
Subject: Re: Contour irregular earth data?
Posted by [dan](#) on Tue, 11 Jun 1996 07:00:00 GMT
[View Forum Message](#) <> [Reply to Message](#)

In article <31BDCFF6.468D@al.noaa.gov>, Jeff Hicke <jhicke@al.noaa.gov> writes:

|> Hello,
|>
|> I am running into problems trying to contour irregularly gridded earth
|> data. For example, I have a lat/lon list of cities and temperatures,
|> and want to contour them. However, using IDL's sph_scatter together with
|> map_image or contour gives unsatisfying results. Artificial highs and
|> lows are created instead of simply interpolating between cities. Also,
|> contours are drawn in areas far from the cities, and I would like to
|> have the map blank in those areas. Does anyone have code or suggestions
|> about how to accomplish this?
|>
|> Thanks in advance,
|> Jeff Hicke

The following routine will map scattered data onto a grid on the surface of a sphere. It uses distance weighting (great circle distance) to interpolate so no artificial max or min values are generated. As far as not wanting to plot contours far from your scattered data, I'm not sure how you could accomplish that. Be careful, for large numbers of data points this routine can be slow.

```
; $ID$

;+
; Name:
;   INTERP_SPHERE
;
; PURPOSE:
;   This function maps scattered data defined by
;   (longitude,latitude,value) onto a regular, but not
;   necessarily evenly spaced, grid whose coordinates are
;   also defined by longitude and latitude. The procedure searches
;   for the N (default = 5) closest data points to each grid
;   point and then averages these N data points weighted by
;   distance^power from the grid point to the particular data point.
;   Default is power=-1 which weights the points inversely by
;   distance. All distances are along great circles on a sphere
;   (the shortest distance between two points along the
;   surface of a sphere).
;
; CATEGORY:
;   Interpolation?
;
; CALLING SEQUENCE:
```

```

; grid = INTERP_SPHERE(lat,lon,data)
;
;
; INPUTS:
;
; lat:   The latitudes on the grid where interpolated
;        values are desired (in degrees)
;
; lon:   The longitudes on the grid where interpolated
;        values are desired (in degrees)
;
; data:  An array (3,ndata) where ndata is the number of
;        data points, and can be any number larger than N.
;        each row of data should contain a longitude, a
;        latitude, and a value to be interpolated.
;
; KEYWORD PARAMETERS:
;
; N:     The number of closest data points to be used
;        for each grid point interpolation. Default = 5
;
; power: The exponent for the distance weighting function.
;        Default = -1 (weighting inversely by distance).
;        An input of power=-.5 would weight inversely by the
;        square root of the distance.
;
; latwt: The weighting for the interpolation in the meridional
;        (North-South) direction. For negative power,
;        latwt > 1 produces a weighting with less latitude
;        influence. Default = 1
;
; mask:  Mask for calculating grid values
;
; OUTPUTS:
;
; grid:  An array of interpolated data values. It has dimensions
;        (nlon,nlat) where nlon is the number of entries in the
;        input lon, and nlat is the number of entries in the input
;        lat.
;
; EXAMPLE:
;
; MODIFICATION HISTORY:
;
; written by:  Dan Bergmann dbergmann@llnl.gov 11/10/94
;
;
;

```

```
FUNCTION INTERP_SPHERE,lat,lon,data,n=n,power=power,latwt=latwt
```

```
nlat = (size(lat))(1)
nlon = (size(lon))(1)
grid = fltarr(nlon,nlat)
```

```
if (not(keyword_set(n))) then n = 5
if (not(keyword_set(power))) then power = -1
if (not(keyword_set(latwt))) then latwt = 1
if (not(keyword_set(mask))) then begin
    mask = intarr(nlon,nlat)
    mask(*,*) = 1
endif
```

```
dtr = !pi / 180.
```

```
; convert lat and lon to radians
```

```
latr = dtr * lat
lonr = dtr * lon
```

```
; convert the lat and lon of the data to radians
```

```
dlatr = dtr * data(1,*)
dlonr = dtr * data(0,*)
```

```
; calculate the cartesian coordinates of the data points
; assuming a unit sphere.
```

```
xdata = cos(dlatr) * sin(dlonr)
ydata = cos(dlatr) * cos(dlonr)
zdata = sin(dlatr)
```

```
for x=0,nlon-1 do begin
```

```
    sinlonr = sin(lonr(x))
    coslonr = cos(lonr(x))
```

```
    for y=0,nlat-1 do begin
```

```
; check to see if this grid should be calculated
```

```
    if (mask(x,y) ne 0) then begin
```

```
; calculate the cartesian coordinates of this particular
; grid point.
```

```
        xorig = cos(latr(y)) * sinlonr
```

```

yorig = cos(latr(y)) * coslonr
zorig = sin(latr(y))

; calculate the length squared of the cords connecting this grid
; point to all the data points and then sort the data points by
; these values.

corddistsq = (xorig-xdata)^2+(yorig-ydata)^2+((zorig-zdata)*latwt)^2

sortdist = (sort(corddistsq))(0:n-1)

; if a data point lies directly on top of this grid point, then
; assign that value to the grid point.
; Otherwise calculate the n great circle distances and do a weighted
; average of the data values.

if ((corddistsq(sortdist))(0) eq 0) then begin

    grid(x,y) = data(2,(sortdist)(0))

endif else begin

    grcirdis = asin(sqrt(corddistsq(sortdist))/2.)

    grid(x,y) = (total(data(2,sortdist) * grcirdis^power)) / total(grcirdis^power)

endelse

endif

endfor

endfor

return,grid

end
--
*****
** Dan Bergmann                dbergmann@llnl.gov **
** Atmospheric Science Division    fax (510) 422-5844 **
** Lawrence Livermore National Lab  human (510) 423-6765 **

```
