

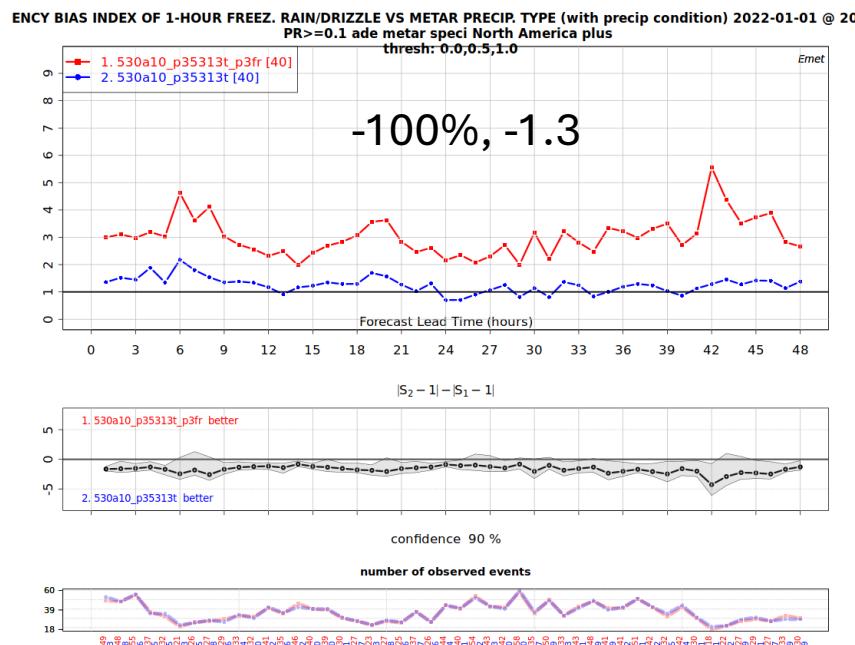
P3-v5.3.14

HRDPS validation in GEM5.3.10-a10 and PA3a configuration
HM changes for freezing rain problem in P3

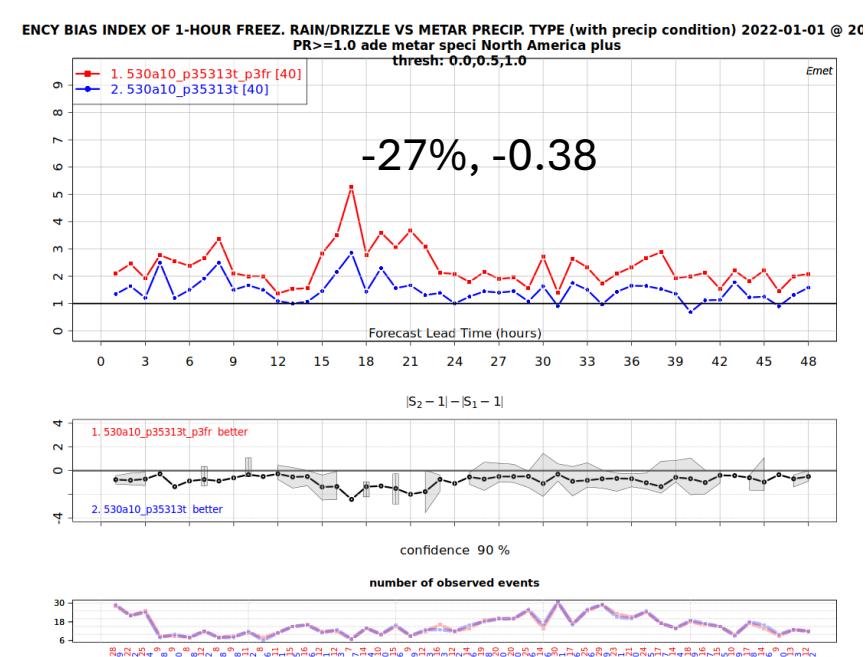
Freezing rain status

P3 FR (FR1+FR2) field is overestimated compared to FR (from Bourgouin), especially for small PR. It is doubled for PR > 0.1 mm and 30% more for PR > 1mm.

PR>0.1 mm



PR>1 mm

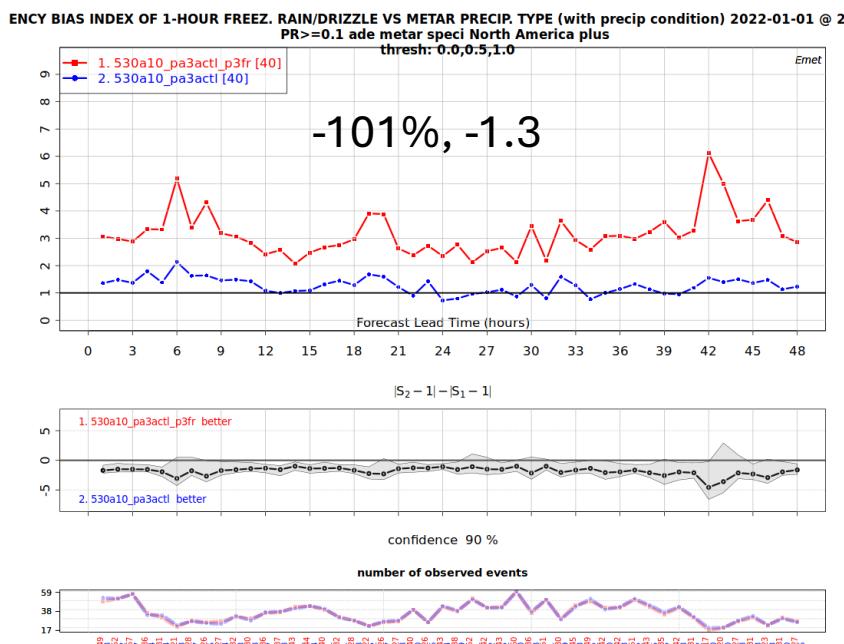


FR (P3) = FR1+FR2
FR (Bourgouin)

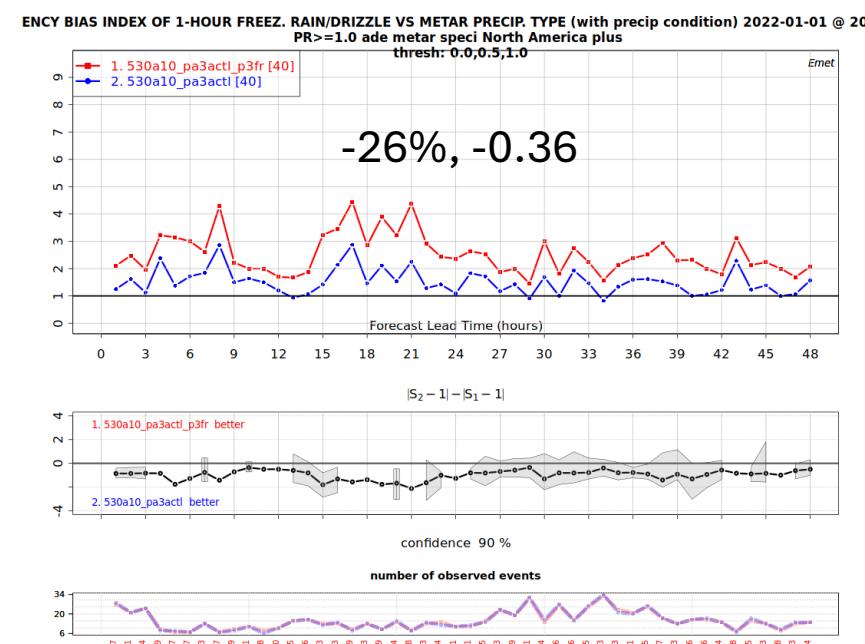
Freezing rain status (P3-v5.3.6)

P3 FR (FR1+FR2) field is overestimated compared to FR (from Bourgouin), especially for small PR. It is doubled for PR > 0.1 mm and 30% more for PR > 1mm.

PR>0.1 mm



PR>1 mm

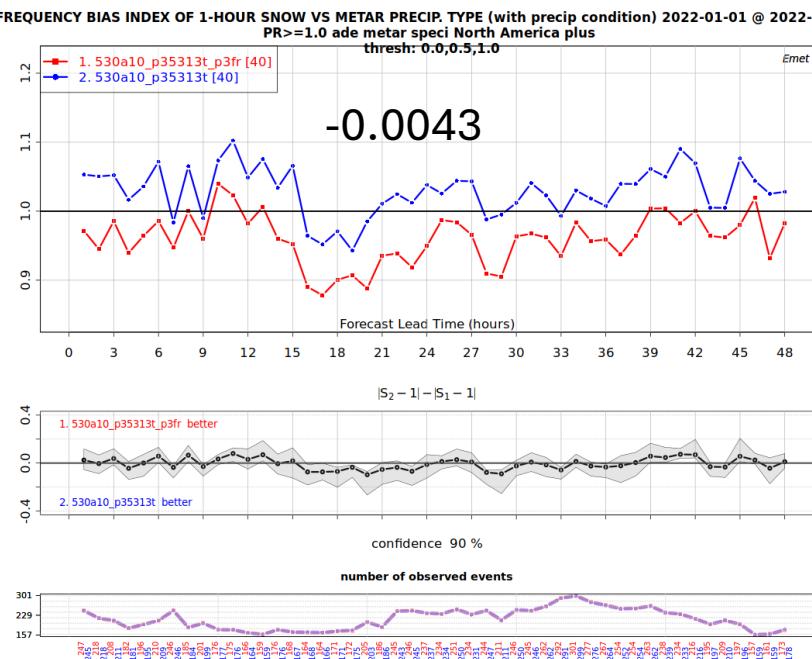


FR (P3) = FR1+FR2
FR (Bourgouin)

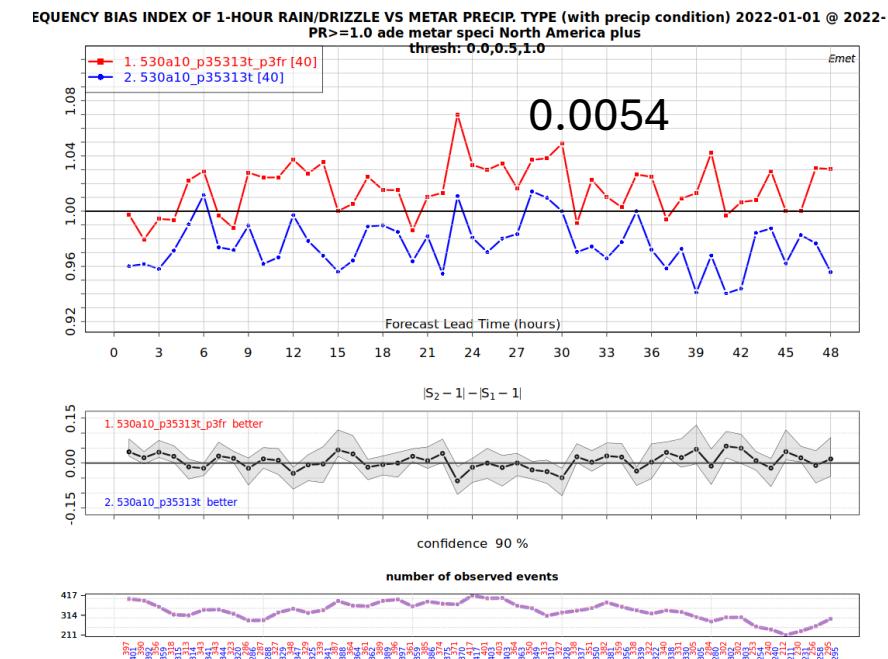
Other precipitation types

Statistics between P3 and bourgouin for the other precipitation types are similar with small differences.

SN (P3) SN1+SN2+SN3+WS
SN (Bourgouin)



RN (P3) RN1+RN2 RN (Bourgouin)



v5.3.13 -- Bourgouin vs. P3 (FR, SN, RN)

ETS

POD

FAR

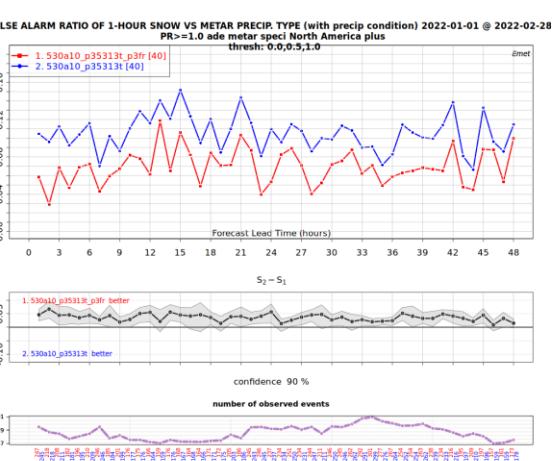
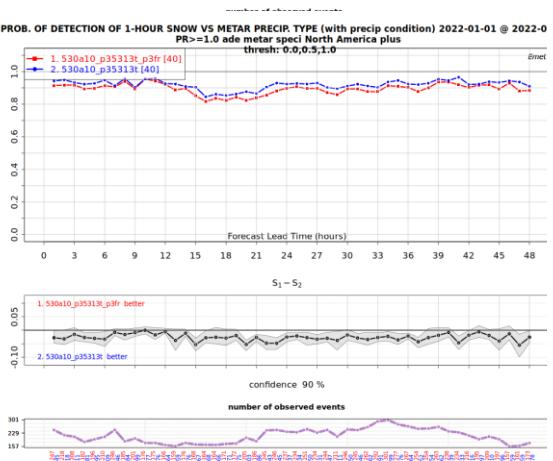
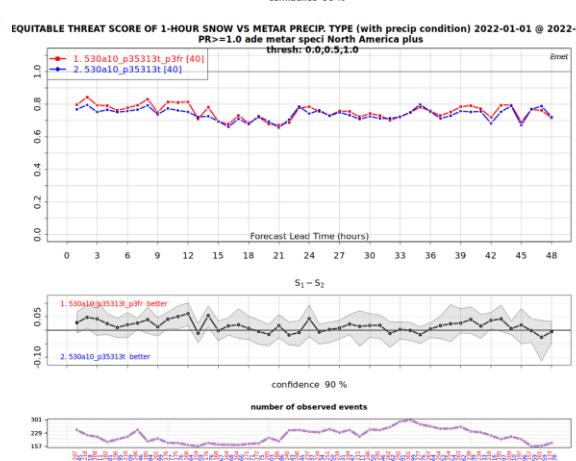
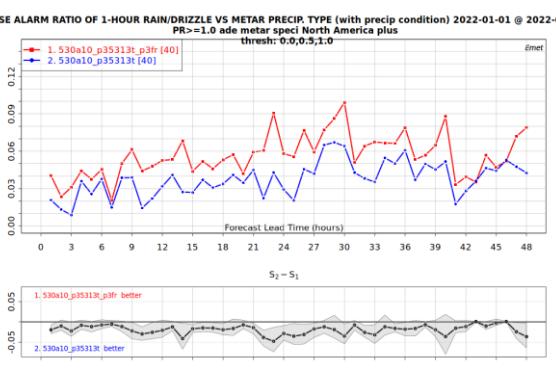
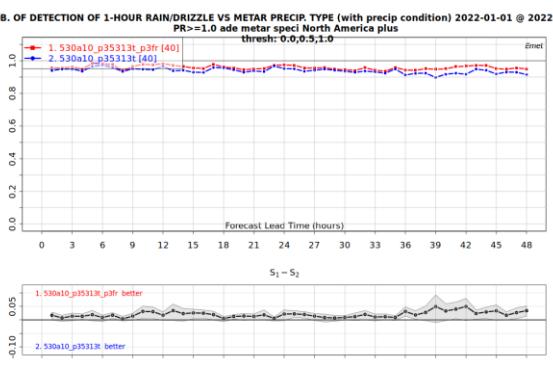
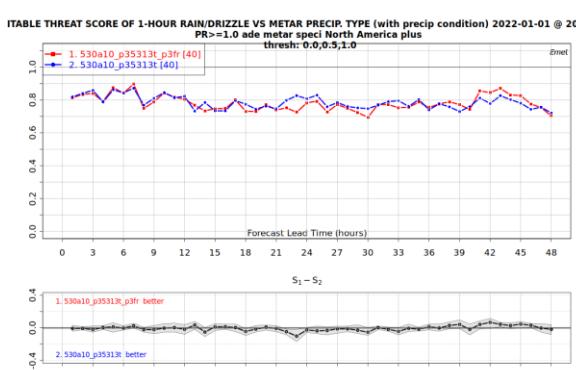
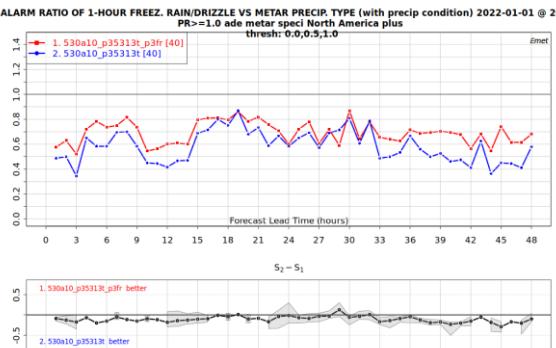
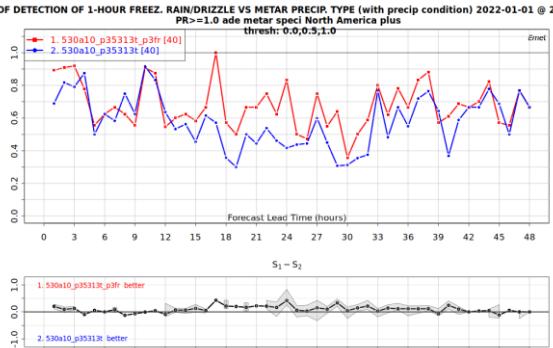
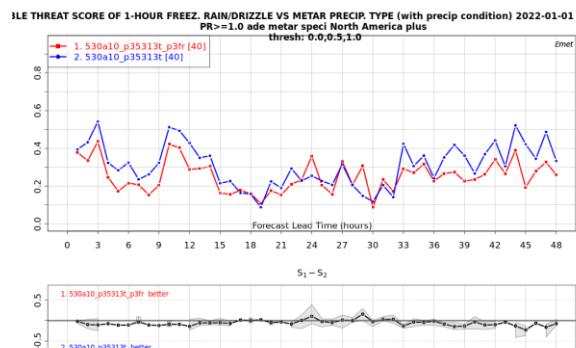
PR> 1 mm

FR

RN

Similar for
v5.3.6

SN



v5.3.13 -- Bourgouin vs. P3 (PE)

Similar for v5.3.6 and v5.3.12

ETS

FBI

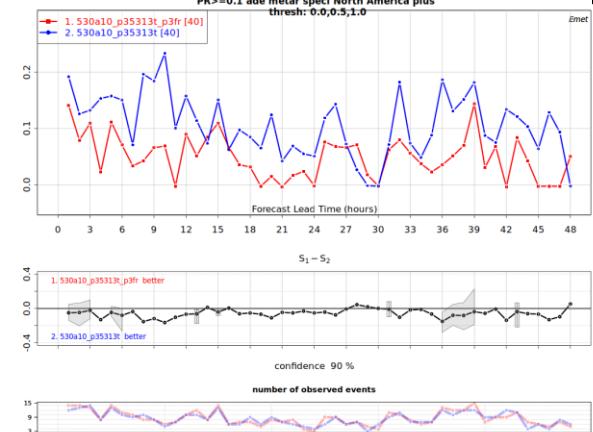
POD

FAR

TABLE THREAT SCORE OF 1-HOUR ICE PELLET VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 20

PR>=0.1 ade metar speci North America plus

thresh: 0.0,0.5,1.0



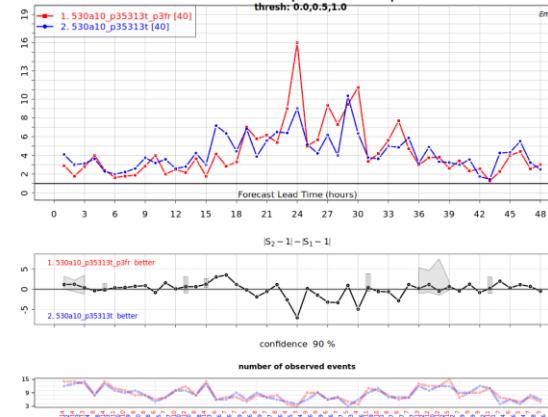
REQUENCY BIAS INDEX OF 1-HOUR ICE PELLET VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-0

PROB.

