

Météo-France contribution for the YOPP NWP modeling part

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For YOPP-NH: Specific output on the YOPPsuperSite YOPP-siteMIP document (Svensson et al. 2017)

- **from the operational ARPEGE** model (stretched over France with 7.5km and 35km over Australia) but based on the long cut-off analysis. Only the nearest grid point was extracted, unfortunately for Barrow and Baranova it is a sea point.
 - SOP1 (1 Feb. - 31 March 2018) : The 13 Arctic sites (Barrow, Baranova, Sodankyla, etc) are available. File name: arpege_baranova_2018021812.nc. (See annex A).
 - SOP2 (1 July 30 - Sept; 2018) : 13 Arctic sites + 4 points on the third pole + 4 points for the Ocean points. File name: arpege-ao1_2018071812.nc (See annex A)
- **from an specific AROME** experiment done within the APPLICATE project at 2.5km with 65 vertical levels in a dynamical adaptation from the ARPEGE model (no specific upper air analysis or surface analysis) over the Barentz Sea. The AROME configuration is the previous operational one described in Seity et al (2011). Due to the domain size only Sodankyla with 3 grid points, Nyalesund (5 pts) and Pallas (1 pts) are available. File name: arome_nyalesund_2018092800.nc. (See annex B)
- ftp <ftp.umr-cnrm.fr> . user:yopp / passwd:Arpege : cd YOPP-NH/NetCdf-MIP/\${site} also available on the YOPP data portal

For YOPP-SH : 16 Nov 2018-16 Feb 2019.

- **A dedicated configuration of the global model ARPEGE, ARPEGE-SH:** specific configuration of the operational global model ARPEGE (4DVar), created for the YOPP-SH period (15/11/2018–15/02/2019). ARPEGE-SH is based on the operational global model used for Numerical Weather Prediction (NWP) ARPEGE (Pailleux et al., 2015) but with the high resolution area over Antarctica around 7.5km instead of over France. A 4DVar assimilation was performed every 6h with the observation used by the ARPEGE operational version. 10 days and 5 days forecast have been provided at resp. at 00UTC and 12UTC and only 06h forecast at 6 and 18UTC. (Fig 1)
- 21 YOPP super-site (17 over Antarctica and 4 for the Third Pole) are available. For several super sites, near the coast, the two nearest grid points have been extracted: one over sea and one over land. (See annex C)
- The NetCdf-MIP output files are available also on the <ftp.umr-cnrm.fr> cd YOPP-SH/NetCdf-MIP/\${site}. The forecast length available in the NetCdf file for the YOPP-Super-Site is only 78h.
- A specific post processing have been performed on a regular grid at 0.2 degree on the Southern Hemisphere domain [0, -90, 360, -10] every 3h up to 48h lead time and 6h after. The file format is GRIB and can be found on the ftp <ftp.umr-cnrm.fr> . user:yopp / passwd:Arpege under YOPP-SH/3DFIELDS/YYYYMMJJHH/ (Fig 2 and Fig 3)
- Two AROME configurations (only dynamical adaptation from ARPEGE-SH at 1.3km will be provided: one around DDU and one for the Alexander Tower and Mc Murdo and available on the same ftp site.

ARPEGE description :

- Spectral global model T1198 with a stretching factor $c=2.2$. The high resolution area with 7.5km is over France for ARPEGE-NWP used for YOPP-NH (SOP1 and SOP2) and for the specific ARPEGE-SH the high resolution area is over Antarctica: with 7.5km.
- 105 vertical levels with a first level at 10m and 31 levels below 3000m. The time step is 360s with a semi-Lagrangian scheme.

