ECCC-CAPS supersite model output

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1. Introduction

As contribution to the Year of Polar Prediction (YOPP), Environment and Climate Change Canada (ECCC) has developed the Canadian Arctic Prediction System (CAPS). CAPS has been runned in operation at the Canadian Meteorological Service in experimental mode since February 2018. Prior to the 28th of June 2018 (included), CAPS was runned uncoupled, whereas since the 29th of June 2018 (included), CAPS was coupled with the Canadian Regional Ice and Ocean Prediction system (RIOPS).

This document aims to describe the CAPS output data produced in support of the YOPPsiteMIP at the YOPP Arctic supersites. These dataset (along with this documentation) can be found at http://thredds.met.no/thredds/catalog/alertness/YOPP_supersite/ECCC-CAPS/catalog.html. Gridded CAPS output data, along with a description of the gridded data, can be found on the ECCC datamart repository at http://dd.alpha.meteo.gc.ca/yopp/model_caps.

2. CAPS modelling characteristics

CAPS is a Limited Area Model (LAM) with a horizontal resolution of approxinately 3km and a grid with rotated equator and a latitude-longitude projection which covers the whole Arctic Basin (Figure 1). In the vertical CAPS uses Charney-Phillips (sigma hybrid) vertical coordinates with staggered momentum and thermodinamic levels, for a total of 62 levels.

The dynamical core of CAPS is the Canadian Global Environmental Multiscale (GEM) model, which is a non-hydrostatic atmospheric model that solves the fully compressible Euler equations (Cote' et al, 1998a,b; Girard et al, 2014). Model version for CAPS is GEM 4.9.2 before the 28th of June, and GEM 4.9.4 after the 29th of June (2018).

CAPS is initialized (downscaled) by the Canadian Global Deterministic Prediction System (GDPS, Buehner et al 2015), which is coupled to the Global Ice and Ocean Prediction system (GIOPS, Smith et al 2016). The uncoupled CAPS (prior to the 28th of June 2018) uses persisted sea-ice and ocean conditions, inherited from the coupled global prediction systems (3DVar ice analysis, Buehner et al, 2016; and CMC Ice analysis, Brasnett et al, 2008). From the 29th of June 2018, CAPS is fully coupled with the Canadian Regional Ice and Ocean Prediction system (RIOPS, Lemieux et al, 2016; Dupont et al, 2015) with initial ice-ocean conditions downscaled from GIOPS (Smith et al., 2016) using a spectral nudging method, and blended with a regional 3DVar ice analysis (Lemieux et al., 2016).

For clouds and precipitation CAPS uses a hot start, where hydrometeors at the initial step comes from the previous 12h forecast. CAPS uses a Parameterization of Cloud Microphysics Based on the Prediction of Bulk Ice Particle Properties (P3, Morrison and Milbrandt, 2015; Milbrandt and Morrison, 2016). Surface model is the Interaction between Soil, Biosphere and Atmosphere (ISBA, Noilhan and Planton, 1989; Belair et al, 2003a,b). The Lateral Boundary Conditions come from the 00,12 UTC GDPS forecast runs, whereas in the vertical we use a upper-level boundary nesting (McTaggart-Cowan et al 2011).

3. CAPS supersite model output

The CAPS super-site model output (when possible) is produced in alignement with the directives provided by the YOPPsiteMIP online guidance documentation available at https://www.polarprediction.net/fileadmin/user_upload/www.polarprediction.net/Home/Organization/Task_Teams/Modelling_Task_Team/YOPP_Supersite_common_model_output_rev2.pdf.

The CAPS time-series are produced for 12 Arctic supersites : Barrow, Oliktok Point, White Horse, Eureka, Iqaluit, Alert, Summit, Ny-Ålesund / Zeppelin, Pallas / Sodankyla, Baranova, Tiksi, Cherskii. For each supersite, time-series are produced for a beam of 7 x 7 grid-points centered on the supersite. **Appendix B provides the latitude and longitude of the model gridpoints associated with each supersite.**

The CAPS time series are produced for the two CAPS daily runs inizialized at 00 and 12 UTC. Time series up to 48 hours lead-time are produced. The data is recorded with a time frequency of 7'30", equivalent to 5 time steps of 90" each. For the 48 hour leadtime runs, 384 outputs are recoded in the time-series files (8 records / hour, 192 = 24 x 8 records / day).

The files are named as :
${SITE}_${INTITUTION}-${MODEL}_${YYYY}${MM}${DD}${HH}.nc
where
${SITE} indicates the supersite name
${INTITUTION} = ECCC indicates the name of the research institution
${MODEL} = CAPS indicates the name of the NWP system
${YYYY}${MM}${DD}${HH} indicates the year, month, day and hour of the time-series inizialization.
Each files contains the ECCC-CAPS time-series (for all output variables) for the beam of 7x7 gridpoints surrounding the super-site, for the 48 hour lead time run initialized at ${YYYY}${MM}${DD}${HH}.

Files are in netCDF format (netCDF version 4 classic) with variables named, following (when possible) the CF naming convention (http://cfconventions.org/Data/cf-standard-names/). **Appendix A provides a list of all CAPS output varibles** (divided by theme).

Because of the unique characteristics of the CAPS microphysics scheme (P3; Morrison and Milbrandt, 2015; Milbrandt and Morrison, 2016), CAPS output variables associated with hydrometeors and cloud microphysics have been renamed coherently with the following :

1. The CF naming convention does not use "solid precipitation" versus "liquid precipitation". **In the CF naming convention "snowfall" indicates "solid precipitation", whereas "rainfall" indicates "liquid precipitation"**. The CAPS microphysics scheme produces several precipitation types, which include (but are not limited) rain and snow. The use of "rainfall" (instead of "liquid precipitation") in CAPS is mis-leading, because CAPS model output for liquid precipitation includes both rain and drizzle (CAPS also output freezing rain, freezing drizzle). Similarly, the use of "snowfall" (instead of "solid precipitation") in CAPS is mis-leading, because solid precipitation in CAPS includes: snow, ice crystals, graupel, ice pellets, hail, large hail. **In renaming the microphysics variables of CAPS for YOPPsiteMIP we use "liquid precipitation" and "solid precipitation".**
2. For precipitation and clouds, **the CF naming convention uses "stratiform" to indicate**

prognostic variables expliciteely resolved by a grid-scale process, versus "convective" to indicate a diagnostic variable resolved impliciteely by a sub-grid scale parametrization. However, in CAPS, stratiform (precipitation and clouds) are explicit, whereas convective (precipitation and clouds) are resolved in part explicitly and in part implicitly. The use of "stratiform" and "convective" is misleading for CAPS model output, and therefore has not been used. On the other hand, **while renaming CAPS output variables related to precipitation and clouds, we have introduced "explicit" and "implicit"** (where appropriate).

Nevertheless, the CF onthology guidance has been respected while renaming these variables.

The model output for the uncoupled CAPS (prior the 28th June 2018) differs from the model output for the coupled CAPS (after the 29th June 2018) for the following :

1. The uncoupled CAPS does not have the following variables :

[GZMO]	zgmo	geopotential height on momentum levels	m
[GZTH]	zgth	geopotential height on thermodynamic levels	m
[FLDL]	rld	downwelling_longwave_flux_in_air	W m-2
[FLDS]	rsd	downwelling_shortwave_flux_in_air	W m-2
[FLUL]	rlu	upwelling_longwave_flux_in_air	W m-2
[FLUS]	rsu	upwelling_shortwave_flux_in_air	W m-2
[SLW]	prslw	mass concentration of cloud supercooled liquid water in air	kg/m³

2. For the uncoupled CAPS geopotential height is provided on energy levels.

[GZ]	zg	geopotential_height	dam

The energy levels are as the thermodynamic levels except for level nk,nk-1. In the physic, level nk is the diagnostic level, nk-1 is the level closest to the surface (which is at sigma = 1).

