

PA1-P3v5

Comparison with P3v3 for summer and winter 2022

GEM5.2.0-rc3

Melissa Cholette, PA group

V5 includes minor bugfixes

- | | |
|---|--|
| 1. Added the detrainment of Nc because cloud is 2-moment | 8. Use of .ge. instead of .gt. in sedimentation for consistency) |
| 2. Use of gz_mom instead of gz_therm for sedimentation | 9. Precompute Firim, Filiq before updating variables since they are assumed constant |
| 3. Proper limits to vapor transfer mass terms | 10. Fixed function instead of T/th (because of T is not updated only th) |
| 4. Change in wet growth equation | 11. Update Nr for the complete melting of very small amounts |
| 5. Criteria for cloud autoconversion (only with cloud fraction) | 12. Missing *rho for ze_rain (only diagnostic) |
| 6. Conservation of water vapor sources/sinks | 13. Missing *iSCF for ice self-collection (only with cloud fraction) |
| 7. Conservation of Nx terms | 14. 4 bugfixes only with nCat>1 (only with nCat > 1) |



Changes compared to v3

New physics options in `gem_settings.nml`:

- `P3_trplmomi` = .false. (or .true.)
- `P3_liqfrac` = .false. (or .true.)

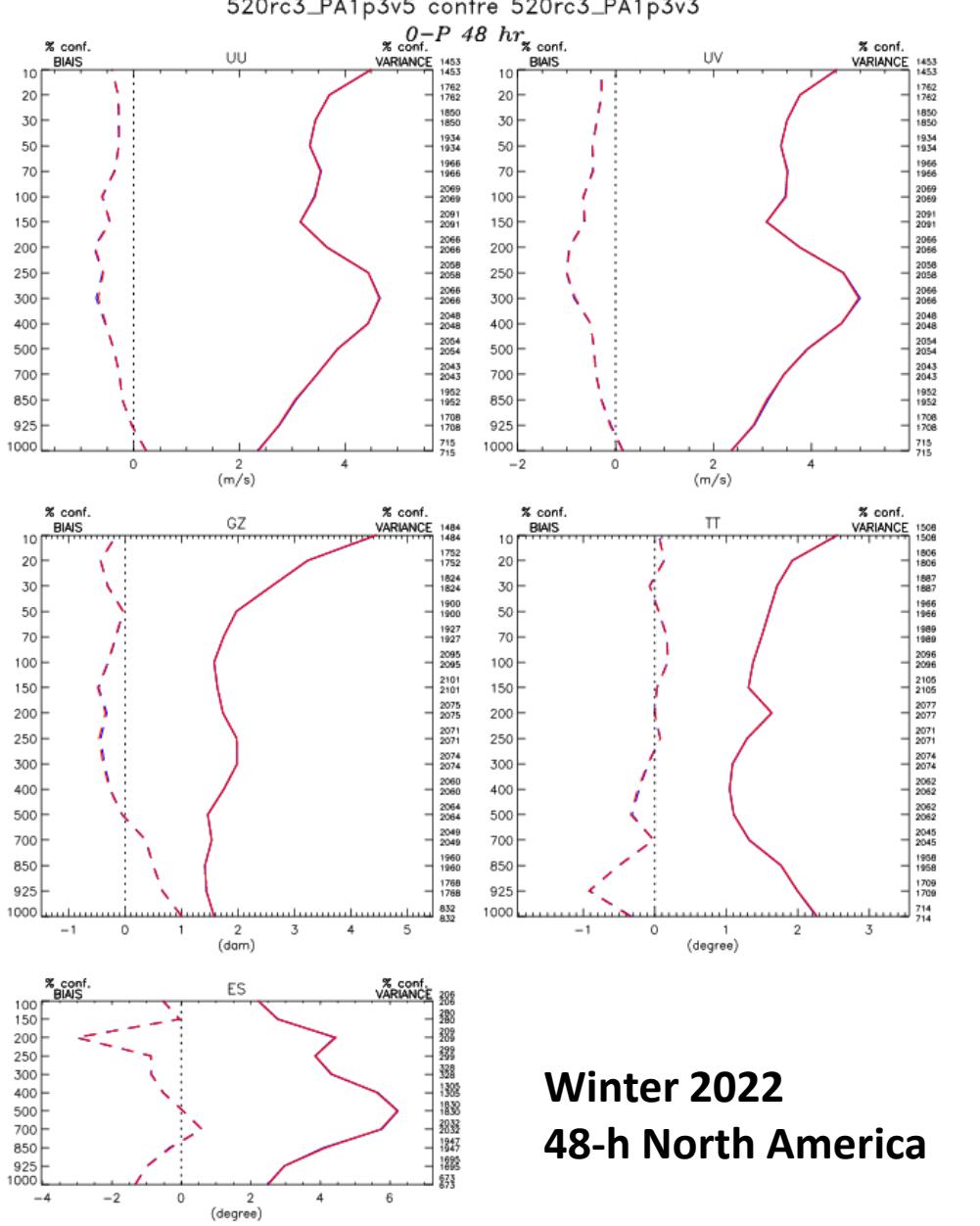
Note: the code is not optimized yet with `P3_trplmomi` and `P3_liqfrac` set to true. This will come in the next versions.

Changes the results

Does not change the results much

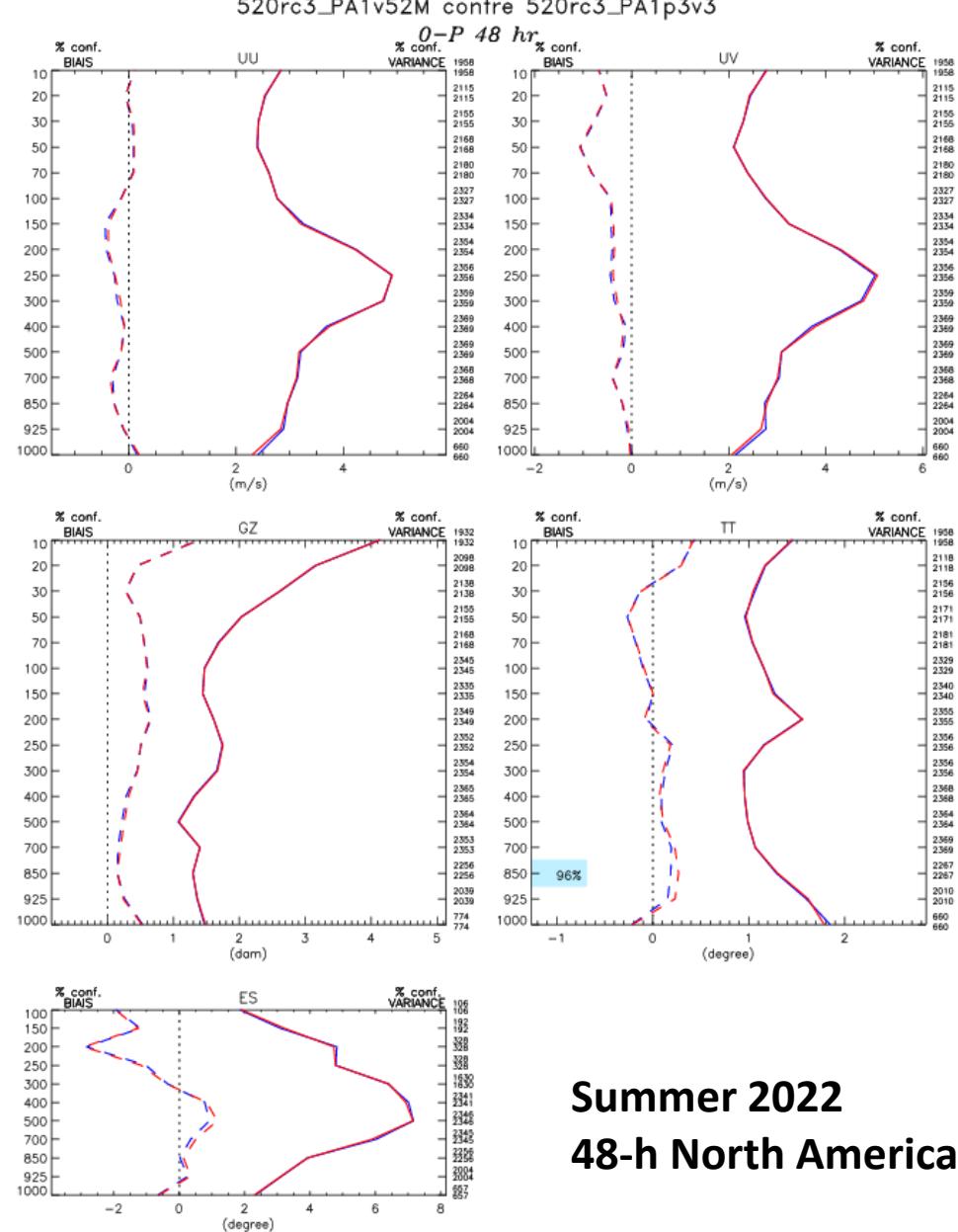
Not tested yet

- A. Shape parameter for $\mu_r = 1$ instead of 0 (include a bugfix in LT1) → improve convective core reflectivity
- B. No more conditions on supersaturation and ice effective diameter to determine binary cloud fraction (with `p3_scpf = .false. only`) → this increase LWC in the low level, PR and cloud coverage
- C. New shape parameter for 2-moment ice based on 3-moment results → helps with the convective cases and increases PR.
- D. Allowing sublimation/deposition at $T > 0^\circ\text{C}$, this cools the low levels, which helps with the warm bias in summer (HRDPS).
- E. New algorithm for precipitation types based on liquid fraction. With `p3_liqfrac=.false.,` the algo is also improved for PE1 (ice pellets) and PE2 (hail) (diagnostic impact only).
- F. Use a combined Goff-Graffch and Flatau formula for es (internal to P3) instead of only Flatau. Does not change the solution because we now use GEM tdpack for the computation of es in all P3 versions.
- G. Constant latent heat instead of T-dependant, this should be revisited in the future.
- H. Densification (riming) during melting (when `P3_liqfrac = .false. only`). Not tested by me, but physical.

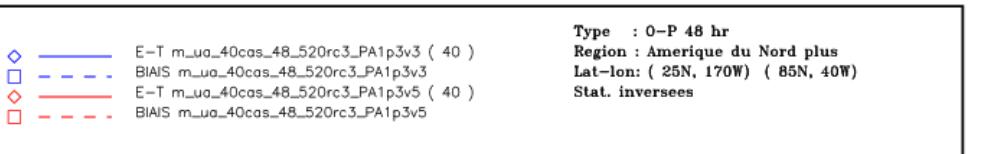


**Winter 2022
48-h North America**

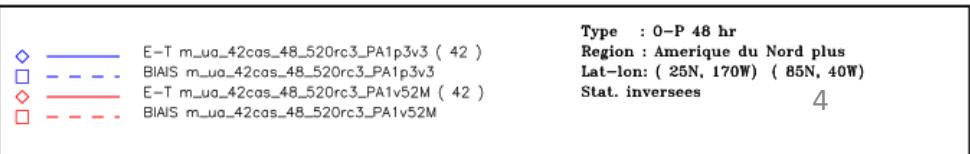
Arcad mostly
neutral, except for
the warm bias in the
low levels during
summer
→ combination of
changes A, B, C and
bugfix 1



**Summer 2022
48-h North America**



P3v3
P3v5



Summer 2022

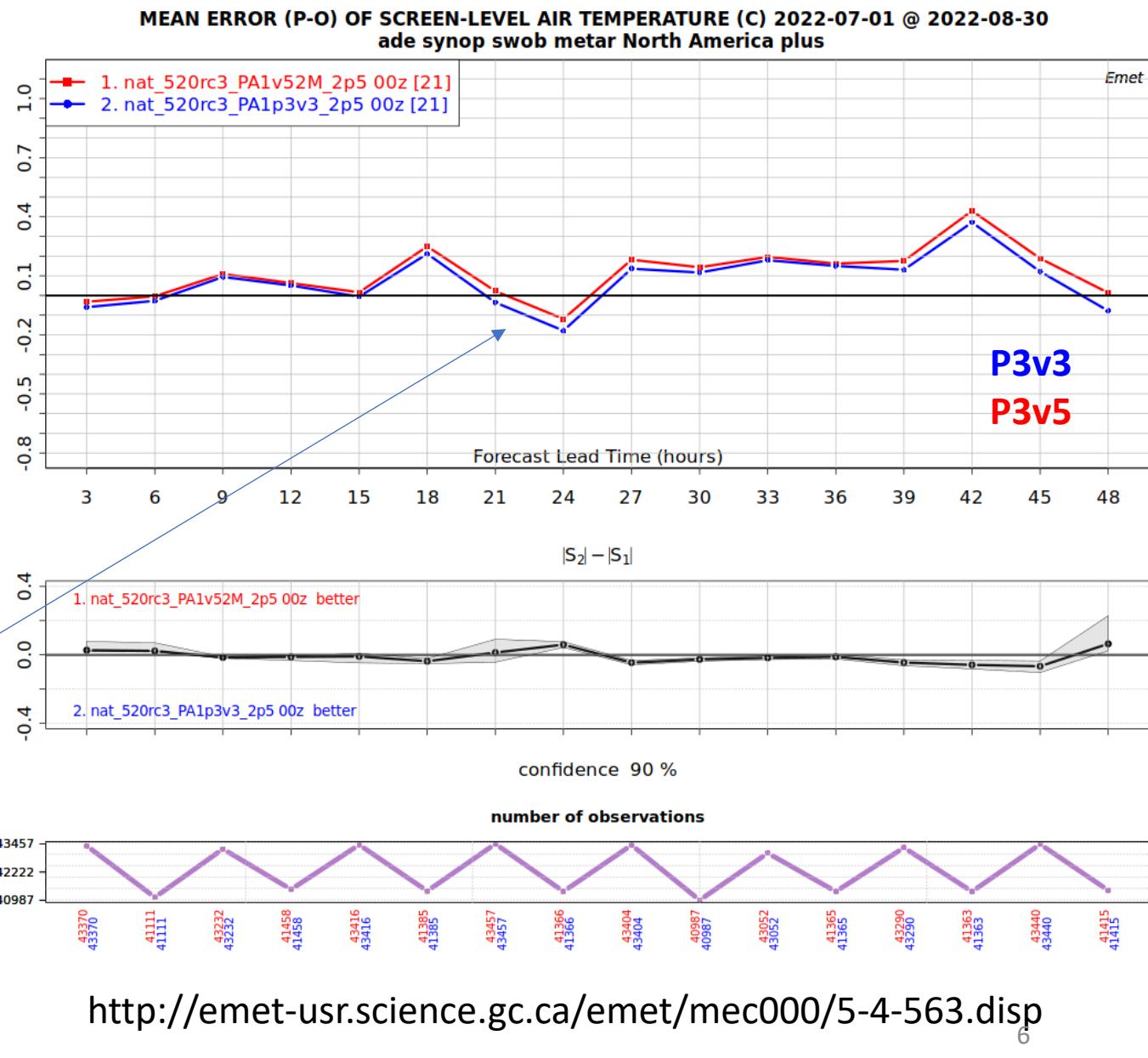
RMSE

STDEV

BIAS

Temperature bias (North America)

