



Numerical experiment with global model ARPEGE and the NH model AROME for YOPP-SH

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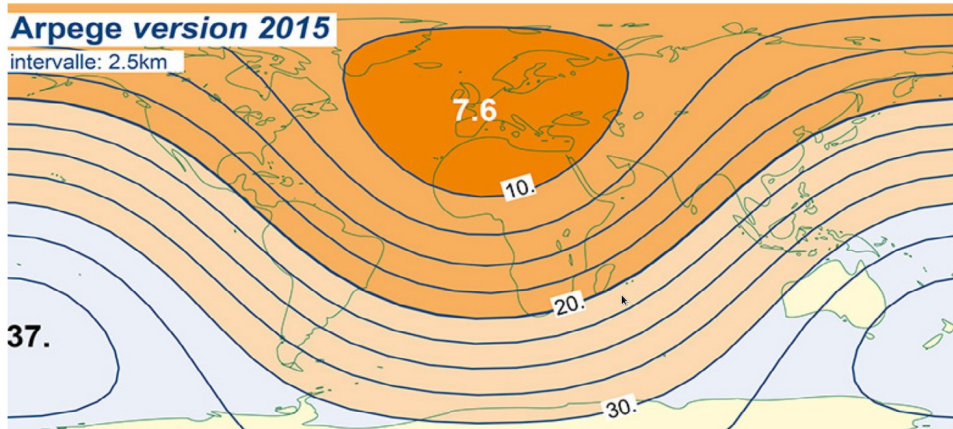
IUGG 2019 – 13 July 2019 – Montréal, Canada

Operational Weather Forecasting system at the time of YOPP-SH: a wide range of spatial and temporal scale

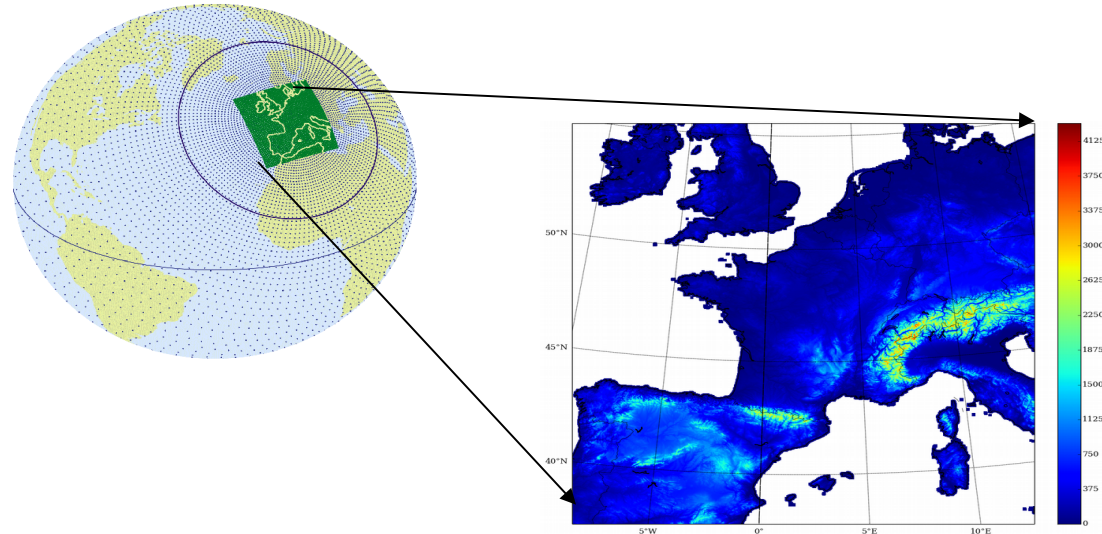
NWP systems based on IFS/ARPEGE software developed in collaboration with ECMWF and ALADIN, HIRLAM NWP Consortia.

Arpege version 2015

intervalle: 2.5km



Nouvelle résolution horizontale (en km) du modèle Arpege en version « déterministe »



Global ARPEGE-IFS:forecasts every 6 hours up to 114h. $dx=7.5$ km over France, and 35 over Australia
T1198 with stretching factor $c=2$. 2. L105 1st level 10m
4DVar Inc Data Assimilation system 135km and 50km

