

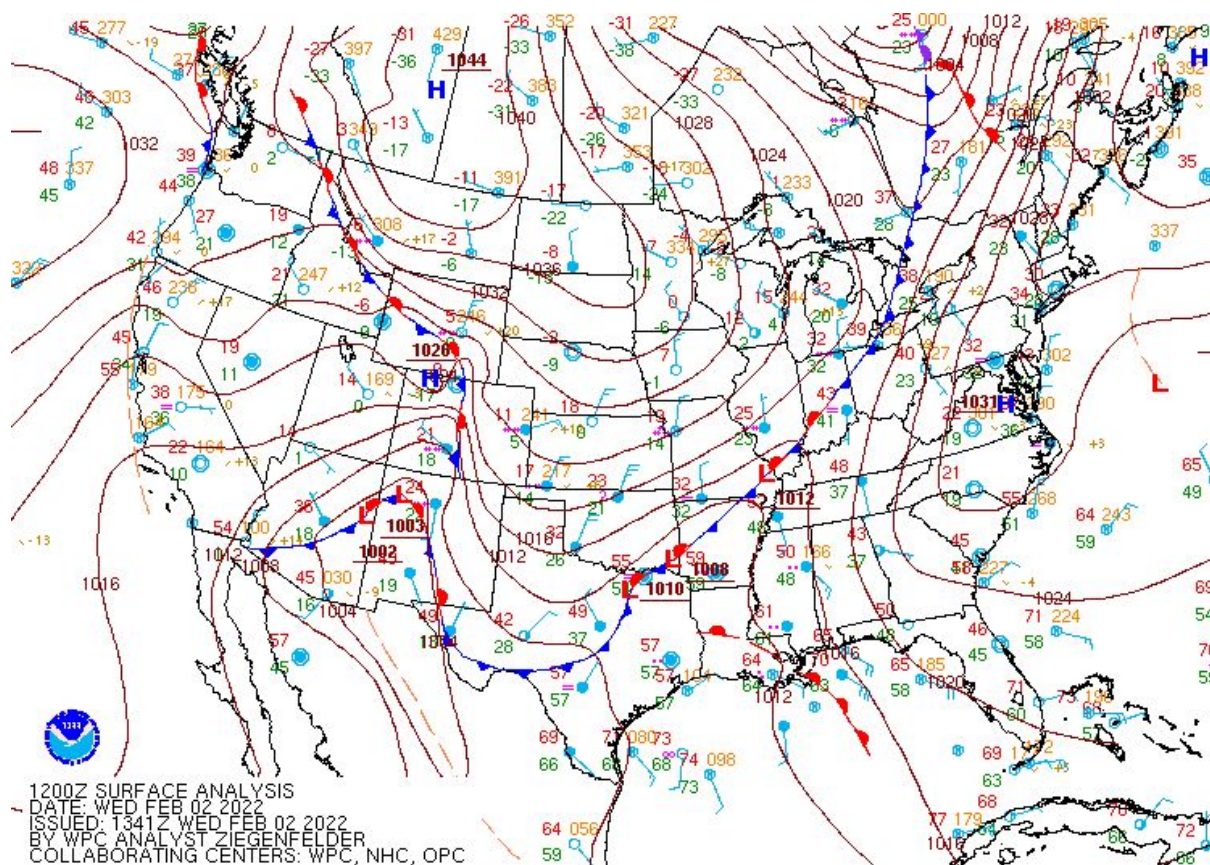
NOAH LSM

- **CTL:** Precip ice density (dsnew):
if (tempc <= -15.0) then
 dsnew = 0.05
else
 dsnew = 0.05 + 0.0017*(tempc + 15.0)**1.5
endif
- **EXP:** Precip ice density (rhonewsn1):
! -- calculate snow, graupel and ice fractions in falling frozen precip
 snowrat=min(1.,max(0.,snow0(i)/(prcpncfr + prcpncufr)))
 grauprat=min(1.,max(0.,graupel0(i)/(prcpncfr + prcpncufr)))
 icerat=min(1.,max(0.,(prcpncfr-snow0(i)-graupel0(i)) &
 /(prcpncfr + prcpncufr)))
 curat=min(1.,max(0.,(prcpncufr/(prcpncfr + prcpncufr))))

 rhonewsnow=min(125.,1000.0/max(8.,(17.*tanh((276.65-gt0(i,1))*0.15))))
 rhonewgr=min(500.,rhowater/max(2.,(3.5*tanh((274.15-gt0(i,1))*0.3333))))
 rhonewice=rhonewsnow

!--- compute density of "precip ice" from weighted contribution
!
 rhoprpcice = min(500.,max(58.8,(rhonewsnow*snowrat + &
 rhonewgr*grauprat + rhonewice*icerat + rhonewgr*curat)))
rhonewsn1(i)=rhoprpcice

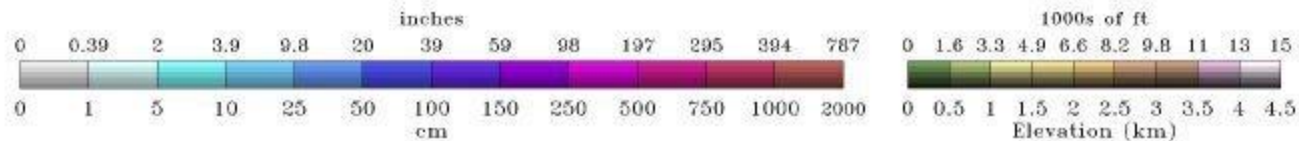
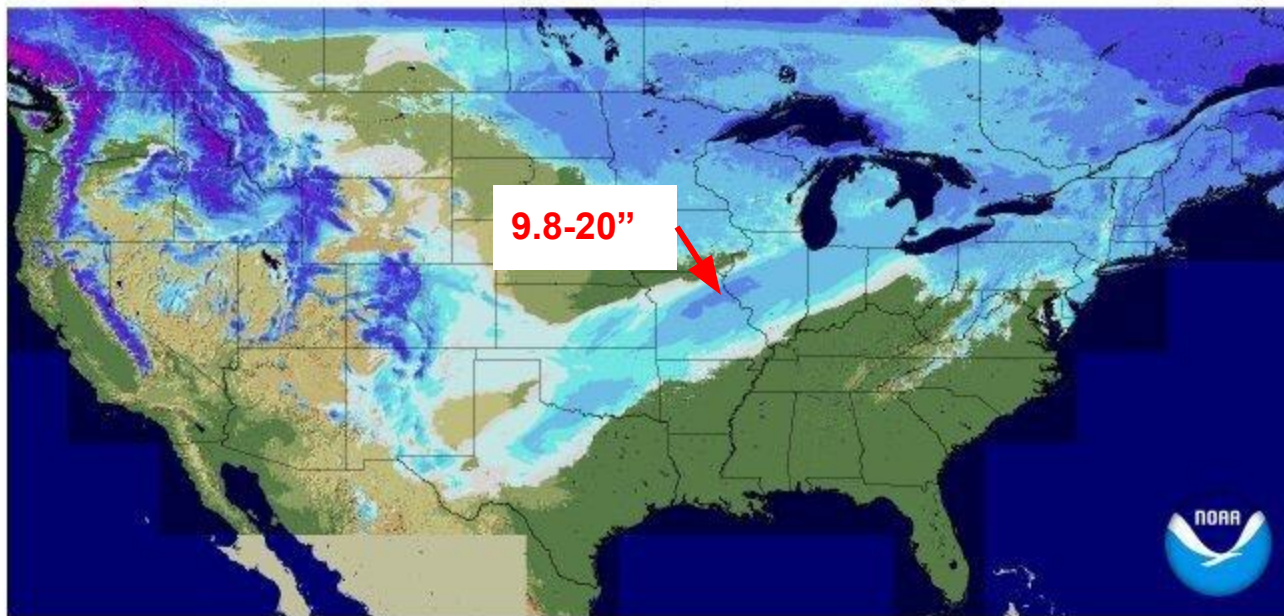
Surface Analysis Valid 12 UTC 02 February 2022



1200Z SURFACE ANALYSIS
DATE: WED FEB 02 2022
ISSUED: 1341Z WED FEB 02 2022
BY WPC ANALYST ZIEGENFELDER
COLLABORATING CENTERS: WPC, NHC, OPC

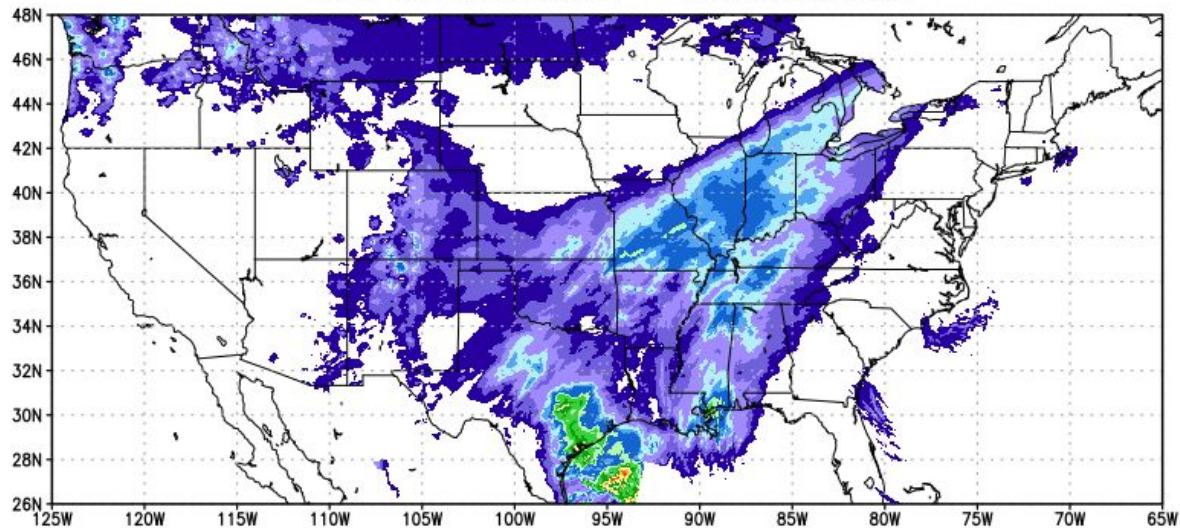
Snow Depth

2022-02-03 06 UTC



60-h Observed Accumulation of Precipitation

Total Observed Precipitation
Valid 12Z31JAN2022 – 00Z03FEB2022

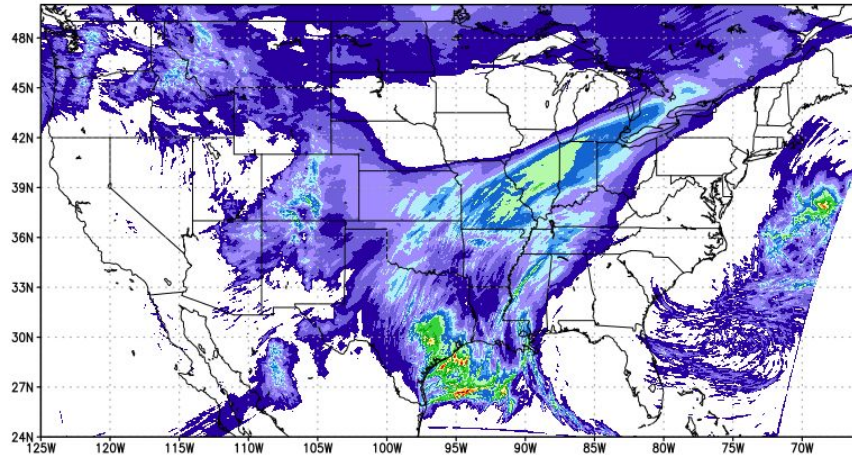


60-h Accumulations

NOAH LSM

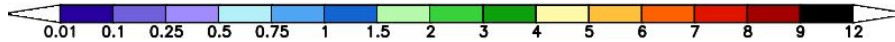
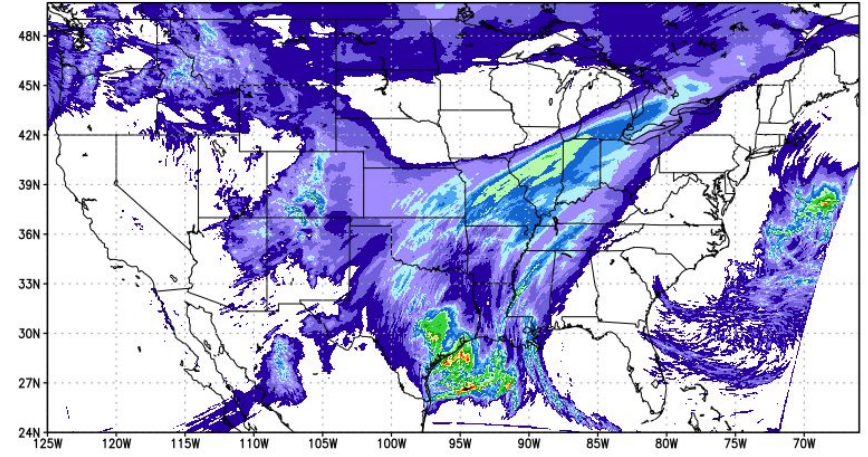
CTL