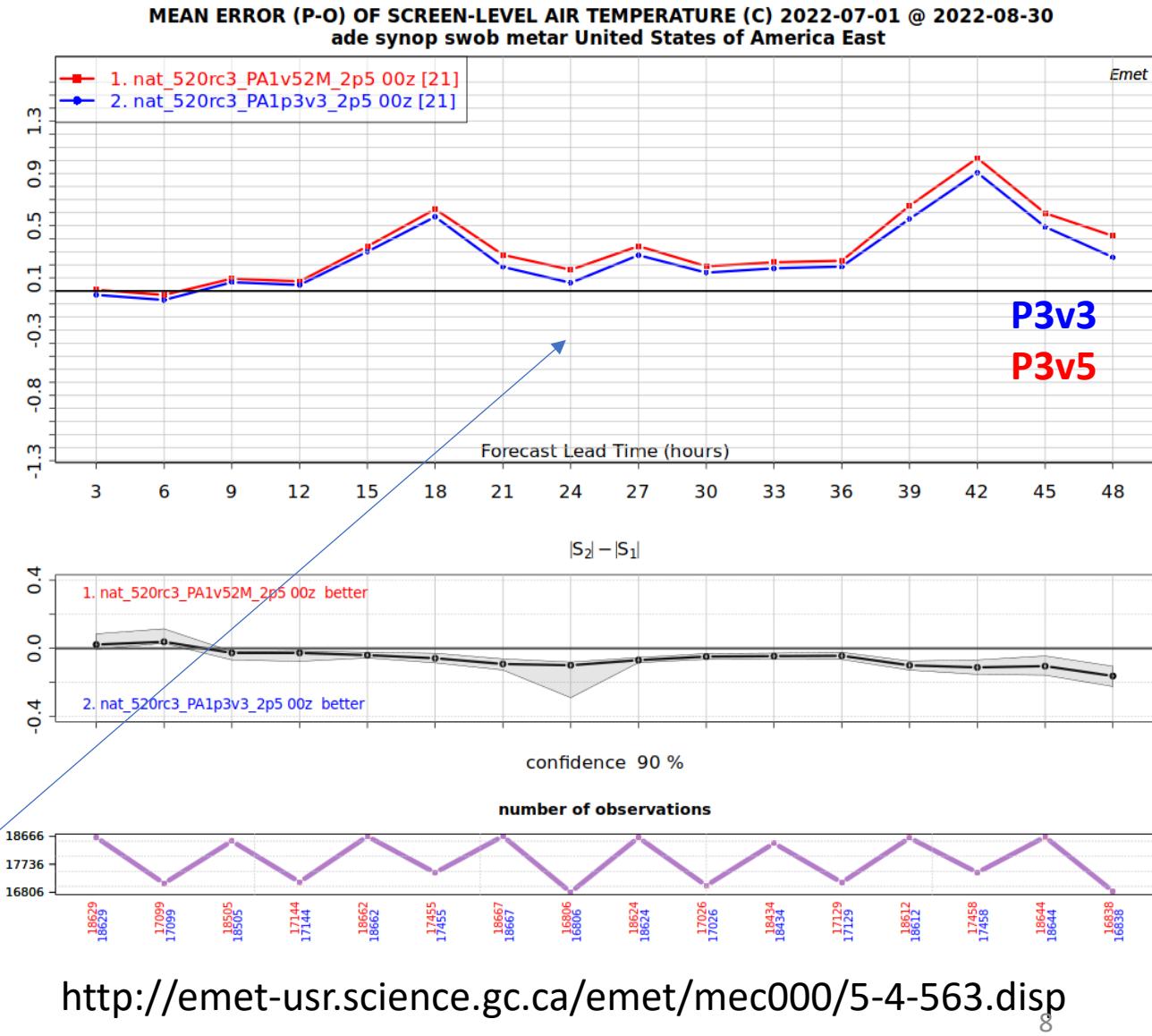
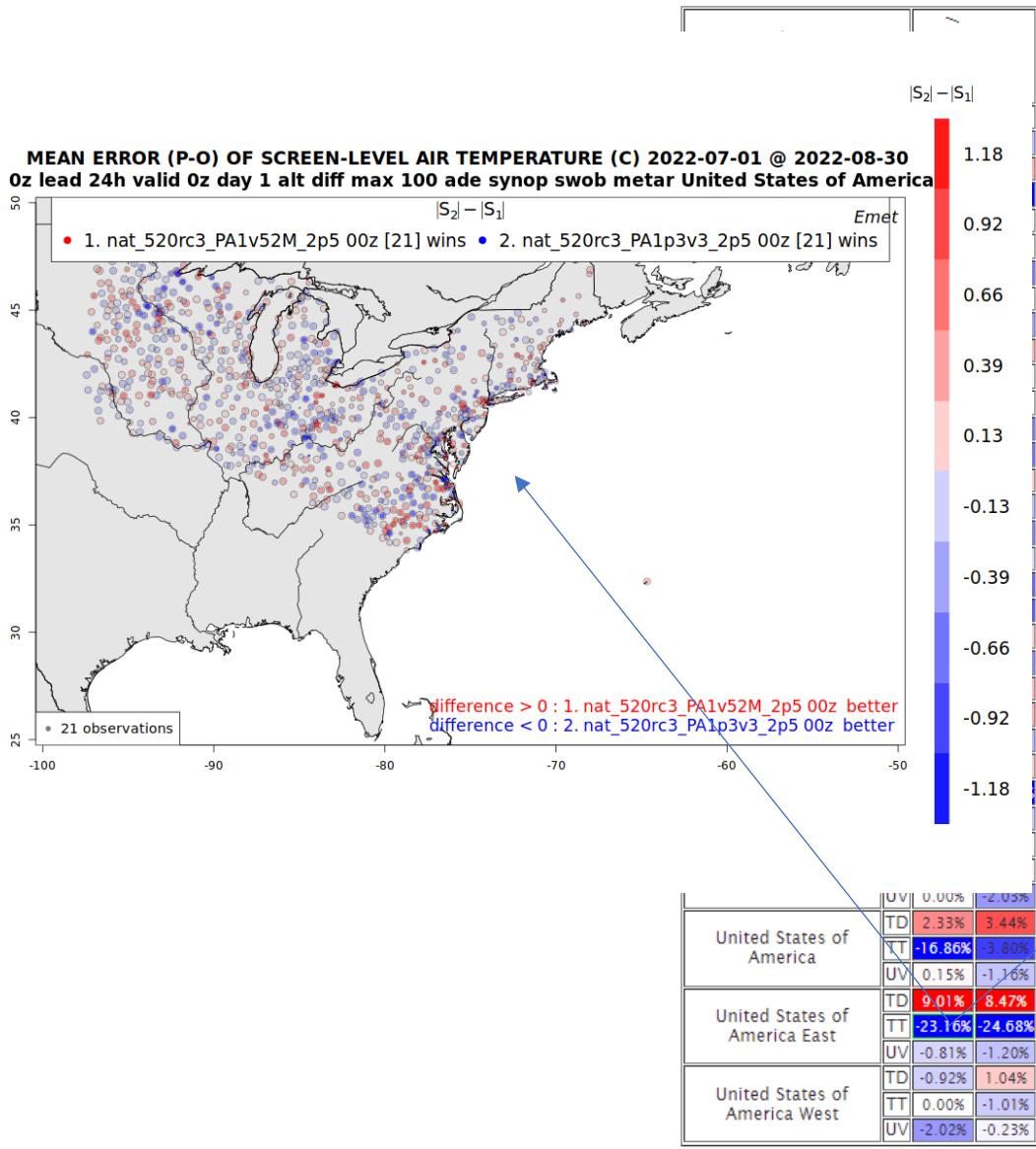
	rmse	stdev	bias
	nat_520rc3_PA1v52M_2p5 / nat_520rc3_PA1p3v3_2p5	nat_520rc3_PA1v52M_2p5 / nat_520rc3_PA1p3v3_2p5	nat_520rc3_PA1v52M_2p5 / nat_520rc3_PA1p3v3_2p5
	00z 12z	00z 12z	00z 12z
Alaska	TD 0.00% -0.21% TT 0.34% 0.14% UV 0.67% 0.20%	TD 0.00% -0.08% TT 0.04% 0.07% UV 0.57% 0.20%	TD -1.82% -1.35% TT 3.62% 1.60% UV 5.28% -5.05%
Alberta-Saskatchewan	TD -0.20% -0.20% TT -0.36% 0.00% UV 0.25% -0.21%	TD 0.00% -0.26% TT 0.36% 0.00% UV 0.34% -0.20%	TD 0.00% -0.15% TT -1.82% 0.00% UV 0.00% -2.54%
British Columbia	TD 0.00% 0.00% TT -0.21% -0.09% UV 0.20% -0.04%	TD 0.00% 0.00% TT -0.16% -0.06% UV 0.26% -0.04%	TD 6.29% 0.00% TT -2.22% -1.84% UV -5.34% 1.45%
British Columbia 2	TD -0.10% -0.17% TT 0.02% 0.00% UV 0.24% 0.01%	TD -0.24% 0.00% TT 0.02% 0.00% UV 0.24% 0.02%	TD 4.33% 0.23% TT -1.65% 0.00% UV -2.54% -2.40%
Canada	TD -0.17% -0.15% TT -0.24% 0.00% UV 0.36% 0.07%	TD -0.17% -0.12% TT -0.30% 0.00% UV 0.35% 0.11%	TD -0.46% -2.72% TT 7.40% 1.03% UV 0.00% -1.37%
Canadian Arctic	TD -0.04% 0.00% TT -0.11% 0.15% UV 0.00% 0.10%	TD 0.03% 0.00% TT -0.11% 0.09% UV 0.00% 0.11%	TD -2.60% -2.43% TT 0.46% -0.72% UV -1.01% -3.01%
Maritimes	TD -0.42% -0.19% TT -0.18% 0.00% UV 0.00% 0.09%	TD -0.39% -0.07% TT -0.30% 0.16% UV 0.00% 0.07%	TD -3.52% -3.28% TT 2.20% 0.93% UV -0.88% -2.29%
North America plus	TD -0.34% -0.08% TT -0.33% 0.38% UV 0.30% 0.19%	TD -0.39% -0.10% TT -0.30% 0.36% UV 0.30% 0.26%	TD 1.15% 1.37% TT -7.75% 1.69% UV 0.84% -1.42%
Ontario-Quebec	TD -0.18% -0.22% TT -0.60% 0.00% UV 0.18% 0.11%	TD -0.27% -0.29% TT -0.47% 0.25% UV 0.23% 0.17%	TD 1.05% 1.08% TT -22.10% -27.35% UV 1.38% -1.15%
Prairies	TD -0.33% -0.26% TT -0.36% 0.00% UV 0.11% -0.09%	TD -0.18% -0.21% TT -0.25% 0.00% UV 0.23% -0.02%	TD -1.40% 0.16% TT -3.58% 0.30% UV 0.00% -2.03%
United States of America	TD -0.30% 0.00% TT -0.48% 0.82% UV 0.21% 0.32%	TD -0.48% -0.14% TT -0.35% 0.83% UV 0.26% 0.46%	TD 2.33% 3.44% TT -16.86% 3.80% UV 0.15% -1.16%
United States of America East	TD -0.29% 0.11% TT -0.53% 1.31% UV 0.25% 0.48%	TD -0.73% 0.00% TT 0.07% 1.88% UV 0.25% 0.54%	TD 9.01% 8.47% TT -23.16% -24.68% UV -0.81% -1.20%
United States of America West	TD -0.20% -0.21% TT -0.16% 0.00% UV 0.25% -0.14%	TD -0.14% -0.32% TT -0.17% 0.00% UV 0.27% -0.03%	TD -0.92% 1.04% TT 0.00% -1.01% UV -2.02% -0.23%



Summer 2022

Temperature bias (US east)

BIAS



Summer 2022

RMSE

STDEV

BIAS

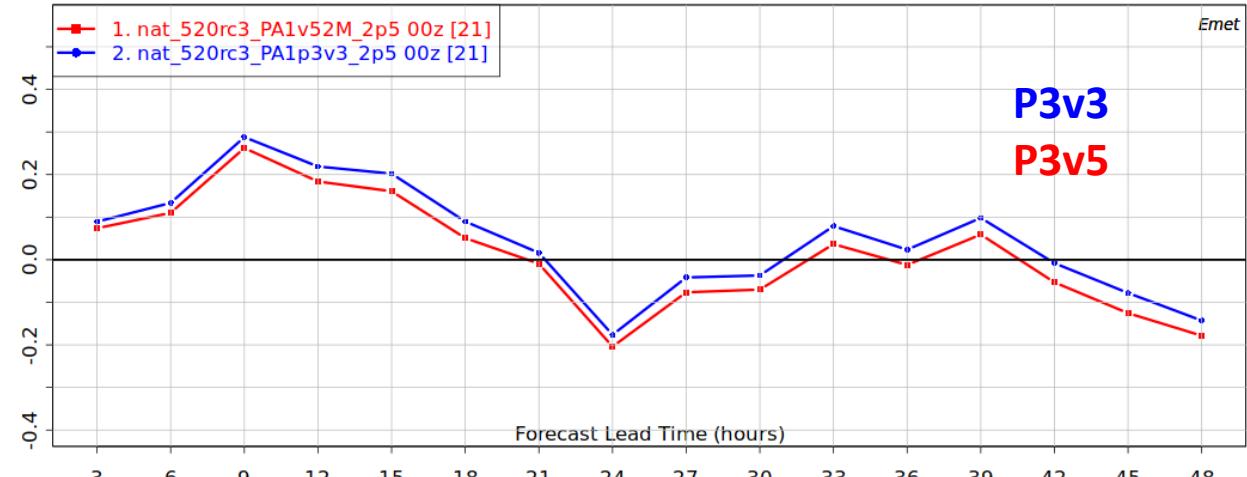
Pressure bias (North America)

rmse		2020701 / 2020831	
nat_520rc3_PA1v52M_2p5 / nat_520rc3_PA1p3v3_2p5		00z	12z
Alaska	PO	-0.81%	0.00%
Alberta-Saskatchewan	PO	0.00%	-1.09%
British Columbia	PO	0.11%	-0.02%
British Columbia 2	PO	0.00%	0.00%
Canada	PO	0.11%	0.00%
Canadian Arctic	PO	-0.38%	-0.44%
Maritimes	PO	0.87%	0.26%
North America plus	PO	0.04%	0.00%
Ontario-Quebec	PO	0.14%	0.00%
Prairies	PO	0.00%	-0.77%
United States of America	PO	-1.15%	-0.93%
United States of America East	PO	-1.15%	-1.07%
United States of America West	PO	-0.79%	-0.42%

