
Subject: Re: Vector or Streamline plots on map base?

Posted by [andy](#) on Thu, 05 May 1994 19:48:50 GMT

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In article <CpAFKt.2BpH@yuma.ACNS.ColoState.EDU>, scott@abyss.ATMOS.ColoState.Edu (Scott Denning) writes:

> I need to make vector and/or streamline (flow) plots on a map base. I am
> looking at the userlib procedures VELOVECT.PRO and VEL.PRO for ideas.
> These are nice routines, but they ignore the map coordinates set by
> MAP_SET, even if NO_ERASE is set in the call.
>
> Has anybody hacked these routines to make maps of wind vectors or
> streamlines? Am I missing something obvious?
>
> Any help is much appreciated. Post or email will reach me.
>

Mr. Scott Denning,

I don't think you are missing anything. Velovect is conceptually ok, but it does have a few "features" that are usually unwanted. I have stripped the core of velovect.pro and added a lot of keywords to a routine called map_vec.pro, let me know what you think... especially if you make any changes. The help tool is invoked by typing map_vec with no parameters or keywords at all.

Andy

andy@toto.gsfc.nasa.gov

;This "front end" procedure is a help tool for map_vec.

pro vec_help

```
base = widget_base(title='VEC_HELP', /row)
list = widget_text(base, xsize=85, ysize=20, scroll=1, $
    font='-adobe-helvetica-medium-r-normal--14-140-75-75-p-77-is o8859-1', $
    value=[
'=====',$
'>>>> MAP_VEC HELP MENU <<<<', $
'', $
'    The map_vec procedure plots vectors within an existing plot space.', $
'    Usually a map is produced, then vectors are overlayed using velovect.', $
'', $
'-----',$
'USAGE:    map_vec, u, v, x, y, missing=missing, length=length, maxvec=maxvec, round=round, $
', $
'          dots=dots, color=color, everyx=everyx, everyy=everyy, arrowsize=arrowsize, $, $
'          limit=limit, refvec=refvec, refunit=refunit, refposx=refposx, $,$
'          refposy=refposy, reflabely=reflabely, charsize=charsize, help=help', $
```

```

=====',$
'', $
'PARAMETERS:', $
'  u,v..... 2-D data arrays specifying the zonal and meridional velocity components.', $
'  x,y..... Meridional and zonal location vectors (longitude, latitude).', $
'', $
'KEYWORDS:', $
'  missing..... Do not plot vectors with a magnitude greater or equal to this value.', $
'  length..... Length factor. The default of 1.0 makes the longest vector the', $
'    length of one grid cell.', $
'  maxvec..... Maximum vector magnitude for scaling. Default is computed', $
'  round..... Round computed maxvec so it is divisible by 5.', $
'  dots..... After setting dots to 1, a dot is placed at missing data points.', $
'  color..... Color index for drawing vectors. Default is zero.', $
'  everyx..... Plot every 2nd, 3rd, 4th... vector in the x direction. Default is 1.', $
'  everyy..... Plot every 2nd, 3rd, 4th... vector in the y direction. Default is 1.', $
'  arrowsize..... Factor by which default arrowsize is multiplied.', $
'  limit..... vector containing [latmin, lonmin, latmx, lonmax] for plotting area.', $
'', $
'  refvec..... After setting refvec to 1, a "max vector magnitude" arrow appears on the plot.', $
"  refunit..... String variable containing unit of the reference vector. Default is 'm s!U-1!n.'", $
'  refposx..... Ending x position (in data coords.) for drawing refvec. Default is computed.', $
'  refposy..... Y position (in data coords.) for drawing refvec. Default is computed.', $
'  reflabely..... Y position (in data coords.) for drawing label beneath refvec. Default is
computed.', $
'  charsize..... Character size for reference vector label. Default is .88', $
'  help..... Bring up this help menu.', $
'.....'+$
'.....'+$
'.....',$
'', $
'  EXAMPLE: Plotting global tau_x, tau_y data.', $
"    tau_x = rz('/data/obs/nmc/stress/tau_x_9_90', xloc=x, yloc=y)", $
"    tau_y = rz('/data/obs/nmc/stress/tau_y_9_90')", $
'    gplot, tau_x, x, y, /nodata ... or ... map_set, 0, 180, /cont, /cyl', $
'', $
'    map_vec, tau_x, tau_y, x, y, missing=999., everyx=2, everyy=1, length=5, /dots, $', $
"    /refvec, refunit='dynes cm !e-2!n', refposx=340., refposy=-100., $", $
'    reflabely=-106.', $
  '')

