



Progress and plans at Météo-France

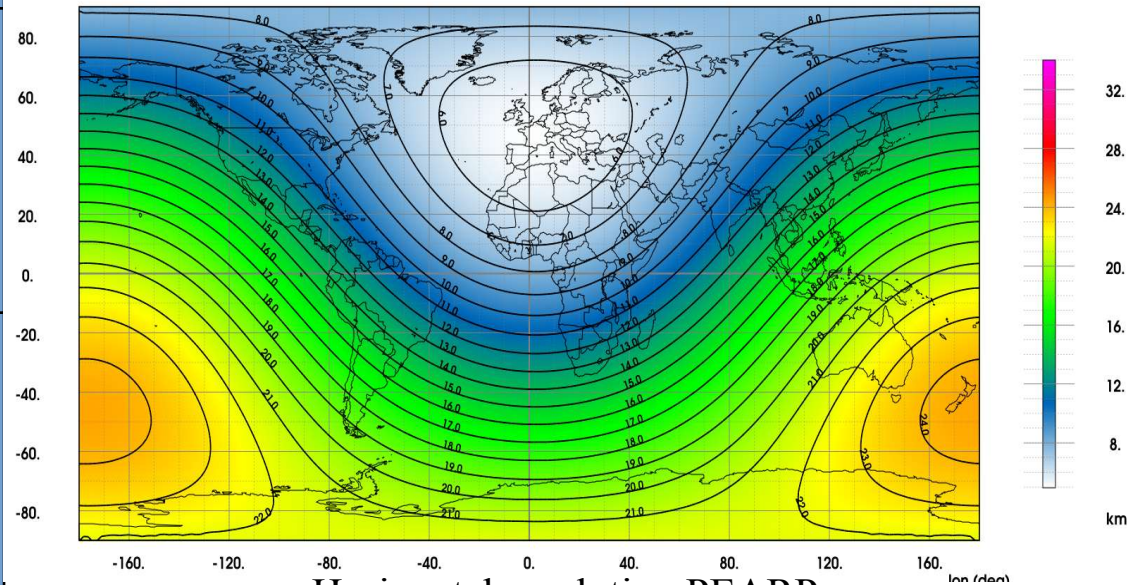
GMAP

Joint Aladin GA / Hirlam Council ; Tuesday 17 December, 2019

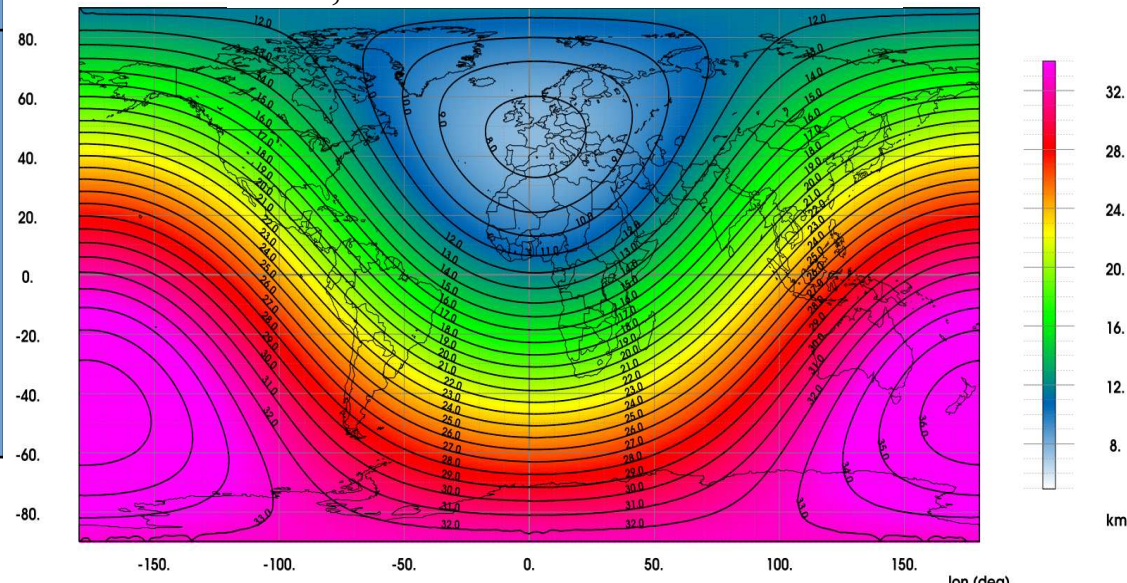
Global operational NWP systems based on ARPEGE

System	Characteristics
ARPEGE <i>Deterministic</i>	5km on W Europe 4DVar (6h cycle) 5 forecasts per day up to 114h
ARPEGE-EDA (AEARP)	50 members 4D-Var (6h cycle) Background covariances averaged on 12h and updated every 6h
ARPEGE-EPS (PEARP)	7.5km on W Europe 35 members four times per day up to 108h