RRFS TOTAL ACCUMULATED PRECIP (IN) ENDING 00Z03FEB2022



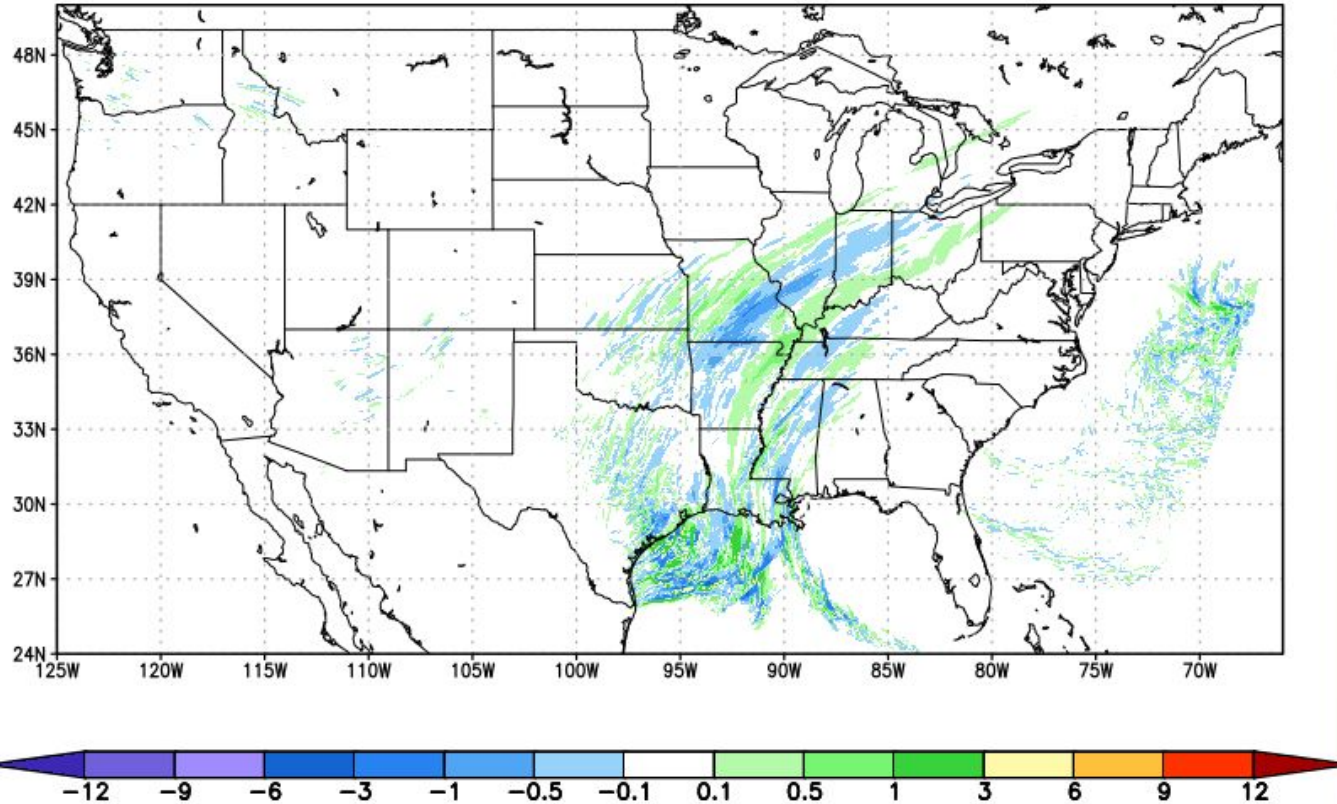
EXP

RRFS TOTAL ACCUMULATED PRECIP (IN) ENDING 00Z03FEB2022



60-h Accumulated Differences

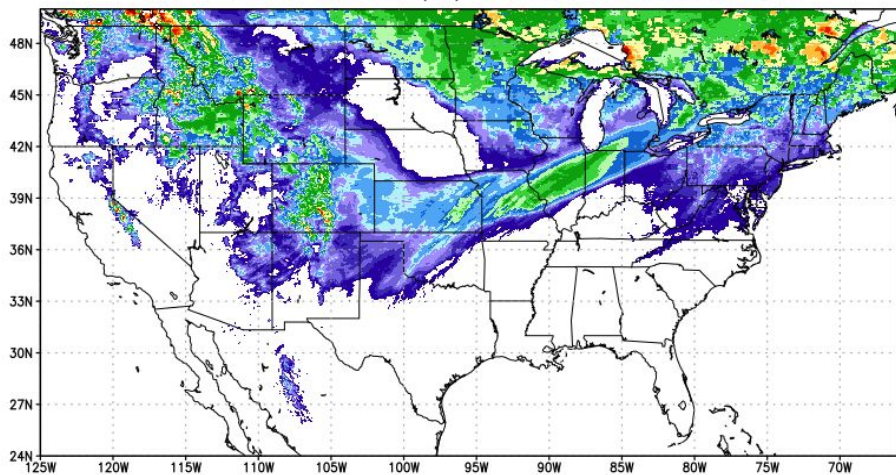
QPF DIFFERENCES (EXP-CTL) (IN) ENDING 00Z03FEB2022



60-h Accumulation of Snow Depth

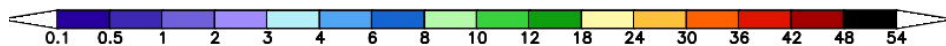
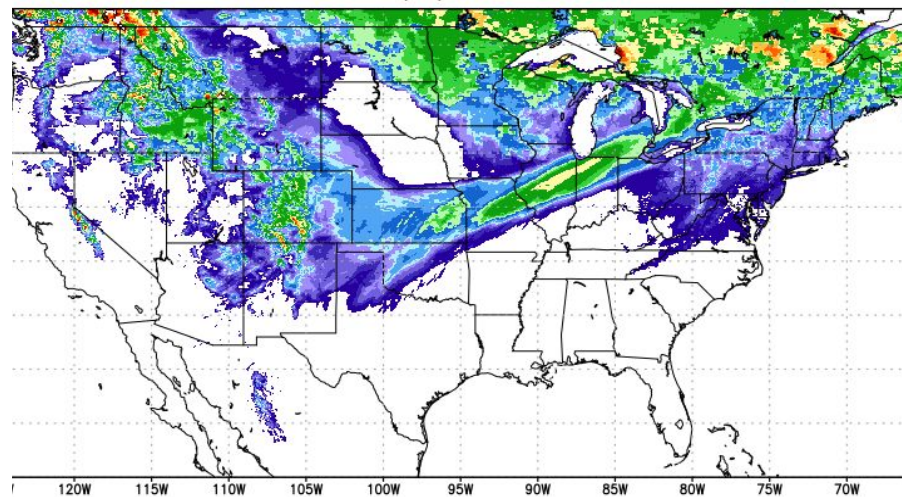
CTL

RRFS SNOW DEPTH (IN) ENDING 00Z03FEB2022



EXP

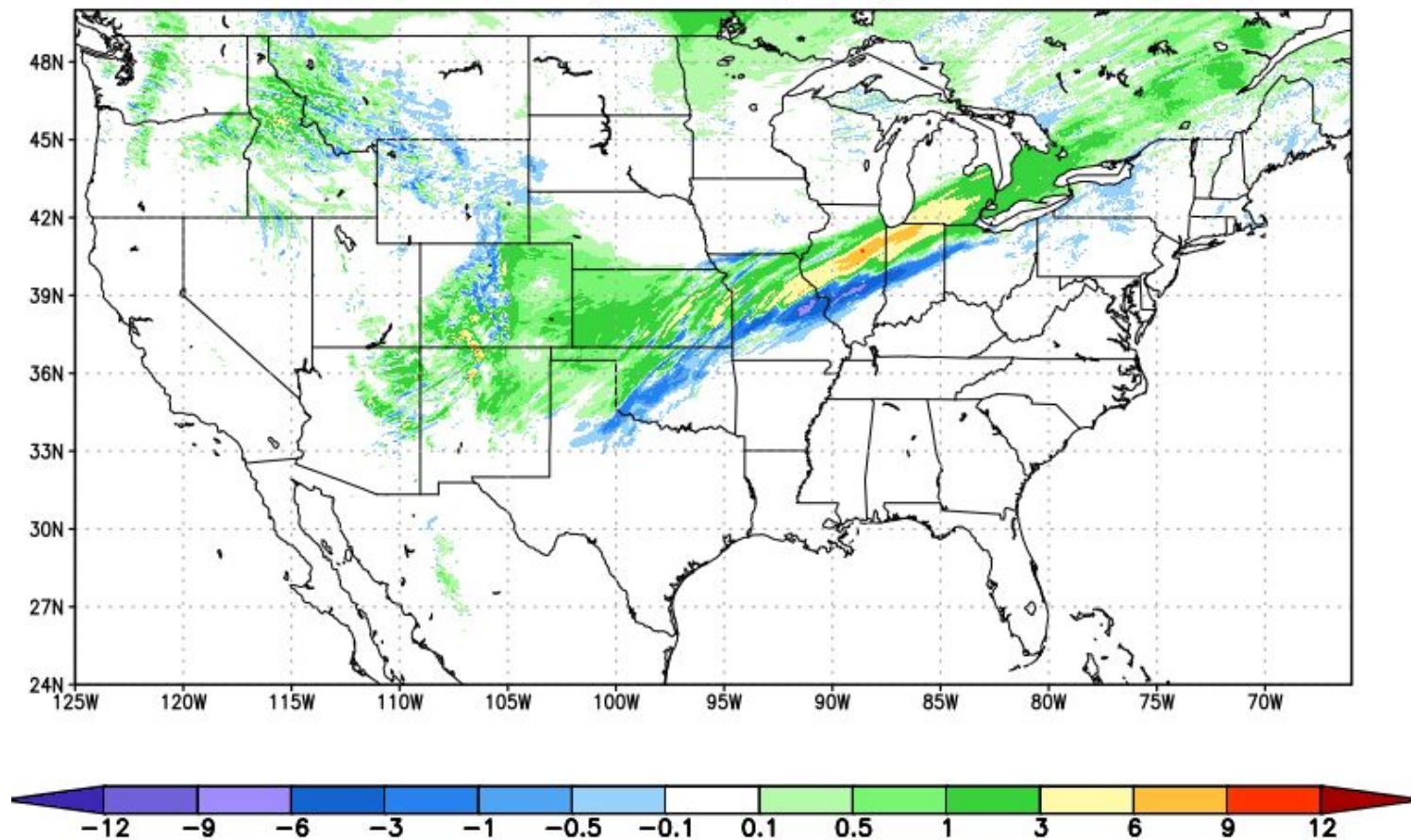
RRFS SNOW DEPTH (IN) ENDING 00Z03FEB2022