```

widget_control, /realize, base

end

pro map_vec, u, v, x, y, missing=missing, length=length, maxvec=maxvec, round=round, \$

dots=dots, color=color, everyx=everyx, everyy=everyy, arrowsize=arrowsize, \$
limit=limit, refvec=refvec, refunit=refunit, refposx=refposx, refposy=refposy, \$
reflably=reflably, charsize=charsize, help=help

```
;
;
; NAME:
; MAP_VEC
;
;
;
; PURPOSE:
; Produce a two-dimensional velocity field plot.
;
; A directed arrow is drawn at each point showing the direction and
; magnitude of the field.
;
;
; CATEGORY:
; Plotting, two-dimensional.
;
;
; CALLING SEQUENCE:
; MAP_VEC, U, V, X, Y
;
;
; INPUTS:
; U: The X component of the two-dimensional field.
; U must be a two-dimensional array.
;
; V: The Y component of the two dimensional field. Y must have
; the same dimensions as X. The vector at point (i,j) has a
; magnitude of:
;
;  $\text{SQRT} ( U(i,j)^2 + V(i,j)^2 )$ 
;
; and a direction of:
;
;  $\text{ATAN2} ( V(i,j), U(i,j) )$ 
;
;
; OPTIONAL INPUT PARAMETERS:
; X: Optional abscissae values. X must be a vector with a length
; equal to the first dimension of U and V.
;
; Y: Optional ordinate values. Y must be a vector with a length
; equal to the first dimension of U and V.
;
;
; KEYWORD INPUT PARAMETERS:
```

```

; MISSING: Missing data value. Vectors with a LENGTH greater
; than MISSING are ignored.
;
; LENGTH: Length factor. The default of 1.0 makes the longest (U,V)
; vector the length of a cell.
;
; DOTS: Set this keyword to 1 to place a dot at each missing point.
; Set this keyword to 0 or omit it to draw nothing for missing
; points. Has effect only if MISSING is specified.
;
; COLOR: The color index used for the arrows.
;
; EVERY: Plot every ____ vector. Default is 1.
;
; REFARROW: Plot a maximum vector magnitude. Default is 0 (NO).
;
; REFUNIT: Unit of max arrow. Default is m s!e-1!n (i.e., m/s)
;
; REFPOSEX: X starting position of maxxarrow. Default is computed.
;
; REFPOSY: Y position of maxxarrow. Default is computed.
;
; REFLABELY: Y position of refveclabel. Default is computed.
;
;
; OUTPUTS:
; None.
;
;
; COMMON BLOCKS:
; None.
;
;
; SIDE EFFECTS:
; Plotting on the selected device is performed.
;
;
; RESTRICTIONS:
; None.
;
;
; PROCEDURE:
; Straightforward. The system variables !XTITLE, !YTITLE and
; !MTITLE can be set to title the axes.
;
;
; MODIFICATION HISTORY:
; DMS, RSI, Oct., 1983.

```

```

;
; For Sun, DMS, RSI, April, 1989.
;
; Added TITLE, Oct, 1990.
;
; Added POSITION, NOERASE, COLOR, Feb 91, RES.
;
; Added all keywords past color.      June 1993, Andrew F. Loughe
; Draw to current plot area (usually a map).

```

```

on_error, 2      ;Return to caller if an error occurs
help = keyword_set(help)
if (help eq 1 or n_params() eq 0) then begin
    vec_help
    message, 'Stopped for help in map_vec.pro'
endif

```

```

s = size(u)
t = size(v)

```

```

; Check size of input arrays.

```

```

if n_params(1) lt 4 then $
    message, 'Must specify u, v, x, y'

```

```

if s(0) ne 2 then begin
baduv:  message, 'U and V parameters must be 2D and same size.'
endif

```

```

if total(abs(s(0:2)-t(0:2))) ne 0 then goto, baduv

```

```

if (n_elements(x) ne s(1) or n_elements(y) ne s(2)) then $
    message, 'X and Y arrays have incorrect size.'

```

```

; Set some default values.

```

```

if n_elements(missing) le 0 then missing = 1.0e10
if n_elements(length) le 0 then length = 1.0
if n_elements(maxvec) le 0 then maxvec = -1.
if n_elements(round) le 0 then round = 0
if n_elements(everyx) le 0 then everyx = 1
if n_elements(everyy) le 0 then everyy = 1
if n_elements(arrowsize) le 0 then arrowsize = 1.
if n_elements(limit) le 0 then limit = [-100.,-10000.,100.,10000.]
if n_elements(title) le 0 then title = ""
if n_elements(charsize) le 0 then charsize = .88
if n_elements(color) le 0 then color = 0