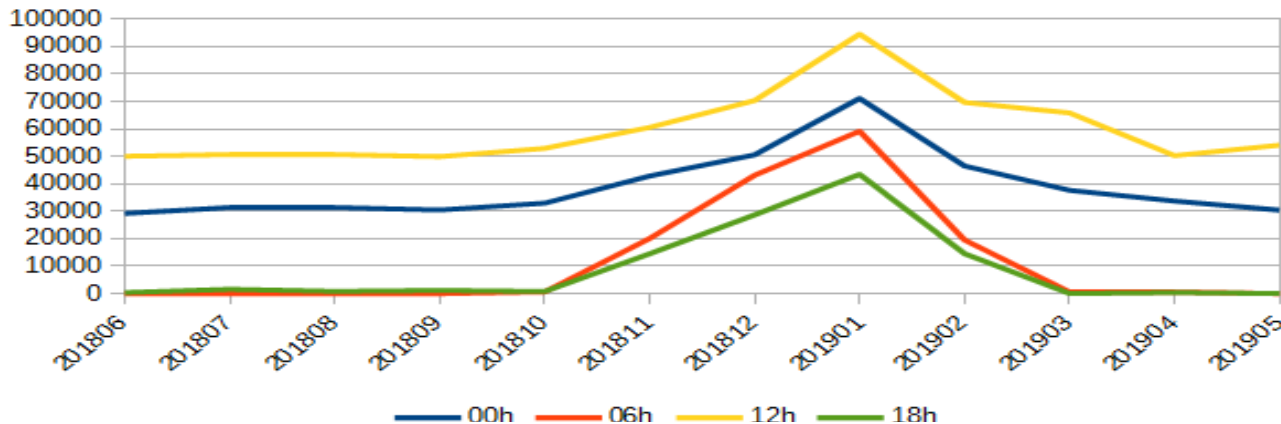
Cloud Resolving Model AROME over France (1536x1440pts)
5 forecasts per day $dx=1.3$ km, 90 Levels (1st at 5m) ,
 $dt= 50s$ (SL)
3DVar Data Assimilation system (RUC1h)

Additional Radiosondes during YOPP-SH

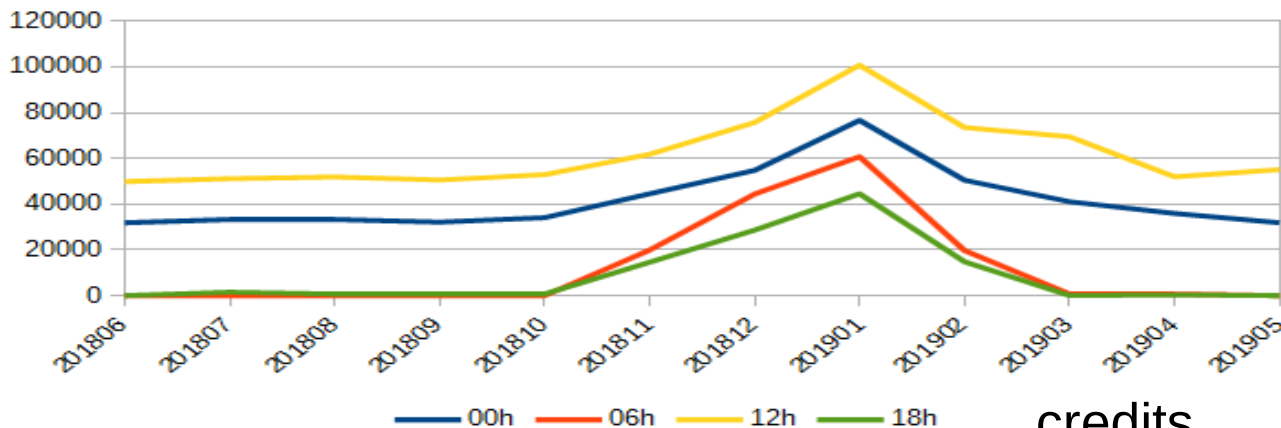
- At the French station of Dumont d'Urville (DDU)
 - In routine, only one sonde per day at 00 UTC
 - For YOPP-SH 16th November 2018 → 15th Feb. 2019 two additional sondes per day:
 - around 4h50 for the 6 UTC assimilation time
 - around 10h50 for the 12 UTC assimilation time
- Many other sites released additional sondes
- Additional sondes have been sent on the GTS and probably used by all NWP centers in real time.

Number of radiosonde data used in ARPEGE

Temperature



Wind



Domain:
Antarctica

Dumont d'Urville : 1st YOPP-SH added radiosonde by the TA68 team



Special thanks to DDU staff
(TA68, TA69, G. Heymes, C. Louvet,
Jérémy Beauchard, etc.)

+

Colleagues from other stations
around Antarctica

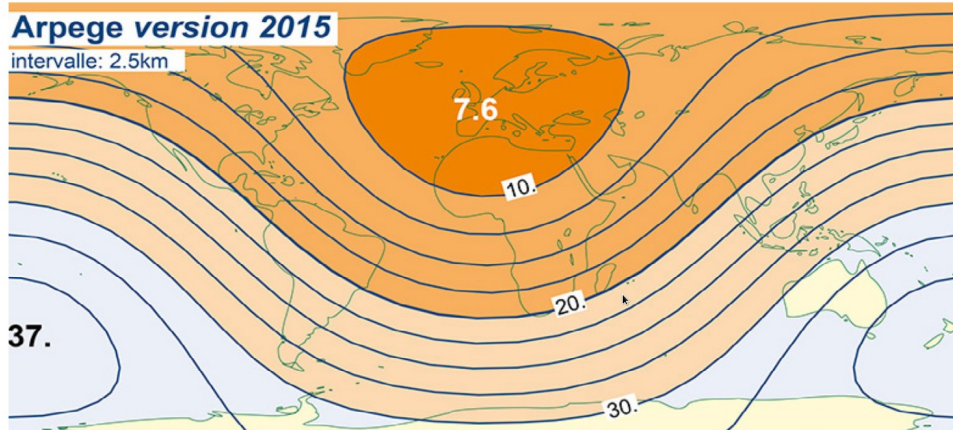
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ARPEGE global model configuration for YOPP-SH SOP

