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## [NCL: need help to alculate Relative Vorticity & Divergence](#)

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### [NCL: need help to alculate Relative Vorticity & Divergence](#)

by [sahidul](#) » Thu Jul 01, 2010 1:19 pm

NCL Users,

I am having WRF forecast files(wrfout\_d0\* files), saved in 1 hour interval having total 88 files. We want contour plot for "Relative Vorticity" and "Divergence" every hourly.

Is there any function or Script for calculating "Relative Vorticity" and "Divergence" ?

Kindly help me to plot these variables.

Thanking you,

[sahidul](#)

**Posts:** 39

**Joined:** Wed Apr 30, 2008 1:46 am

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### [Re: NCL: need help to alculate Relative Vorticity & Divergence](#)

by [dbh409](#) » Thu Jul 01, 2010 7:19 pm

There are several built-in scripts for NCL that calculate RV and Div, depending on what method you wish to use to calculate it. Here are a couple using finite differencing:

[http://www.ncl.ucar.edu/Document/Functions/Built-in/uv2vr\\_cfd.shtml](http://www.ncl.ucar.edu/Document/Functions/Built-in/uv2vr_cfd.shtml)

<http://www.ncl.ucar.edu/Document/Functions/Built-in/uv2vrdivF.shtml>

If you want one WRF specific, that's a different story, and I'm not completely sure where to send you, though I know I've seen something like that before. One method for relative vorticity is to use the function wrf\_avo and subtract coriolis at every grid point.

[dbh409](#)

**Posts:** 89

**Joined:** Wed Mar 24, 2010 11:46 am

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## **Re: NCL: need help to alculate Relative Vorticity & Divergence**

by [tomk](#) » Fri Jun 17, 2011 10:46 am

I was also wondering about this and emailed wrfhelp about it. They confirmed that for a horizontal vector field with components (A,B) in the x- and y-directions on the lambert grid, then the divergence is given by  

$$m^2 * [ d/dx(A/m) + d/dy(B/m) ]$$
  
 and the curl is  

$$m^2 * [ d/dx(B/m) - d/dy(A/m) ],$$
  
 where m is the map factor.

You can use my fortran routines (with wrapit) to compute vorticity and divergence, if you like.

[tomk](#)

**Posts:** 7

**Joined:** Mon Jun 06, 2011 2:17 am

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## **Re: NCL: need help to alculate Relative Vorticity & Divergence**

by [tomk](#) » Fri Jun 17, 2011 10:47 am

Here's the fortran routine for curl (wrf\_curl.f):

```
c-----
C NCLFORTSTART
SUBROUTINE DCOMPUTECURL(CRL,U,V,MSFT,DX,DY,NX,NY,NZ)
IMPLICIT NONE
INTEGER NX,NY,NZ
DOUBLE PRECISION U(NX,NY,NZ),V(NX,NY,NZ)
DOUBLE PRECISION CRL(NX,NY,NZ),MSFT(NX,NY)
DOUBLE PRECISION DX,DY
C NCLEND
INTEGER JP1,JM1,IP1,IM1,I,J,K
DOUBLE PRECISION DSY,DSX,DVDX,DUDY
DOUBLE PRECISION MM
C Note all data must be on T-pts
DO K = 1,NZ
DO J = 1,NY
JP1 = MIN(J+1,NY)
JM1 = MAX(J-1,1)
DO I = 1,NX
IP1 = MIN(I+1,NX)
IM1 = MAX(I-1,1)

DSX = (IP1-IM1)*DX
DSY = (JP1-JM1)*DY
c Careful with map factors...
MM = MSFT(I,J)*MSFT(I,J)
DVDX = (V(IP1,J,K)/MSFT(IP1,J) -
+ V(IM1,J,K)/MSFT(IM1,J))/DSX*MM
```

```
DUDY = (U(I,JP1,K)/MSFT(I,JP1) -
+ U(I,JM1,K)/MSFT(I,JM1))/DSY*MM
```

```
CRL(I,J,K) = DVDX - DUDY
END DO
END DO
END DO
RETURN
END
```