3. The uncoupled CAPS miss the bottom level (time series have 61 vertical levels). The levels are

0.00410016 0.00742534 0.0134471 0.0227437 0.0338256 0.0451936
0.0556271 0.0644377 0.0714344 0.0771276 0.0825822 0.0883959
0.0946183 0.101277 0.108407 0.116043 0.124213 0.13295799
0.142318 0.152337 0.16306099 0.174539 0.186827 0.19997901
0.21404199 0.22904401 0.245002 0.26192001 0.279814 0.29867801
0.31848899 0.33922401 0.360861 0.383349 0.40663299 0.43065301
0.45533401 0.48060501 0.50638801 0.532601 0.55916101 0.58596599
0.61293602 0.63997698 0.66699898 0.69391501 0.72063202 0.74708402
0.77318698 0.798859 0.823982 0.84829098 0.87148702 0.89333802
0.913683 0.93241203 0.94946498 0.96484298 0.97859901 0.99003798
0.99749702

3D variables with vertical profile on momentum levels are :
--profile-momentum-vars GZMO,UUWE,VVSN,TU,TV,KM

[GZMO]	zgmo	geopotential height on momentum levels	m
[UUWE]	ua	eastward_wind	m/s
[VVSN]	va	northward_wind	m/s
[TU]	tnxa	tendency of x-wind due to vertical diffusion	m s-2
[TV]	tnya	tendency of y-wind due to vertical diffusion	m s-2
[KM]	vdiffmo	atmosphere_momentum_diffusivity	m²/s

3D variables with vertical profile on thermodynamic levels are :
--profile-thermodynamic-vars GZ,GZTH,PX,TT,TH,T2,TI,TA,TF,TD,TW,WW,HR,HU,QA,QF,
MPQC,MPQR,REI1,SLW,ZET,NU,NS,FLDS,FLUS,FLDL,FLUL,KT,EN

[GZ]	zg	geopotential_height	dam
[GZTH]	zgth	geopotential height on thermodynamic levels	m
[PX]	plev	air_pressure	Pa
[TT]	ta	air_temperature	K
[TH]	theta	air_potential_temperature	K
[T2]	tntars	tendency_of_air_temperature_due_to_shortwave_heating	K/s
[TI]	tntarl	tendency_of_air_temperature_due_to_longwave_heating	K/s
[TA]	tntacc	tendency of air temperature due to convection and condensation	K/s
[TF]	tntavd	tendency of temperature due to vertical diffusion	K/s
[TD]	tdpa	dew_point_temperature	K
[TW]	thetawb	potential_wet_bulb_temperature	K
[WW]	wap	upward_air_velocity (omega)	Pa/s
[HR]	hur	relative_humidity	1
[HU]	hus	specific_humidity	kg/kg
[QA]	tnhuscc	tendency of specific humidity due to convection and condensation	s^{-1}
[QF]	tnhusvd	tendency of specific humidity due to vertical diffusion	s^{-1}
[MPQC]	mmrcl	mass_mixing_ratio_of_cloud_droplets	kg/kg
[MPQR]	mmrrn	mass_mixing_ratio_of_rain	kg/kg
[REI1]	priceradius	effective_radius_of_cloud_ice_droplets	m
[SLW]	prslw	mass concentration of cloud supercooled liquid water in air	kg/m^3
[ZET]	rradar	equivalent_radar_reflectivity	dBZ
[NU]	cl	cloud_area_fraction_in_atmosphere_layer	1
[NS]	cls	explicit cloud area fraction in atmosphere layer	1
[FLDL]	rld	downwelling_longwave_flux_in_air	W m-2
[FLDS]	rsd	downwelling_shortwave_flux_in_air	W m-2
[FLUL]	rlu	upwelling_longwave_flux_in_air	W m-2
[FLUS]	rsu	upwelling_shortwave_flux_in_air	W m-2
[KT]	vdiffth	atmosphere_heat_diffusivity	m^2/s
[EN]	turbke	turbulent kinetic energy content of model layer	m^2/s^2

Each surface tile is characterized by four surface types: soil, glacier, water, land. Several surface and near-surface variables are evaluated for each surface type (as an example : surface latent and sensible heat fluxes, surface albedo, surface skin temperature, surface roughness length and near-surface air temperature). In the CAPS timeseries, unless specified, the aggregated value for each tile (area weighted mean) is provided.

References and Resources:

ECCC-MSC web page hosting the history of the Canadian model updates (genot):
http://collaboration.cmc.ec.gc.ca/cmc/cmoi/product_guide/docs/changes_e.html

Bélair, S., L-P. Crevier, J. Mailhot, B. Bilodeau, and Y. Delage, 2003a: Operational implementation of the ISBA land surface scheme in the Canadian regional weather forecast model. Part I: Warm season results. *J. Hydrometeor.*, **4,** 352–370.

Bélair, S., R. Brown, J. Mailhot, B. Bilodeau, and L.-P. Crevier, 2003b: Operational implementation of the ISBA land surface scheme in the Canadian regional weather forecast model. Part II: Cold season results. *J. Hydrometeor.*, **4**, 371–386.

Brasnett, B., 2008: The impact of satellite retrievals in a global sea-surface-temperature analysis. *Quart. J. Roy. Meteor. Soc.*, **134**, 1745–1760.

Brasseur O. 2001. Development and application of a physical approach to estimating wind gusts. *Mon. Weather Rev.* **129**: 5–25.

Buehner, M., and Coauthors, 2015: Implementation of deterministic weather forecasting systems based on ensemble–variational data assimilation at Environment Canada. Part I: The global system. *Mon. Wea. Rev.*, **143**, 2532–2559.

Buehner M, Caya A, Carrieres T, Pogson L. 2016. Assimilation of SSMIS and ASCAT data and the replacement of highly uncertain estimates in the Environment Canada Regional Ice Prediction System. *Q. J.R. Meteorol. Soc.*, **142**, 562-573.

Coté, J., A. Gravel, A. Méthot, A. Patoine, M. Roch, and A. Staniforth, 1998a: The operational CMC-MRB Global Environmental Multiscale (GEM) model. Part I: Design considerations and formulation. *Mon. Wea. Rev.,* **126**, 1373–1395.

Coté, J., J.-G. Desmarais, A. Gravel, A. Méthot, A. Patoine, M. Roch, and A. Staniforth, 1998b: The operational CMC-MRB Global Environmental Multiscale (GEM) model. Part II: Results. *Mon. Wea. Rev.*, **126**, 1397–1418.

Dupont, F., Higginson, S., Bourdallé-Badie, R., Lu, Y., Roy, F., Smith, G. C., Lemieux, J.-F., Garric, G., and Davidson, F., 2015: A high-resolution ocean and sea-ice modelling system for the Arctic and North Atlantic oceans. *Geosci. Model Dev*., **8**, 1577-1594.

Girard, C., and Coauthors, 2014: Staggered vertical discretization of the Canadian Environmental Multiscale (GEM) model using a coordinate of the log-hydrostatic-pressure type. *Mon. Wea. Rev.*, **142**, 1183–1196.

Lemieux, J.F. and co-authors, 2016: The Regional Ice Prediction system (RIPS): verification of forecast sea ice concentration, *Q. J.R. Meteorol. Soc.*, **142**, 632-643.

McTaggart-Cowan, R., C. Girard, A. Plante, and M. Desgagné, 2011: The utility of upper-boundary nesting in NWP. *Mon. Wea. Rev.*, **139**, 2117–2144.

Hugh Morrison, Jason A. Milbrandt (2015) Parameterization of Cloud Microphysics Based on the Prediction of Bulk Ice Particle Properties. Part I: Scheme description and idealized tests. *Journal of the Atmospheric Sciences* **72**:1, 287-311.

Hugh Morrison, Jason A. Milbrandt, George H. Bryan, Kyoko Ikeda, Sarah A. Tessendorf, and Gregory Thompson. (2015) Parameterization of Cloud Microphysics Based on the Prediction of Bulk Ice Particle Properties. Part II: Case Study Comparisons with Observations and Other Schemes. *Journal of the Atmospheric Sciences* **72**:1, 312-339.

J. A. Milbrandt and H. Morrison. (2016) Parameterization of Cloud Microphysics Based on the Prediction of Bulk Ice Particle Properties. Part III: Introduction of Multiple Free Categories. *Journal of the Atmospheric Sciences* **73**:3, 975-995.

Noilhan, J., and S. Planton, 1989: A simple parameterization of land surface processes for meteorological models. *Mon. Wea. Rev.*, **117**, 536–549.

Smith, G.C. and co-authors, 2016: Sea ice forecast verification in the Canadian Global Ice Ocean Prediction System, *Q. J.R. Meteorol. Soc.*, **142**, 659-671.