GrADS/COLA

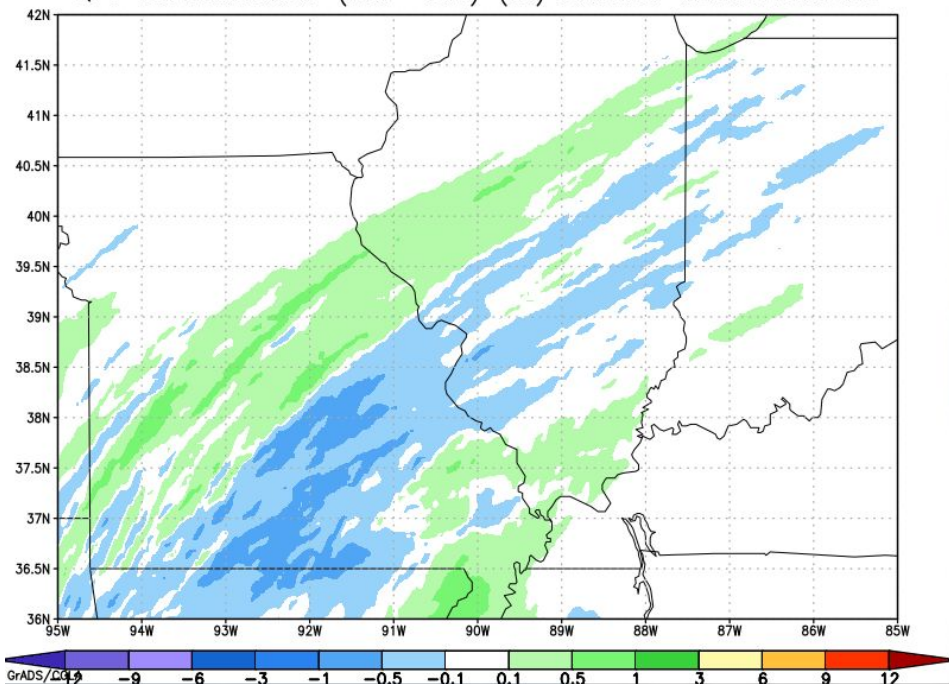
60-h Accumulated Differences

SNOW DEPTH DIFFERENCE (EXP-CTL) (IN) ENDING 00Z03FEB2022

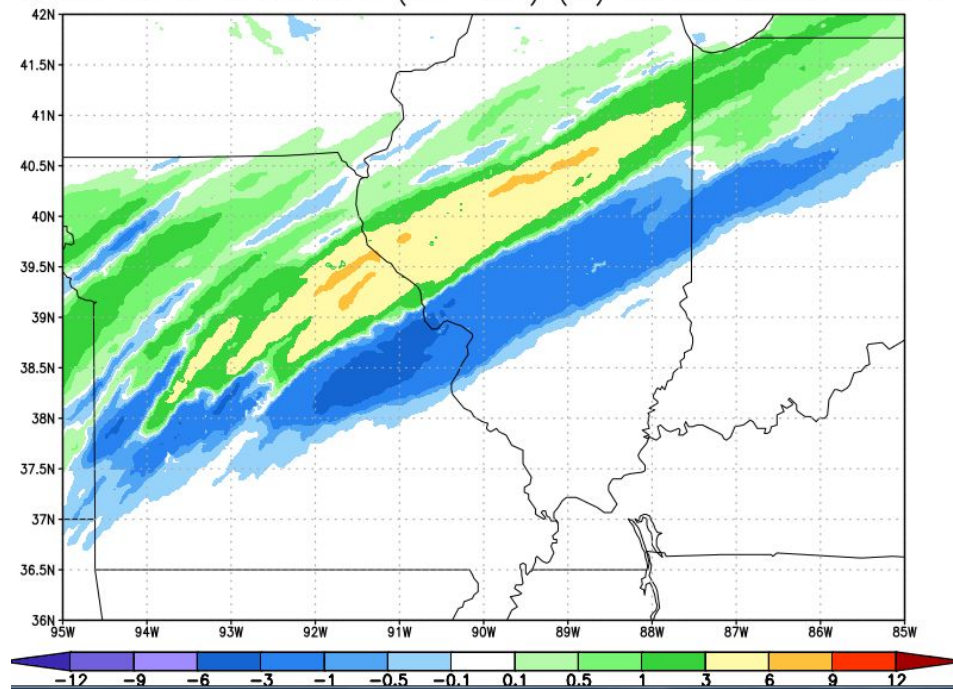


48-h Accumulated Differences

QPF DIFFERENCES (EXP-CTL) (IN) ENDING 12Z02FEB2022



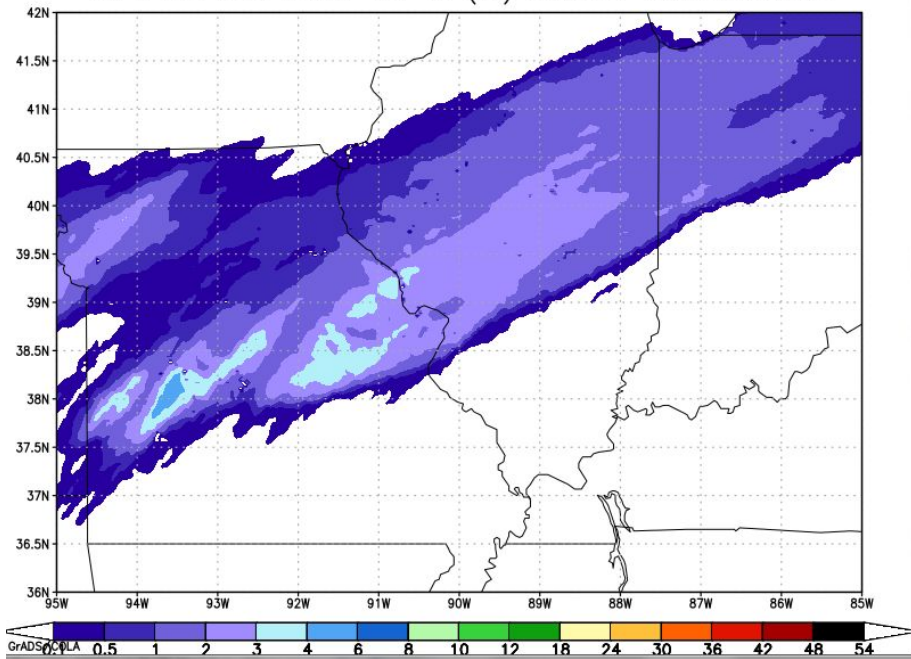
SNOW DEPTH DIFFERENCE (EXP-CTL) (IN) ENDING 12Z02FEB2022



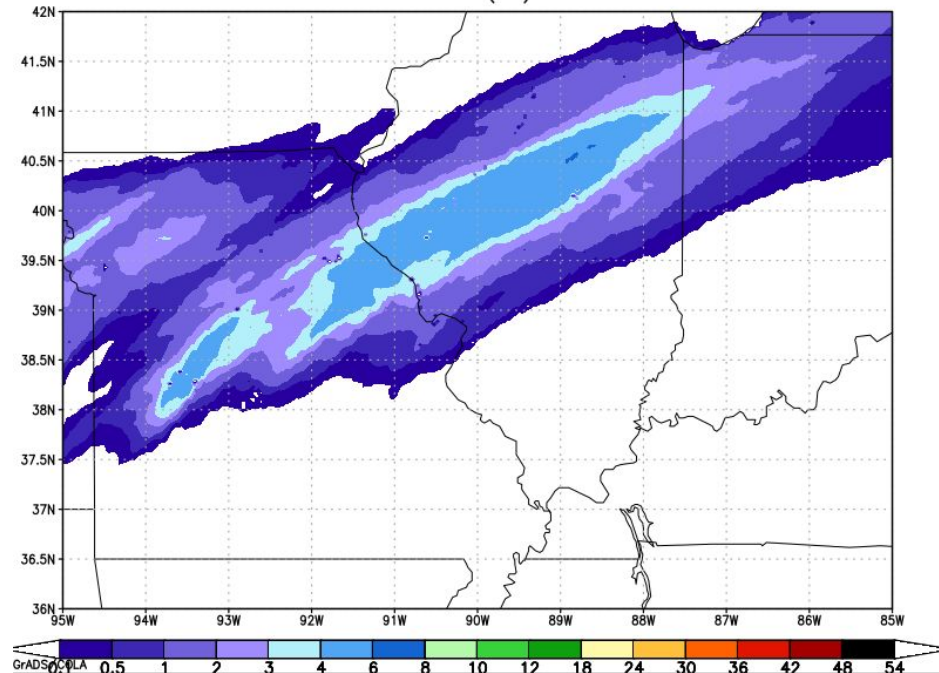
Period from 45-h to 48-h

CTL 3-h Positive Change in Snow Depth **EXP**

RRFS 3H ACC SNOW DEPTH (IN) ENDING 12Z31JAN2022

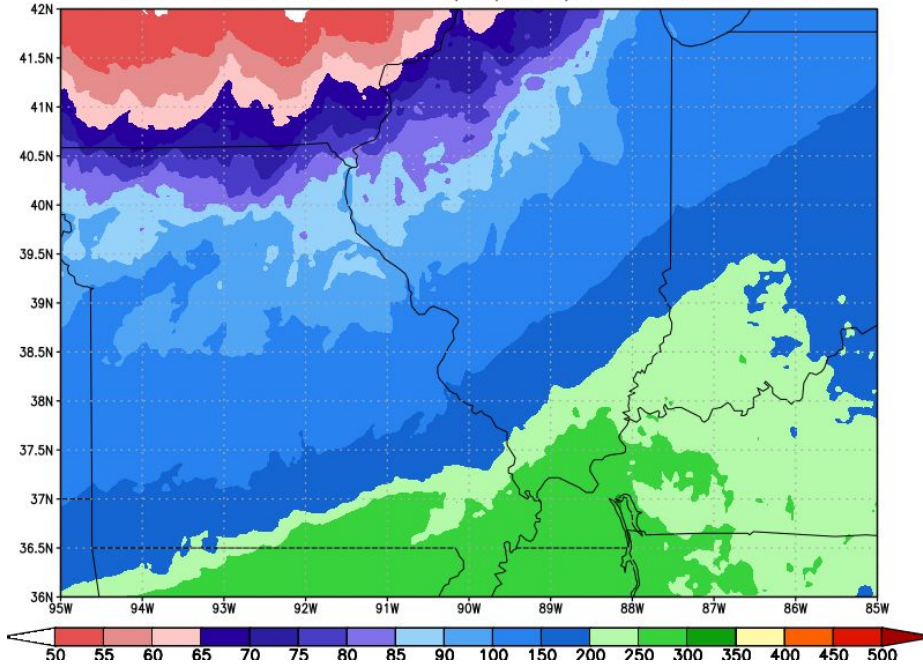


RRFS 3H ACC SNOW DEPTH (IN) ENDING 12Z31JAN2022



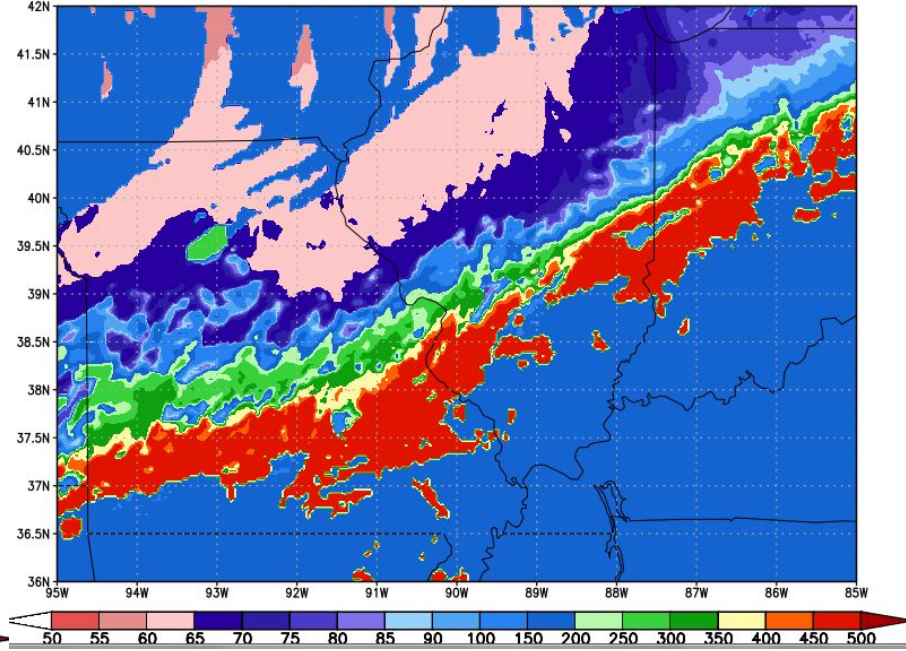
Valid at 45-h

PRECIP ICE DENSITY CTL (KG/M³) AT 09Z02FEB2022



NOAH Original Formulation

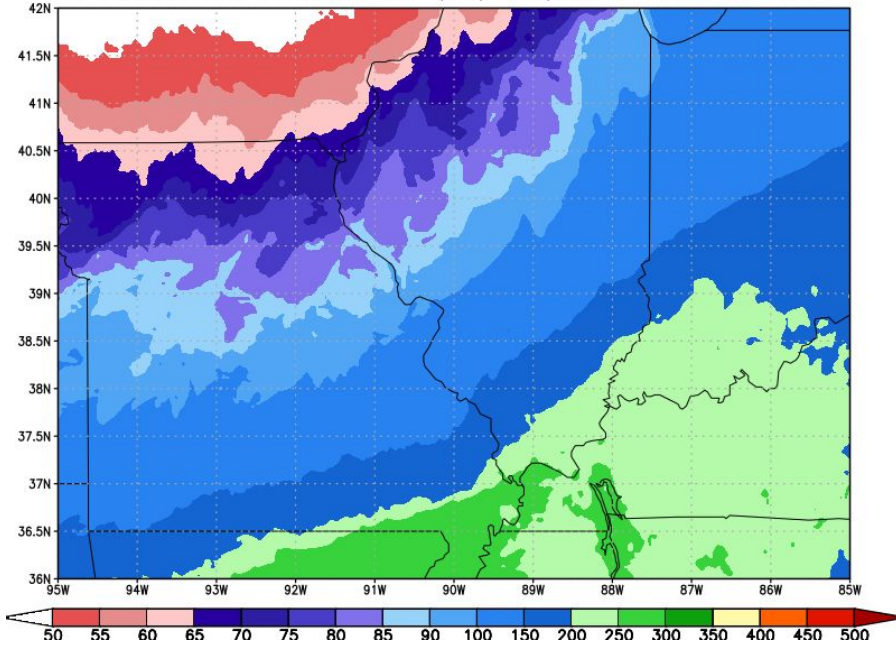
PRECIP ICE DENSITY EXP (KG/M³) AT 09Z02FEB2022



New Precip Ice Density

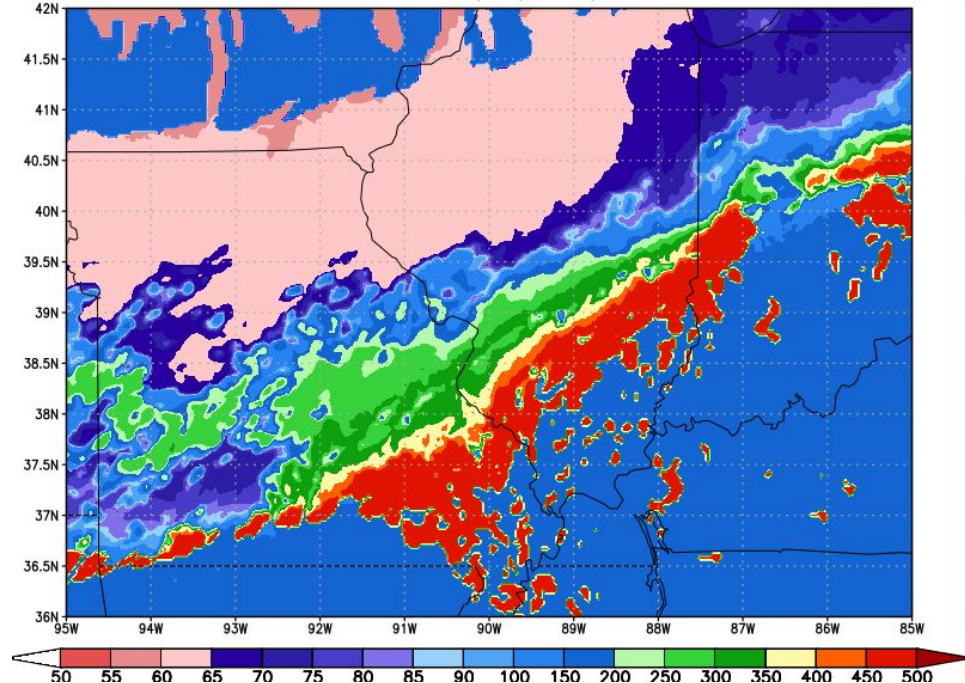
Valid at 48-h

PRECIP ICE DENSITY CTL (KG/M³) AT 12Z02FEB2022



NOAH Original Formulation

PRECIP ICE DENSITY EXP (KG/M³) AT 12Z02FEB2022



New Precip Ice Density

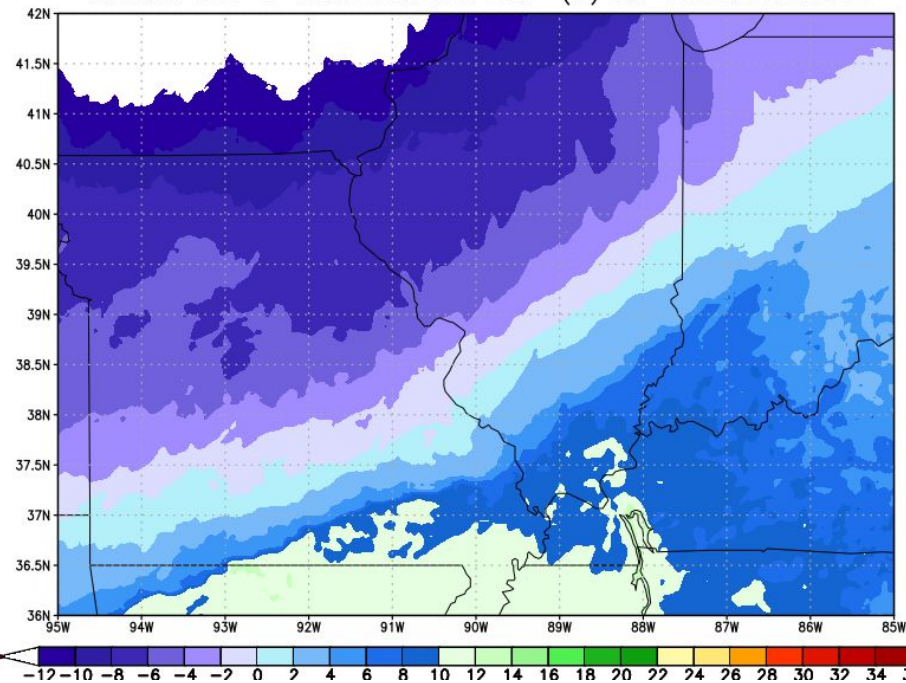
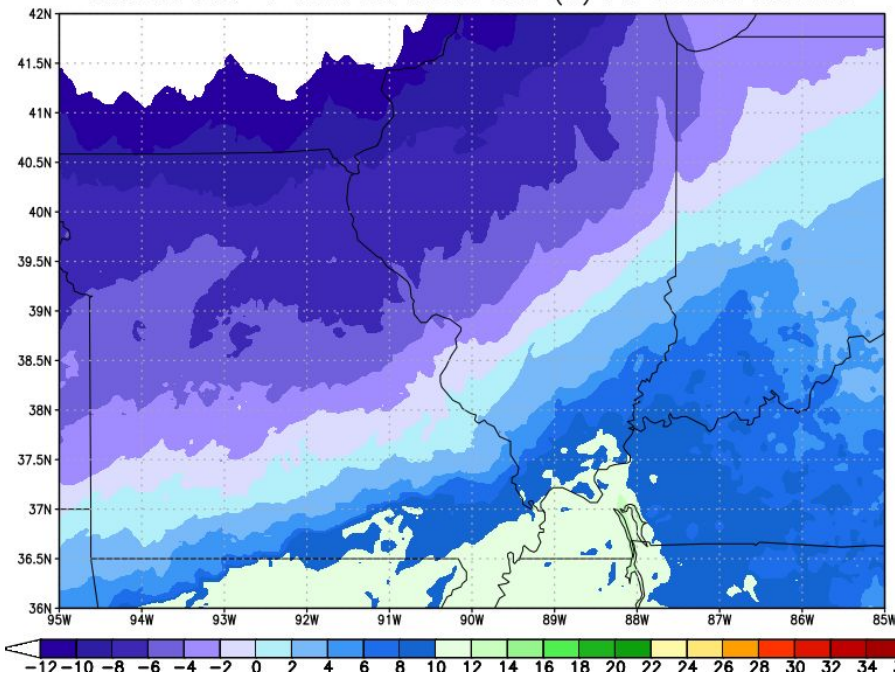
CTL