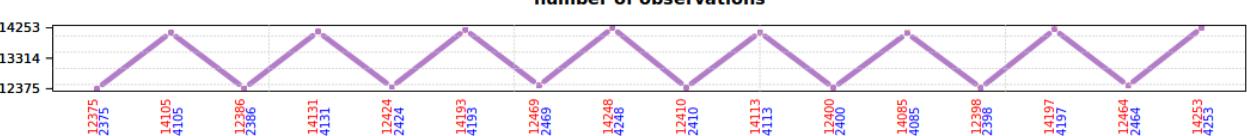
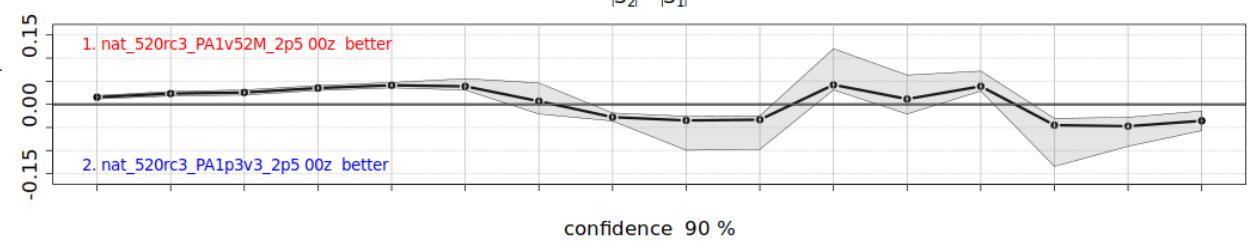
stdev		2020701 / 2020831	
nat_520rc3_PA1v52M_2p5 / nat_520rc3_PA1p3v3_2p5		00z	12z
Alaska	PO	-1.01%	0.00%
Alberta-Saskatchewan	PO	-0.96%	-1.72%
British Columbia	PO	0.09%	-0.14%
British Columbia 2	PO	0.00%	-0.03%
Canada	PO	0.00%	0.00%
Canadian Arctic	PO	-0.46%	-0.87%
Maritimes	PO	0.00%	0.41%
North America plus	PO	0.00%	0.00%
Ontario-Quebec	PO	0.07%	0.00%
Prairies	PO	-0.53%	-0.94%
United States of America	PO	0.00%	0.19%
United States of America East	PO	0.24%	0.36%
United States of America West	PO	-0.53%	-0.02%

bias		2020701 / 2020831	
nat_520rc3_PA1v52M_2p5 / nat_520rc3_PA1p3v3_2p5		00z	12z
Alaska	PO	-0.73%	-6.00%
Alberta-Saskatchewan	PO	14.68%	16.32%
British Columbia	PO	4.33%	1.94%
British Columbia 2	PO	1.41%	0.89%
Canada	PO	12.79%	13.94%
Canadian Arctic	PO	8.87%	1.99%
Maritimes	PO	10.60%	0.22%
North America plus	PO	2.17%	7.00%
Ontario-Quebec	PO	-14.04%	4.06%
Prairies	PO	13.07%	15.45%
United States of America	PO	-9.28%	-7.84%
United States of America East	PO	-10.62%	-10.09%
United States of America West	PO	-2.38%	-1.68%

MEAN ERROR (P-O) OF ALT. CORRECT. SURFACE PRESSURE (hPa) 2022-07-01 @ 2022-08-30
alt diff max 100 ade synop North America plus



P3v3
P3v5



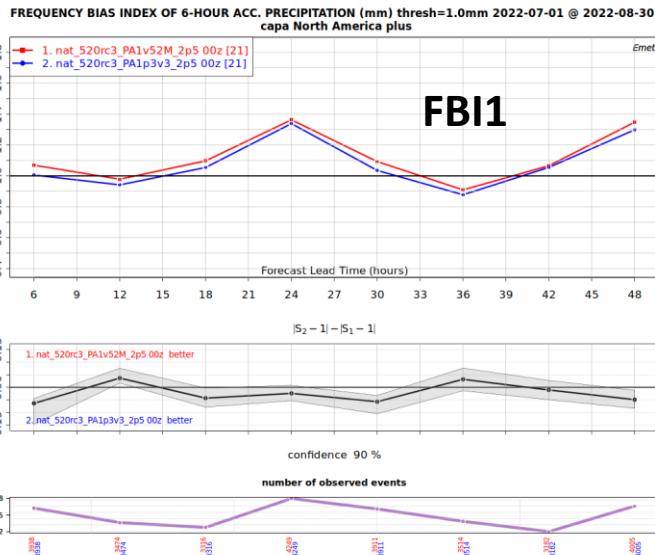
<http://emet-usr.science.gc.ca/emet/mec000/5-4-172.disp>

Summer 2022

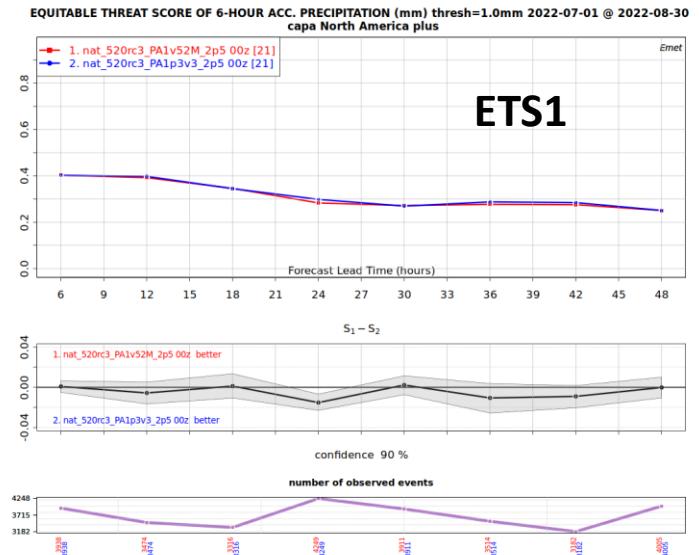
P3v3
P3v5

PR6 (North America)

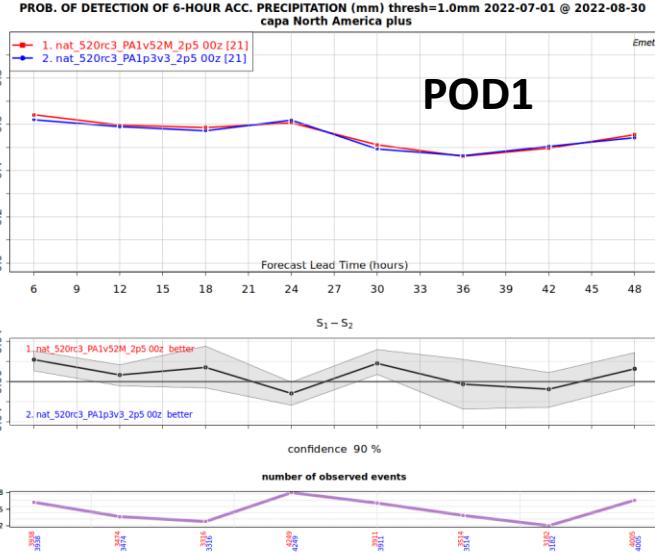
fbi1		20220701 /
nat_520rc3_PA1v52M_2p5	/	20220831
nat_520rc3_PA1p3v3_2p5		
00z	12z	
Alaska	PR6	8.47% 4.71%
Alberta-Saskatchewan	PR6	0.34% -1.77%
British Columbia	PR6	2.15% 3.45%
British Columbia 2	PR6	-0.48% 5.38%
Canada	PR6	-1.65% -2.45%
Canadian Arctic	PR6	-1.44% 2.37%
Maritimes	PR6	0.00% 0.47%
North America plus	PR6	-2.05% -1.72%
Ontario-Quebec	PR6	-1.02% 0.58%
Prairies	PR6	-1.21% -2.08%
United States of America	PR6	-0.39% 0.00%
United States of America East	PR6	-0.83% 0.60%
United States of America West	PR6	-2.99% 3.50%



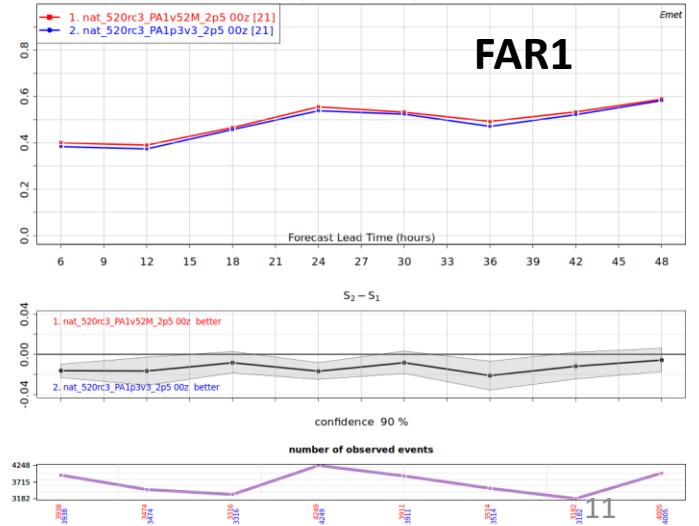
ets1		20220701 /
nat_520rc3_PA1v52M_2p5	/	20220831
nat_520rc3_PA1p3v3_2p5		
00z	12z	
Alaska	PR6	-5.42% 0.00%
Alberta-Saskatchewan	PR6	-1.91% 0.00%
British Columbia	PR6	-1.19% -2.31%
British Columbia 2	PR6	-0.79% 0.00%
Canada	PR6	-0.42% 0.00%
Canadian Arctic	PR6	-0.88% -0.20%
Maritimes	PR6	-0.30% -1.09%
North America plus	PR6	-0.60% 0.37%
Ontario-Quebec	PR6	0.00% 1.40%
Prairies	PR6	0.00% 0.00%
United States of America	PR6	-1.00% 1.57%
United States of America East	PR6	-0.90% 2.00%
United States of America West	PR6	7.14% 0.00%



pod1		20220701 /
nat_520rc3_PA1v52M_2p5	/	20220831
nat_520rc3_PA1p3v3_2p5		
00z	12z	
Alaska	PR6	8.98% 14.43%
Alberta-Saskatchewan	PR6	2.12% 0.00%
British Columbia	PR6	3.07% 2.95%
British Columbia 2	PR6	4.42% 0.77%
Canada	PR6	0.89% 1.03%
Canadian Arctic	PR6	2.20% 1.87%
Maritimes	PR6	0.00% 1.06%
North America plus	PR6	0.64% 0.98%
Ontario-Quebec	PR6	0.29% 0.77%
Prairies	PR6	1.21% 2.04%
United States of America	PR6	0.00% 0.00%
United States of America East	PR6	0.66% 0.00%
United States of America West	PR6	9.38% 0.00%

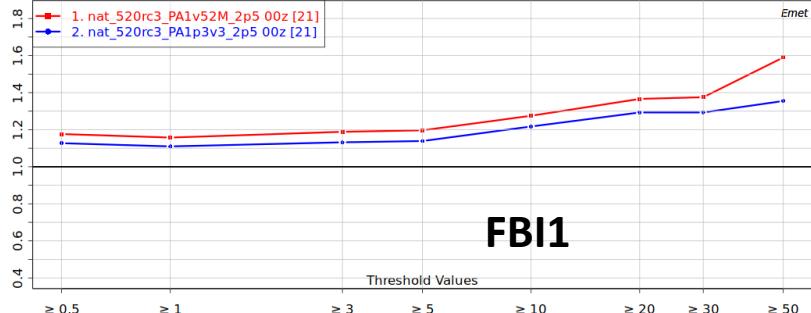


far1		20220701 /
nat_520rc3_PA1v52M_2p5	/	20220831
nat_520rc3_PA1p3v3_2p5		
00z	12z	
Alaska	PR6	0.00% 0.00%
Alberta-Saskatchewan	PR6	-2.82% 0.00%
British Columbia	PR6	-4.31% -8.47%
British Columbia 2	PR6	-4.08% -5.69%
Canada	PR6	-0.94% -1.85%
Canadian Arctic	PR6	-1.88% -3.18%
Maritimes	PR6	-1.10% -2.03%
North America plus	PR6	-1.84% -1.24%
Ontario-Quebec	PR6	0.00% -0.45%
Prairies	PR6	-1.04% -0.89%
United States of America	PR6	-1.91% 0.52%
United States of America East	PR6	-1.20% 1.56%
United States of America West	PR6	-1.38% -3.77%

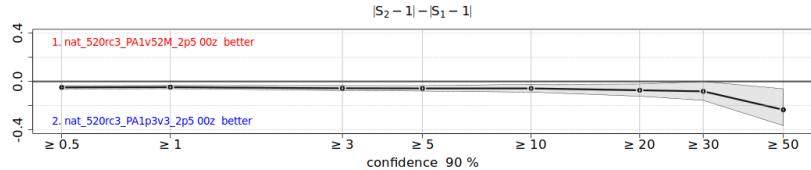


Summer 2022

FREQUENCY BIAS INDEX OF 24-HOUR ACC. PRECIPITATION (mm) 2022-07-01 @ 2022-08-30
capa North America plus



FBI1



$|S_2 - 1| - |S_1 - 1|$

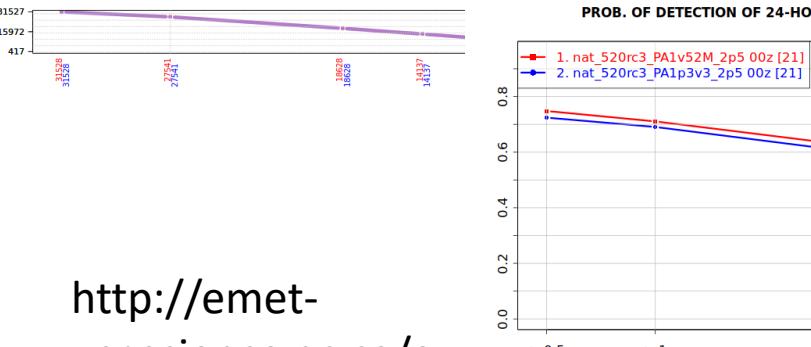
1. nat_520rc3_PA1v52M_2p5 00z [21]
2. nat_520rc3_PA1p3v3_2p5 00z [21]

confidence 90 %

1. nat_520rc3_PA1v52M_2p5 00z better

2. nat_520rc3_PA1p3v3_2p5 00z better

number of observed



POD1

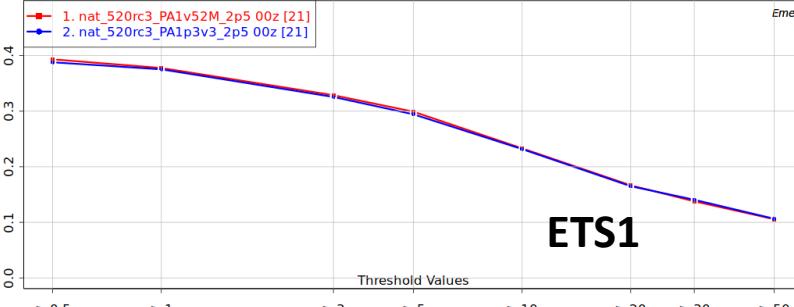
<http://emet-usr.science.gc.ca/emet/mec000/5-4-153.disp>