OF DETECTION OF 1-HOUR ICE PELLET VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-02

PR>=0.1 ade metar speci North America plus

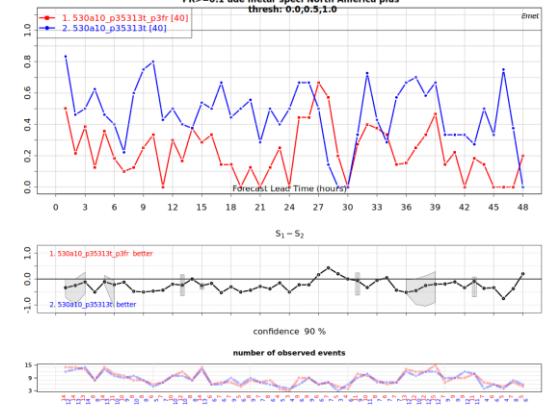
thresh: 0.0,0.5,1.0



THRESHOLD OF 1-HOUR ICE PELLET VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-02

PR>=0.1 ade metar speci North America plus

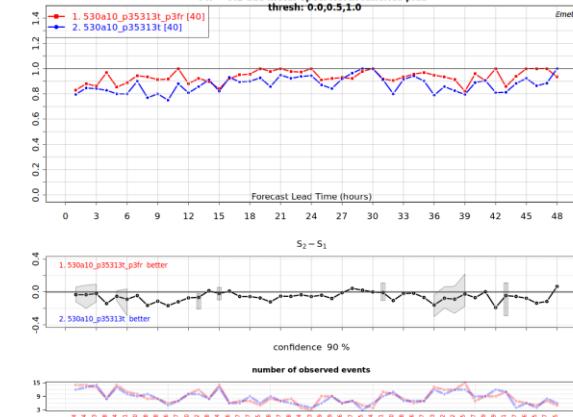
thresh: 0.0,0.5,1.0



FALSE ALARM RATIO OF 1-HOUR ICE PELLET VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-02

PR>=0.1 ade metar speci North America plus

thresh: 0.0,0.5,1.0

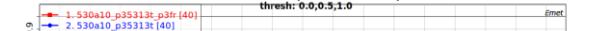


$PR > 0.1 \text{ mm}$

TABLE THREAT SCORE OF 1-HOUR ICE PELLET 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



REQUENCY BIAS INDEX OF 1-HOUR ICE PELLET VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-0

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

thresh: 0.0,0.5,1.0



THRESHOLD 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

thresh: 0.0,0.5,1.0



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

thresh: 0.0,0.5,1.0

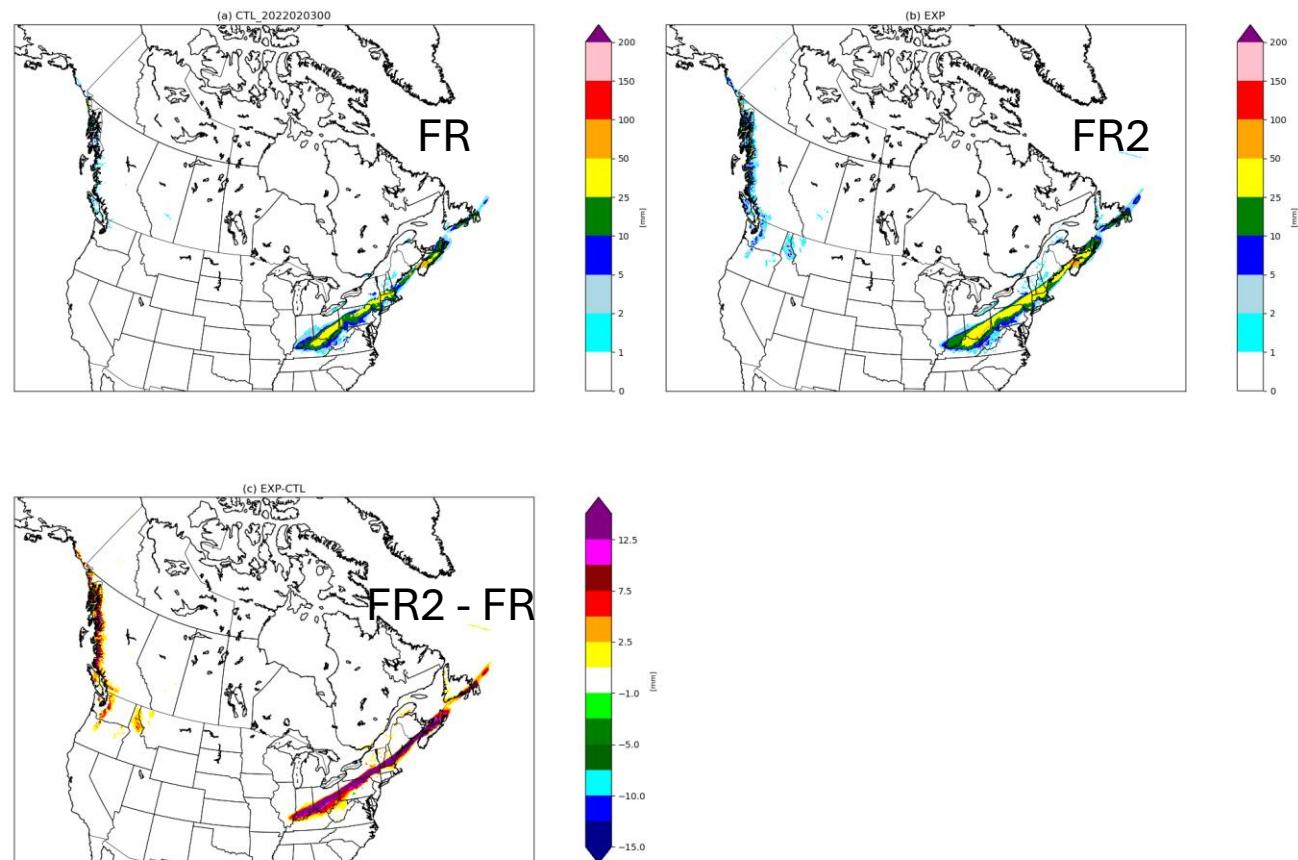


$PR > 1 \text{ mm}$

Freezing rain problem

- From a case-by-case analysis, the main problem seems to be that there is a larger spatial distribution of FR2 compared to FR, especially over the mountains in the west.
- A second problem is a higher FR2 amounts than FR where both are simulated.

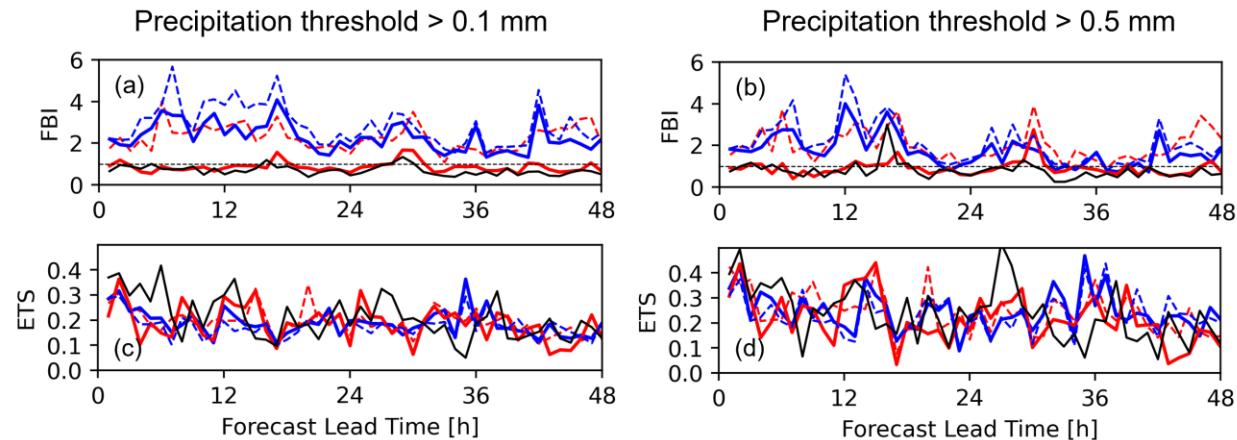
1 case example (2022020300), P3-v5.3.13



Cholette et al. (2024), GRL

- Cholette et al. (2024) showed that the overestimation of freezing rain can be eliminated using secondary ice production processes.
- In P3, the rime splintering (Hallett-Mossop 1974) is parameterized, but it was turned off with nCat=1 because it kills summer convection.

Freezing rain statistics for H2O (40 cases)



Simulation	Mean (threshold > 0.1 mm)		Mean (threshold > 0.5 mm)	
	FBI	ETS	FBI	ETS
<i>nCat1_noHM_Bourgouin</i>	0.691	0.210	0.786	0.238
<i>nCat1_noHM</i>	2.873	0.177	2.095	0.235
<i>nCat1_HM</i>	2.295	0.188	1.721	0.244
<i>nCat2_noHM</i>	2.272	0.196	1.981	0.243
<i>nCat2_HM</i>	0.859	0.188	0.887	0.217

Note that *nCat1_HM* improved *nCat1_noHM*, but not as much as for *nCat2*. This indicates that HM, as parameterized in P3, is not optimized for *nCat1*.

Litterature

- In P3 in GEM5.3.0-a10 (P3-v5.3.6), HM is included for ice nCat=1 when $T_{kbot} < 5^{\circ}\text{C}$, but it includes only the collected rain. Only that reduced by 30% the explicit freezing rain FBI of the previous version.
- From Cholette et al. (2024): “While the model results presented in this study with the HM process included are encouraging and show a systematic improvement in hindcast simulations of freezing rain, one must keep in mind that laboratory studies of rime splintering and other SIP processes have several limitations (Korolev et al., 2020) and the reproducibility of the original experiments reported in Hallett and Mossop (1974) have been recently questioned (Seidel et al., 2023). Thus, model parameterizations of SIP based on past studies are uncertain. Nonetheless, our results demonstrate that accounting for SIP in the simulation can have a large beneficial impact on the explicit simulation of winter precipitation.”
- Cholette et al. (2019; 2020) shows that the predicted liquid fraction of mixed-phase particles decreases the amount of freezing rain, because of smaller particles produced.
- Cholette et al. (2025, in review) shows that the predicted liquid fraction of mixed-phase particles improves the simulation of wet snow by changing the phase of precipitation from rain to wet snow during 10 winter orographic cases (ICE-POP 2018).

Objective and set-up

To improve the forecast of explicit freezing rain in the HRDPS:

- Improving the representation of rime splintering
- Including the explicit prediction of mixed-phase particles

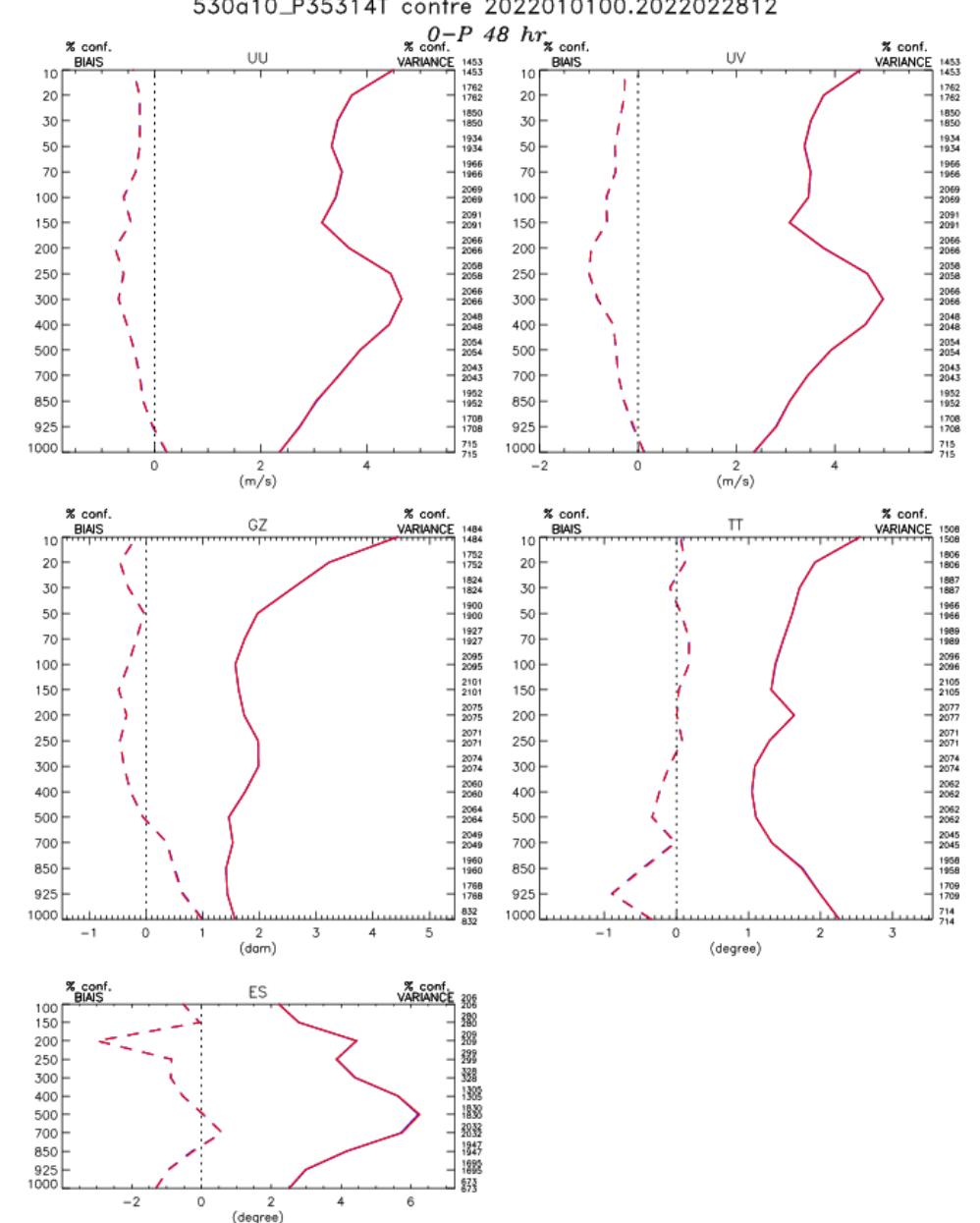
Experimental set-up

- GEM 5.3.0-a10, HRDPS PA3a configuration for 40 cases winter 2022

Experiment	Description	Rime splintering
p3v5313	Control (similar to v5.3.6 in GEM, see github) 2MOM_noLF_n1	HM (rain only) for $F_{i,liq} < 0.1$ Ice splinters with $D_{init_HM} = 0.01$ mm
p3v5314	2MOM_noLF_n1 + HM changes	HM (rain and cloud) Relaxed D_{min_HM} to initiate HM from 1 mm to 0.25 mm Compute HM for $q_{i,rim} > q_{small}$ and not only for $F_{irim} > 0.5$ (this has no impacts) $T_{kbot} < 9^\circ\text{C}$ instead of $T_{kbot} < 5^\circ\text{C}$ Increase $\rho_{i,rim}$ from 750 kg/m^3 to 850 kg/m^3 to differentiate between SN3 and PE1 and increase F_{irim} from 0.5 to 0.6 to differentiate between SN2 and SN3 (only diagnostic)
p3v5314LF	2MOM_LF_n1 + HM changes	+ predicted liquid fraction

Scores v5.3.13 vs. 5.3.14

- Arcad → completely neutral

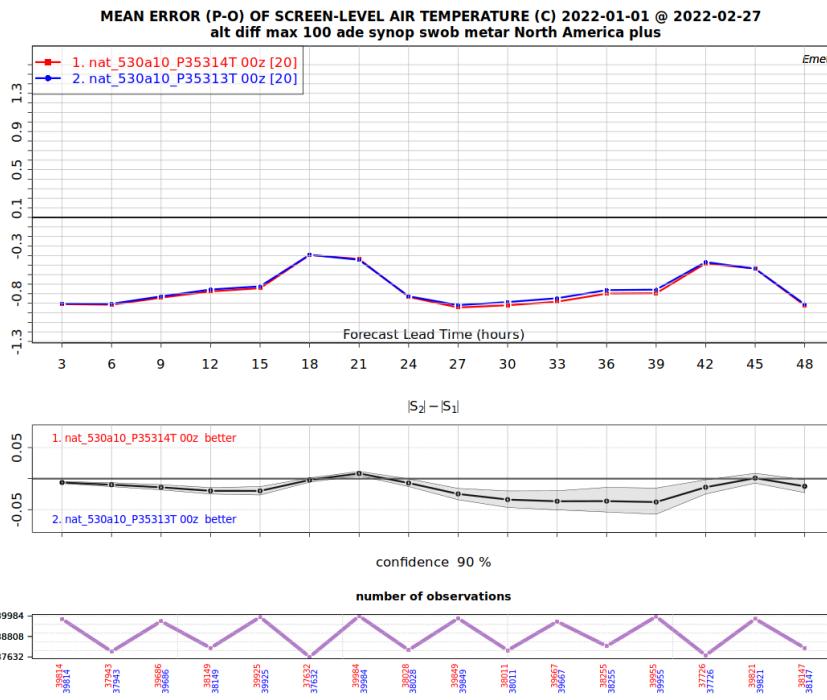


◆ ———	E-T m_uo_530a10_P3531T_2022010100.2022022812 (40)
□ -----	BIAS m_uo_530a10_P3531T_2022010100.2022022812
◆ ———	E-T m_uo_530a10_P3531T_2022010100.2022022812 (40)
□ -----	BIAS m_uo_530a10_P3531T_2022010100.2022022812

