Subject: Re: PVWAVE and NCAR mapping
Posted by keller on Tue, 24 Sep 1991 15:41:47 GMT
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In article <LEGLER.91Sep23113234@masig2.masig1.ocean.fsu.edu>
legler@masig2.masig1.ocean.fsu.edu (David M. Legler) writes:
>
> I need some help drawing some geographical outlines on a PVWave plot.
> Something like what NCAR graphics can do. For example, lets say a
> sample plot of the US outline in black with an overlay of colors
> indicating temperatures for a specific month. NCAR has a very nice
> geographical map drawing facility and our sales rep says he thinks
> others have already written code to use their data base for map
> drawing. Is that true, please speak up if so.
>
> Thanks,
>
> Mr. David M. Legler ||(904)644-3797
> Mesoscale Air-Sea Interaction ||Arpa   legler@masig1.ocean.fsu.edu(128.186.3.1)
>   Group ||SPAN   SCRI1::"legler@masig1.ocean.fsu.edu"
> MS B-174   Love-012 ||Bitnet legler%masig1.ocean.fsu.edu@fsuavm
> Florida State University ||
> Tallahassee, FL 32306-3041 || "An Apple II a day, keeps the PC blues away"
>

BELOW is an IDL map program that I use. It draws a 'pseudo mercator'
map: lats/lons are parallel and equidistant.
I've included a subroutine that converts lats/lons to Lambert Conformal.
In DOMAP are two commented out lines that apply the conversion.

The algorithm in words: Find a map data base (I'm assuming you can
acquire one).
This will probably be divided into 'line segments'...a series of
lat/lon pairs that are to be connected 'pen down'. There is also
likely to be associated with each line segment the max and min
lat/lon for each line segment. This is used to determine whether
or not you wish to even consider drawing the line. This data
may come separately from the line segements, or may be listed
within the segment as if it were the first two points:
43.00 -89.00 41.00 -91.00 42.12 -89.34 41.56 -89.78.....
^^^^^ ^^^^^^ ^^^^^ ^^^^^^
MaxlatMinlonMinlat Maxlon
These are your data structures to work with.

The DOMAP code looks intimidating because 1) I make the user key in
POSITIVE west longitudes, and I jump thru hoops to convert to negative.
2) I set/preserve a bunch of system variables.

Look for 'MEAT OF THE PROGRAM'

Note your 'screen' will be in lat/lon coordinates, with negative
longitudes for the U.S. I leave it that way, so that the user can
follow up and plot something on it.

Following the 'meat' is 'LAST LINE SEGMENT', which is the same code,
with concessions to the problem of the last subscript. This is the
'last line segment' of the entire data base, so, it's probably not
drawn on any given map anyway.

To overlay something on top: This is tricky only in that you have
to think. (If someone knows better, tell us all!).
I'll assume that you have a grid that is one gridpoint at every lat/lon
square. Big assumption! What you need to do is to reset your
coordinate system to something that the grid knows: 'grid coordinates'!
Example follows:

```
avetemps = fltarr(41,26)
;CODE TO FILL THIS ARRAY HERE
domap,25,50,65,105        ;MY FAVORITE MAP...NOTE THAT IT MATCHES THE
                 ;DIMENSIONS OF THE GRID
set_xy,0,40,0,25          ;SET COORDINATE SYSTEM FOR GRID
!noeras = 1              ;SO CONTOUR WILL NOT ERASE YOUR MAP
contour,AVETEMPS          ;
set_xy,-105,-65,25,50     ;RESTORE COORDINATE SYSTEM TO MATCH THE MAP
                 ;(PSEUDO MERCATOR), not necessary for this
                 ;example...just being 'general'
```

I found the NCAR Graphics manual to be helpful on map projections other
than pseudo mercator. There is a 10 page or so tutorial on the
equations that cover all the conic projections, it's under EZMAP
in one of the NCAR manuals. That is where I got the TOLAMBERT code.

Below is code that transforms the lats and lons to 'Lambert Conformal':
Note that map these get transformed to a U,V system, which is (as you
would expect) a cartesian sytem, with a min and max of +/-1. I forget
which directions are positive. Experiment with TOLAMBERT and you'll
find out.