P3v3

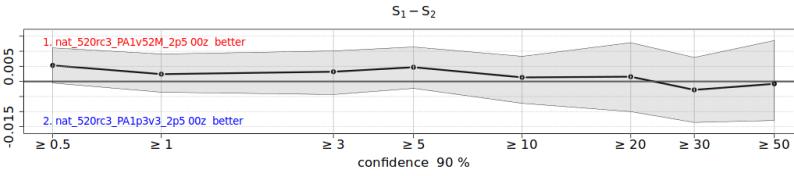
P3v5

PR24 (North America)

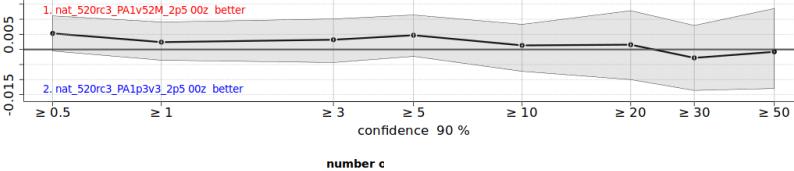
EQUITABLE THREAT SCORE OF 24-HOUR ACC. PRECIPITATION (mm) 2022-07-01 @ 2022-08-30
capa North America plus



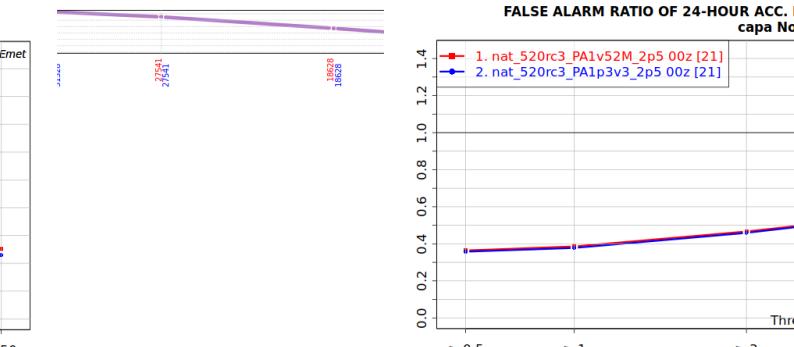
ETS1



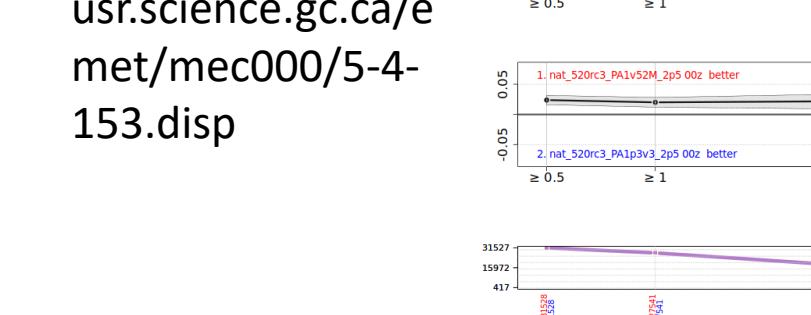
$S_1 - S_2$



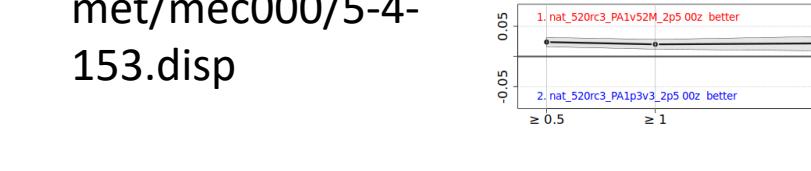
number c



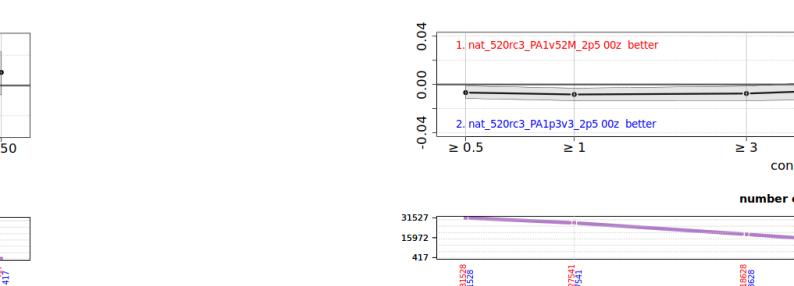
FAR1



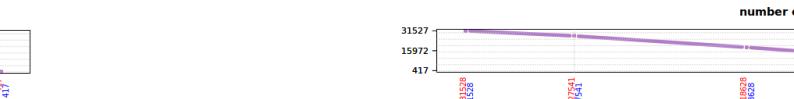
$S_2 - S_1$



number of observed events



$S_2 - S_1$



number of observed events

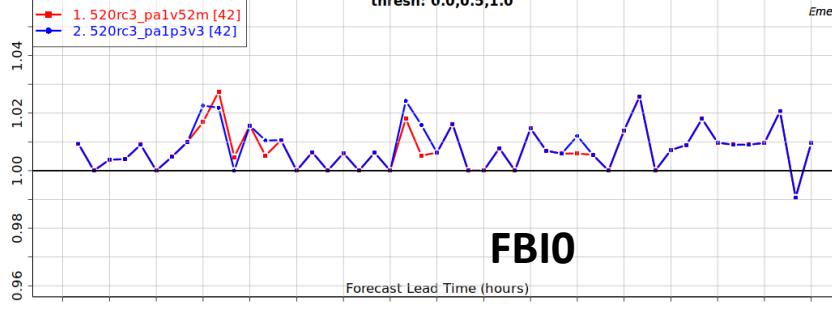
Summer 2022

P3v3

P3v5

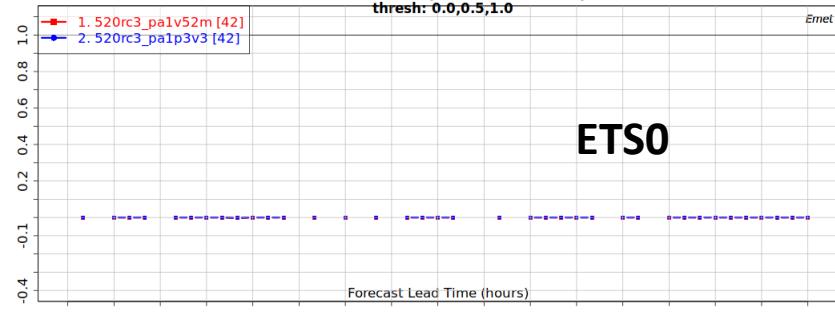
Phase frequency (rain; RN Bourgouin)

FREQUENCY BIAS INDEX OF 1-HOUR RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-07-01 @ 2022-07-01
PR>=1.0 ade metar speci North America plus
thresh: 0.0,0.5,1.0



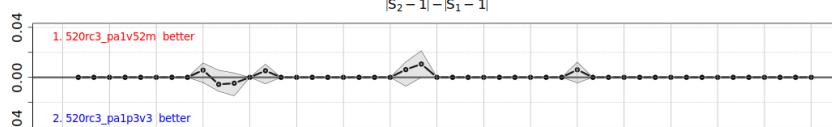
FBI0

THREAT SCORE OF 1-HOUR RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-07-01 @ 2022-07-01
PR>=1.0 ade metar speci North America plus
thresh: 0.0,0.5,1.0

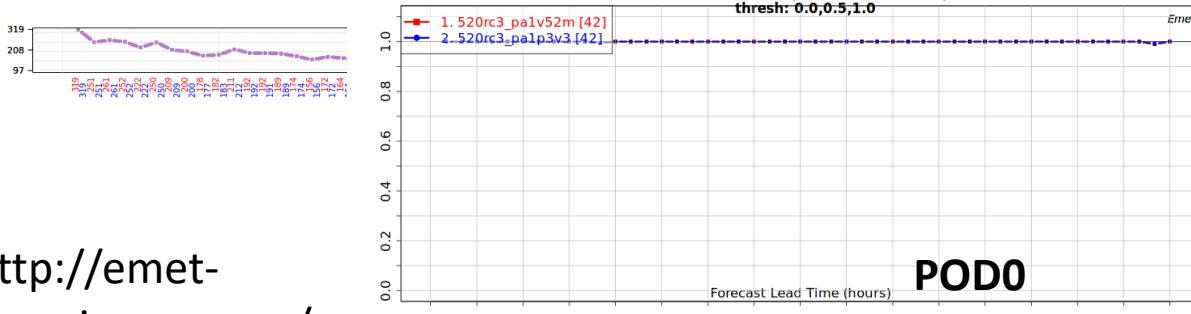


ETSO

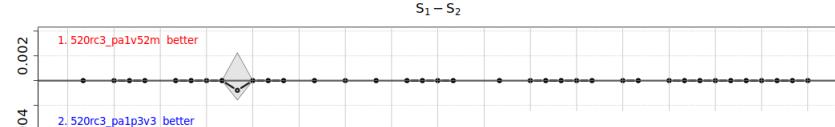
Scores for SN are not shown since they are 0



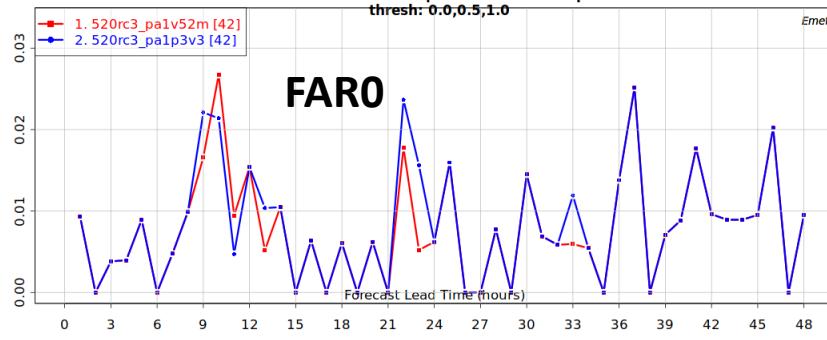
ROB. OF DETECTION OF 1-HOUR RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-07-01 @ 2022-07-01
PR>=1.0 ade metar speci North America plus
thresh: 0.0,0.5,1.0



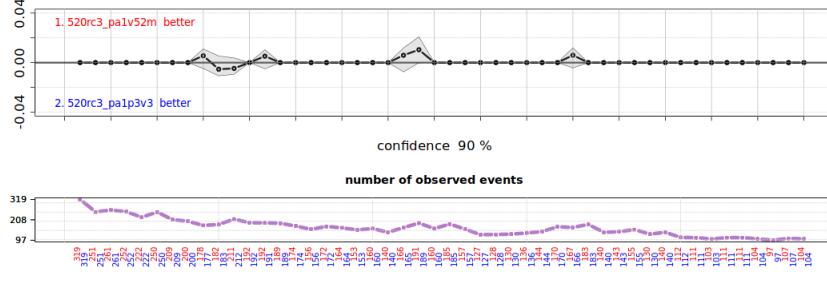
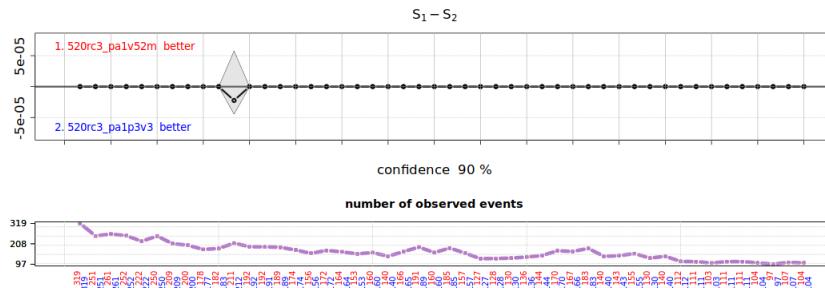
PODO



ALSE ALARM RATIO OF 1-HOUR RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-07-01 @ 2022-07-01
PR>=1.0 ade metar speci North America plus
thresh: 0.0,0.5,1.0



FARO



<http://emet-usr.science.gc.ca/emet/mec000/6-2-35.disp>

Winter 2022

Temperature bias (North America)

RMSE

STDEV

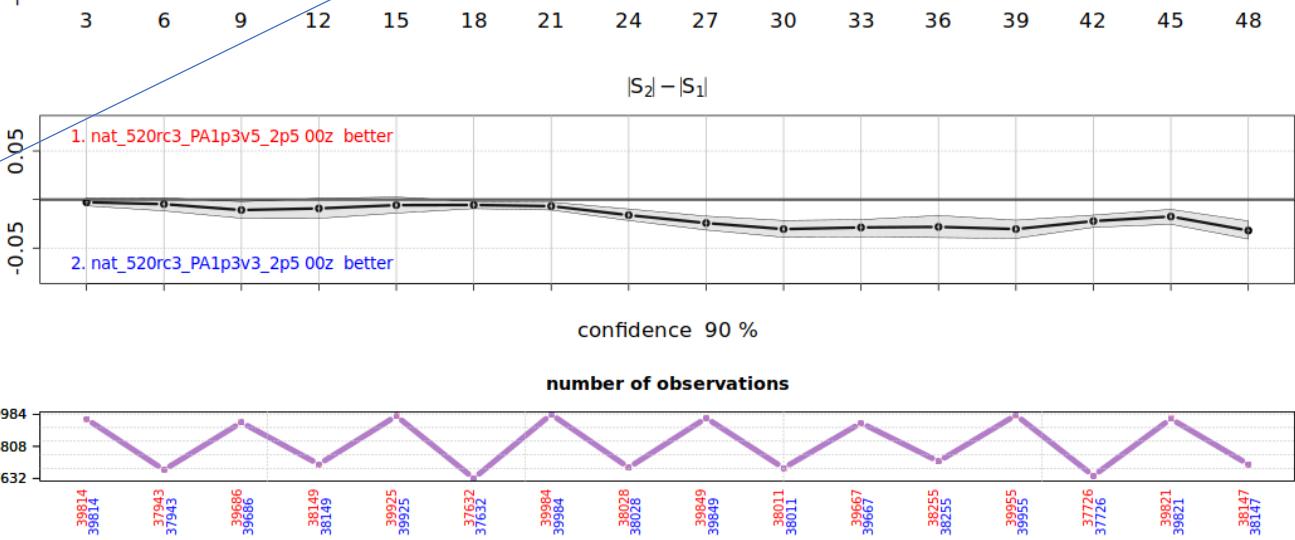
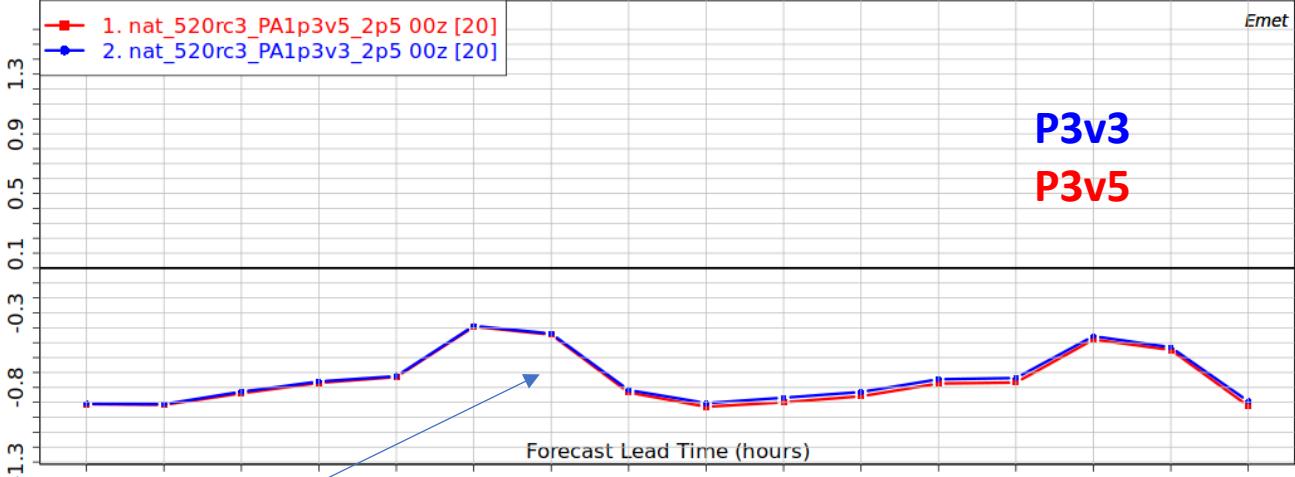
BIAS

