Specific to mixing ratios conversion in wrapper_gem of P3

HRDPS series (E22, H22)

BigBird PA1

Jan. 2024 by Melissa Cholette

```
!===============================================================================================!
#ifdef ECCCGEM

 function mp_p3_wrapper_gem(ttend,qtend,qctend,qrtend,qitend,                                  &
                            qvap_m,qvap,temp_m,temp,dt,dt_max,ww,psfc,gztherm,gzmom,sigma,kount,&
                            trnch,ni,nk,prt_liq,prt_sol,prt_drzl,prt_rain,prt_crys,prt_snow,    &
                            prt_grpl,prt_pell,prt_hail,prt_sndp,prt_wsnow,diag_Zet,diag_Zec,    &
                            diag_effc,qc,nc,qr,nr,n_diag_2d,diag_2d,n_diag_3d,diag_3d,          &
                            clbfact_dep,clbfact_sub,debug_on,diag_hcb,diag_hsn,diag_vis,        &
                            diag_vis1,diag_vis2,diag_vis3,diag_slw,                             &
                            scpf_on,scpf_pfrac,scpf_resfact,cldfrac,maxD_hail,                  &
                            qi_type_1,qi_type_2,qi_type_3,qi_type_4,qi_type_5,qi_type_6,        &
                            qitot_1,qirim_1,nitot_1,birim_1,diag_effi_1,zitot_1,qiliq_1,        &
                            qitot_2,qirim_2,nitot_2,birim_2,diag_effi_2,zitot_2,qiliq_2,        &
                            qitot_3,qirim_3,nitot_3,birim_3,diag_effi_3,zitot_3,qiliq_3,        &
                            qitot_4,qirim_4,nitot_4,birim_4,diag_effi_4,zitot_4,qiliq_4)        &
                            result(end_status)

!-----------------------------------------------------------------------------------------------!
! This wrapper subroutine is the main GEM interface with the P3 microphysics scheme.  It       !
! prepares some necessary fields (converts temperature to potential temperature, etc.),         !
! passes 2D slabs (i,k) to the main microphysics subroutine ('P3_MAIN') -- which updates        !
! the prognostic variables (hydrometeor variables, temperature, and water vapor) and           !
! computes various diagnostics fields (precipitation rates, reflectivity, etc.) -- and         !
! finally converts the updated potential temperature to temperature.                           !
!-----------------------------------------------------------------------------------------------!

 implicit none
```

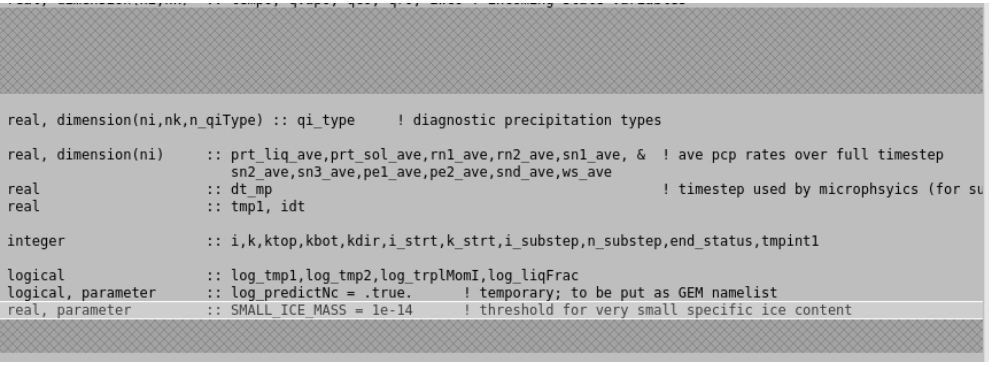
```
!===============================================================================================!
#ifdef ECCCGEM

 function mp_p3_wrapper_gem(ttend,qtend,qctend,qrtend,qitend,                                  &
                            qvap_m,qvap,temp_m,temp,dt,dt_max,ww,psfc,gztherm,gzmom,sigma,kount,&
                            trnch,ni,nk,prt_liq,prt_sol,prt_drzl,prt_rain,prt_crys,prt_snow,    &
                            prt_grpl,prt_pell,prt_hail,prt_sndp,prt_wsnow,diag_Zet,diag_Zec,    &
                            diag_effc,qc_m,qc,nc,qr_m,qr,nr,n_diag_2d,diag_2d,n_diag_3d,diag_3d,&
                            clbfact_dep,clbfact_sub,debug_on,diag_hcb,diag_hsn,diag_vis,        &
                            diag_vis1,diag_vis2,diag_vis3,diag_slw,                             &
                            scpf_on,scpf_pfrac,scpf_resfact,cldfrac,maxD_hail,                  &
                            qi_type_1,qi_type_2,qi_type_3,qi_type_4,qi_type_5,qi_type_6,        &
                            qitot_1m,qitot_1,qirim_1,nitot_1,birim_1,diag_effi_1,zitot_1,qiliq_1,&
                            qitot_2m,qitot_2,qirim_2,nitot_2,birim_2,diag_effi_2,zitot_2,qiliq_2,&
                            qitot_3m,qitot_3,qirim_3,nitot_3,birim_3,diag_effi_3,zitot_3,qiliq_3,&
                            qitot_4m,qitot_4,qirim_4,nitot_4,birim_4,diag_effi_4,zitot_4,qiliq_4)&
                            result(end_status)

!-----------------------------------------------------------------------------------------------!
! This wrapper subroutine is the main GEM interface with the P3 microphysics scheme.  It       !
! prepares some necessary fields (converts temperature to potential temperature, etc.),         !
! passes 2D slabs (i,k) to the main microphysics subroutine ('P3_MAIN') -- which updates        !
! the prognostic variables (hydrometeor variables, temperature, and water vapor) and           !
! computes various diagnostics fields (precipitation rates, reflectivity, etc.) -- and         !
! finally converts the updated potential temperature to temperature.                           !
!-----------------------------------------------------------------------------------------------!

 implicit none
```

New inputs at time minus needed to compute total mass at time minus

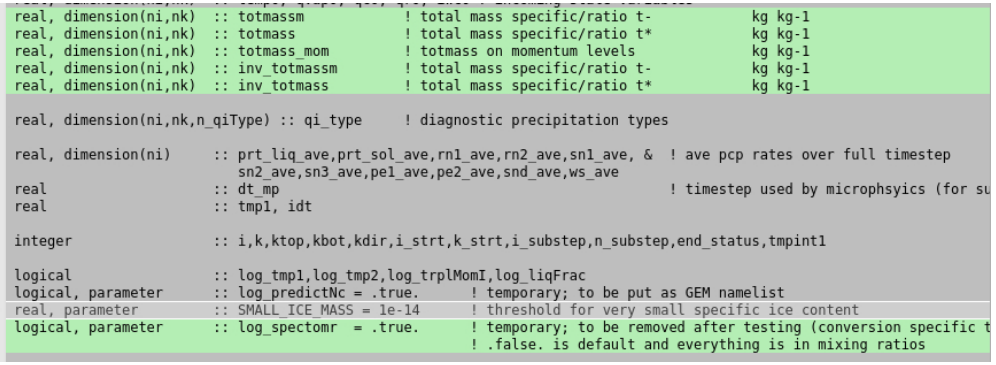
```
real, intent(inout), dimension(ni,nk)  :: qc                ! cloud mixing ratio, mass          kg kg-1
real, intent(inout), dimension(ni,nk)  :: nc                ! cloud mixing ratio, number        #  kg-1
real, intent(inout), dimension(ni,nk)  :: qr                ! rain  mixing ratio, mass          kg kg-1
real, intent(inout), dimension(ni,nk)  :: nr                ! rain  mixing ratio, number        #  kg-1

real, dimension(:,:), pointer, contiguous  :: qitot_1       ! ice   mixing ratio, mass (total)  kg kg-1
real, dimension(:,:), pointer, contiguous  :: qirim_1       ! ice   mixing ratio, mass (rime)   kg kg-1
real, dimension(:,:), pointer, contiguous  :: nitot_1       ! ice   mixing ratio, number        #  kg-1
real, dimension(:,:), pointer, contiguous  :: birim_1       ! ice   mixing ratio, volume        m3 kg-1
real, dimension(:,:), pointer, contiguous  :: diag_effi_1   ! ice   effective radius, (cat 1)    m
real, intent(inout), dimension(ni,nk), optional  :: zitot_1 ! ice   mixing ratio, reflectivity  m^6 kg-1
real, intent(inout), dimension(ni,nk), optional  :: qiliq_1 ! ice   mixing ratio, mass (liquid) kg kg-1

real, dimension(:,:), pointer, contiguous  :: qitot_2       ! ice   mixing ratio, mass (total)  kg kg-1
real, dimension(:,:), pointer, contiguous  :: qirim_2       ! ice   mixing ratio, mass (rime)   kg kg-1
real, dimension(:,:), pointer, contiguous  :: nitot_2       ! ice   mixing ratio, number        #  kg-1
real, dimension(:,:), pointer, contiguous  :: birim_2       ! ice   mixing ratio, volume        m3 kg-1
real, dimension(:,:), pointer, contiguous  :: diag_effi_2   ! ice   effective radius, (cat 2)    m
real, intent(inout), dimension(ni,nk), optional  :: zitot_2 ! ice   mixing ratio, reflectivity  m^6 kg-1
real, intent(inout), dimension(ni,nk), optional  :: qiliq_2 ! ice   mixing ratio, mass (liquid) kg kg-1

real, dimension(:,:), pointer, contiguous  :: qitot_3       ! ice   mixing ratio, mass (total)  kg kg-1
real, dimension(:,:), pointer, contiguous  :: qirim_3       ! ice   mixing ratio, mass (rime)   kg kg-1
real, dimension(:,:), pointer, contiguous  :: nitot_3       ! ice   mixing ratio, number        #  kg-1
real, dimension(:,:), pointer, contiguous  :: birim_3       ! ice   mixing ratio, volume        m3 kg-1
real, dimension(:,:), pointer, contiguous  :: diag_effi_3   ! ice   effective radius,  (cat 3)   m
real, intent(inout), dimension(ni,nk), optional  :: zitot_3 ! ice   mixing ratio, reflectivity  m^6 kg-1
real, intent(inout), dimension(ni,nk), optional  :: qiliq_3 ! ice   mixing ratio, mass (liquid) kg kg-1

real, dimension(:,:), pointer, contiguous  :: qitot_4       ! ice   mixing ratio, mass (total)  kg kg-1
real, dimension(:,:), pointer, contiguous  :: qirim_4       ! ice   mixing ratio, mass (rime)   kg kg-1
real, dimension(:,:), pointer, contiguous  :: nitot_4       ! ice   mixing ratio, number        #  kg-1
real, dimension(:,:), pointer, contiguous  :: birim_4       ! ice   mixing ratio, volume        m3 kg-1
real, dimension(:,:), pointer, contiguous  :: diag_effi_4   ! ice   effective radius, (cat 4)    m
real, intent(inout), dimension(ni,nk), optional  :: zitot_4 ! ice   mixing ratio, reflectivity  m^6 kg-1
real, intent(inout), dimension(ni,nk), optional  :: qiliq_4 ! ice   mixing ratio, mass (liquid) kg kg-1
```

```
real, intent(inout), dimension(ni,nk)  :: qc                ! cloud specific ratio, mass          kg kg-1
real, intent(inout), dimension(ni,nk)  :: nc                ! cloud specific ratio, number        #  kg-1
real, intent(inout), dimension(ni,nk)  :: qr                ! rain  specific ratio, mass          kg kg-1
real, intent(inout), dimension(ni,nk)  :: nr                ! rain  specific ratio, number        #  kg-1
real, intent(in),    dimension(ni,nk)  :: qc_m              ! cloud specific ratio, mass t-       kg kg-1
real, intent(in),    dimension(ni,nk)  :: qr_m              ! rain  specific ratio, mass t-       kg kg-1

real, dimension(:,:), pointer, contiguous  :: qitot_1       ! ice   specific ratio, mass (total)  kg kg-1
real, dimension(:,:), pointer, contiguous  :: qitot_1m      ! ice   specific ratio, mass (t-)     kg kg-1
real, dimension(:,:), pointer, contiguous  :: qirim_1       ! ice   specific ratio, mass (rime)   kg kg-1
real, dimension(:,:), pointer, contiguous  :: nitot_1       ! ice   specific ratio, number        #  kg-1
real, dimension(:,:), pointer, contiguous  :: birim_1       ! ice   specific ratio, volume        m3 kg-1
real, dimension(:,:), pointer, contiguous  :: diag_effi_1   ! ice   effective radius, (cat 1)    m
real, intent(inout), dimension(ni,nk), optional  :: zitot_1 ! ice   specific ratio, reflectivity  m^6 kg-1
real, intent(inout), dimension(ni,nk), optional  :: qiliq_1 ! ice   specific ratio, mass (liquid) kg kg-1

real, dimension(:,:), pointer, contiguous  :: qitot_2       ! ice   specific ratio, mass (total)  kg kg-1
real, dimension(:,:), pointer, contiguous  :: qitot_2m      ! ice   specific ratio, mass (t-)     kg kg-1
real, dimension(:,:), pointer, contiguous  :: qirim_2       ! ice   specific ratio, mass (rime)   kg kg-1
real, dimension(:,:), pointer, contiguous  :: nitot_2       ! ice   specific ratio, number        #  kg-1
real, dimension(:,:), pointer, contiguous  :: birim_2       ! ice   specific ratio, volume        m3 kg-1
real, dimension(:,:), pointer, contiguous  :: diag_effi_2   ! ice   effective radius, (cat 2)    m
real, intent(inout), dimension(ni,nk), optional  :: zitot_2 ! ice   specific ratio, reflectivity  m^6 kg-1
real, intent(inout), dimension(ni,nk), optional  :: qiliq_2 ! ice   specific ratio, mass (liquid) kg kg-1

real, dimension(:,:), pointer, contiguous  :: qitot_3       ! ice   specific ratio, mass (total)  kg kg-1
real, dimension(:,:), pointer, contiguous  :: qitot_3m      ! ice   specific ratio, mass (t-)     kg kg-1
real, dimension(:,:), pointer, contiguous  :: qirim_3       ! ice   specific ratio, mass (rime)   kg kg-1
real, dimension(:,:), pointer, contiguous  :: nitot_3       ! ice   specific ratio, number        #  kg-1
real, dimension(:,:), pointer, contiguous  :: birim_3       ! ice   specific ratio, volume        m3 kg-1
real, dimension(:,:), pointer, contiguous  :: diag_effi_3   ! ice   effective radius,  (cat 3)    m
real, intent(inout), dimension(ni,nk), optional  :: zitot_3 ! ice   specific ratio, reflectivity  m^6 kg-1
real, intent(inout), dimension(ni,nk), optional  :: qiliq_3 ! ice   specific ratio, mass (liquid) kg kg-1

real, dimension(:,:), pointer, contiguous  :: qitot_4       ! ice   specific ratio, mass (total)  kg kg-1
real, dimension(:,:), pointer, contiguous  :: qitot_4m      ! ice   specific ratio, mass (t-)     kg kg-1
real, dimension(:,:), pointer, contiguous  :: qirim_4       ! ice   specific ratio, mass (rime)   kg kg-1
real, dimension(:,:), pointer, contiguous  :: nitot_4       ! ice   specific ratio, number        #  kg-1
real, dimension(:,:), pointer, contiguous  :: birim_4       ! ice   specific ratio, volume        m3 kg-1
real, dimension(:,:), pointer, contiguous  :: diag_effi_4   ! ice   effective radius, (cat 4)    m
real, intent(inout), dimension(ni,nk), optional  :: zitot_4 ! ice   specific ratio, reflectivity  m^6 kg-1
real, intent(inout), dimension(ni,nk), optional  :: qiliq_4 ! ice   specific ratio, mass (liquid) kg kg-1
```

