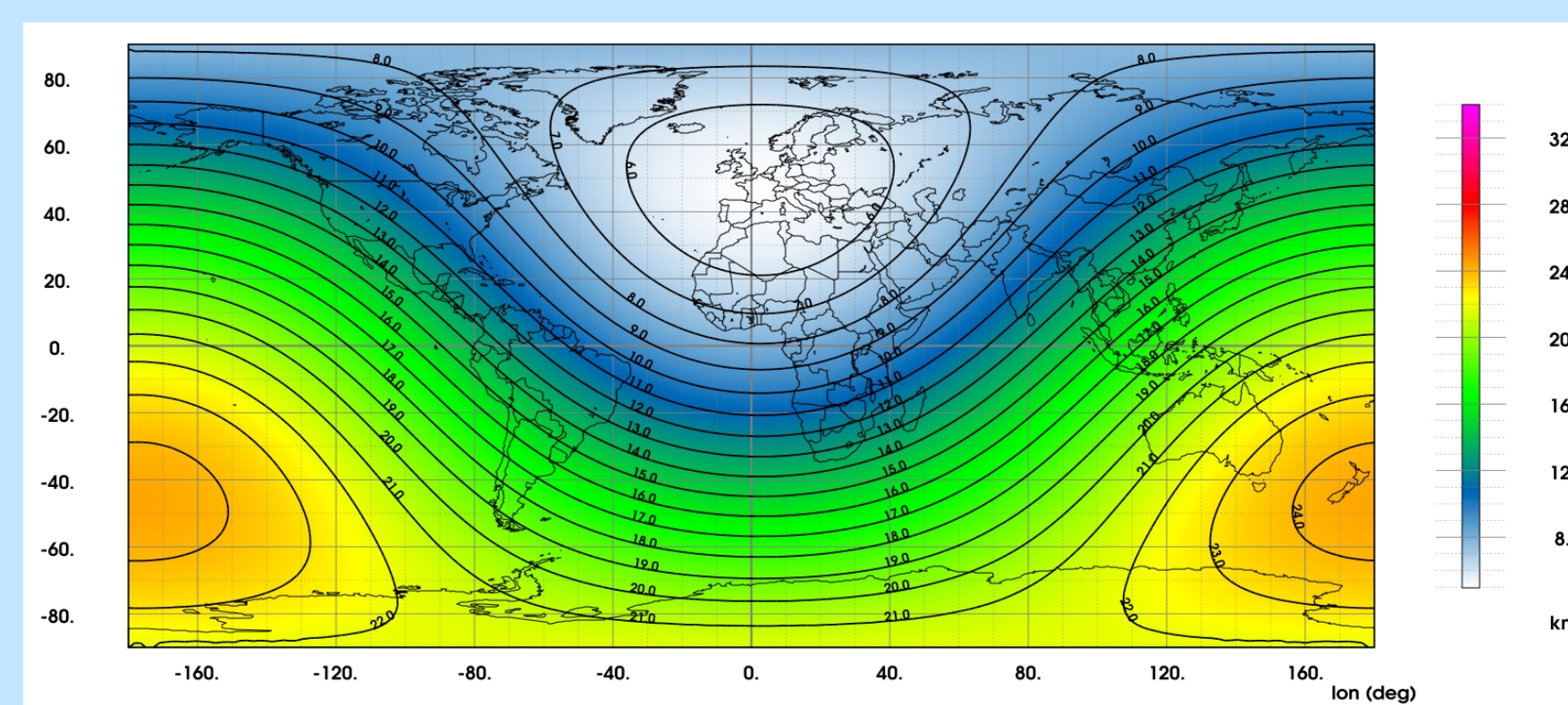

Figure 1: Horizontal resolution ARPEGE
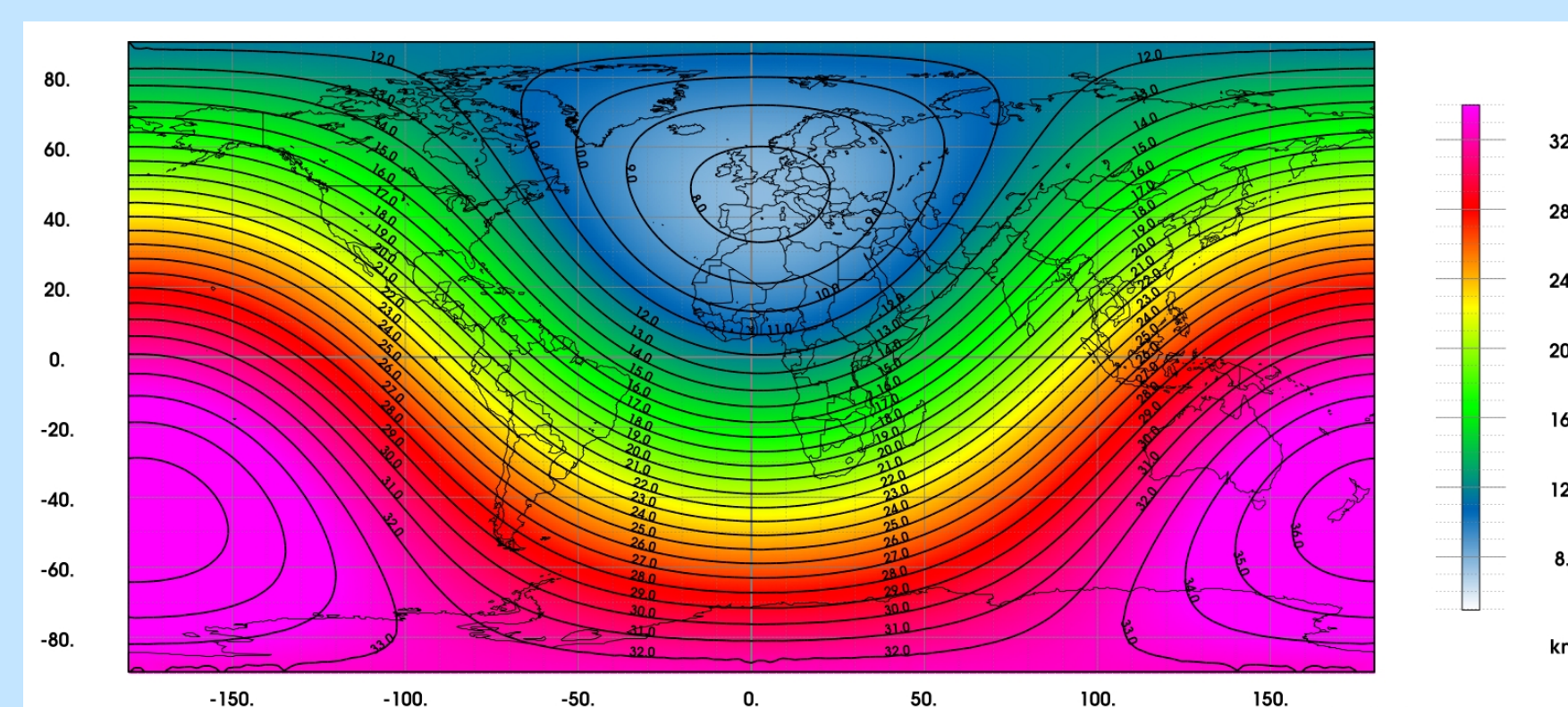*Min 5km – Mean 11km – Max 24km*

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

Operational upgrades in 2020

CY43T2_op4: on 5 May 2020. The scientific novelties include:
• Assimilation of GOES17 winds
• Monitoring of AEOLUS observations
• Activation of Variational bias correction for ground-based GNSS data in the production analyses of 4D-VAR
• Improvement of some observation pre-processing aspects (error tolerance threshold for AEOLUS, use of high level TEMP data when mid-level values were discarded in QC selection steps etc.)

Some specific changes in the Arpège assimilation have been implemented in operations on-the-fly, once routinely available:
• **9 June 2020**: assimilation of CrIS hyper-spectral IR radiances on-board S-NPP, change of the BUFR template for Norwegian RS
• **10 June 2020**: assimilation of temporary additional aircraft date, AFIRS and TAMDAR distributed by the aviation company FLHYT

CY43T2_op6: on 30 June 2020. New observations have been added in the Arpège 4D-VAR assimilation:
• LIDAR winds from ADM-AELOUS
• Data from 10 sensors from GNSS-RO space-borne geographical localization (constellation COSMIC-2A, FY3C, FY3D, PAZ et KOMPSAT-5) added to the 5 sensors already assimilated before
• Assimilation of specific IASI data from MetopA/-B received at the DBNet local station of Tahiti/DIRPF in the production analysis

note: **CY43T2_op5** was a version label in preparation of the operational mirror NWP suites on the new BULL-Sequana cluster

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