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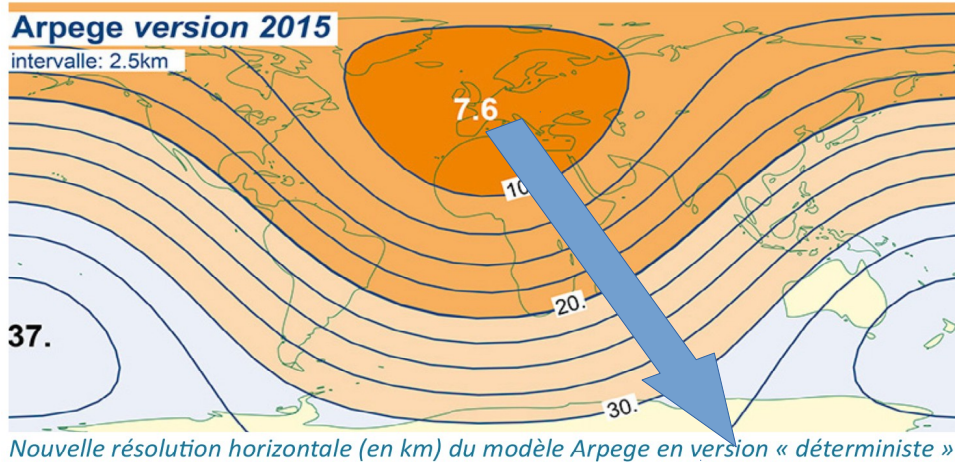
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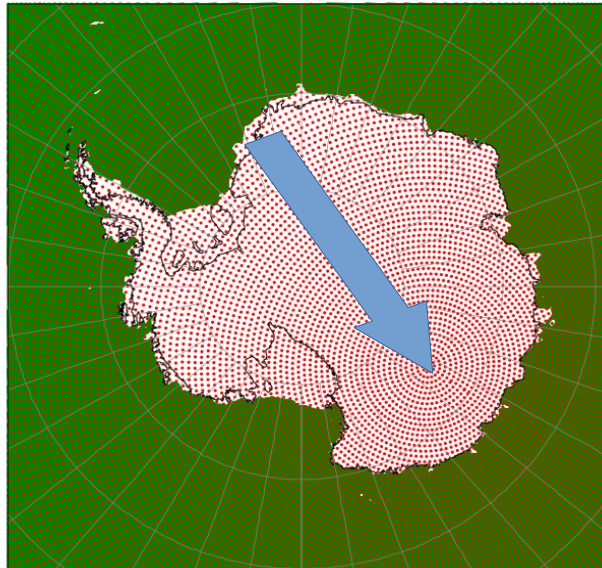
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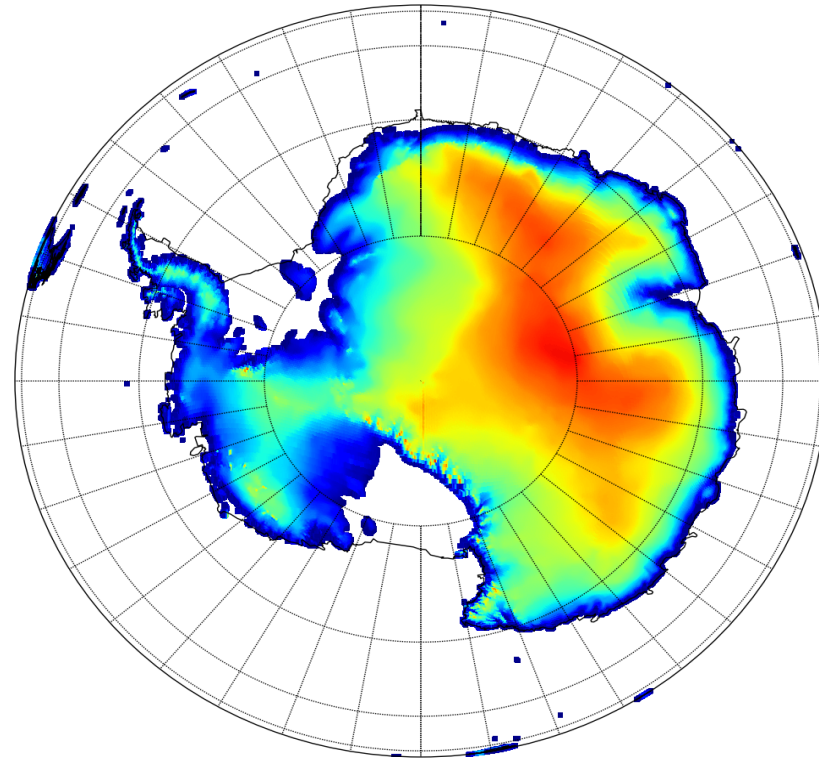
Stretching pole moved
from France
to Dome C Antarctica