Includes new inputs in the wrapper



```
real, dimension(ni,nk,n_qiType) :: qi_type     ! diagnostic precipitation types

real, dimension(ni)     :: prt_liq_ave,prt_sol_ave,rn1_ave,rn2_ave,sn1_ave, &  ! ave pcp rates over full timestep
                           sn2_ave,sn3_ave,pe1_ave,pe2_ave,snd_ave,ws_ave
real                    :: dt_mp                                              ! timestep used by microphsyics (for su
real                    :: tmp1, idt

integer                 :: i,k,ktop,kbot,kdir,i_strt,k_strt,i_substep,n_substep,end_status,tmpint1

logical                 :: log_tmp1,log_tmp2,log_trplMomI,log_liqFrac
logical, parameter      :: log_predictNc = .true.      ! temporary; to be put as GEM namelist
real, parameter         :: SMALL_ICE_MASS = 1e-14      ! threshold for very small specific ice content
```



```
real, dimension(ni,nk)  :: totmassm            ! total mass specific/ratio t-            kg kg-1
real, dimension(ni,nk)  :: totmass             ! total mass specific/ratio t*            kg kg-1
real, dimension(ni,nk)  :: totmass_mom         ! totmass on momentum levels              kg kg-1
real, dimension(ni,nk)  :: inv_totmassm        ! total mass specific/ratio t-            kg kg-1
real, dimension(ni,nk)  :: inv_totmass         ! total mass specific/ratio t*            kg kg-1

real, dimension(ni,nk,n_qiType) :: qi_type     ! diagnostic precipitation types

real, dimension(ni)     :: prt_liq_ave,prt_sol_ave,rn1_ave,rn2_ave,sn1_ave, &  ! ave pcp rates over full timestep
                           sn2_ave,sn3_ave,pe1_ave,pe2_ave,snd_ave,ws_ave
real                    :: dt_mp                                              ! timestep used by microphsyics (for su
real                    :: tmp1, idt

integer                 :: i,k,ktop,kbot,kdir,i_strt,k_strt,i_substep,n_substep,end_status,tmpint1

logical                 :: log_tmp1,log_tmp2,log_trplMomI,log_liqFrac
logical, parameter      :: log_predictNc = .true.      ! temporary; to be put as GEM namelist
real, parameter         :: SMALL_ICE_MASS = 1e-14      ! threshold for very small specific ice content
logical, parameter      :: log_spectomr  = .true.      ! temporary; to be removed after testing (conversion specific t
                                                       ! .false. is default and everything is in mixing ratios
```

New local variables in the wrapper and a local logical

```
! External forcings are distributed evenly over steps
! Note qqdelta is converted from specific to mixing ratio
qqdelta = (qvap/(1-qvap)-qvap_m/(1-qvap_m)) / float(n_substep)
ttdelta = (temp-temp_m) / float(n_substep)
! initialise for the 1st substepping
qvap = qvap_m/(1-qvap_m) ! mixing ratio instead of specific humidity
temp = temp_m
```

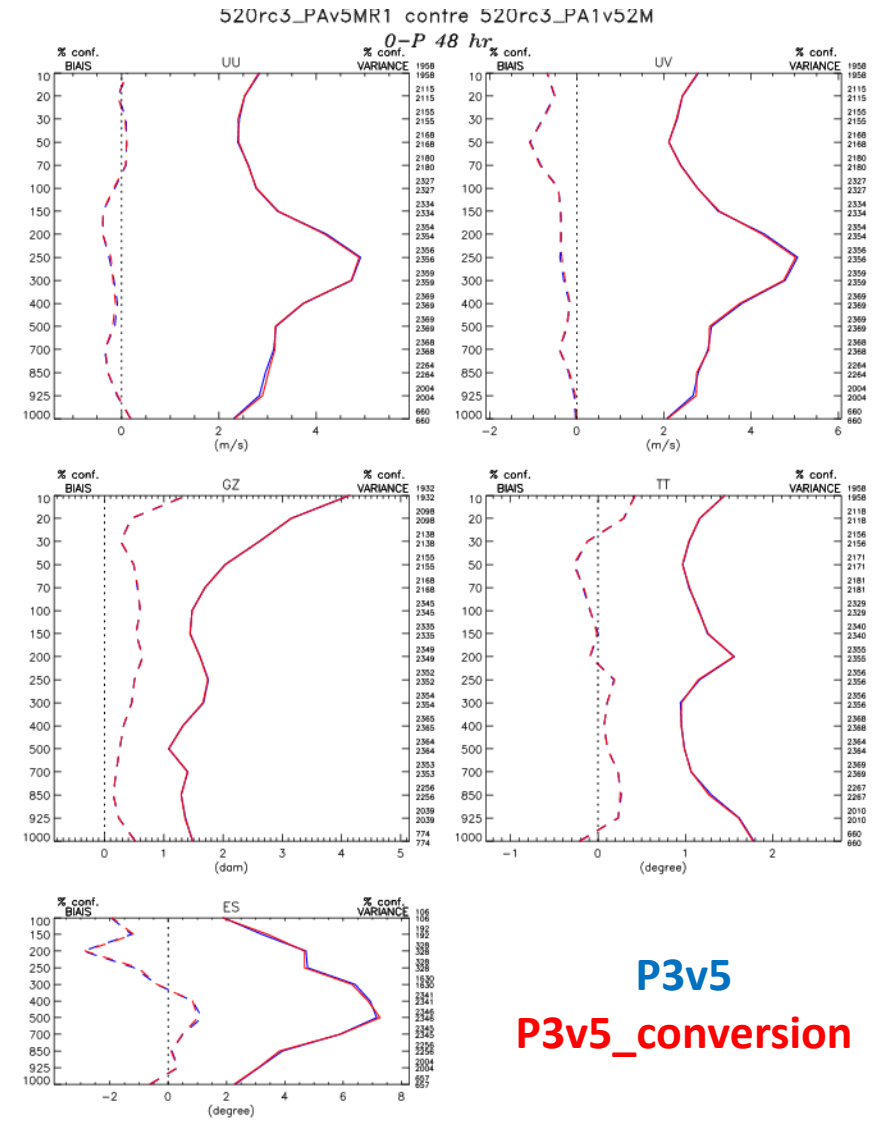
```
if (log_spectomr) then
   ! Transform every specific mass to mixing ratio
   ! Total sum at t-
   totmassm(:,:) = qvap_m(:,:)+qr_m(:,:)+qc_m(:,:)+qitot_1m(:,:)
   if (n_iceCat > 1) totmassm(:,:) = totmassm(:,:) + qitot_2m(:,:)
   if (n_iceCat > 2) totmassm(:,:) = totmassm(:,:) + qitot_3m(:,:)
   if (n_iceCat > 3) totmassm(:,:) = totmassm(:,:) + qitot_4m(:,:)
   inv_totmassm(:,:) = 1./(1.-totmassm(:,:))
   ! Total sum at t*
   totmass(:,:) = qvap(:,:)+qr(:,:)+qc(:,:)+qitot_1(:,:)
   if (n_iceCat > 1) totmass(:,:) = totmass(:,:) + qitot_2(:,:)
   if (n_iceCat > 2) totmass(:,:) = totmass(:,:) + qitot_3(:,:)
   if (n_iceCat > 3) totmass(:,:) = totmass(:,:) + qitot_4(:,:)
   inv_totmass(:,:) = 1./(1.-totmass(:,:))
   ! Water vapour:
   qvap(:,:) = qvap(:,:)*inv_totmass(:,:)
   qvapm1(:,:) = qvap_m(:,:)*inv_totmassm(:,:)
   ! Cloud water:
   qc(:,:) = qc(:,:)*inv_totmass(:,:)
   nc(:,:) = nc(:,:)*inv_totmass(:,:)
   ! Rain water:
   qr(:,:) = qr(:,:)*inv_totmass(:,:)
   nr(:,:) = nr(:,:)*inv_totmass(:,:)
   ! Ice:
   qitot_1(:,:) = qitot_1(:,:)*inv_totmass(:,:)
   qirim_1(:,:) = qirim_1(:,:)*inv_totmass(:,:)
   nitot_1(:,:) = nitot_1(:,:)*inv_totmass(:,:)
   birim_1(:,:) = birim_1(:,:)*inv_totmass(:,:)
   if (present(zitot_1)) zitot_1(:,:) = zitot_1(:,:)*inv_totmass(:,:)
   if (present(qiliq_1)) qiliq_1(:,:) = qiliq_1(:,:)*inv_totmass(:,:)
   if (n_iceCat >= 2) then
      qitot_2(:,:) = qitot_2(:,:)*inv_totmass(:,:)
      qirim_2(:,:) = qirim_2(:,:)*inv_totmass(:,:)
      nitot_2(:,:) = nitot_2(:,:)*inv_totmass(:,:)
      birim_2(:,:) = birim_2(:,:)*inv_totmass(:,:)
      if (present(zitot_2)) zitot_2(:,:) = zitot_2(:,:)*inv_totmass(:,:)
      if (present(qiliq_2)) qiliq_2(:,:) = qiliq_2(:,:)*inv_totmass(:,:)
      if (n_iceCat >= 3) then
         qitot_3(:,:) = qitot_3(:,:)*inv_totmass(:,:)
         qirim_3(:,:) = qirim_3(:,:)*inv_totmass(:,:)
         nitot_3(:,:) = nitot_3(:,:)*inv_totmass(:,:)
         birim_3(:,:) = birim_3(:,:)*inv_totmass(:,:)
         if (present(zitot_3)) zitot_3(:,:) = zitot_3(:,:)*inv_totmass(:,:)
         if (present(qiliq_3)) qiliq_3(:,:) = qiliq_3(:,:)*inv_totmass(:,:)
         if (n_iceCat >= 4) then
            qitot_4(:,:) = qitot_4(:,:)*inv_totmass(:,:)
            qirim_4(:,:) = qirim_4(:,:)*inv_totmass(:,:)
            nitot_4(:,:) = nitot_4(:,:)*inv_totmass(:,:)
            birim_4(:,:) = birim_4(:,:)*inv_totmass(:,:)
            if (present(zitot_4)) zitot_4(:,:) = zitot_4(:,:)*inv_totmass(:,:)
            if (present(qiliq_4)) qiliq_4(:,:) = qiliq_4(:,:)*inv_totmass(:,:)
         endif
      endif
   endif

   ! Now all variables are in mixing ratios

   ! External forcings are distributed evenly over steps
   qqdelta = (qvap-qvapm1) / float(n_substep)
   ttdelta = (temp-temp_m) / float(n_substep)
   ! initialise for the 1st substepping
   qvap = qvapm1
   temp = temp_m
else
   ! External forcings are distributed evenly over steps
   ! Note qqdelta is converted from specific to mixing ratio
   qqdelta = (qvap/(1-qvap)-qvap_m/(1-qvap_m)) / float(n_substep)
   ttdelta = (temp-temp_m) / float(n_substep)
   ! initialise for the 1st substepping
   qvap = qvap_m/(1-qvap_m) ! mixing ratio instead of specific humidity (only vapor)
   temp = temp_m
endif
```