[tomk](#)

**Posts:** 7

**Joined:** Mon Jun 06, 2011 2:17 am

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## [Re: NCL: need help to alculate Relative Vorticity & Divergence](#)

by [tomk](#) » Fri Jun 17, 2011 10:48 am

...and for divergence (wrf.div.f):

```
c-----
C NCLFORTSTART
SUBROUTINE DCOMPUTEDIV(DIV,U,V,MSFT,DX,DY,NX,NY,NZ)
IMPLICIT NONE
INTEGER NX,NY,NZ
DOUBLE PRECISION U(NX,NY,NZ),V(NX,NY,NZ)
DOUBLE PRECISION DIV(NX,NY,NZ),MSFT(NX,NY)
DOUBLE PRECISION DX,DY
C NCLEND
INTEGER JP1,JM1,IP1,IM1,I,J,K
DOUBLE PRECISION DSY,DSX,DUDX,DVDY
DOUBLE PRECISION MM
C Note all data must be on T-pts
DO K = 1,NZ
DO J = 1,NY
JP1 = MIN(J+1,NY)
JM1 = MAX(J-1,1)
DO I = 1,NX
IP1 = MIN(I+1,NX)
IM1 = MAX(I-1,1)

DSX = (IP1-IM1)*DX
DSY = (JP1-JM1)*DY
c Careful with map factors...
MM = MSFT(I,J)*MSFT(I,J)
c DVDX = (V(IP1,J,K)/MSFT(IP1,J) -
c + V(IM1,J,K)/MSFT(IM1,J))/DSX*MM
c DUDY = (U(I,JP1,K)/MSFT(I,JP1) -
c + U(I,JM1,K)/MSFT(I,JM1))/DSY*MM
DUDX = ( U(IP1,J,K)/MSFT(IP1,J) -
+ U(IM1,J,K)/MSFT(IM1,J) )/DSX*MM
DVDY = ( V(I,JP1,K)/MSFT(I,JP1) -
+ V(I,JM1,K)/MSFT(I,JM1) )/DSY*MM
DIV(I,J,K) = DUDX + DVDY
END DO
END DO
```

END DO  
RETURN  
END

[tomk](#)

**Posts:** 7

**Joined:** Mon Jun 06, 2011 2:17 am

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### [Re: NCL: need help to alculate Relative Vorticity & Divergence](#)

by [kindahero](#) » Mon Sep 19, 2011 10:56 pm

@tomk

thanks for sharing the fortran code.. really helpful

[kindahero](#)

**Posts:** 63

**Joined:** Sat Aug 28, 2010 9:04 am

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### [Re: NCL: need help to alculate Relative Vorticity & Divergence](#)

by [kindahero](#) » Tue Sep 20, 2011 7:15 pm

@tomk

it would be even better., if you can post the associated ncl script.

[kindahero](#)

**Posts:** 63

**Joined:** Sat Aug 28, 2010 9:04 am

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### [Re: NCL: need help to alculate Relative Vorticity & Divergen](#)

by [ronbeag](#) » Tue Dec 03, 2013 7:00 am

Unless I'm mistaken, you can also get WRF to output divergence as a standard output variable...

In Registry.EM\_COMMON around line 1327 (ARW version 3.4.1) there's the variable "div", described as "DIVERGENCE". So you can either edit the Registry file so that this variable is written to history, or use 'Run-Time IO' (see ARW manual page 5-23) while running WRF.

[ronbeag](#)

**Posts:** 12

**Joined:** Thu Jul 26, 2012 12:12 pm

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### [Re: NCL: need help to alculate Relative Vorticity & Divergen](#)

by [Basit](#) » Mon Sep 22, 2014 9:38 pm

Hi Tom,

I also want to calculate relative vorticity form my WRF model output. I have few questions about the wrf\_cur.f

1. Your have written a subroutine, why it is not a 'function' ? because it is calculating vorticity but won't return anything.
2. The first argument in this subroutine is CRL that i believe is the curl(rel. vorticity). But this is what we are trying to calculate. So, why and what should we pass for the first argument when I would call this subroutine from my ncl script?
3. I believe you have already tested this code and it works correctly?

