High Resolution Deterministic Land Surface Prediction System (HRDLPS)

Evaluation of the IC-3 Innovations and Final Runs

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Many thanks to the SPS 6.1 and GenPhysX developers:

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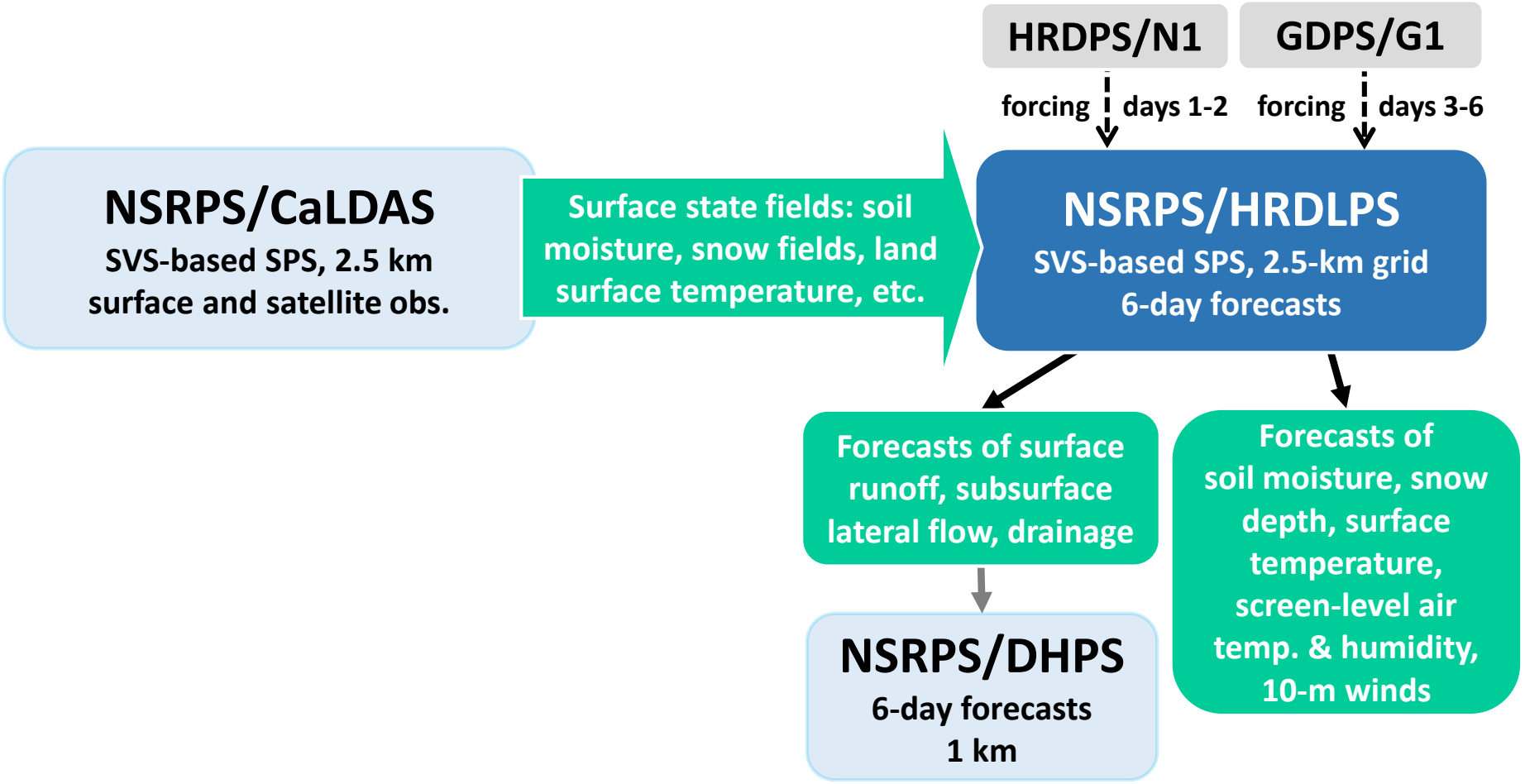
Dependencies and Downstream Systems



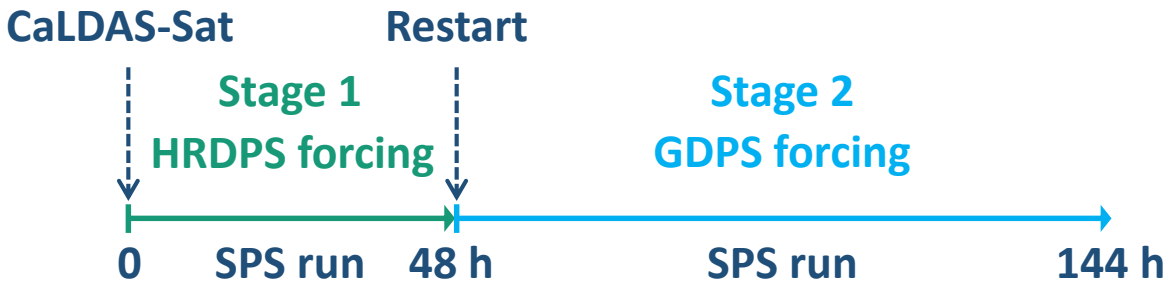
Main Motivation for Development of HRDLPS

