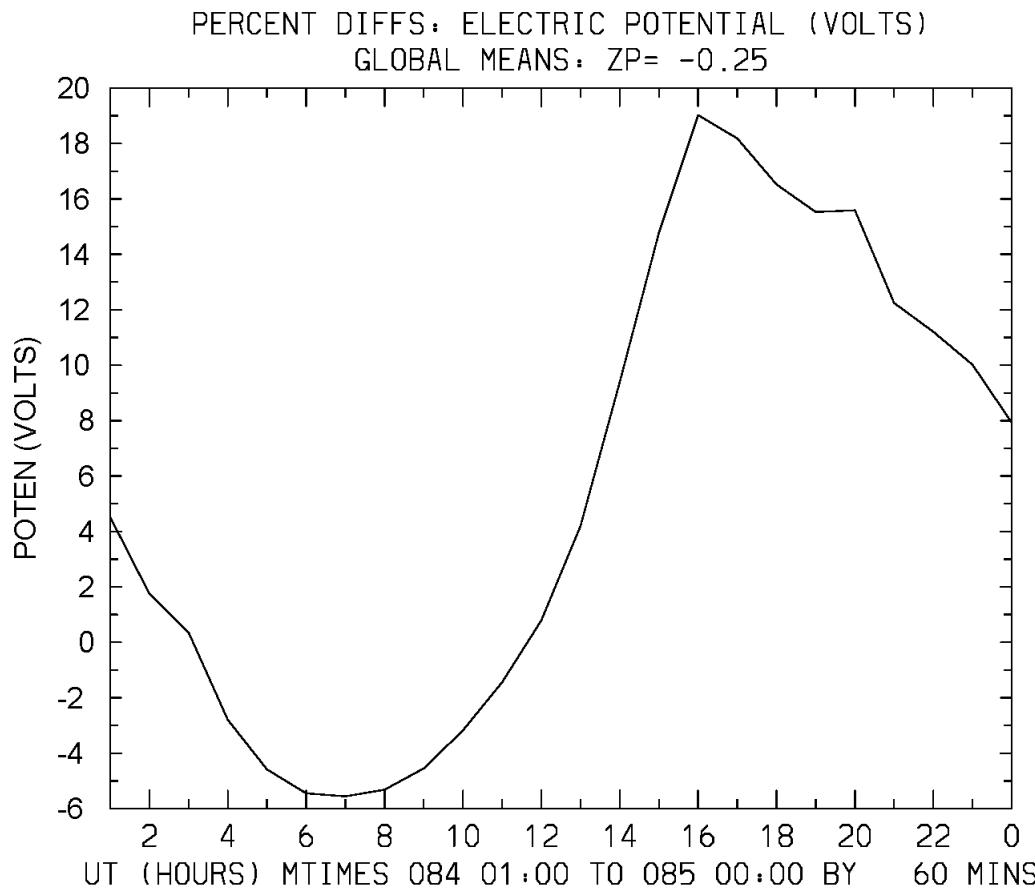


Steady-State 5-day equinox tiegcm runs: Dynamic vs Constant Critical Latitudes

- Concrit Heelis c30p8 -> crit = 15., 30.
- Dyncrit Heelis c30p8 -> crit = 17.25, 32.25
- Concrit Heelis c95p58 -> crit = 15., 30.
- Dyncrit Heelis c95p58 -> crit = 21.12, 36.12
- Concrit Weimer BZ+5 -> crit = 15., 30.
- Dyncrit Weimer BZ+5 -> crit = 17.09, 32.09
- Concrit Weimer BZ-5 -> crit = 15., 30.
- Dyncrit Weimer BZ-5 -> crit = 20.09, 35.09

Weimer BZ=+5 (%Diffs: dyncrit-concrit)

