Subject: circles on the sky
Posted by Christopher Thom on Fri, 27 Mar 2009 17:53:20 GMT
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Hi all,

I'm drawing some points on a sky map. The map is <0.5deg across, so I thought a flat approximation would be ok...this may not be true. Around my central point, I draw a circle using a flat geometry relation [x = x0+r*cos(theta); y = y0 + r*sin(theta)], but i see a point outside the circle that I expect to be inside.

I expect this point to be inside the circle, because the radius of the circle (in arcsec) is *greater* than the great-circle angular distance from the centre of the circle to the point.

So...I'm thinking that my flat-geometry assumption is false. My question: can anyone point me towards forumlae/code that will calculate this circle on the sky (i.e. all points which have a fixed great-circle distance from the centre)? I'm using the astro library gcirc.pro to calculte my great-circle angular distances...I kind of want the "inverse" of that routine, I guess.

Or...is there a better way to do it? [Or maybe my bug is elsewhere?]

cheers
chris

Subject: Re: circles on the sky
Posted by Kenneth P. Bowman on Tue, 31 Mar 2009 19:34:09 GMT
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In article <alpine.OSX.1.10.0903311335490.8491@kanangra.uchicago.edu>,
 Christopher Thom <cthom@oddjob.uchicago.edu> wrote:

> Given a co-ordinate position (ra/dec or lat/long), a direction (e.g an
> angle east of north, for instance), and a great circle angular distance,
> how do I compute the coordinate of the final position?

LL_ARC_DISTANCE.

What! That wasn't obvious? :-)

(This function should be referenced in the manual page for MAP_2POINTS, and vice versa.)

Ken Bowman

Subject: Re: circles on the sky
Posted by pgrigis on Tue, 31 Mar 2009 20:00:06 GMT
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Kenneth P. Bowman wrote:
> In article <alpine.OSX.1.10.0903311335490.8491@kanangra.uchicago.edu>,
> Christopher Thom <cthom@oddjob.uchicago.edu> wrote:
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>
> LL_ARC_DISTANCE.

Also, for some background geometry:
http://en.wikipedia.org/wiki/Law_of_cosines_(spherical)

Ciao,
Paolo

>
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> (This function should be referenced in the manual page for MAP_2POINTS,
> and vice versa.)
>
> Ken Bowman

Subject: Re: circles on the sky
Posted by Christopher Thom on Tue, 31 Mar 2009 21:07:34 GMT
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Quoth Kenneth P. Bowman:

> In article <alpine.OSX.1.10.0903311335490.8491@kanangra.uchicago.edu>,
> Christopher Thom <cthom@oddjob.uchicago.edu> wrote:
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AHA!!! Missed this one. Now, by just passing all azimuths 0 -> 360deg, i
have the coordinates of the "circles" i'm trying to draw (where, by
"circle", i mean "the set of all points that are r distance from my
lon/lat").

thanks all for the help
chris

Subject: Re: circles on the sky
Posted by pgrigis on Tue, 31 Mar 2009 21:20:48 GMT
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Christopher Thom wrote:
> Quoth Kenneth P. Bowman:
>
>> In article <alpine.OSX.1.10.0903311335490.8491@kanangra.uchicago.edu>,
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Is that significantly different than a circle with radius r drawn
in the projected map, if r is about 0.5 degree as yous said
in the original post?

Ciao,
Paolo

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> chris

Subject: Re: circles on the sky
Posted by Christopher Thom on Tue, 31 Mar 2009 22:27:54 GMT
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Quoth Paolo:

> Christopher Thom wrote:
>> Quoth Kenneth P. Bowman:
>>
>>> In article <alpine.OSX.1.10.0903311335490.8491@kanangra.uchicago.edu>,
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Well...I think so. Map projections continually confuse me, and getting
them right in IDL confuses me even more! what I can say for sure is this:

If i just calculate a cartesian circle, using the following code:

```
theta = findgen(361)/!DRADEG
xx = x0 + r*cos(theta)
```

yy = y0 + r*sin(theta)
plot, x0, y0
oplot, xx, yy

I get a very circular object in my plots, both on an equirectangular plot of points, as well as a projected map, made using map_set.

BUT...if i now calculate the great circle distance to each of the 361 points in my cartesian circle from the centre of the circle, the distance is NOT constant, as I expect. Rather, it is sinusoidal, approaching r at the maximum of the curve.

OTOH, using ll_arc_distance gives me a rather egg-like "circle", but at least the distance from the centre to all the points on my "circle" is constant (i.e. r), as expected.

I must have spent 2 or 3 days digging through my code, convinced that I must have screwed up the object locations, rather than just the "drawing a circle" part.

cheers
chris

Subject: Re: circles on the sky
Posted by pgrigis on Tue, 31 Mar 2009 22:45:57 GMT
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Christopher Thom wrote:
> Quoth Paolo:
>
>> Christopher Thom wrote:
>>> Quoth Kenneth P. Bowman:
>>>
>>>> In article <alpine.OSX.1.10.0903311335490.8491@kanangra.uchicago.edu>,
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> OTOH, using ll_arc_distance gives me a rather egg-like "circle", but at
> least the distance from the centre to all the points on my "circle" is
> constant (i.e. r), as expected.

Well, I tried:

```
;go to the equator at central meridian
x=0
y=0

;0.5 degrees distance
arc_dist=0.5/360*!Pi*2

;define azimuts from 0 to 2Pi
az=findgen(100)/99*2*!Pi

;result coordinates
resx=az*0
resy=az*0
```

```
;ll_arc_distance seems not to be vectorized?
;or maybe I misread the docs
.run
FOR i=0,n_elements(az)-1 DO BEGIN
  res=ll_arc_distance([x,y],arc_dist,az[i])
  resx[i]=res[0]
  resy[i]=res[1]
ENDFOR
end

;plot result coordinates
plot,resx,resy,/iso
;looks very circular to me
```

I did not do map projections because I'd like to keep
what remains of my sanity :) but I don't expect them
to distort that circle too much...

Ciao,
Paolo

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> must have screwed up the object locations, rather than just the "drawing a
> circle" part.
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> cheers
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Subject: Re: circles on the sky
Posted by JDS on Tue, 07 Apr 2009 14:17:37 GMT
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On Mar 31, 6:27 pm, Christopher Thom <ct...@oddjob.uchicago.edu>
wrote:
> Quoth Paolo:
>
>
>
>> Christopher Thom wrote:
>>> Quoth Kenneth P. Bowman:
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> the maximum of the curve.

That's not surprising. Only certain projections preserve shape in the
2D plane. Conformal projections like Mercator are among them (but in
that case relative areas are not preserved: the Greenland effect).

JD