MEAN ERROR (P-O) OF SCREEN-LEVEL AIR TEMPERATURE (C) 2022-01-01 @ 2022-02-27
alt diff max 100 ade synop swob metar North America plus

rmse		nat_520rc3_PA1p3v5_2p5 / nat_520rc3_PA1p3v3_2p5		20220101 / 20220228	
		00z	12z		
Alaska	TD	-0.09%	0.34%		
	TT	0.00%	0.08%		
	UV	-0.08%	-0.21%		
Alberta-Saskatchewan	TD	0.08%	-0.19%		
	TT	0.00%	-0.27%		
	UV	-0.10%	-0.18%		
British Columbia	TD	-0.08%	-0.41%		
	TT	-0.44%	-0.81%		
	UV	0.00%	-0.00%		
British Columbia 2	TD	0.00%	-0.41%		
	TT	-0.43%	-0.56%		
	UV	0.00%	0.00%		
Canada	TD	0.00%	-0.11%		
	TT	-0.06%	-0.28%		
	UV	0.00%	-0.13%		
Canadian Arctic	TD	0.00%	0.00%		
	TT	-0.09%	0.00%		
	UV	-0.04%	0.00%		
Maritimes	TD	-0.12%	-0.05%		
	TT	-0.68%	-0.10%		
	UV	0.07%	0.02%		
North America plus	TD	-0.08%	-0.19%		
	TT	-0.30%	-0.51%		
	UV	-0.06%	-0.10%		
Ontario-Quebec	TD	0.00%	-0.22%		
	TT	-0.11%	-0.85%		
	UV	-0.02%	0.00%		
Prairies	TD	0.00%	-0.14%		
	TT	0.00%	-0.24%		
	UV	-0.08%	-0.14%		
United States of America	TD	-0.29%	-0.23%		
	TT	-0.39%	-0.65%		
	UV	-0.06%	-0.03%		
United States of America East	TD	-0.25%	-0.21%		
	TT	-0.37%	-0.73%		
	UV	-0.04%	0.00%		
United States of America West	TD	-0.23%	-0.24%		
	TT	-0.38%	-0.50%		
	UV	-0.13%	0.00%		

stdev		nat_520rc3_PA1p3v5_2p5 / nat_520rc3_PA1p3v3_2p5		20220101 / 20220228	
		00z	12z		
Alaska	TD	0.00%	0.55%		
	TT	0.03%	0.20%		
	UV	-0.12%	-0.21%		
Alberta-Saskatchewan	TD	-0.04%	-0.45%		
	TT	0.00%	-0.29%		
	UV	-0.06%	-0.18%		
British Columbia	TD	0.00%	-0.34%		
	TT	-0.22%	-0.49%		
	UV	0.00%	-0.01%		
British Columbia 2	TD	0.00%	-0.23%		
	TT	-0.26%	-0.33%		
	UV	0.00%	0.03%		
Canada	TD	-0.08%	-0.35%		
	TT	-0.09%	-0.36%		
	UV	0.02%	-0.09%		
Canadian Arctic	TD	-0.16%	-0.20%		
	TT	-0.20%	-0.33%		
	UV	0.00%	0.03%		
Maritimes	TD	-0.49%	-0.07%		
	TT	-0.69%	-0.07%		
	UV	-0.02%	0.01%		
North America plus	TD	-0.15%	-0.24%		
	TT	-0.14%	-0.24%		
	UV	0.00%	-0.06%		
Ontario-Quebec	TD	0.00%	-0.41%		
	TT	-0.12%	-0.74%		
	UV	0.02%	0.00%		
Prairies	TD	-0.03%	-0.39%		
	TT	0.00%	-0.28%		
	UV	-0.06%	-0.11%		
United States of America	TD	-0.23%	-0.21%		
	TT	-0.23%	-0.30%		
	UV	-0.05%	0.00%		
United States of America East	TD	-0.20%	-0.20%		
	TT	-0.21%	-0.28%		
	UV	0.00%	-0.01%		
United States of America West	TD	-0.09%	-0.22%		
	TT	-0.13%	-0.15%		
	UV	-0.08%	0.00%		

bias		nat_520rc3_PA1p3v5_2p5 / nat_520rc3_PA1p3v3_2p5		20220101 / 20220228	
		00z	12z		
Alaska	TD	-2.91%	-2.47%		
	TT	-0.74%	-1.08%		
	UV	-0.26%	0.00%		
Alberta-Saskatchewan	TD	3.08%	6.00%		
	TT	-1.01%	11.83%		
	UV	-0.46%	-0.58%		
British Columbia	TD	-13.22%	-17.09%		
	TT	-5.86%	-6.46%		
	UV	-3.18%	0.52%		
British Columbia 2	TD	-4.60%	-9.83%		
	TT	-2.09%	-3.74%		
	UV	-0.01%	0.00%		
Canada	TD	0.76%	8.54%		
	TT	-4.50%	5.68%		
	UV	-1.32%	-1.49%		
Canadian Arctic	TD	7.94%	6.39%		
	TT	9.04%	7.10%		
	UV	-0.85%	-0.20%		
Maritimes	TD	-7.22%	1.28%		
	TT	-12.22%	-0.65%		
	UV	3.59%	1.11%		
North America plus	TD	-0.36%	2.40%		
	TT	-2.15%	-4.02%		
	UV	-1.36%	-1.64%		
Ontario-Quebec	TD	4.03%	8.22%		
	TT	-2.05%	-5.37%		
	UV	-0.52%	-2.78%		
Prairies	TD	3.76%	6.80%		
	TT	-3.63%	9.32%		
	UV	-0.64%	-0.65%		
United States of America	TD	-0.75%	-1.19%		
	TT	-0.90%	-2.02%		
	UV	-1.12%	-1.52%		
United States of America East	TD	-0.97%	-0.83%		
	TT	-0.72%	-1.86%		
	UV	-1.30%	-1.63%		
United States of America West	TD	-1.33%	-2.02%		
	TT	-1.72%	-1.94%		
	UV	-0.71%	-0.51%		



<http://emet-usr.science.gc.ca/emet/mec000/5-2-47618.disp>

Winter 2022

Pressure bias (North America)

RMSE

STDEV

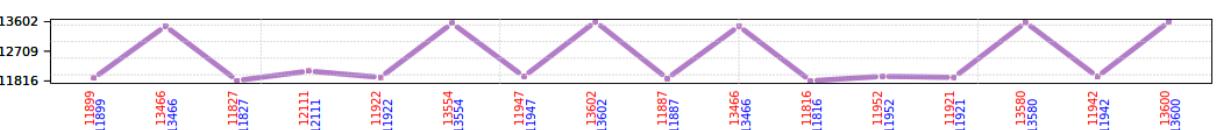
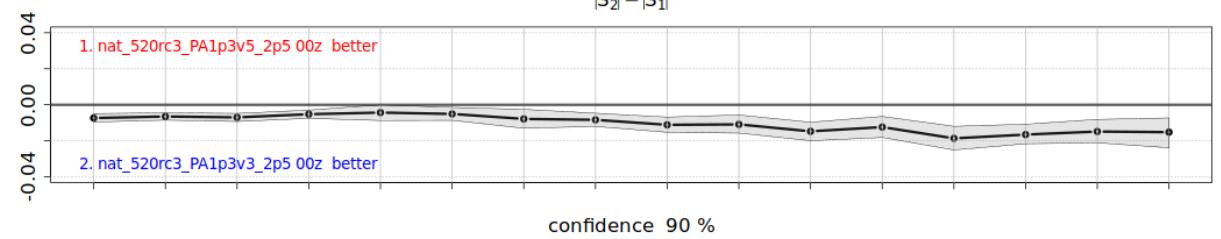
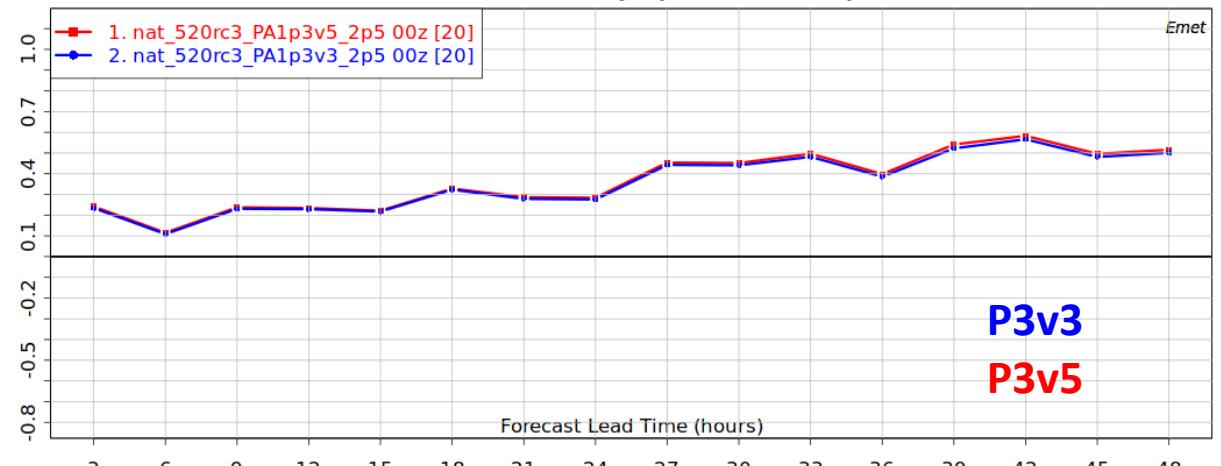
BIAS

rmse		20220101 / 20220228	
nat_520rc3_PA1p3v5_2p5 / nat_520rc3_PA1p3v3_2p5		00z 12z	
Alaska	PO	-0.04%	0.11%
Alberta-Saskatchewan	PO	-0.55%	-0.21%
British Columbia	PO	0.00%	-0.10%
British Columbia 2	PO	0.00%	-0.03%
Canada	PO	-0.42%	-0.11%
Canadian Arctic	PO	-0.12%	-0.05%
Maritimes	PO	-0.46%	0.00%
North America plus	PO	-0.39%	-0.12%
Ontario-Quebec	PO	-0.38%	-0.37%
Prairies	PO	-0.41%	-0.13%
United States of America	PO	0.00%	-0.08%
United States of America East	PO	N/A	N/A
United States of America West	PO	-0.02%	-0.07%

stdev		20220101 / 20220228	
nat_520rc3_PA1p3v5_2p5 / nat_520rc3_PA1p3v3_2p5		00z 12z	
Alaska	PO	0.00%	0.22%
Alberta-Saskatchewan	PO	0.00%	-0.08%
British Columbia	PO	0.00%	0.04%
British Columbia 2	PO	0.00%	0.01%
Canada	PO	-0.10%	0.00%
Canadian Arctic	PO	0.00%	0.03%
Maritimes	PO	-0.43%	-0.17%
North America plus	PO	-0.09%	-0.03%
Ontario-Quebec	PO	-0.09%	-0.24%
Prairies	PO	0.00%	0.07%
United States of America	PO	0.03%	-0.07%
United States of America East	PO	N/A	N/A
United States of America West	PO	-0.04%	-0.09%

bias		20220101 / 20220228	
nat_520rc3_PA1p3v5_2p5 / nat_520rc3_PA1p3v3_2p5		00z 12z	
Alaska	PO	-2.90%	0.00%
Alberta-Saskatchewan	PO	-3.58%	-2.41%
British Columbia	PO	10.32%	-7.71%
British Columbia 2	PO	-4.00%	-7.55%
Canada	PO	-2.93%	-1.62%
Canadian Arctic	PO	-2.13%	-1.19%
Maritimes	PO	-0.74%	-0.42%
North America plus	PO	-2.92%	-1.75%
Ontario-Quebec	PO	-1.47%	-0.68%
Prairies	PO	-3.39%	-1.95%
United States of America	PO	-1.44%	-1.77%
United States of America East	PO	N/A	N/A
United States of America West	PO	2.19%	0.41%

MEAN ERROR (P-O) OF ALT. CORRECT. SURFACE PRESSURE (hPa) 2022-01-01 @ 2022-02-27
alt diff max 100 ade synop North America plus