To satisfy two important needs at CCMEP:

- **Physically-coherent high-resolution medium-range** forecasts of screen-level temperature and dewpoint, and 10-m wind
- Quality surface runoff, subsurface lateral flow and drainage necessary to drive the Deterministic Hydrological Prediction System (DHPS)

HRDLPS Currently Running in Operations

- Relies on the SVS-based SPS (Surface Prediction System), which is run on the **2.5-km National grid**
  - geophysical fields and configuration as in CaLDAS-Sat providing the initial conditions
    exceptions: diurnal SST parametrization in HRDLPS, monthly climatology of surface emissivity in CaLDAS
- SPS runs in two stages



Products

- Hourly forecasts with lead times up to 144 h of near-surface, surface and subsurface variables, such as:
  - 1.5-m temperature and dewpoint, 10-m wind
  - surface temperatures (bare ground, vegetation, snow)
  - snow depth
  - soil moisture
- Hourly hydrological fluxes that could be used to drive river routing models, such as surface runoff, subsurface lateral flow and drainage (already used in DHPS)
  - currently disseminated via the Collaboration site in netcdf format; will be migrated to Datamart-Alpha

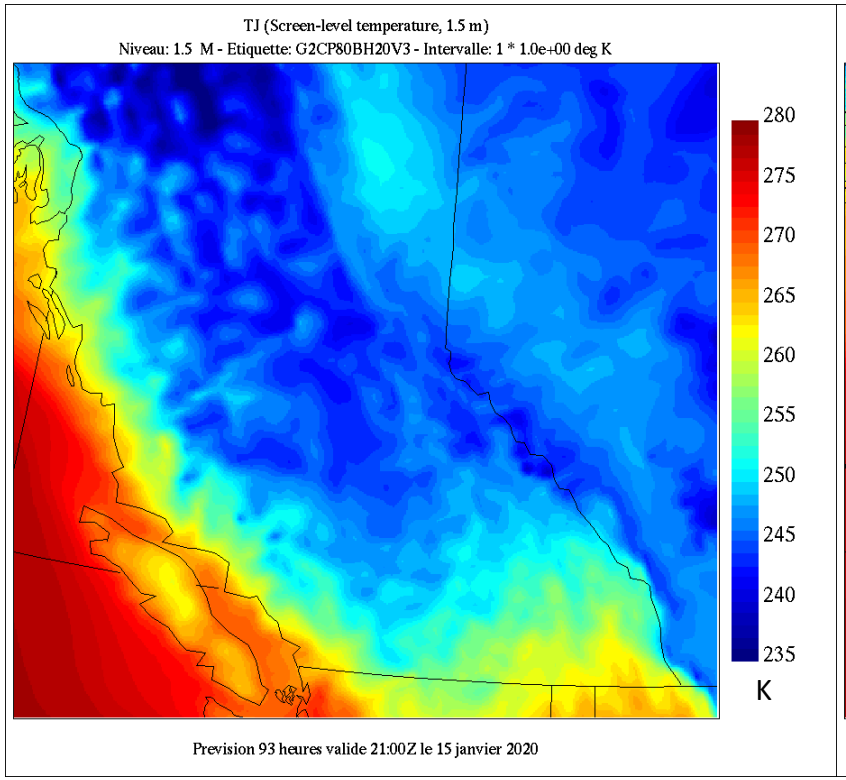
Clients

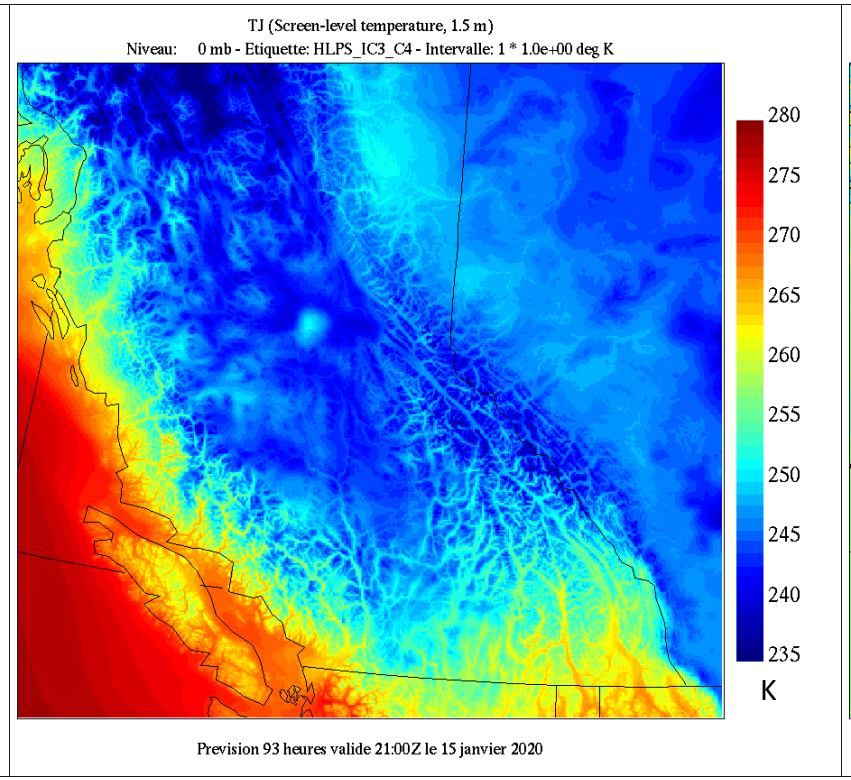
- Internal
  - Hydrological prediction systems (DHPS, SHOP soon)
  - possible: CMDW (for WEoG)
- External
  - Water Management and Monitoring Division, Government of the Northwest Territories

