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Subject: Re: differences among map\_proj\_image, map\_image and map\_patch  
Posted by [David Fanning](#) on Mon, 18 Feb 2013 18:23:48 GMT

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Olivia writes:

> I wanna project air temperature (tmean: [7025 (lon), 3105 (lat)]) over the U.S. from geographic coordinate to Lambert Azimuthal Equal-Area coordinate, and need to know the x,y value of the new variable.

This is a fairly complicated question, unfortunately. Before I agree to take it on, how much do you know about map projections, generally, and what exactly do you mean by the "x,y value of the new variable". Can you tell me very specifically what value (or values) you are looking for?

Cheers,

David

--

David Fanning, Ph.D.

Fanning Software Consulting, Inc.

Coyote's Guide to IDL Programming: <http://www.idlcoyote.com/>

Sepore ma de ni thue. ("Perhaps thou speakest truth.")

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Subject: Re: differences among map\_proj\_image, map\_image and map\_patch  
Posted by [David Fanning](#) on Mon, 18 Feb 2013 18:29:54 GMT

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David Fanning writes:

>

> Olivia writes:

>

>> I wanna project air temperature (tmean: [7025 (lon), 3105 (lat)]) over the U.S. from geographic coordinate to Lambert Azimuthal Equal-Area coordinate, and need to know the x,y value of the new variable.

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> take it on, how much do you know about map projections, generally, and  
> what exactly do you mean by the "x,y value of the new variable". Can you  
> tell me very specifically what value (or values) you are looking for?

It also might help, if you can tell me where I can download that data set. I'm afraid the answer to this question is going to involve more

than just text. :-(

Cheers,

David

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Subject: Re: differences among map\_proj\_image, map\_image and map\_patch  
Posted by [Olivia](#) on Mon, 18 Feb 2013 18:46:31 GMT

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I know it is a complex question.

I am a newbie in this area, and began to use IDL just days ago.

The x, y value of new variable means the coordinate value of each point on the projection map.

Thanks for your instant response.

Olivia

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Subject: Re: differences among map\_proj\_image, map\_image and map\_patch  
Posted by [Olivia](#) on Mon, 18 Feb 2013 18:53:01 GMT

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Thanks so much, David.

You can download the data using the link below.

<https://www.dropbox.com/s/r7uqxwm3huf796p/tmean.nc>

Olivia

On Monday, February 18, 2013 12:29:54 PM UTC-6, David Fanning wrote:

> David Fanning writes:

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>> Olivia writes:

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Subject: Re: differences among map\_proj\_image, map\_image and map\_patch  
Posted by [David Fanning](#) on Tue, 19 Feb 2013 01:55:21 GMT  
[View Forum Message](#) <> [Reply to Message](#)

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Olivia writes:

> I wanna project air temperature (tmean: [7025 (lon), 3105 (lat)]) over the U.S. from geographic coordinate to Lambert Azimuthal Equal-Area coordinate, and need to know the x,y value of the new variable.  
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> Information of Lambert Azimuthal Equal-Area coordinate:  
> The central longitude and latitude is -100 and 50, respectively. Both false northing and false easting are 0. The ellipsoid is WGS 84.  
>  
> I didn't notice much difference among map\_proj\_image, map\_image and map\_patch according to the manual, so I used these three routines, and wanna compare them.  
>  
> I use tmean1, tmean2 and tmean3 to represent results from map\_proj\_image, map\_image and map\_patch, respectively.  
>  
> The spatial pattern of tmean1 and tmean3 are very similar, both of them showed the warped image correctly. Except, the dimension of tmean1 is [7025, 3105], which is the same with original tmean (I can understand this), and the dimension of tmean2 is [1171, 666].  
> tmean2 is totally wrong, and its dimension is [1, 680].  
>  
> Could someone help me to clarify the differences among these three routines, please?  
>  
> It seems all these three routines just warp the image, and won't give any information about the value of x, y. How can I know the x,y of projected image?

OK, I am going to try to answer these questions now. :-)

First, let me say your questions shows some evidence of confusion. This is normal and is the result of two different phenomenon. First, you are probably reading the IDL documentation. This is generally a Big Mistake. Second, map projections are inherently hard to understand. I once took a job at the National Snow and Ice Data Center specifically so I could learn to work with map projections. (This is where I learned reading the IDL documentation was a Big Mistake.) It took me about three years to finally come to grips with map projections, and I worked with them daily. Matt Savoie and I would get together about once a week and I would convince him that everything he knew about map projections was wrong, and he would do the same for me. Then we would swap places, until the next week, when we would convince each other to swap places again. By iteration, over three years time, we both got to the point that we were sure the other person was out of his mind!

Anyway, there are two different ways to set up map projections in IDL. You have used both incorrectly. :-)

Map\_Set is very old and is considered (generously, I think) a semi-professional way of handling map projections. The serious map professionals I worked with wouldn't consider using it, although I have come to think of it as useful when working with some map projections (although, God knows, NOT Mercator!) when you want a global map and are not concerned with matters of great precision. It works in lat/lon space (which is NOT where you want to be when working with map projected images) and is good for warping images to a map projection (something that sets many map projection expert's teeth on edge).

Map\_Proj\_Init is based on the GCTP software that was state of the art 15-20 years ago, very professional in its time, and still generally useful today, although nowhere near the state of the art now. The Map\_Proj\*\* routines work in the much more sensible projected meter space, which matches map projected images extremely well, and will allow you to fit a map projection to your image, as God meant for it to be done. There is almost no support structure built into IDL for working with Map\_Proj\_Init. In fact, I'm pretty sure folks at ExelisVis don't really understand Map\_Proj\_Init, so strong is their bias for warping images to map projections, instead of the reverse.