Appendix A: CAPS output variables for the YOPP supersites

This appendix provides the list fo the CAPS output variables, divided by theme.
The first column indicates the variable names in the original ECCC-RPN standard files [nomvar] : knowledge of this variable names might be useful in the future, if the ECCC-CAPS supersite data need to be retrieved from the ECCC archive. In the netcdf files the variables were re-named following (when possible) the CF naming convention: in the second column we provide short names, which we matched with the ones used in CMIP6 (black font; whereas blue font indicate short names that we were not able to find in the CMIP variable-name tables). In the third column we provide either the CF standard names (black font, the name definition uses underscores), or a descriptive long name that was built following the same principles as in the CF naming onthology (blue font). The right column indicates the variable units.

#---- coordinates / metadata (variables corresponding to ip3==0)

[SH]	sigmath	thermodynamic atmosphere hybrid sigma pressure coordinate	1
[SV]	sigmamo	momentum atmosphere hybrid sigma pressure coordinate	1
[STNS]	station	grid point index (station index)	1
[HH]	time	time	hour

#---- surface fix variables (variables corresponding to ip3==0)

[MG]	sftlf	land_area_fraction	1
[Z0]	z0mo	surface_roughness_length_for_momentum_in_air	m

#---- pressure

[GZ]	zg	geopotential_height	dam
[GZMO]	zgmo	geopotential height on momentum levels	m
[GZTH]	zgth	geopotential height on thermodynamic levels	m
[PX]	plev	air_pressure	Pa
[P0]	ps	surface_air_pressure	Pa

#---- wind

[UU]	x_wind	x_wind	knot
[VV]	y_wind	y_wind	knot
[UUWE]	ua	eastward_wind	m/s
[VVSN]	va	northward_wind	m/s
[UDWE]	uas	near-surface (10m) eastward wind	m/s
[VDSN]	vas	near-surface (10m) northward wind	m/s
[WD]	wdir	wind_from_direction	degree
[VE]	wspeed	wind_speed	m/s
[WW]	wap	upward_air_velocity (omega)	Pa/s
[WGE]	wsg	wind_speed_of_gust	m/s
[WGN]	wsgmin	wind speed of gust minimum	m/s
[WGX]	wsgmax	wind speed of gust maximum	m/s

#---- temperature

[TT]	ta	air_temperature	K
[TD]	tdpa	dew_point_temperature	K
[ES]	dpda	dew_point_depression	K
[TJ]	tas	surface air temperature	K
[TS]	ts	surface skin temperature	K
[TH]	theta	air_potential_temperature	K
[TW]	thetawb	wet_bulb_potential_temperature	K

#---- moisture

[HU]	hus	specific_humidity	kg/kg
[DQ]	huss	surface_specific_humidity	kg/kg
[HR]	hur	relative_humidity	1

#---- visibility

[VIS]	vis	visibility_in_air	m
[VIS1]	visfog	visibility through liquid fog	m
[VIS2]	visrain	visibility through rain	m
[VIS3]	vissnow	visibility through snow	m

#---- precipitation and clouds

Note : we use liquid and solid, as opposed to rainfall and snowfall
Note : we use explicit and implicit, as opposed to stratiform and convective

#---- precipitation accumulation

[PR]	prlwe	lwe_thickness_of_precipitation_amount	m
[AE]	prlwes	lwe thickness of explicit precipitation amount	m
[A2]	prlwesl	lwe thickness of explicit liquid precipitation amount	m
[A4]	prlwess	lwe thickness of explicit solid precipitation amount	m
[PC]	prlwec	lwe thickness of implicit precipitation amount	m

#---- precipitation rate

[RT]	prr	lwe_precipitation_rate	m/s
[RC]	prrc	lwe implicit precipitation rate	m/s
[P1]	prrcl	lwe implicit liquid precipitation rate	m/s
[P3]	prrcs	lwe implicit solid precipitation rate	m/s
[RR]	prrs	lwe explicit precipitation rate	m/s
[P2]	prrsl	lwe explicit liquid precipitation rate	m/s

[P4]	prrss	lwe explicit solid precipitation rate	m/s

#---- precipitation accumulation, different hydrometeors

[RN]	prlwel	lwe thickness of liquid precipitation amount	m
[RN1]	prlweledr	lwe thickness of explicit liquid drizzle amount	m
[RN2]	prlwelern	lwe thickness of explicit liquid rain amount	m
[FR]	prlwelf	lwe thickness of freezing liquid precipitation amount	m
[FR1]	prlwelfedr	lwe thickness of explicit freezing drizzle amount	m
[FR2]	prlwelfern	lwe thickness of explicit freezing rain amount	m
[PE]	prlwesip	lwe thickness of ice pellets amount	m
[PE1]	prlweseip	lwe thickness of explicit ice pellets amount	m
[PE2]	prlweseh	lwe thickness of explicit hail amount	m
[PE2L]	prlwesehl	lwe thickness of explicit large hail amount	m
[SN]	prlwessn	lwe thickness of snowfall amount	m
[SN1]	prlweseic	lwe thickness of explicit ice crystals amount	m
[SN2]	prlwesesn	lwe thickness of explicit snowfall amount	m
[SN3]	prlwesegr	lwe thickness of explicit graupel amount	m
[SND]	prtsn	thickness of unmelted snowfall amount	m
[S2L]	prtslr	solid-to-liquid ratio of snowfall amount (accumulated)	kg/kg

Note: S2L = SND/(SN1+SN2+SN3)

#---- precipitation rate, different hydrometeors

[RRN1]	prrledr	lwe explicit liquid drizzle rate	m/s
[RRN2]	prrlern	lwe explicit liquid rain rate	m/s
[RFR1]	prrlfedr	lwe explicit freezing drizzle rate	m/s
[RFR2]	prrlfern	lwe explicit freezing rain rate	m/s
[RPE1]	prrseip	lwe explicit ice pellets rate	m/s
[RPE2]	prrseh	lwe explicit hail rate	m/s
[RPEL]	prrsehl	lwe explicit large hail rate	m/s
[RSN1]	prrseic	lwe explicit ice crystals rate	m/s
[RSN2]	prrsesn	lwe explicit snowfall rate	m/s
[RSN3]	prrsegr	lwe explicit graupel rate	m/s
[RSND]	prrsn	unmelted snowfall rate	m/s
[RS2L]	prrslr	solid-to-liquid ratio of snowfall (instantaneous)	kg/kg
[SLW]	prslw	mass concentration of cloud supercooled liquid water in air	kg/m^3

#---- additional hydrometeor prognostic variables

[MPQC]	cldmr	cloud droplets mixing ratio	kg/kg
[MPQR]	prlmr	rain mixing ratio	kg/kg
[REI1]	priceradius	effective radius of explicit cloud ice particles	m

#---- reflectivity

[ZEC]	rradarmax	column maximum equivalent radar reflectivity	dBZ
[ZET]	rradar	equivalent radar reflectivity	dBZ

#---- clouds

[TCC]	clt	cloud_area_fraction	1
[ECC]	clotalt	cloud area fraction weighted by cloud optical thickness at each atmosphere layer	1
[ECCH]	clotalh	high level cloud area fraction weighted by cloud optical thickness	1
[ECCL]	clotall	low level cloud area fraction weighted by cloud optical thickness	1
[ECCM]	clotalm	mid level cloud area fraction weighted by cloud optical thickness	1
[NT]	clott	cloud area fraction weighted by cloud optical thickness	1

Note : TCC is defined independenty on opacity of clouds
(in TCC the presence of cumulus or thin cirrus give the same result)
Note: NT and ECC, on the other hand, account for the opacity of clouds
NT = TCC*(1-alpha exp(W3+W4)) with alpha = 0.1 tunable parameter

[NU]	cl	cloud_area_fraction_in_atmosphere_layer	1
[NS]	cls	explicit cloud area fraction in atmosphere layer	1
[W1]	cllwviic	atmosphere mass content of cloud liquid water incloud	kg/m²
[W2]	cliviic	atmosphere mass content of cloud ice water incloud	kg/m²
[W3]	cllwotvi	atmosphere optical thickness due to liquid cloud	1
[W4]	cliotvi	atmosphere optical thickness due to ice cloud	1
[ICR]	cllwvir	atmosphere mass content of cloud liquid water for radiation	kg/m²
[IIR]	clivir	atmosphere mass content of cloud ice for radiation	kg/m²
[IC]	cllwvi	atmosphere mass content of cloud liquid water	kg/m²
[II]	clivi	atmosphere_mass_content_of_cloud_ice	kg/m²
[IE]	clwvi	atmosphere_mass_content_of_cloud_condensed_water	kg/m²
[IB]	clslwvi	atmosphere mass content of cloud supercooled liquid water	kg/m²