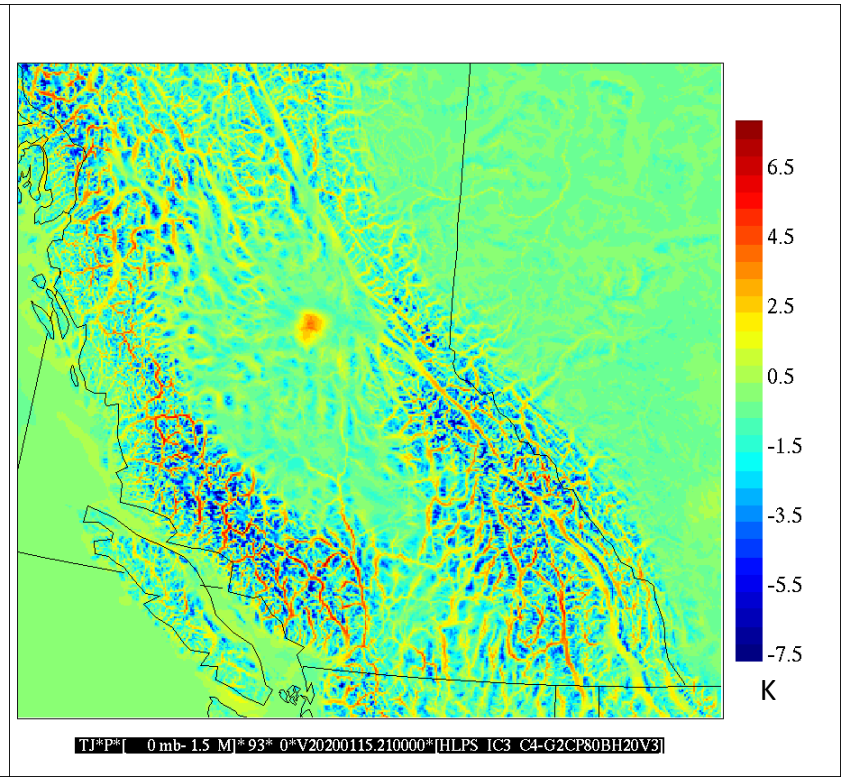
Product Example: High-Resolution Medium-Range Forecast of Screen-Level Temperature

1.5-m Temperature Simulated by GDPS IC3 and HRDLPS IC3

93-h forecasts (day 4) valid at 21:00 UTC (14:00 local time) **15 January 2020**







Coupled GDPS

- grid spacing: approx. **15 km**
- model orography is **filtered**
- field interpolated on HRDLPS grid