- “Same” incremental 4DVar for ARPEGE-NWP and ARPEGE-SH: T1149c1L105 (135km) and T1399c1 L105 (50km). Surface analysis based on an Optimal Interpolation done at T1198.
- ARPEGE-NWP and ARPEGE-SH both assimilate conventional in-situ observations (radiosondes, aircraft, ground-based stations, buoys and ships) and satellite observations (passive infrared -IASI, CrIS, AIRS, geostationary- and microwave -AMSU-A, MHS, SSMIS, SAPHIR, GMI, MWHS2-, GNSS radio-occultation and total zenithal delays, scatterometers and atmospheric motion vectors). ARPEGE-SH additionally inter-channel observation error correlations for the hyperspectral sounders IASI and CrIS.
- Physics parameterization:
 - The radiation scheme is based for the long-wave on the so-called RRTM scheme (Mlawer et al.,1997; Iacono et al., 2008) and for the short wave the six-band Fouquart-Morcrette scheme (Fouquart and Bonnel, 1980;Morcrette, 1993).
 - The boundary layer parameterization is based on the prognostic equation of the Turbulent Kinetic Energy (Cuxart et al., 2000). The shallow convection scheme (KFB) is based on a CAPE closure (Bechtold et al., 2001).
 - The TKE and the KFB scheme are linked by the thermal production of TKE computed by the KFB scheme and by a modification of the original mixing length from Bougeault and Lacarrere (1989) by the shallow cloud from KFB (Bazile et al., 2011).
 - The deep convection is represented by an updated version of the mass-flux scheme based on a moisture convergence closure (Bougeault, 1985).
 - The cloud microphysics has four prognostic variables (cloud ice/water and solid/liquid precipitation) for the resolved precipitation (Lopez, 2002; Bouteloup et al., 2005) and the probability distribution function for the statistical cloud scheme comes from (Smith, 1990).
 - A parameterization of subgrid orographic effects (Catry et al., 2008) represents gravity wave drag, wave deposition, wave trapping, form drag and lift effects.
 - For the continental surface the SURFEX software (Masson et al., 2003) is used with the force restore scheme (Noilhan and Planton, 89)

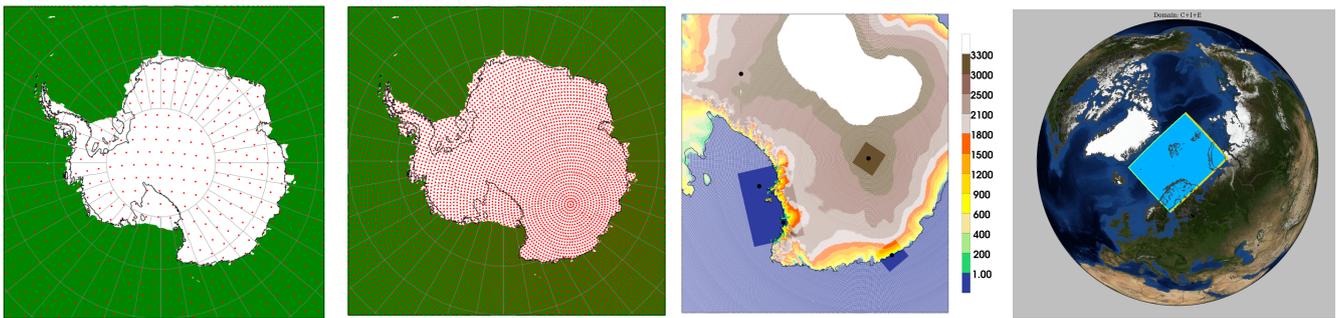


Fig 1: From the left to the right: ARPEGE-NWP (stretched over France). ARPEGE-SH (stretched over DomeC). Only 1 point over 8. AROME for YOPP-SH with initial and lateral boundary condition from ARPEGE-SH. AROME-Barentz sea for YOPP-NH SOP1 and SOP2.