Do the conversion and compute the external forcings of dT and dHU

```
endif

! From mixing ratios to specific masses (only t+ is needed)
if (.not. log_spectomr) then
   qvap(:,:) = qvap(:,:)/(1+qvap(:,:))
else
   ! Total sum at t+
   totmass(:,:) = qvap(:,:)+qr(:,:)+qc(:,:)+qitot_1(:,:)
   if (n_iceCat > 1) totmass(:,:) = totmass(:,:) + qitot_2(:,:)
   if (n_iceCat > 2) totmass(:,:) = totmass(:,:) + qitot_3(:,:)
   if (n_iceCat > 3) totmass(:,:) = totmass(:,:) + qitot_4(:,:)
   inv_totmass(:,:) = 1./(1.+totmass(:,:))
   ! Water vapour:
   qvap(:,:) = qvap(:,:)*inv_totmass(:,:)
   ! Cloud water:
   qc(:,:) = qc(:,:)*inv_totmass(:,:)
   nc(:,:) = nc(:,:)*inv_totmass(:,:)
   ! Rain water:
   qr(:,:) = qr(:,:)*inv_totmass(:,:)
   nr(:,:) = nr(:,:)*inv_totmass(:,:)
   ! Ice:
   qitot_1(:,:) = qitot_1(:,:)*inv_totmass(:,:)
   qirim_1(:,:) = qirim_1(:,:)*inv_totmass(:,:)
   nitot_1(:,:) = nitot_1(:,:)*inv_totmass(:,:)
   birim_1(:,:) = birim_1(:,:)*inv_totmass(:,:)
   if (present(zitot_1)) zitot_1(:,:) = zitot_1(:,:)*inv_totmass(:,:)
   if (present(qiliq_1)) qiliq_1(:,:) = qiliq_1(:,:)*inv_totmass(:,:)
   if (n_iceCat >= 2) then
      qitot_2(:,:) = qitot_2(:,:)*inv_totmass(:,:)
      qirim_2(:,:) = qirim_2(:,:)*inv_totmass(:,:)
      nitot_2(:,:) = nitot_2(:,:)*inv_totmass(:,:)
      birim_2(:,:) = birim_2(:,:)*inv_totmass(:,:)
      if (present(zitot_2)) zitot_2(:,:) = zitot_2(:,:)*inv_totmass(:,:)
      if (present(qiliq_2)) qiliq_2(:,:) = qiliq_2(:,:)*inv_totmass(:,:)
      if (n_iceCat >= 3) then
         qitot_3(:,:) = qitot_3(:,:)*inv_totmass(:,:)
         qirim_3(:,:) = qirim_3(:,:)*inv_totmass(:,:)
         nitot_3(:,:) = nitot_3(:,:)*inv_totmass(:,:)
         birim_3(:,:) = birim_3(:,:)*inv_totmass(:,:)
         if (present(zitot_3)) zitot_3(:,:) = zitot_3(:,:)*inv_totmass(:,:)
         if (present(qiliq_3)) qiliq_3(:,:) = qiliq_3(:,:)*inv_totmass(:,:)
         if (n_iceCat >= 4) then
            qitot_4(:,:) = qitot_4(:,:)*inv_totmass(:,:)
            qirim_4(:,:) = qirim_4(:,:)*inv_totmass(:,:)
            nitot_4(:,:) = nitot_4(:,:)*inv_totmass(:,:)
            birim_4(:,:) = birim_4(:,:)*inv_totmass(:,:)
            if (present(zitot_4)) zitot_4(:,:) = zitot_4(:,:)*inv_totmass(:,:)
            if (present(qiliq_4)) qiliq_4(:,:) = qiliq_4(:,:)*inv_totmass(:,:)
         endif
      endif
   endif
endif
```

Do the conversion at the end (from mixing ratios to specific masses)

E22 – 48h

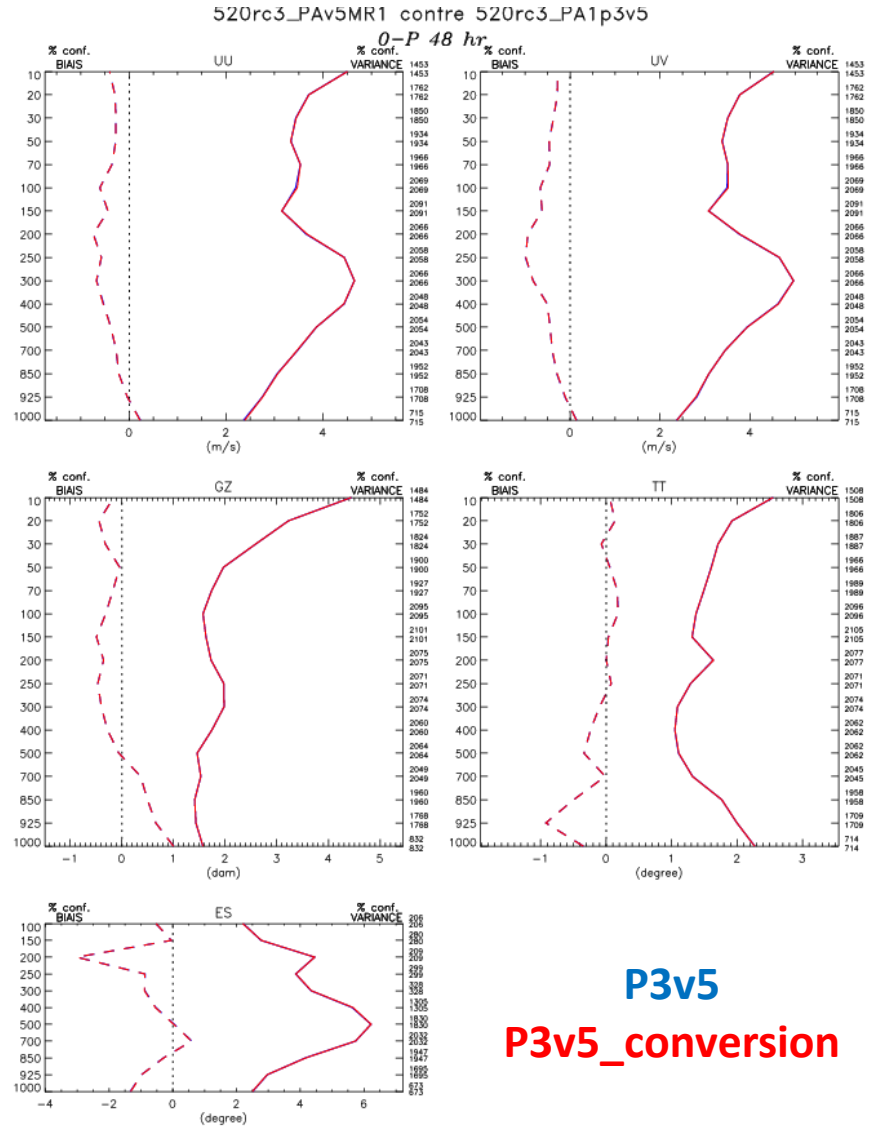


P3v5

P3v5_conversion

Arcad scores neutral for both seasons.