Below that is the MAP program.

I think I've covered the basics. Play with the routines in the usual
interactive way, and you'll be able to go far.

```
;=========================================================== ==========
pro TOLAMBERT, lat, lon, u, v, stdlat1, stdlat2, stdlon
;INPUT: lat,lon
```

```
;OUTPUT: u,v, that ought to be in a plane, converted
;          to look like Lambert Conformal
IF n_params(0) lt 7 THEN BEGIN
  QHELP:
  print," Keyin:
  ;;;;;;;;NOTE REVID (REVERSE VIDEO) IS IN MY PRIVATE LIBRARY
  print,"   ",revid(1),"IDL> TOLAMBERT,lat,lon,u,v,stdlat1,stdlat2,stdlon",revid(0)
  print," Where:
  print,"   OUTPUTS are variables U,V (u-v coordinate system, ranges from -1 to +1
  print,"   INPUTS  are lat,lon
  print,"        stdlat1, stdlat2 are southern, northern standard latitudes,
  print,"        stdlon is standard longitude.
  print,"   Reference: NCAR Graphics GKS manual, under EZMAP
  print," Example:
  print,"   IDL> TOLAMBERT,35,98,u,v,30,45,90
  print,'   IDL> xyouts,u,v,"Chickasha, Oklahoma"
  GOTO,THE_END
ENDIF
IF is_help(lat) THEN GOTO,QHELP        ;IS_HELP() IS IN 'MY' LIBRARY
a=0.785398163
;pi=3.141592654
rlat1=1.*stdlat1/!radeg
rlat2=1.*stdlat2/!radeg
clon=1.*stdlon/!radeg
cone=(alog10(cos(rlat1))-alog10(cos(rlat2)))/$
   (alog10(tan(a-(rlat1/2.)))-alog10(tan(a-(rlat2/2.))))
latrad = lat/!radeg
lonrad = lon/!radeg
r = (tan(a-(latrad/2.)))^cone
u = r*sin(cone*(lonrad-clon))
v = r*cos(cone*(lonrad-clon))   ;make negative if need be
THE_END:
END



;============================================================= =========
;MAP.PRO
; D. KELLER  SEPT 1988 CIMMS @ NOAA/NSSL
;MOD JULY 23, 90, CHANGED NPTS TO NPTSEG

pro MAPHELP,fake
 print," "
 print," Keyin:
 print,"IDL>DOMAP                    (entire USA)
 print,"IDL>DOMAP,minlat,maxlat,minlon,maxlon,linetype
 print,"                 (use '+' numbers for west longitude)
 print," "
 END
```

```
function ONSCREEN,i,mlat,xlat,mlon,xlon
 ;INPUT : i(th) line segment within mlat,xlat,mlon,xlon
 ;OUTPUT: 0=no, 1=yes
 ;NOTE  : mlon, xlon should be negative west
 common EXTENTS,mlats,xlats,mlons,xlons,begs,NPTSEG
 ;try to make the segment to be off of the screen
 ONSCREEN = 1
 IF mlats(i) gt xlat THEN GOTO,ZERO
 IF xlats(i) lt mlat THEN GOTO,ZERO
 IF mlons(i) gt xlon THEN GOTO,ZERO
 IF xlons(i) lt mlon THEN GOTO,ZERO
 GOTO,QEND
 ZERO:
 ONSCREEN = 0
 QEND:
 RETURN,onscreen
 END


pro DOMAP,mlat,xlat,mlon,xlon,linetype,restore
;INPUT : mlat,xlat,mlon,xlon: Min/Max LATitude, LONgitude. optional LINETYPE
;OUTPUT: Pseudo-Mercator map
 common NSEGMENTS,nmaplines
 common MAPLALO,maplats,maplons
 common EXTENTS,mlats,xlats,mlons,xlons,begs,NPTSEG

 ;VARIABLE STRATEGY:
 ; MLAT,XLAT,MLON,XLON ARE PRESERVED:
 ; MINLAT,MINLON,MAXLAT,MAXLON ARE MUCKED WITH within this routine.

 np = n_params(0)
 lsave = !linetype
 !linetype = 0