ARPEGE global model configuration for YOPP-SH SOP

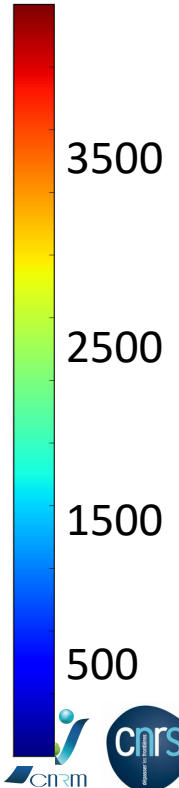
ARPEGE-SH : Specific ARPEGE 4DVar T1198 with the stretching pole at DomeC c2.2 → $dx=7.5$ km around DomeC and all Antarctica.
105 vertical levels with the 1st level at 10m



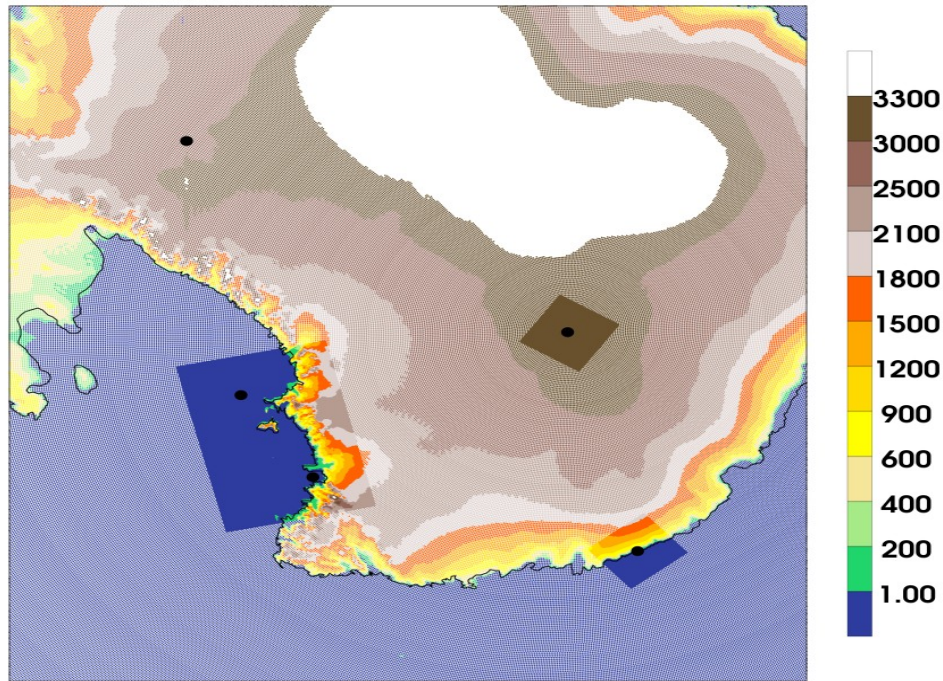
Only 1 plotted pt over 8



Orography (m)



Several AROME domain @1.3km around Dumont d'Urville, Alexander Tower and may be DomeC



Orography (m)

Specific AROME-SH use initial and lateral boundary conditions from ARPEGE-SH. $dx= 1.3\text{km}$. Vertical levels L90. First level: 5m. $dt=50\text{s}$ 200x200

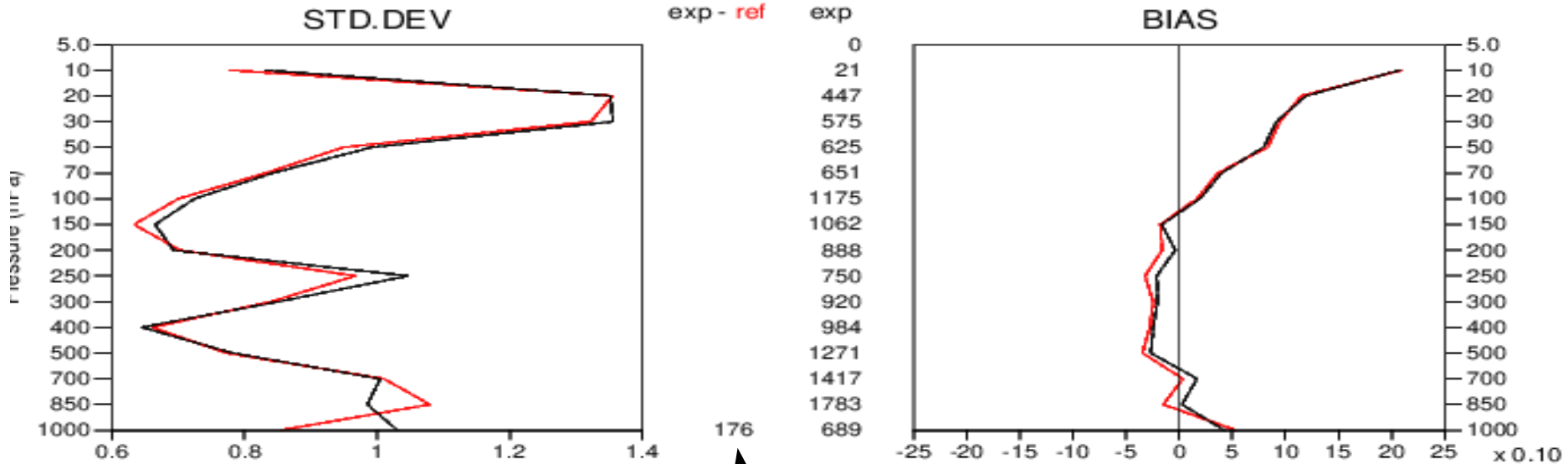
AROME-DDU and DomeC :
200x200 grid points