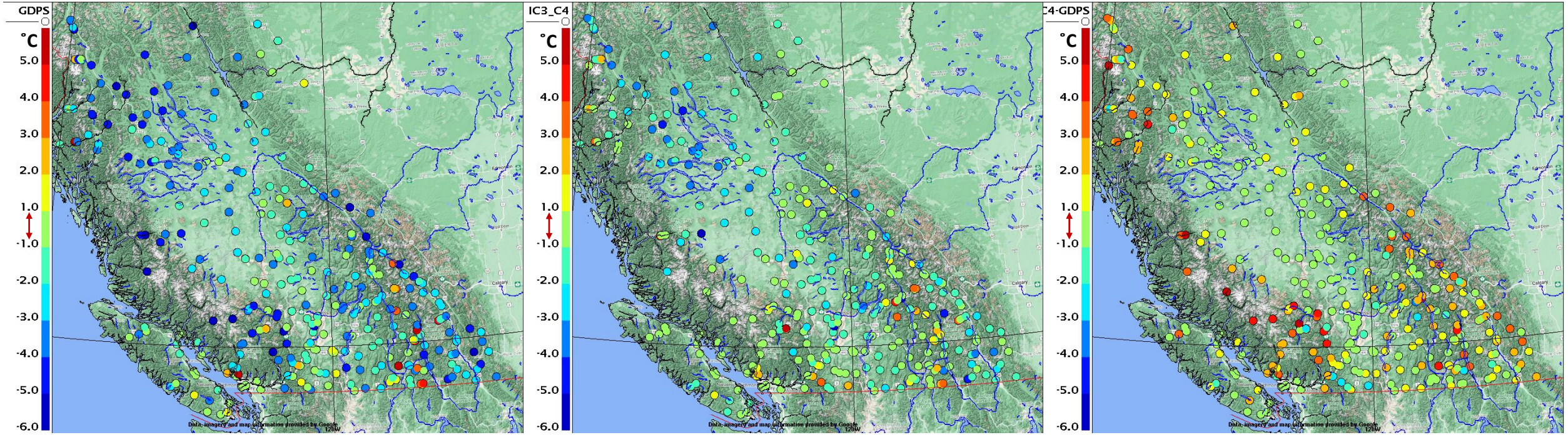
HRDLPS

- grid spacing: approx. **2.5 km**
- model orography is **unfiltered**
- **forcing for day 4 from coupled GDPS**

HRDLPS - GDPS

Product Example: High-Resolution Medium-Range Forecasts of Screen-Level Temperature (continued)

Mean Error (Bias) of **93-h Forecasts** of 1.5-m Temperature for **January-February 2020**
(00Z runs, observations from the BCTRAN and BCFOREST networks, no EMET filters)



Coupled GDPS IC3

HRDLPS IC3

- **bias is generally lower compared to that of GDPS where the orography of HRDLPS is more realistic**

Bias Difference

BD = |S2 | - | S1 |

- S1: Bias of HRDLPS forecasts
- S2: Bias of GDPS forecasts
- BD > 0 indicates HRDLPS better

Surface station networks
BCTRAN: Ministry of Transportation and Infrastructure, Government of British Columbia
BCFOREST: Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Government of British Columbia

IC3 Changes/Innovations and Experiments

	HLPS_**V120**	HLPS_IC3_**CTR**	HLPS_IC3_**C0**	HLPS_IC3_**C1**	HLPS_IC3_**C3**	HLPS_IC3_**C4**
Main reference: HRDLPS v1.2.0 (ops)	●					
Changes for IC3						
Input relative humidity calculated wrt. to water phase for subzero temps. (stage 1)		●	●	●	●	●
New surface elevation and subgrid slope			●	●	●	●
SPS 6.1 + Lmin on all surface types			●	●	●	●
Time-dependent Lmin over land (soil) + Beljaars' stability func. for stable conds.			●	●	●	●
Modified parameters for urban surface			●	●	●	●
ICs from CaLDAS w/ all innovations				●	●	●
CaLDAS w/ HREPA precipitation					●	●
Input/forcing from final cycles of NWP systems for IC-3 in all systems						●

Forcing from operational HRDPS and GDPS

Hybrid initial conditions

- Daily 00 Z runs for a 14-month period (Jul 2019 – Aug 2020); exception: Jul-Aug 2019 and Jan-Feb 2020 in HLPS_IC3_4
- Verification of screen-level temperature and dewpoint, and 10-m wind speed over Canada with EMET
  - **interpolation to nearest point**, **no filtering** based on altitude difference or land-water mask
- Indirect evaluation of hydrological fluxes done in DHPS through evaluation of streamflow forecasts

HLPS_IC3_CTR vs. HLPS_V120: Impact of Relative Humidity Fix

RMSE: 3-144 h

RMSE avg relative change (%) hlps_ic3_ctr - hlps_v120 average 3.0h - 144.0h		2019-07-04 2019-08-31 ade_synop_swob_metar	2019-09-01 2019-10-31 ade_synop_swob_metar	2019-11-01 2019-12-31 ade_synop_swob_metar	2020-01-01 2020-02-29 ade_synop_swob_metar	2020-03-01 2020-04-30 ade_synop_swob_metar	2020-05-01 2020-06-30 ade_synop_swob_metar	2020-07-01 2020-08-31 ade_synop_swob_metar
		0Z	0Z	0Z	0Z	0Z	0Z	0Z
British_Columbia_2	TD	-0.00	-0.20	-0.32	0.24	0.19	-0.04	0.00
	TT	-0.00	-0.02	-0.08	-0.05	-0.03	-0.00	-0.00
	UV	0.00	0.00	0.00	0.01	0.01	0.00	-0.00
Alberta-Saskatchewan	TD	0.00	-0.41	1.32	4.03	2.35	-0.01	0.00
	TT	0.00	-0.06	-0.12	-0.01	0.03	-0.00	0.00
	UV	-0.00	0.00	0.02	-0.03	0.00	0.00	-0.00
Canadian_Arctic_West	TD	-0.01	-0.39	2.26	4.62	5.50	0.55	-0.00
	TT	-0.00	-0.10	-0.06	0.10	0.12	0.01	-0.00
	UV	0.00	-0.01	0.10	0.08	0.04	-0.01	-0.00
Canadian_Arctic_East	TD	-0.00	0.40	4.89	7.92	7.00	1.78	-0.00
	TT	-0.00	-0.05	0.01	0.13	0.23	0.04	0.00
	UV	0.00	-0.02	-0.22	-0.14	-0.10	-0.05	0.00
Ontario-Quebec	TD	0.00	-0.00	1.91	3.51	1.35	-0.03	-0.00
	TT	-0.00	-0.01	-0.12	-0.06	0.01	-0.01	-0.00
	UV	-0.00	0.00	0.04	0.05	0.02	0.00	0.00
Maritimes	TD	-0.00	-0.01	1.73	2.02	1.18	0.00	-0.00
	TT	-0.00	-0.00	-0.06	-0.11	-0.01	-0.00	-0.00
	UV	0.00	0.00	0.02	0.05	0.01	0.00	0.00
Canada	TD	-0.00	-0.22	1.73	3.92	2.91	0.13	-0.00
	TT	-0.00	-0.04	-0.09	0.01	0.05	-0.00	-0.00
	UV	0.00	-0.00	0.02	0.02	0.01	-0.00	-0.00