Type : 0-P 48 hr
Region : Amerique du Nord plus
Lat-lon: (25N, 170W) (85N, 40W)
Stat. inversees

Scores v5.3.13 vs. 5.3.14

- Emet TT, TD, UV, P0
- Very small differences



bias < >

nat_530a10_P35314T 00z / nat_530a10_P35313T 00z

	TD	TT
All	0.0	-0.0052
Appalachia CLIM	0.0	0.0025
Arctic All CLIM	0.0025	0.0041
Arctic Land CLIM	0.0032	0.0046
Boreal CLIM	0.022	0.0041
Canada	0.023	-0.011
Central CLIM	-0.006	-0.019
Central Plains CLIM	-0.0027	8.2e-05
Great Lakes CLIM	-0.00094	-0.0078
MidAtlantic CLIM	-0.0027	0.0021
Mt West CLIM	-0.083	-0.073
North America plus	-0.0071	-0.016
North Atlantic CLIM	-0.00049	-0.0038
North Plains CLIM	0.037	-0.027
Pacific North West CLIM	0.0	-0.02
Prairie CLIM	-0.0074	-0.0028

rmse < >

nat_530a10_P35314T 00z / nat_530a10_P35313T 00z

	TD	TT
All	0.0	-0.0052
Appalachia CLIM	0.0	-0.0052
Arctic All CLIM	0.0066	-0.0045
Arctic Land CLIM	-0.0045	-0.0071
Boreal CLIM	0.0	-0.0017
Canada	-0.0013	-0.0025
Central CLIM	-0.0001	-0.00065
Central Plains CLIM	0.0	0.0032
Great Lakes CLIM	-0.0019	-0.003
MidAtlantic CLIM	0.0	0.0
Mt West CLIM	-0.056	-0.053
North America plus	-0.0076	-0.01
North Atlantic CLIM	-0.0042	-0.0054
North Plains CLIM	0.0044	0.0045
Pacific North West CLIM	-0.0033	-0.0033
Prairie CLIM	-0.0012	-0.0099

stdev < >

nat_530a10_P35314T 00z / nat_530a10_P35313T 00z

	TD	TT
All	0.0	-0.0054
Appalachia CLIM	0.0	-0.0072
Arctic All CLIM	-0.0072	-0.0073
Arctic Land CLIM	-0.008	-0.0028
Boreal CLIM	0.0	-0.0038
Canada	-0.0064	-0.0026
Central CLIM	-0.00095	0.0
Central Plains CLIM	0.0	0.0036
Great Lakes CLIM	0.0	-0.0093
MidAtlantic CLIM	0.0	-0.001
Mt West CLIM	-0.025	-0.0055
North America plus	-0.0075	-0.0044
North Atlantic CLIM	-0.0037	-0.0019
North Plains CLIM	0.0	0.00086
Pacific North West CLIM	-0.0032	-0.001
Prairie CLIM	0.0	0.0

bias < >

nat_530a10_P35314T 00z / nat_530a10_P35313T 00z

	PO
All	0.0086
Appalachia CLIM	0.0068
Arctic All CLIM	0.0
Arctic Land CLIM	0.0
Boreal CLIM	0.0097
Canada	0.012
Central CLIM	0.014
Central Plains CLIM	-0.0023
Great Lakes CLIM	0.0061
MidAtlantic CLIM	0.0076
Mt West CLIM	0.0068
North America plus	0.012
North Atlantic CLIM	0.016
North Plains CLIM	0.015
Pacific North West CLIM	-0.0028

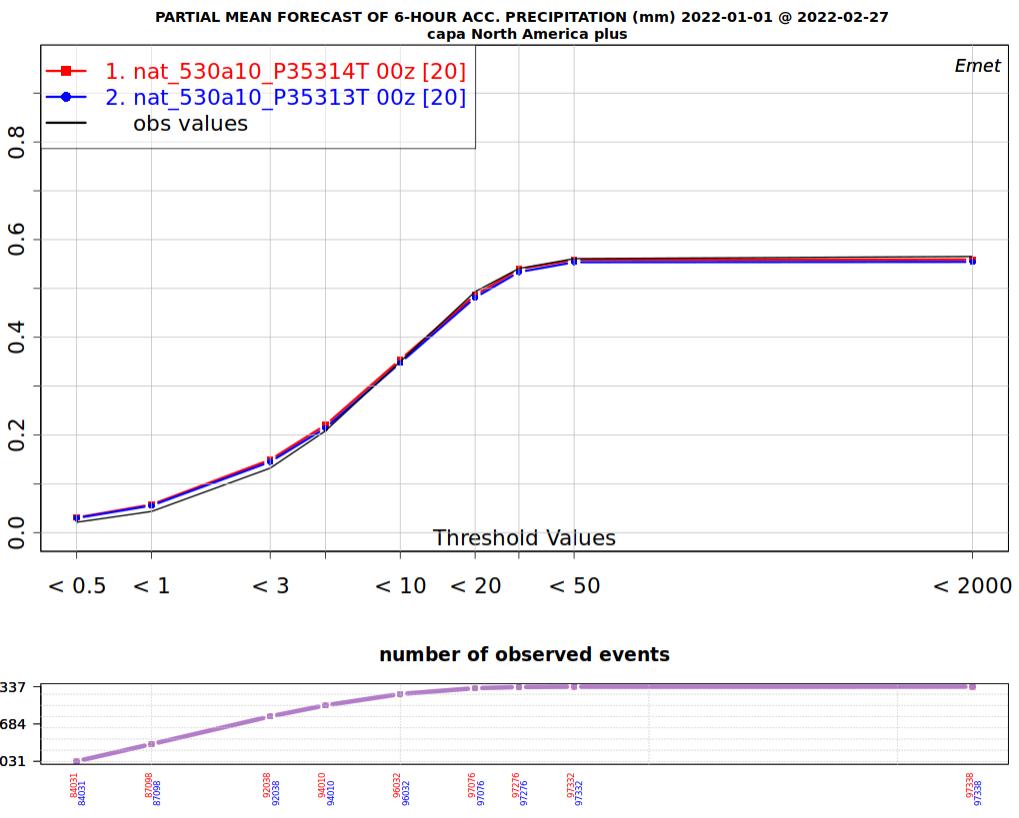
bias < >

nat_530a10_P35314T 00z / nat_530a10_P35313T 00z

	UV
All	0.0026
Appalachia CLIM	0.0
Arctic All CLIM	0.0
Arctic Land CLIM	0.0
Boreal CLIM	-0.0024
Canada	-0.0045
Central CLIM	-0.0074
Central Plains CLIM	0.0
Great Lakes CLIM	0.0
MidAtlantic CLIM	0.0
Mt West CLIM	-0.0096
North America plus	-0.0031
North Atlantic CLIM	0.0
North Plains CLIM	-0.01
Pacific North West CLIM	-0.0012
Prairie CLIM	-0.0025

Scores v5.3.13 vs. v5.3.14

- Emet (PR6 and PR24)



fbi		▼		<	>
nat_530a10_P35314T 00z / nat_530a10_P35313T 00z		/20220101 / /20220228		All	
Appalachia CLIM		PR24	-0.00092		
		PR6	-0.0021		
Arctic All CLIM		PR24	0.0		
		PR6	0.0		
Arctic Land CLIM		PR24	0.0		
		PR6	0.0		
Boreal CLIM		PR24	0.0		
		PR6	-0.011		
Canada		PR24	-0.0058		
		PR6	-0.0055		
Central CLIM		PR24	0.0063		
		PR6	-0.027		
Central Plains CLIM		PR24	0.0		
		PR6	0.0		
Great Lakes CLIM		PR24	0.0		
		PR6	-0.022		
MidAtlantic CLIM		PR24	0.014		
		PR6	-0.005		
Mt West CLIM		PR24	0.0		
		PR6	-0.032		
North America plus		PR24	0.0068		
		PR6	0.0056		
North Atlantic CLIM		PR24	0.0085		
		PR6	0.0048		
North Plains CLIM		PR24	0.0		
		PR6	0.0		
Pacific North West CLIM		PR24	0.0022		
		PR6	-0.028		
Prairie CLIM		PR24	0.012		
		PR6	-0.017		

ets	ets	
nat_530a10_P35314T 00z / nat_530a10_P35313T 00z	PR24	20220101 / 20220228
	PR6	All
Appalachia CLIM	PR24	0.0013
	PR6	-0.0027
Arctic All CLIM	PR24	0.0
	PR6	0.0
Arctic Land CLIM	PR24	0.0
	PR6	0.0047
Boreal CLIM	PR24	0.0059
	PR6	-0.0076
Canada	PR24	0.0018
	PR6	-0.0019
Central CLIM	PR24	-0.00051
	PR6	0.0
Central Plains CLIM	PR24	0.0
	PR6	0.0
Great Lakes CLIM	PR24	0.0
	PR6	0.0067
MidAtlantic CLIM	PR24	-0.0023
	PR6	0.0041
Mt West CLIM	PR24	0.027
	PR6	0.0019
North America plus	PR24	0.0
	PR6	0.0038
North Atlantic CLIM	PR24	-0.0024
	PR6	0.0
North Plains CLIM	PR24	0.0
	PR6	0.0
Pacific North West CLIM	PR24	0.0031
	PR6	-0.0045
Prairie CLIM	PR24	0.0016
	PR6	0.0033

far	<	>
far		
nat_530a10_P35314T		20220101 /
00z /		20220228
nat_530a10_P35313T		
00z		All
Appalachia CLIM	PR24	0.00076
	PR6	0.0024
Arctic All CLIM	PR24	0.0
	PR6	0.0
Arctic Land CLIM	PR24	0.0
	PR6	0.0044
Boreal CLIM	PR24	0.0042
	PR6	0.0
Canada	PR24	0.0011
	PR6	-0.0055
Central CLIM	PR24	-0.067
	PR6	0.0
Central Plains CLIM	PR24	0.0
	PR6	0.0
Great Lakes CLIM	PR24	0.0
	PR6	0.0079
MidAtlantic CLIM	PR24	-0.012
	PR6	0.0
Mt West CLIM	PR24	0.023
	PR6	0.01
North America plus	PR24	-0.004
	PR6	0.0045
North Atlantic CLIM	PR24	-0.0023
	PR6	-0.0011
North Plains CLIM	PR24	0.0
	PR6	0.0
Pacific North West CLIM	PR24	-0.0085
	PR6	-0.011
Prairie CLIM	PR24	-0.064
	PR6	0.0

pod		<	>
nat_530a10_P35314T 00z /		2020101 / 2022020	2022020
nat_530a10_P35313T 00z		2022020	2022020
	All		
Appalachia CLIM	PR24	0.002	
	PR6	0.0	
Arctic All CLIM	PR24	0.0	
	PR6	0.0	
Arctic Land CLIM	PR24	0.0	
	PR6	0.0	
Boreal CLIM	PR24	0.0064	
	PR6	-0.019	
Canada	PR24	0.0052	
	PR6	0.0	
Central CLIM	PR24	0.0014	
	PR6	-0.0054	
Central Plains CLIM	PR24	0.0	
	PR6	0.0	
Great Lakes CLIM	PR24	0.044	
	PR6	0.016	
MidAtlantic CLIM	PR24	0.0	
	PR6	0.0072	
Mt West CLIM	PR24	0.012	
	PR6	-0.013	
North America plus	PR24	0.006	
	PR6	0.0056	
North Atlantic CLIM	PR24	0.0018	
	PR6	-0.00067	
North Plains CLIM	PR24	0.0	
	PR6	0.0	
Pacific North West CLIM	PR24	0.019	
	PR6	0.0043	
Prairie CLIM	PR24	0.0034	
	PR6	-0.00093	

PR>0.1 mm

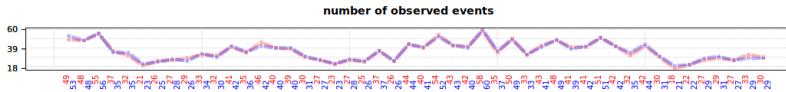
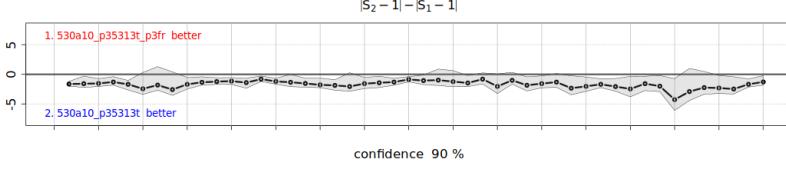
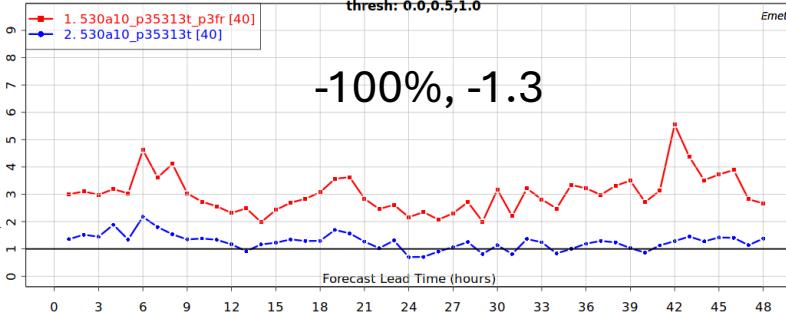
PR>1 mm

V5.3.13

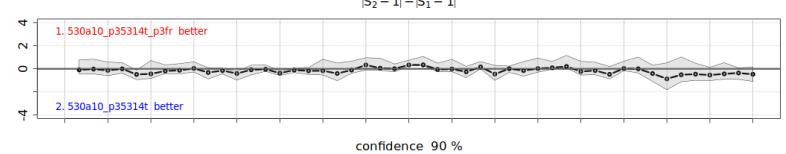
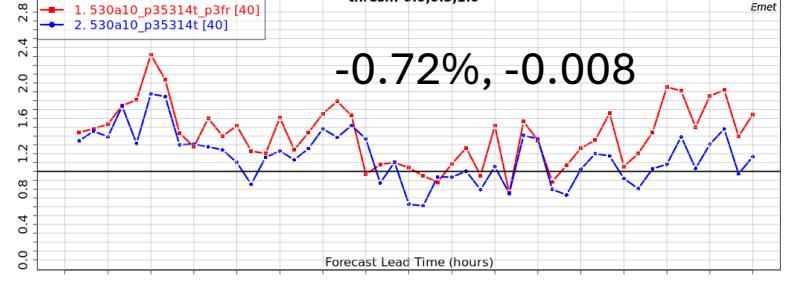
FR (P3) = FR1+FR2
FR (Bourgouin)

V5.3.14

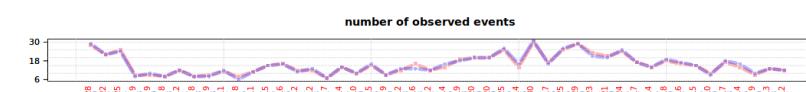
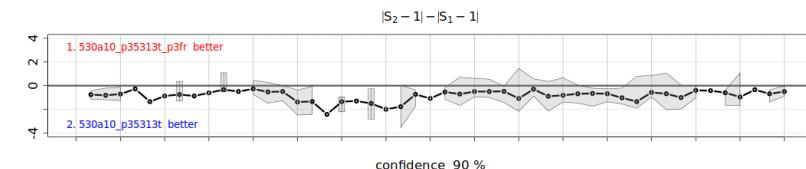
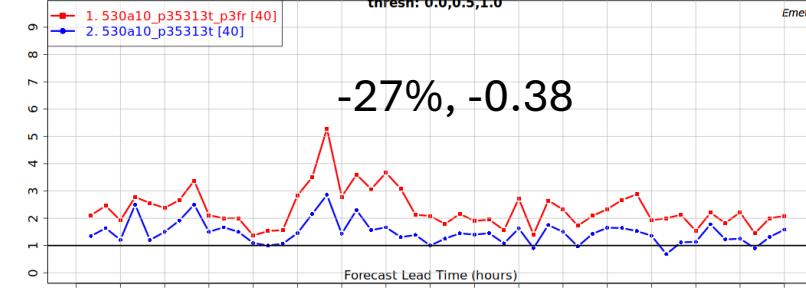
ENCY BIAS INDEX OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 20
PR>=0.1 ade metar speci North America plus
thresh: 0.0,0.5,1.0



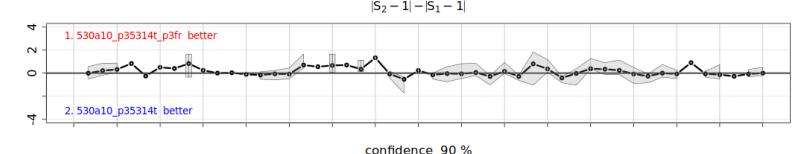
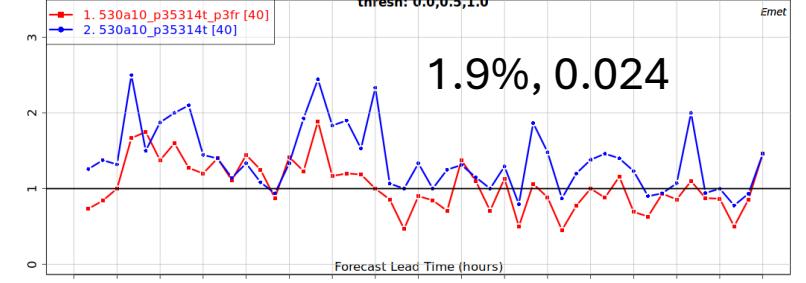
ENCY BIAS INDEX OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 20
PR>=0.1 ade metar speci North America plus
thresh: 0.0,0.5,1.0