Regards,

BAS.

[Basit](#)

**Posts:** 8

**Joined:** Fri Aug 05, 2011 6:03 am

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## [Re: NCL: need help to alculate Relative Vorticity & Divergen](#)

by [MeteoBoy4](#) » Wed Jun 21, 2017 12:13 am

*tomk wrote:*...and for divergence (wrf.div.f):

```

c-----
C NCLFORTSTART
SUBROUTINE DCOMPUTEDIV(DIV,U,V,MSFT,DX,DY,NX,NY,NZ)
IMPLICIT NONE
INTEGER NX,NY,NZ
DOUBLE PRECISION U(NX,NY,NZ),V(NX,NY,NZ)
DOUBLE PRECISION DIV(NX,NY,NZ),MSFT(NX,NY)
DOUBLE PRECISION DX,DY
C NCLEND
INTEGER JP1,JM1,IP1,IM1,I,J,K
DOUBLE PRECISION DSY,DSX,DUDX,DVDY
DOUBLE PRECISION MM
C Note all data must be on T-pts
DO K = 1,NZ
DO J = 1,NY
JP1 = MIN(J+1,NY)
JM1 = MAX(J-1,1)
DO I = 1,NX
IP1 = MIN(I+1,NX)
IM1 = MAX(I-1,1)

DSX = (IP1-IM1)*DX
DSY = (JP1-JM1)*DY
c Careful with map factors...
MM = MSFT(I,J)*MSFT(I,J)
c DVDX = (V(IP1,J,K)/MSFT(IP1,J) -
c + V(IM1,J,K)/MSFT(IM1,J))/DSX*MM
c DUDY = (U(I,JP1,K)/MSFT(I,JP1) -
c + U(I,JM1,K)/MSFT(I,JM1))/DSY*MM
DUDX = ( U(IP1,J,K)/MSFT(IP1,J) -
+ U(IM1,J,K)/MSFT(IM1,J) )/DSX*MM
DVDY = ( V(I,JP1,K)/MSFT(I,JP1) -

```

```

+ V(I,JM1,K)/MSFT(I,JM1) )/DSY*MM
DIV(I,J,K) = DUDX + DVDY
END DO
END DO
END DO
RETURN
END

```

Actually, in NCL source code (in \$NCARG\_ROOT/ni/src/lib/nfpfort/wrf\_pvo.f), the calculation of absolute vorticity does not require on u,v unstaggering to t grid. But I have some problems understanding why map scale factor outside the parentheses is that of t-grid's.

Following is NCL source code segment:

```

DO k = 1,nz
DO j = 1,ny
jp1 = MIN(j+1, ny)
jm1 = MAX(j-1, 1)
DO i = 1,nx
ip1 = MIN(i+1, nx)
im1 = MAX(i-1, 1)
! PRINT *,jp1,jm1,ip1,im1
dsx = (ip1 - im1) * dx
dsy = (jp1 - jm1) * dy
mm = msft(i,j)*msft(i,j)
! PRINT *,j,i,u(i,jp1,k),msfu(i,jp1),u(i,jp1,k)/msfu(i,jp1)
dudy = 0.5D0*(u(i,jp1,k)/msfu(i,jp1) + u(i+1,jp1,k)/msfu(i+1,jp1) - &
u(i,jm1,k)/msfu(i,jm1) - u(i+1,jm1,k)/msfu(i+1,jm1))/dsy*mm
dvdx = 0.5D0*(v(ip1,j,k)/msfv(ip1,j) + v(ip1,j+1,k)/msfv(ip1,j+1) - &
v(im1,j,k)/msfv(im1,j) - v(im1,j+1,k)/msfv(im1,j+1))/dsx*mm
avort = dvdx - dudy + cor(i,j)
av(i,j,k) = avort*1.D5
END DO
END DO
END DO

```

[MeteoBoy4](#)

**Posts:** 1

**Joined:** Tue Jun 20, 2017 11:37 pm

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