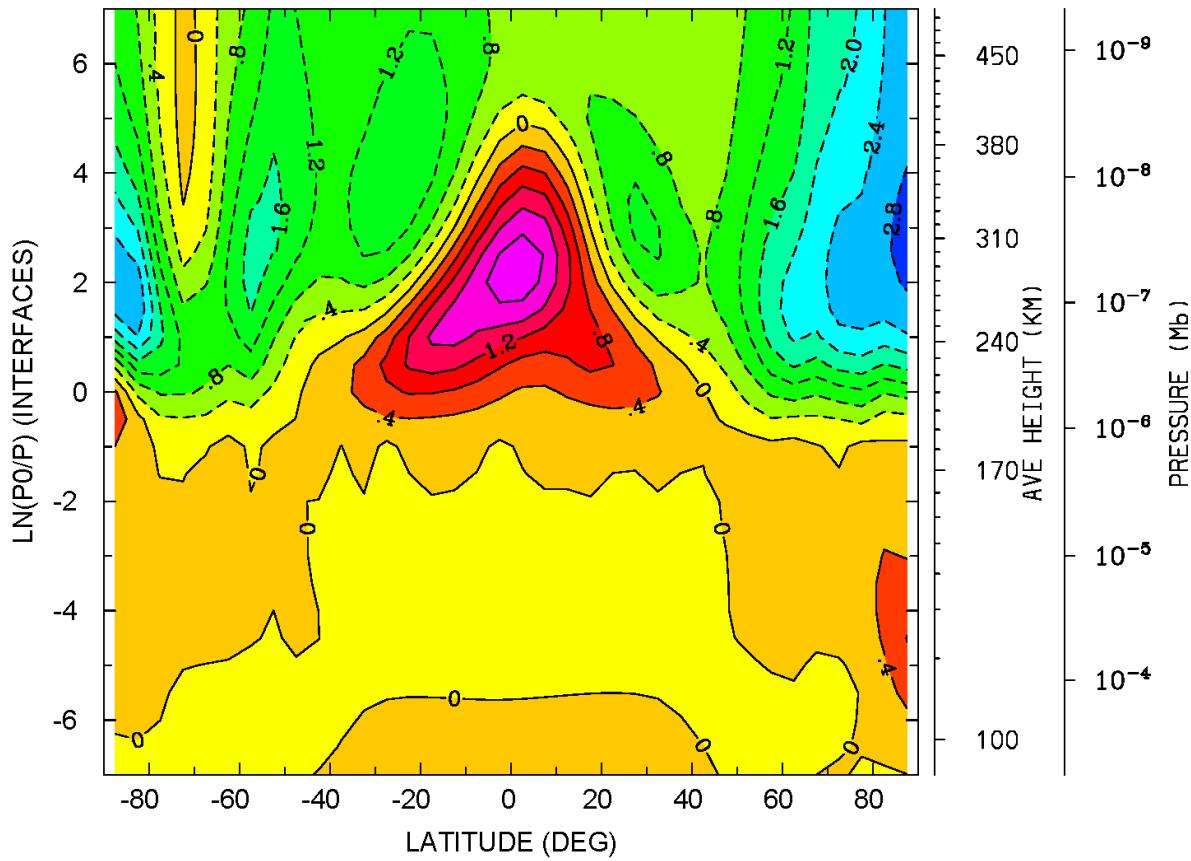


MIN,MAX= -5.5584E+00 1.9025E+01
PERT FILE: tiegcm_dyncrit_weimer.s_eqnx_bz+5_003.nc
CNTR FILE: tiegcm_concrit_weimer.s_eqnx_bz+5_003.nc

%Diffs Min,Max = -5.5, 19.0

Weimer BZ=+5 (%Diffs: dyncrit-concrit)