Horizontal resolution ARPEGE
Min 5km – Mean 11km – Max 24 km

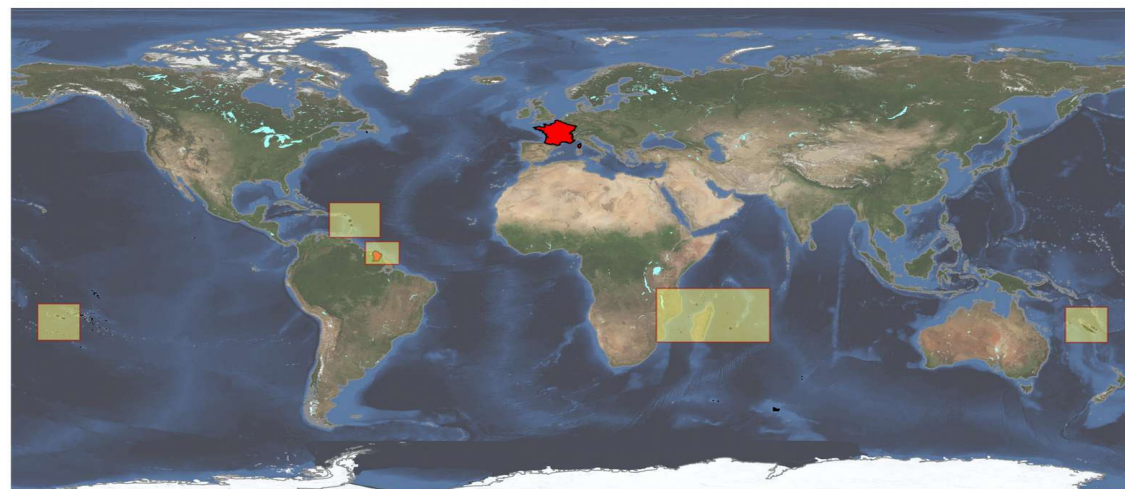
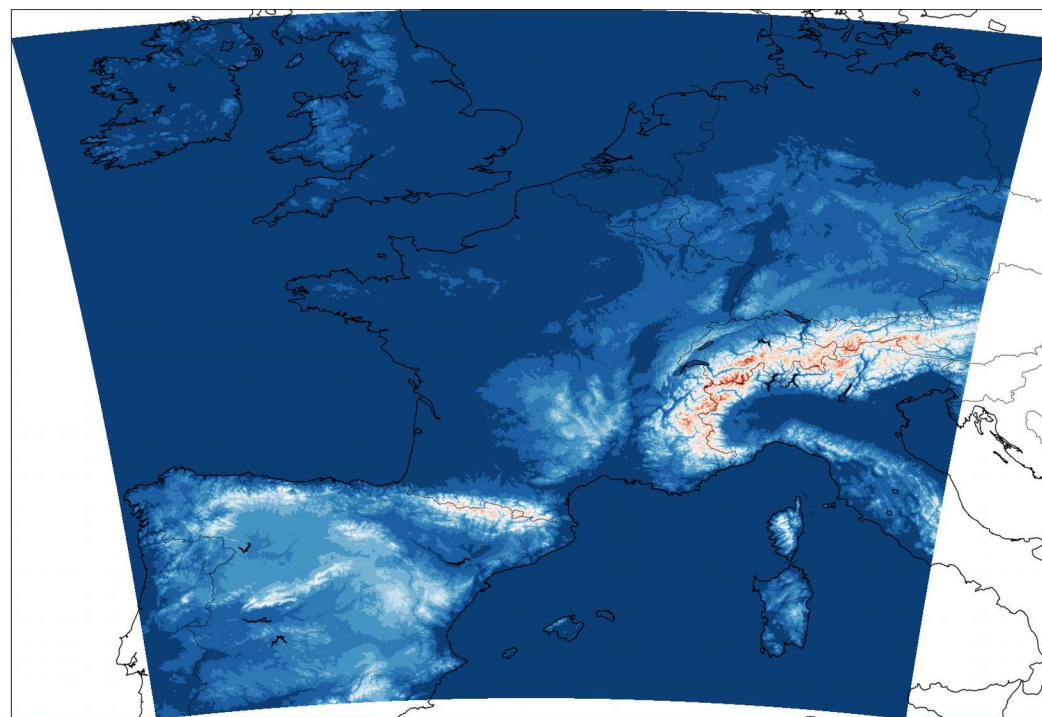