AROME-AlexanderTower :
421x629 grid points

YOPP-SH is a good opportunity (added observation) to evaluate the coupling of the 1D sea-ice model GELATO with ARPEGE and AROME

Added value of ARPEGE-SH versus ARPEGE

DDU Temperature @ 12UTC – statistics of radiosonde minus model for assimilated data



ARPEGE
ARPEGE-SH

More observation are used in the 4Dvar with ARPEGE-SH → less rejection



Added value of ARPEGE-SH versus ARPEGE

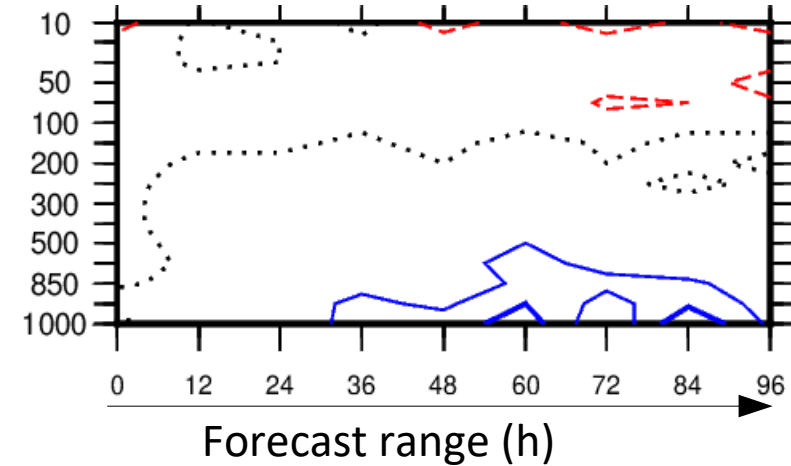
Forecast scores for temperature domain 90S-20S

RMSE for ARPEGE *minus*
RMSE for ARPEGE-SH

Blue = ARPEGE-SH better
than ARPEGE

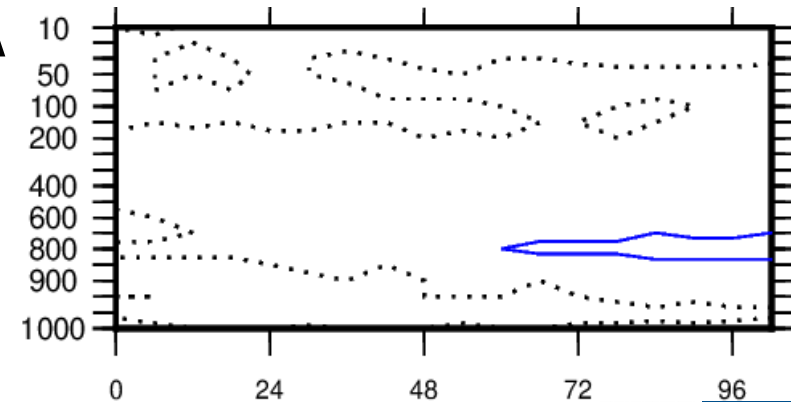


Against
sondes



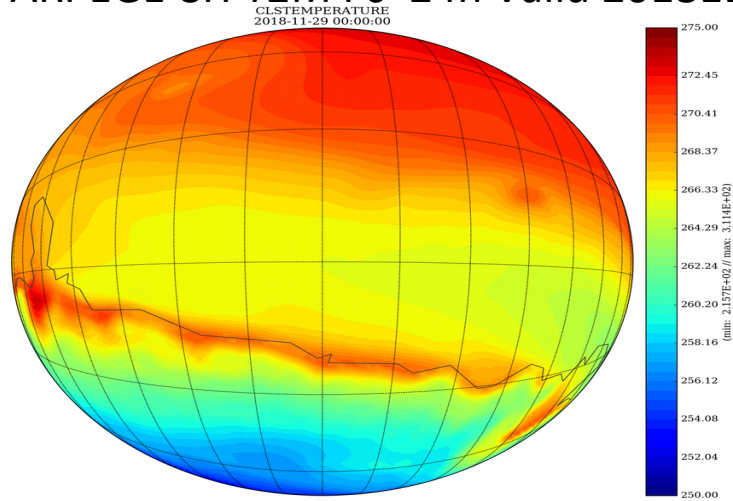
Against
ECMWF
analyses

Altitude
(hPa)