% DIFFS: ELECTRON DENSITY
UT= 0.00 ZONAL MEANS

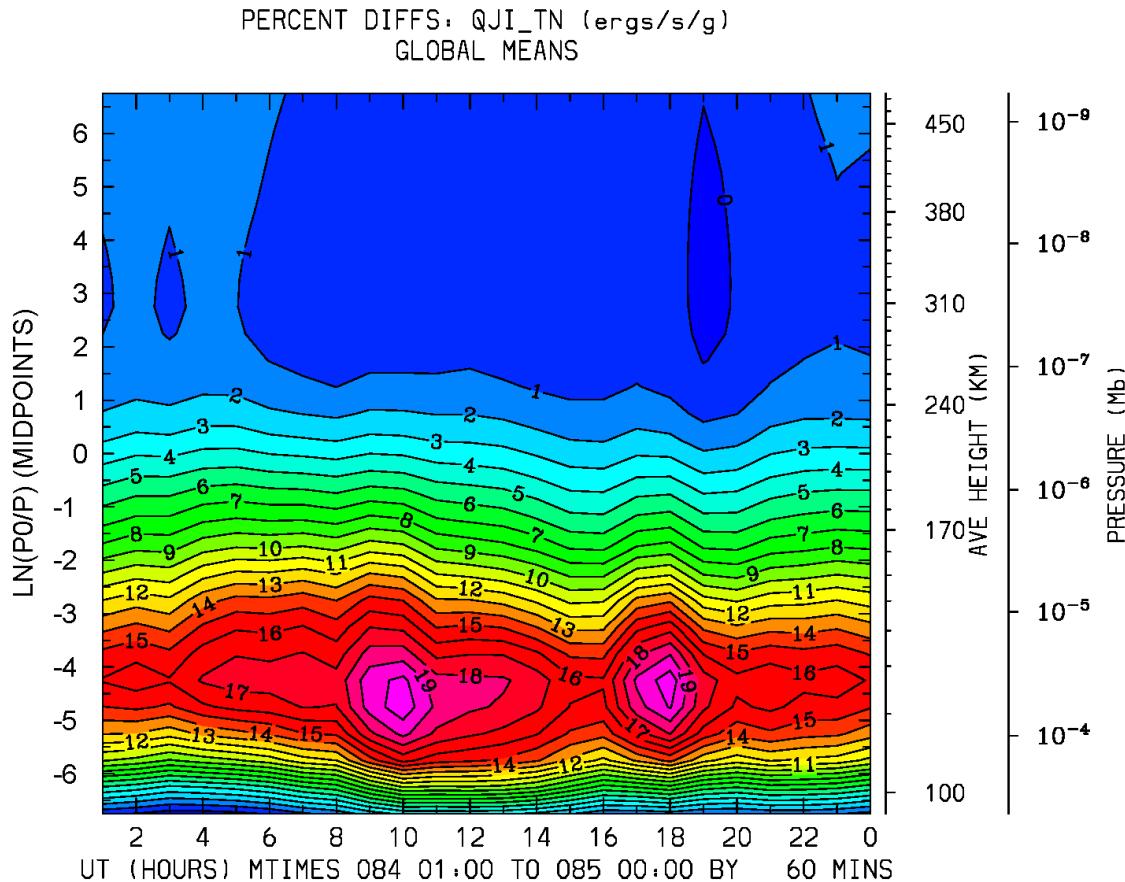


MIN,MAX= -2.9092E+00 2.2368E+00 INTERVAL= 4.0000E-01
tiegcm_trunk (DAY,HR,MIN= 85, 0, 0)
it_weimer.s_eqnx_bz+5_003.nc MINUS tiegcm_concrit_weimer.s_eqnx_bz+5_003.r

%Diffs Min,Max = -2.9, 2.2

Joule Heating (TN)

Weimer BZ=+5 (%Diffs: dyncrit-concrit)

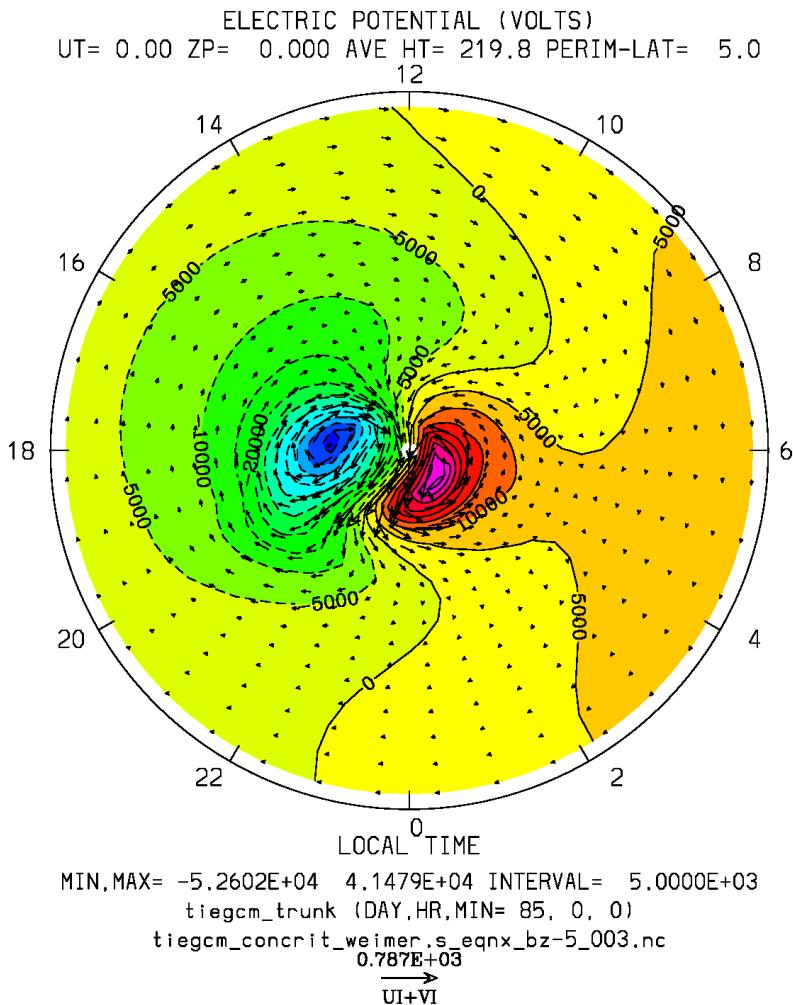


MIN,MAX= -5.2091E-01 2.0641E+01 INTERVAL= 1.0000E+00
PERT FILE: tiegcm_dyncrit_weimer.s_eqnx_bz+5_003.nc
CNTR FILE: tiegcm_concrit_weimer.s_eqnx_bz+5_003.nc