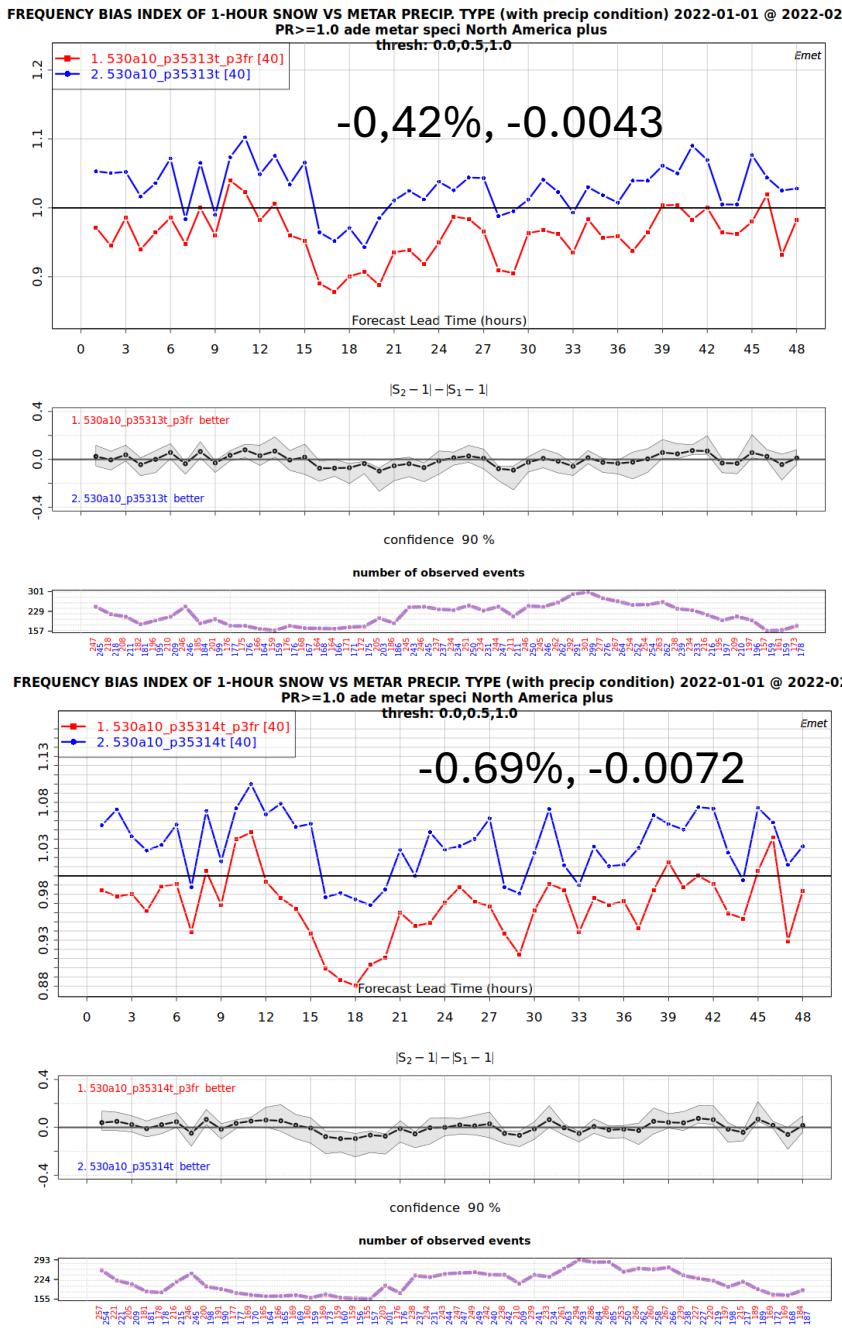
ENCY BIAS INDEX OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 20
PR>=1.0 ade metar speci North America plus
thresh: 0.0,0.5,1.0



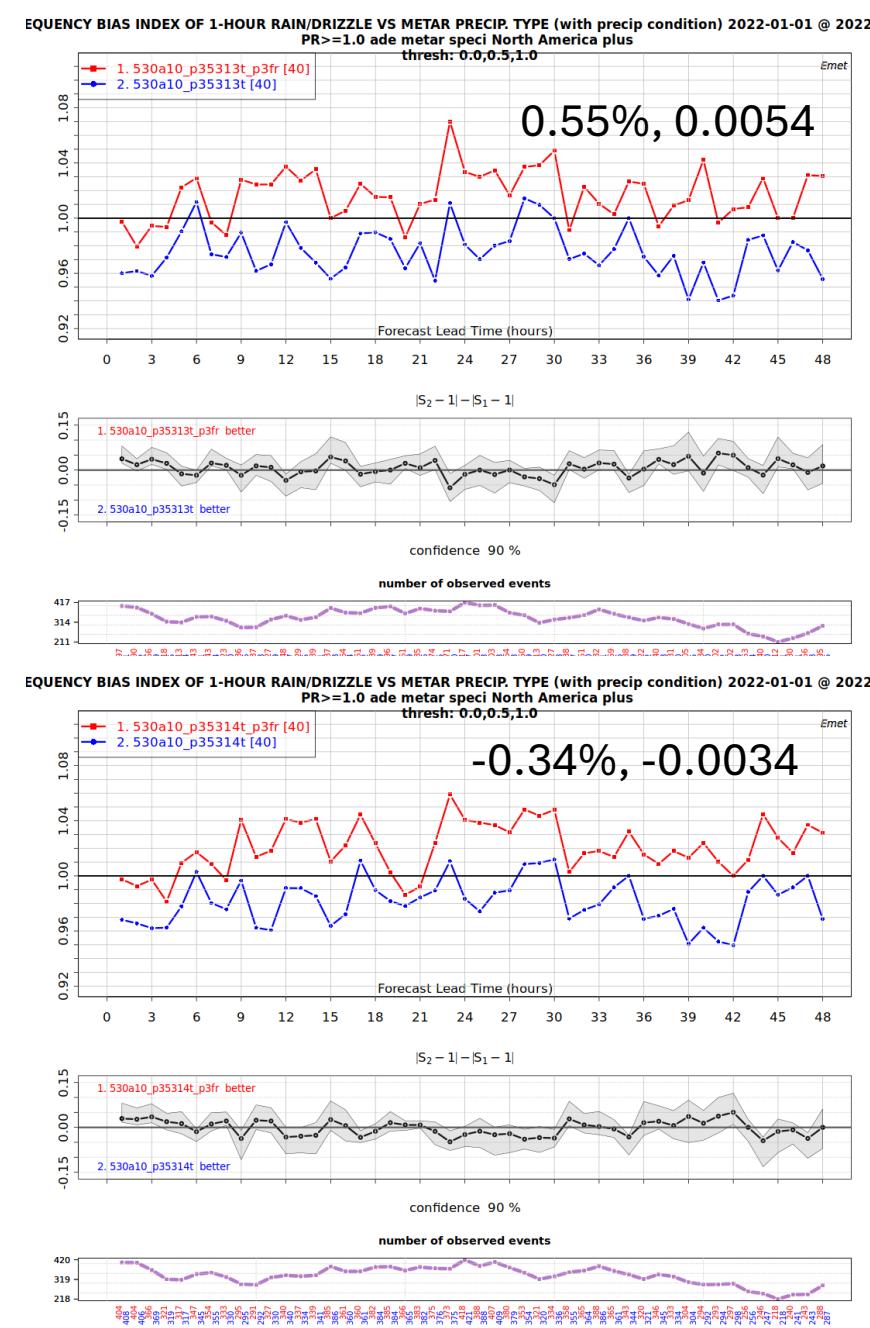
ENCY BIAS INDEX OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 20
PR>=1.0 ade metar speci North America plus
thresh: 0.0,0.5,1.0



Snow



Rain



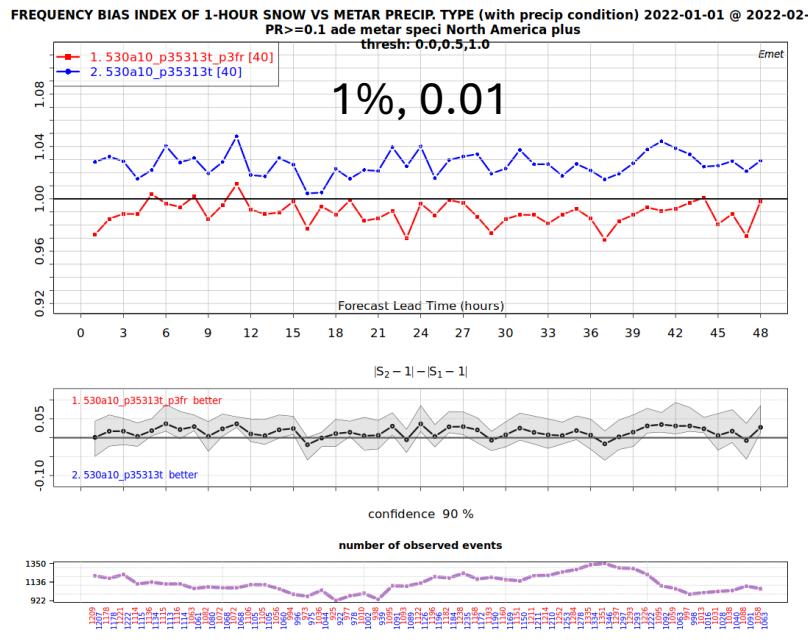
PR > 1 mm

SN (P3)
 SN1+SN2+SN3
 SN (Bourgouin)

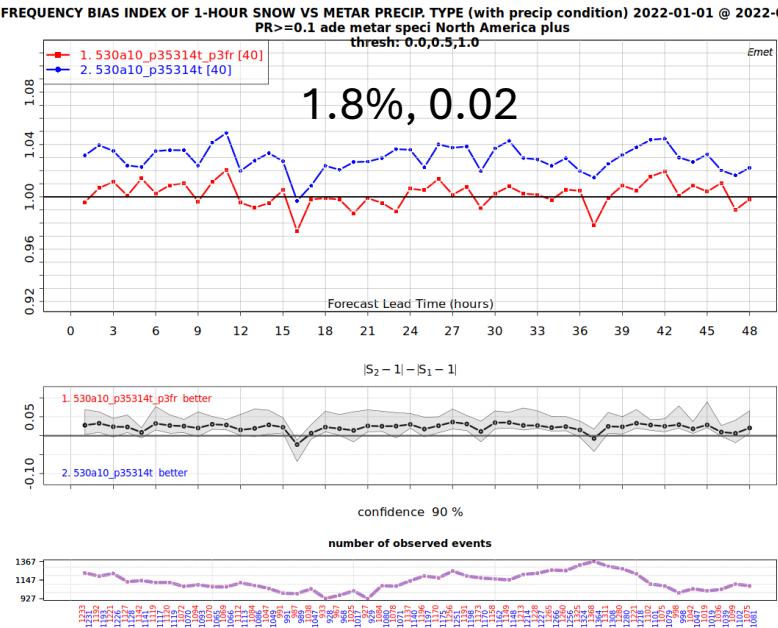
RN (P3) RN1+RN2
 RN (Bourgouin)

Snow

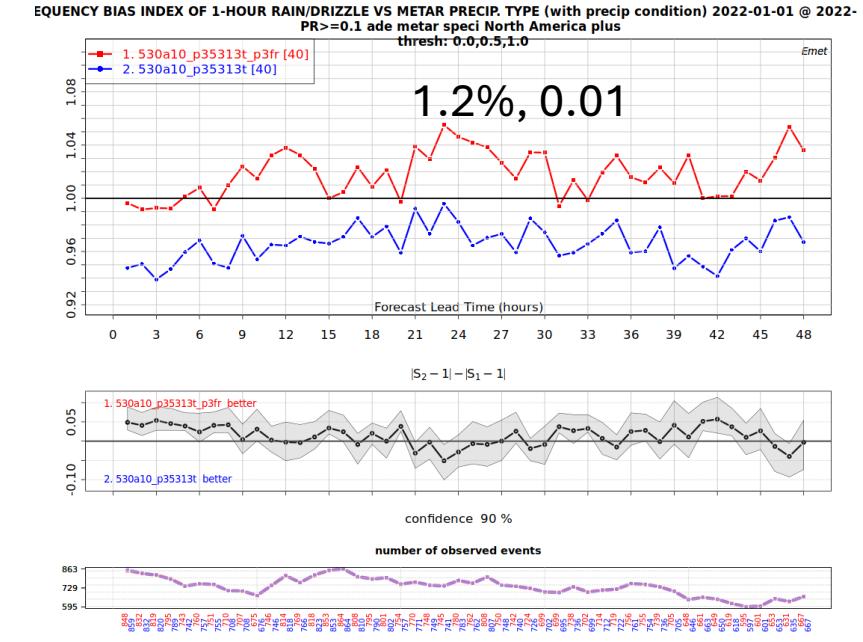
V5.3.13



V5.3.14



Rain



PR > 0.1 mm

SN (P3)
SN1+SN2+SN3
SN (Bourgouin)

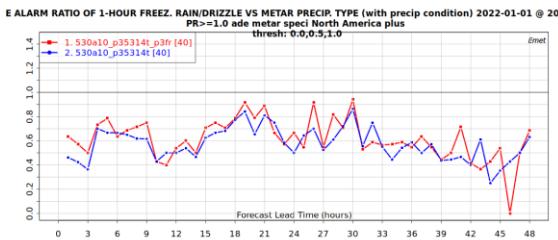
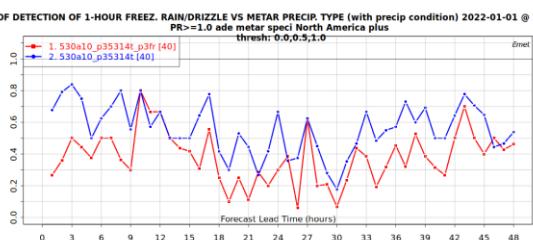
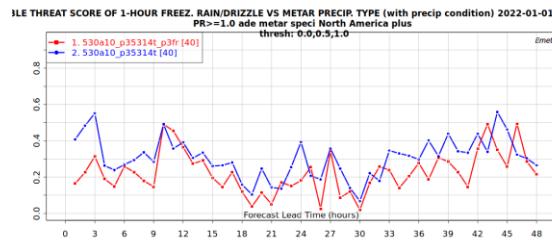
RN (P3) RN1+RN2
RN (Bourgouin)

v5.3.14 -- Bourgouin vs. P3 (FR, SN, RN)

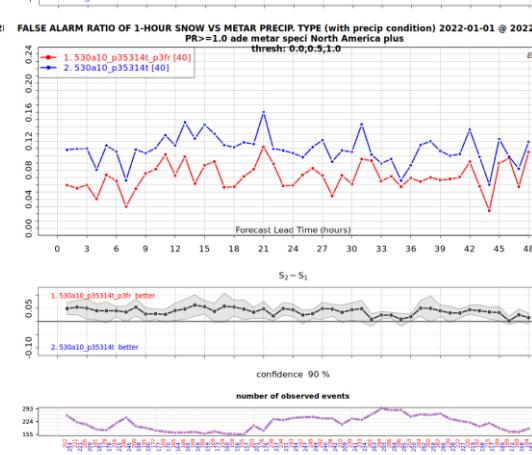
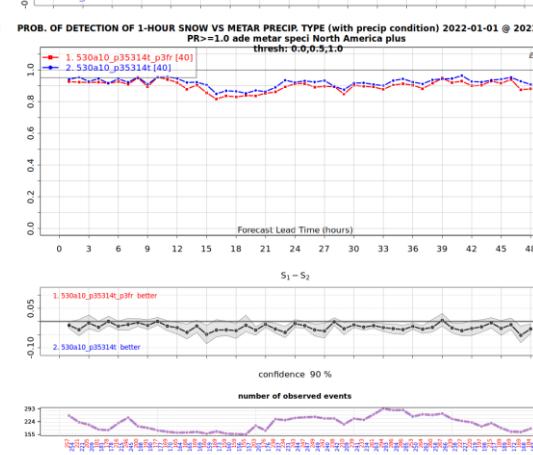
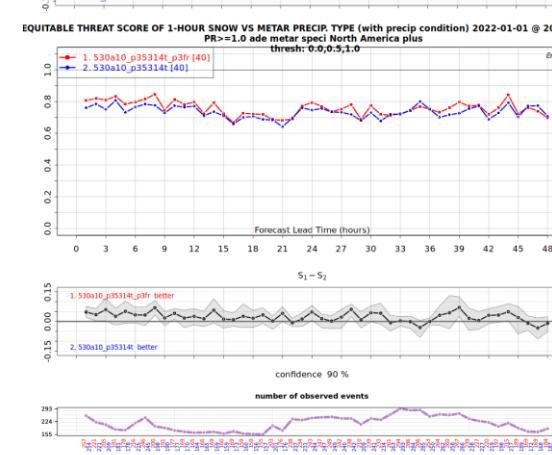
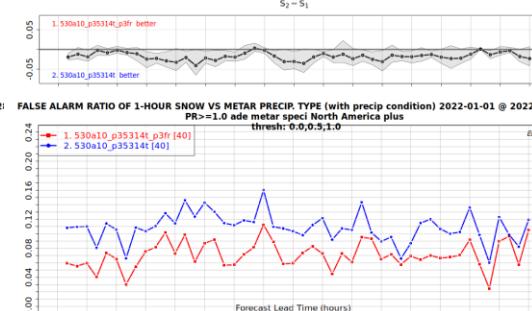
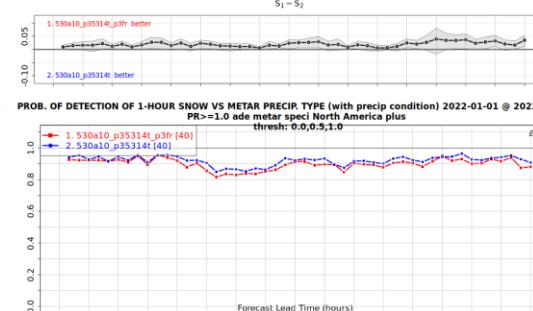
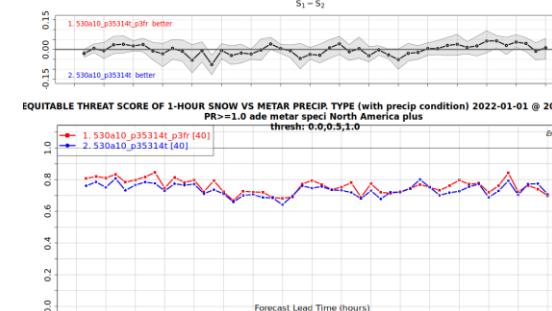
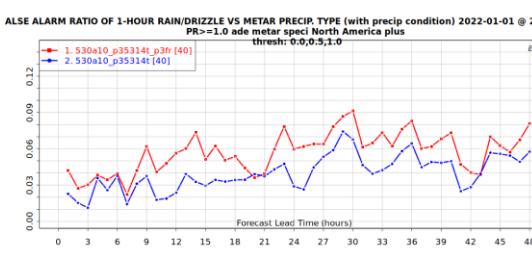
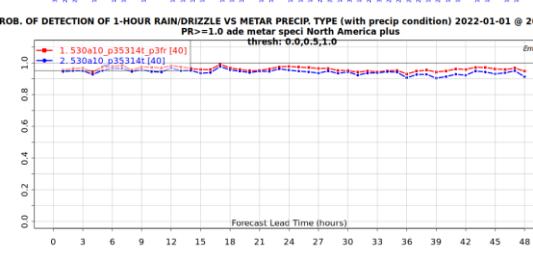
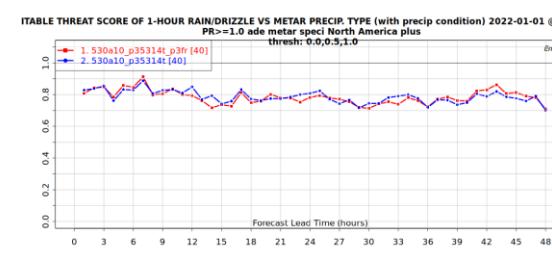
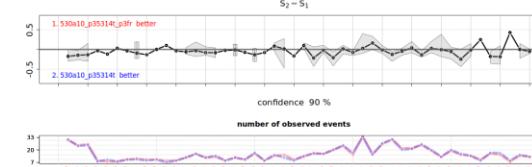
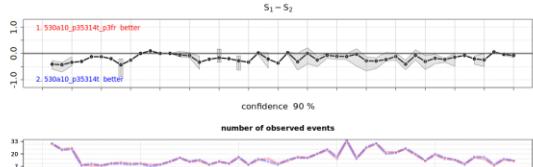
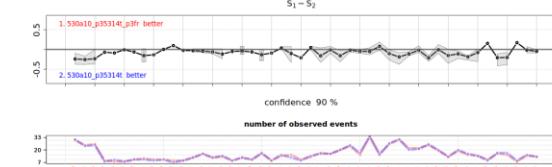
ETS