H22 – 48h



P3v5

P3v5_conversion

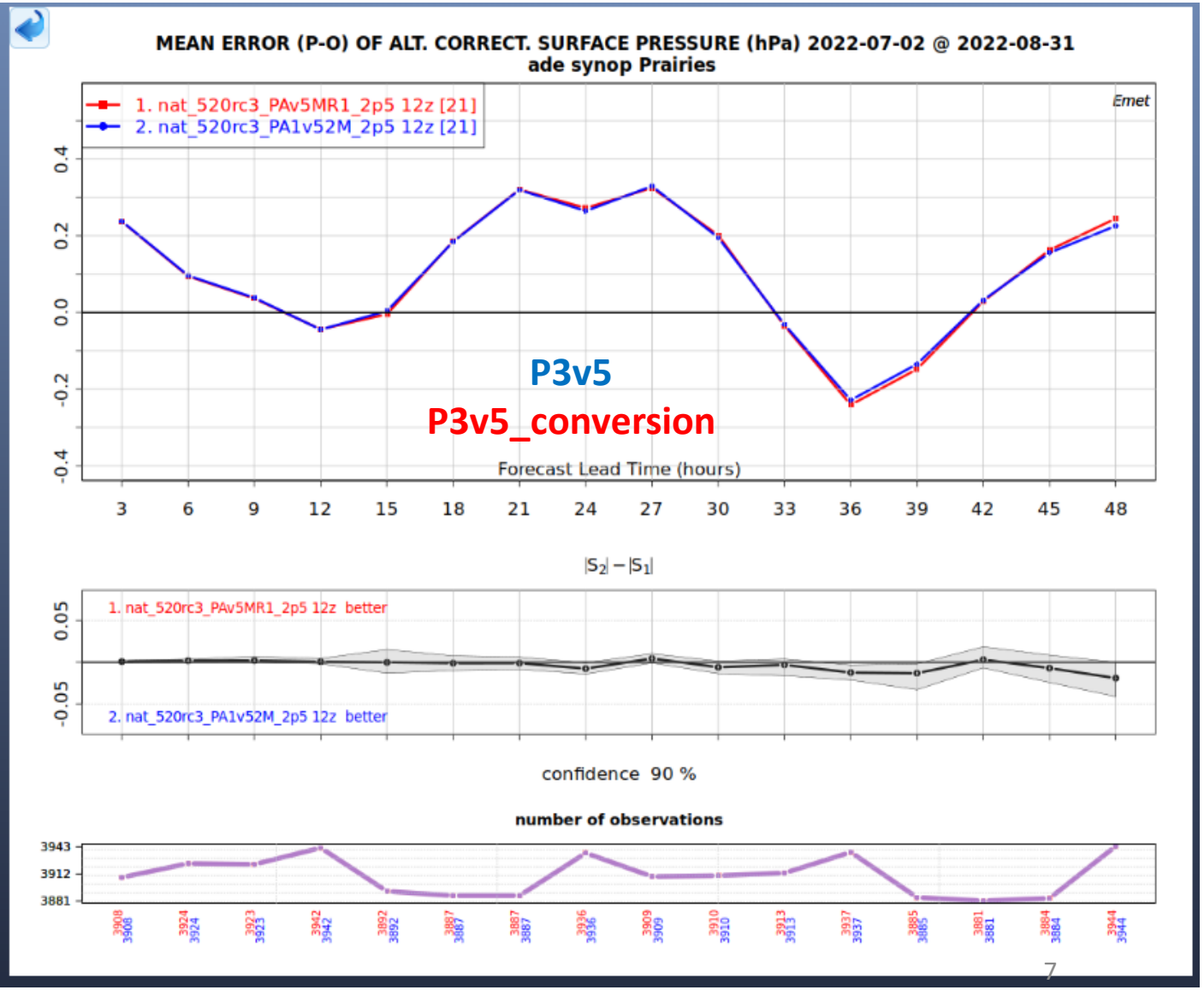
Emet scores (E22)

http://emet-usr.science.gc.ca/emet/mec000/5-10-33342.disp

- P0 very neutral

bias < >

bias nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1v52M_2p5		20220701 / 20220831	
		00z	12z
Alaska	P0	0.11%	0.62%
Alberta-Saskatchewan	P0	0.76%	-0.66%
British Columbia	P0	-0.36%	-0.78%
British Columbia 2	P0	-0.94%	-0.20%
Canada	P0	0.00%	0.50%
Canadian Arctic	P0	0.00%	0.00%
Maritimes	P0	0.04%	0.00%
North America plus	P0	0.14%	-0.93%
Ontario-Quebec	P0	0.00%	-0.60%
Prairies	P0	0.49%	-2.08%
United States of America	P0	-0.32%	-0.17%
United States of America East	P0	-0.39%	-0.22%
United States of America West	P0	-0.07%	0.00%



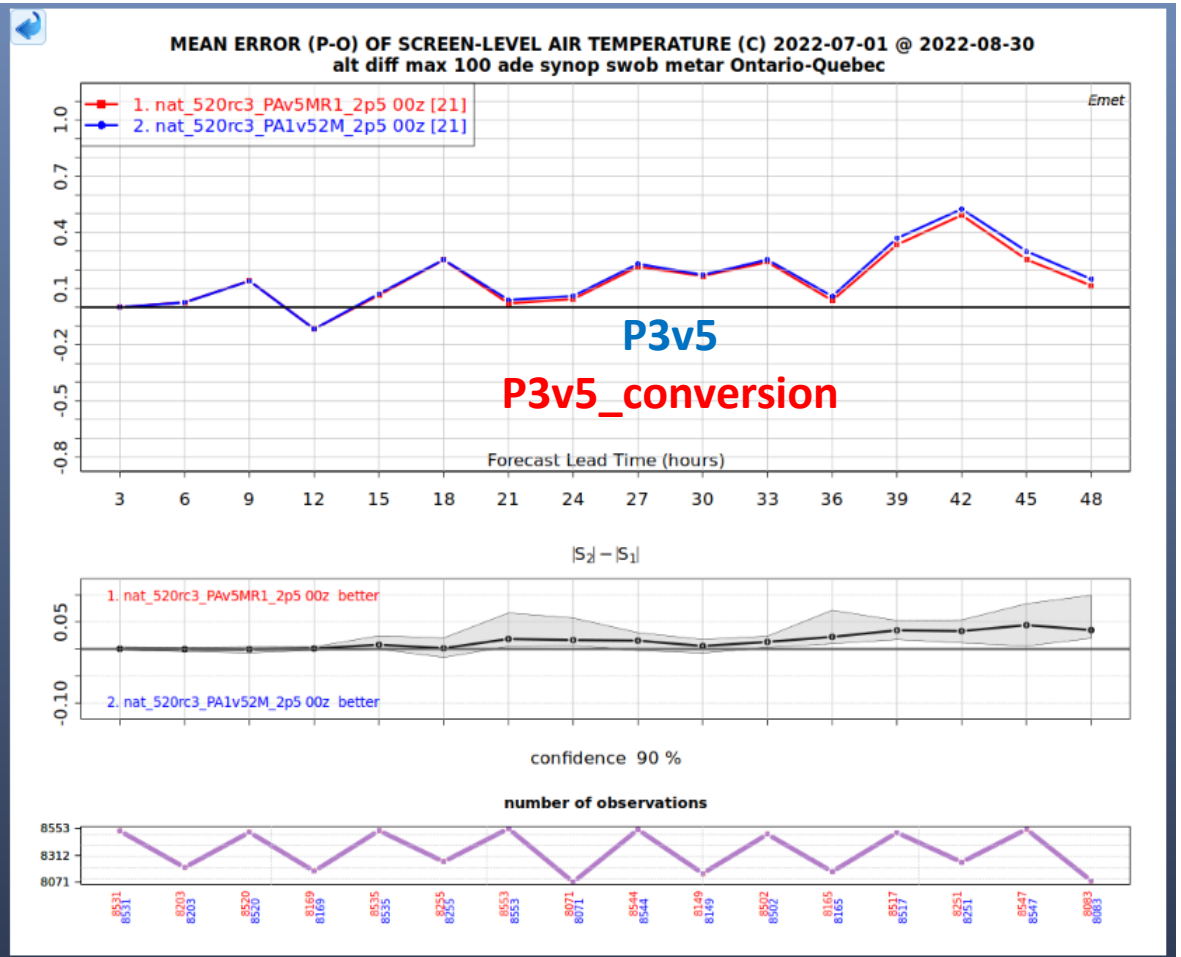
Emet scores (E22)

http://emet-usr.science.gc.ca/emet/mec000/5-10-37736.disp

- P0 very neutral
- TT improves a bit
- UV & TD biases neutral
- TT, UV & TD: RMSE and stdev neutral

bias < >

bias nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1v52M_2p5		20220701 / 20220831 00z	12z
Alaska	TD	1.43%	0.00%
	TT	0.00%	0.00%
	UV	1.09%	0.00%
Alberta-Saskatchewan	TD	0.00%	-0.20%
	TT	0.00%	0.45%
	UV	0.00%	-0.15%
British Columbia	TD	0.80%	0.00%
	TT	-0.01%	0.57%
	UV	0.00%	0.00%
British Columbia 2	TD	0.00%	0.00%
	TT	0.00%	-0.63%
	UV	0.00%	-0.27%
Canada	TD	-0.39%	-0.22%
	TT	0.04%	0.13%
	UV	0.00%	-1.13%
Canadian Arctic	TD	-0.28%	0.14%
	TT	0.23%	0.00%
	UV	0.00%	-0.20%
Maritimes	TD	0.21%	0.38%
	TT	-0.53%	0.00%
	UV	1.03%	-0.12%
North America plus	TD	0.09%	-0.02%
	TT	1.27%	-0.12%
	UV	0.00%	0.10%
Ontario-Quebec	TD	0.58%	-0.49%
	TT	7.79%	1.47%
	UV	-0.56%	-0.47%
Prairies	TD	0.01%	0.00%
	TT	0.00%	0.00%
	UV	0.00%	-0.34%
United States of America	TD	0.50%	0.00%
	TT	0.43%	1.87%
	UV	0.00%	0.45%
United States of America East	TD	0.00%	0.05%
	TT	0.26%	2.44%
	UV	0.14%	0.37%
United States of America West	TD	0.00%	0.00%
	TT	1.63%	0.00%
	UV	0.00%	0.00%

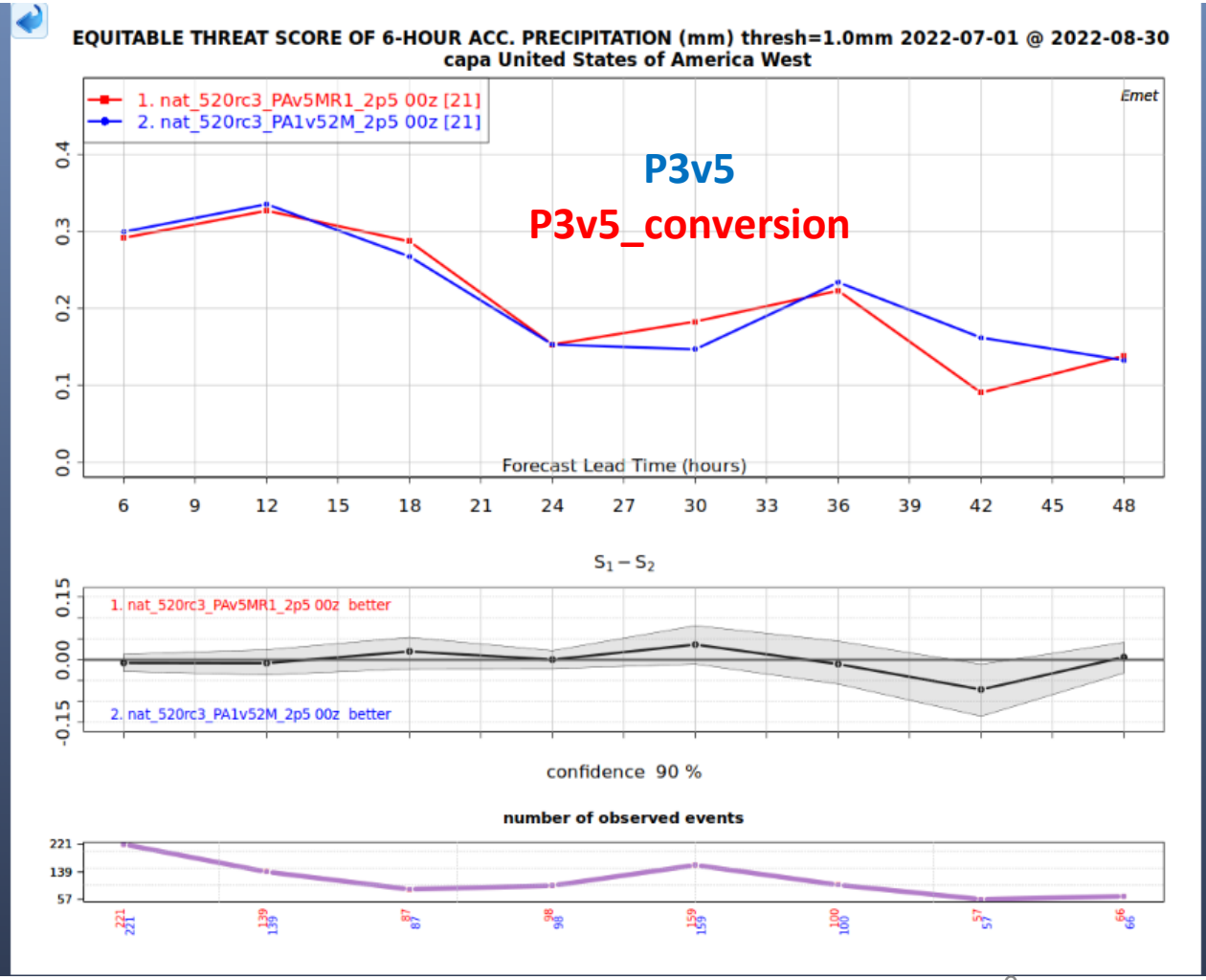


Emet scores (E22)