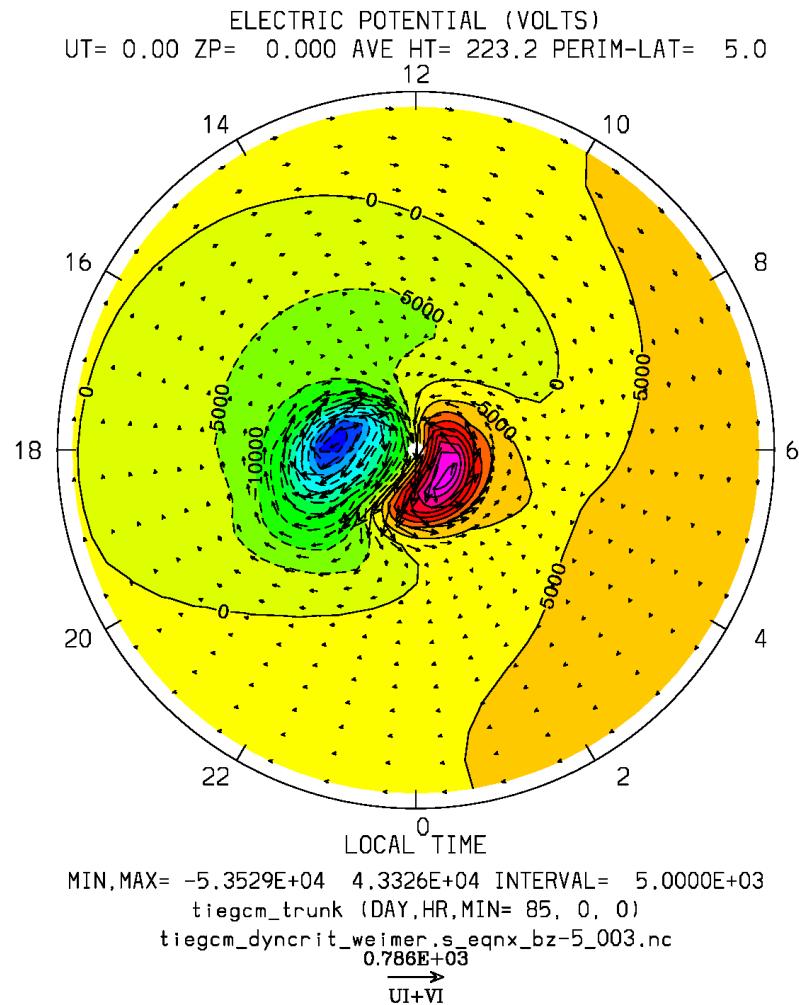
%Diffs Min,Max = -0.5, 20.6

Electric Potential + UI,VI (full fields)