POD

FAR



PR> 1 mm



FR

RN

SN

Similar to
v5.3.13

v5.3.14 -- Bourgouin vs. P3 (PE)

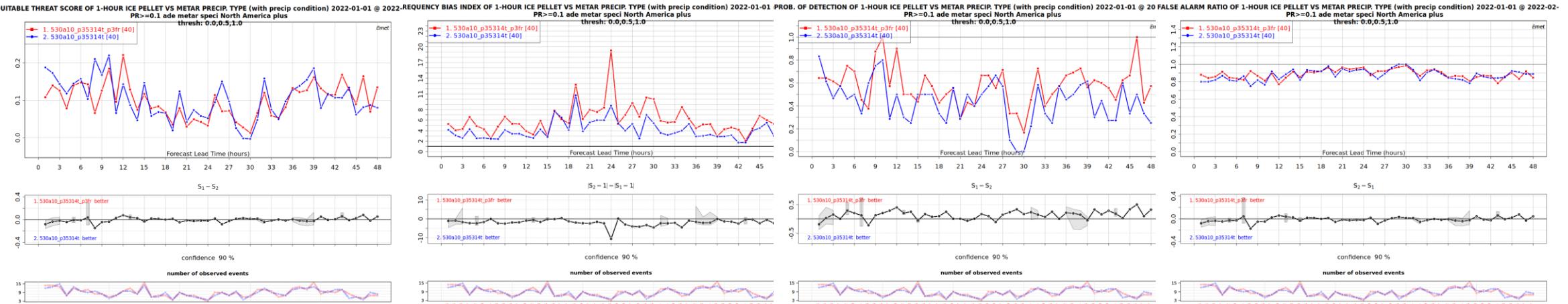
Similar to v5.3.13

ETS

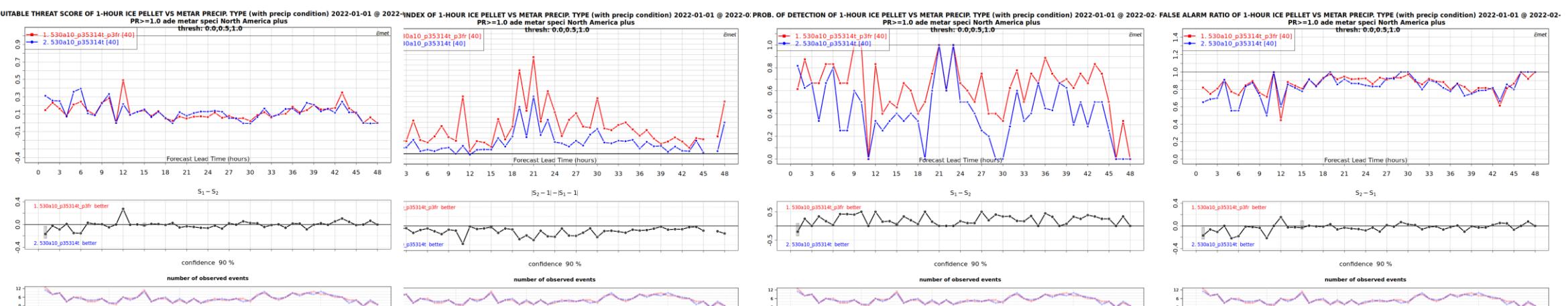
FBI

POD

FAR



$PR > 0.1$
mm

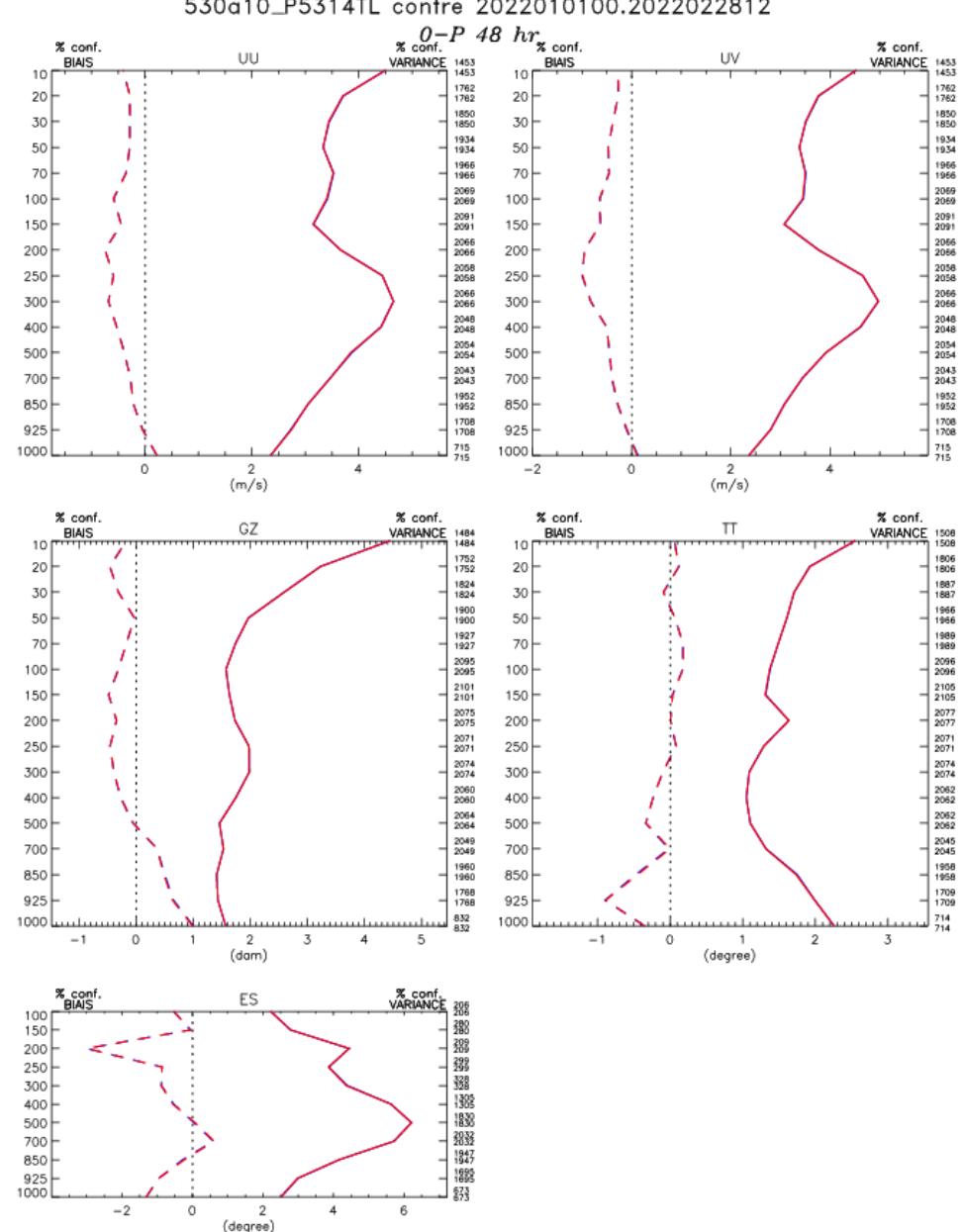


$PR > 1$
mm

P3-v5.3.14 with predicted liquid fraction

Scores v5.3.13 vs. 5.3.14FL

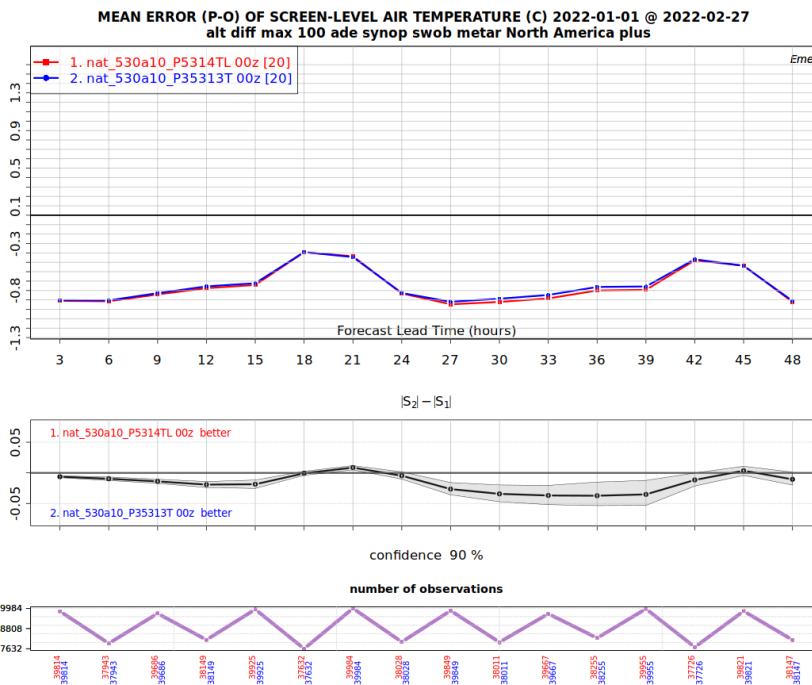
- Arcad → completely neutral



E-T m_ua_530a10_P5313T_2022010100.2022022812 (40)	Type : 0-P 48 hr
BIAS m_ua_530a10_P5313T_2022010100.2022022812	Region : Amerique du Nord plus
E-T m_ua_530a10_P5314TL_2022010100.2022022812 (40)	Lat-lon: (25N, 170W) (85N, 40W)
BIAS m_ua_530a10_P5314TL_2022010100.2022022812	Stat. inversees

Scores v5.3.13 vs. 5.3.14FL

- Emet TT, TD, UV, P0
- Very small differences



bias < >

bias		nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z		20220101 / 20220228	
		All			
Appalachia CLIM	TD	-0.0032			
	TT	0.0042			
Arctic All CLIM	TD	0.0034			
	TT	0.0055			
Arctic Land CLIM	TD	0.0032			
	TT	0.0053			
Boreal CLIM	TD	0.023			
	TT	0.0044			
Canada	TD	0.022			
	TT	-0.01			
Central CLIM	TD	-0.0068			
	TT	-0.019			
Central Plains CLIM	TD	0.0			
	TT	-0.00058			
Great Lakes CLIM	TD	0.0			
	TT	-0.007			
MidAtlantic CLIM	TD	0.0019			
	TT	0.0038			
Mt West CLIM	TD	-0.084			
	TT	-0.071			
North America plus	TD	-0.0079			
	TT	-0.015			
North Atlantic CLIM	TD	-0.00096			
	TT	-0.0035			
North Plains CLIM	TD	0.035			
	TT	-0.022			
Pacific North West CLIM	TD	0.0			
	TT	-0.018			
Prairie CLIM	TD	-0.0063			
	TT	-0.0059			

rmse < >

rmse		nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z		20220101 / 20220228	
		All			
Appalachia CLIM	TD	0.0			
	TT	-0.0017			
Arctic All CLIM	TD	-0.0035			
	TT	-0.0057			
Arctic Land CLIM	TD	-0.0038			
	TT	-0.0055			
Boreal CLIM	TD	0.0			
	TT	0.0			
Canada	TD	-0.00089			
	TT	-0.0017			
Central CLIM	TD	-0.00021			
	TT	-0.00066			
Central Plains CLIM	TD	0.0			
	TT	0.0			
Great Lakes CLIM	TD	-0.0022			
	TT	-0.0023			
MidAtlantic CLIM	TD	0.0			
	TT	0.0			
Mt West CLIM	TD	-0.056			
	TT	-0.052			
North America plus	TD	-0.0072			
	TT	-0.0096			
North Atlantic CLIM	TD	-0.0037			
	TT	-0.0021			
North Plains CLIM	TD	0.00037			
	TT	0.00058			
Pacific North West CLIM	TD	-0.0012			
	TT	-0.0029			
Prairie CLIM	TD	-0.0013			
	TT	-0.0026			

stdev < >

stdev		nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z		20220101 / 20220228	
		All			
Appalachia CLIM	TD	0.0			
	TT	-0.0053			
Arctic All CLIM	TD	-0.0046			
	TT	-0.0064			
Arctic Land CLIM	TD	-0.0043			
	TT	-0.0064			
Boreal CLIM	TD	0.0			
	TT	-0.0024			
Canada	TD	-0.0026			
	TT	-0.0013			
Central CLIM	TD	-0.00094			
	TT	0.0			
Central Plains CLIM	TD	0.0			
	TT	0.0023			
Great Lakes CLIM	TD	-0.002			
	TT	0.0084			
MidAtlantic CLIM	TD	0.0			
	TT	0.0			
Mt West CLIM	TD	-0.024			
	TT	-0.011			
North America plus	TD	-0.0072			
	TT	-0.0049			
North Atlantic CLIM	TD	-0.0038			
	TT	-0.001			
North Plains CLIM	TD	0.0			
	TT	0.00097			
Pacific North West CLIM	TD	-0.0013			
	TT	-3.9e-05			
Prairie CLIM	TD	-0.0011			
	TT	0.0			

bias < >

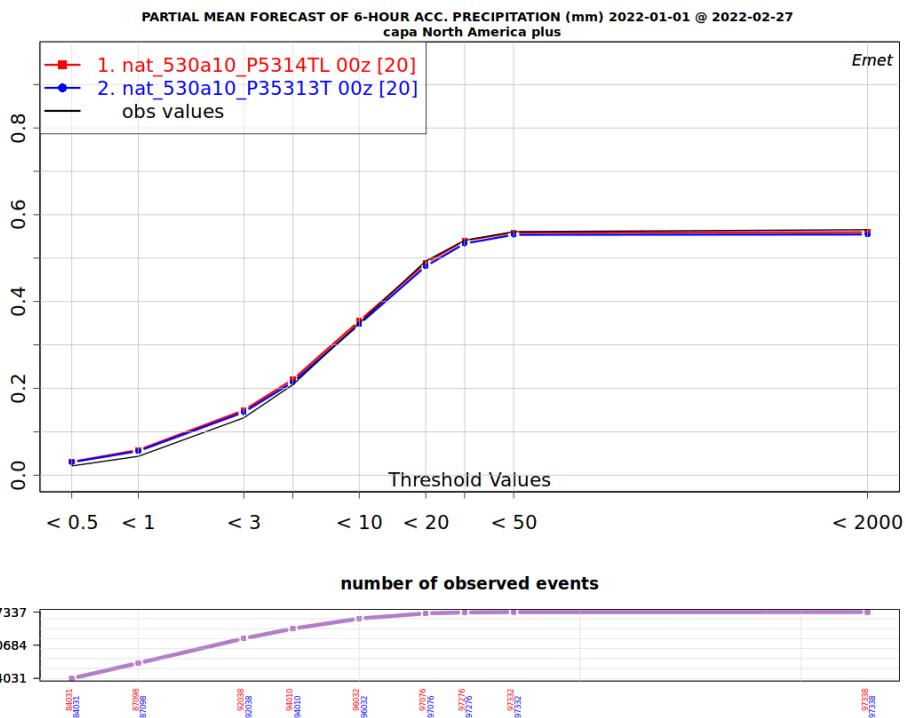
bias		nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z		20220101 / 20220228	
		All			
Appalachia CLIM	PO	0.0071			
Arctic All CLIM	PO	0.00053			
Arctic Land CLIM	PO	0.0			
Boreal CLIM	PO	0.01			
Canada	PO	0.013			
Central CLIM	PO	0.015			
Central Plains CLIM	PO	0.0016			
Great Lakes CLIM	PO	0.0052			
MidAtlantic CLIM	PO	0.0065			
Mt West CLIM	PO	0.0086			
North America plus	PO	0.013			
North Atlantic CLIM	PO	0.017			
North Plains CLIM	PO	0.016			
Pacific North West CLIM	PO	-0.0044			
Prairie CLIM	PO	0.0066			

bias < >

bias		nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z		20220101 / 20220228	
		All			
Appalachia CLIM	UV	0.0001			
Arctic All CLIM	UV	0.0004			
Arctic Land CLIM	UV	0.00039			
Boreal CLIM	UV	-0.003			
Canada	UV	-0.0035			
Central CLIM	UV	-0.0066			
Central Plains CLIM	UV	0.0			
Great Lakes CLIM	UV	0.0			
MidAtlantic CLIM	UV	0.0			
Mt West CLIM	UV	-0.012			
North America plus	UV	-0.002			
North Atlantic CLIM	UV	-0.00063			
North Plains CLIM	UV	-0.0075			
Pacific North West CLIM	UV	0.0			
Prairie CLIM	UV	-0.0025			