In the absence of support for the Map\_Proj\*\* routines, I have built my own supporting routines for working with the Map\_Proj\*\* programs. These are available in the Coyote Library.

The point is, both of these routines produce "map structures," but they are different and cannot be used interchangeably, as you are doing in your example code. You must pick one system or the other, and live with your choice.

Map\_Proj\_Image works with the structure created with Map\_Proj\_Init, as you would expect. It does a much better job of "warping" an image from one map projection to another, because the warping is done on regular grids of map projected XY (sometimes called UV) coordinates. You can expect excellent results when warping in this manner.

Map\_Image is the warping routine for Map\_Set and I think of it as a sort of "display" routine. It is not really interested in preserving image values. It's main purpose is to warp an image to a map projection in a close-enough-for-government-work sort of way.

Map\_Patch is the back-up shortstop for when Map\_Image fails to do its job (usually when one of the poles is involved). It uses a slightly different (and slower) algorithm that is often more reliable. It is also the routine of choice if you have a lat/lon value for every pixel in the image. But, again, it is used mostly for "display", not science. (I've written an equivalent routine for Map\_Proj\_Init, named cgWarpToMap. It

does low-resolution display things very well.)

The data you have is extremely high resolution (too high to be shown on a graphics display, unless you have a wall-sized monitor). So, I am not absolutely sure it matters what routine you use to warp it, although I am always partial to `Map_Proj_Image`. I certainly wouldn't warp it and then inquire of the warped image what its value is. I'd make a small, low-resolution image for display and I'd keep the original image around and use that to get actual values.

So, I guess the answer to your question is really another question. What exactly are you planning to do with this image that you need to know its warped values?

Cheers,

David

P.S. I'm not entirely sure this answer will satisfy you. But, as I said, you asked a very complicated question, and there is no simple answer. In the end, it matters what you are hoping to do with the information. Tell us that, and we may be able to advise you more sensibly.

--

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Subject: Re: differences among `map_proj_image`, `map_image` and `map_patch`  
Posted by [Olivia](#) on Tue, 19 Feb 2013 19:54:06 GMT

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---

Thanks David for your answer, and I am really appreciate it. Now, I am more clear about the differences among these routines.

I learned map projection mainly from book "AcrGIS 9 Understanding Map Projections." I began to doubt whether my understanding about map projection is right. If you can give us an example how to understand map projection will benefit many people.

My research is about the climate change of national parks. For example, what't the temperature change at the end of 21st century under different climate scenarios? Since the geographic coordinate is not area conserve, and if I do analysis on the geographic coordinate directly, there will be some biases towards high latitude. That's the reason I wanna project the original data to the Lambert Azimuthal Equal-Area projection, and I need to know the value of warped image.

I have found an easier way to solve my problem using ENVI. Using this software I can customize

the output x/y pixel size, define the way to warp the image, and also know the warped value and its position on the image.

Cheers,

Fuyao

On Monday, February 18, 2013 7:55:21 PM UTC-6, David Fanning wrote:

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Subject: Re: differences among map\_proj\_image, map\_image and map\_patch  
Posted by [David Fanning](#) on Tue, 19 Feb 2013 20:56:56 GMT  
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Olivia writes:

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>  
> I have found an easier way to solve my problem using ENVI. Using this software I can customize the output x/y pixel size, define the way to warp the image, and also know the warped value and its position on the image.

Yes, ENVI has better map projection software than IDL (it is using, at least in part, the state-of-the-art proj4 software now). It is a shame it doesn't trickle down to IDL. Still, I routinely display warped images like this in the Catalyst application, ImgWin. This is a resizable graphics window that allows me to click in the window, on the image, and obtain both the cursor location (in map coordinates) and the image value at that location. So, ENVI is not strictly required. :-)

I've put a static version of your data in the Coyote Plot Gallery:

<http://www.idlcoyote.com/gallery/>

And I've also put a Catalyst program here, that will allow you to display this data in a resizable graphics window. As you draw your cursor over the image, you will see the pixel location, map location, and image value printed in the window.

[http://www.idlcoyote.com/usa\\_mean\\_temperature.pro](http://www.idlcoyote.com/usa_mean_temperature.pro)

Cheers,

David

--

David Fanning, Ph.D.

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Subject: Re: differences among map\_proj\_image, map\_image and map\_patch  
Posted by [David Fanning](#) on Tue, 19 Feb 2013 21:11:40 GMT

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David Fanning writes:

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- >
- > [http://www.idlcoyote.com/usa\\_mean\\_temperature.pro](http://www.idlcoyote.com/usa_mean_temperature.pro)

Whoops! That's not going to work. Try this:

[http://www.idlcoyote.com/misc/usa\\_mean\\_temperature.pro](http://www.idlcoyote.com/misc/usa_mean_temperature.pro)

Cheers,

David

--

David Fanning, Ph.D.

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Subject: Re: differences among map\_proj\_image, map\_image and map\_patch  
Posted by [Olivia](#) on Wed, 20 Feb 2013 16:53:32 GMT

[View Forum Message](#) <> [Reply to Message](#)

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Thanks David. It is really helpful.

Have a nice day.

Olivia

On Tuesday, February 19, 2013 3:11:40 PM UTC-6, David Fanning wrote:

> David Fanning writes:

>

>

>

>> And I've also put a Catalyst program here, that will allow you to

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