- P0 very neutral
- TT improves a bit
- UV & TD biases neutral
- TT, UV & TD: RMSE and stdev neutral
- PR6:
  - Ets1 generally improved

ets1 < >

ets1 nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1v52M_2p5		20220701 / 20220831	
		00z	12z
Alaska	PR6	0.00%	-7.28%
Alberta-Saskatchewan	PR6	0.00%	-0.03%
British Columbia	PR6	1.30%	0.52%
British Columbia 2	PR6	0.64%	0.63%
Canada	PR6	-0.91%	0.80%
Canadian Arctic	PR6	3.86%	1.16%
Maritimes	PR6	0.60%	-0.89%
North America plus	PR6	0.43%	-0.01%
Ontario-Quebec	PR6	0.52%	1.31%
Prairies	PR6	1.10%	0.00%
United States of America	PR6	0.97%	-0.32%
United States of America East	PR6	2.50%	-1.15%
United States of America West	PR6	-4.13%	0.00%

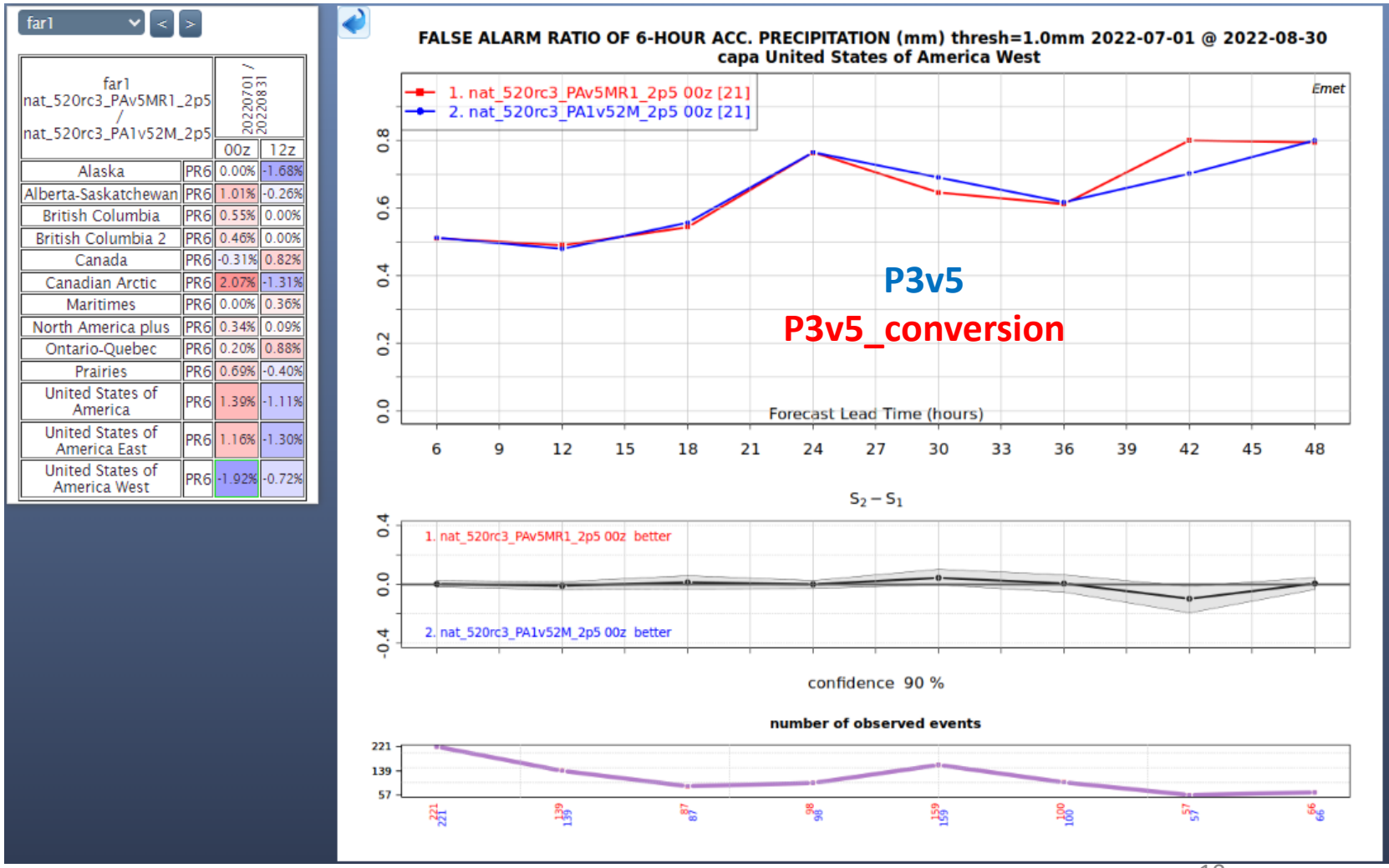


Emet scores (E22)

- P0 very neutral
- TT improves a bit
- UV & TD biases neutral
- TT, UV & TD: RMSE and stdev neutral
- PR6:
  - Ets1 generally improved
  - Far1 neutral

far1 < >

far1 nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1v52M_2p5		20220701 / 20220831	
		00z	12z
Alaska	PR6	0.00%	-1.68%
Alberta-Saskatchewan	PR6	1.01%	-0.26%
British Columbia	PR6	0.55%	0.00%
British Columbia 2	PR6	0.46%	0.00%
Canada	PR6	-0.31%	0.82%
Canadian Arctic	PR6	2.07%	-1.31%
Maritimes	PR6	0.00%	0.36%
North America plus	PR6	0.34%	0.09%
Ontario-Quebec	PR6	0.20%	0.88%
Prairies	PR6	0.69%	-0.40%
United States of America	PR6	1.39%	-1.11%
United States of America East	PR6	1.16%	-1.30%
United States of America West	PR6	-1.92%	-0.72%

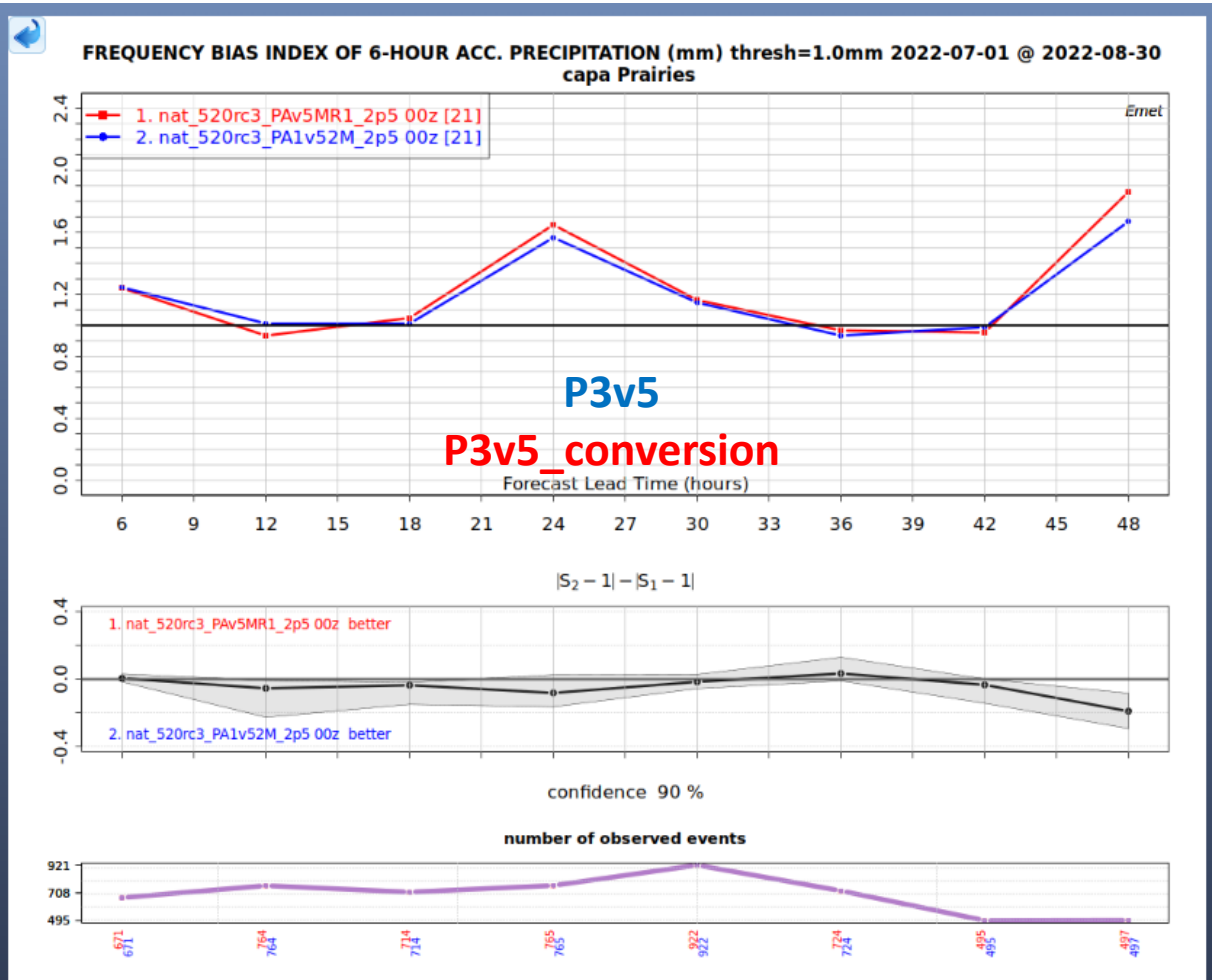


Emet scores (E22)

- P0 very neutral
- TT improves a bit
- UV & TD biases neutral
- TT, UV & TD: RMSE and stdev neutral
- PR6:
  - Ets1 generally improved
  - Far1 neutral
  - Fbi1 neutral

fbi1 < >

fbi1 nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1v52M_2p5		20220701 / 20220831	
		00z	12z
Alaska	PR6	0.00%	0.00%
Alberta-Saskatchewan	PR6	-2.82%	-0.80%
British Columbia	PR6	-0.26%	0.24%
British Columbia 2	PR6	0.00%	0.28%
Canada	PR6	-0.83%	0.00%
Canadian Arctic	PR6	-0.62%	1.11%
Maritimes	PR6	-2.14%	-0.90%
North America plus	PR6	-0.24%	0.00%
Ontario-Quebec	PR6	-0.54%	0.00%
Prairies	PR6	-2.95%	-0.76%
United States of America	PR6	1.26%	-0.49%
United States of America East	PR6	1.33%	-0.60%
United States of America West	PR6	0.46%	-0.81%