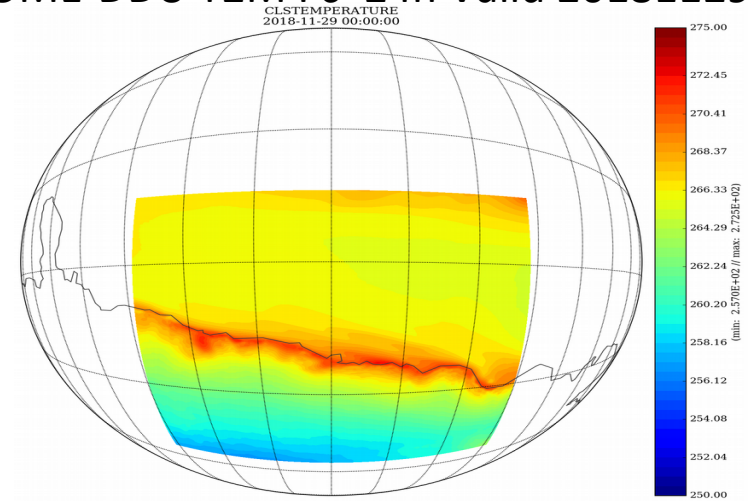


AROME-DDU : preliminary results and spatial variability

ARPEGE-SH T2M Fc+24h Valid 2018112900

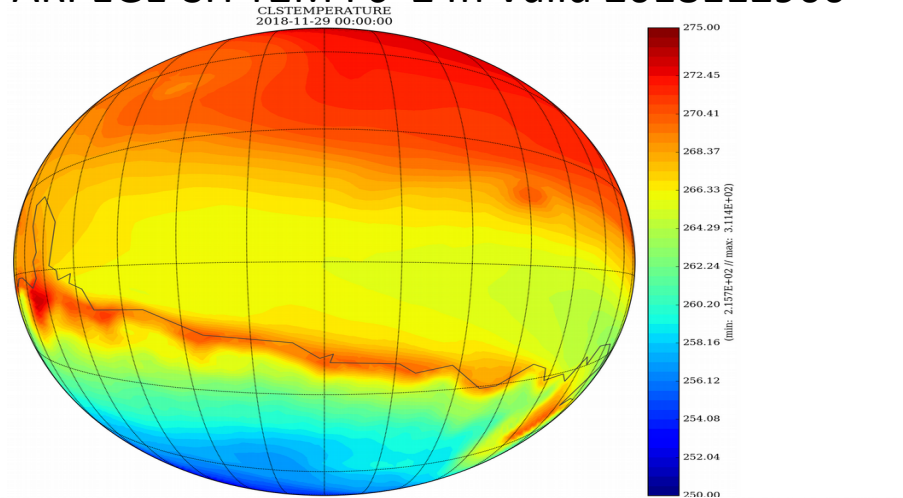


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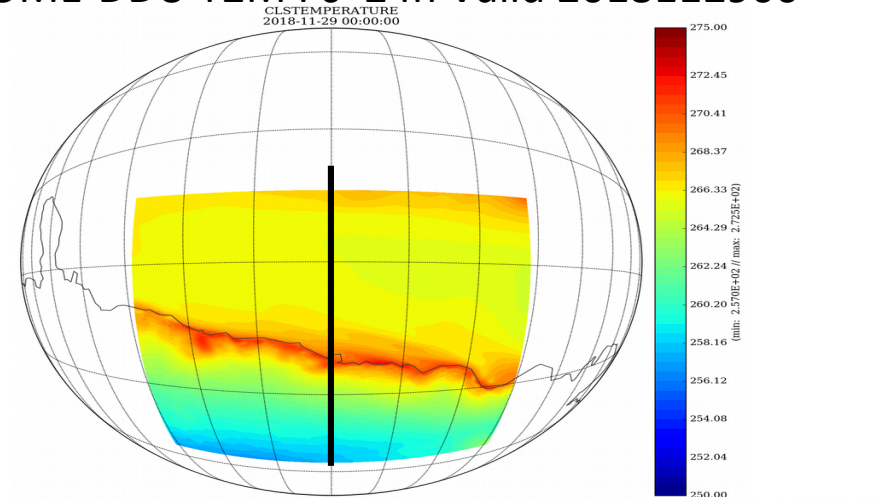