Scores v5.3.13 vs. v5.3.14FL

- Emet (PR6 and PR24)



fbi		< >	
nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z	All	2020101 / 202020228	
Appalachia CLIM	PR24 0.0012	PR6 0.0	
Arctic All CLIM	PR24 0.063	PR6 0.012	
Arctic Land CLIM	PR24 0.062	PR6 0.0	
Boreal CLIM	PR24 0.0	PR6 -0.014	
Canada	PR24 0.0051	PR6 -0.0056	
Central CLIM	PR24 0.0063	PR6 -0.015	
Central Plains CLIM	PR24 0.0	PR6 0.0	
Great Lakes CLIM	PR24 0.0	PR6 0.0077	
MidAtlantic CLIM	PR24 0.0	PR6 -0.0075	
Mt West CLIM	PR24 0.0	PR6 -0.0046	
North America plus	PR24 0.0048	PR6 0.0083	
North Atlantic CLIM	PR24 0.034	PR6 0.0056	
North Plains CLIM	PR24 0.0	PR6 0.0	
Pacific North West CLIM	PR24 0.01	PR6 -0.021	
Prairie CLIM	PR24 0.0063	PR6 0.0075	

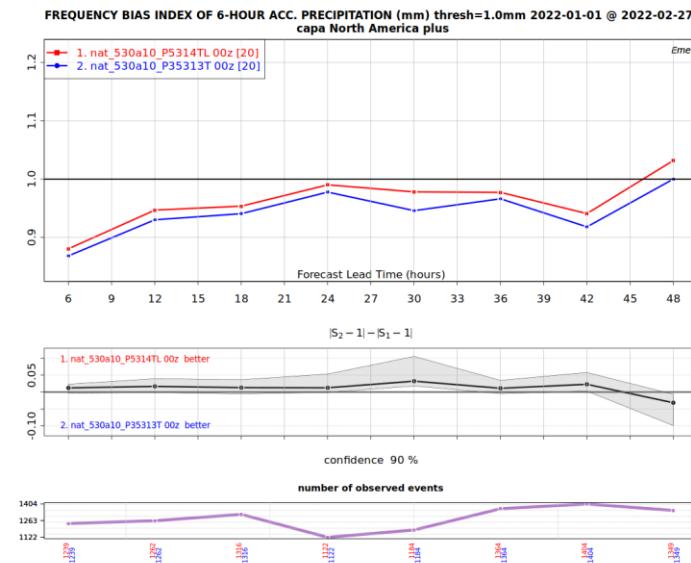
ets		< >	
nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z	All	2020101 / 202020228	
Appalachia CLIM	PR24 -0.0012	PR6 0.0	
Arctic All CLIM	PR24 0.0	PR6 -0.0023	
Arctic Land CLIM	PR24 0.0	PR6 0.0	
Boreal CLIM	PR24 0.0	PR6 0.028	
Canada	PR24 0.0019	PR6 -0.0014	
Central CLIM	PR24 -0.00051	PR6 0.0054	
Central Plains CLIM	PR24 0.0	PR6 0.0	
Great Lakes CLIM	PR24 0.013	PR6 -9.8e-06	
MidAtlantic CLIM	PR24 0.0	PR6 -0.0057	
Mt West CLIM	PR24 0.0053	PR6 -0.0029	
North America plus	PR24 0.0	PR6 0.0	
North Atlantic CLIM	PR24 0.019	PR6 0.0	
North Plains CLIM	PR24 0.0	PR6 0.0	
Pacific North West CLIM	PR24 0.005	PR6 -0.0023	
Prairie CLIM	PR24 -0.00084	PR6 0.0	

far		< >	
nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z	All	20220101 / 20220228	
Appalachia CLIM	PR24 -0.0023	PR6 0.0	
Arctic All CLIM	PR24 0.0	PR6 -0.0023	
Arctic Land CLIM	PR24 0.0	PR6 0.0	
Boreal CLIM	PR24 0.0	PR6 0.019	
Canada	PR24 0.0027	PR6 -0.0031	
Central CLIM	PR24 -0.067	PR6 0.0045	
Central Plains CLIM	PR24 0.0	PR6 0.0	
Great Lakes CLIM	PR24 0.01	PR6 -0.00049	
MidAtlantic CLIM	PR24 -0.03	PR6 -0.015	
Mt West CLIM	PR24 0.0	PR6 0.0	
North America plus	PR24 -0.0016	PR6 -0.0029	
North Atlantic CLIM	PR24 0.0011	PR6 -0.0013	
North Plains CLIM	PR24 0.0	PR6 0.0	
Pacific North West CLIM	PR24 -0.0034	PR6 -0.01	
Prairie CLIM	PR24 -0.054	PR6 0.0	

pod		< >	
nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z	All	20220101 / 20220228	
Appalachia CLIM	PR24 -0.0012	PR6 -0.0019	
Arctic All CLIM	PR24 0.0	PR6 0.0	
Arctic Land CLIM	PR24 0.0	PR6 0.0	
Boreal CLIM	PR24 -0.019	PR6 0.006	
Canada	PR24 0.0066	PR6 0.0022	
Central CLIM	PR24 0.0014	PR6 -0.0023	
Central Plains CLIM	PR24 0.0	PR6 0.0	
Great Lakes CLIM	PR24 0.009	PR6 0.009	
MidAtlantic CLIM	PR24 0.0	PR6 0.0	
Mt West CLIM	PR24 0.012	PR6 -0.003	
North America plus	PR24 0.0011	PR6 0.0023	
North Atlantic CLIM	PR24 0.005	PR6 0.0032	
North Plains CLIM	PR24 0.0	PR6 0.0	
Pacific North West CLIM	PR24 0.023	PR6 0.0065	
Prairie CLIM	PR24 0.0018	PR6 0.0013	

Scores v5.3.13 vs. v5.3.14FL

- FBI



fbi1

Model	Series	Value
fbi1	nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z	20220101 / 20220228
fbi1	All	0.0
Appalachia CLIM	PR6	0.0
Arctic All CLIM	PR6	0.0083
Arctic Land CLIM	PR6	0.036
Boreal CLIM	PR6	0.0
Canada	PR6	0.0038
Central CLIM	PR6	0.015
Central Plains CLIM	PR6	0.0
Great Lakes CLIM	PR6	0.0
MidAtlantic CLIM	PR6	0.0
Mt West CLIM	PR6	-0.0042
North America plus	PR6	0.0029
North Atlantic CLIM	PR6	0.016
North Plains CLIM	PR6	0.0
Pacific North West CLIM	PR6	-0.019
Prairie CLIM	PR6	0.0

fbi2

Model	Series	Value
fbi2	nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z	20220101 / 20220228
fbi2	All	0.0
Appalachia CLIM	PR6	0.0032
Arctic All CLIM	PR6	0.0
Arctic Land CLIM	PR6	-0.0095
Boreal CLIM	PR6	-0.016
Canada	PR6	0.0045
Central CLIM	PR6	0.0
Central Plains CLIM	PR6	0.0
Great Lakes CLIM	PR6	0.0
MidAtlantic CLIM	PR6	-0.006
Mt West CLIM	PR6	0.0065
North America plus	PR6	0.0048
North Atlantic CLIM	PR6	0.0
North Plains CLIM	PR6	0.0
Pacific North West CLIM	PR6	-0.0064
Prairie CLIM	PR6	0.0048

fbi5

Model	Series	Value
fbi5	nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z	20220101 / 20220228
fbi5	All	0.0
Appalachia CLIM	PR6	-0.014
Arctic All CLIM	PR6	0.0
Arctic Land CLIM	PR6	0.0
Boreal CLIM	PR6	-0.0042
Canada	PR6	0.0054
Central CLIM	PR6	-0.019
Central Plains CLIM	PR6	0.0
Great Lakes CLIM	PR6	-0.014
MidAtlantic CLIM	PR6	-0.0014
Mt West CLIM	PR6	-0.047
North America plus	PR6	0.0062
North Atlantic CLIM	PR6	-0.015
North Plains CLIM	PR6	0.0
Pacific North West CLIM	PR6	0.0068
Prairie CLIM	PR6	-0.019

fbi10

Model	Series	Value
fbi10	nat_530a10_P5314TL 00z / nat_530a10_P35313T 00z	20220101 / 20220228
fbi10	All	0.0
Appalachia CLIM	PR6	0.015
Arctic All CLIM	PR6	0.0
Arctic Land CLIM	PR6	0.0
Boreal CLIM	PR6	-0.086
Canada	PR6	-0.023
Central CLIM	PR6	-0.067
Central Plains CLIM	PR6	0.0
Great Lakes CLIM	PR6	0.13
MidAtlantic CLIM	PR6	-0.014
Mt West CLIM	PR6	0.0
North America plus	PR6	-0.0082
North Atlantic CLIM	PR6	0.011
North Plains CLIM	PR6	0.0
Pacific North West CLIM	PR6	0.0078
Prairie CLIM	PR6	-0.067

PR>0.1 mm

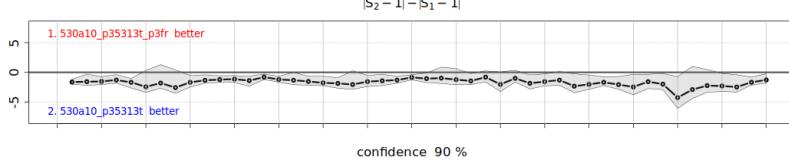
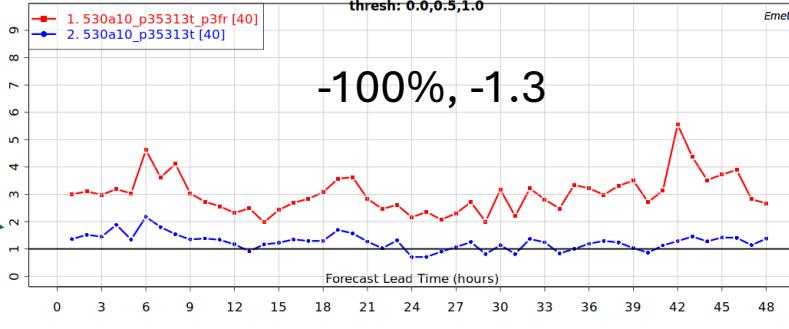
PR>1 mm

V5.3.13

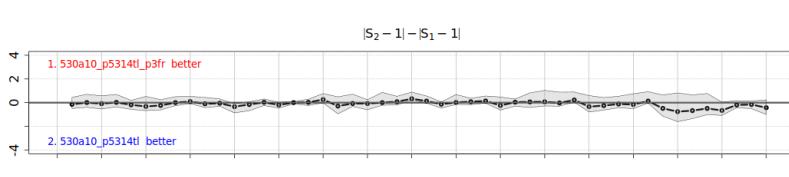
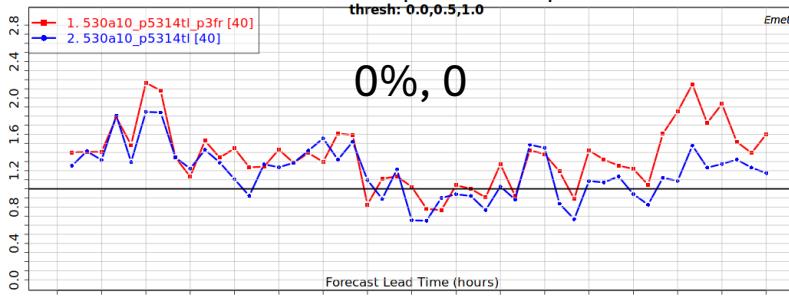
FR (P3) = FR1+FR2
FR (Bourguin)

V5.3.14FL

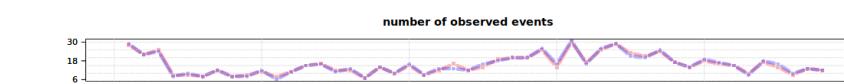
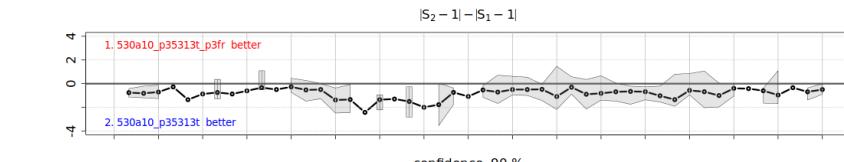
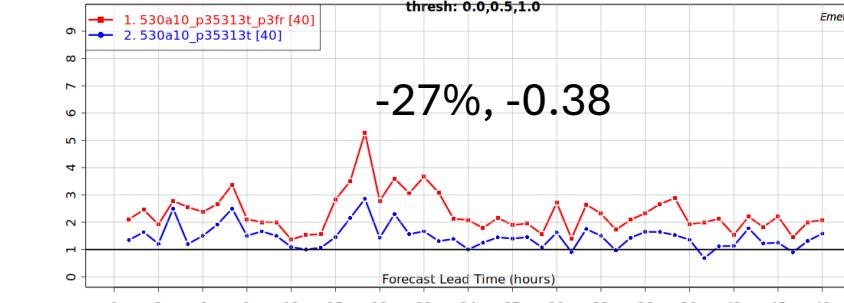
ENCY BIAS INDEX OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 20
PR>=0.1 ade metar speci North America plus
thresh: 0.0,0.5,1.0



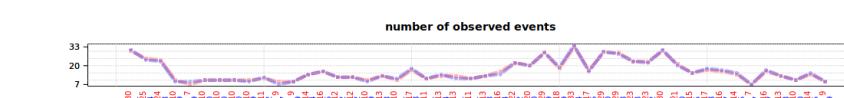
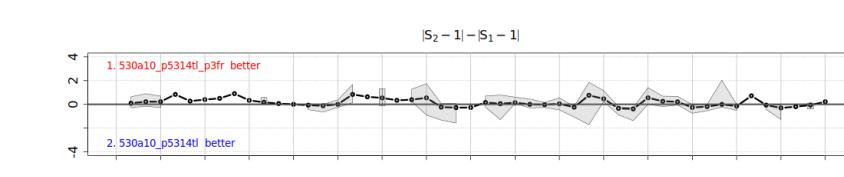
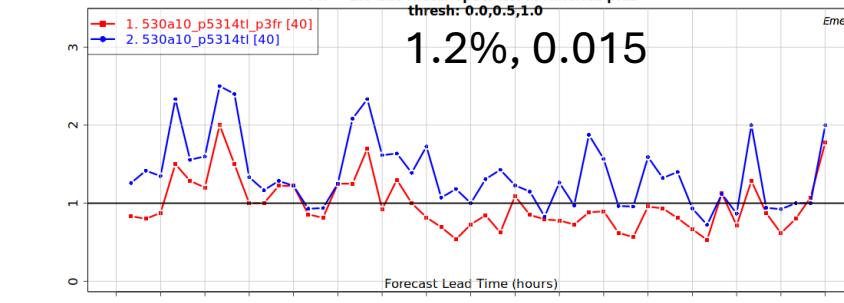
ENCY BIAS INDEX OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 20
PR>=0.1 ade metar speci North America plus
thresh: 0.0,0.5,1.0



ENCY BIAS INDEX OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 20
PR>=1.0 ade metar speci North America plus
thresh: 0.0,0.5,1.0

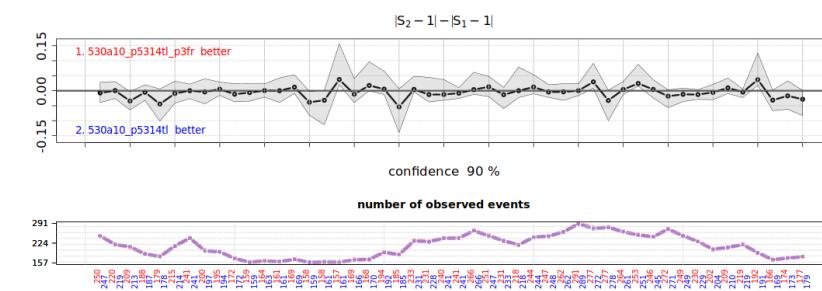
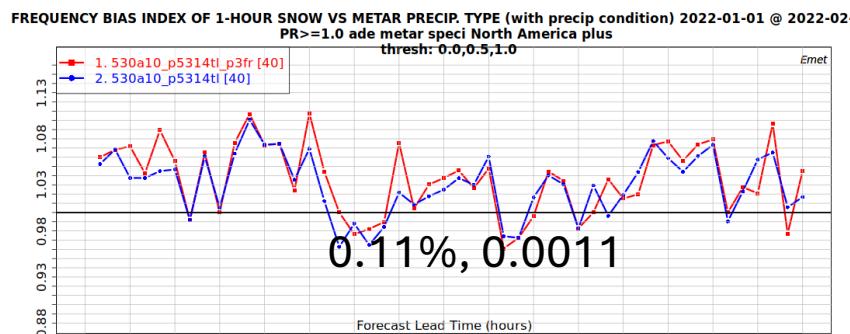
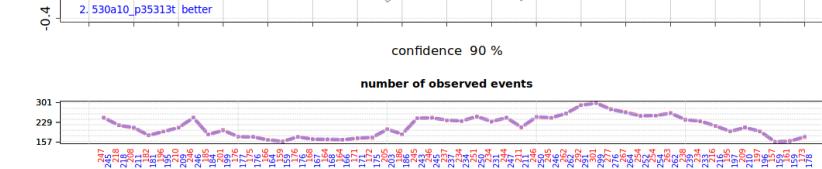
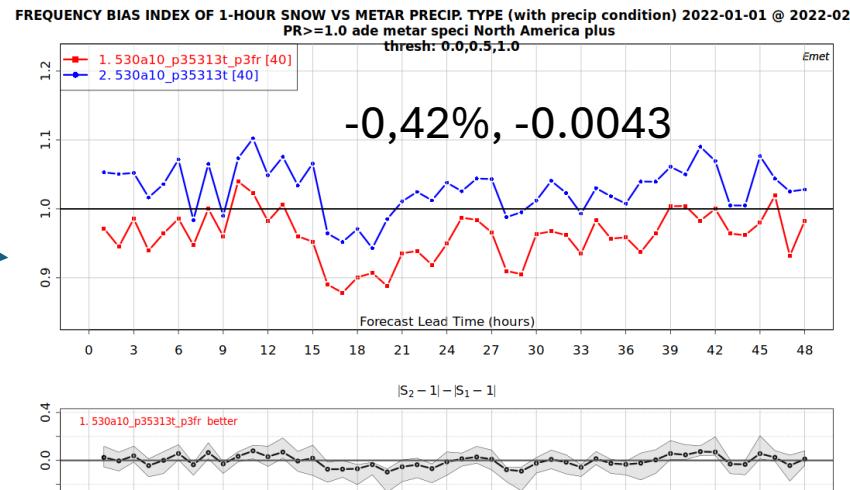