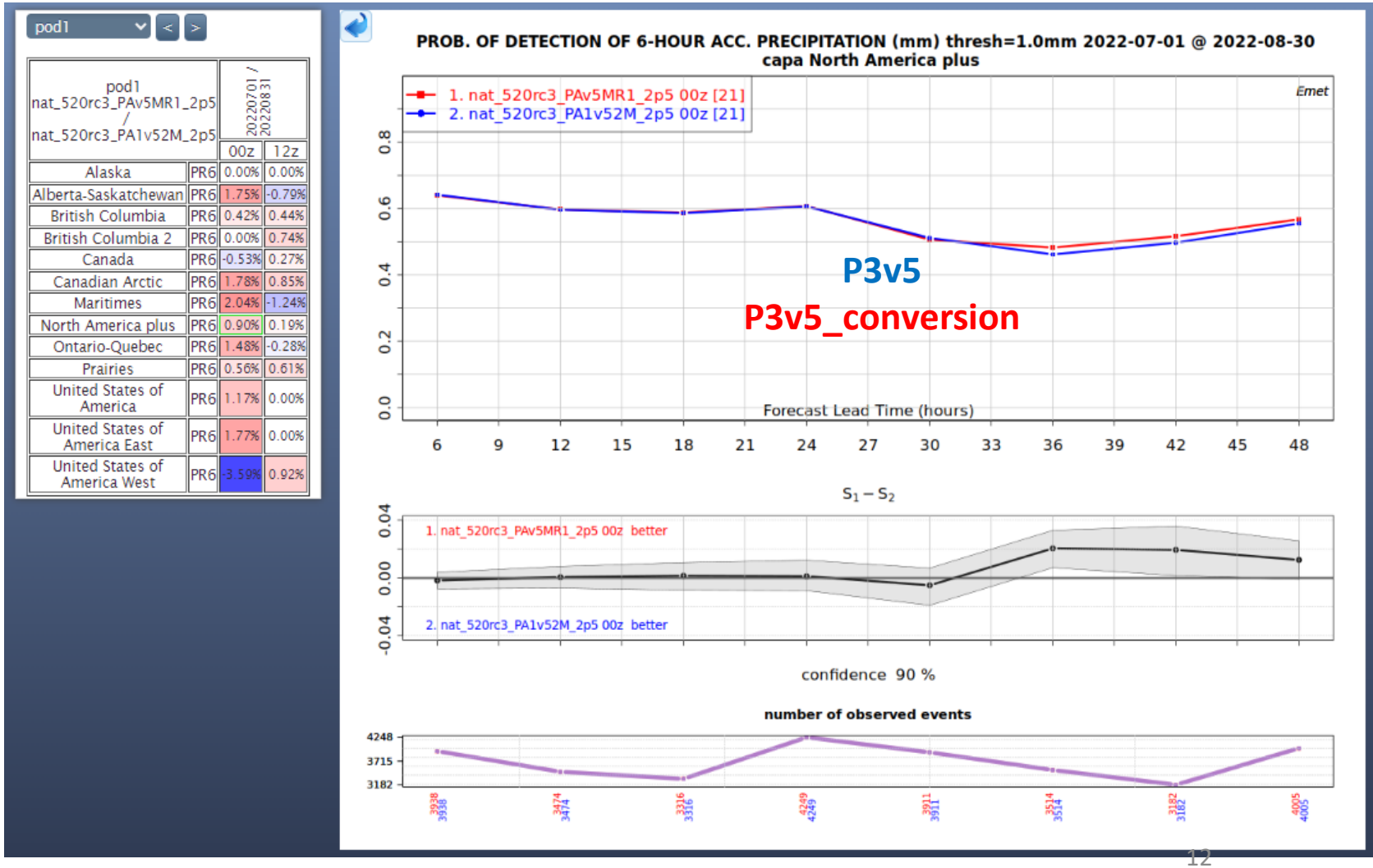


Emet scores (E22)

- P0 very neutral
- TT improves a bit
- UV & TD biases neutral
- TT, UV & TD: RMSE and stdev neutral
- PR6:
  - Ets1 generally improved
  - Far1 neutral
  - Fbi1 neutral
  - Pod1 improved

pod1 < >

pod1 nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1v52M_2p5		20220701 / 20220831	
		00z	12z
Alaska	PR6	0.00%	0.00%
Alberta-Saskatchewan	PR6	1.75%	-0.79%
British Columbia	PR6	0.42%	0.44%
British Columbia 2	PR6	0.00%	0.74%
Canada	PR6	-0.53%	0.27%
Canadian Arctic	PR6	1.78%	0.85%
Maritimes	PR6	2.04%	-1.24%
North America plus	PR6	0.90%	0.19%
Ontario-Quebec	PR6	1.48%	-0.28%
Prairies	PR6	0.56%	0.61%
United States of America	PR6	1.17%	0.00%
United States of America East	PR6	1.77%	0.00%
United States of America West	PR6	3.59%	0.92%



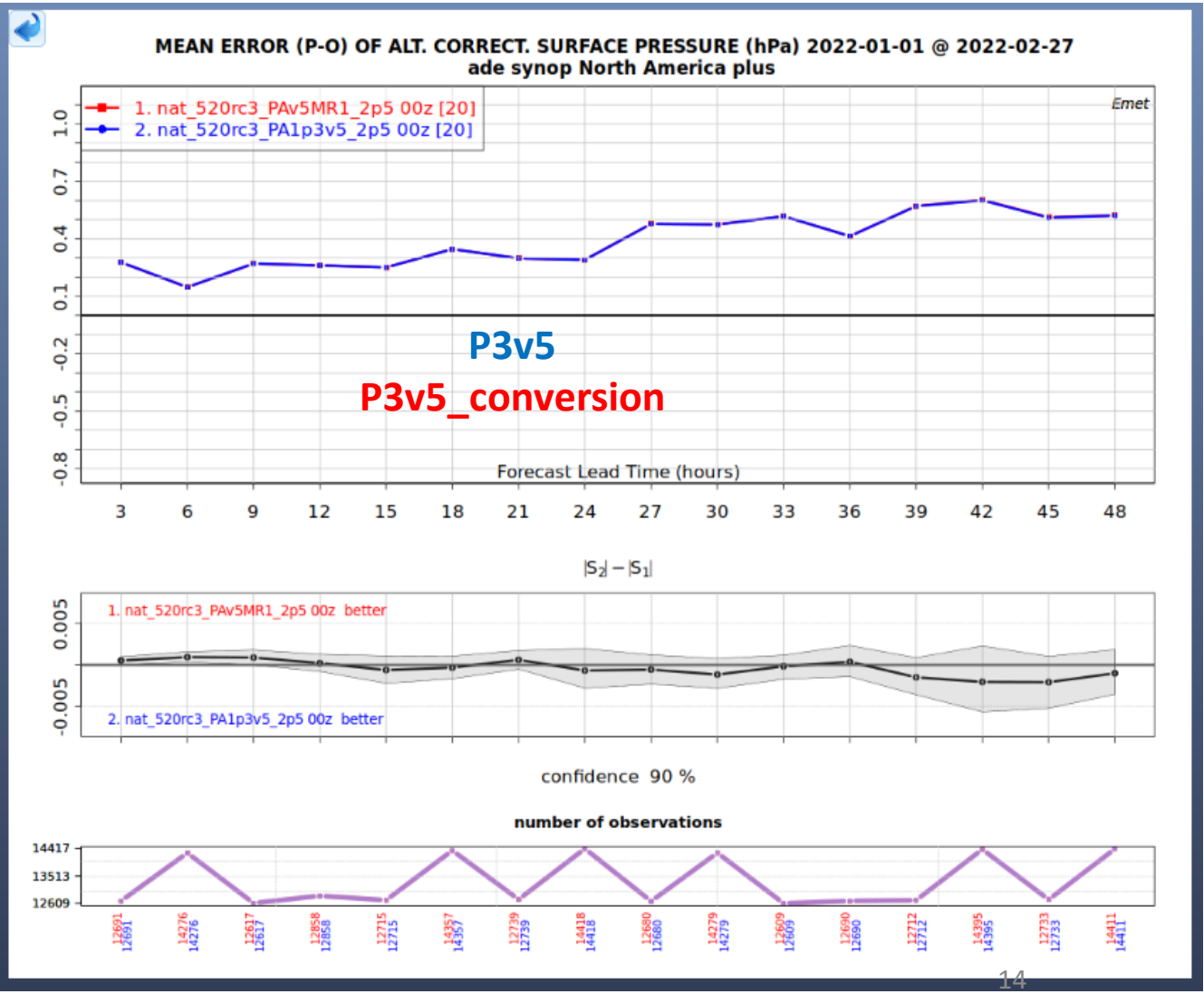
Emet scores (H22)

http://emet-usr.science.gc.ca/emet/mec000/5-13-136.disp

- P0 very neutral

bias < >

bias nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1p3v5_2p5		20220101 / 20220228	
		00z	12z
Alaska	P0	-0.05%	0.04%
Alberta-Saskatchewan	P0	0.00%	-0.00%
British Columbia	P0	0.00%	0.00%
British Columbia 2	P0	0.00%	0.00%
Canada	P0	0.03%	0.00%
Canadian Arctic	P0	-0.01%	-0.09%
Maritimes	P0	-0.03%	0.00%
North America plus	P0	0.00%	0.00%
Ontario-Quebec	P0	-0.04%	-0.00%
Prairies	P0	0.00%	-0.03%
United States of America	P0	0.00%	0.24%
United States of America East	P0	0.15%	0.30%
United States of America West	P0	0.00%	0.00%