- Wet bias largely reduced in the cold season in stage 1 (0-48 h)
- *Thanks to Bernard Bilodeau for pinpointing the input HR as the cause of the wet bias at subzero temps.*

HLPS_IC3_C0 vs. HLPS_IC3_CTR: Impact of Surface Model Innovations

RMSE: 3-144 h

RMSE avg relative change (%) hlps_ic3_c0 - hlps_ic3_ctr average 3.0h - 144.0h		2019-07-04 2019-08-31 ade_synop_swob_metar	2019-09-01 2019-10-31 ade_synop_swob_metar	2019-11-01 2019-12-31 ade_synop_swob_metar	2020-01-01 2020-02-29 ade_synop_swob_metar	2020-03-01 2020-04-30 ade_synop_swob_metar	2020-05-01 2020-06-30 ade_synop_swob_metar	2020-07-01 2020-08-31 ade_synop_swob_metar
		0Z	0Z	0Z	0Z	0Z	0Z	0Z
British_Columbia_2	TD	-0.28	6.00	12.76	5.87	2.82	1.68	-0.48
	TT	0.58	10.78	15.79	10.02	9.58	5.00	-0.27
	UV	-3.69	-2.02	-1.80	-1.52	-2.26	-2.95	-3.14
Alberta-Saskatchewan	TD	-0.59	1.65	1.46	0.92	0.42	-0.23	-0.48
	TT	-0.32	3.13	2.82	2.48	0.81	-0.86	-0.34
	UV	-2.14	-1.13	-1.32	-1.06	-1.30	-1.62	-1.73
Canadian_Arctic_West	TD	-1.48	1.87	0.80	-0.64	-0.77	-0.81	-1.19
	TT	0.30	4.46	2.88	1.37	1.12	1.26	-0.08
	UV	-1.65	-1.21	-1.17	-1.33	-1.47	-1.66	-1.77
Canadian_Arctic_East	TD	-1.91	0.79	0.98	0.96	-0.19	0.18	-1.62
	TT	-1.68	0.95	2.18	2.36	0.19	1.18	-1.24
	UV	-1.01	-0.49	-0.48	-0.45	-0.47	-0.83	-1.15
Ontario-Quebec	TD	-0.39	-0.61	1.64	1.28	0.50	-0.29	-0.41
	TT	0.44	0.58	3.64	2.57	2.31	1.32	0.29
	UV	-0.13	-0.23	-0.42	-0.36	-0.41	-0.22	-0.34
Maritimes	TD	-0.03	-0.87	0.53	1.87	1.14	0.22	-0.03
	TT	-0.08	-1.07	1.25	3.28	1.68	0.08	-0.22
	UV	-0.62	-0.54	-0.50	-0.47	-0.58	-0.53	-0.58
Canada	TD	-0.68	1.82	3.08	1.40	0.60	0.15	-0.66
	TT	0.18	3.87	5.07	3.32	2.45	1.06	-0.23
	UV	-1.62	-1.02	-1.06	-0.98	-1.15	-1.37	-1.50

- Large net positive impact of lower limit imposed on Obukhov length > 0, except in summer (sl_lmin_soil reduced to 1 m)
- Large reduction of nocturnal cold bias over urban areas in summer (result of reduced thermal coeff. of urban class in SVS)
- Removal of artificial minimum wind speed in SPS 6.1 had a negative effect on the wind scores
- *Details on impact of individual model changes can be found in this presentation (IC3 Workshop, Oct 27, 2020)*

HLPS_IC3_C1 vs. HLPS_IC3_C0

Impact of ICs from CaLDAS-Sat Cycles with All of Its Innovations (Hybrid ICs Dropped)