ENCY BIAS INDEX OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 20
PR>=1.0 ade metar speci North America plus
thresh: 0.0,0.5,1.0



Snow

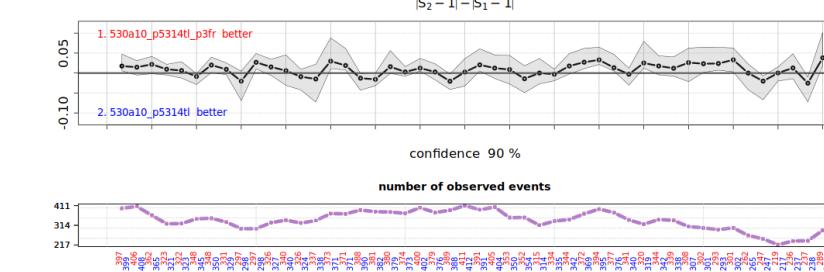
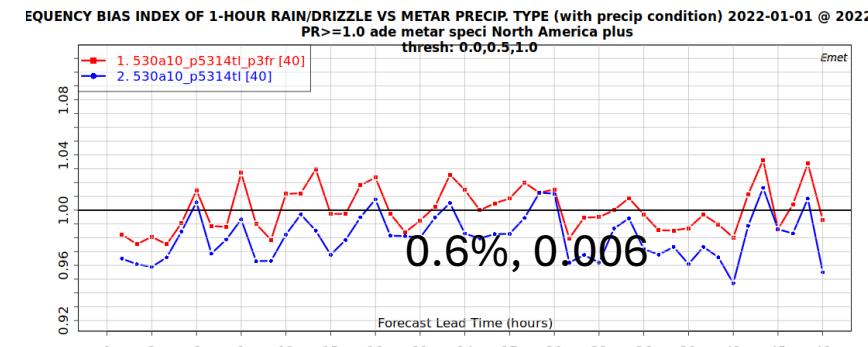
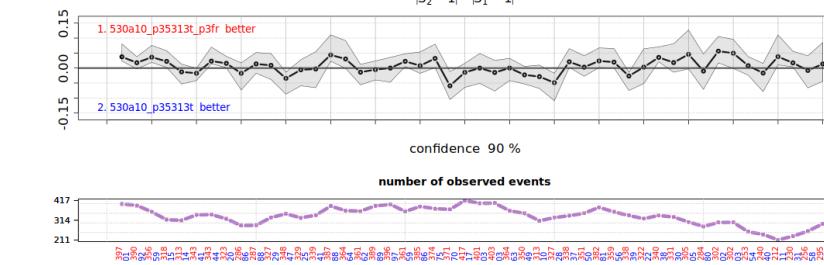
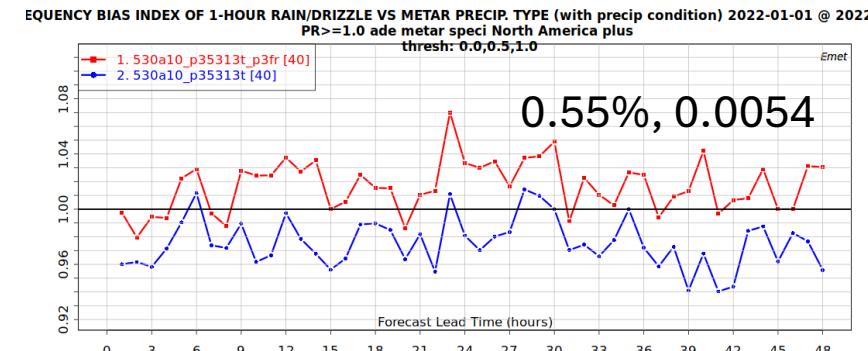
V5.3.13



Rain

PR > 1 mm

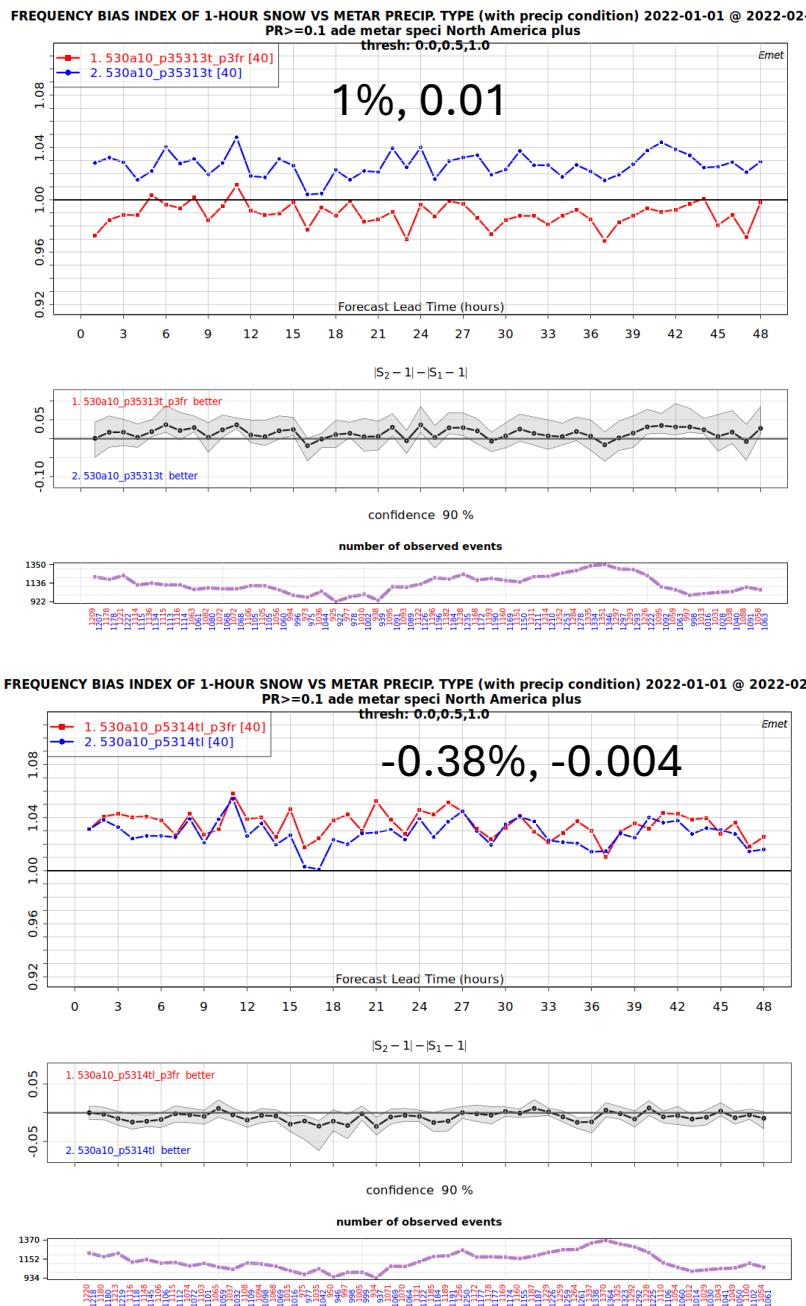
V5.3.14FL



SN (P3)
SN1+SN2+SN3+
WS
SN (Bourgouin)
RN (P3) RN1+RN2
RN (Bourgouin)

Snow

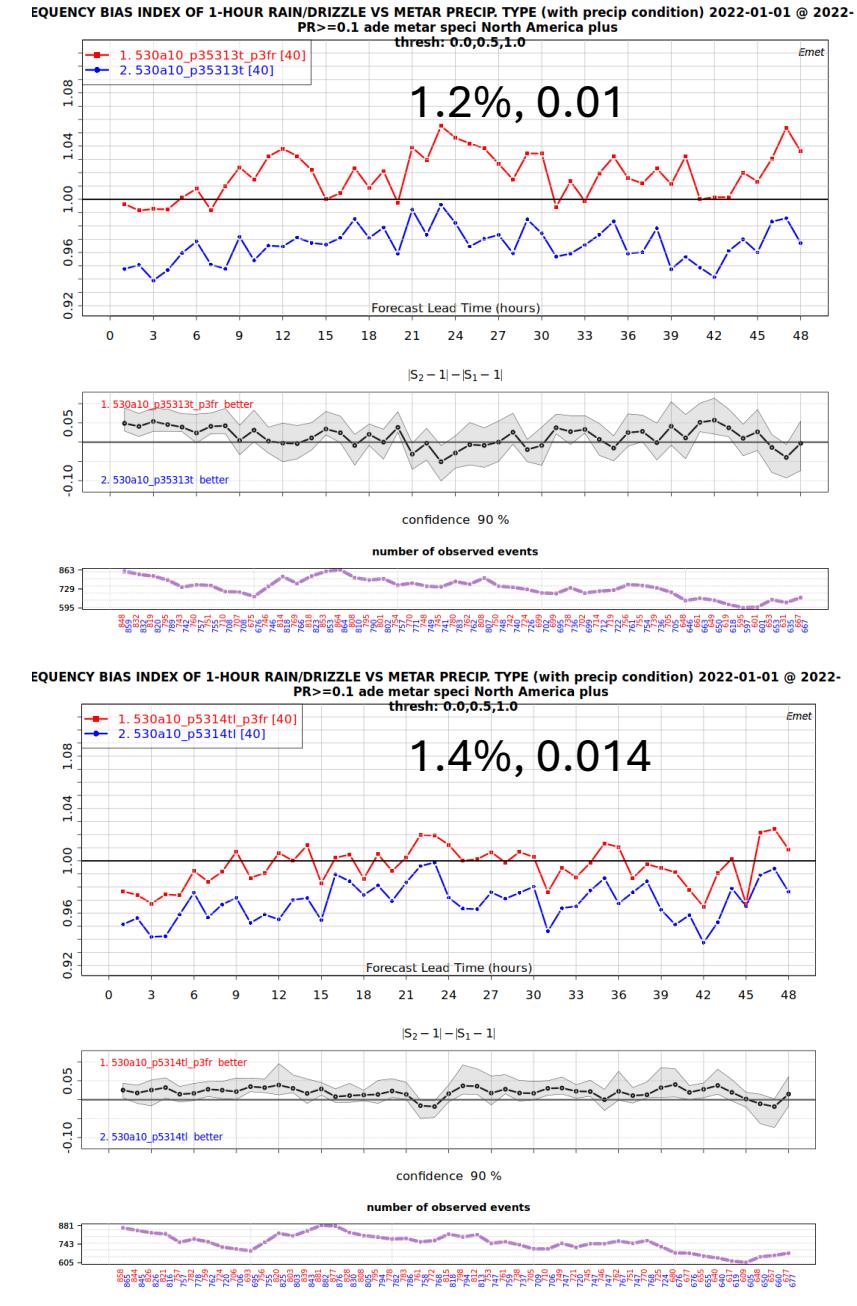
V5.3.13



Rain

PR > 0.1 mm

SN (P3)
SN1+SN2+SN3+
WS
SN (Bourgouin)
RN (P3) RN1+RN2
RN (Bourgouin)



V5.3.14FL

v5.3.14FL -- Bourgouin vs. P3 (FR, SN, RN)

ETS

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

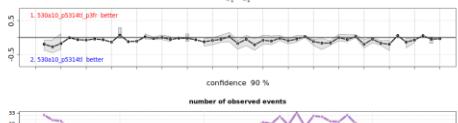
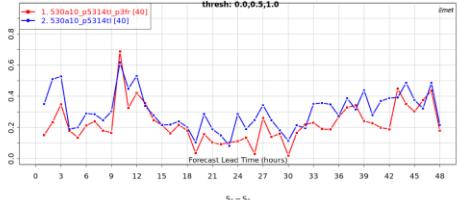
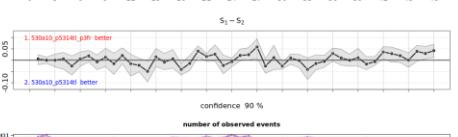
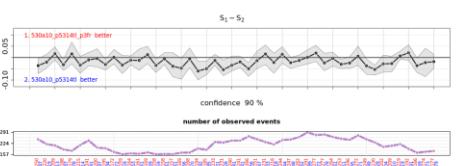
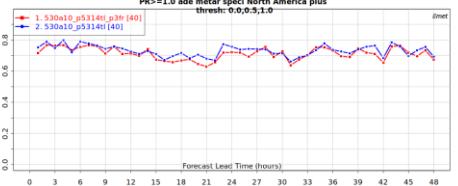


TABLE THREAT SCORE OF 1-HOUR RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-01-01
PR>=1.0 ade meter spec North America plus
thresh: 0.0,0.5,1.0

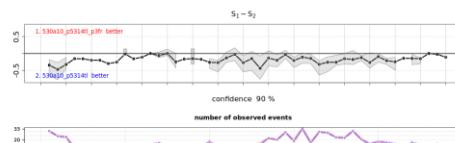


EQUITABLE THREAT SCORE OF 1-HOUR SNOW VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-01-01
PR>=1.0 ade meter spec North America plus
thresh: 0.0,0.5,1.0

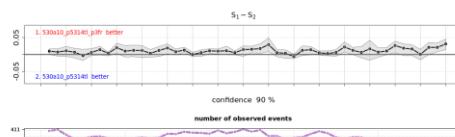


POD

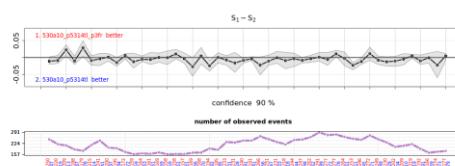
1-HR OF DETECTION OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-01-01
PR>=1.0 ade meter spec North America plus
thresh: 0.0,0.5,1.0



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

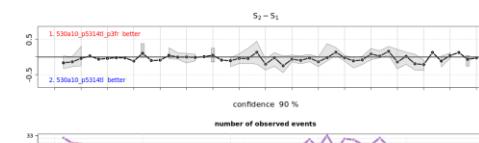
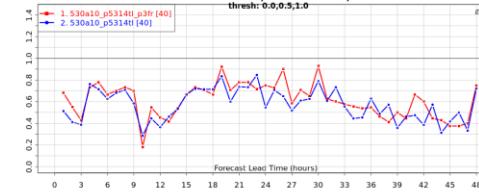


PROB. OF DETECTION OF 1-HOUR SNOW VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-01-01
PR>=1.0 ade meter spec North America plus
thresh: 0.0,0.5,1.0

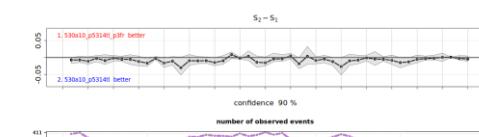
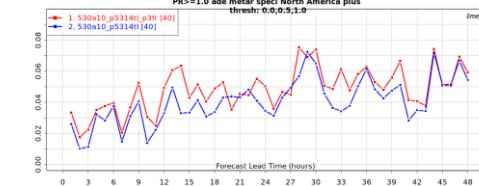


FAR

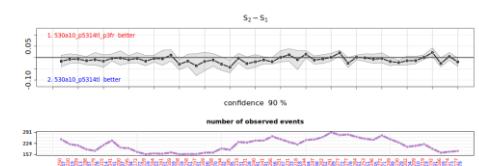
E ALARM RATIO OF 1-HOUR FREEZ. RAIN/DRIZZLE VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-01-01
PR>=1.0 ade meter spec North America plus
thresh: 0.0,0.5,1.0



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



FALSE ALARM RATIO OF 1-HOUR SNOW VS METAR PRECIP. TYPE (with precip condition) 2022-01-01 @ 2022-01-01
PR>=1.0 ade meter spec North America plus
thresh: 0.0,0.5,1.0



PR > 1 mm

FR

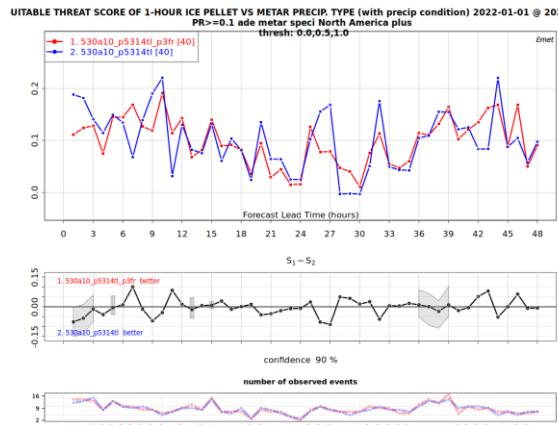
Similar to
v5.3.13

SN

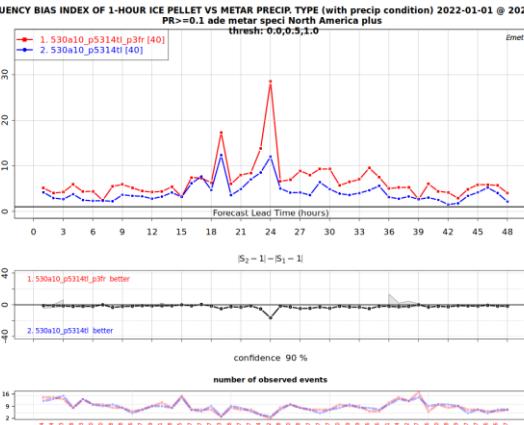
v5.3.14FL -- Bourgouin vs. P3 (PE)