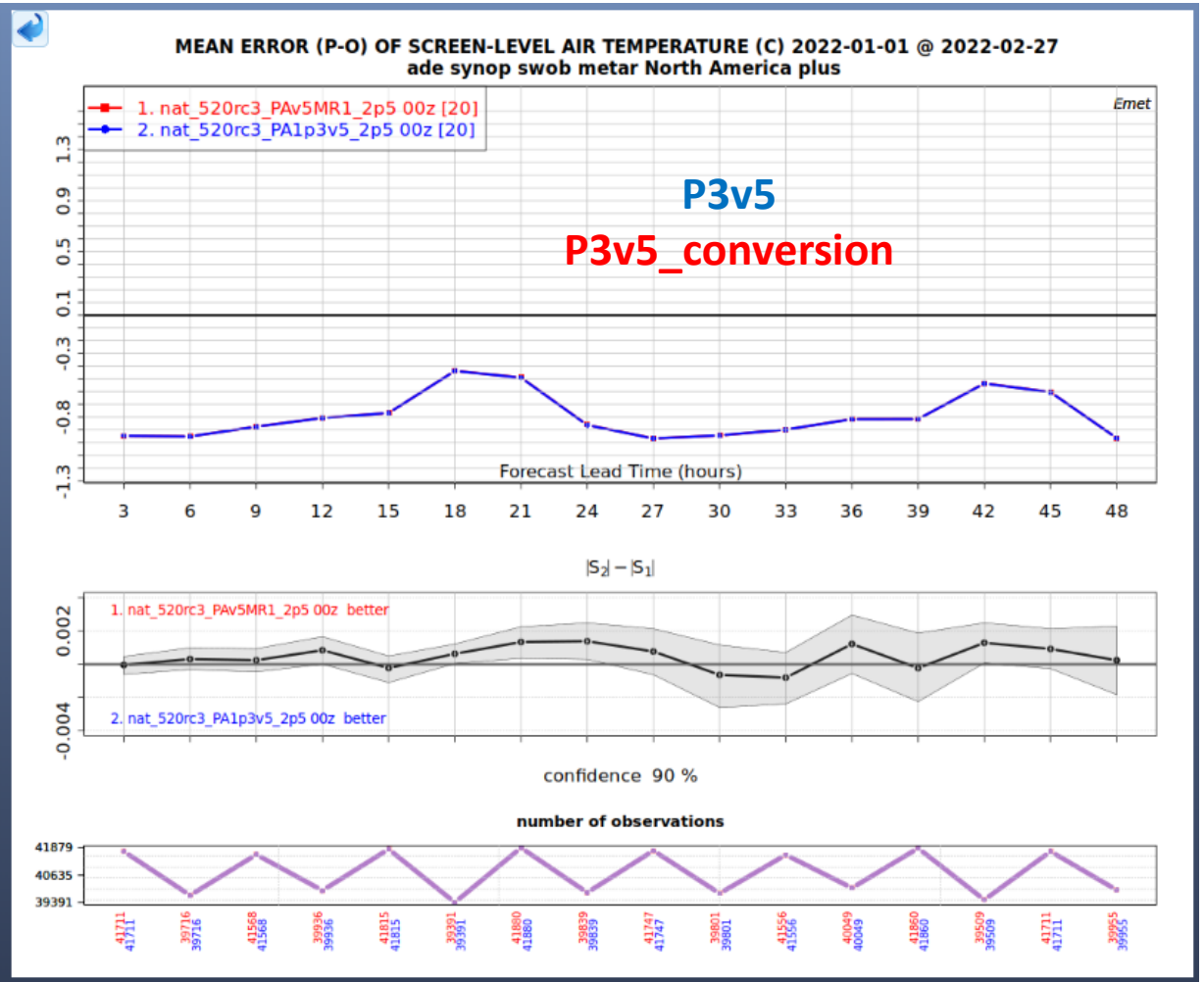
Emet scores (H22)

http://emet-usr.science.gc.ca/emet/mec000/5-13-423.disp

- P0 very neutral
- TT, UV & TD neutral

bias < >

bias nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1p3v5_2p5		20220101 / 20220228 00z	12z
Alaska	TD	-0.10%	0.11%
	TT	-0.04%	0.00%
	UV	0.11%	0.07%
Alberta-Saskatchewan	TD	0.01%	-0.06%
	TT	-0.09%	0.00%
	UV	0.03%	0.00%
British Columbia	TD	0.00%	0.00%
	TT	0.00%	0.06%
	UV	0.00%	1.01%
British Columbia 2	TD	0.00%	0.00%
	TT	0.06%	0.06%
	UV	0.00%	0.00%
Canada	TD	0.13%	-0.11%
	TT	0.00%	-0.22%
	UV	0.00%	0.02%
Canadian Arctic	TD	0.08%	0.00%
	TT	0.00%	0.00%
	UV	-0.09%	0.01%
Maritimes	TD	-0.80%	0.36%
	TT	-0.15%	-0.21%
	UV	0.13%	0.00%
North America plus	TD	0.00%	0.01%
	TT	0.04%	0.00%
	UV	0.00%	0.03%
Ontario-Quebec	TD	-0.26%	0.00%
	TT	0.06%	0.07%
	UV	0.00%	0.12%
Prairies	TD	0.05%	-0.13%
	TT	0.00%	-0.52%
	UV	-0.00%	0.00%
United States of America	TD	-0.01%	0.00%
	TT	0.05%	0.00%
	UV	0.01%	-0.01%
United States of America East	TD	0.09%	0.03%
	TT	0.03%	0.00%
	UV	0.00%	0.01%
United States of America West	TD	-0.14%	-0.01%
	TT	0.06%	0.00%
	UV	0.08%	-0.09%



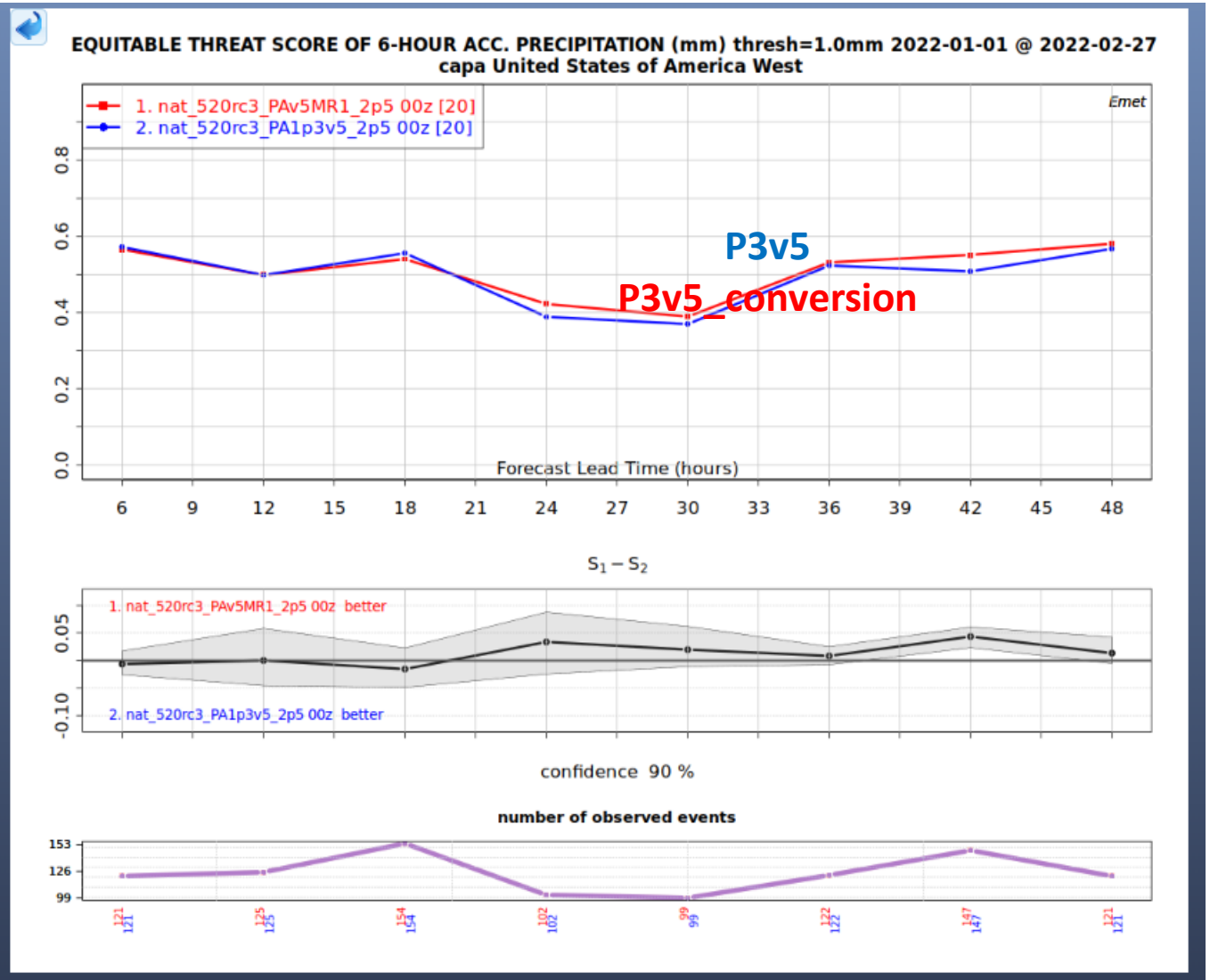
Emet scores (H22)

http://emet-usr.science.gc.ca/emet/mec000/5-13-17.disp

- P0 very neutral
- TT, UV & TD neutral
- PR6:
  - Ets1 generally improved

ets1 < >

ets1 nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1p3v5_2p5		20220101 / 20220228	
		00z	12z
Alaska	PR6	0.00%	0.00%
Alberta-Saskatchewan	PR6	0.42%	-0.96%
British Columbia	PR6	0.00%	0.00%
British Columbia 2	PR6	0.20%	-0.62%
Canada	PR6	0.62%	0.00%
Canadian Arctic	PR6	0.55%	1.35%
Maritimes	PR6	0.91%	0.28%
North America plus	PR6	0.20%	0.00%
Ontario-Quebec	PR6	0.00%	-0.21%
Prairies	PR6	0.40%	-0.80%
United States of America	PR6	0.00%	0.00%
United States of America East	PR6	-0.30%	-0.25%
United States of America West	PR6	1.09%	0.00%



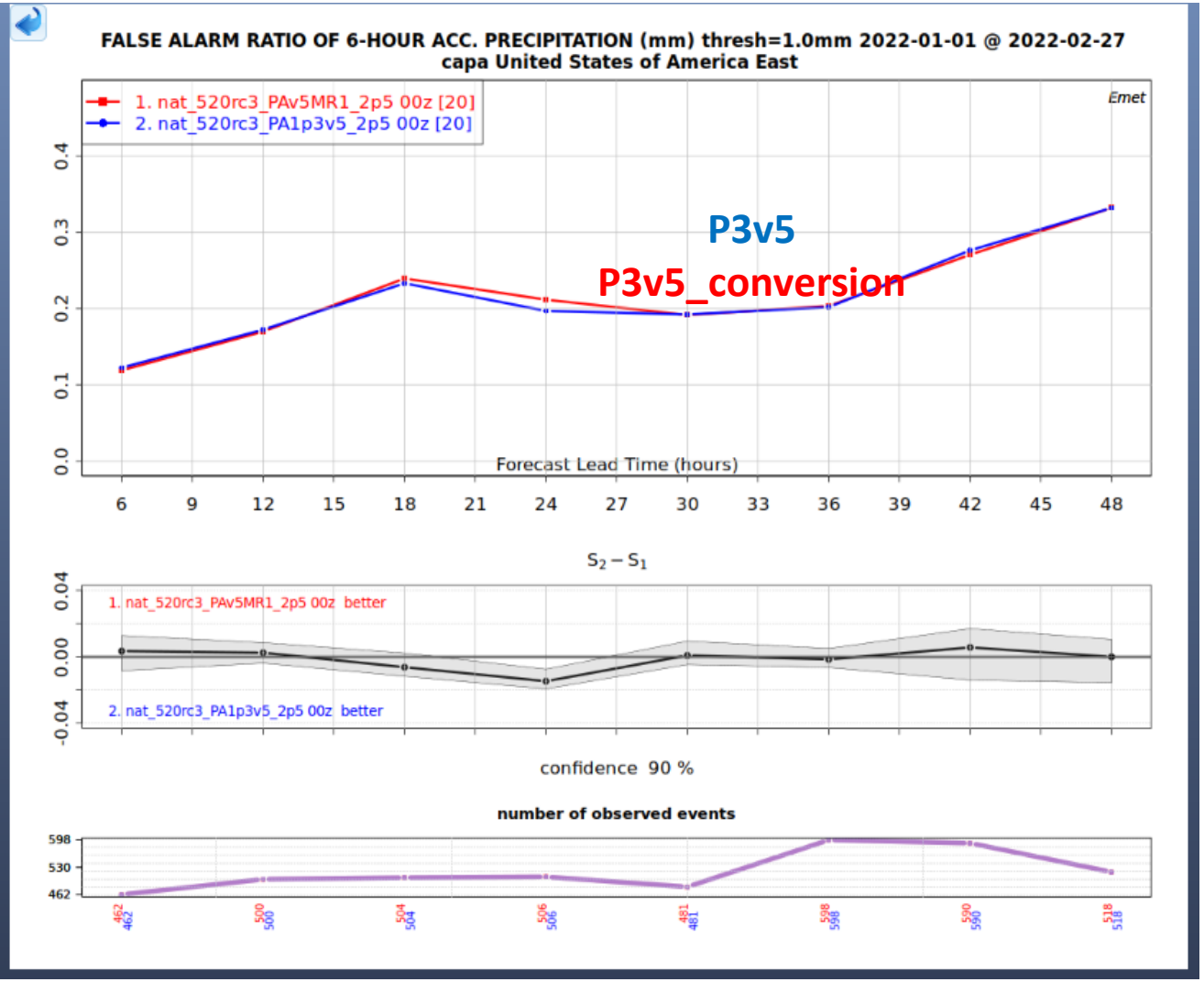
Emet scores (H22)

http://emet-usr.science.gc.ca/emet/mec000/5-13-17.disp

- P0 very neutral
- TT, UV & TD neutral
- PR6:
  - Ets1 generally improved
  - Far1 neutral

far1 < >

far1 nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1p3v5_2p5		20220101 / 20220228	
		00z	12z
Alaska	PR6	0.00%	0.00%
Alberta-Saskatchewan	PR6	0.00%	-0.68%
British Columbia	PR6	0.00%	-0.91%
British Columbia 2	PR6	2.62%	0.00%
Canada	PR6	1.52%	-0.57%
Canadian Arctic	PR6	-0.12%	0.00%
Maritimes	PR6	1.14%	-0.15%
North America plus	PR6	0.49%	0.00%
Ontario-Quebec	PR6	0.00%	-0.25%
Prairies	PR6	0.21%	-0.94%
United States of America	PR6	0.00%	0.00%
United States of America East	PR6	-0.85%	0.00%
United States of America West	PR6	0.00%	0.00%