RMSE: 3-144 h

RMSE avg relative change (%) hlps_ic3_c1 - hlps_ic3_c0 average 3.0h - 144.0h		2019-07-04 2019-08-31 ade_synop_swob_metar	2019-09-01 2019-10-31 ade_synop_swob_metar	2019-11-01 2019-12-31 ade_synop_swob_metar	2020-01-01 2020-02-29 ade_synop_swob_metar	2020-03-01 2020-04-30 ade_synop_swob_metar	2020-05-01 2020-06-30 ade_synop_swob_metar	2020-07-01 2020-08-31 ade_synop_swob_metar
		0Z	0Z	0Z	0Z	0Z	0Z	0Z
British_Columbia_2	TD	0.22	-0.07	0.07	0.18	-0.02	0.07	0.11
	TT	0.13	-0.03	-0.17	-0.10	-0.05	0.18	0.28
	UV	-0.06	-0.12	-0.11	-0.08	-0.10	-0.07	-0.04
Alberta-Saskatchewan	TD	-0.03	-0.58	0.03	-0.11	-1.21	-0.86	1.13
	TT	0.72	-0.14	-0.16	0.15	0.37	2.09	1.83
	UV	0.05	-0.06	-0.07	-0.14	-0.13	-0.17	0.28
Canadian_Arctic_West	TD	0.10	-0.10	-0.21	-0.17	0.17	-0.07	-0.02
	TT	-0.27	-0.00	-0.27	-0.22	0.06	-0.03	0.20
	UV	-0.00	-0.02	-0.07	-0.09	-0.05	0.00	0.01
Canadian_Arctic_East	TD	-0.18	-0.03	-0.28	-0.15	0.02	-0.11	0.47
	TT	0.30	-0.01	-0.24	-0.12	0.25	0.35	0.56
	UV	-0.02	-0.01	0.01	0.09	-0.04	-0.14	0.03
Ontario-Quebec	TD	0.04	0.02	-0.02	0.06	0.03	0.02	-0.02
	TT	-0.15	-0.08	0.06	0.09	-0.03	0.08	-0.05
	UV	-0.08	-0.03	0.02	0.06	0.02	0.02	-0.02
Maritimes	TD	0.07	0.06	-0.01	0.15	0.07	0.04	0.12
	TT	0.12	-0.01	-0.01	0.19	-0.11	0.21	0.06
	UV	-0.01	-0.02	-0.02	-0.00	0.01	-0.00	-0.00
Canada	TD	0.04	-0.35	-0.04	-0.04	-0.42	-0.39	0.44
	TT	0.23	-0.09	-0.15	0.03	0.14	0.73	0.75
	UV	-0.03	-0.06	-0.05	-0.05	-0.06	-0.08	0.07

- Largest impact in the Prairies (Alberta-Saskatchewan evaluation domain)
  - important improvement in RMSE for temperature in May-Aug and dewpoint in Jul-Aug 2020
  - RMSE of dewpoint degraded in the transition seasons

HLPS_IC3_C3 vs. HLPS_IC3_C1

Impact of ICs from CaLDAS-Sat with All of Its Innovations + HREPA Precipitation

RMSE: 3-144 h

RMSE avg relative change (%) hlps_ic3_c3 - hlps_ic3_c1 average 3.0h - 144.0h		2019-07-01 2019-08-31 ade_synop_swob_metar	2019-09-01 2019-10-31 ade_synop_swob_metar	2019-11-01 2019-12-31 ade_synop_swob_metar	2020-01-01 2020-02-29 ade_synop_swob_metar	2020-03-01 2020-04-30 ade_synop_swob_metar	2020-05-01 2020-06-30 ade_synop_swob_metar	2020-07-01 2020-08-31 ade_synop_swob_metar
		0Z	0Z	0Z	0Z	0Z	0Z	0Z
British_Columbia_2	TD	0.10	0.09	-0.03	-0.00	-0.04	0.01	-0.03
	TT	0.04	0.00	-0.03	0.02	-0.02	-0.01	0.01
	UV	0.00	0.01	-0.00	0.00	-0.00	-0.00	-0.00
Alberta-Saskatchewan	TD	0.10	0.11	-0.02	-0.01	0.15	0.04	-0.00
	TT	-0.04	0.01	0.01	0.02	0.03	-0.13	-0.11
	UV	0.01	0.02	0.03	0.06	0.02	0.02	-0.01
Canadian_Arctic_West	TD	0.03	-0.00	-0.03	-0.02	0.03	0.03	-0.03
	TT	-0.08	-0.02	-0.05	-0.02	0.07	0.09	0.00
	UV	-0.02	-0.01	0.02	0.00	-0.02	-0.01	-0.00
Canadian_Arctic_East	TD	-0.11	-0.00	-0.01	0.00	0.06	-0.00	0.02
	TT	-0.05	-0.00	-0.01	0.00	0.07	0.06	0.01
	UV	-0.00	0.01	-0.00	-0.01	-0.01	-0.03	-0.00
Ontario-Quebec	TD	0.04	-0.00	-0.01	-0.00	0.02	-0.01	0.04
	TT	-0.05	0.02	0.00	0.01	-0.00	-0.05	-0.06
	UV	-0.05	-0.01	0.00	-0.00	0.00	-0.03	-0.04
Maritimes	TD	0.03	0.01	0.00	-0.01	0.02	-0.01	-0.00
	TT	0.00	0.02	-0.00	-0.03	-0.06	-0.01	0.01
	UV	-0.01	0.00	-0.00	-0.01	-0.00	-0.00	-0.01
Canada	TD	0.07	0.08	-0.02	-0.01	0.06	0.02	-0.00
	TT	-0.03	0.01	-0.01	0.01	0.02	-0.03	-0.04
	UV	-0.01	0.00	0.01	0.01	0.00	-0.00	-0.01