Horizontal resolution PEARP
Min 7,5km – Mean 17km – Max 37 km



Regional operational NWP systems based on AROME

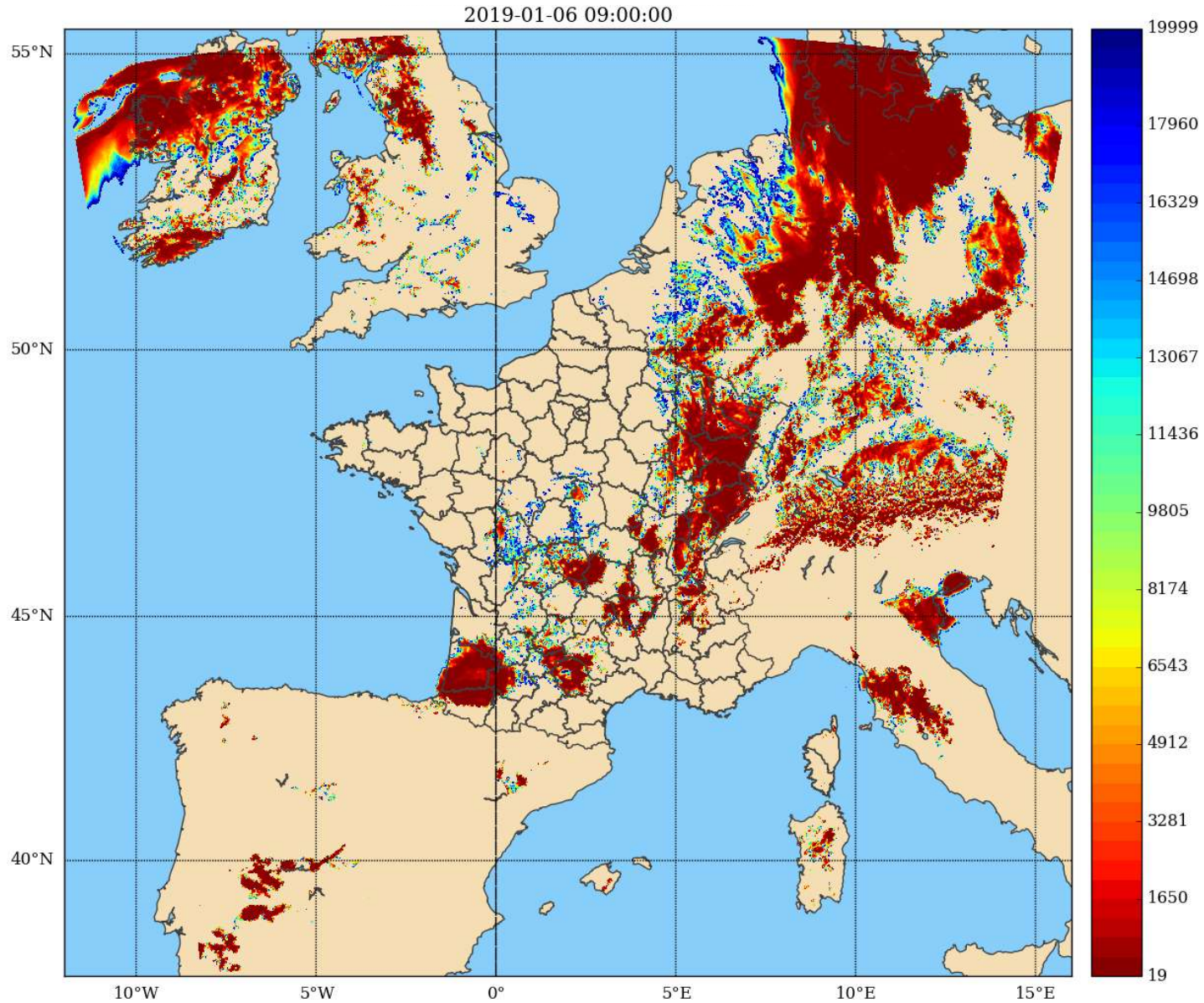
System	Characteristics
AROME-France <i>Deterministic</i>	1.3km 3DVar (1h cycle) 5 forecasts per day up to 48h
AROME-France <i>Nowcasting</i>	1.3km 3DVar (no cycling – 10' cut-off) 24 forecasts per day up to 6h
AROME-IFS	2.5km Downscaling of IFS (altitude) and AROME-France (surface) 2 forecasts per day up to 48h
AROME-EPS (PEARO)	2.5km / 16 members Four times per day up to 51h Initial and boundary conditions from PEARP
AROME-EDA (AEARO)	3.25km 25 members 3DVar (3h cycle)
AROME Overseas (5 domains)	2.5km Downscaling of IFS (altitude) and ARPEGE (surface) 4 forecasts per day up to 48h