45-h

EXP

HYBRID LEV 1 TEMPERATURE CTL (C) AT 09Z02FEB2022

HYBRID LEV 1 TEMPERATURE EXP (C) AT 09Z02FEB2022

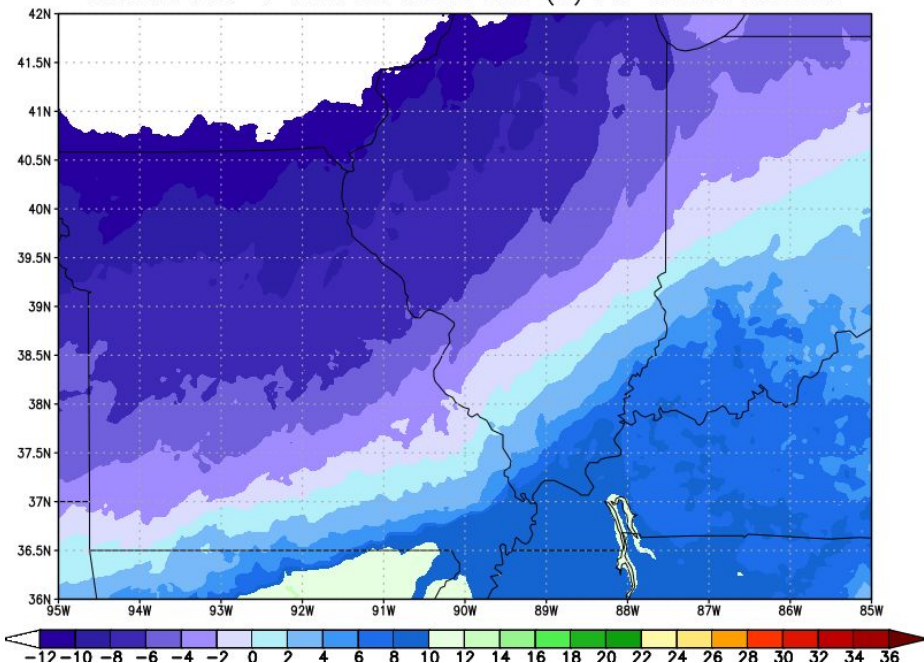


CTL

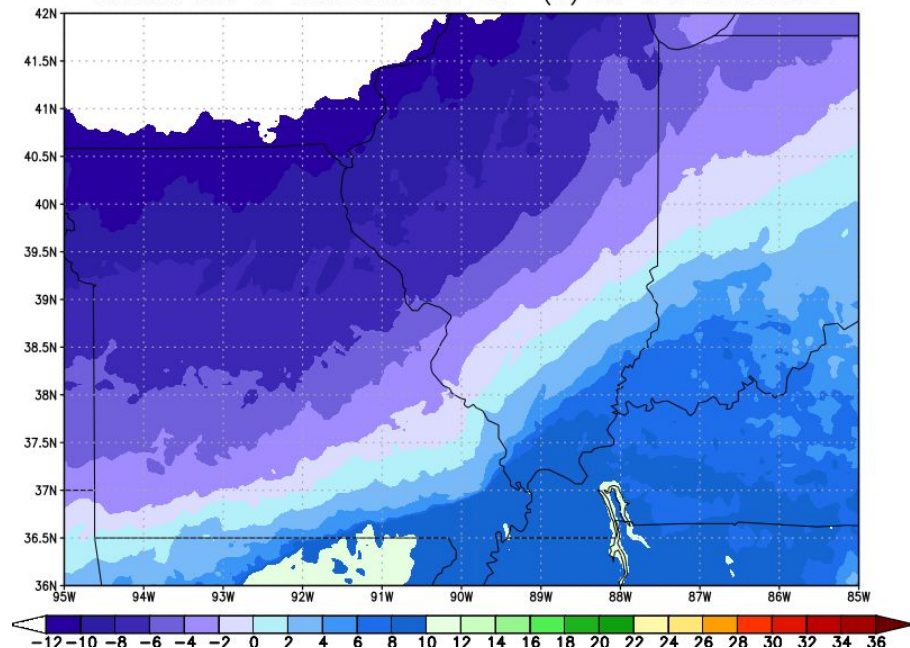
48-h

EXP

HYBRID LEV 1 TEMPERATURE CTL (C) AT 12Z02FEB2022



HYBRID LEV 1 TEMPERATURE EXP (C) AT 12Z02FEB2022

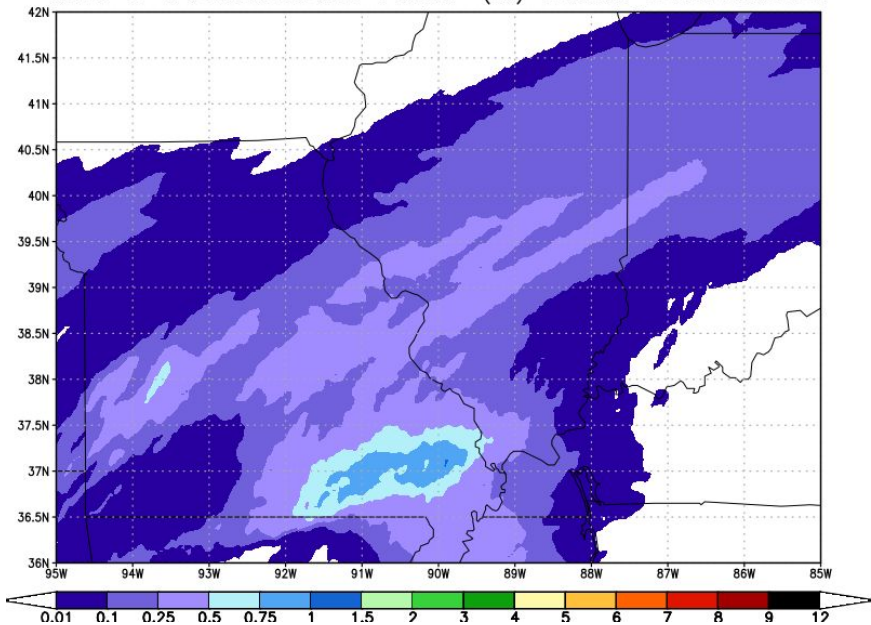


CTL

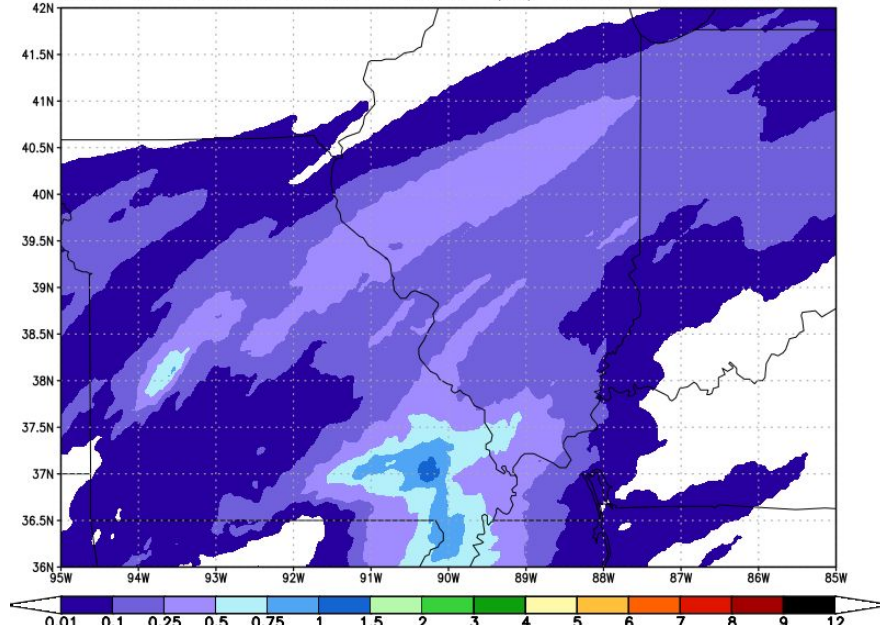
3-h QPF

EXP

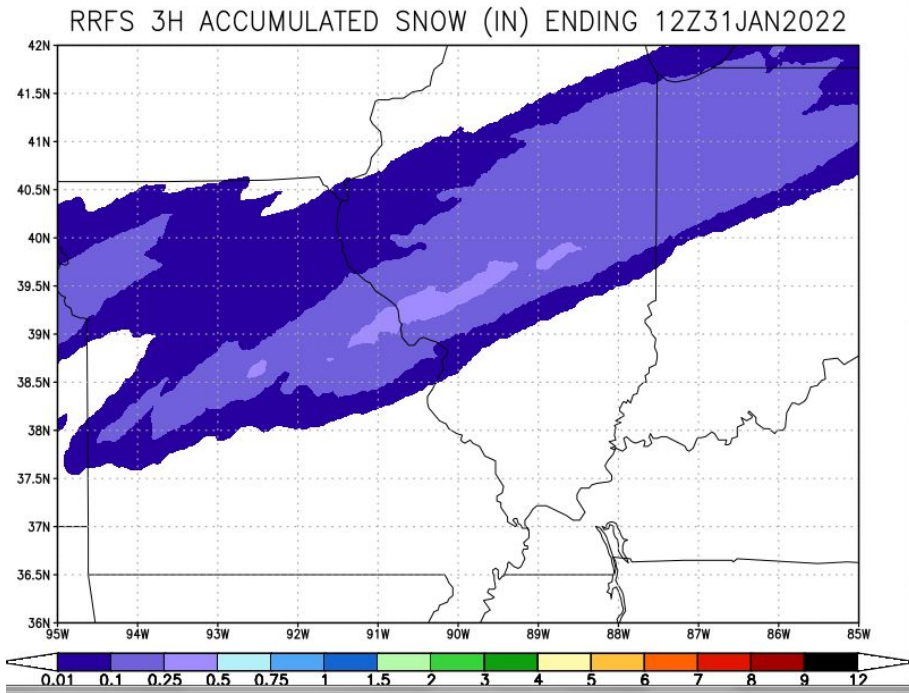
RRFS 3-H ACCUMULATED PRECIP (IN) ENDING 12Z31JAN2022



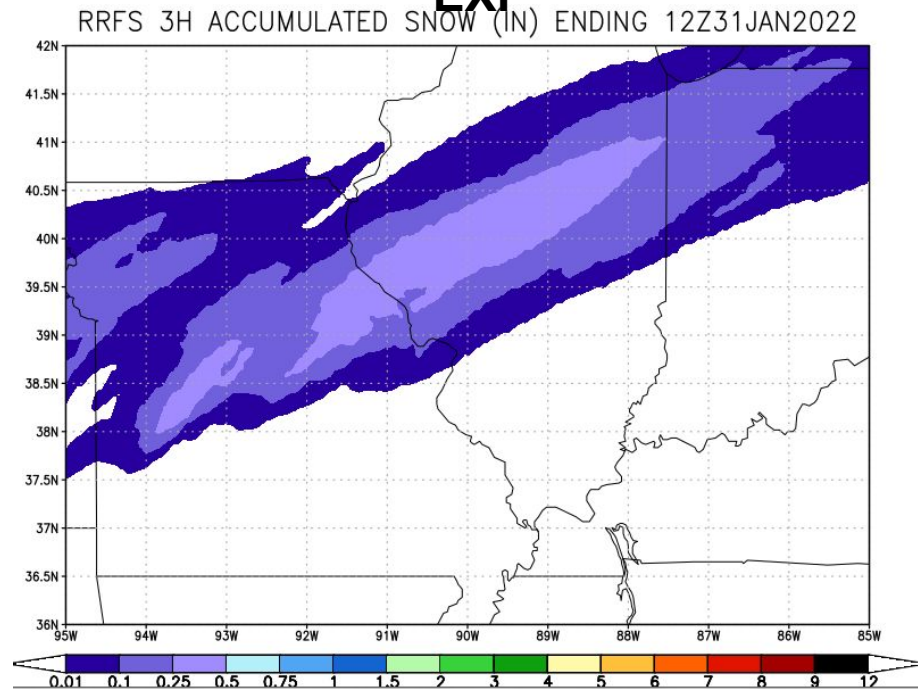
RRFS 3-H ACCUMULATED PRECIP (IN) ENDING 12Z31JAN2022



CTL 3-h Snowfall Accumulation

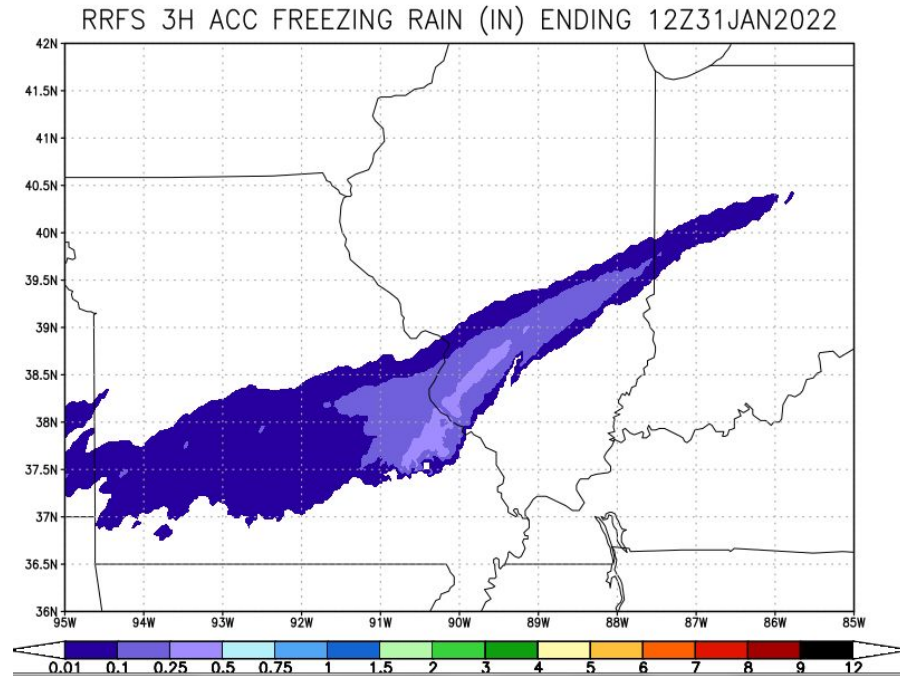
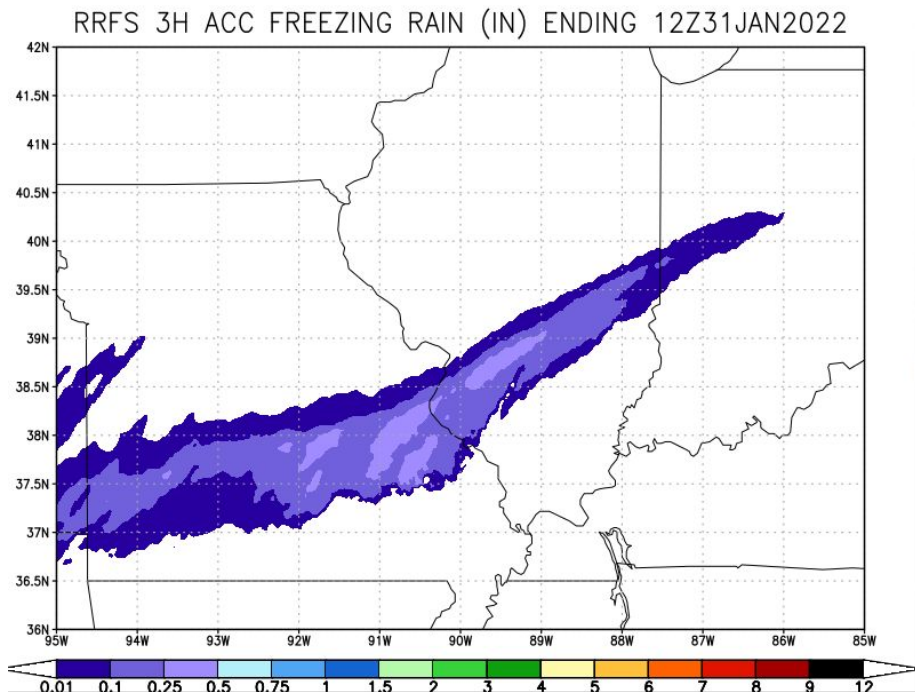