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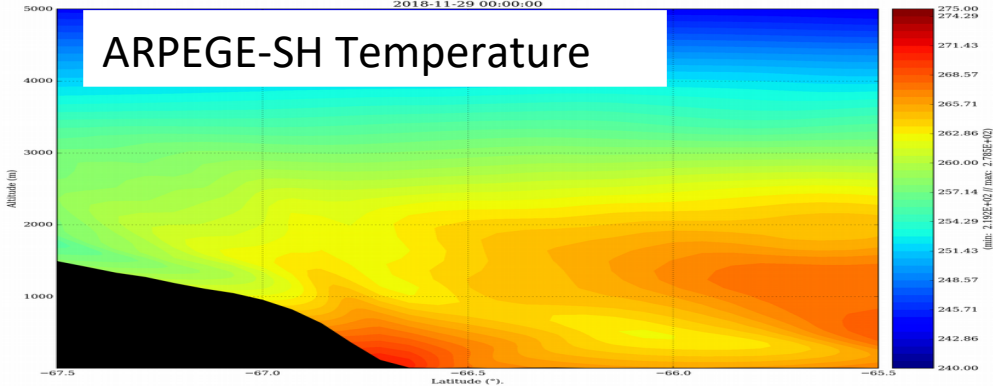
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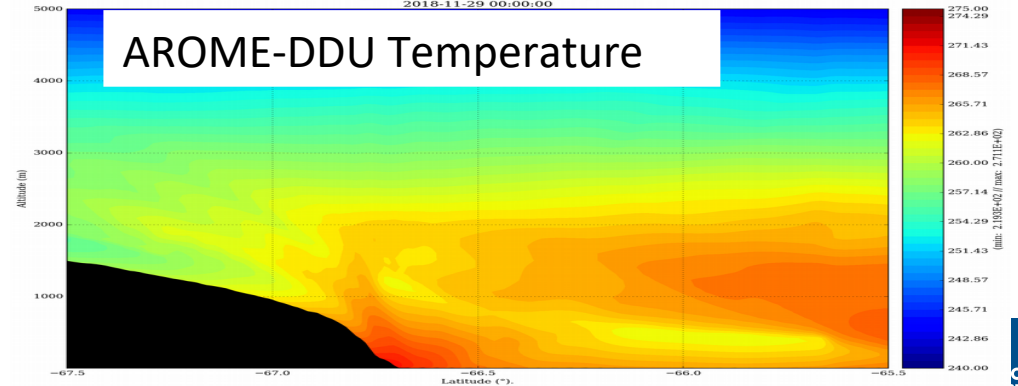
Section of {u'FA': 'S*TEMPERATURE'} between
<- (140.0, -65.5) and (140.0, -67.5) ->
2018-11-29 00:00:00

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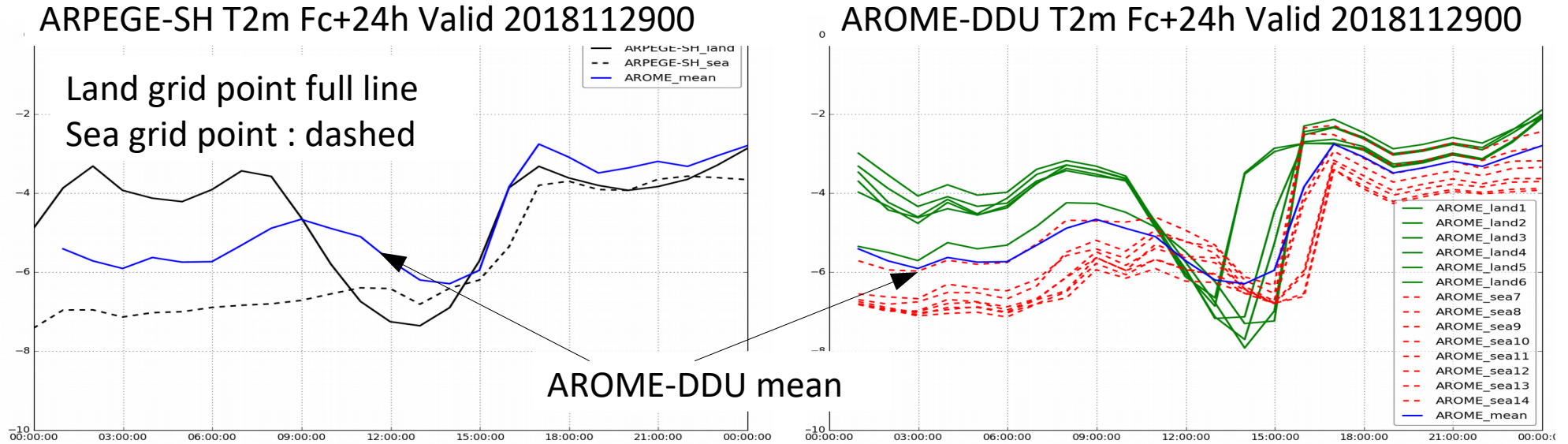
ARPEGE-SH Temperature



AROME-DDU Temperature



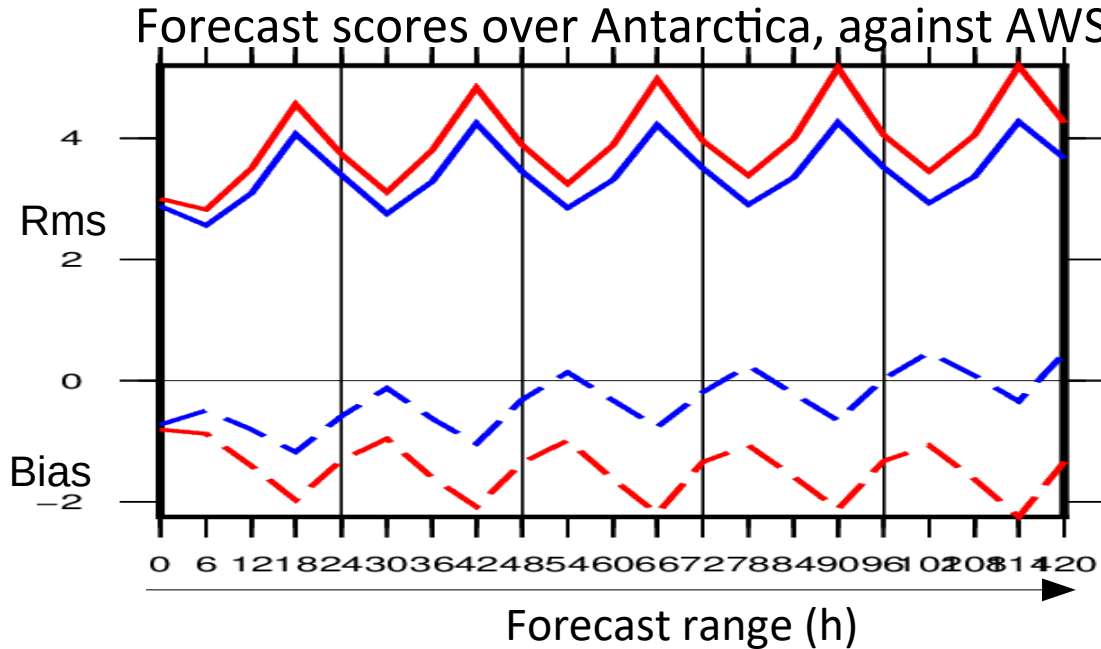
AROME-DDU : preliminary results and spatial variability