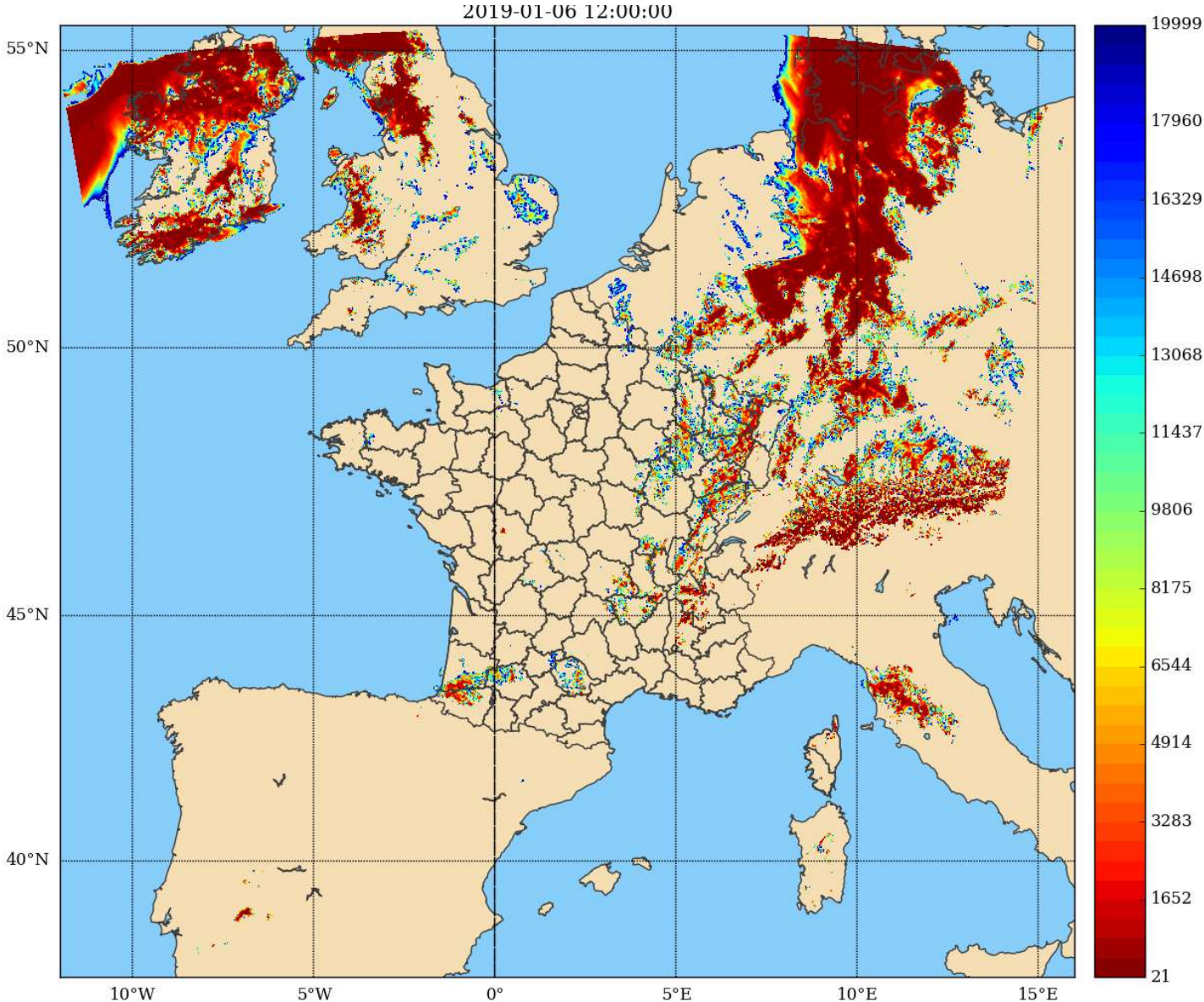
Recent evolution

- **02/07/19 : operational switch of CY43T2_op2.02**
 - *New resolutions for global models ARPEGE (5km over W Europe) & PEARP (7.5km over W Europe)*
 - *50 members for AEARP, 16 members for PEARO*
 - *new observations assimilated from Metop-C and NOAA-20*
 - *new diagnostics: type of precipitations, visibility, etc.*
- **01/10/19 : operational switch of CY43T2_op2.03**
 - *New observations assimilated from IASI/Metop-C and CRIS/NOAA-20, new list of ground GPS*

Visibility (min 1h), AROME 2019-01-06 00UTC + 09h




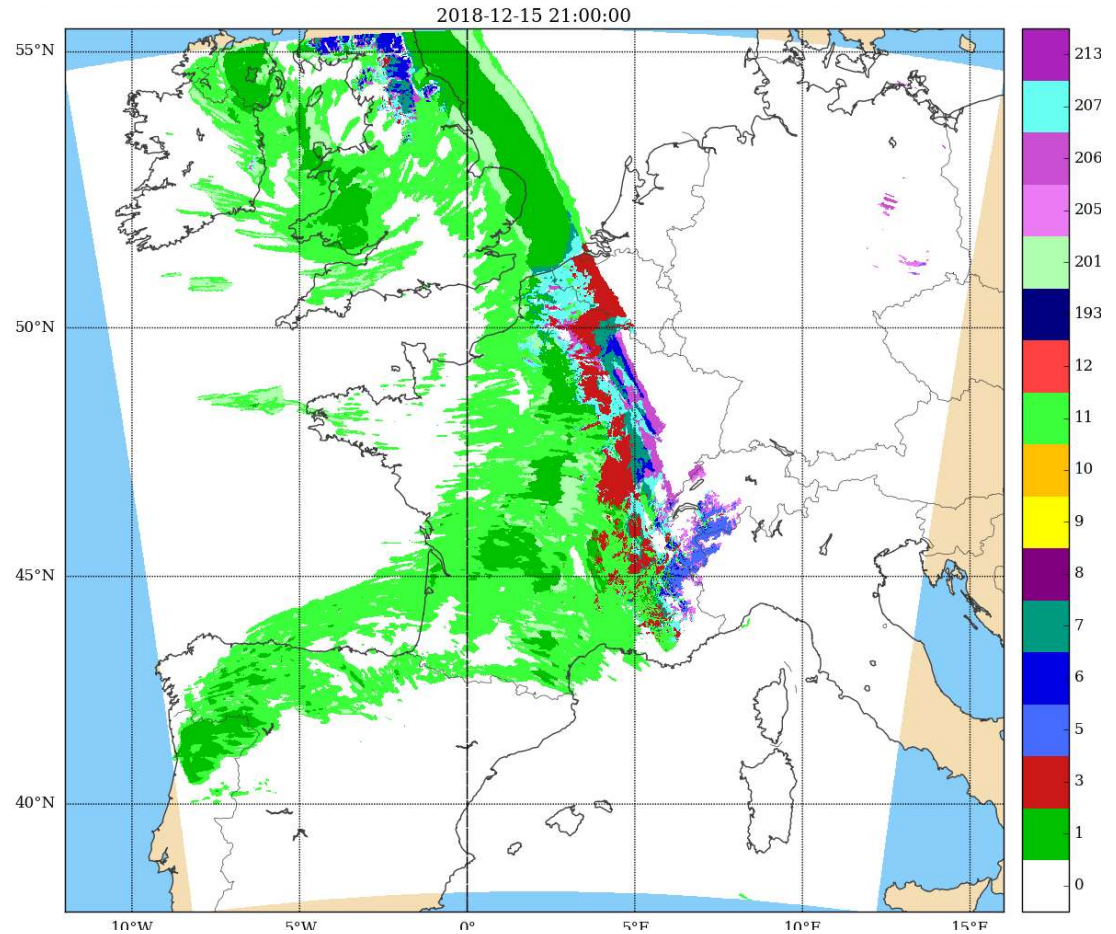
Visibility (min 1h), AROME 2019-01-06 00UTC + 12h



