

BUG REPORT
Odman Group
Georgia Tech
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Synopsis: In MCIP version 3.4.1, subroutine WIND, which calculates wind speed and wind direction from U and V components (these are the components of real winds, in real meters per second, along the map coordinates), does not return correct wind direction when $|U| < 0.001$. For such winds, the direction is returned as zero (northerly) or 180 degrees (southerly) regardless of the position on earth.

Description: Small U ($U < 0.001$) is treated as a special case stating that division by zero can occur. This includes winds from the north and south of the map. No rotation is applied to these winds to account for the difference of the map north from real north. As can be seen below, rotation is applied only to the ELSE branch of the outermost IF/ELSE conditional block by the “WDIR = WDIR – DIFF” statement.

```
!-----  
! Handle special case where U wind speed is very small  
! and divide by zero can occur.  
!-----
```

```
IF ( ABS(u) < 0.001 ) THEN
```

```
    IF ( v <= 0.0 ) THEN  
        wdir = 0.0  
    ELSE  
        wdir = 180.0  
    ENDIF
```

```
!-----  
! Otherwise, find wind direction using simple trigonometry.  
! Modify wind direction so that it is earth-relative.  
!-----
```

```
ELSE
```

```
    wdir = 270.0 - ( ATAN2(v,u) * rad2deg )
```

```
    IF ( wdir > 360.0 ) THEN  
        wdir = wdir - 360.0  
    ENDIF
```

```
    diff = (xlonc - xlon) * xn  
    IF (diff > 180.0) diff = diff - 360.0  
    IF (diff < -180.0) diff = diff + 360.0
```

```
    wdir = wdir - diff
```

```
    IF (wdir > 360.0) wdir = wdir - 360.0  
    IF (wdir < 0.0) wdir = wdir + 360.0
```

```
ENDIF
```

Remedy:

Rotation can be applied outside the IF/ELSE conditional block. However, there is really no reason for division by zero to occur. This may have been the case if ATAN were used (perhaps in earlier versions). The single argument of ATAN would have to be V/U and division by zero could occur for small U. With ATAN2, there are 2 separate arguments, V and U so the intrinsic function ATAN2 internally handles the possibility of division by zero. Therefore, we recommend getting rid of the IF/ELSE conditional block all together. In addition, ATAN2 returns a value between -90 and +90 degrees. Therefore, there is no need to check if wind direction is larger than 360 degrees before the rotation. In summary, instead of the piece of code above use the following.

```
!-----  
! Find wind direction using simple trigonometry.  
! Modify wind direction so that it is earth-relative.  
!-----
```

```
wdir = 270.0 - ( ATAN2(v,u) * rad2deg )  
  
diff = (xlonc - xlon) * xn  
IF (diff > 180.0) diff = diff - 360.0  
IF (diff < -180.0) diff = diff + 360.0  
  
wdir = wdir - diff  
  
IF (wdir > 360.0) wdir = wdir - 360.0  
IF (wdir < 0.0) wdir = wdir + 360.0
```