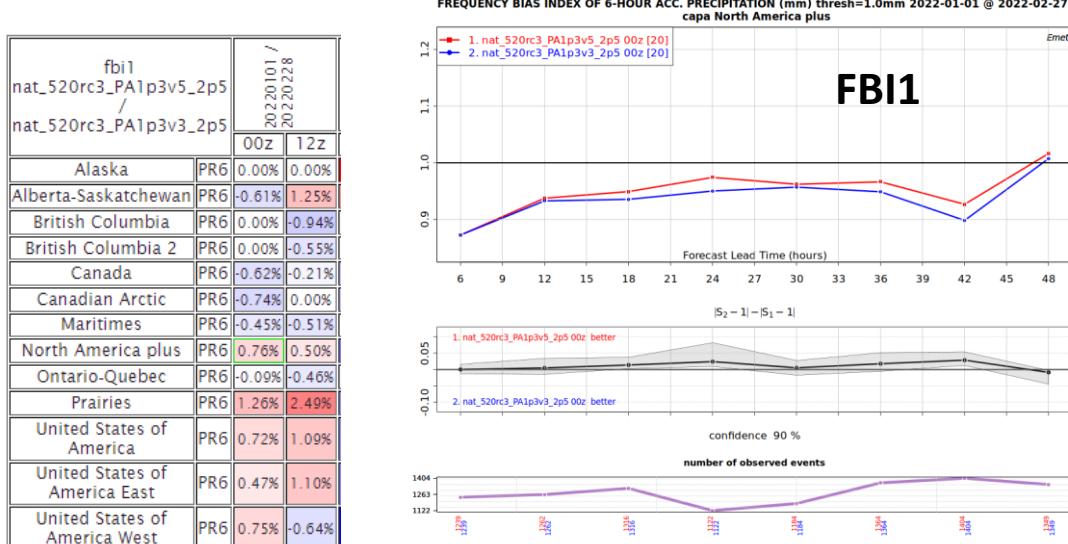
<http://emet-usr.science.gc.ca/emet/mec000/5-2-47385.disp>

Winter 2022

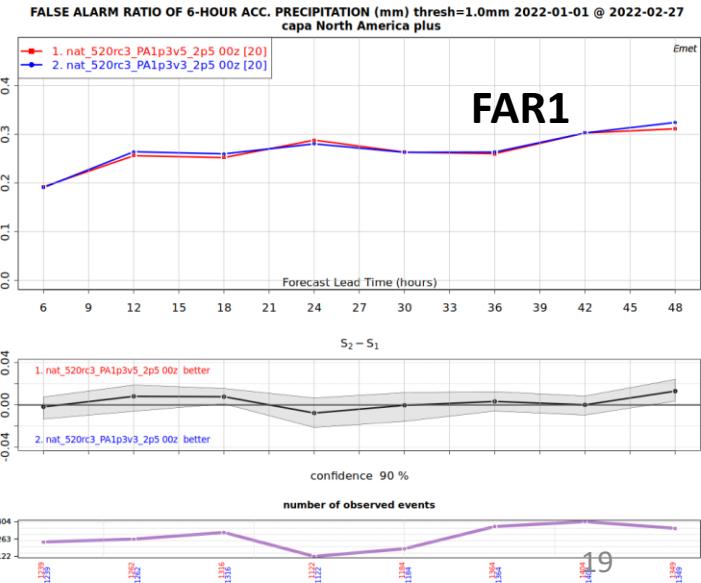
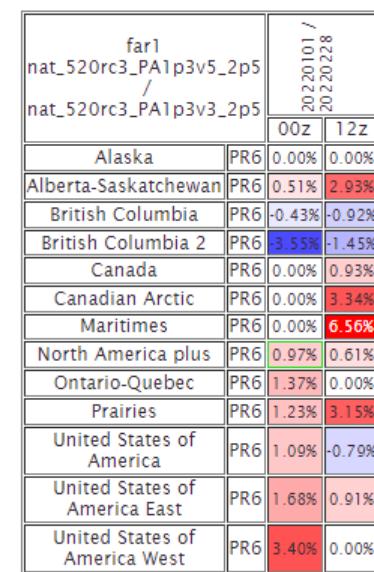
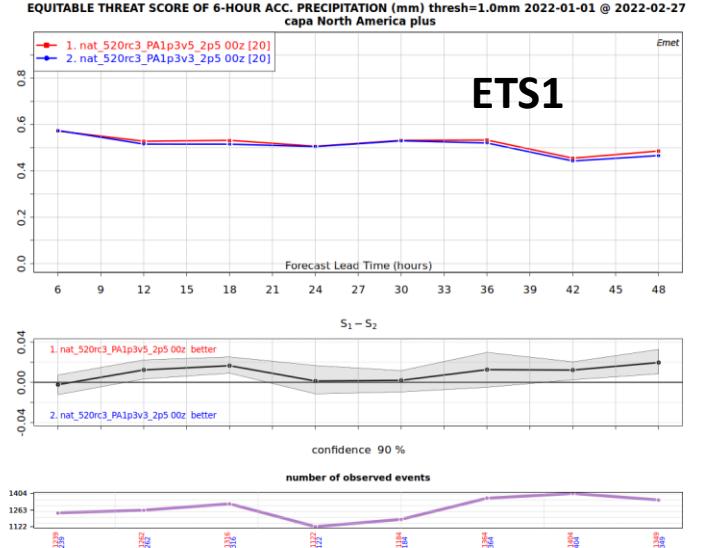
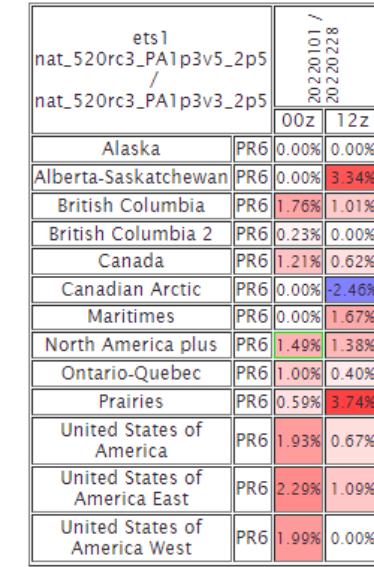
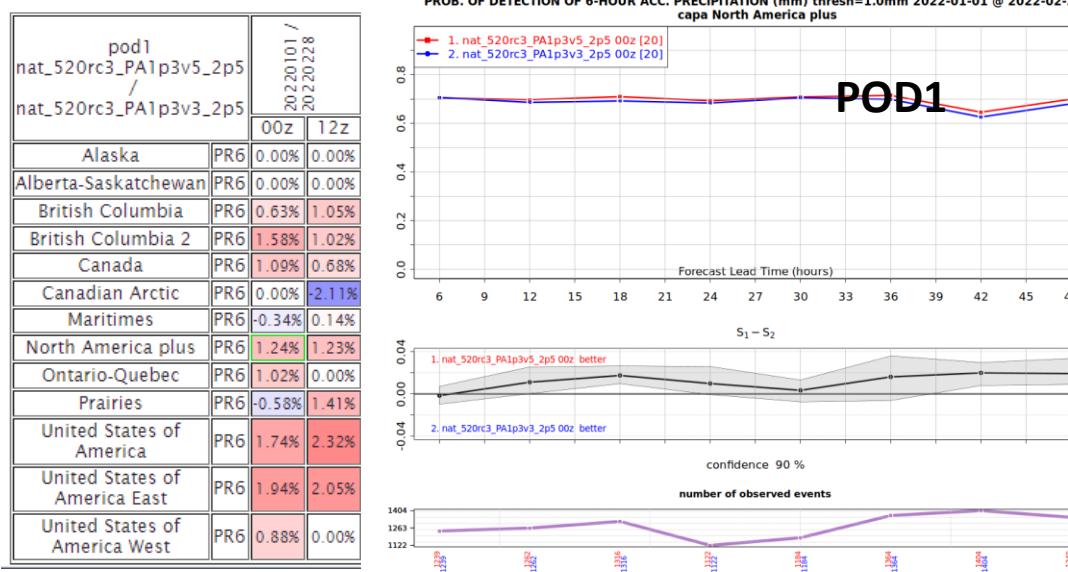
P3v3

P3v5

PR6 (North America)

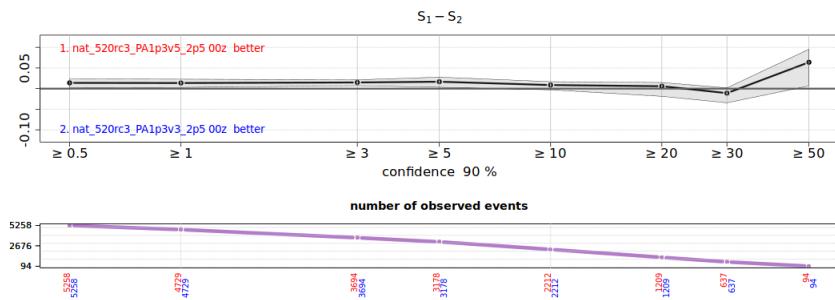
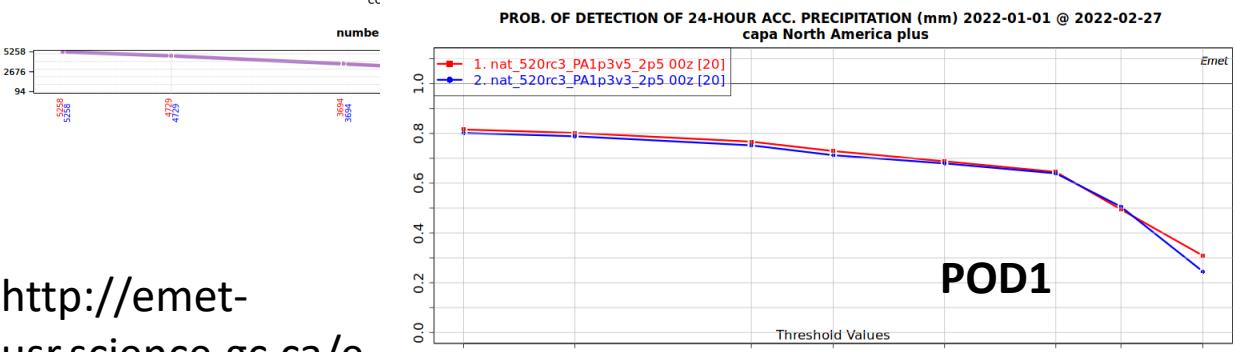
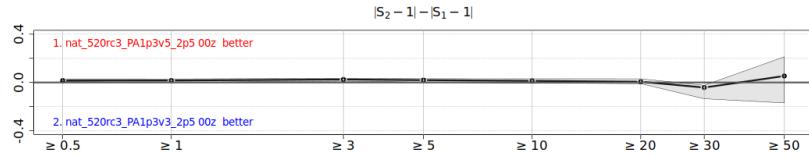
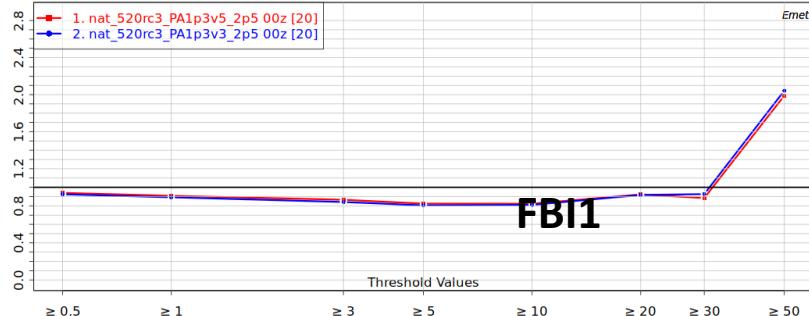


<http://emet-usr.science.gc.ca/emet/mec000/5-2-46535.disp>



Winter 2022

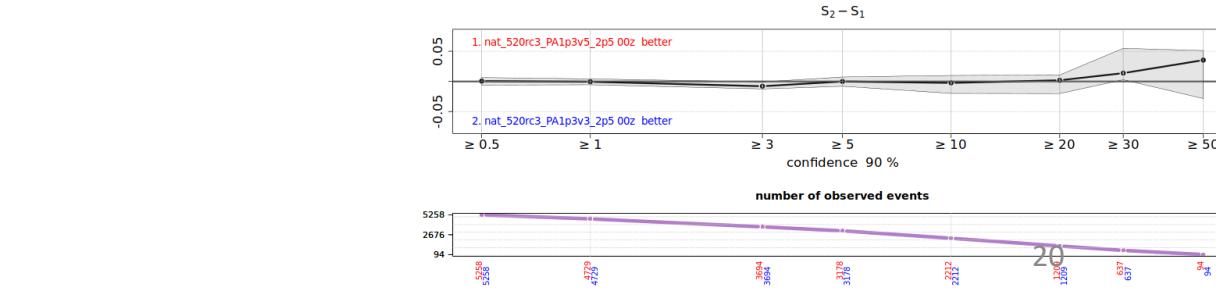
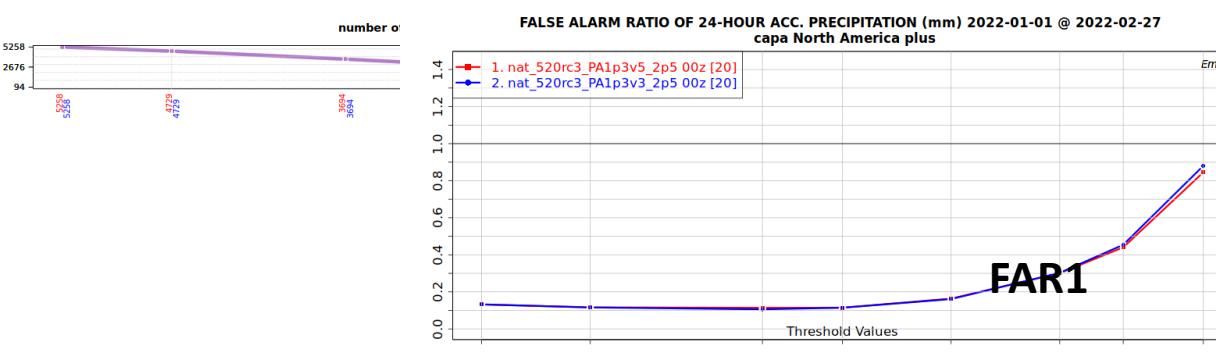
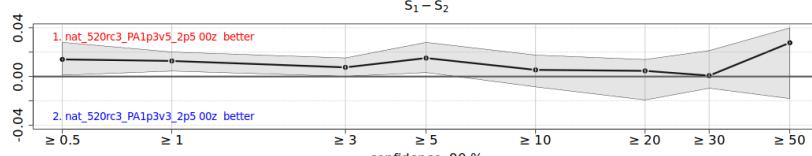
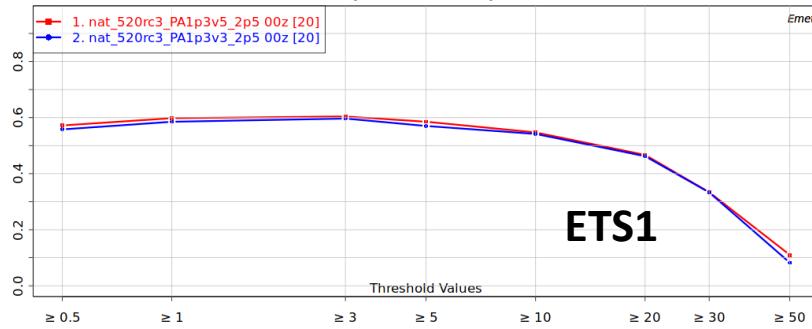
FREQUENCY BIAS INDEX OF 24-HOUR ACC. PRECIPITATION (mm) 2022-01-01 @ 2022-02-27
capa North America plus