Concrit: Weimer BZ=-5



Dyncrit: Weimer BZ=-5

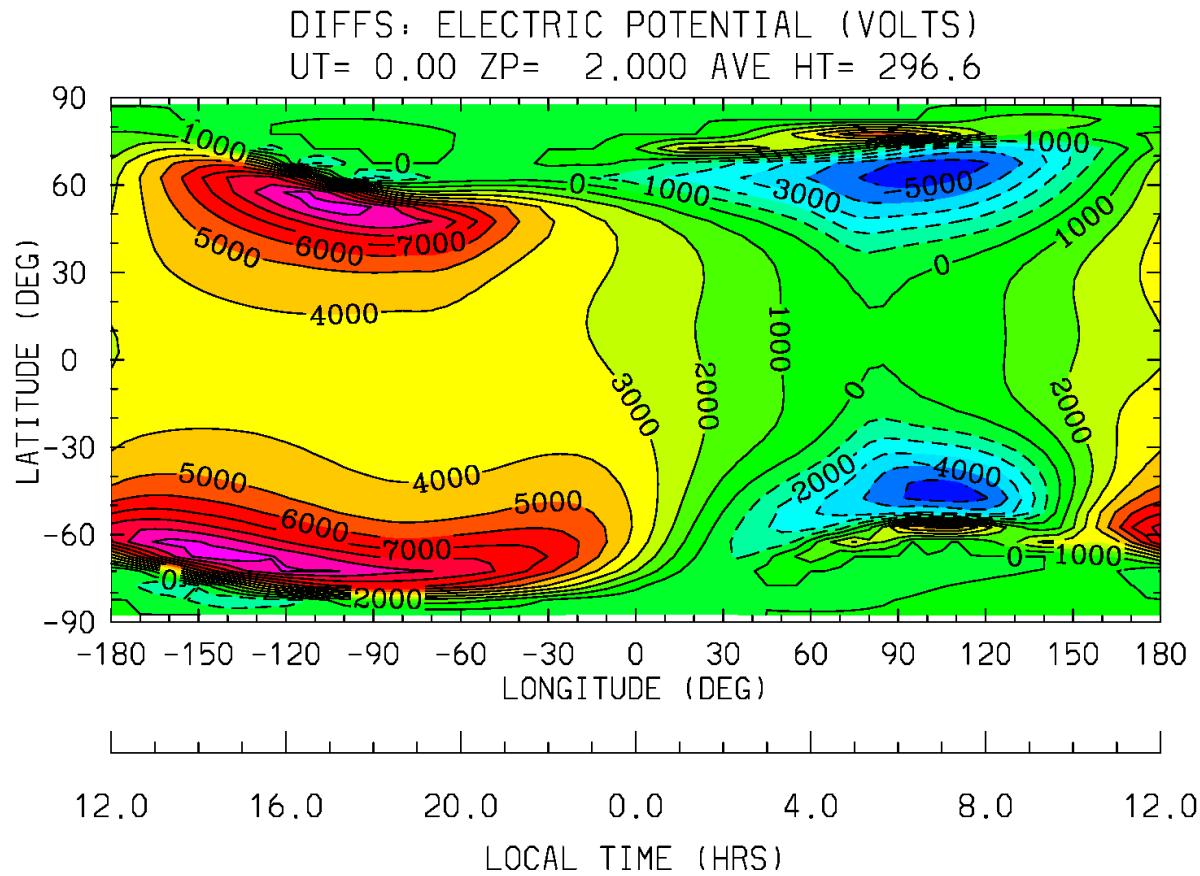


Min,Max = -5e+4, 4e+4

Potential fall-off is faster with dyncrit

Electric Potential

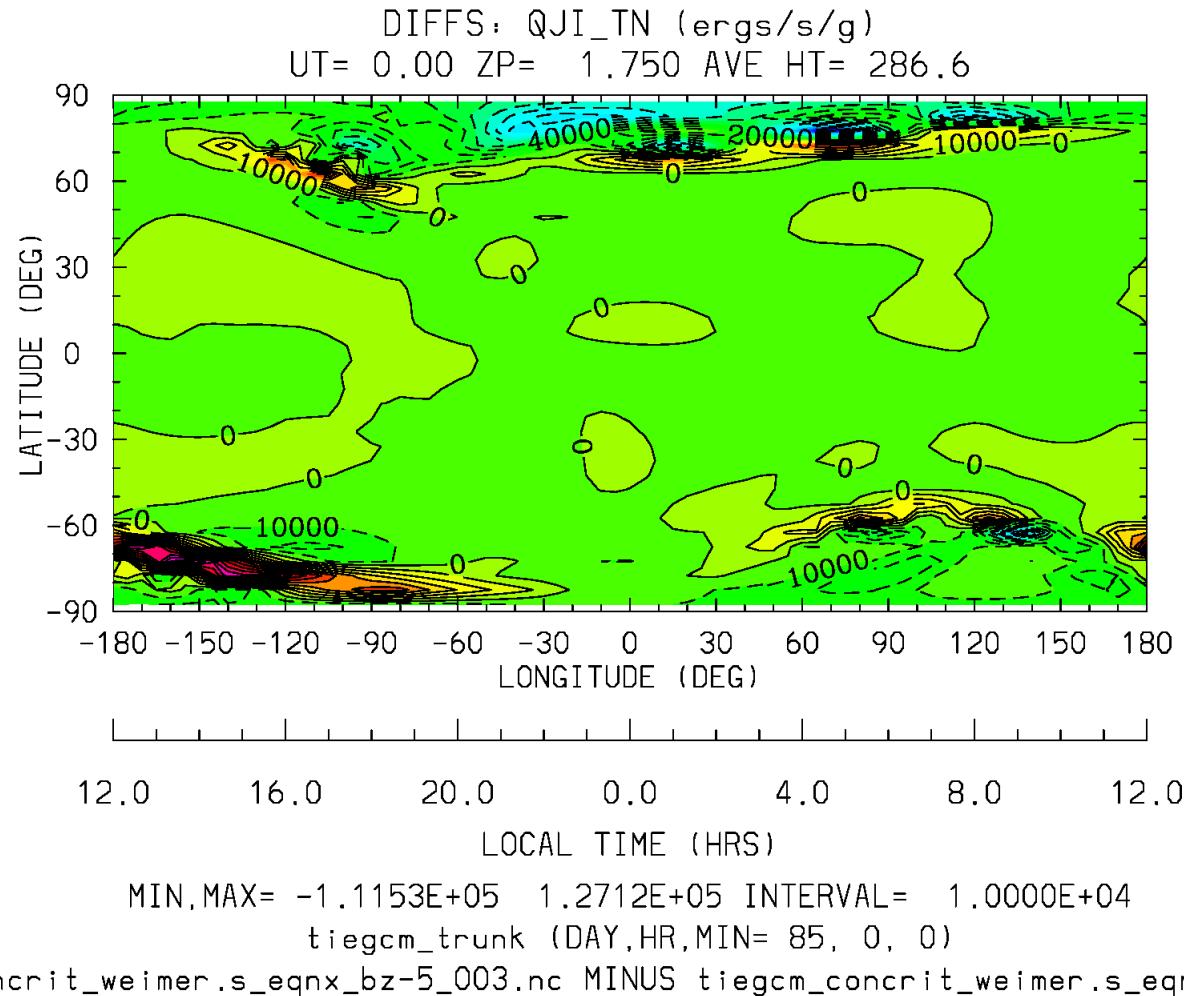
Weimer BZ = -5 (Diffs: dyncrit-concrit)



MIN,MAX= -5.5207E+03 1.0762E+04 INTERVAL= 1.0000E+03
tiegcm_trunk (DAY,HR,MIN= 85, 0, 0)
ncrit_weimer.s_eqnx_bz-5_003.nc MINUS tiegcm_concrit_weimer.s_eqn