EXP



Note: No SLR has been applied

CTL 3-h Freezing Rain Accumulation EXP

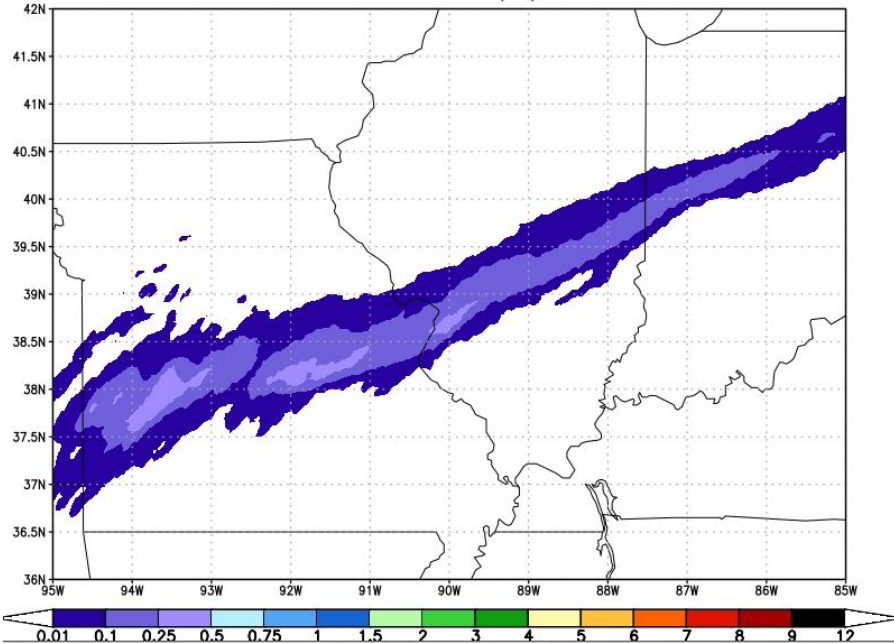


CTL

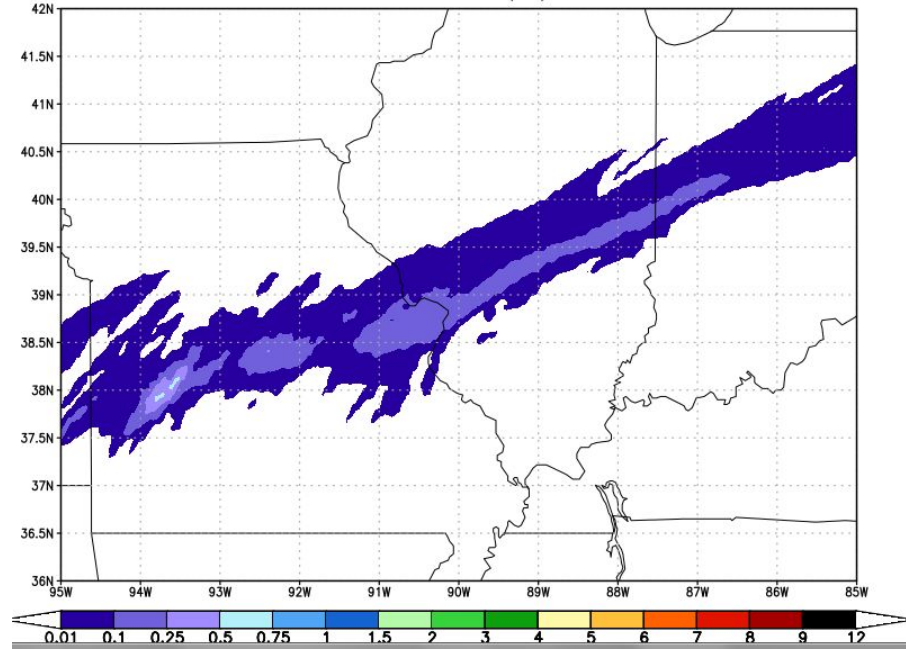
3-h Graupel/Sleet Accumulations

EXP

RRFS 3H ACCUMULATED GRAUPEL (IN) ENDING 12Z31JAN2022



RRFS 3H ACCUMULATED GRAUPEL (IN) ENDING 12Z31JAN2022

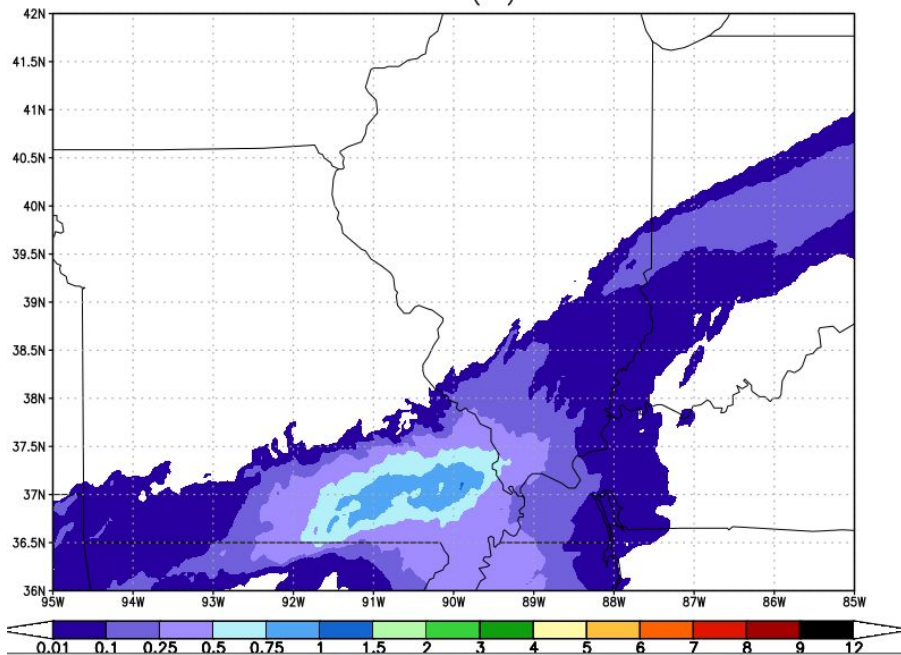


Note: No SLR has been applied

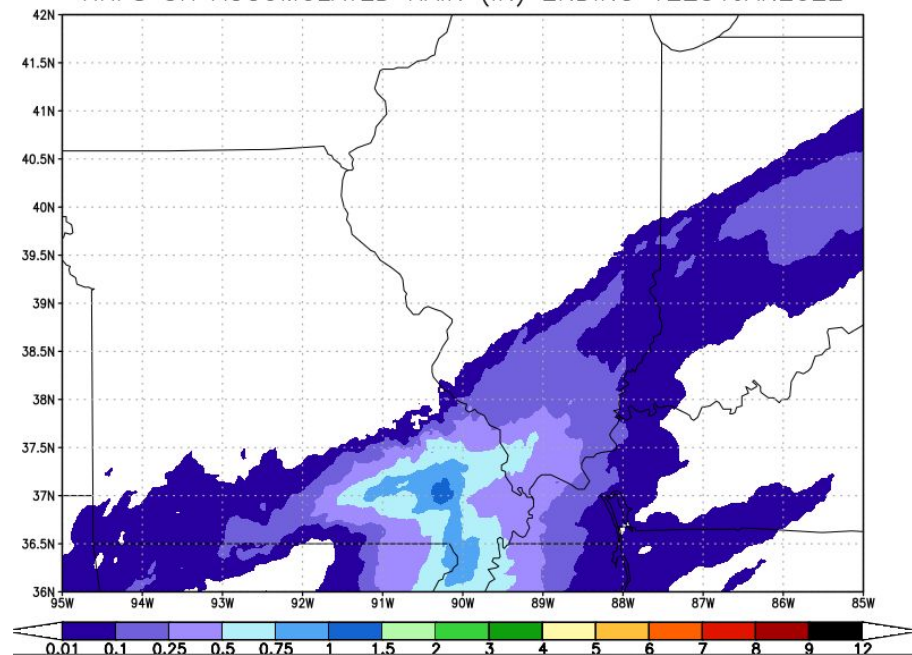
CTL 3-h Rain Accumulation

EXP

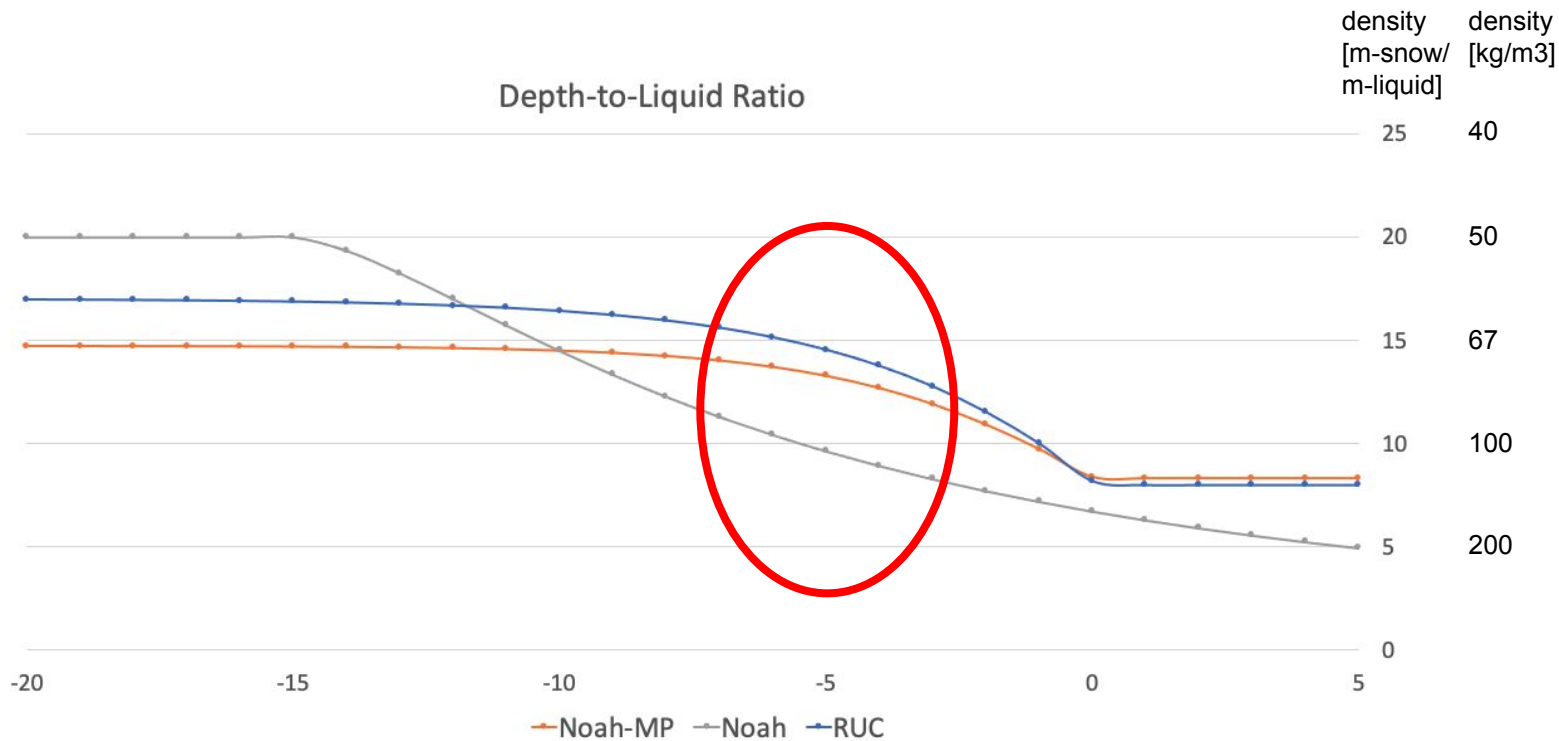
RRFS 3H ACCUMULATED RAIN (IN) ENDING 12Z31JAN2022



RRFS 3H ACCUMULATED RAIN (IN) ENDING 12Z31JAN2022



Precipitation Ice Density (kg/m³)



RUC LSM

60-h Accumulated Fields

- **CTL:** Precip ice density computed inside RUC LSM
- **EXP:** Precip ice density computed after call to microphysics

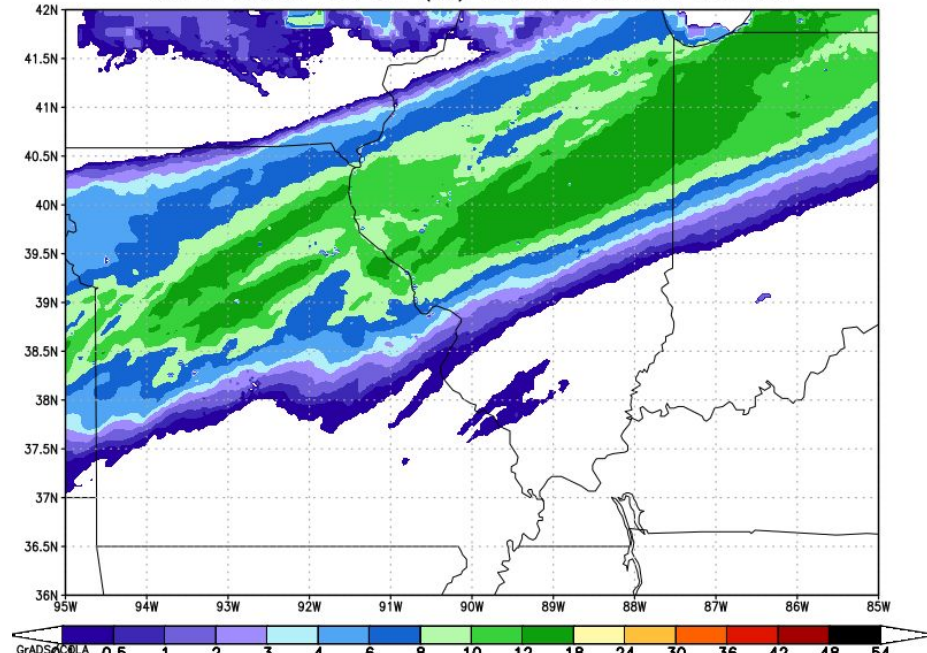
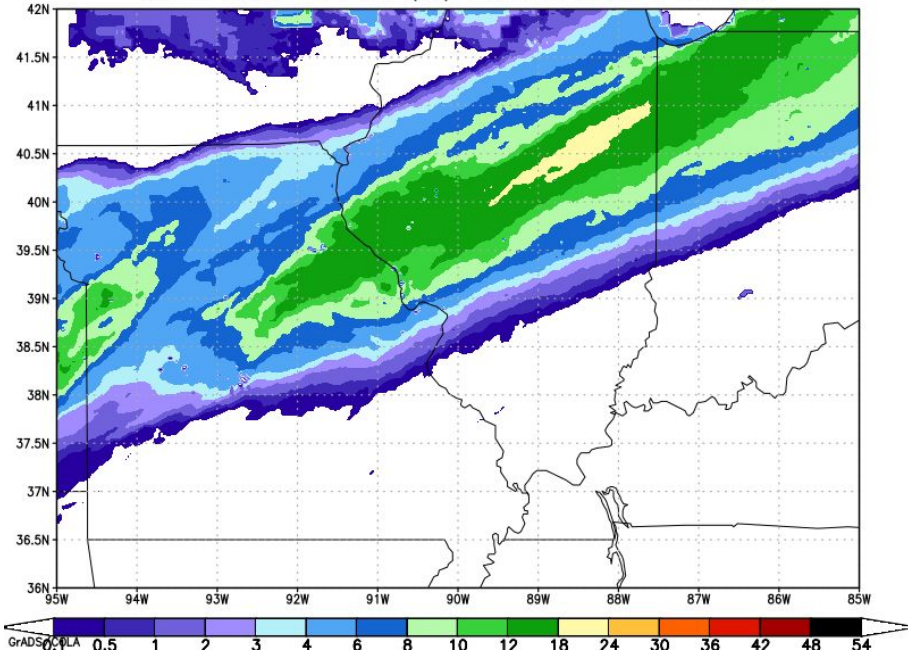
0-60h Snow Depth

