Subject: Re: Vector Field Plot on Irregular Grid
Posted by Randy Zagar on Thu, 04 Dec 1997 08:00:00 GMT
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Mike Wiltberger wrote:
>
> Hello,
> I would like to make a vector field plot of some 2d electric field
> data. The problem is that the data was computed on an irregular grid
> and the routines within idl only allow for regular grids. Has anyone
> written a routine to do this with irregular grids?
>

I wrote this for PV-Wave some time ago, but I don't think I used
anything that won't also work in IDL. I should also warn you that
you may have to experiment with the SymSize option as this routine
does not do any pre-scaling of the input data...

Correction: There is one section of this program that uses PV-Wave
Date/Time structures. If you are using IDL, you should
comment out this part...

**** cut here ****
```
; TO DO:
;    - Legends (hard)
;
; PROCEDURE STICKPLOT, U, V
; PROCEDURE STICKPLOT, X, U, V
; PROCEDURE STICKPLOT, X, Y, U, V
; PROCEDURE STICKPLOT, DT, U, V  (Eliminate this part if you're using
IDL)
;
;   The best method for plotting vectors is to make a user-defined
;   symbol for each vector that is plotted... This is the only way
;   I have found to insure that the vectors' angle is preserved
;   no matter how the plot is scaled...
;
;   This procedure can be called in one of two ways:
;      - for plotting a vector time-series, or
;      - for plotting vectors in a 2-D plane
;
; Plotting Vector Time-Series:
;   STICKPLOT, dates, u, v
;      The 'dates' variable is an array of date/time structures, and
'u', 'v'
;      are the two components of the vector.  The horizontal axis will
be
;      a standard PV-Wave date/time axis and my plans are to support
```

```
all
;       options relating to these types of plots.
;
; Plotting Vector Fields:
;    STICKPLOT, X, Y, U, V
;
; INPUTS:
;    DT        An array of Date/Time structures...
;    X         The X coordinate for the vectors' starting point.
;    Y         The Y coordinate for the vectors' starting point.
;    U         The U component of the vector (east/west).
;    V         The V component of the vector (north/south).
;
; KEYWORDS:
;    Many of the standard plotting keywords are implemented in this
routine.
;    The keywords that are currently implemented are:
;        Symsize
;        DT_Range
;        XRange
;        YRange
;        Title
;        XTitle
;        YTitle

PRO STICKPLOT, X, Y, U, V, $
    Symsize=mySymsize, $
    DT_Range=myDT_Range, $
    XRange=myXRange, $
    YRange=myYRange, $
    Title=myTitle, $
    XTitle=myXTitle, $
    YTitle=myYTitle

; Some keywords should just modify system variables.
; Old values are restored at the end of this routine...

IF KEYWORD_SET(myTitle) THEN BEGIN
    oldTitle = !P.Title
    !P.Title = myTitle
ENDIF

IF KEYWORD_SET(myXTitle) THEN BEGIN
    oldXTitle = !X.Title
    !X.Title = myXTitle
ENDIF

IF KEYWORD_SET(myYTitle) THEN BEGIN
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   oldYTitle = !Y.Title
   !Y.Title = myYTitle
ENDIF

Nm1 = N_ELEMENTS(X)-1

IF NOT KEYWORD_SET(mySymsize) THEN mySymsize = 1.0

x_info = SIZE(X)
x_dims = x_info(0)
x_type = x_info( n_elements(x_info) - 2)

IF ( x_type EQ 8 ) THEN BEGIN

   ; The independent variable is a date/time structure...

   IF  (n_params() NE 3) THEN BEGIN
      PRINT, 'stickplot error: need exactly 3 parameters when plotting
versus date/time.'
      RETALL
   ENDIF

   IF NOT KEYWORD_SET(myDT_Range) THEN BEGIN
      myDT_Range = [X(0).julian, X(Nm1).julian]
   ENDIF

   ; Okay, this is going to be a vector diagram
   ; with a date/time horizontal axis...

   ; Need the magnitude for future scaling...

   Mag = sqrt(Y*Y + U*U)
   Xhat   = Y / Mag
   Yhat   = U / Mag

   ; Create a little unit vector...
   USERSYM, [0,Xhat(0)], [0,Yhat(0)]

   PLOT, X(0), [0], $
      XStyle=1, YRange=[-1,1], $
      YTickLen=1.E-8, YTicks=2, YTickname = REPLICATE(' ',30), $
      DT_Range=myDT_Range, $
      Psym = 8, Symsize=Mag(0)*mySymsize

   FOR i = 1,Nm1 DO BEGIN
      USERSYM, [0,Xhat(i)], [0,Yhat(i)]
      OPLOT, X(i), [0], $
         Psym = 8, Symsize=Mag(i)*mySymsize
```

```
   ENDFOR

ENDIF ELSE BEGIN

   ; The independent variable is an array of real numbers (doubles, or
integers)

   IF  (N_PARAMS() EQ 2) THEN BEGIN

      IF NOT KEYWORD_SET(myXRange) THEN BEGIN
         myXRange = [0, Nm1]
      ENDIF

      ; This case handles
      ;     STICKPLOT, X, Y
      ; where 'X', and 'Y' are the components of the vector...

      Mag = sqrt(X*X + Y*Y)
      Xhat   = X / Mag
      Yhat   = Y / Mag

      ; Create a little unit vector...
      USERSYM, [0,Xhat(0)], [0,Yhat(0)]

      PLOT, [0], [0], $
         XRange=myXRange, YRange=[-1,+1], $
         YTickLen=1.E-8, YTicks=2, YTickname = REPLICATE(' ',30), $
         Psym = 8, Symsize=Mag(0)*mySymsize

      FOR i = 1,Nm1 DO BEGIN
         USERSYM, [0,Xhat(i)], [0,Yhat(i)]
         OPLOT, [i], [0], $
            Psym = 8, Symsize=Mag(i)*mySymsize
      ENDFOR
   ENDIF ELSE IF (N_PARAMS() EQ 3) THEN BEGIN

      ; This case handles
      ;     STICKPLOT, X, U, V
      ; where 'U', and 'V' are the components of the vector,
      ; and 'X' is the independent variable on the horizontal axis.

      Mag = sqrt(Y*Y+U*U)

      Xhat   = Y / Mag
      Yhat   = U / Mag

      IF NOT KEYWORD_SET(myXRange) THEN BEGIN
         myXRange = [min(X), max(X)]
```