 CASE np OF
 0 : BEGIN  minlat=25 & maxlat=50 & minlon=-130 & maxlon=-65 & END
 1 : BEGIN MAPHELP & GOTO,THE_END & END
 2 : BEGIN MAPHELP & GOTO,THE_END & END
 3 : BEGIN MAPHELP & GOTO,THE_END & END
 4 : BEGIN
      q=xlon & maxlon=-mlon & minlon=-q & maxlat=xlat & minlat=mlat
    END
 5 : BEGIN  q=xlon & maxlon=-mlon & minlon=-q & minlat=mlat & maxlat=xlat
        !linetype=linetype
    END
 6 : BEGIN  q=xlon & maxlon=-mlon & minlon=-q & minlat=mlat & maxlat=xlat
        !linetype=linetype
    END
 ELSE : BEGIN MAPHELP & GOTO,THE_END & END
```

```
 ENDCASE
 xmins=!xmin  &  xmaxs=!xmax  &  ymins=!ymin  &  ymaxs=!ymax
 cxm = !cxmin &  cxx = !cxmax &  cym = !cymin &  cyx = !cymax
 xs = !xs    &  ys = !ys
 ;
 ;MEAT OF THE PROGRAM
 set_xy,minlon,maxlon,minlat,maxlat
 FOR i=0,nmaplines-2 DO BEGIN
   flag = ONSCREEN(i,minlat,maxlat,minlon,maxlon)
   IF flag eq 1 THEN BEGIN
    b = begs(i)
    e = begs(i+1) - 1
    ;LAMBERT EXAMPLE      tolambert,maplats(b:e),-maplons(b:e),x,y,stdlat1,stdlat2,std lon
    ;LAMBERT EXAMPLE     plots,x,y
    plots,maplons(b:e),maplats(b:e)
   ENDIF
 ENDFOR
 ;LAST LINE SEGMENT
 flag = ONSCREEN(i,minlat,maxlat,minlon,maxlon)
 IF flag eq 1 THEN BEGIN
   b = begs(nmaplines-1)
   e = b + 10 - 1                  ;LAST SEGMENT LENGTH
   plots,maplons(b:e),maplats(b:e)
 ENDIF
 !linetype = lsave
 IF n_params(0) eq 6 THEN BEGIN
   !xmin=xmins  &  !ymin=ymins  &  !xmax=xmaxs  &  !ymax=ymaxs
   !cxmin = cxm  &  !cxmax = cxx  &  !cymin = cym  &  !cymax = cyx
   !xs = xs    &  !ys = ys
 ENDIF
 THE_END:
 END


;*==================* MAIN *=====================*
common MAPLALO,maplats,maplons
common EXTENTS,mlats,xlats,mlons,xlons,begs,NPTSEG
common NSEGMENTS,nmaplines

dlk = 'disk$scratch:[publicscr.keller]map.stuff'   ;THIS IS MY DATABASE
IF n_elements(maplats) eq 0 THEN RESTORE,dlk
MAPMENU

END
```

Subject: Re: PVWAVE and NCAR mapping
Posted by dank on Wed, 25 Sep 1991 19:47:07 GMT

legler@masig2.masig1.ocean.fsu.edu (David M. Legler) writes:
> I need some help drawing some geographical outlines on a PVWave plot.
> For example, lets say a sample plot of the US outline in black ...

keller@nsslsun.nssl.uoknor.edu (Dave Keller) writes:
> BELOW is an IDL map program that I use. It draws a 'pseudo mercator'
> map: lats/lons are parallel and equidistant.
> The algorithm in words: Find a map data base (I'm assuming you can
> acquire one)....

A large data base is available for a few bucks from The Austin Codeworks,
Austin, Texas (they are in the phone book).
It's in decimal lat lon format, and has about 100k points
total, including islands and lakes. Only a few inconsistancies.
The data may also be available elsewhere, as it is shareware.

If anyone knows of another such database, or of a topo map database,
I'd love to hear about it.
- Dan Kegel (dank@blacks.jpl.nasa.gov)