CTL

EXP

RRFS SNOW DEPTH (IN) ENDING 00Z03FEB2022

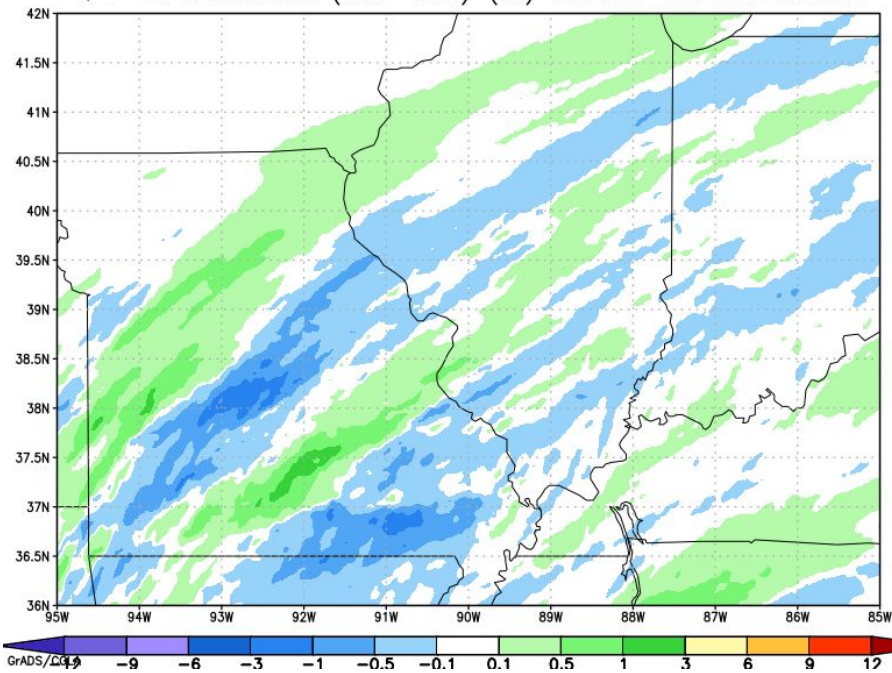
RRFS SNOW DEPTH (IN) ENDING 00Z03FEB2022



60-h Accum. Diff. (EXP-CTL)

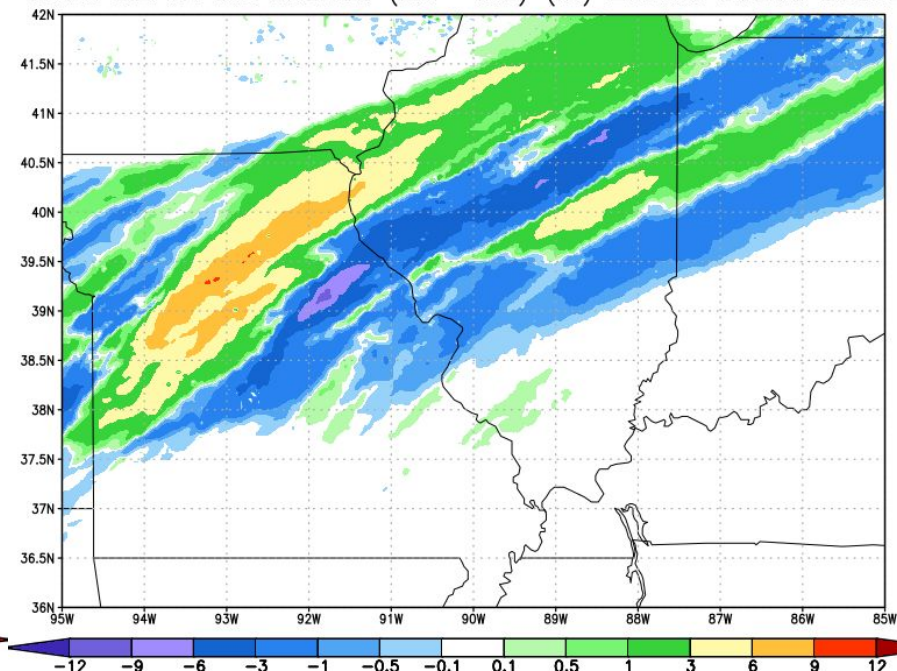
QPF

QPF DIFFERENCES (EXP-CTL) (IN) ENDING 00Z03FEB2022



Snow Depth

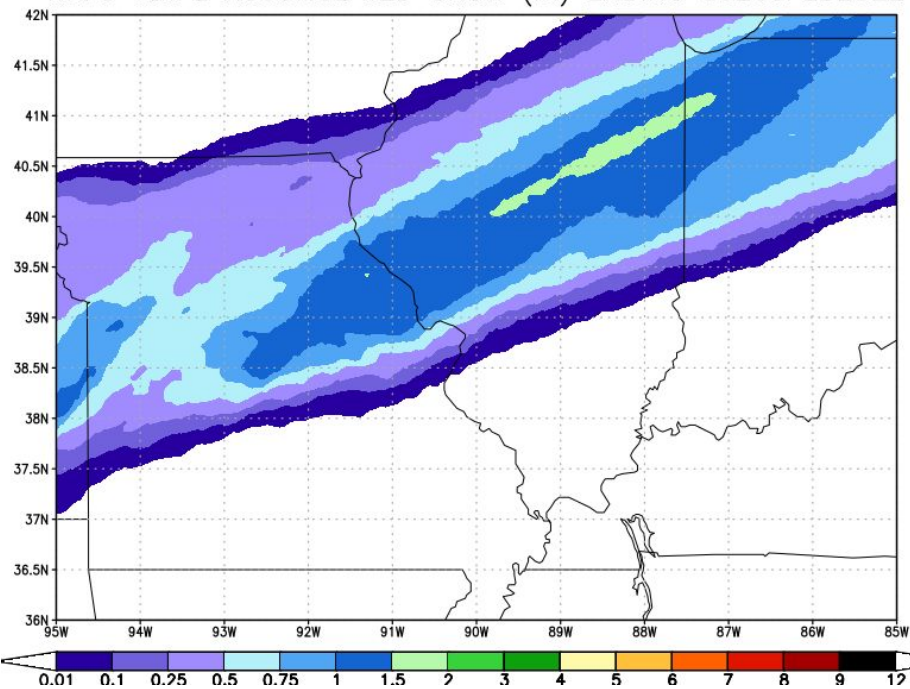
SNOW DEPTH DIFFERENCE (EXP-CTL) (IN) ENDING 00Z03FEB2022



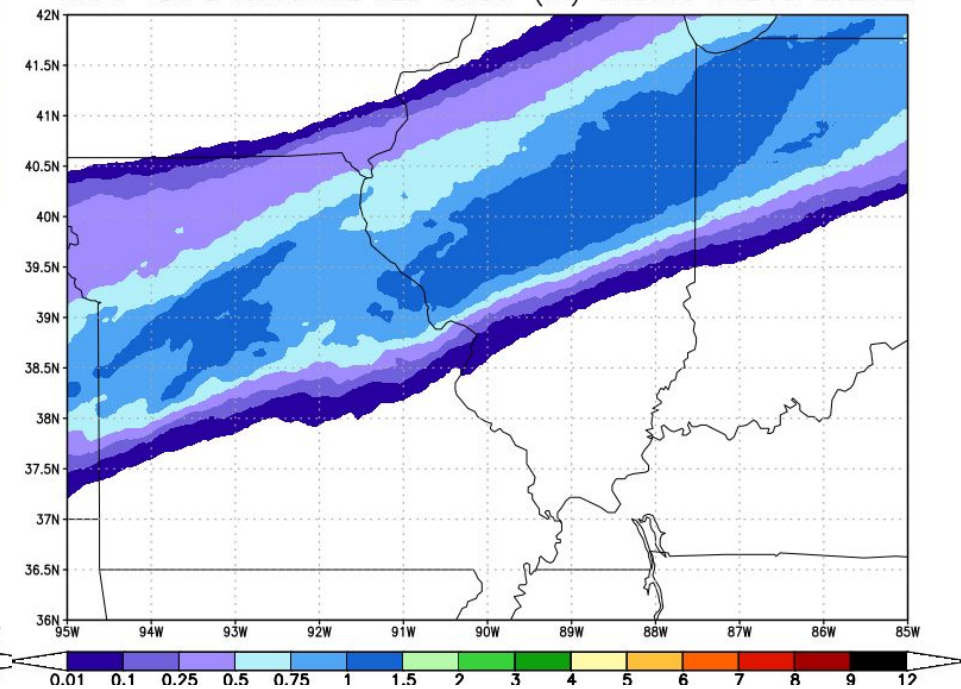
CTL 60-h Snowfall Accumulation

EXP

RRFS TOTAL ACCUMULATED SNOW (IN) ENDING 00Z03FEB2022



RRFS TOTAL ACCUMULATED SNOW (IN) ENDING 00Z03FEB2022

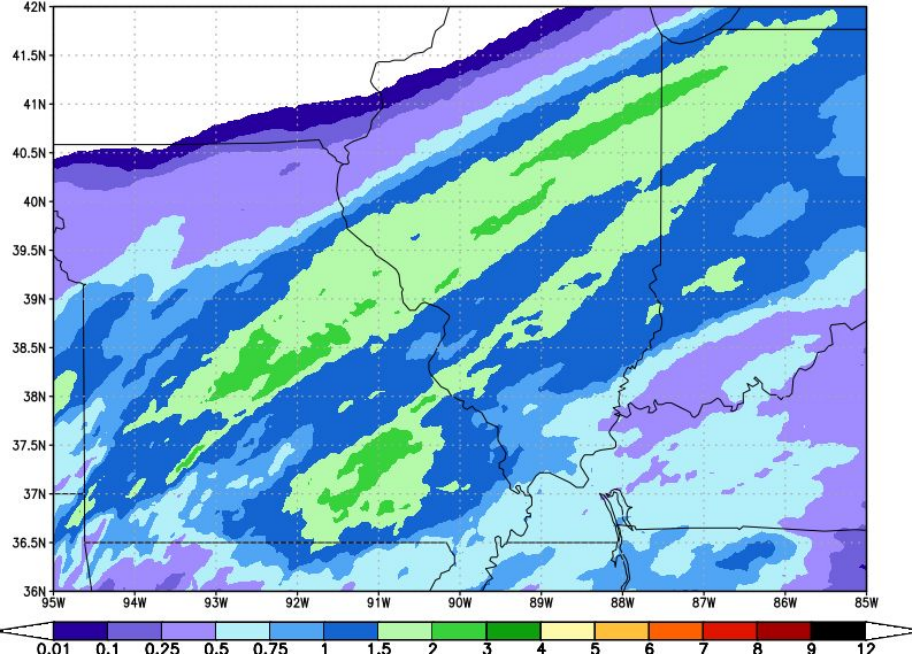


CTL

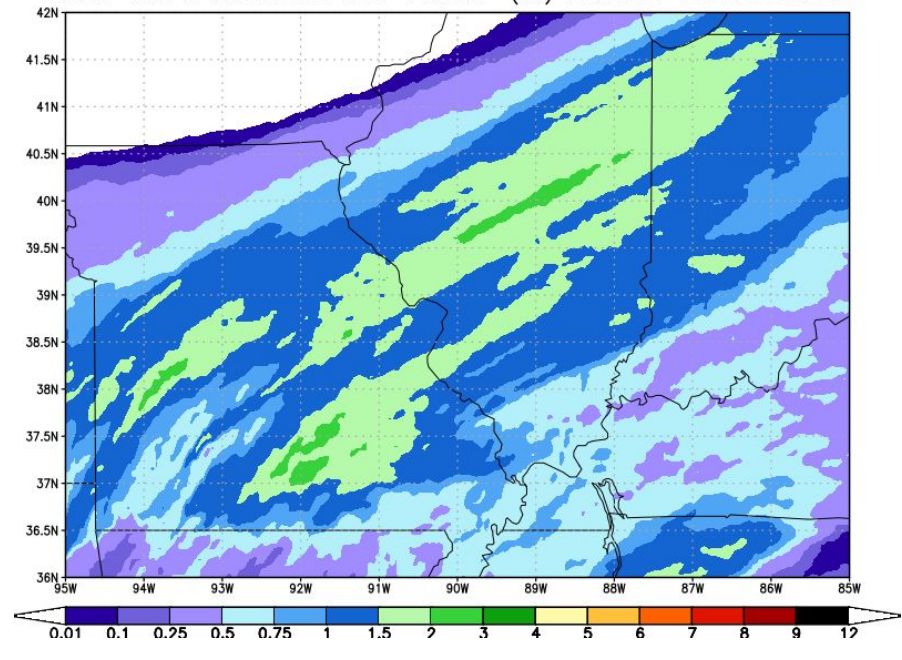
60-h QPF

EXP

RRFS TOTAL ACCUMULATED PRECIP (IN) ENDING 00Z03FEB2022



RRFS TOTAL ACCUMULATED PRECIP (IN) ENDING 00Z03FEB2022



NOAH MP LSM

60-h Accumulated Fields

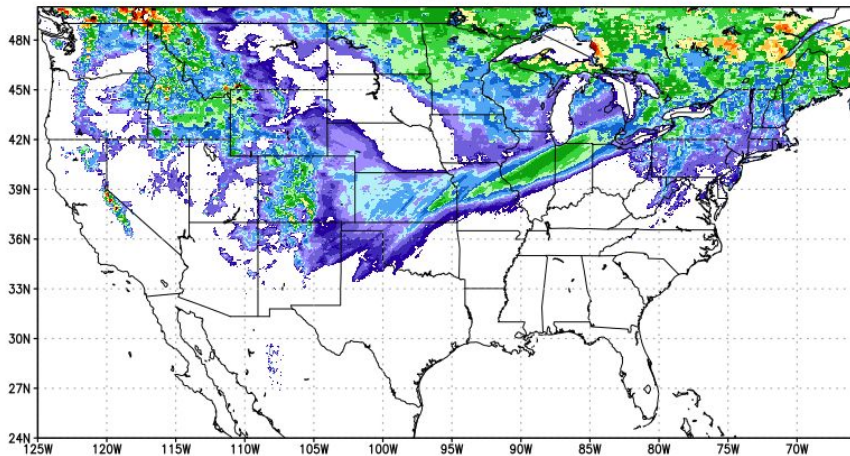
- **CTL:** Precip ice density (bdfall):
Bdfall = $\min(120., 67.92 + 51.25 \cdot \exp((\text{sfctmp} - \text{tfrz})/2.59))$ ←for snow
Bdfall = $\text{bdfall} \cdot (\text{prcpsnow}/\text{prcp_frozen}) +$
 $\text{rho_grpl} \cdot (\text{prcpgrpl}/\text{prcp_frozen}) + \&$
 $\text{rho_hail} \cdot (\text{prcphail}/\text{prcp_frozen})$
Rho_grpl = 500 kg/m³
Rho_hail = 917 kg/m³
- **EXP:** Precip ice density computed after call to microphysics

0-60h Snow Depth

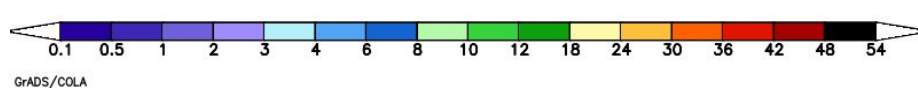
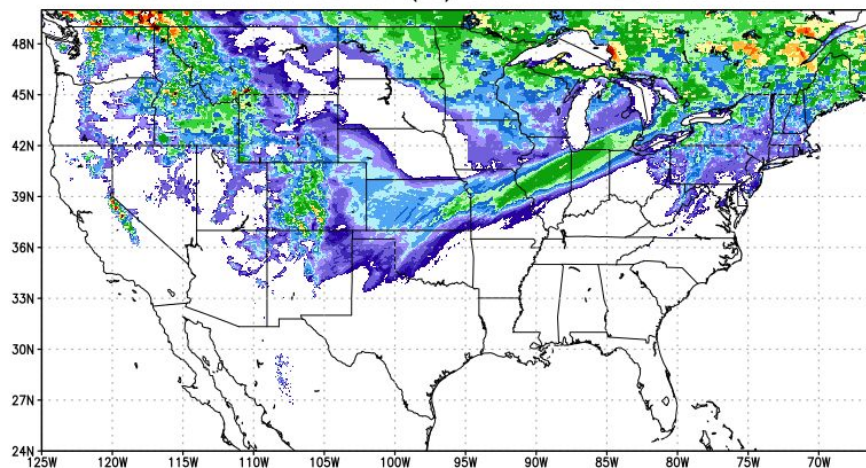
CTL