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    ENDIF

    IF NOT KEYWORD_SET(myYRange) THEN BEGIN
       myYRange = [-1, +1]
    ENDIF

    ; Create a little unit vector...
    USERSYM, [0,Xhat(0)], [0,Yhat(0)]

    PLOT, [X(0)], [0], $
       XRange=myXRange, YRange=myYRange, $
       YTickLen=1.E-8, YTicks=2, YTickname = REPLICATE(' ',30), $
       Psym = 8, Symsize=Mag(0)*mySymsize

    FOR i = 1,Nm1 DO BEGIN
       USERSYM, [0,Xhat(i)], [0,Yhat(i)]
       OPLOT, [X(i)], [0], $
          Psym = 8, Symsize=Mag(i)*mySymsize
    ENDFOR
 ENDIF ELSE IF (N_PARAMS() EQ 4) THEN BEGIN
    Mag = sqrt(U*U + V*V)

    IF NOT KEYWORD_SET(myXRange) THEN BEGIN
       myXRange = [min(X), max(X)]
    ENDIF

    IF NOT KEYWORD_SET(myYRange) THEN BEGIN
       myYRange = [min(Y), max(Y)]
    ENDIF

    ; Create a little unit vector...

    ang  = atan(v(0), u(0))
    Xtmp = [ 0, 0.8, 0.8,  1.0,  0.8,  0.8, 0 ]
    Ytmp = [ 0,   0, 0.05,   0, -0.05,   0, 0 ]
    Xhat = cos(ang) * Xtmp + sin(ang)*Ytmp
    Yhat = cos(ang) * Ytmp - sin(ang)*Xtmp

    USERSYM, Xhat, Yhat

    PLOT, [X(0)], [Y(0)], $
       XRange=myXRange, YRange=myYRange, $
       Psym = 8, Symsize=Mag(0)*mySymsize

    FOR i = 1,Nm1 DO BEGIN
       ang  = atan(v(i), u(i))
       Xhat = cos(ang) * Xtmp + sin(ang)*Ytmp
       Yhat = cos(ang) * Ytmp - sin(ang)*Xtmp
```

```
        USERSYM, Xhat, Yhat
        OPLOT, [X(i)], [Y(i)], $
           Psym = 8, Symsize=Mag(i)*mySymsize
      ENDFOR
   ENDIF ELSE BEGIN
        PRINT, 'stickplot error: incorrect number of parameters.'
        RETALL
   ENDELSE

ENDELSE

IF KEYWORD_SET(myTitle) THEN BEGIN
   !P.Title = oldTitle
ENDIF

IF KEYWORD_SET(myXTitle) THEN BEGIN
   !X.Title = oldXTitle
ENDIF

IF KEYWORD_SET(myYTitle) THEN BEGIN
   !Y.Title = oldYTitle
ENDIF

RETURN
END
```

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