Diffs: Min,Max = -5.5,10.7 (kv)

Joule Heating (TN) (Diffs: dyncrit-concrit)

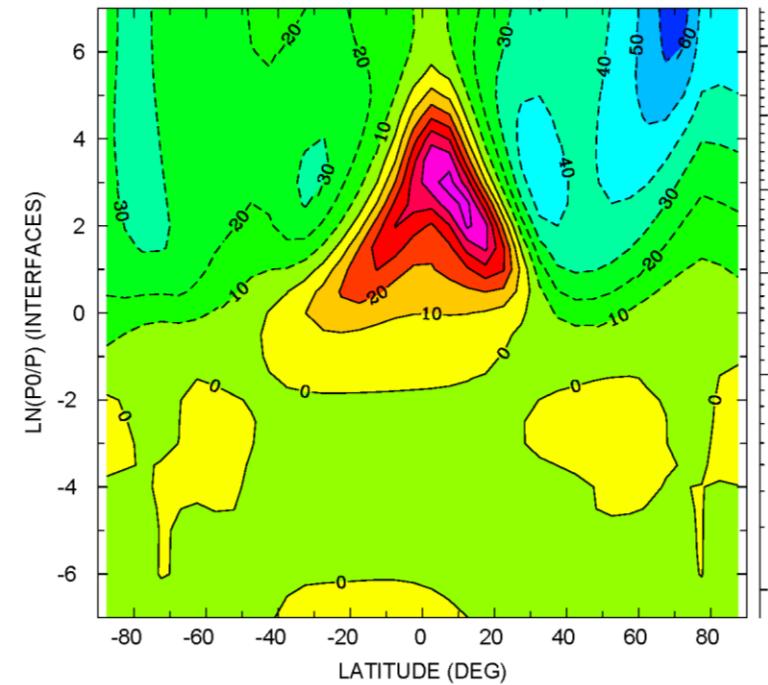


Diffs: Min,Max = -1.1e+5, 1.3e+5

Electron Density (%diffs: dyncrit-concrit)

Weimer BZ=-5 (%Diffss)

% DIFFS: ELECTRON DENSITY
UT= 0.00 LON= -180.00 (DEG) SLT=12.00 (HRS)



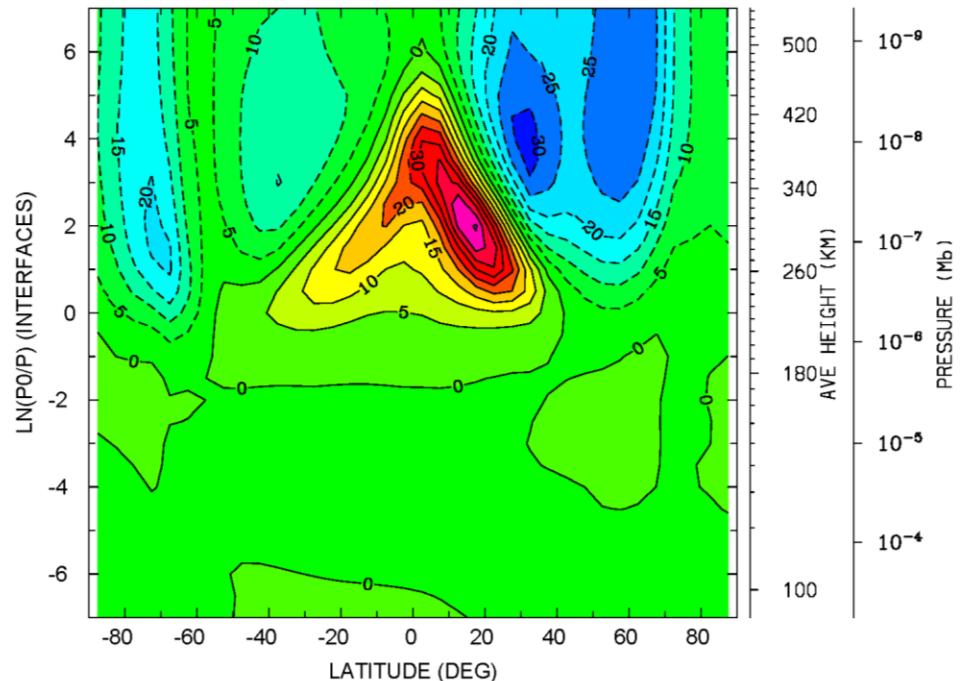
```
MIN,MAX= -6.3836E+01 6.3944E+01 INTERVAL= 1.0000E+01
tiegcm_trunk (DAY,HR,MIN= 85, 0, 0)
```

```
rit_weimer.s_eqnx_bz-5_003.nc MINUS tiegcm_concrit_weimer.s_eqnx_bz-5_0t_heelis.s_eqnx_c95p58_003.nc MINUS tiegcm_concrit_heelis.s_eqnx_c95p58_003.
```

%Diffss: Min,Max = -64, 64

Heelis c95p58 (%Diffss)