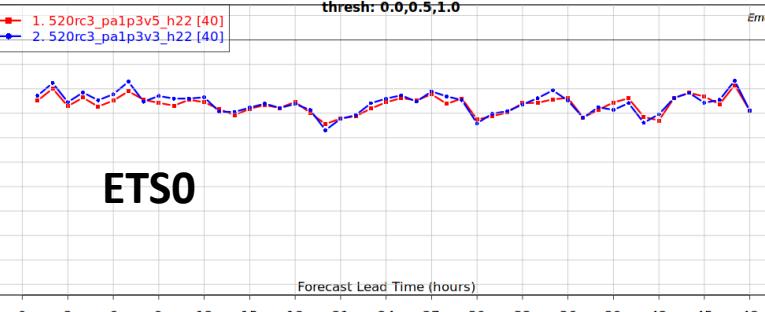
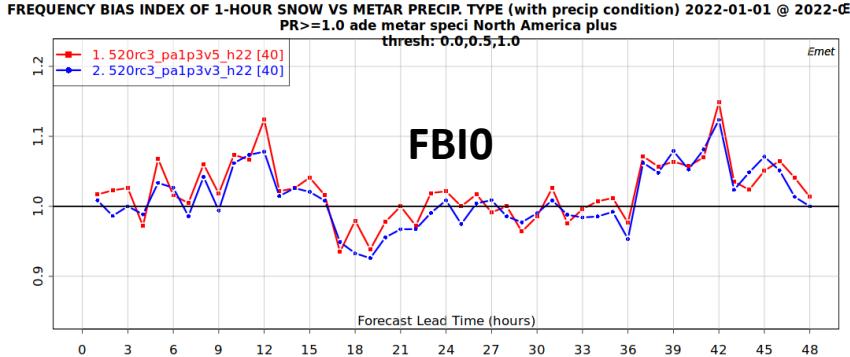
P3v3
P3v5

PR24 (North America)

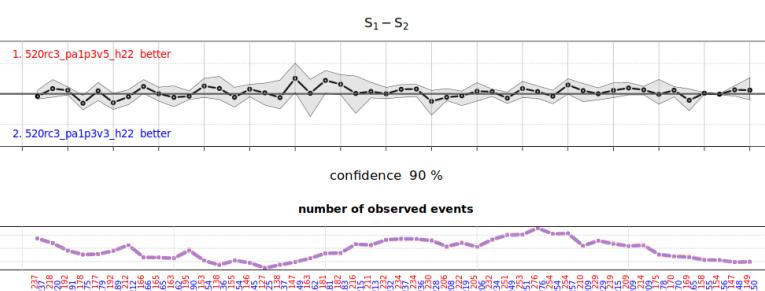
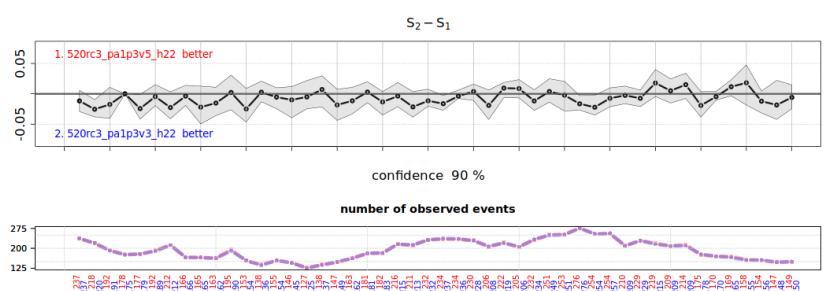
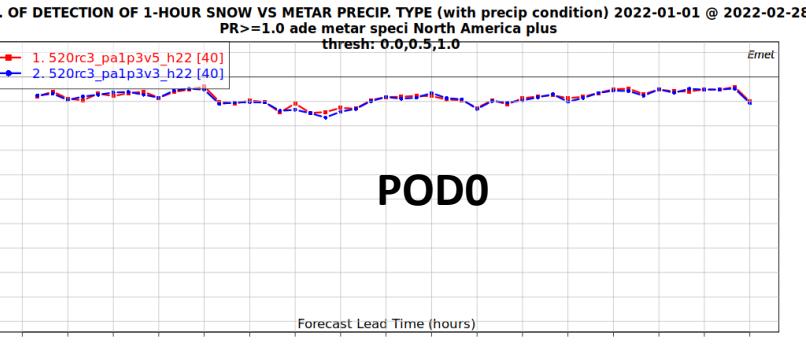
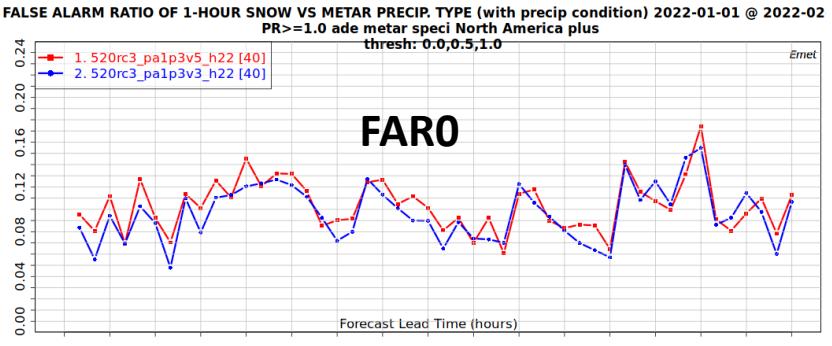
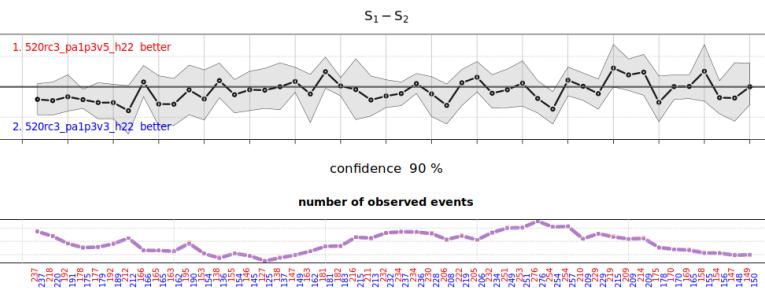
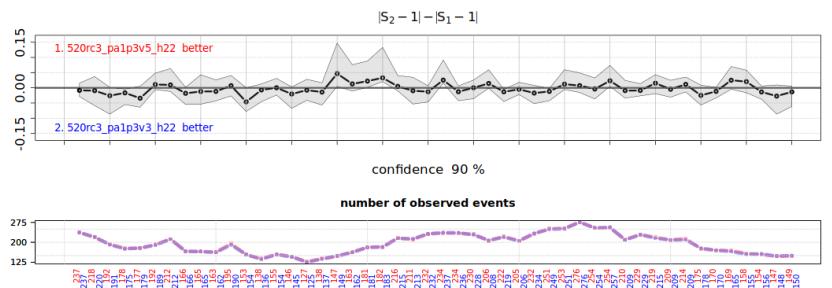
EQUITABLE THREAT SCORE OF 24-HOUR ACC. PRECIPITATION (mm) 2022-01-01 @ 2022-02-27
capa North America plus



<http://emet-usr.science.gc.ca/emet/mec000/5-2-51794.disp>

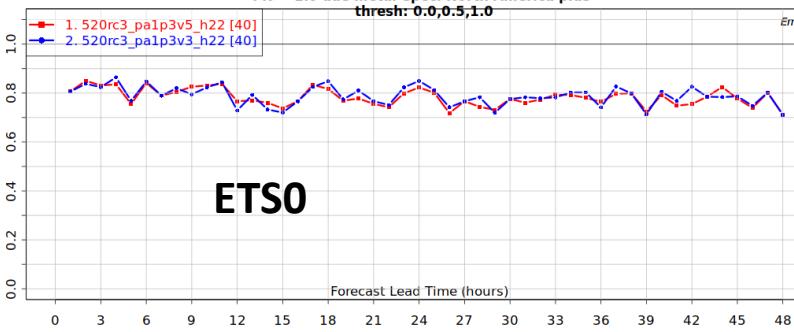
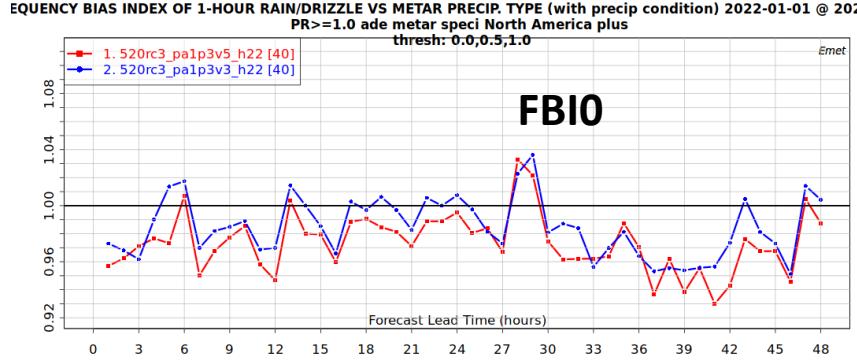


Winter 2022

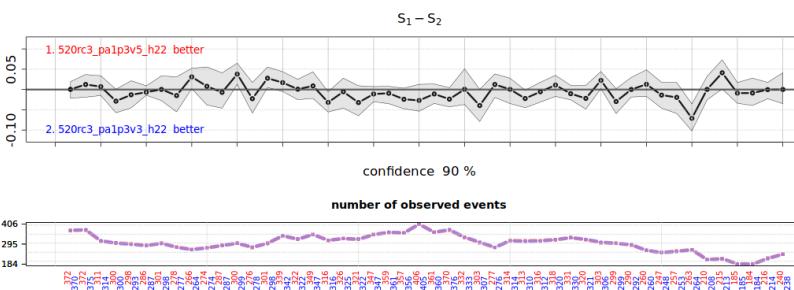
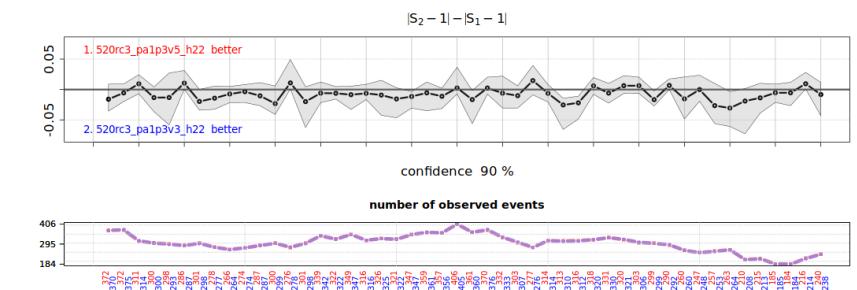


**SN phase frequency
(PR>1mm/h) over
North America**

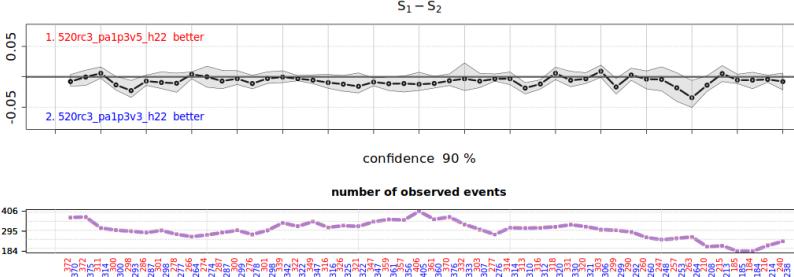
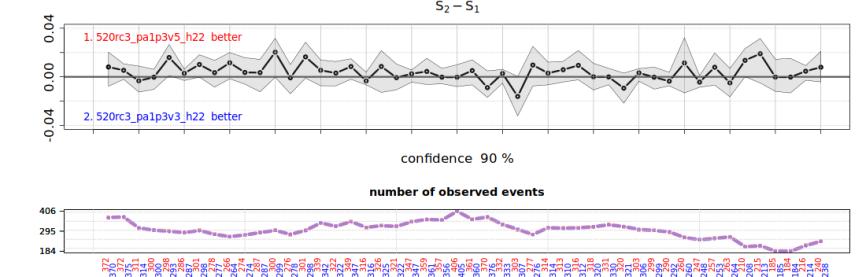
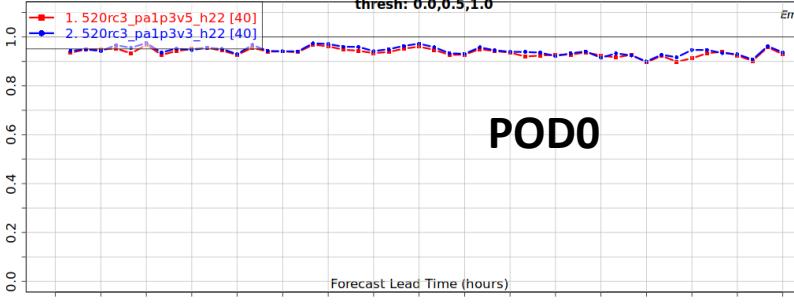
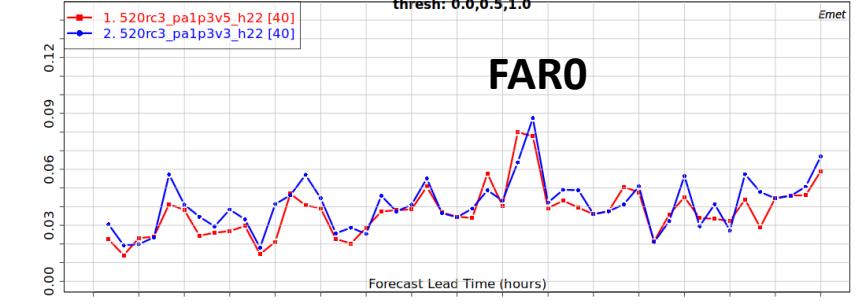
<http://emet-usr.science.gc.ca/emet/mec000/6-1-59.disp>



Winter 2022

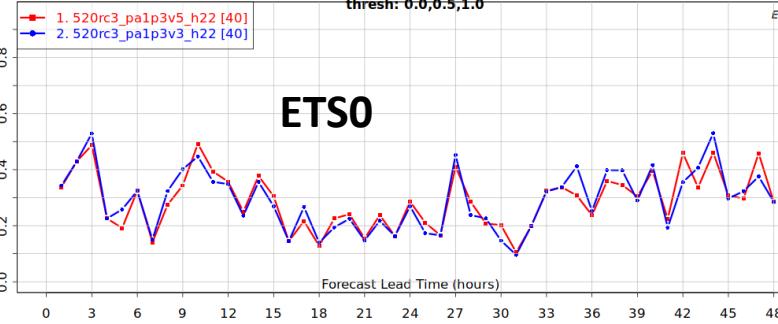
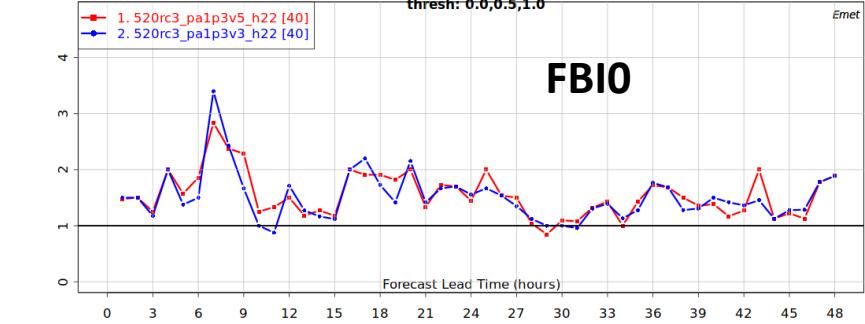