Similar to v5.3.13

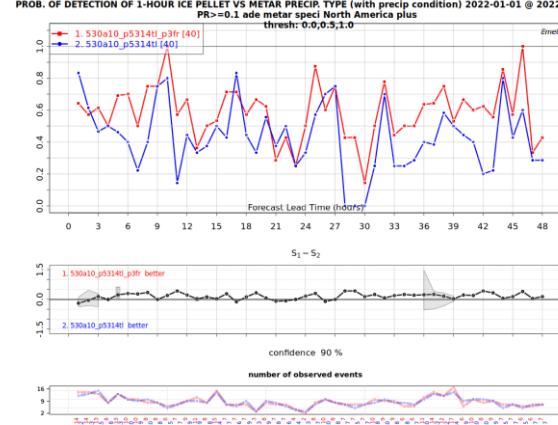
ETS



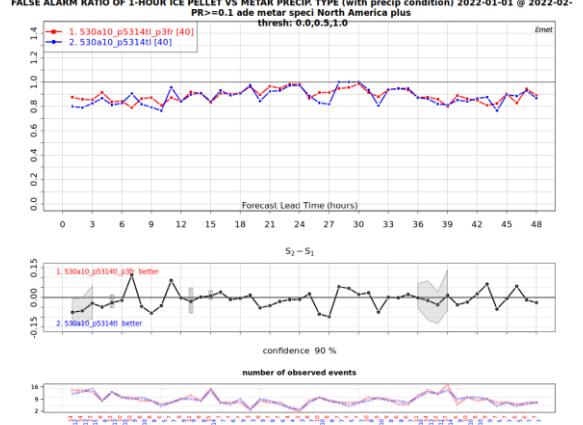
FBI



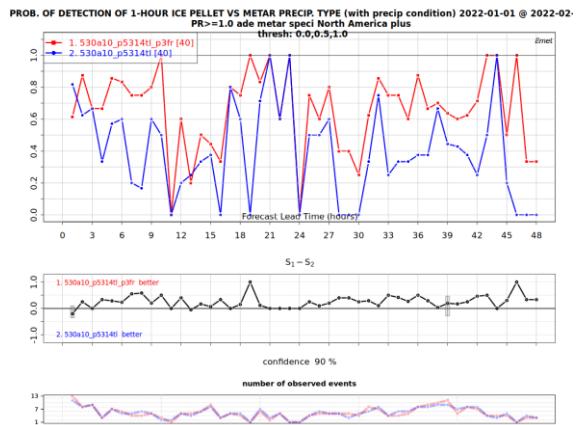
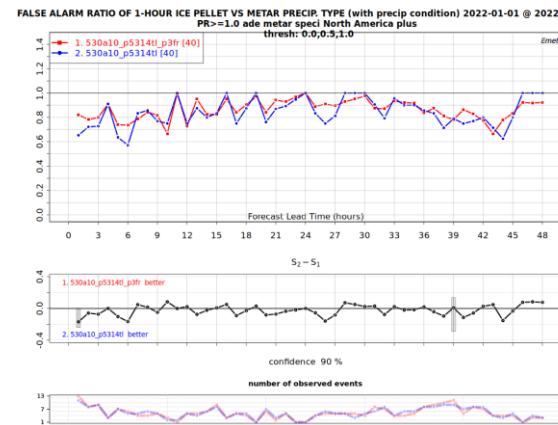
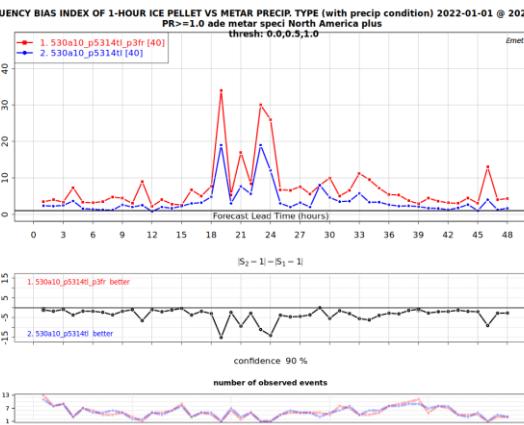
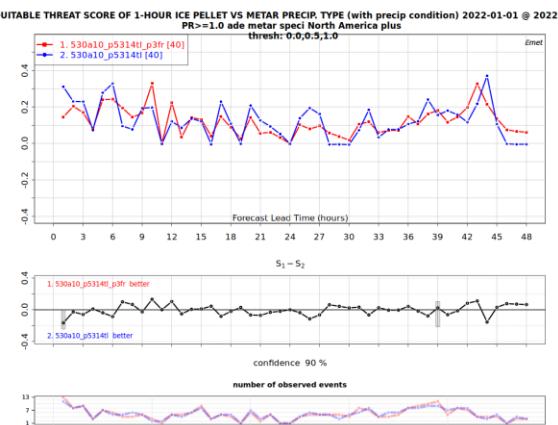
POD



FAR



$\text{PR} > 0.1 \text{ mm}$



$\text{PR} > 1 \text{ mm}$

Timing v5.3.6

/home/mec000/data/ppp5/HRnat/530a10_PA3actl/gridpt/prog/listings
Grep -a "Execution time" *

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HRnat_530a10_PA3actl_2022010100_M_4452398.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5498.1409 seconds (13.74 ms logging)
HRnat_530a10_PA3actl_2022010212_M_4452405.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5665.0667 seconds (13.73 ms logging)
HRnat_530a10_PA3actl_2022010400_M_4452391.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5556.7192 seconds (13.54 ms logging)
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HRnat_530a10_PA3actl_2022011412_M_4452436.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5512.3375 seconds (13.53 ms logging)
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Mean (2MOM_noLF_n1):
 $220250/40 = 5506$ seconds

Timing v5.3.13

HRnat_530a10_P35313T_2022010100_M_4528735.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5560.1555 seconds (15.18 ms logging)
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HRNat_530a10_P35313T_2022012200_M_4528744.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5550.3684 seconds (13.88 ms logging)
HRNat_530a10_P35313T_2022012312_M_4528771.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5428.5591 seconds (14.09 ms logging)
HRNat_530a10_P35313T_2022012500_M_4528736.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5384.5051 seconds (13.68 ms logging)
HRNat_530a10_P35313T_2022012612_M_4528729.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5444.5608 seconds (13.65 ms logging)
HRNat_530a10_P35313T_2022012800_M_4528780.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5574.4600 seconds (13.41 ms logging)
HRNat_530a10_P35313T_2022012912_M_4528789.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5749.0651 seconds (13.54 ms logging)
HRNat_530a10_P35313T_2022013100_M_4529159.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5386.6415 seconds (14.13 ms logging)
HRNat_530a10_P35313T_2022020112_M_4529161.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5424.0181 seconds (13.62 ms logging)
HRNat_530a10_P35313T_2022020300_M_4529163.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5566.8092 seconds (13.78 ms logging)
HRNat_530a10_P35313T_2022020412_M_4529166.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5596.9427 seconds (13.66 ms logging)
HRNat_530a10_P35313T_2022020600_M_4529168.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5491.9851 seconds (14.23 ms logging)
HRNat_530a10_P35313T_2022020712_M_4529167.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5485.8368 seconds (13.52 ms logging)
HRNat_530a10_P35313T_2022020900_M_4529165.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5555.7424 seconds (13.67 ms logging)
HRNat_530a10_P35313T_2022021012_M_4529170.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5386.0668 seconds (13.94 ms logging)
HRNat_530a10_P35313T_2022021200_M_4529171.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5374.7710 seconds (13.89 ms logging)
HRNat_530a10_P35313T_2022021312_M_4529169.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5526.7886 seconds (13.53 ms logging)
HRNat_530a10_P35313T_2022021500_M_4529175.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5419.7554 seconds (14.11 ms logging)
HRNat_530a10_P35313T_2022021612_M_4529173.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5496.8354 seconds (13.64 ms logging)
HRNat_530a10_P35313T_2022021800_M_4529177.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5636.6898 seconds (13.70 ms logging)
HRNat_530a10_P35313T_2022021912_M_4529178.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5543.5745 seconds (13.71 ms logging)
HRNat_530a10_P35313T_2022022100_M_4529183.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5425.1493 seconds (13.56 ms logging)
HRNat_530a10_P35313T_2022022212_M_4529181.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5494.9121 seconds (13.80 ms logging)
HRNat_530a10_P35313T_2022022400_M_4529184.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5517.2154 seconds (13.67 ms logging)
HRNat_530a10_P35313T_2022022512_M_4529180.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5442.1864 seconds (13.66 ms logging)
HRNat_530a10_P35313T_2022022700_M_4529187.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5477.2324 seconds (14.03 ms logging)
HRNat_530a10_P35313T_2022022812_M_4529189.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5474.7376 seconds (13.74 ms logging)

Mean (2MOM_noLF_n1):

220821/40 = 5520 seconds (-0.13%)

Timing v5.3.14

HRnat_530a10_P35314T_2022010100_M_4566858.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5539.1469 seconds (13.40 ms logging)
HRnat_530a10_P35314T_2022010212_M_4566863.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5702.7311 seconds (13.34 ms logging)
HRnat_530a10_P35314T_2022010400_M_4566848.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5565.9317 seconds (13.51 ms logging)
HRnat_530a10_P35314T_2022010512_M_4566861.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5529.9992 seconds (13.77 ms logging)
HRnat_530a10_P35314T_2022010700_M_4566868.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5614.4304 seconds (13.36 ms logging)
HRnat_530a10_P35314T_2022010812_M_4566854.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5463.8206 seconds (13.35 ms logging)
HRnat_530a10_P35314T_2022011000_M_4566871.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5467.2939 seconds (13.76 ms logging)
HRnat_530a10_P35314T_2022011112_M_4566884.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5404.6790 seconds (13.60 ms logging)
HRnat_530a10_P35314T_2022011300_M_4566870.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5451.0425 seconds (13.65 ms logging)
HRnat_530a10_P35314T_2022011412_M_4566886.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5521.4016 seconds (13.53 ms logging)
HRnat_530a10_P35314T_2022011600_M_4566853.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5483.7060 seconds (13.37 ms logging)
HRNat_530a10_P35314T_2022011712_M_4566879.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5568.0553 seconds (13.68 ms logging)
HRNat_530a10_P35314T_2022011900_M_4566857.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5510.3228 seconds (13.73 ms logging)
HRNat_530a10_P35314T_2022012012_M_4566852.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5493.3345 seconds (13.47 ms logging)
HRNat_530a10_P35314T_2022012200_M_4566873.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5494.0376 seconds (13.86 ms logging)
HRNat_530a10_P35314T_2022012312_M_4566880.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5369.3044 seconds (13.58 ms logging)
HRNat_530a10_P35314T_2022012500_M_4566867.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5350.7144 seconds (13.64 ms logging)
HRNat_530a10_P35314T_2022012612_M_4566865.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5407.6152 seconds (13.32 ms logging)
HRNat_530a10_P35314T_2022012800_M_4566843.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5544.9767 seconds (13.49 ms logging)
HRNat_530a10_P35314T_2022012912_M_4566889.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5698.5934 seconds (13.54 ms logging)
HRNat_530a10_P35314T_2022013100_M_4567187.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5336.5137 seconds (13.43 ms logging)
HRNat_530a10_P35314T_2022020112_M_4567189.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5386.7856 seconds (13.54 ms logging)
HRNat_530a10_P35314T_2022020300_M_4567190.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5422.8279 seconds (13.71 ms logging)
HRNat_530a10_P35314T_2022020412_M_4567191.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5467.3502 seconds (13.36 ms logging)
HRNat_530a10_P35314T_2022020600_M_4567188.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5446.0372 seconds (13.54 ms logging)
HRNat_530a10_P35314T_2022020712_M_4567211.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5450.2427 seconds (13.87 ms logging)
HRNat_530a10_P35314T_2022020900_M_4567217.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5533.1442 seconds (13.42 ms logging)
HRNat_530a10_P35314T_2022021012_M_4567227.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5375.1154 seconds (14.82 ms logging)
HRNat_530a10_P35314T_2022021200_M_4567230.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5374.6365 seconds (13.83 ms logging)
HRNat_530a10_P35314T_2022021312_M_4567232.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5516.7504 seconds (13.34 ms logging)
HRNat_530a10_P35314T_2022021500_M_4567255.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5363.8138 seconds (13.64 ms logging)
HRNat_530a10_P35314T_2022021612_M_4567265.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5469.9788 seconds (13.62 ms logging)
HRNat_530a10_P35314T_2022021800_M_4567262.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5617.5971 seconds (13.44 ms logging)
HRNat_530a10_P35314T_2022021912_M_4567258.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5484.5912 seconds (13.66 ms logging)
HRNat_530a10_P35314T_2022022100_M_4567281.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5451.8357 seconds (13.84 ms logging)
HRNat_530a10_P35314T_2022022212_M_4567282.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5471.1615 seconds (13.66 ms logging)
HRNat_530a10_P35314T_2022022400_M_4567298.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5460.3636 seconds (13.50 ms logging)
HRNat_530a10_P35314T_2022022512_M_4567306.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5464.0724 seconds (13.66 ms logging)
HRNat_530a10_P35314T_2022022700_M_4567361.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5440.2581 seconds (13.71 ms logging)
HRNat_530a10_P35314T_2022022812_M_4567396.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5517.8689 seconds (13.76 ms logging)

Mean (2MOM_noLF_n1):

$219212/40 = 5480$ seconds (-0.72%)

Timing v5.3.14FL

HRnat_530a10_P5314TL_2022010100_M_4566859.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5754.1508 seconds (13.91 ms logging)
HRnat_530a10_P5314TL_2022010212_M_4566864.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5882.2037 seconds (13.78 ms logging)
HRnat_530a10_P5314TL_2022010400_M_4566849.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5791.4423 seconds (13.83 ms logging)
HRnat_530a10_P5314TL_2022010512_M_4566856.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5703.0139 seconds (13.75 ms logging)
HRnat_530a10_P5314TL_2022010700_M_4566869.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5830.7763 seconds (13.89 ms logging)
HRnat_530a10_P5314TL_2022010812_M_4566927.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5706.5820 seconds (13.57 ms logging)
HRnat_530a10_P5314TL_2022011000_M_4566890.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5629.6374 seconds (13.99 ms logging)
HRnat_530a10_P5314TL_2022011112_M_4566883.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5637.8190 seconds (13.60 ms logging)
HRnat_530a10_P5314TL_2022011300_M_4566932.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5684.7961 seconds (13.70 ms logging)
HRnat_530a10_P5314TL_2022011412_M_4566887.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5728.1482 seconds (13.71 ms logging)
HRnat_530a10_P5314TL_2022011600_M_4566931.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5676.5187 seconds (13.60 ms logging)
HRNat_530a10_P5314TL_2022011712_M_4566881.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5781.5197 seconds (13.85 ms logging)
HRNat_530a10_P5314TL_2022011900_M_4566933.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5703.8977 seconds (13.72 ms logging)
HRNat_530a10_P5314TL_2022012012_M_4566934.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5696.2527 seconds (13.66 ms logging)
HRNat_530a10_P5314TL_2022012200_M_4566935.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5733.1125 seconds (14.21 ms logging)
HRNat_530a10_P5314TL_2022012312_M_4566925.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5558.6439 seconds (13.86 ms logging)
HRNat_530a10_P5314TL_2022012500_M_4566913.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5562.3907 seconds (13.73 ms logging)
HRNat_530a10_P5314TL_2022012612_M_4566866.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5613.3915 seconds (13.89 ms logging)
HRNat_530a10_P5314TL_2022012800_M_4566936.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5718.4565 seconds (14.08 ms logging)
HRNat_530a10_P5314TL_2022012912_M_4566888.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5910.5760 seconds (13.62 ms logging)
HRNat_530a10_P5314TL_2022013100_M_4567218.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5511.2656 seconds (13.70 ms logging)
HRNat_530a10_P5314TL_2022020112_M_4567212.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5607.3930 seconds (13.75 ms logging)
HRNat_530a10_P5314TL_2022020300_M_4567228.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5613.4428 seconds (13.48 ms logging)
HRNat_530a10_P5314TL_2022020412_M_4567263.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5741.5991 seconds (13.50 ms logging)
HRNat_530a10_P5314TL_2022020600_M_4567266.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5689.2031 seconds (14.06 ms logging)
HRNat_530a10_P5314TL_2022020712_M_4567271.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5675.3520 seconds (13.66 ms logging)
HRNat_530a10_P5314TL_2022020900_M_4567305.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5732.8475 seconds (13.99 ms logging)
HRNat_530a10_P5314TL_2022021012_M_4567308.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5542.4169 seconds (13.61 ms logging)
HRNat_530a10_P5314TL_2022021200_M_4567376.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5552.7663 seconds (14.23 ms logging)
HRNat_530a10_P5314TL_2022021312_M_4567377.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5704.5030 seconds (13.85 ms logging)
HRNat_530a10_P5314TL_2022021500_M_4567414.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5602.9368 seconds (13.65 ms logging)
HRNat_530a10_P5314TL_2022021612_M_4567694.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5680.7841 seconds (14.12 ms logging)
HRNat_530a10_P5314TL_2022021800_M_4567696.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5791.3184 seconds (13.94 ms logging)
HRNat_530a10_P5314TL_2022021912_M_4567698.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5688.0538 seconds (13.87 ms logging)
HRNat_530a10_P5314TL_2022022100_M_4567697.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5570.5174 seconds (13.52 ms logging)
HRNat_530a10_P5314TL_2022022212_M_4567699.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5675.9249 seconds (13.74 ms logging)
HRNat_530a10_P5314TL_2022022400_M_4567702.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5675.6607 seconds (13.57 ms logging)
HRNat_530a10_P5314TL_2022022512_M_4567701.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5672.7570 seconds (13.54 ms logging)
HRNat_530a10_P5314TL_2022022700_M_4567704.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5619.2008 seconds (13.67 ms logging)
HRNat_530a10_P5314TL_2022022812_M_4567705.sc6pbs-001-ib.out.000:oe-00000-00000: Execution time : 5687.3144 seconds (13.82 ms logging)

Mean (2MOM_LF_n1):

$227319/40 = 5682$ seconds (+3%)

5640, 5645

Conclusions

- Rime splintering is improving the explicit freezing rain FBI even when using 1 ice category. It reduces spatial overestimation as well as overestimation in accumulation.
- Including the predicted liquid fraction improves many things without adding cost (<3%). These improvements are:
 - Better physical processes (Cholette et al. 2019)
 - Decrease of freezing rain (Cholette et al. 2020; 2024)
 - Improved reflectivity (bright band; Cholette et al. 2023)
 - Change the phase when wet snow is accumulated (Cholette et al. 2025)
- Other scores remain quite neutral with these changes (both rime splintering and LF_on), with a very small cooling when rime splintering is included.
- Small deterioration of PE but there is no way to know if the scores are significant (very low number of cases).
- In some cases, P3_FR acc. is smaller than FR_bourgouin and PE is higher, so I think we should find a way to validate these accumulations, since we base our analysis only on phase scores.

In an upcoming presentation

- Test P3-v5.3.14 for 3-moment ice
- Summer 2022 series
- New version (5.4) of P3 (full 3-moment ice; Morrison et al., 2025)