Note : IC, II, IE and IB represent quantities within each grid-box
whereas W1 and W2 represent the *incloud* quantities,
i.e. quantities evaluated for the portion of the tile with clouds

[BE]	tacltop	air_temperature_at_cloud_top	K
[BP]	pacltop	air_pressure_at_cloud_top	Pa
[H_CB]	zclbase	cloud_base_altitude	m

#--- TOA radiation

[EI]	rlut	toa_outgoing_longwave_flux	W/m²
[EV]	rsut	oa_outgoing_shortwave_flux	W/m²
[IV]	rsdt	toa_incoming_shortwave_flux	W/m²

#---- radiation in air

[FLDL]	rld	downwelling_longwave_flux_in_air	W/m²
[FLDS]	rsd	downwelling_shortwave_flux_in_air	W/m²
[FLUL]	rlu	upwelling_longwave_flux_in_air	W/m²
[FLUS]	rsu	upwelling_shortwave_flux_in_air	W/m²

#--- surface radiation

[FI]	rlds	surface_downwelling_longwave_flux	W/m²
[SI]	rldsnet	surface_net_downward_longwave_flux	W/m²
[FU]	rsds	surface_downwelling_shortwave_flux	W/m²
[FS]	rsdsnet	surface_net_downward_shortwave_flux	W/m²
[FC]	hfss	surface_upward_sensible_heat_flux	W/m²
[FV]	hfls	surface_upward_latent_heat_flux	W/m²

#---- albedo

[AP]	albp	planetary_albedo	1
[AL]	albs	surface_albedo	1
[I6]	albsn	snow albedo	1

#---- surface scheme

[SD]	snd	surface_snow_thickness	m
[DN]	rhos	snow_density	kg/m³
[FL]	hfsoild	downward_heat_flux_in_soil	W/m²
[TG]	t4s	radiative surface skin temperature	K

Note : the radiative surface skin temperature T^4 is evaluated for each
type of surface type (soil,water,glacier,seaice), then these are aggregated
(accounting for the proportion of each surface type), finally the sqrt4 is taken.

#---- boundary layer, turbulence

[F2]	zmla	atmosphere_boundary_layer_thickness	m
[EN]	turbke	turbulent kinetic energy content of model layer	m²/s²

[FQ]	turbss	turbulent surface stress	Pa
[SDWD]	turbwdir	turbulence surface wind direction	degree
[SDWS]	turbwspeed	turbulence surface wind speed	m/s

Note: SDWD,SDWS are related to a gust parametrization which follows Brasseur (2001)

[KM]	vdiffmo	atmosphere_momentum_diffusivity	m^2/s
[KT]	vdiffth	atmosphere_heat_diffusivity	m^2/s

#---- tendency

[T2]	tntars	tendency_of_air_temperature_due_to_shortwave_heating	K/s
[TI]	tntarl	tendency_of_air_temperature_due_to_longwave_heating	K/s
[QA]	tnhuscc	tendency of specific humidity due to convection and condensation	s^{-1}
[TA]	tntacc	tendency of air temperature due to convection and condensation	K/s
[QF]	tnhusvd	tendency of specific humidity due to vertical diffusion	s^{-1}
[TF]	tntavd	tendency of temperature due to vertical diffusion	K/s
[TU]	tnxa	tendency of x-wind due to vertical diffusion	m/s^2
[TV]	tnya	tendency of y-wind due to vertical diffusion	m/s^2

#---- end

Appendix B: supersite georeferences

The CAPS time-series are produced for 12 Arctic supersites: Barrow, Oliktok Point, White Horse, Eureka, Iqaluit, Alert, Summit, Ny-Ålesund / Zeppelin, Pallas / Sodankyla, Baranova, Tiksi, Cherskii. For each of these 12 Arctic supersites, time-series are produced for a beam of 7 x 7 grid-points centered on the supersite. The tables in the following pages of this Appendix provide the latitude and longitude of the model gridpoints associated with each supersite. Moreover, in the last column, we provide the station ID within the ECCC-RPN standard files (IP3 code) : knowledge of this code might be useful in the future, if the ECCC-CAPS supersite data need to be retrieved from the ECCC archive.

In what follow, ${SITE} indicate one of the supersites.

${SITE}+0+0 indicates the CAPS grid-point nearest to the station

${SITE}+1+0 indicates the CAPS grid-point to the grid-east of ${SITE}+0+0
${SITE}+0+1 indicates the CAPS grid-point to the grid-north of ${SITE}+0+0
${SITE}-1+0 indicates the CAPS grid-point to the grid-west of ${SITE}+0+0
${SITE}+0-1 indicates the CAPS grid-point to the grid-south of ${SITE}+0+0

${SITE}+i-j indicates the CAPS grid-point which is displaced i positions towards the grid_east (grid_west if negative) and j positions towards the grid_north (grid_south if negative) with respect of ${SITE}+0+0.

BARROW, IP3 station = 254-260; 268-274; 282-316

'BARROW-3-3', 71.220, -156.506, 254
'BARROW-2-3', 71.246, -156.463, 255
'BARROW-1-3', 71.271, -156.420, 256
'BARROW+0-3', 71.296, -156.378, 257
'BARROW+1-3', 71.322, -156.335, 258
'BARROW+2-3', 71.347, -156.292, 259
'BARROW+3-3', 71.373, -156.248, 260
'BARROW-3-2', 71.234, -156.586, 268
'BARROW-2-2', 71.259, -156.543, 269
'BARROW-1-2', 71.285, -156.501, 270
'BARROW+0-2', 71.310, -156.458, 271
'BARROW+1-2', 71.336, -156.415, 272
'BARROW+2-2', 71.361, -156.372, 273
'BARROW+3-2', 71.387, -156.329, 274
'BARROW-3-1', 71.248, -156.666, 282
'BARROW-2-1', 71.273, -156.623, 283
'BARROW-1-1', 71.299, -156.581, 284
'BARROW+0-1', 71.324, -156.538, 285
'BARROW+1-1', 71.350, -156.495, 286
'BARROW+2-1', 71.375, -156.453, 287
'BARROW+3-1', 71.400, -156.410, 288
'BARROW-3+0', 71.262, -156.746, 289
'BARROW-2+0', 71.287, -156.704, 290
'BARROW-1+0', 71.313, -156.661, 291
'BARROW+0+0', 71.338, -156.619, 292
'BARROW+1+0', 71.363, -156.576, 293
'BARROW+2+0', 71.389, -156.533, 294
'BARROW+3+0', 71.414, -156.490, 295
'BARROW-3+1', 71.275, -156.827, 296
'BARROW-2+1', 71.301, -156.784, 297
'BARROW-1+1', 71.326, -156.742, 298
'BARROW+0+1', 71.352, -156.699, 299
'BARROW+1+1', 71.377, -156.657, 300
'BARROW+2+1', 71.403, -156.614, 301
'BARROW+3+1', 71.428, -156.571, 302
'BARROW-3+2', 71.289, -156.907, 303
'BARROW-2+2', 71.315, -156.865, 304
'BARROW-1+2', 71.340, -156.823, 305
'BARROW+0+2', 71.366, -156.780, 306
'BARROW+1+2', 71.391, -156.738, 307
'BARROW+2+2', 71.417, -156.695, 308
'BARROW+3+2', 71.442, -156.652, 309
'BARROW-3+3', 71.303, -156.988, 310
'BARROW-2+3', 71.328, -156.946, 311
'BARROW-1+3', 71.354, -156.903, 312
'BARROW+0+3', 71.379, -156.861, 313
'BARROW+1+3', 71.405, -156.818, 314
'BARROW+2+3', 71.430, -156.776, 315
'BARROW+3+3', 71.456, -156.733, 316