- Negligible impact in terms of RMSE

V120 -> CTR -> C0 -> C1 -> **C3**

HLPS_IC3_C3 vs. HLPS_V120

Impact of All Innovations, Except for IC3 Forcing

RMSE: 3-144 h

RMSE avg relative change (%) hlps_ic3_c3 - hlps_v120 average 3.0h - 144.0h		2019-07-04 2019-08-31 ade_synop_swob_metar	2019-09-01 2019-10-31 ade_synop_swob_metar	2019-11-01 2019-12-31 ade_synop_swob_metar	2020-01-01 2020-02-29 ade_synop_swob_metar	2020-03-01 2020-04-30 ade_synop_swob_metar	2020-05-01 2020-06-30 ade_synop_swob_metar	2020-07-01 2020-08-31 ade_synop_swob_metar
		0Z	0Z	0Z	0Z	0Z	0Z	0Z
British_Columbia_2	TD	0.06	5.84	12.51	6.27	2.94	1.72	-0.41
	TT	0.76	10.74	15.54	9.90	9.49	5.16	0.02
	UV	-3.76	-2.13	-1.91	-1.59	-2.35	-3.02	-3.19
Alberta-Saskatchewan	TD	-0.52	0.79	2.79	4.87	1.76	-0.99	0.65
	TT	0.36	2.92	2.55	2.64	1.24	1.13	1.38
	UV	-2.07	-1.18	-1.34	-1.18	-1.40	-1.77	-1.45
Canadian_Arctic_West	TD	-1.35	1.39	2.93	3.98	4.98	-0.29	-1.24
	TT	-0.06	4.34	2.51	1.24	1.38	1.33	0.12
	UV	-1.67	-1.24	-1.12	-1.34	-1.50	-1.67	-1.76
Canadian_Arctic_East	TD	-2.22	1.15	5.60	8.73	6.94	1.85	-1.13
	TT	-1.43	0.89	1.95	2.37	0.75	1.62	-0.65
	UV	-1.03	-0.52	-0.69	-0.52	-0.63	-1.06	-1.12
Ontario-Quebec	TD	-0.30	-0.60	3.49	4.76	1.88	-0.31	-0.39
	TT	0.23	0.51	3.58	2.60	2.28	1.34	0.19
	UV	-0.26	-0.27	-0.36	-0.26	-0.37	-0.23	-0.39
Maritimes	TD	0.06	-0.81	2.24	3.97	2.39	0.25	0.08
	TT	0.04	-1.06	1.18	3.32	1.49	0.28	-0.16
	UV	-0.64	-0.56	-0.51	-0.44	-0.56	-0.53	-0.59
Canada	TD	-0.56	1.33	4.74	5.26	3.16	-0.07	-0.22
	TT	0.38	3.73	4.84	3.36	2.64	1.75	0.48
	UV	-1.65	-1.08	-1.07	-0.99	-1.19	-1.45	-1.43

- Largest improvements in winter and the transition seasons, especially in BC

V120 -> CTR -> C0 -> C1 -> **C3 -> C4**

V120 -> CTR -> C0 -> C1 -> C3 -> **C4**

HLPS_IC3_C4 vs. HLPS_IC3_C3
Impact of IC3 Forcing in All Systems

RMSE avg relative change (%) hlps_ic3_c4 - hlps_ic3_c3 average 3.0h - 144.0h		2019-07-01 2019-08-31 ade_synop_swob_metar 0Z	2020-01-01 2020-02-29 ade_synop_swob_metar 0Z
British_Columbia_2	TD	-0.23	3.22
	TT	0.45	0.73
	UV	0.49	1.72
Alberta-Saskatchewan	TD	4.37	1.65
	TT	3.68	1.67
	UV	1.80	0.18
Canadian_Arctic_West	TD	1.87	1.84
	TT	3.23	2.16
	UV	2.51	1.08
Canadian_Arctic_East	TD	-1.29	0.10
	TT	-0.26	-0.88
	UV	-0.26	-0.60
Ontario-Quebec	TD	1.11	1.08
	TT	1.63	1.13
	UV	0.45	-0.25
Maritimes	TD	2.46	1.85
	TT	2.40	0.66
	UV	0.54	2.68
Canada	TD	2.19	1.93
	TT	2.06	1.54
	UV	1.13	1.27