Coupling 1D sea-ice model GELATO in ARPEGE-SH

(thanks to N. Azouz and A. Napoly)

- the 1D sea-ice model GELATO is available in the SURFEX platform but not used in operations
- in the frame of YOPP-SH, a 4Dvar ARPEGE-SH with GELATO is now running



Summary

- Preliminary results with the ARPEGE-SH-GELATO are promising → add the data on the ftp site ?
- Re-run the 4DVAR without the added RS ...probably done this summer
- AROME experiments will be available in the coming months, however we are thinking to provide only AROME coupled with GELATO 1D.
- Strong interest to use all the surface observation available over Antarctica to estimate the added value of the GELATO-1D ?

Summary

- All the data from ARPEGE-SH 4Dvar are now available for studies, comparisons, evaluations ...
 - 3D fields : on pressure levels and height (t, wind, cloud, etc ..) on a regular grid 0.2° on a Southern Hemisphere domain [0, -90, 360, -10]
 - 1d profile output for the 21 YOPP super-site (17 over Antarctica).

Ftp site: [ftp.umr-cnrm.fr](ftp://ftp.umr-cnrm.fr) user: yopp Passwd: Arpege

- ARPEGE-SH-GELATO can probably be provided in a near real-time mode for a new YOPP-SH SOP

Available data from ARPEGE-SH experiment

2 types of output: 3D fields and 1d output for the 21 YOPPsuper Site Observation

- **3D fields** : on pressure levels and height (t, wind, cloud, etc ..) on a regular grid 0.2° on a Southern Hemisphere domain [0, -90, 360, -10]
 - 10 days forecast from 00UTC, 5 days forecast from 12UTC and only 6h forecast from 6 and 18UTC.
 - Every 3h output up to 48h forecast and every 6h after.
 - ~ 2.8Tb (GRIB files)
- **1d profile** output for the 21 YOPP super-site (17 over Antarctica and 4 for the Third Pole).
 - NetCdf-MIP format with all the vertical levels no interpolation, hourly output, surface fluxes and vertical profile for all variables (t, q, clouds etc ..) and fluxes such as precipitation, Sw, Lw ...
 - Only the first 78h forecast from 00 UTC and 12UTC and the 6h forecast from 6 and 18UTC
 - For some coastal station the two nearest grid points have been extracted: one over sea and one over land

Available data from ARPEGE-SH experiment

Ftp site : `ftp.umr-cnrm.fr` user: `yopp` Passwd: `Arpege`

- **3D fields : cd YOPP-SH/3DFIELDS/YYYYMMJJHH/**

- `-rw-r--r-- 1 2052 981 16486869699 Jun 19 05:35 ARPEGE-SH_20190101r00.grib.tgz`
- `-rw-r--r-- 1 2052 981 992638127 Jun 19 05:42 ARPEGE-SH_20190101r06.grib.tgz`
- `-rw-r--r-- 1 2052 981 9707005322 Jun 19 06:54 ARPEGE-SH_20190101r12.grib.tgz`
- `-rw-r--r-- 1 2052 981 993843065 Jun 19 07:01 ARPEGE-SH_20190101r18.grib.tgz`

- **1d NetCDF: cd YOPP-SH/NetCdf-MIP/\$name_site**

- `-rw-r--r-- 1 2052 981 2318900 Jun 12 07:55 arpege-sh_alexander_2019010100.nc`
- `-rw-r--r-- 1 2052 981 224852 Jun 12 07:55 arpege-sh_alexander_2019010106.nc`
- `-rw-r--r-- 1 2052 981 2318900 Jun 12 07:55 arpege-sh_alexander_2019010112.nc`
- `-rw-r--r-- 1 2052 981 224852 Jun 12 07:55 arpege-sh_alexander_2019010118.nc`

- **The 1d NetCdf file are now also available on the YOPP data portal thanks to Egil Storen and Oysten Godoy:**

http://thredds.met.no/thredds/catalog/alertness/YOPP_supersite/arpege/YOPP-SH/catalog.html

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