OLIKTOK, IP3 station = 120-168

'OLIKTOK-3-3', 70.380, -149.825, 120
'OLIKTOK-2-3', 70.404, -149.776, 121
'OLIKTOK-1-3', 70.427, -149.727, 122
'OLIKTOK+0-3', 70.451, -149.679, 123
'OLIKTOK+1-3', 70.474, -149.630, 124
'OLIKTOK+2-3', 70.498, -149.580, 125
'OLIKTOK+3-3', 70.521, -149.531, 126
'OLIKTOK-3-2', 70.397, -149.897, 127
'OLIKTOK-2-2', 70.420, -149.848, 128
'OLIKTOK-1-2', 70.444, -149.799, 129
'OLIKTOK+0-2', 70.467, -149.750, 130
'OLIKTOK+1-2', 70.491, -149.701, 131
'OLIKTOK+2-2', 70.515, -149.652, 132
'OLIKTOK+3-2', 70.538, -149.603, 133
'OLIKTOK-3-1', 70.413, -149.968, 134
'OLIKTOK-2-1', 70.437, -149.920, 135
'OLIKTOK-1-1', 70.461, -149.871, 136
'OLIKTOK+0-1', 70.484, -149.822, 137
'OLIKTOK+1-1', 70.508, -149.773, 138
'OLIKTOK+2-1', 70.531, -149.724, 139
'OLIKTOK+3-1', 70.555, -149.675, 140
'OLIKTOK-3+0', 70.430, -150.040, 141
'OLIKTOK-2+0', 70.454, -149.992, 142
'OLIKTOK-1+0', 70.477, -149.943, 143
'OLIKTOK+0+0', 70.501, -149.894, 144
'OLIKTOK+1+0', 70.524, -149.845, 145
'OLIKTOK+2+0', 70.548, -149.796, 146
'OLIKTOK+3+0', 70.571, -149.747, 147
'OLIKTOK-3+1', 70.446, -150.112, 148
'OLIKTOK-2+1', 70.470, -150.064, 149
'OLIKTOK-1+1', 70.494, -150.015, 150
'OLIKTOK+0+1', 70.517, -149.967, 151
'OLIKTOK+1+1', 70.541, -149.918, 152
'OLIKTOK+2+1', 70.565, -149.869, 153
'OLIKTOK+3+1', 70.588, -149.820, 154
'OLIKTOK-3+2', 70.463, -150.184, 155
'OLIKTOK-2+2', 70.487, -150.136, 156
'OLIKTOK-1+2', 70.510, -150.087, 157
'OLIKTOK+0+2', 70.534, -150.039, 158
'OLIKTOK+1+2', 70.558, -149.990, 159
'OLIKTOK+2+2', 70.581, -149.941, 160
'OLIKTOK+3+2', 70.605, -149.892, 161
'OLIKTOK-3+3', 70.479, -150.257, 162
'OLIKTOK-2+3', 70.503, -150.208, 163
'OLIKTOK-1+3', 70.527, -150.160, 164
'OLIKTOK+0+3', 70.550, -150.111, 165
'OLIKTOK+1+3', 70.574, -150.062, 166
'OLIKTOK+2+3', 70.598, -150.014, 167
'OLIKTOK+3+3', 70.621, -149.965, 168

WHITEHORSE, IP3 station = 60-108

'WHITEHORSE-3-3', 60.582, -135.053, 60
'WHITEHORSE-2-3', 60.601, -135.013, 61
'WHITEHORSE-1-3', 60.619, -134.972, 62
'WHITEHORSE+0-3', 60.637, -134.932, 63
'WHITEHORSE+1-3', 60.656, -134.891, 64
'WHITEHORSE+2-3', 60.674, -134.851, 65
'WHITEHORSE+3-3', 60.692, -134.810, 66
'WHITEHORSE-3-2', 60.604, -135.093, 67
'WHITEHORSE-2-2', 60.622, -135.053, 68
'WHITEHORSE-1-2', 60.640, -135.013, 69
'WHITEHORSE+0-2', 60.659, -134.972, 70
'WHITEHORSE+1-2', 60.677, -134.932, 71
'WHITEHORSE+2-2', 60.695, -134.891, 72
'WHITEHORSE+3-2', 60.714, -134.850, 73
'WHITEHORSE-3-1', 60.625, -135.134, 74
'WHITEHORSE-2-1', 60.643, -135.094, 75
'WHITEHORSE-1-1', 60.662, -135.053, 76
'WHITEHORSE+0-1', 60.680, -135.013, 77
'WHITEHORSE+1-1', 60.699, -134.972, 78
'WHITEHORSE+2-1', 60.717, -134.931, 79
'WHITEHORSE+3-1', 60.735, -134.891, 80
'WHITEHORSE-3+0', 60.646, -135.175, 81
'WHITEHORSE-2+0', 60.665, -135.134, 82
'WHITEHORSE-1+0', 60.683, -135.094, 83
'WHITEHORSE+0+0', 60.702, -135.053, 84
'WHITEHORSE+1+0', 60.720, -135.013, 85
'WHITEHORSE+2+0', 60.738, -134.972, 86
'WHITEHORSE+3+0', 60.757, -134.931, 87
'WHITEHORSE-3+1', 60.668, -135.215, 88
'WHITEHORSE-2+1', 60.686, -135.175, 89
'WHITEHORSE-1+1', 60.705, -135.134, 90
'WHITEHORSE+0+1', 60.723, -135.094, 91
'WHITEHORSE+1+1', 60.742, -135.053, 92
'WHITEHORSE+2+1', 60.760, -135.013, 93
'WHITEHORSE+3+1', 60.778, -134.972, 94
'WHITEHORSE-3+2', 60.689, -135.256, 95
'WHITEHORSE-2+2', 60.708, -135.216, 96
'WHITEHORSE-1+2', 60.726, -135.175, 97
'WHITEHORSE+0+2', 60.745, -135.135, 98
'WHITEHORSE+1+2', 60.763, -135.094, 99
'WHITEHORSE+2+2', 60.781, -135.053, 100
'WHITEHORSE+3+2', 60.800, -135.013, 101
'WHITEHORSE-3+3', 60.711, -135.297, 102
'WHITEHORSE-2+3', 60.729, -135.256, 103
'WHITEHORSE-1+3', 60.748, -135.216, 104
'WHITEHORSE+0+3', 60.766, -135.175, 105
'WHITEHORSE+1+3', 60.784, -135.135, 106
'WHITEHORSE+2+3', 60.803, -135.094, 107
'WHITEHORSE+3+3', 60.821, -135.053, 108

EUREKA, IP3 station = 169-182,184-218

'EUREKA-3-3', 80.014, -86.947, 169
'EUREKA-2-3', 80.009, -86.783, 170
'EUREKA-1-3', 80.004, -86.619, 171
'EUREKA+0-3', 79.999, -86.456, 172
'EUREKA+1-3', 79.994, -86.292, 173
'EUREKA+2-3', 79.989, -86.129, 174
'EUREKA+3-3', 79.984, -85.966, 175
'EUREKA-3-2', 80.042, -86.920, 176
'EUREKA-2-2', 80.038, -86.755, 177
'EUREKA-1-2', 80.033, -86.591, 178
'EUREKA+0-2', 80.028, -86.427, 179
'EUREKA+1-2', 80.023, -86.263, 180
'EUREKA+2-2', 80.018, -86.099, 181
'EUREKA+3-2', 80.013, -85.936, 182
'EUREKA-3-1', 80.071, -86.892, 184
'EUREKA-2-1', 80.067, -86.727, 185
'EUREKA-1-1', 80.062, -86.563, 186
'EUREKA+0-1', 80.057, -86.398, 187
'EUREKA+1-1', 80.052, -86.234, 188
'EUREKA+2-1', 80.047, -86.069, 189
'EUREKA+3-1', 80.042, -85.905, 190
'EUREKA-3+0', 80.100, -86.864, 191
'EUREKA-2+0', 80.095, -86.699, 192
'EUREKA-1+0', 80.091, -86.534, 193
'EUREKA+0+0', 80.086, -86.369, 194
'EUREKA+1+0', 80.081, -86.204, 195
'EUREKA+2+0', 80.076, -86.039, 196
'EUREKA+3+0', 80.070, -85.875, 197
'EUREKA-3+1', 80.129, -86.837, 198
'EUREKA-2+1', 80.124, -86.671, 199
'EUREKA-1+1', 80.119, -86.505, 200
'EUREKA+0+1', 80.115, -86.340, 201
'EUREKA+1+1', 80.109, -86.174, 202
'EUREKA+2+1', 80.104, -86.009, 203
'EUREKA+3+1', 80.099, -85.844, 204
'EUREKA-3+2', 80.158, -86.809, 205
'EUREKA-2+2', 80.153, -86.642, 206
'EUREKA-1+2', 80.148, -86.476, 207
'EUREKA+0+2', 80.143, -86.310, 208
'EUREKA+1+2', 80.138, -86.144, 209
'EUREKA+2+2', 80.133, -85.979, 210
'EUREKA+3+2', 80.128, -85.813, 211
'EUREKA-3+3', 80.187, -86.780, 212
'EUREKA-2+3', 80.182, -86.614, 213
'EUREKA-1+3', 80.177, -86.447, 214
'EUREKA+0+3', 80.172, -86.281, 215
'EUREKA+1+3', 80.167, -86.114, 216
'EUREKA+2+3', 80.162, -85.948, 217
'EUREKA+3+3', 80.157, -85.782, 218