Precipitation Type

Most frequent type and most severe type defined with forecasters.

Rain	1	
Freezing rain	3	
Dry snow	5	
Wet snow	6	
Rain snow mixture	7	
Ice pellets	8	
Graupel/small hail	9	
Hail	10	
Drizzle	11	
Freezing drizzle	12	
Moist snow/sleet	193	
Intermittent rain	201	
Intermittent dry snow	205	
Intermittent wet snow	206	
Intermittent rain snow mixture	207	
Intermittent moist snow/sleet	213	



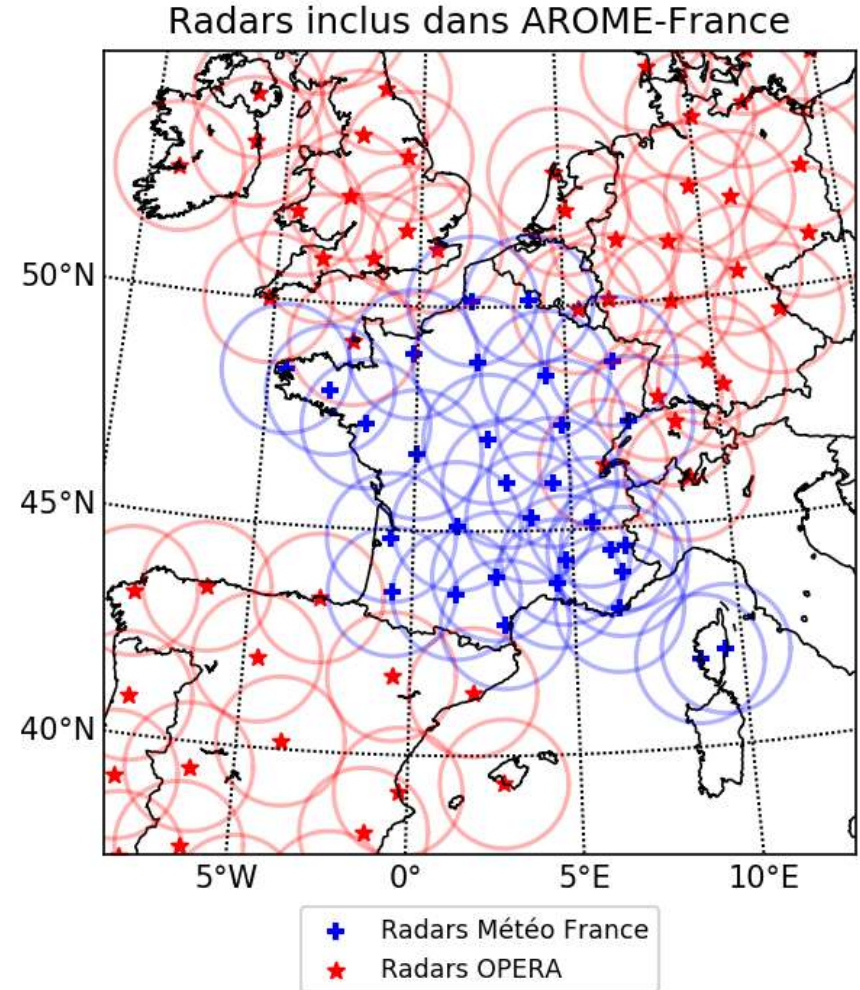
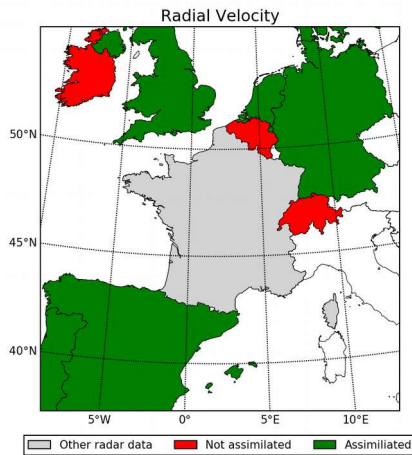
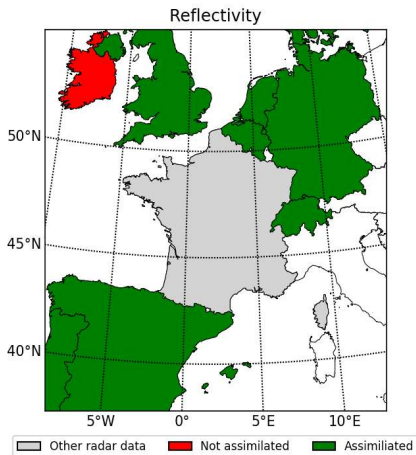
Ingrid Etchevers