EXP

RRFS SNOW DEPTH (IN) ENDING 00Z03FEB2022



RRFS SNOW DEPTH (IN) ENDING 00Z03FEB2022

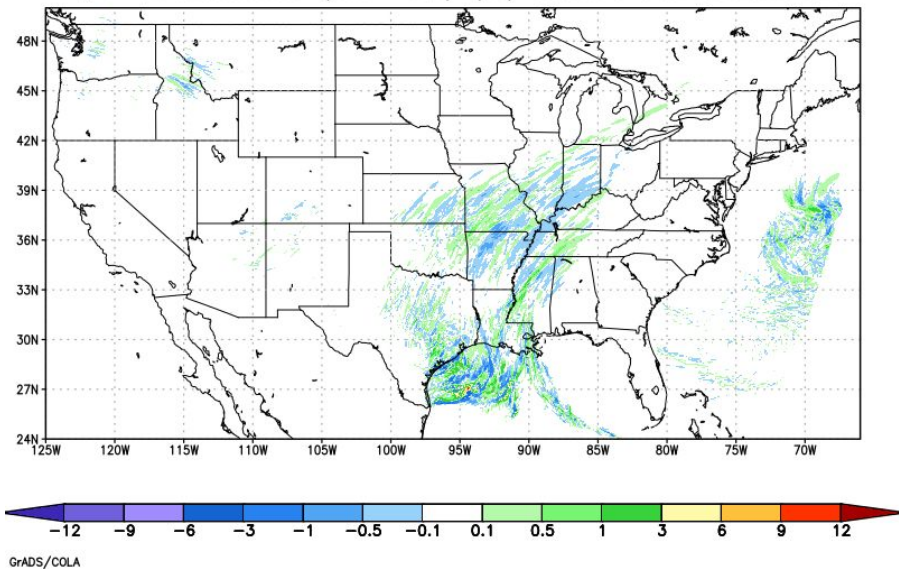


60-h Accum. Diff. (EXP-CTL)