IQALUIT, IP3 station = 9-32,33=34=35,36-59

'IQALUIT-3-3', 63.713, -68.784, 9
'IQALUIT-2-3', 63.699, -68.731, 10
'IQALUIT-1-3', 63.686, -68.679, 11
'IQALUIT+0-3', 63.672, -68.626, 12
'IQALUIT+1-3', 63.659, -68.574, 13
'IQALUIT+2-3', 63.645, -68.521, 14
'IQALUIT+3-3', 63.632, -68.469, 15
'IQALUIT-3-2', 63.738, -68.751, 16
'IQALUIT-2-2', 63.725, -68.698, 17
'IQALUIT-1-2', 63.711, -68.645, 18
'IQALUIT+0-2', 63.698, -68.593, 19
'IQALUIT+1-2', 63.684, -68.540, 20
'IQALUIT+2-2', 63.671, -68.488, 21
'IQALUIT+3-2', 63.657, -68.436, 22
'IQALUIT-3-1', 63.763, -68.718, 23
'IQALUIT-2-1', 63.750, -68.665, 24
'IQALUIT-1-1', 63.736, -68.612, 25
'IQALUIT+0-1', 63.723, -68.560, 26
'IQALUIT+1-1', 63.709, -68.507, 27
'IQALUIT+2-1', 63.696, -68.455, 28
'IQALUIT+3-1', 63.682, -68.402, 29
'IQALUIT-3+0', 63.789, -68.684, 30
'IQALUIT-2+0', 63.775, -68.632, 31
'IQALUIT-1+0', 63.762, -68.579, 32
'IQALUIT+0+0', 63.748, -68.526, **34**
'IQALUIT+1+0', 63.735, -68.474, 36
'IQALUIT+2+0', 63.721, -68.421, 37
'IQALUIT+3+0', 63.707, -68.369, 38
'IQALUIT-3+1', 63.814, -68.651, 39
'IQALUIT-2+1', 63.801, -68.598, 40
'IQALUIT-1+1', 63.787, -68.546, 41
'IQALUIT+0+1', 63.773, -68.493, 42
'IQALUIT+1+1', 63.760, -68.441, 43
'IQALUIT+2+1', 63.746, -68.388, 44
'IQALUIT+3+1', 63.733, -68.336, 45
'IQALUIT-3+2', 63.839, -68.618, 46
'IQALUIT-2+2', 63.826, -68.565, 47
'IQALUIT-1+2', 63.812, -68.512, 48
'IQALUIT+0+2', 63.799, -68.460, 49
'IQALUIT+1+2', 63.785, -68.407, 50
'IQALUIT+2+2', 63.772, -68.355, 51
'IQALUIT+3+2', 63.758, -68.302, 52
'IQALUIT-3+3', 63.865, -68.585, 53
'IQALUIT-2+3', 63.851, -68.532, 54
'IQALUIT-1+3', 63.838, -68.479, 55
'IQALUIT+0+3', 63.824, -68.426, 56
'IQALUIT+1+3', 63.810, -68.374, 57
'IQALUIT+2+3', 63.797, -68.321, 58
'IQALUIT+3+3', 63.783, -68.268, 59

ALERT, IP3 station = 317-354,355=356=357,358-367

'ALERT-3-3', 82.451, -63.426, 317
'ALERT-2-3', 82.435, -63.240, 318
'ALERT-1-3', 82.419, -63.056, 319
'ALERT+0-3', 82.403, -62.872, 320
'ALERT+1-3', 82.387, -62.689, 321
'ALERT+2-3', 82.371, -62.507, 322
'ALERT+3-3', 82.355, -62.325, 323
'ALERT-3-2', 82.475, -63.304, 324
'ALERT-2-2', 82.460, -63.119, 325
'ALERT-1-2', 82.444, -62.934, 326
'ALERT+0-2', 82.428, -62.749, 327
'ALERT+1-2', 82.411, -62.566, 328
'ALERT+2-2', 82.395, -62.384, 329
'ALERT+3-2', 82.379, -62.202, 330
'ALERT-3-1', 82.500, -63.182, 331
'ALERT-2-1', 82.484, -62.996, 332
'ALERT-1-1', 82.468, -62.811, 333
'ALERT+0-1', 82.452, -62.626, 334
'ALERT+1-1', 82.436, -62.443, 335
'ALERT+2-1', 82.419, -62.260, 336
'ALERT+3-1', 82.403, -62.078, 337
'ALERT-3+0', 82.524, -63.059, 338
'ALERT-2+0', 82.508, -62.873, 339
'ALERT-1+0', 82.492, -62.687, 340
'ALERT+0+0', 82.476, -62.502, 341
'ALERT+1+0', 82.460, -62.318, 342
'ALERT+2+0', 82.444, -62.135, 343
'ALERT+3+0', 82.427, -61.953, 344
'ALERT-3+1', 82.549, -62.935, 345
'ALERT-2+1', 82.533, -62.749, 346
'ALERT-1+1', 82.517, -62.563, 347
'ALERT+0+1', 82.501, -62.377, 348
'ALERT+1+1', 82.484, -62.193, 349
'ALERT+2+1', 82.468, -62.009, 350
'ALERT+3+1', 82.451, -61.827, 351
'ALERT-3+2', 82.573, -62.811, 352
'ALERT-2+2', 82.557, -62.624, 353
'ALERT-1+2', 82.541, -62.437, 354
'ALERT+0+2', 82.525, -62.252, **357**
'ALERT+1+2', 82.508, -62.067, 358
'ALERT+2+2', 82.492, -61.883, 359
'ALERT+3+2', 82.476, -61.700, 360
'ALERT-3+3', 82.598, -62.685, 361
'ALERT-2+3', 82.582, -62.498, 362
'ALERT-1+3', 82.565, -62.311, 363
'ALERT+0+3', 82.549, -62.125, 364
'ALERT+1+3', 82.533, -61.940, 365
'ALERT+2+3', 82.516, -61.756, 366
'ALERT+3+3', 82.500, -61.573, 367

SUMMIT, IP3 station = 219-253, 261-267, 275-281

'SUMMIT-3-3', 72.599, -38.841, 219
'SUMMIT-2-3', 72.575, -38.791, 220
'SUMMIT-1-3', 72.550, -38.741, 221
'SUMMIT+0-3', 72.526, -38.690, 222
'SUMMIT+1-3', 72.501, -38.641, 223
'SUMMIT+2-3', 72.476, -38.591, 224
'SUMMIT+3-3', 72.452, -38.541, 225
'SUMMIT-3-2', 72.615, -38.758, 226
'SUMMIT-2-2', 72.590, -38.707, 227
'SUMMIT-1-2', 72.565, -38.657, 228
'SUMMIT+0-2', 72.541, -38.607, 229
'SUMMIT+1-2', 72.516, -38.557, 230
'SUMMIT+2-2', 72.491, -38.508, 231
'SUMMIT+3-2', 72.467, -38.458, 232
'SUMMIT-3-1', 72.630, -38.674, 233
'SUMMIT-2-1', 72.605, -38.624, 234
'SUMMIT-1-1', 72.581, -38.574, 235
'SUMMIT+0-1', 72.556, -38.524, 236
'SUMMIT+1-1', 72.531, -38.474, 237
'SUMMIT+2-1', 72.507, -38.424, 238
'SUMMIT+3-1', 72.482, -38.375, 239
'SUMMIT-3+0', 72.645, -38.590, 240
'SUMMIT-2+0', 72.620, -38.540, 241
'SUMMIT-1+0', 72.596, -38.490, 242
'SUMMIT+0+0', 72.571, -38.440, 243
'SUMMIT+1+0', 72.546, -38.391, 244
'SUMMIT+2+0', 72.522, -38.341, 245
'SUMMIT+3+0', 72.497, -38.291, 246
'SUMMIT-3+1', 72.660, -38.506, 247
'SUMMIT-2+1', 72.636, -38.456, 248
'SUMMIT-1+1', 72.611, -38.406, 249
'SUMMIT+0+1', 72.586, -38.357, 250
'SUMMIT+1+1', 72.561, -38.307, 251
'SUMMIT+2+1', 72.537, -38.257, 252
'SUMMIT+3+1', 72.512, -38.208, 253
'SUMMIT-3+2', 72.675, -38.422, 261
'SUMMIT-2+2', 72.651, -38.372, 262
'SUMMIT-1+2', 72.626, -38.323, 263
'SUMMIT+0+2', 72.601, -38.273, 264
'SUMMIT+1+2', 72.576, -38.223, 265
'SUMMIT+2+2', 72.552, -38.174, 266
'SUMMIT+3+2', 72.527, -38.124, 267
'SUMMIT-3+3', 72.691, -38.338, 275
'SUMMIT-2+3', 72.666, -38.288, 276
'SUMMIT-1+3', 72.641, -38.238, 277
'SUMMIT+0+3', 72.616, -38.189, 278
'SUMMIT+1+3', 72.591, -38.139, 279
'SUMMIT+2+3', 72.567, -38.090, 280
'SUMMIT+3+3', 72.542, -38.041, 281