Current E-suite CY43T2_op3

- **AROME-France:**
 - Implementation of a snow analysis,
 - Assimilation of OPERA radars,
 - New satellite observations assimilated (ScatSat1, AMSU-A & MHS/Metop-C, ATMS/NOAA-20, IASI/Metop-C)
- **ARPEGE :**
 - New diagnostics for aviation: clear air turbulence and icing
 - assimilation of ASCAT/Metop-C, preparation of observation monitoring for AMV GOES17, NOAA-20, Metop-C, AEOLUS and GOES17 ABI radiances
- Operational switch planned for mid-January 2020

Assimilation of OPERA radars

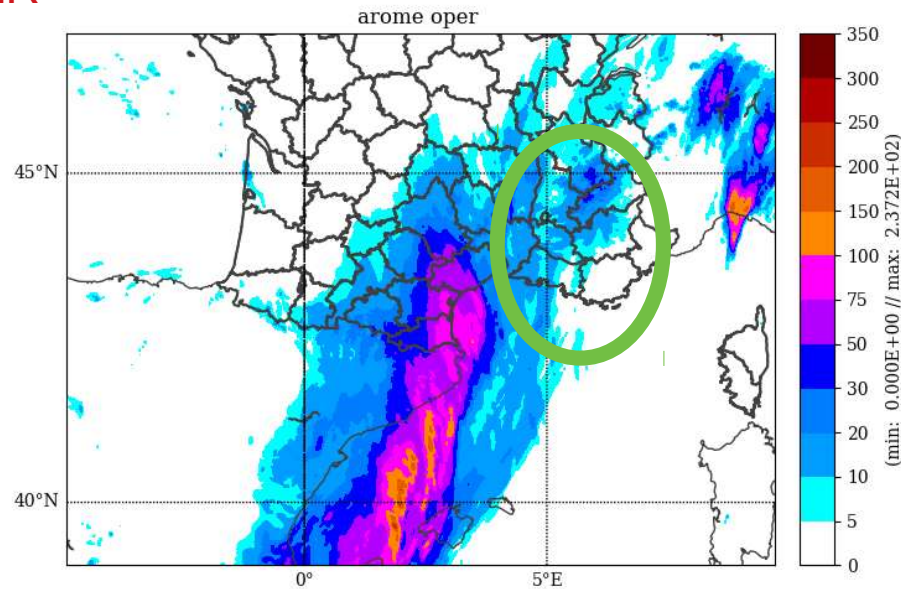
- OPERA radars
 - 62 radars from neighbouring countries
 - Reflectivity and radial wind velocity when available
- Number of observations increase
 - +100 % for reflectivity
 - +50 % for radial velocity