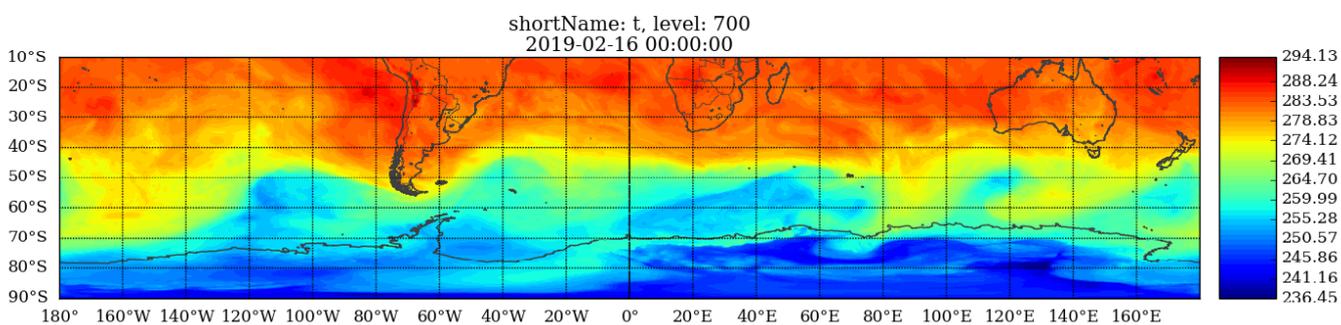


Fig 2 : Post processing domain for the ARPEGE-SH model. Temperature at 700hPa

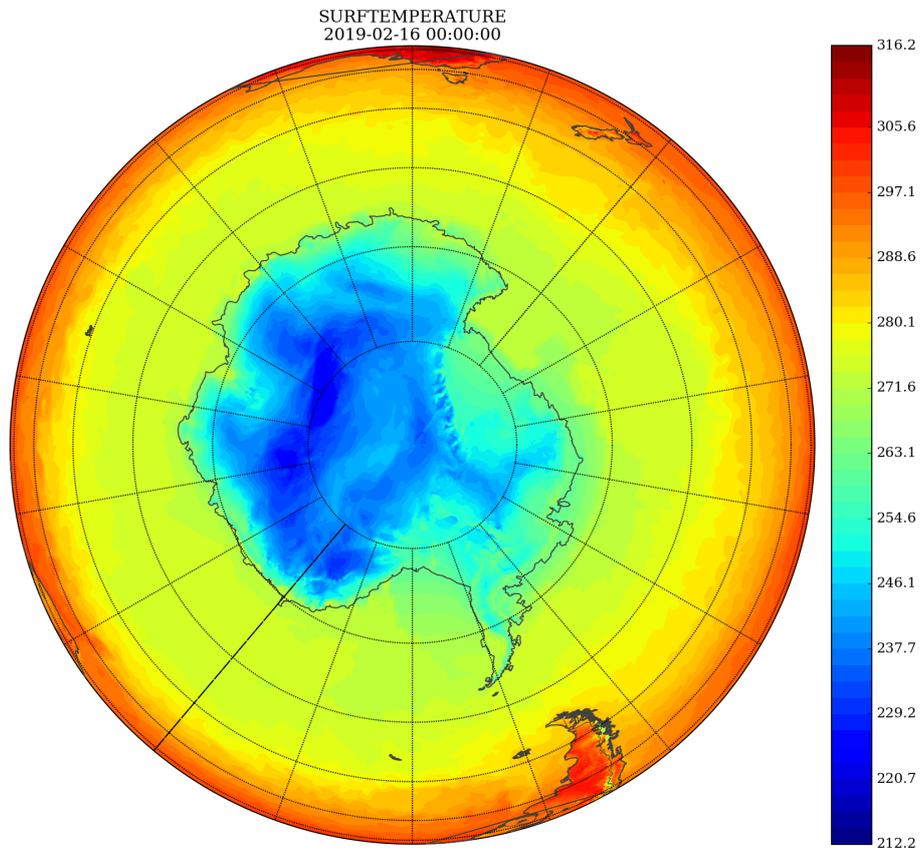


Fig 3 : Surface temperature from the ARPEGE-SH model

Annex A:

ARPEGE-NH (7HPT) Output for the YOPP-SuperSite over Arctic

Alert: 2-210m

Land: lon_request = -62.51, lat_request = 82.49
lon = -62.89308, lat = 82.4687, zmod=138m

Ao1: 0m

Sea: lon_request = 10.00, lat_request = 85.00
lon = 10.156, lat = 85.02594, zmod=0m

Ao2: 0m

Sea: lon_request = 00.00, lat_request = 90.00
lon = 2.57831, lat = 90.00, zmod=0m