HLPS_IC3_C4 (proposed) vs. HLPS_V120 (ops.)
Impact of all IC3 innovations

RMSE avg relative change (%) hlps_ic3_c4 - hlps_v120 average 3.0h - 144.0h		2019-07-04 2019-08-31 ade_synop_swob_metar 0Z	2020-01-01 2020-02-29 ade_synop_swob_metar 0Z
British_Columbia_2	TD	-0.40	9.37
	TT	1.18	10.71
	UV	-3.18	0.15
Alberta-Saskatchewan	TD	4.10	6.36
	TT	4.46	4.29
	UV	-0.05	-1.00
Canadian_Arctic_West	TD	0.80	5.74
	TT	3.38	3.39
	UV	1.03	-0.24
Canadian_Arctic_East	TD	-3.64	8.76
	TT	-2.06	1.53
	UV	-1.43	-1.13
Ontario-Quebec	TD	0.50	5.77
	TT	1.96	3.69
	UV	0.07	-0.50
Maritimes	TD	2.06	5.82
	TT	2.01	3.96
	UV	-0.30	2.26
Canada	TD	1.62	7.05
	TT	2.56	4.88
	UV	-0.50	0.28

- Important improvements in all regions, but the Eastern Arctic

Comparison with the Systems Providing the Forcing

HLPS_IC3_C4 vs. HRDPS IC3 (3-48 h)

RMSE avg relative change (%) hlps_ic3_c4 - hrdps_ic3 average 3.0h - 48.0h		2019-07-01 2019-08-31 ade_synop_swob_metar	2020-01-01 2020-02-29 ade_synop_swob_metar
		0Z	0Z
British_Columbia_2	TD	-2.31	10.52
	TT	1.10	1.54
	UV	1.17	1.15
Alberta-Saskatchewan	TD	2.92	3.90
	TT	2.77	1.72
	UV	1.35	1.12
Canadian_Arctic_West	TD	-0.22	-6.61
	TT	6.27	-5.22
	UV	0.41	-0.89
Canadian_Arctic_East	TD	3.90	-0.06
	TT	-0.44	-0.76
	UV	-0.05	0.16
Ontario-Quebec	TD	2.73	3.19
	TT	1.80	1.72
	UV	1.84	2.52
Maritimes	TD	1.77	6.35
	TT	6.04	4.65
	UV	3.67	3.90
Canada	TD	1.43	2.30
	TT	2.11	0.14
	UV	1.47	1.25

HLPS_IC3_C4 vs. GDPS IC3 (51-144 h)

RMSE avg relative change (%) hlps_ic3_c4 - gdps_ic3 average 51.0h - 144.0h		2019-07-01 2019-08-31 ade_synop_swob_metar	2020-01-01 2020-02-29 ade_synop_swob_metar
		0Z	0Z
British_Columbia_2	TD	9.94	15.62
	TT	14.47	15.80
	UV	0.55	-1.01
Alberta-Saskatchewan	TD	3.32	1.30
	TT	2.89	1.39
	UV	3.32	0.84
Canadian_Arctic_West	TD	1.98	-0.92
	TT	8.01	-0.03
	UV	2.72	-1.72
Canadian_Arctic_East	TD	5.84	1.11
	TT	4.78	1.56
	UV	1.60	-0.46
Ontario-Quebec	TD	3.23	1.48
	TT	4.99	2.21
	UV	4.12	3.41
Maritimes	TD	2.11	1.25
	TT	6.82	2.68
	UV	6.17	7.92
Canada	TD	4.06	2.74
	TT	6.71	3.36
	UV	3.47	2.03

- HRDLPS better overall than both HRDPS and GDPS for the first time

Conclusion

The IC3 innovations have an important net positive impact on the performance of HRDLPS, based on the EMET scores for the screen-level temperature and dewpoint forecasts

Links to EMET Scores

- HLPS_IC3_CTR vs. HLPS_V120: http://emet-dev.science.gc.ca/emet/dde000/6-50-19493.disp
- HLPS_IC3_C0 vs HLPS_IC3_CTR: http://emet-dev.science.gc.ca/emet/dde000/6-52-383.disp
- HLPS_IC3_C1 vs HLPS_IC3_0: http://emet-dev.science.gc.ca/emet/dde000/6-53-2.disp
- HLPS_IC3_C3 vs HLPS_IC3_1: http://emet-dev.science.gc.ca/emet/dde000/6-54-2.disp
- HLPS_IC3_C3 vs HLPS_V120: http://emet-dev.science.gc.ca/emet/dde000/6-56-250.disp
- HLPS_IC3_C4 vs HLPS_IC3_3: http://emet-dev.science.gc.ca/emet/dde000/6-49-12166.disp
- HLPS_IC3_C4 vs HLPS_V120: http://emet-dev.science.gc.ca/emet/dde000/6-55-186.disp
- HLPS_IC3_C4 vs HRDPS IC3: http://emet-dev.science.gc.ca/emet/dde000/6-48-4241.disp
- HLPS_IC3_C4 vs GDPS IC3: http://emet-dev.science.gc.ca/emet/dde000/6-47-3412.disp