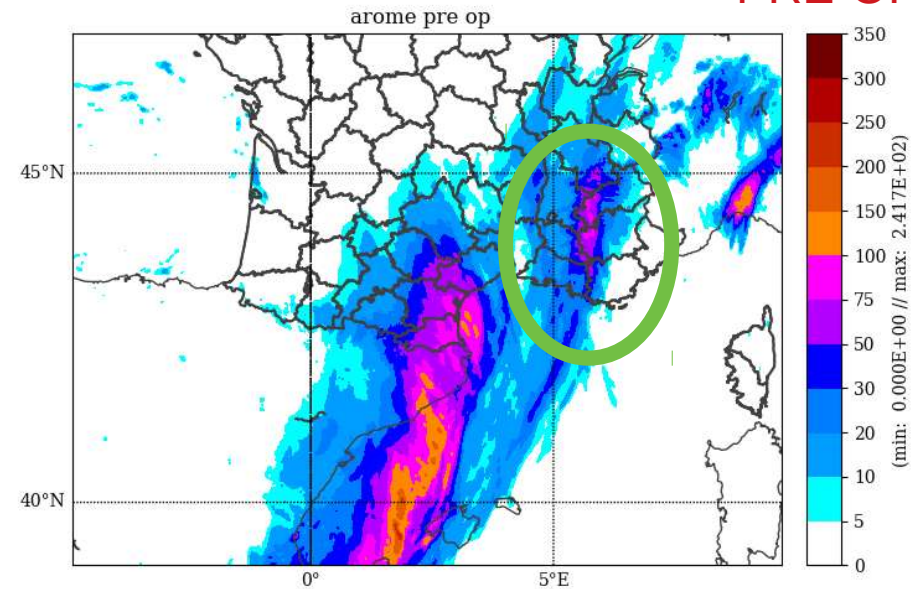
Assimilation of OPERA radars

Case study : 21-23 October 2019

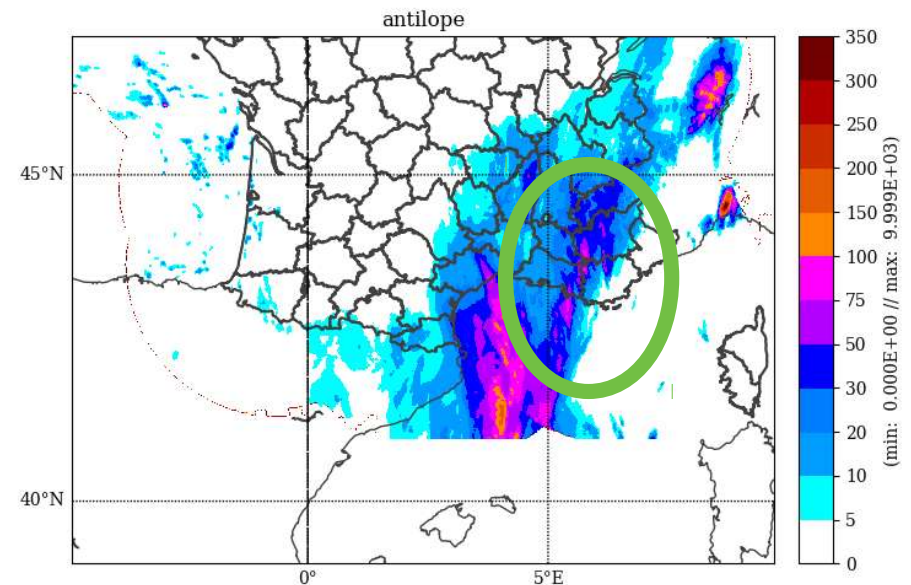
OPER



PRE-OP

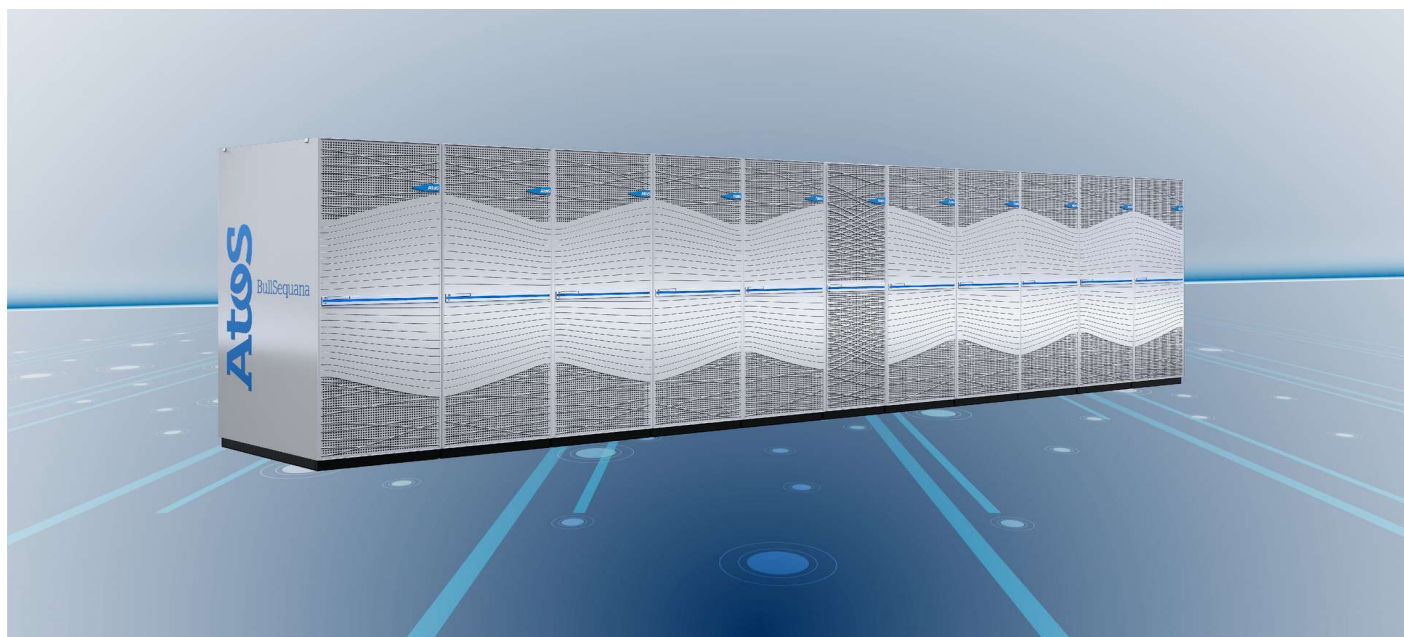


- Forecast from 21/10 12h
- Accumulated precipitations over 24h
- Improved precipitation forecast in Rhône valley when comparing with a specific reanalysis product (Antilope)



Perspectives for 2020

- Migration of applications to new HPC (BULL) => expect about 5 times increase of numerical performance
- Operational switch of O-suite on new HPC expected in June/July 2020



Perspectives 2020 and beyond

- **Start of next E-suite (CY46T1?) in autumn 2020:**
 - AROME (PEARO) and ARPEGE (PEARP) EPS change of resolution to the deterministic ones
 - IFS convection and radiation schemes in ARPEGE and PEARP
 - Snow analysis and sea-ice model in ARPEGE
 - Change how model error is taken into account in PEARP (from multi-physics towards SPP)
 - New observations assimilated (AEOLUS, Mode-S, ...)
 - New or improved diagnostics
- Collaboration with ECMWF and LAM partners on the next upcoming important IFS code overhaul, in preparation of porting the NWP codes to new architectures (eg. CPU/GPU ...)
- Ensemble variational solution for data assimilation in AROME-France, possibly in-line with first operational implementation of OOPS
- IFS gravity wave scheme tested in ARPEGE, in association with revisited choices for orography