NY-ALESUND, IP3 station = 368-416

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'NY-ALESUND-3-3',  79.042,   11.209, 368
'NY-ALESUND-2-3',  79.014,   11.164, 369
'NY-ALESUND-1-3',  78.986,   11.120, 370
'NY-ALESUND+0-3',  78.958,   11.075, 371
'NY-ALESUND+1-3',  78.930,   11.031, 372
'NY-ALESUND+2-3',  78.902,   10.987, 373
'NY-ALESUND+3-3',  78.874,   10.943, 374
'NY-ALESUND-3-2',  79.033,   11.356, 375
'NY-ALESUND-2-2',  79.006,   11.311, 376
'NY-ALESUND-1-2',  78.978,   11.266, 377
'NY-ALESUND+0-2',  78.950,   11.221, 378
'NY-ALESUND+1-2',  78.922,   11.177, 379
'NY-ALESUND+2-2',  78.894,   11.133, 380
'NY-ALESUND+3-2',  78.866,   11.088, 381
'NY-ALESUND-3-1',  79.025,   11.503, 382
'NY-ALESUND-2-1',  78.997,   11.458, 383
'NY-ALESUND-1-1',  78.969,   11.412, 384
'NY-ALESUND+0-1',  78.941,   11.367, 385
'NY-ALESUND+1-1',  78.913,   11.322, 386
'NY-ALESUND+2-1',  78.885,   11.278, 387
'NY-ALESUND+3-1',  78.857,   11.233, 388
'NY-ALESUND-3+0',  79.016,   11.650, 389
'NY-ALESUND-2+0',  78.988,   11.604, 390
'NY-ALESUND-1+0',  78.960,   11.558, 391
'NY-ALESUND+0+0',  78.932,   11.513, 392
'NY-ALESUND+1+0',  78.905,   11.467, 393
'NY-ALESUND+2+0',  78.877,   11.423, 394
'NY-ALESUND+3+0',  78.849,   11.378, 395
'NY-ALESUND-3+1',  79.007,   11.796, 396
'NY-ALESUND-2+1',  78.979,   11.750, 397
'NY-ALESUND-1+1',  78.952,   11.704, 398
'NY-ALESUND+0+1',  78.924,   11.658, 399
'NY-ALESUND+1+1',  78.896,   11.613, 400
'NY-ALESUND+2+1',  78.868,   11.567, 401
'NY-ALESUND+3+1',  78.840,   11.522, 402
'NY-ALESUND-3+2',  78.998,   11.942, 403
'NY-ALESUND-2+2',  78.971,   11.896, 404
'NY-ALESUND-1+2',  78.943,   11.849, 405
'NY-ALESUND+0+2',  78.915,   11.803, 406
'NY-ALESUND+1+2',  78.887,   11.757, 407
'NY-ALESUND+2+2',  78.859,   11.712, 408
'NY-ALESUND+3+2',  78.831,   11.666, 409
'NY-ALESUND-3+3',  78.989,   12.088, 410
'NY-ALESUND-2+3',  78.962,   12.041, 411
'NY-ALESUND-1+3',  78.934,   11.994, 412
'NY-ALESUND+0+3',  78.906,   11.948, 413
'NY-ALESUND+1+3',  78.878,   11.902, 414
'NY-ALESUND+2+3',  78.850,   11.856, 415
'NY-ALESUND+3+3',  78.823,   11.810, 416
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SODANKYLA, IP3 station = 515-563

'SODANKYLA-3-3', 67.474, 26.542, 515
'SODANKYLA-2-3', 67.449, 26.504, 516
'SODANKYLA-1-3', 67.424, 26.466, 517
'SODANKYLA+0-3', 67.400, 26.428, 518
'SODANKYLA+1-3', 67.375, 26.390, 519
'SODANKYLA+2-3', 67.350, 26.353, 520
'SODANKYLA+3-3', 67.326, 26.315, 521
'SODANKYLA-3-2', 67.459, 26.608, 522
'SODANKYLA-2-2', 67.434, 26.570, 523
'SODANKYLA-1-2', 67.410, 26.532, 524
'SODANKYLA+0-2', 67.385, 26.494, 525
'SODANKYLA+1-2', 67.360, 26.456, 526
'SODANKYLA+2-2', 67.336, 26.418, 527
'SODANKYLA+3-2', 67.311, 26.381, 528
'SODANKYLA-3-1', 67.444, 26.673, 529
'SODANKYLA-2-1', 67.419, 26.635, 530
'SODANKYLA-1-1', 67.395, 26.597, 531
'SODANKYLA+0-1', 67.370, 26.559, 532
'SODANKYLA+1-1', 67.345, 26.521, 533
'SODANKYLA+2-1', 67.321, 26.484, 534
'SODANKYLA+3-1', 67.296, 26.446, 535
'SODANKYLA-3+0', 67.429, 26.739, 536
'SODANKYLA-2+0', 67.404, 26.701, 537
'SODANKYLA-1+0', 67.380, 26.663, 538
'SODANKYLA+0+0', 67.355, 26.625, 539
'SODANKYLA+1+0', 67.330, 26.587, 540
'SODANKYLA+2+0', 67.306, 26.549, 541
'SODANKYLA+3+0', 67.281, 26.511, 542
'SODANKYLA-3+1', 67.414, 26.804, 543
'SODANKYLA-2+1', 67.389, 26.766, 544
'SODANKYLA-1+1', 67.365, 26.728, 545
'SODANKYLA+0+1', 67.340, 26.690, 546
'SODANKYLA+1+1', 67.316, 26.652, 547
'SODANKYLA+2+1', 67.291, 26.614, 548
'SODANKYLA+3+1', 67.266, 26.576, 549
'SODANKYLA-3+2', 67.399, 26.869, 550
'SODANKYLA-2+2', 67.374, 26.831, 551
'SODANKYLA-1+2', 67.350, 26.793, 552
'SODANKYLA+0+2', 67.325, 26.755, 553
'SODANKYLA+1+2', 67.301, 26.717, 554
'SODANKYLA+2+2', 67.276, 26.679, 555
'SODANKYLA+3+2', 67.251, 26.641, 556
'SODANKYLA-3+3', 67.384, 26.935, 557
'SODANKYLA-2+3', 67.359, 26.896, 558
'SODANKYLA-1+3', 67.335, 26.858, 559
'SODANKYLA+0+3', 67.310, 26.820, 560
'SODANKYLA+1+3', 67.286, 26.782, 561
'SODANKYLA+2+3', 67.261, 26.744, 562
'SODANKYLA+3+3', 67.236, 26.706, 563