Ao3: 0m

Sea: lon_request = -135.00, lat_request = 81.00

lon = -135.1191, lat = 81.05776, zmod=1m

Baranova: 24m

Sea: lon_request = 101.70, lat_request = 79.30
lon = 101.0387, lat = 79.35286, zmod=3m

Barrow: 8-20m

Sea: lon_request = -156.62, lat_request = 71.32
lon = -156.4367, lat = 71.37228, zmod=3m

Cherskii: 8m

Land: lon_request = 161.38, lat_request = 68.73
lon = 161.3899, lat = 68.75587, zmod=37m

Eureka: 0-610m

Land: lon_request = -86.42, lat_request = 80.08
lon = -86.43795, lat = 80.10743, zmod=143m

Iouhugou China: 4180m

Land: lon_request = 96.5, lat_request = 37.5
lon = 96.45792, lat = 37.47857, zmod=3825m

Iqaluit: 5-11m

Land: lon_request = -68.51, lat_request = 63.74
lon = -68.44897, lat = 63.76048, zmod=167m

Mera Nepal: 4570-4520m

Land: lon_request = 86.9, lat_request = 27.7,
lon = 86.99216, lat = 27.73881, zmod=5486m

Nyalesund: 0-30m

Sea: lon_request = 11.53, lat_request = 78.92
lon = 11.54772, lat = 78.88196, zmod=41m

Olitok: 2-6m

Sea: lon_request = -149.89, lat_request = 70.50
lon = -149.7129, lat = 70.47602, zmod=7m

Pallas: 305m

Land: lon_request = 24.12, lat_request = 67.97
lon = 24.19251, lat = 67.98589, zmod=404m

Sheba: 0m

Sea: lon_request = -165.00, lat_request = 76.00
lon = -164.8047, lat = 76.00953, zmod=2m

Sodankyla: 198m

Land: lon_request = 26.63, lat_request = 67.37
lon = 26.62566, lat = 67.40508, zmod=199m

Summit: 3210-3250m

Land: lon_request = -38.48, lat_request = 72.58
lon = -38.41885, lat = 72.54691, zmod=3180m

Tanggula China: 5100m

Land: lon_request = 91.86, lat_request = 32.58,
lon = 91.75121, lat = 32.46078, zmod=5052m

Tiksi: 1-30m

Land: lon_request = 128.89, lat_request = 71.60
lon = 128.8765, lat = 71.6255, zmod=99m

Whitehorse: 682m

Land: lon_request = -135.07, lat_request = 60.71
lon = -135.026, lat = 60.68933, zmod=1165m

Xidatan China: 4940-6420m

Land: lon_request = 94.13, lat_request = 35.72,
lon = 94.14886, lat = 35.71735, zmod=5045m

Annex B:

AROME-NH (7IYI) Output for the YOPP-SuperSite over Arctic

Nyalesund: 0-30m

Land: lon_request = 11.52, lat_request = 78.96

lon = 11.526, lat = 78.96227, zmod=37m
Sea: lon_request = 11.51, lat_request = 78.88
lon = 11.51156, lat = 78.88129, zmod=11m
Land: lon_request = 11.58, lat_request = 78.90
lon = 11.57959, lat = 78.89954, zmod=161m
Land: lon_request = 11.55, lat_request = 78.93
lon = 11.55287, lat = 78.93091, zmod=171m
Land: lon_request = 11.84, lat_request = 78.90
lon = 11.83712, lat = 78.89146, zmod=309m

Sodankyla: 198m

Land: lon_request = 26.63, lat_request = 67.39
lon = 26.62075, lat = 67.38707, zmod=189m
Land: lon_request = 26.61, lat_request = 67.35
lon = 26.61309, lat = 67.35583, zmod=195m
Land: lon_request = 26.62, lat_request = 67.34
lon = 26.64981, lat = 67.33873, zmod=201m

Pallas: 305m

Land: lon_request = 24.08, lat_request = 67.96
lon = 24.07784, lat = 67.9612, zmod=355m

Annex C:

ARPEGE-SH (7JSQ) Output for the YOPP-SuperSite over Antarctica

Dumont d'Urville : 0-50m

Sea: lon_request = 140.01, lat_request = -66.66,
lon = 139.9328, lat = -66.6515,
Land: lon_request = 140.01, lat_request = -66.71,
lon = 140.0038, lat = -66.74263, zmod=165m

Halley: 130m

Sea: lon_request = -26.66, lat_request = -75.58001,
lon = -26.58314, lat = -75.54222
Land: lon_request = -25, lat_request = -75.85,
lon = -24.88417, lat = -75.85477, zmod=105m

Kingsejong: 10m

Sea: lon_request = -58.79 lat_request = -62.22001,
lon = -58.75549, lat = -62.24062,
Land: lon_request = -58.79 lat_request = -62,15
lon = -58.75262, lat = -62.13772, zmod= 123m

Neumayer: 42m

Sea: lon_request = -8.25, lat_request = -70.64999
lon = -8.246924, lat = -70.6135,
Land: lon_request = -7.4, lat_request = -70.9
lon = -7.385528, lat = -70.87347, zmod=70m

Mawson: 15m

Sea: lon_request = 62.87, lat_request = -67.60001,
lon = 62.91441, lat = -67.59798,
Land: lon_request = 62.8, lat_request = -67.70001,
lon = 62.91091, lat = -67.70096, zmod= 374m,

Syowa: 18-29m

Sea: lon_request = 39.59, lat_request = -68.99999,
lon = 39.52311, lat = -68.99542,
Land: lon_request = 39.8, lat_request = -69.,
lon = 39.82917, lat = -69.00947, zmod=238m

Jangbogo: 36m

Sea: lon_request = 164.23, lat_request = -74.62
lon = 164.2358, lat = -74.62622,
Land: lon_request = 164., lat_request = -74.65
lon = 163.9895, lat = -, -74.6525, zmod= 185m,

Rothera: 4m

Sea: lon_request = -68.13, lat_request = -67.57,
lon = -68.24437, lat = -67.58572,
Land: lon_request = -68.4, lat_request = -67.6,
lon = -68.48113, lat = -67.57796, zmod= 325m

Mcmurdo: 10m

Sea: lon_request = 166.67, lat_request = -77.85,
lon = 166.7863, lat = -77.81778,
Land: lon_request = 166.67, lat_request = -77.62,
lon = 166.6705, lat = -77.62605, zmod=423m,

Troll: 1275m

Land: lon_request = 2.54, lat_request = -72.00999,
lon = 2.68257, lat = -72.01849, zmod=1531m

Mera Nepal: 4570-4520m

Land: lon_request = 86.9, lat_request = 27.7,
lon = 86.99216, lat = 27.73881, zmod=5486m

Tanggula China: 5100m

Land: lon_request = 91.86, lat_request = 32.58,
lon = 91.75121, lat = 32.46078, zmod=5052m

Xidatan China: 4940-6420m

Land: lon_request = 94.13, lat_request = 35.72,
lon = 94.14886, lat = 35.71735, zmod=5045m

Iouhugou China: 4180m

Land: lon_request = 96.5, lat_request = 37.5
lon = 96.45792, lat = 37.47857 zmod=3825m

DomeC: 3233m

Land: lon_request = 123.34, lat_request = -75.07999,
lon = 123.3857, lat = -75.08602, zmod=3231m

Casey: 30m

Land: lon_request = 110.53, lat_request = -66.28,
lon = 110.5986, lat = -66.27431, zmod=93m

Davis:

Land: lon_request = 77.96999, lat_request = -68.58,
lon = 78.06857, lat = -68.5678, zmod=10m

Southpole: 2835m

Land: lon_request = 0.001, lat_request = -90,
lon = -56.7899, lat = -90, zmod=3070m

Byrd: 1539m

Land: lon_request = -119.44, lat_request = -80.01001,
lon = -119.6179, lat = -80.03014, zmod=1503m

Vostok: 3489m

Land: lon_request = 106.84, lat_request = -78.45999,
lon = 106.7897, lat = -78.46083, zmod=3462m

Alexander: 55m

Sea(permanent sea ice): lon_request = 170.72, lat_request = -79.01,
lon = 170.8619, lat = -78.98252,