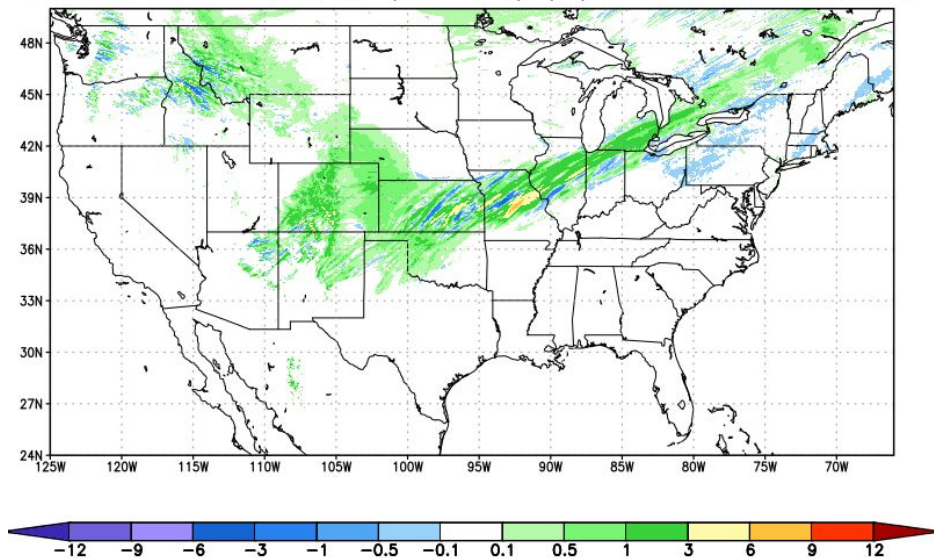
QPF

Snow Depth

QPF DIFFERENCES (EXP-CTL) (IN) ENDING 00Z03FEB2022



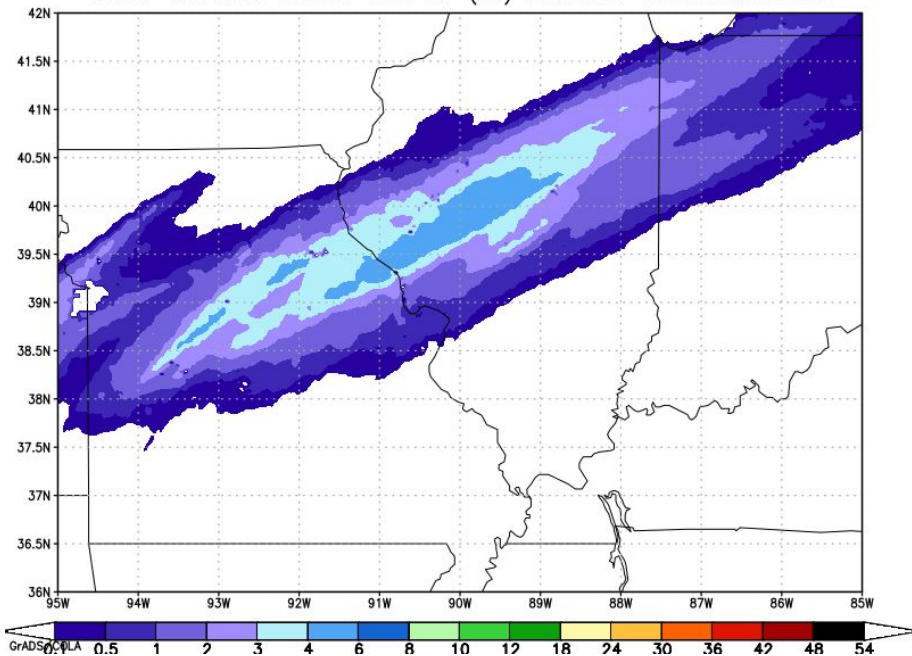
SNOW DEPTH DIFFERENCE (EXP-CTL) (IN) ENDING 00Z03FEB2022



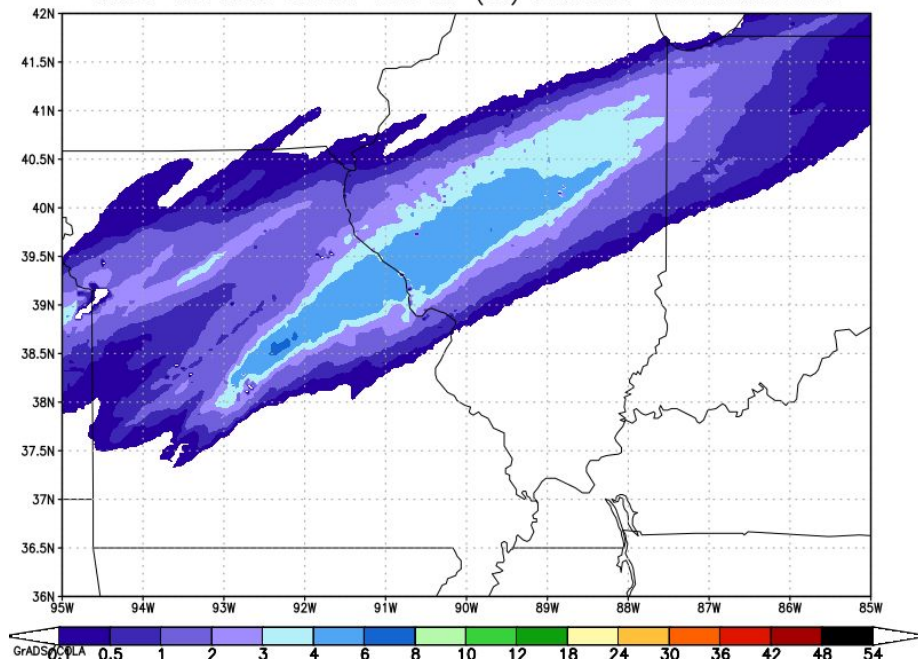
Period from 45-h to 48-h

CTL 3-h Positive Change in Snow Depth **EXP**

RRFS 3H ACC SNOW DEPTH (IN) ENDING 12Z31JAN2022



RRFS 3H ACC SNOW DEPTH (IN) ENDING 12Z31JAN2022

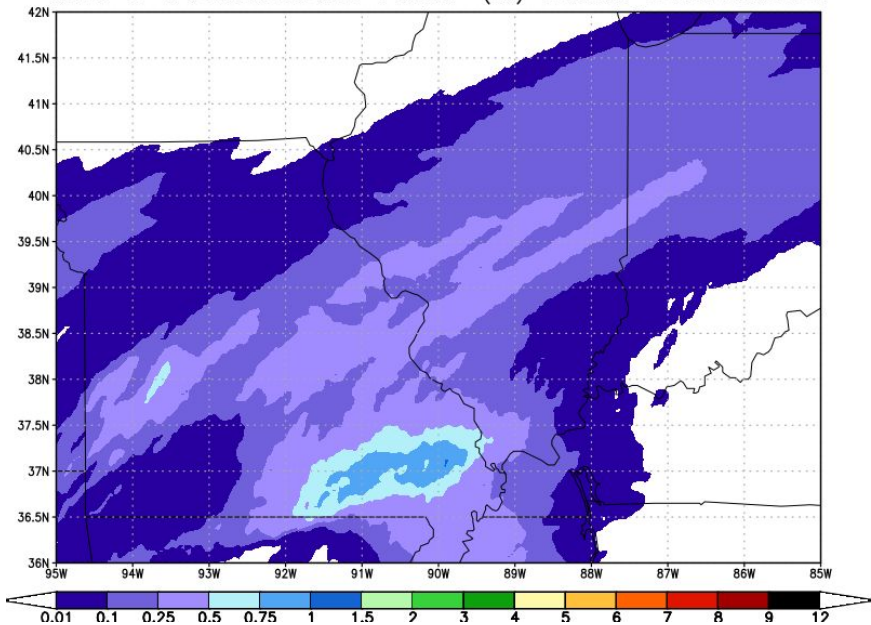


CTL

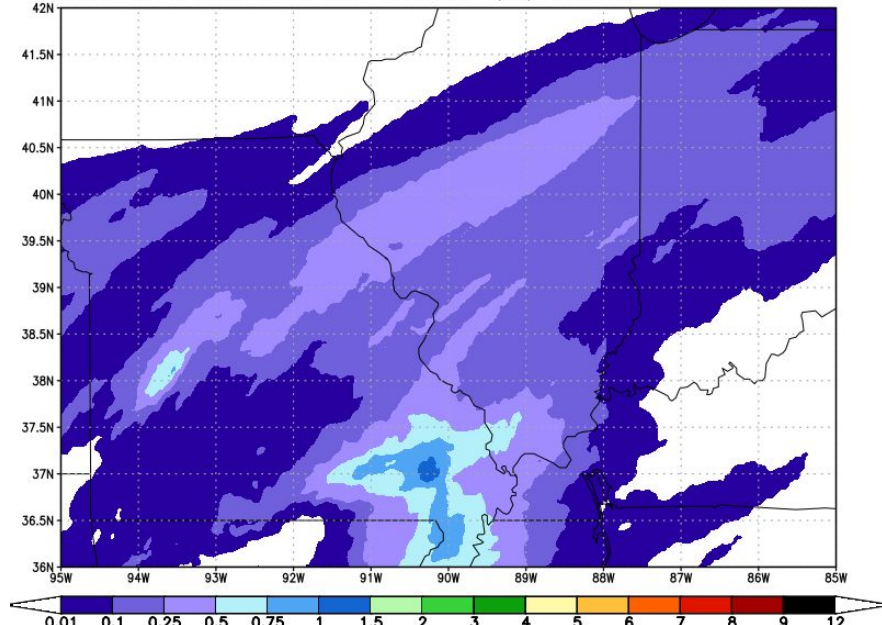
3-h QPF

EXP

RRFS 3-H ACCUMULATED PRECIP (IN) ENDING 12Z31JAN2022

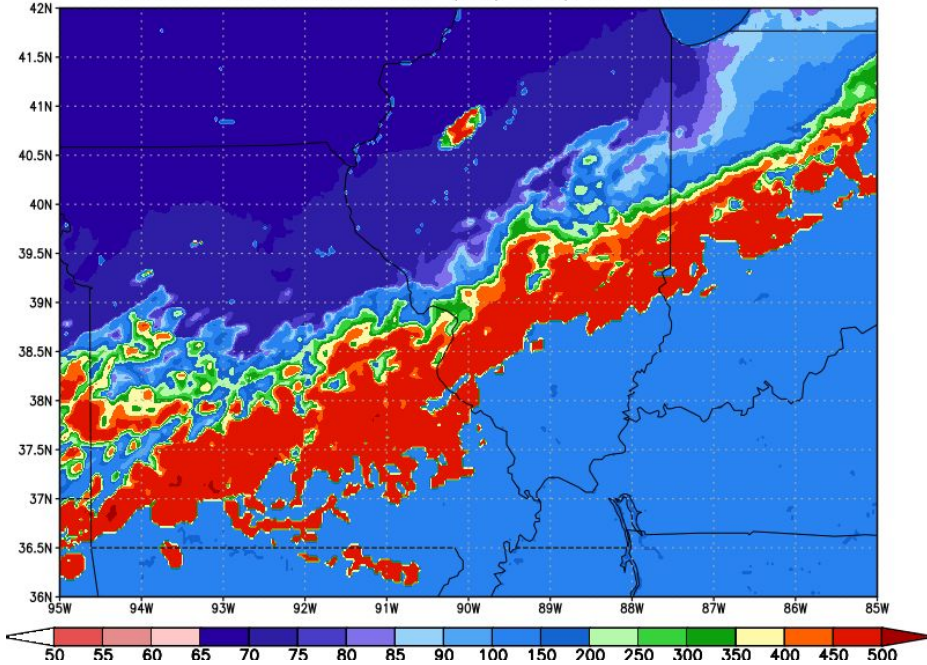


RRFS 3-H ACCUMULATED PRECIP (IN) ENDING 12Z31JAN2022



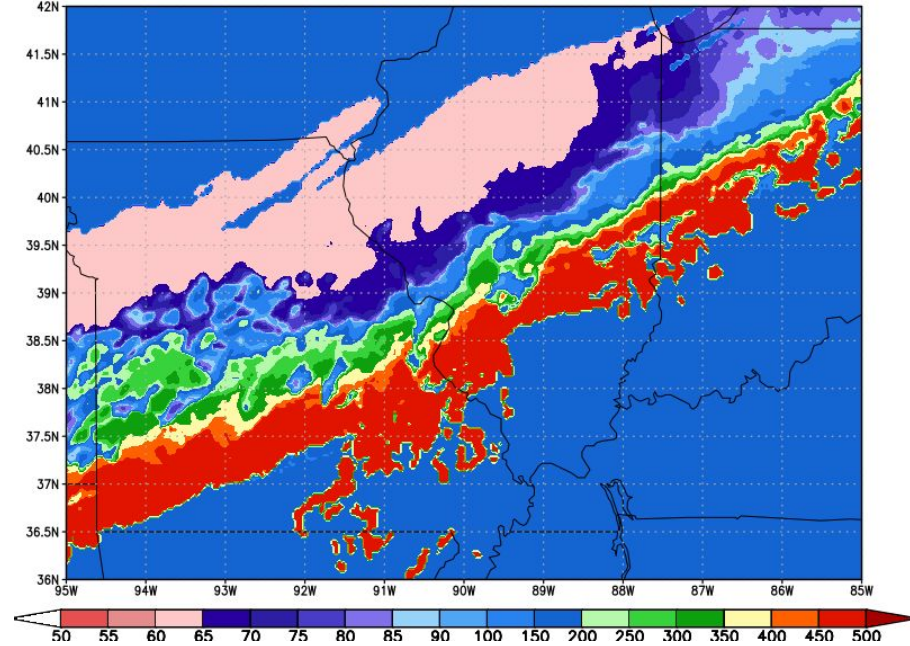
Valid at 45-h

PRECIP ICE DENSITY CTL (KG/M^3) AT 09Z02FEB2022



NOAH MP Original Formulation

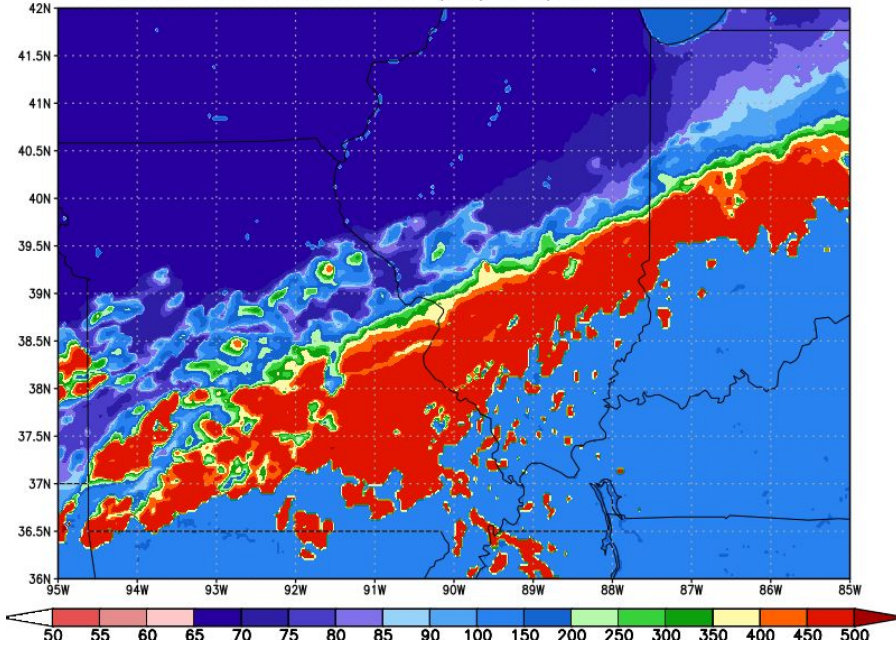
PRECIP ICE DENSITY EXP (KG/M^3) AT 09Z02FEB2022



New Precip Ice Density

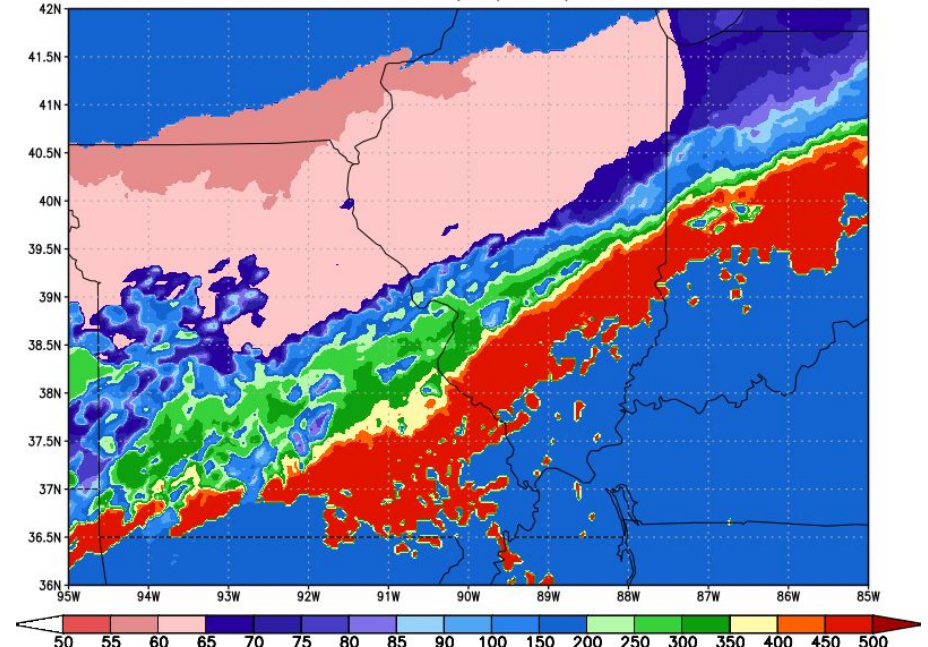
Valid at 48-h

PRECIP ICE DENSITY CTL (KG/M^3) AT 12Z02FEB2022



NOAH MP Original Formulation

PRECIP ICE DENSITY EXP (KG/M^3) AT 12Z02FEB2022



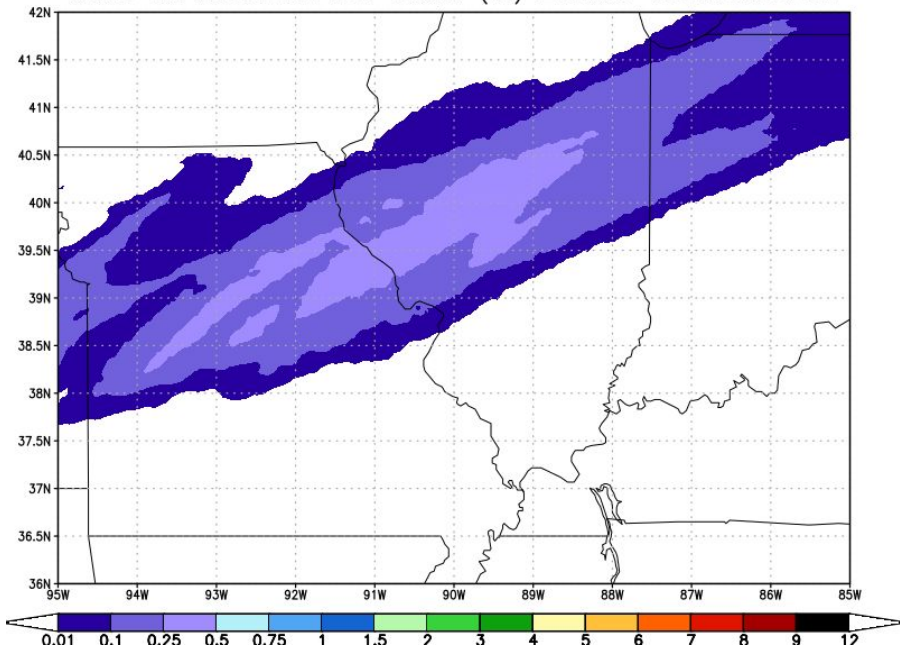
New Precip Ice Density

CTL

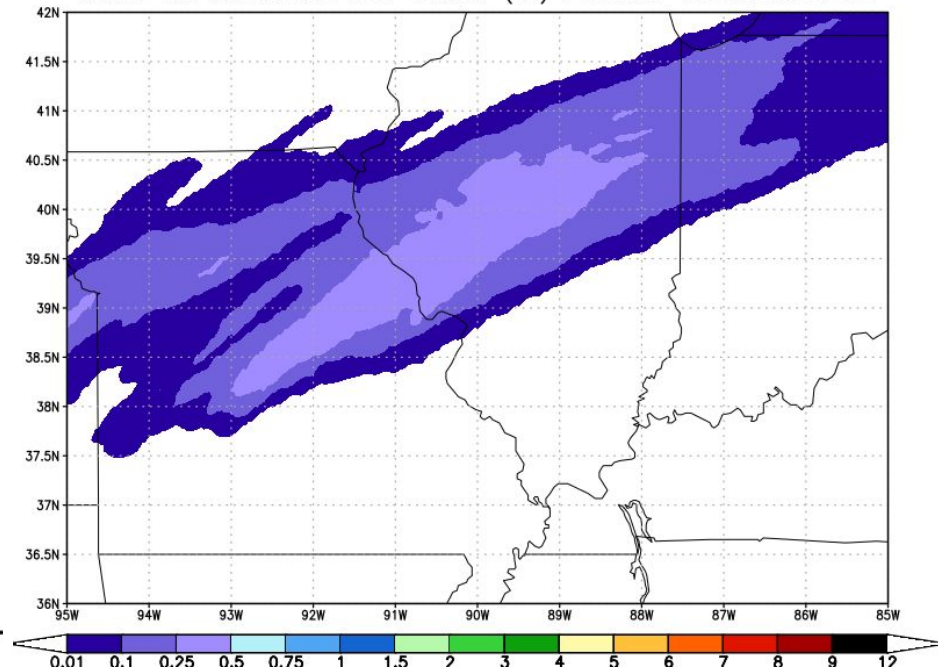
3-h Snowfall Accumulation

EXP

RRFS 3H ACCUMULATED SNOW (IN) ENDING 12Z31JAN2022



RRFS 3H ACCUMULATED SNOW (IN) ENDING 12Z31JAN2022

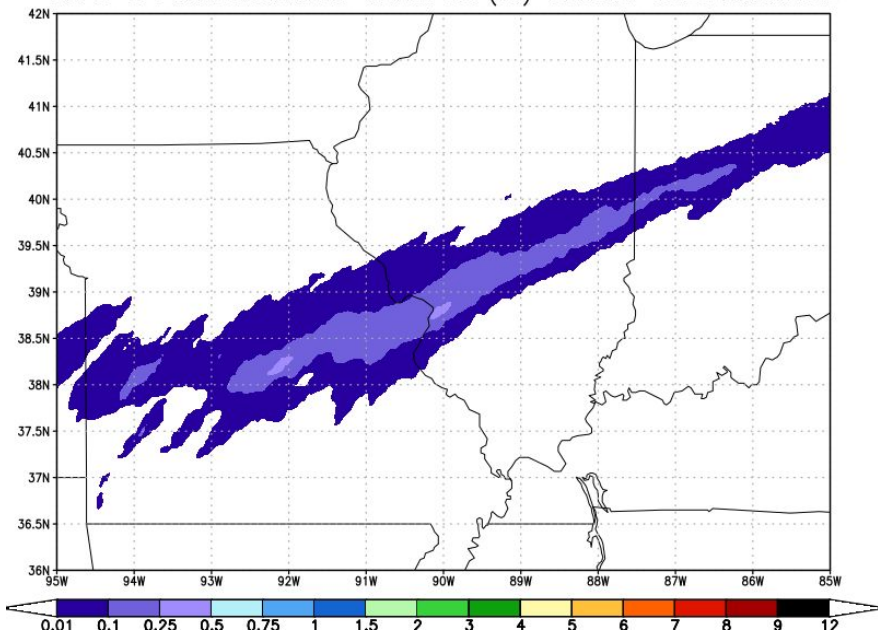


CTL

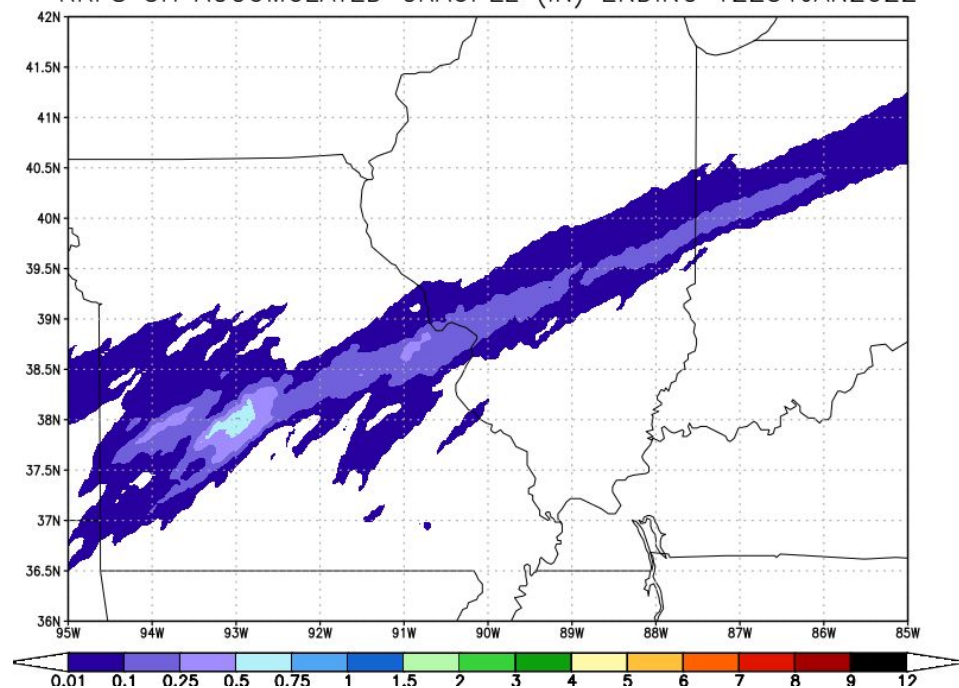
3-h Graupel Accumulation

EXP

RRFS 3H ACCUMULATED GRAUPEL (IN) ENDING 12Z31JAN2022

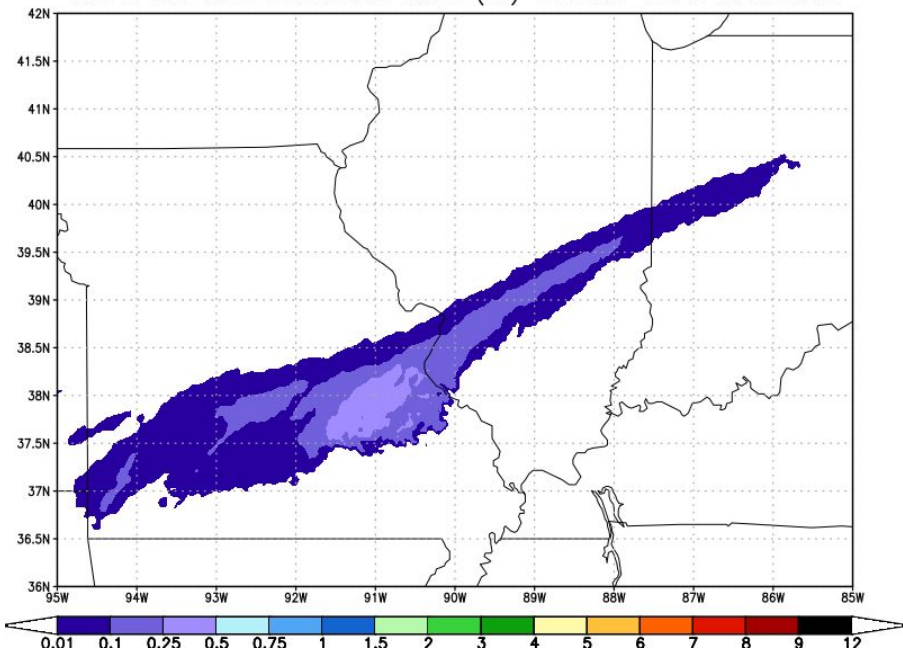


RRFS 3H ACCUMULATED GRAUPEL (IN) ENDING 12Z31JAN2022



CTL 3-h Freezing Rain Accumulation EXP

RRFS 3H ACC FREEZING RAIN (IN) ENDING 12Z31JAN2022



RRFS 3H ACC FREEZING RAIN (IN) ENDING 12Z31JAN2022