% DIFFS: ELECTRON DENSITY
UT= 0.00 LON= -180.00 (DEG) SLT=12.00 (HRS)



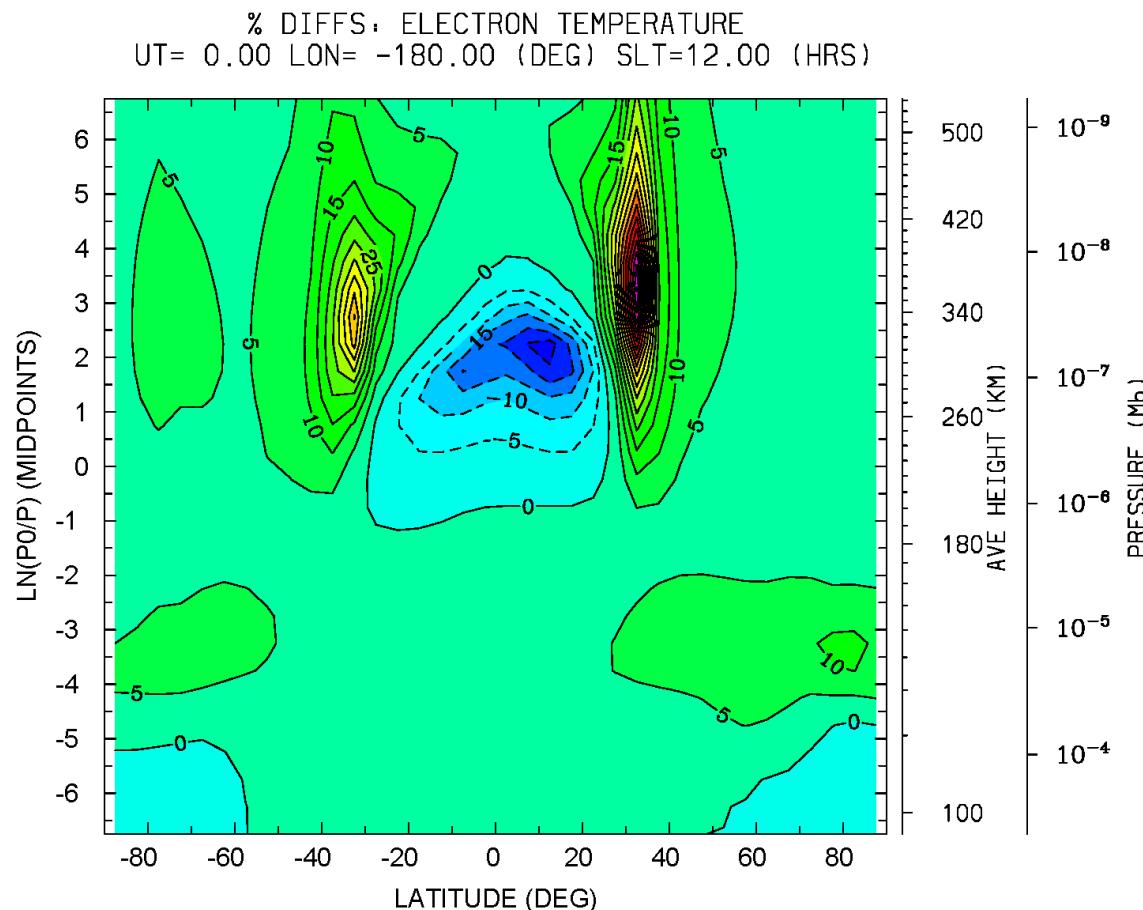
```
MIN,MAX= -3.2385E+01 4.5841E+01 INTERVAL= 5.0000E+00
tiegcm_trunk (DAY,HR,MIN= 85, 0, 0)
```

```
rit_weimer.s_eqnx_bz-5_003.nc MINUS tiegcm_concrit_weimer.s_eqnx_bz-5_0t_heelis.s_eqnx_c95p58_003.nc MINUS tiegcm_concrit_heelis.s_eqnx_c95p58_003.
```

%Diffss: Min,Max = -32, 46

Electron Temperature (%Diffs: dyncrit-concrit)