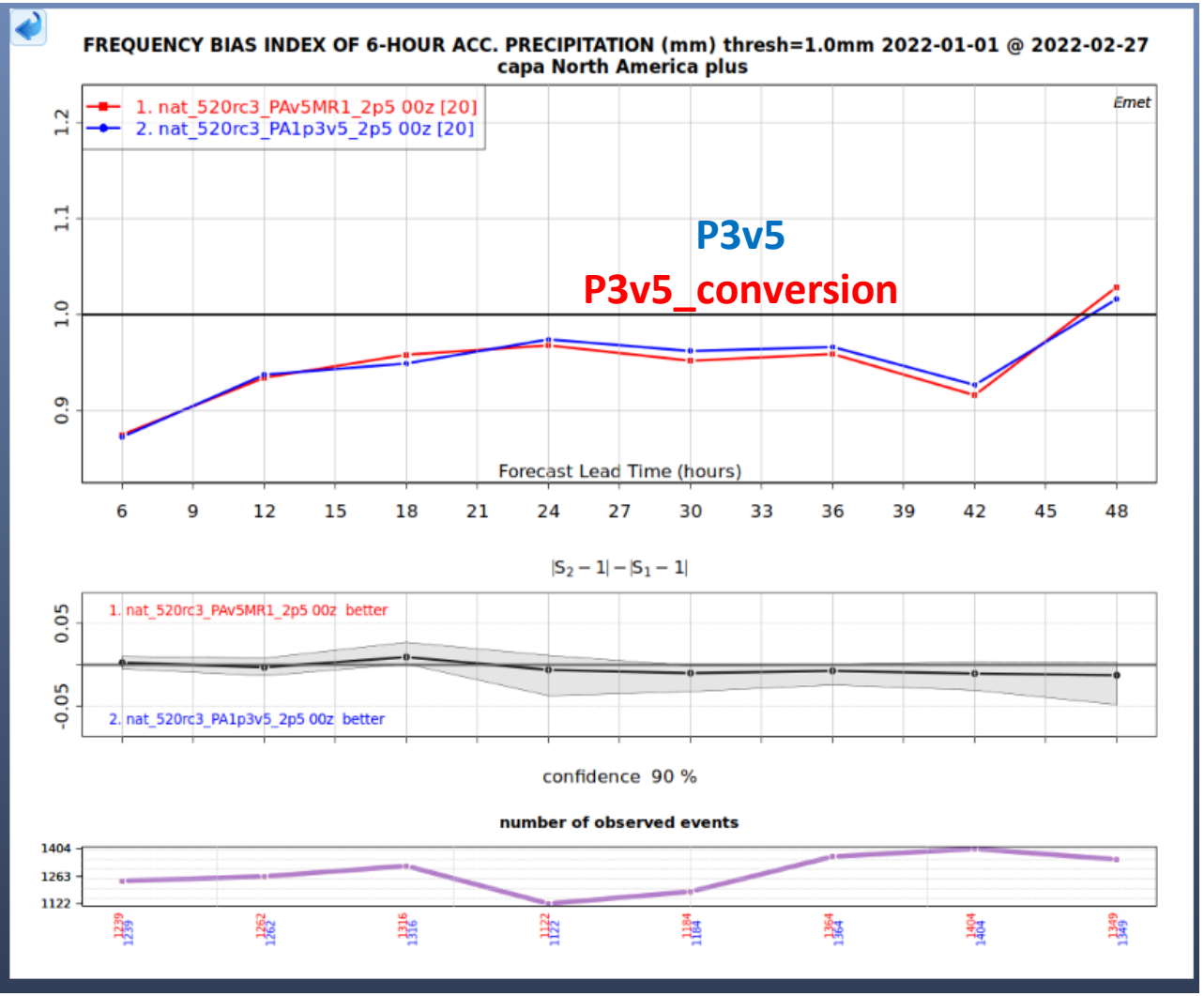
Emet scores (H22)

http://emet-usr.science.gc.ca/emet/mec000/5-13-17.disp

- P0 very neutral
- TT, UV & TD neutral
- PR6:
  - Ets1 generally improved
  - Far1 neutral
  - Fbi1 neutral

fbi1 < >

fbi1 nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1p3v5_2p5		20220101 / 20220228	
		00z	12z
Alaska	PR6	0.00%	0.00%
Alberta-Saskatchewan	PR6	-0.86%	0.00%
British Columbia	PR6	0.00%	-0.77%
British Columbia 2	PR6	0.00%	-0.40%
Canada	PR6	-0.04%	-0.06%
Canadian Arctic	PR6	0.49%	0.00%
Maritimes	PR6	0.56%	-0.25%
North America plus	PR6	-0.01%	0.09%
Ontario-Quebec	PR6	-0.07%	-0.30%
Prairies	PR6	-0.78%	0.00%
United States of America	PR6	0.13%	0.00%
United States of America East	PR6	0.38%	0.00%
United States of America West	PR6	0.00%	0.00%



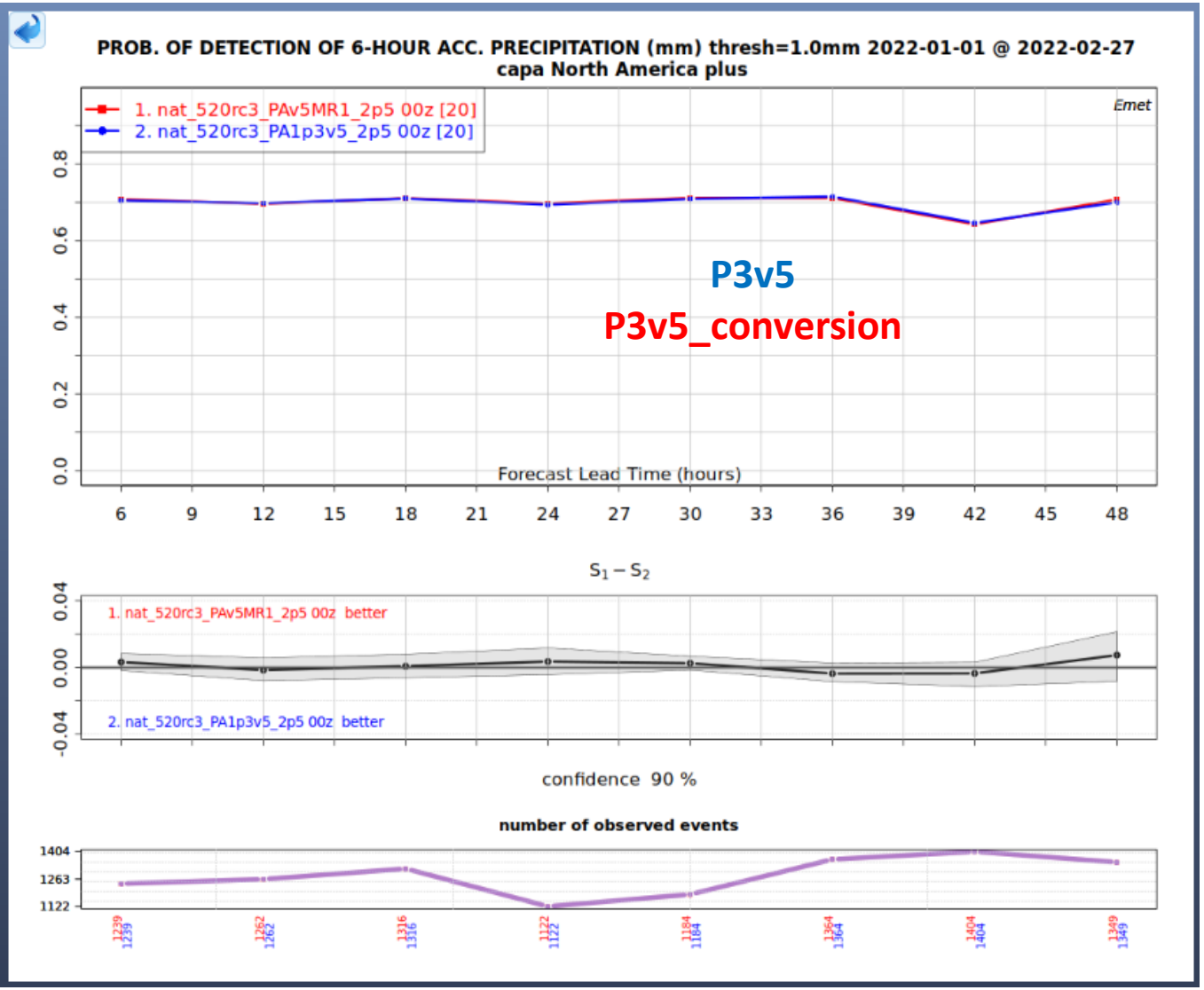
Emet scores (H22)

http://emet-usr.science.gc.ca/emet/mec000/5-13-17.disp

- P0 very neutral
- TT, UV & TD neutral
- PR6:
  - Ets1 generally improved
  - Far1 neutral
  - Fbi1 neutral
  - Pod1 neutral

pod1 < >

pod1 nat_520rc3_PAv5MR1_2p5 / nat_520rc3_PA1p3v5_2p5		20220101 / 20220228	
		00z	12z
Alaska	PR6	0.00%	0.00%
Alberta-Saskatchewan	PR6	1.10%	0.00%
British Columbia	PR6	0.00%	0.31%
British Columbia 2	PR6	0.00%	0.20%
Canada	PR6	0.00%	0.00%
Canadian Arctic	PR6	0.00%	0.00%
Maritimes	PR6	0.47%	0.35%
North America plus	PR6	0.00%	0.00%
Ontario-Quebec	PR6	0.00%	-0.28%
Prairies	PR6	0.00%	0.00%
United States of America	PR6	-0.10%	0.00%
United States of America East	PR6	-0.23%	0.00%
United States of America West	PR6	0.37%	0.00%



Conclusions

- Local logical is added to P3 to convert in and out from specific masses to mixing ratios all prognostics variables (humidity, cloud, rain and ice).
- The results are neutral ARCAD and mostly neutral EMET scores, especially for winter.

- Next: Revisit the conservation of total water in the physics for P3.