Preliminary results of the numerical experiment done with the ARPEGE-SH for YOFP-SH

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Outline

- Specific model configuration for the YOPP-SH SOP
  - Global ARPEGE-SH 4DVAR
  - Specific NH model at 1.3km : AROME

- Available data

- Very preliminary results : DomeC and DDU

- Further development : coupled 1D sea-ice model GELATO in ARPEGE-SH and in AROME
Current Operational Weather Forecasting system: 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.

Global ARPEGE-IFS: forecasts every 6 hours up to 114h. \(dx=7.5\) km over France, and 35 over Australia

T1198 with stretching factor \(c=2\). 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), \(dt=50\) s (SL)

3DVar Data Assimilation system (RUC1h)
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ARPEGE global model configuration for YOPP-SH SOP

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

Only 1 plotted pt over 8
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Several AROME domain @1.3km around Dumont d’Urville, Alexander Tower and may be DomeC

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

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

Temperature RMS error between ARPEGE-SH and ARPEGE vs RS

Blue =

Temperature RMS error between ARPEGE-SH and ARPEGE vs ECWMF analysis

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Added value of ARPEGE-SH versus ARPEGE

At 12UTC Temperature

More observation are used in the 4Dvar with ARPEGE-SH → less rejection
Available data from ARPEGE-SH experiment

2 types of output: 3D fields and 1d output for the 21 YOPP super 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/3DFIELDSD/YYYYYMMJJHH/
  -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
Dome C comparison T2m (C. Genthon)
Dome C comparison 10m wind (C. Genthon)
Dumont d’Urville from 16/11 → 31/12/2018 T2m

ARPEGE-SH nearest grid point = sea point

Observation

From C. Genthon: Observation 12km from the sea, not exactly the RS station

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Dumont d’Urville from 16/11 → 31/12/2018  T2M

Full line = ARPEGE-SH nearest grid point
Dashed line = ARPEGE-SH nearest land grid point in better agreement with the observation

from C. Genthon

ARPEGE-SH nearest grid point = sea point
Observation
AROME-DDU: preliminary results and spatial variability

ARPEGE-SH T2M Fc+24h Valid 2018112900

AROME-DDU T2M Fc+24h Valid 2018112900
AROME-DDU: preliminary results and spatial variability

ARPEGE-SH T2M Fc+24h Valid 2018112900

AROME-DDU T2M Fc+24h Valid 2018112900
AROME-DDU: spatial variability and comparison with observation...

ARPEGE-SH T2m Fc+24h Valid 2018112900

Land grid point full line
Sea grid point: dashed

AROME-DDU mean
AROME-DDU: spatial variability and comparison with observation...

ARPEGE-SH T2m Fc+24h Valid 2018112900

Land grid point full line
Sea grid point: dashed
Coupling 1D sea-ice model GELATO in ARPEGE-SH (thanks to N. Azouz and A. Napoly)

- within the APPLICATE project the 1D sea-ice model GELATO (available in the SURFEX platform) is evaluated in AROME over the Barentz sea.
- YOPP-SH is potentially very useful to evaluate GELATO in ARPEGE-SH.
  - A 4Dvar ARPEGE-SH with GELATO is now running for the YOPP-SH.

Preliminary results for the period 15/11 → 17/12/2018 are encouraging.
Dumont d’Urville from 16/11 → 31/12/2018  T2M

ARPEGE-SH

ARPEGE-SH with GELATO

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Summary

• All the data from ARPEGE-SH 4Dvar are now available for studies, comparisons, evaluations …

• 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?

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