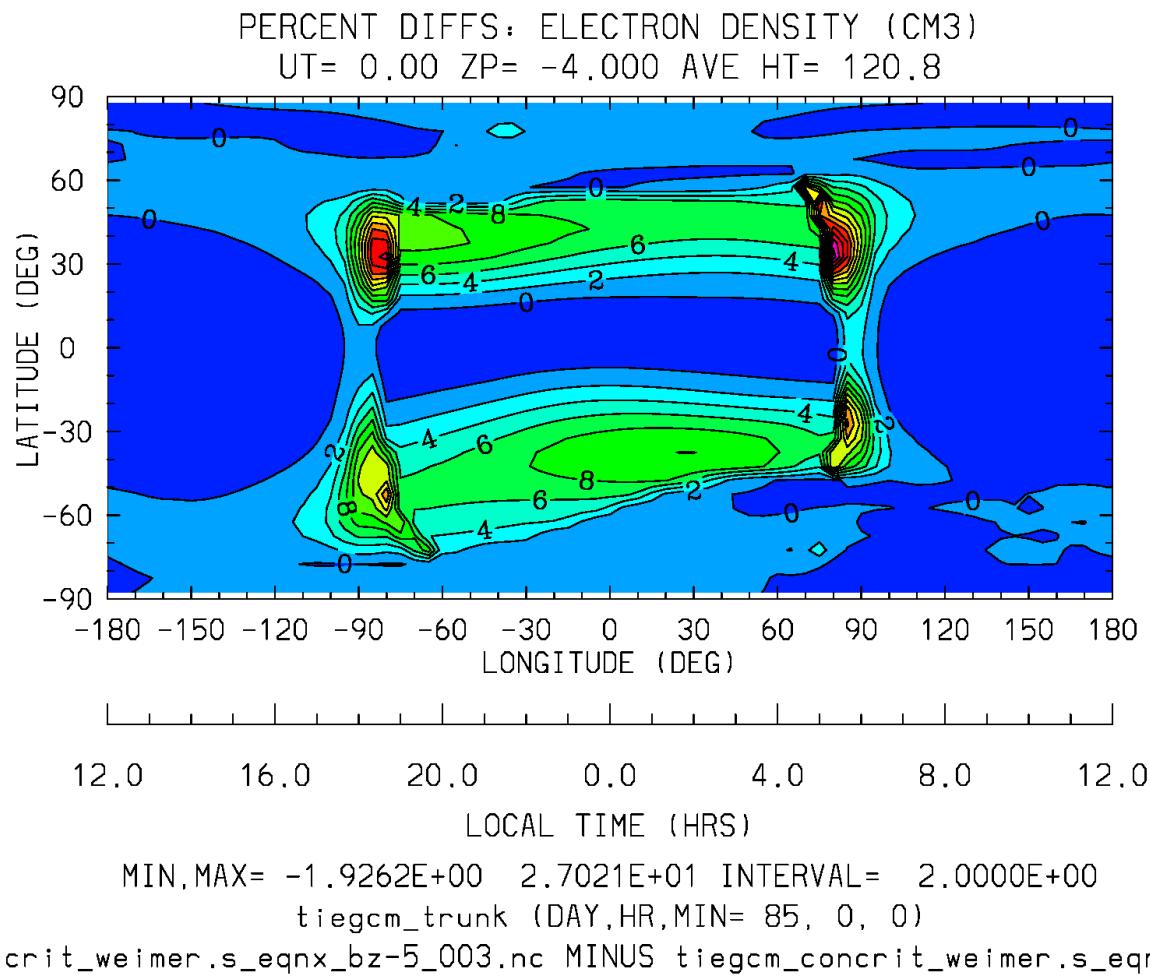
Weimer BZ = -5



%Diffs Min,Max = -27, 80

Electron Density (%Diffs dyncrit-concrit)

Weimer BZ = -5



%Diffs Min,Max = -1.9, 27.0

Code structure with proposed changes:

- Critical latitudes are declared and initialized in cons.F:
! Critical colatitude limits (15,30 deg) for use of Heelis potential in dynamo:
real :: crit(2) = (/0.261799387, 0.523598775/) -> crit = 15., 30. degrees
- Advance calls aurora_cons, which calculates convection theta0:
theta0(isouth) = (-3.80+8.48*(ctpoten**0.1875))*dtr
! Set theta0 = 10 deg so crit(1,2)=15,30 (old values in cons.F) in colath.F for CISM
#if defined(INTERCOMM) || defined(CISMAH)
 theta0(isouth) = 10.*dtr
#endif
- Advance calls Heelis, Weimer, or None, according to namelist input POTENTIAL_MODEL.
 - If weimer, theta0=bndyfitr/2. (wei05loc, overwriting aurora_cons)
 - The potential model calls colath (which is now in its own source file colath.F)

Code structure with crit changes, cont:

- Sub colath (colath.F) calculates crit(1:2) from theta0:

```
! 01/11 bae: Revise crit in rad so crit(1)=theta0 (=crad in rad)+5deg,  
! crit(2)=crit(1)+15deg  
    crit1deg = max(15.,0.5*(theta0(1)+theta0(2))*rtd + 5.)  
    crit1deg = min(30.,crit1deg)  
    crit(1) = crit1deg/rtd  
    crit(2) = crit(1) + 15./rtd
```

- Sub colath then calculates fraction of dynamo potential pfrac from crit (pfrac is declared in dynamo module):

```
pfrac(i,j) = (colatc(i,j)-crit(1))/(crit(2)-crit(1))  
if (pfrac(i,j) < 0.) pfrac(i,j) = 0.  
if (pfrac(i,j) >= 1.) pfrac(i,j) = 1.
```

- Dynamics calls sub aurora (aurora.F), which places cusp according to theta0.
- Advance calls sub dynamo, which calculates ion drift and potential according to pfrac.