```

```

latmin = limit(0)           ;Get geographical limits
lonmin = limit(1)           ;for plotting the data
latmax = limit(2)
lonmax = limit(3)

mag = sqrt(u^2 + v^2)       ;Get magnitude of all vectors

; Get subscripts of good and bad elements.
; good = those points where vector magnitude is less than missing value.
; bad = those points where vector magnitude is greater or equal to missing value.
nbad = 0                     ;# of missing points
if n_elements(missing) gt 0 then begin
    good = where(mag lt missing)
    if keyword_set(dots) then bad = where(mag ge missing, nbad)
endif else begin
    good = lindgen(n_elements(mag))
endelse

; Using good points, find maximum vector magnitude for scaling.
if (maxvec eq -1.) then begin
    mag2 = mag(good)          ;Get magnitude of good points.
    if (max(mag2) le 2) then maxvec = fix(max(mag2))
    if (max(mag2) gt 2) then maxvec = fix(max(mag2)+1)
    if (round eq 1) then begin
        maxvec = fix((max(mag2)+1)/5)*5 ;Round maxvec dwn to number divisible by 5
        print, 'Max vector length for scaling is made divisible by 5: ',maxvec
    endif
    if (maxvec eq 0.) then maxvec = 1
endif

;Grid spacing needed for scaling vectors
deltax = (max(x) - min(x)) / (s(1)-1)
deltay = (max(y) - min(y)) / (s(2)-1)

; Plot vectors and arrow heads (loop through all points).
for j = 0, s(2)-2, fix(everyy) do begin
    for i = 0, s(1)-1, fix(everyx) do begin

; Get scaled vector componets.
; length = If three, the longest vector covers three grid cells.
; u,v = The actual velocity components.
; maxvec = The maximum wind component.

        if (mag(i,j) lt missing) then begin
            dx = length * (deltax) * (u(i,j)/maxvec) ;Get (u,v) components
            dy = length * (deltay) * (v(i,j)/maxvec) ;that will be plotted
        
```

```

x0 = x(i) ;Get beginning/ending coords of vector
x1 = x0 + dx
y0 = y(j)
y1 = y0 + dy

if (y0 ge latmin and y1 le latmax and $
    x0 ge lonmin and x1 le lonmax) then begin
    arrow_andy, x0, y0, x1, y1, color=color, /data, $
    hsize=float(arrowsize)*(!d.x_size/94.)*(mag(i,j)/(2.*maxvec) )
endif
endif
endfor
endfor

```

```

; Plot a "maximum vector" arrow at the bottom righthand corner of the plot
if n_elements(refvec) gt 0 then begin

```

```

; Determine new arrow head size and angle for the reference vector
r = .35 ;Length of arrow head
angle = 15. * !dior ;Half-co-angle of arrowhead
st = r * sin(angle) ;Sin 15 degs * length of head
ct = r * cos(angle)

```

```

dx = length * deltax ;Get x-component
dy = length * deltay ;Get y-component
dy=0

```

```

; Compute (or use supplied value) for the ending x position, and the
; y position of the reference vector.

```

```

if n_elements (refposx) le 0 then refposx= max(x) - dx*3.
if n_elements (refposy) le 0 then refposy= min(y) - (y(3)-y(0))

```

```

x0 = refposx - dx
y0 = refposy
x1 = x0 + dx
y1 = y0 + dy ;No y variation (reference vector is horizontal)

```

```

; Find default (x,y) positions for max vector label
xlabel = (x0 + x1)/2.
ylabel = y0 - (y(4)-y(0))
if n_elements(reflabely) gt 0 then ylabel=reflabely

```

```

; Determine (or use supplied value) unit of the reference vector
if n_elements(refunit) le 0 then refunit= 'm s!U-1!n'

```

```

max_label = strcompress(string(maxvec), /remove_all) ;Get maxvec

```

```
reftitle = max_label + ' '+ refunit
xyouts, xlabel, ylabel, reftitle, align=.5, charsize=charsize, color=color
```

```
; Found it more universally acceptable to plot refvec in normalized coords.
```

```
new_coords = convert_coord (x0, y0, /data, /to_norm)
xx0 = new_coords(0) & yy0 = new_coords(1) ;refvec starts here
```

```
new_coords = convert_coord (x1, y1, /data, /to_norm)
xx1 = new_coords(0) & yy1 = new_coords(1) ;refvec ends here
```

```
new_coords = convert_coord ( x1-(ct*dx-st*dy), y1-(ct*dy+st*dx),$
    /data, /to_norm)
xx2 = new_coords(0) & yy2 = new_coords(1) ;top arrowheads end here
```

```
new_coords = convert_coord ( x1-(ct*dx+st*dy), y1-(ct*dy-st*dx),$
    /data, /to_norm)
xx3 = new_coords(0) & yy3 = new_coords(1) ;bot arrowheads end here
```

```
plots,[xx0, xx1, xx3, xx1, xx3], $
    [yy0, yy1, yy3+2.*(yy1-yy3), yy1, yy3], color=color, $
    thick=1., /norm
```

```
endif
```

```
; Place dots at missing data points
```

```
if nbad gt 0 then $
    oplot, x(bad mod s(1)), y(bad/s(1)), psym=3, color=color
```

```
end
```

```
--
```

```
,__o Andrew F. Loughe (Code 971)
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```