ALSE ALARM RATIO OF 1-HOUR RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-0ROB. OF DETECTION OF 1-HOUR RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-0
PR>=1.0 ade metar speci North America plus
thresh: 0.0,0.5,1.0

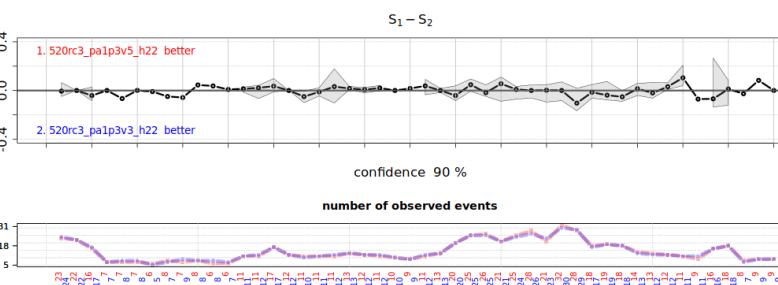
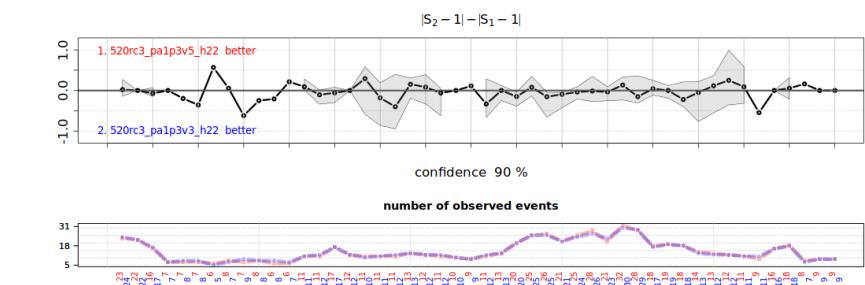


RN phase frequency
(PR>1mm/h) over
North America

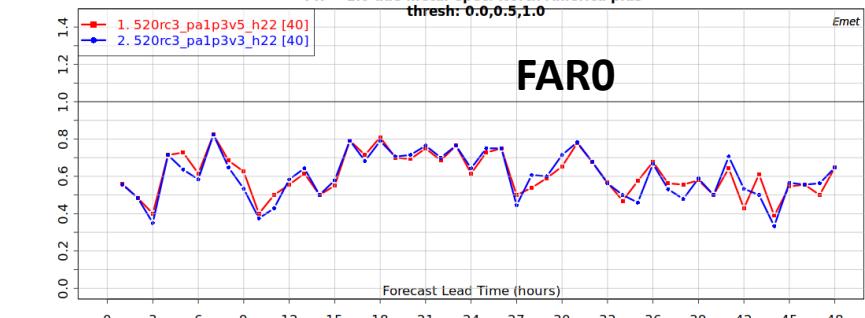
[http://emet-
usr.science.gc.ca/emet/
mec000/6-1-74.disp](http://emet-usr.science.gc.ca/emet/mec000/6-1-74.disp)



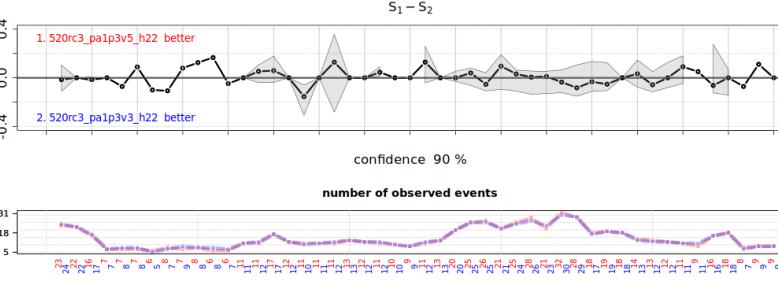
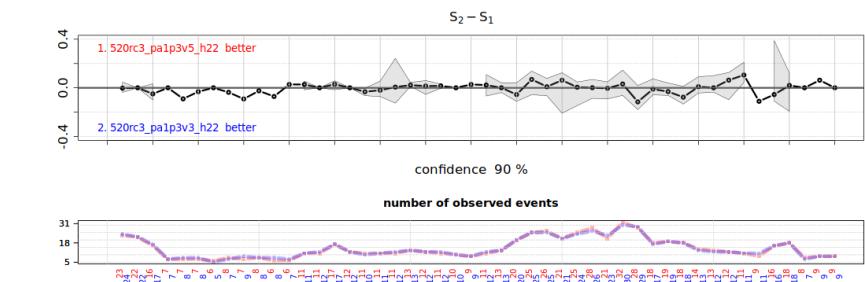
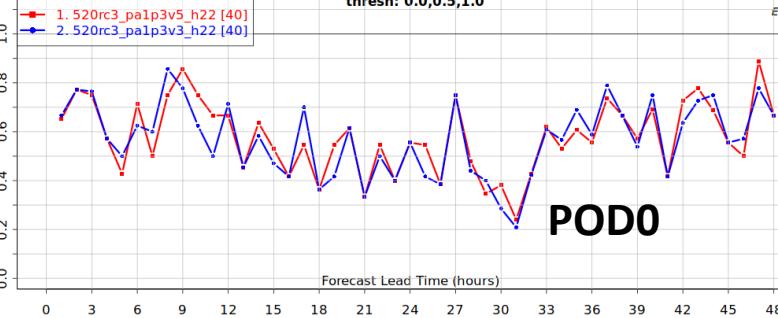
Winter 2022



E ALARM RATIO OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 202
 PR>=1.0 ade metar speci North America plus

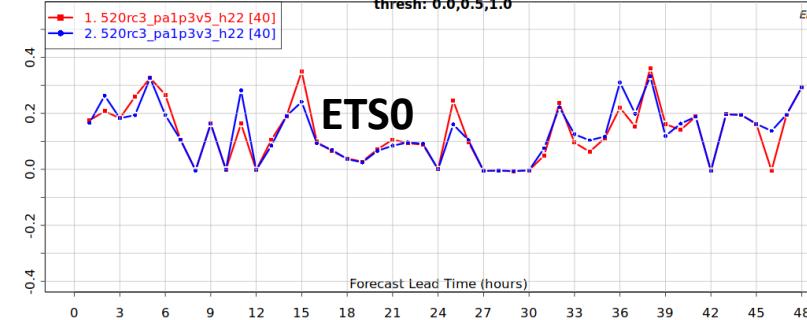
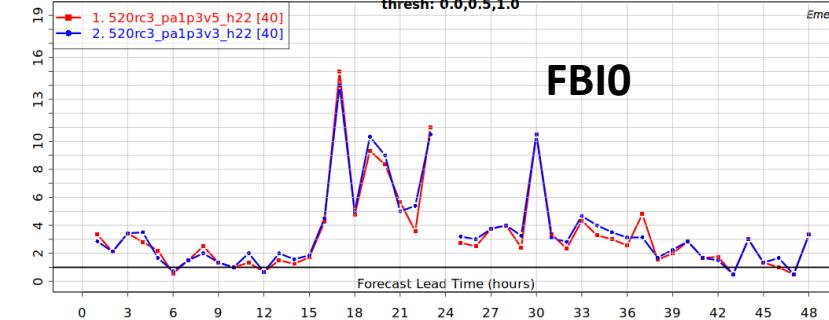


I. OF DETECTION OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 202
 PR>=1.0 ade metar speci North America plus

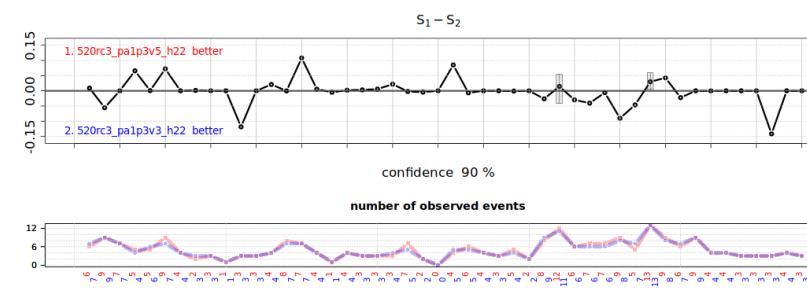
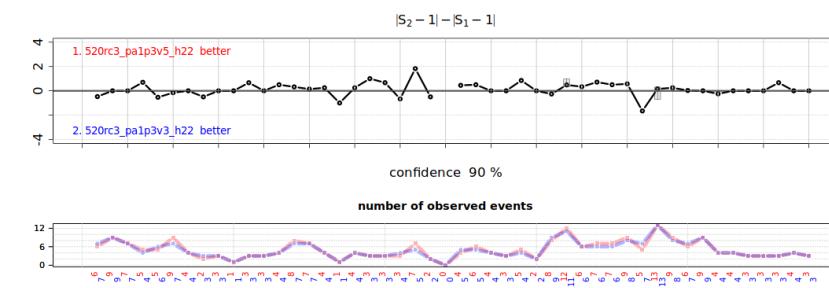


**FR phase frequency
(PR>1mm/h) over
North America**

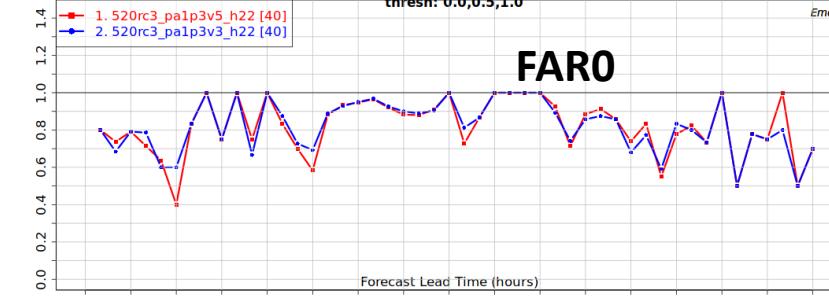
<http://emet-usr.science.gc.ca/emet/mec000/6-1-59.disp>



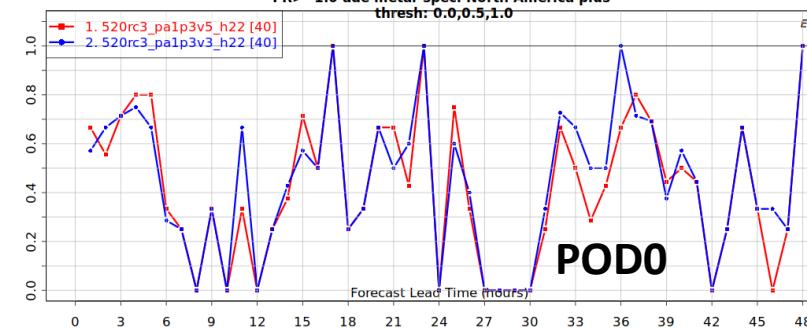
Winter 2022



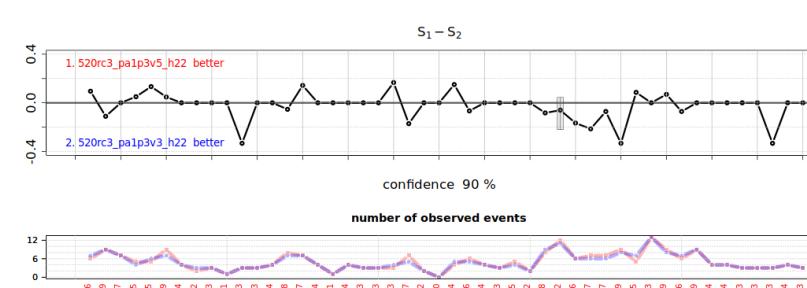
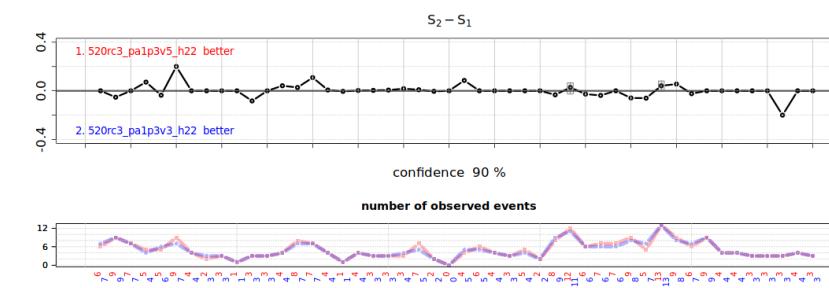
FALSE ALARM RATIO OF 1-HOUR ICE PELLET VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-02-
 PR>=1.0 ade metar speci North America plus



PROB. OF DETECTION OF 1-HOUR ICE PELLET VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-02-
 PR>=1.0 ade metar speci North America plus



**PE phase frequency
 (PR>1mm/h) over
 North America**



<http://emet-usr.science.gc.ca/emet/mec000/6-1-59.disp>

Ongoing work

Specific ratio to mixing ratio conversion (not sure this is compatible with the cloud fraction subroutine).

- Modification to Tr3d_list (already in PA1 but looks wrong with mass=1).

This had a cooling effect in the GDPS (especially with cloud fraction).

Test the conservation of total water in GEM physics.

This had a cooling impact in the GDPS.

Adjust/tune detrainment of Nc and Ni,tot if necessary, with different closure assumptions.

Test the cloud fraction in the HRDPS.

Test the actual and the new (under dev.) approaches for the 3-moment of ice and liquid fraction during summer.

Optimisation with liquid fraction and 3-moment ice.

Expectations:

Will change the results

Will not change the results

Conclusions

Scores:

- Arcad is neutral for both seasons, except an intensification of the warm bias in the lower levels in summer.
- Emet is mostly neutral as well with:
 - A warmer warm bias in summer and colder cold bias in winter.
 - Changes in PO and TT biases are small.
 - P3v5 increases FBI of PR6 in both seasons (good news during winter).
 - Scores for the phase frequencies (Bourgouin types) are mostly neutral especially at higher thresholds of PR (e.g., 1 mm). PE and FR neutral, more differences for SN and RN in winter (not summer).

Other results:

- Timings are comparable between v5 and v3 (tested this summer).
- PE1 is better diagnosed with v5 and it compares better to PE from Bourgouin (summer interns).
- Reflectivity is higher with v5, which seems to compare better (in general) with radar observations for convective cases.
- Triple-moment ice and liquid fraction also give neutral changes to the scores.

Proposition:

- To implement v5 in the latest alpha GEM version and continue PA1-BigBird tests with it.