BARANOVA, IP3 station = 466-514

'BARANOVA-3-3', 79.359, 102.270, 466
'BARANOVA-2-3', 79.368, 102.122, 467
'BARANOVA-1-3', 79.378, 101.974, 468
'BARANOVA+0-3', 79.387, 101.825, 469
'BARANOVA+1-3', 79.396, 101.677, 470
'BARANOVA+2-3', 79.404, 101.528, 471
'BARANOVA+3-3', 79.413, 101.379, 472
'BARANOVA-3-2', 79.332, 102.219, 473
'BARANOVA-2-2', 79.341, 102.072, 474
'BARANOVA-1-2', 79.350, 101.924, 475
'BARANOVA+0-2', 79.359, 101.776, 476
'BARANOVA+1-2', 79.368, 101.628, 477
'BARANOVA+2-2', 79.377, 101.479, 478
'BARANOVA+3-2', 79.385, 101.330, 479
'BARANOVA-3-1', 79.304, 102.169, 480
'BARANOVA-2-1', 79.313, 102.022, 481
'BARANOVA-1-1', 79.322, 101.874, 482
'BARANOVA+0-1', 79.331, 101.727, 483
'BARANOVA+1-1', 79.340, 101.579, 484
'BARANOVA+2-1', 79.349, 101.430, 485
'BARANOVA+3-1', 79.358, 101.282, 486
'BARANOVA-3+0', 79.276, 102.119, 487
'BARANOVA-2+0', 79.285, 101.972, 488
'BARANOVA-1+0', 79.294, 101.825, 489
'BARANOVA+0+0', 79.303, 101.677, 490
'BARANOVA+1+0', 79.312, 101.530, 491
'BARANOVA+2+0', 79.321, 101.382, 492
'BARANOVA+3+0', 79.330, 101.234, 493
'BARANOVA-3+1', 79.248, 102.069, 494
'BARANOVA-2+1', 79.257, 101.922, 495
'BARANOVA-1+1', 79.266, 101.776, 496
'BARANOVA+0+1', 79.275, 101.629, 497
'BARANOVA+1+1', 79.284, 101.481, 498
'BARANOVA+2+1', 79.293, 101.334, 499
'BARANOVA+3+1', 79.302, 101.186, 500
'BARANOVA-3+2', 79.221, 102.019, 501
'BARANOVA-2+2', 79.230, 101.873, 502
'BARANOVA-1+2', 79.239, 101.727, 503
'BARANOVA+0+2', 79.248, 101.580, 504
'BARANOVA+1+2', 79.256, 101.433, 505
'BARANOVA+2+2', 79.265, 101.286, 506
'BARANOVA+3+2', 79.274, 101.139, 507
'BARANOVA-3+3', 79.193, 101.970, 508
'BARANOVA-2+3', 79.202, 101.824, 509
'BARANOVA-1+3', 79.211, 101.678, 510
'BARANOVA+0+3', 79.220, 101.532, 511
'BARANOVA+1+3', 79.229, 101.385, 512
'BARANOVA+2+3', 79.237, 101.238, 513
'BARANOVA+3+3', 79.246, 101.091, 514

TIKSI, IP3 station = 564-612

'TIKSI-3-3', 71.587, 129.286, 564
'TIKSI-2-3', 71.607, 129.225, 565
'TIKSI-1-3', 71.628, 129.163, 566
'TIKSI+0-3', 71.649, 129.101, 567
'TIKSI+1-3', 71.670, 129.039, 568
'TIKSI+2-3', 71.691, 128.976, 569
'TIKSI+3-3', 71.711, 128.914, 570
'TIKSI-3-2', 71.567, 129.219, 571
'TIKSI-2-2', 71.587, 129.157, 572
'TIKSI-1-2', 71.608, 129.095, 573
'TIKSI+0-2', 71.629, 129.033, 574
'TIKSI+1-2', 71.650, 128.971, 575
'TIKSI+2-2', 71.670, 128.909, 576
'TIKSI+3-2', 71.691, 128.846, 577
'TIKSI-3-1', 71.547, 129.151, 578
'TIKSI-2-1', 71.567, 129.090, 579
'TIKSI-1-1', 71.588, 129.028, 580
'TIKSI+0-1', 71.609, 128.966, 581
'TIKSI+1-1', 71.630, 128.904, 582
'TIKSI+2-1', 71.650, 128.841, 583
'TIKSI+3-1', 71.671, 128.779, 584
'TIKSI-3+0', 71.527, 129.084, 585
'TIKSI-2+0', 71.547, 129.022, 586
'TIKSI-1+0', 71.568, 128.961, 587
'TIKSI+0+0', 71.589, 128.898, 588
'TIKSI+1+0', 71.609, 128.836, 589
'TIKSI+2+0', 71.630, 128.774, 590
'TIKSI+3+0', 71.651, 128.712, 591
'TIKSI-3+1', 71.507, 129.017, 592
'TIKSI-2+1', 71.527, 128.955, 593
'TIKSI-1+1', 71.548, 128.893, 594
'TIKSI+0+1', 71.569, 128.831, 595
'TIKSI+1+1', 71.589, 128.769, 596
'TIKSI+2+1', 71.610, 128.707, 597
'TIKSI+3+1', 71.631, 128.644, 598
'TIKSI-3+2', 71.486, 128.950, 599
'TIKSI-2+2', 71.507, 128.888, 600
'TIKSI-1+2', 71.528, 128.826, 601
'TIKSI+0+2', 71.548, 128.764, 602
'TIKSI+1+2', 71.569, 128.702, 603
'TIKSI+2+2', 71.590, 128.640, 604
'TIKSI+3+2', 71.610, 128.577, 605
'TIKSI-3+3', 71.466, 128.883, 606
'TIKSI-2+3', 71.487, 128.821, 607
'TIKSI-1+3', 71.508, 128.760, 608
'TIKSI+0+3', 71.528, 128.698, 609
'TIKSI+1+3', 71.549, 128.635, 610
'TIKSI+2+3', 71.569, 128.573, 611
'TIKSI+3+3', 71.590, 128.511, 612

CHERSKII, IP3 station = 417-465

'CHERSKII-3-3', 68.674, 161.650, 417
'CHERSKII-2-3', 68.703, 161.634, 418
'CHERSKII-1-3', 68.731, 161.618, 419
'CHERSKII+0-3', 68.760, 161.602, 420
'CHERSKII+1-3', 68.788, 161.586, 421
'CHERSKII+2-3', 68.817, 161.570, 422
'CHERSKII+3-3', 68.845, 161.554, 423
'CHERSKII-3-2', 68.668, 161.571, 424
'CHERSKII-2-2', 68.697, 161.555, 425
'CHERSKII-1-2', 68.725, 161.539, 426
'CHERSKII+0-2', 68.754, 161.523, 427
'CHERSKII+1-2', 68.782, 161.507, 428
'CHERSKII+2-2', 68.811, 161.490, 429
'CHERSKII+3-2', 68.840, 161.474, 430
'CHERSKII-3-1', 68.662, 161.492, 431
'CHERSKII-2-1', 68.691, 161.476, 432
'CHERSKII-1-1', 68.719, 161.460, 433
'CHERSKII+0-1', 68.748, 161.444, 434
'CHERSKII+1-1', 68.777, 161.427, 435
'CHERSKII+2-1', 68.805, 161.411, 436
'CHERSKII+3-1', 68.834, 161.395, 437
'CHERSKII-3+0', 68.656, 161.413, 438
'CHERSKII-2+0', 68.685, 161.397, 439
'CHERSKII-1+0', 68.714, 161.381, 440
'CHERSKII+0+0', 68.742, 161.365, 441
'CHERSKII+1+0', 68.771, 161.348, 442
'CHERSKII+2+0', 68.799, 161.332, 443
'CHERSKII+3+0', 68.828, 161.316, 444
'CHERSKII-3+1', 68.651, 161.335, 445
'CHERSKII-2+1', 68.679, 161.318, 446
'CHERSKII-1+1', 68.708, 161.302, 447
'CHERSKII+0+1', 68.736, 161.286, 448
'CHERSKII+1+1', 68.765, 161.269, 449
'CHERSKII+2+1', 68.793, 161.253, 450
'CHERSKII+3+1', 68.822, 161.236, 451
'CHERSKII-3+2', 68.645, 161.256, 452
'CHERSKII-2+2', 68.673, 161.240, 453
'CHERSKII-1+2', 68.702, 161.223, 454
'CHERSKII+0+2', 68.730, 161.207, 455
'CHERSKII+1+2', 68.759, 161.190, 456
'CHERSKII+2+2', 68.787, 161.174, 457
'CHERSKII+3+2', 68.816, 161.157, 458
'CHERSKII-3+3', 68.639, 161.177, 459
'CHERSKII-2+3', 68.667, 161.161, 460
'CHERSKII-1+3', 68.696, 161.144, 461
'CHERSKII+0+3', 68.724, 161.128, 462
'CHERSKII+1+3', 68.753, 161.111, 463
'CHERSKII+2+3', 68.781, 161.095, 464
'CHERSKII+3+3', 68.810, 161.078, 465