sunum bitti. İlginiz için teşekkür ederim

- The talk is over. Thank you for your attention

Visibility diagnostic

- **Visibility** = $-\ln \varepsilon / \beta$ (Koschmieder, 1924)
where ε is the contrast threshold (0.05 OMM, OACI and CIE), β extinction coefficient
- **Visi_{Clid}** = $-\ln(0.05) / (\beta_{clid} + \beta_{ice})$
 $\beta_{clid} = a \cdot C^b \cdot \exp(c \cdot (\log C)^2) \cdot \exp(d \cdot (\log C)^3)$ (C =cloud liquid water content [g m⁻³])
(Olivier Mestre, Ingrid Etchevers)
 $\beta_{ice} = 163.9 C^{(1.0)}$ (C = cloud ice water content [g m⁻³]) after (Stoelinga, 1999)
- **Visi_{Hydro}** = $-\ln(0.05) / (\beta_{rain} + \beta_{snow} + \beta_{graupel})$
 $\beta_{rain} = 2.5 C^{(0.75)}$ (C = rain water content [g m⁻³])
after (Niemelä, 2014), FMI
 $\beta_{snow} = 10.4 C^{(0.78)}$ (C = snow content [g m⁻³])
after (Stoelinga, 1999)
 $\beta_{graupel} = 2.4 C^{(0.78)}$ (C = graupel content [g m⁻³])
after (Niemelä, 2014), FMI
- No aerosol in the above formulas, because climatological aerosols in ARPEGE / AROME. Ongoing effort towards prognostic aerosols (Mohamed Mokhtari, AROME dust)
- Minimum 1h (**Visi_{Clid}**) et Minimum 1h (**Visi_{Hydro}**)

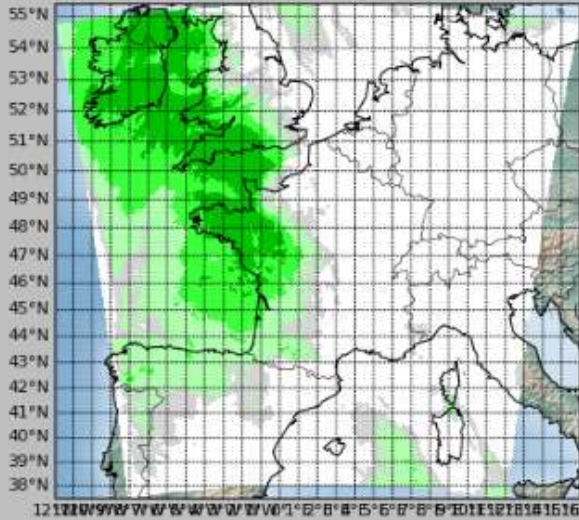
Precipitation types : prob. EPS (AROME)

14-12-2018, run : 21h, echeance : +13h

Cartes de risques

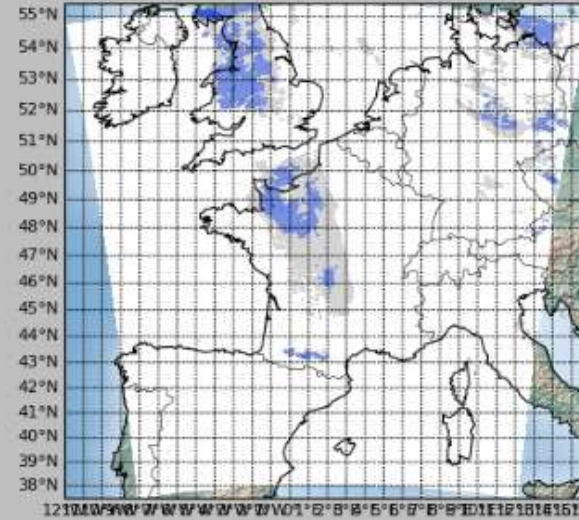
Rain

Pluie



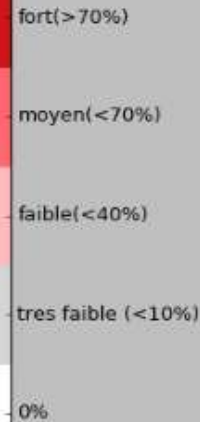
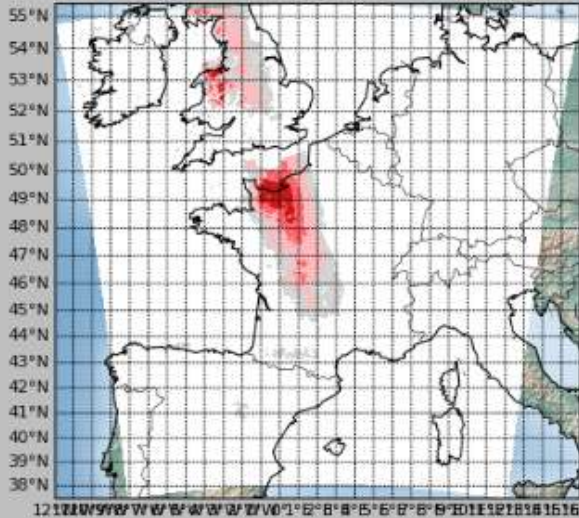
Snow

Neige



Freezing rain / drizzle

verglas



Hail

Grele

