
Subject: Interpolation routines

Posted by [laura.hike](#) on Tue, 02 Feb 2016 00:47:15 GMT

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I was wondering whether anyone could recommend an IDL routine (or extra keywords) that would allow me to interpolate my data correctly. Here are the constraints:

- input data and output data are on irregular 1D grids
- NaN is used as the indicator or bad or missing values
- the input abscissa values always span a broader range than the output values, HOWEVER, sometimes not all of the input locations have ordinate values associated with them. This generally occurs at the top or bottom of the column. In other words, a number of the levels at the top or bottom may be filled with NaNs.

What I'm looking for is a higher order (not linear) interpolation routine that deals gracefully with NaNs and won't interpolate beyond the range of known values.

I tried `interpol` with `/spline`. If I use the `/NaN` option, the program seems to run fine but fails when there are fewer than 4 good values in a row. If I take out the `/NaN`, it does not fail in this case. However, it turns out that it interpolates beyond where there are any valid input values (i.e., out into the NaN area). If I replace the NaNs with zeros, it does the same thing (which surprised me).

I tried the `spline` command instead. It failed when I substituted 0s for the NaNs and returned all NaNs when I left them in.

Rather than continuing to try all of IDL's interpolation routines with all their options, I was hoping someone would be able to answer this question off the top of their head.

Thanks,

Laura

Subject: Re: Interpolation routines

Posted by [Craig Markwardt](#) on Tue, 02 Feb 2016 17:34:14 GMT

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On Monday, February 1, 2016 at 7:47:21 PM UTC-5, [laura...@gmail.com](#) wrote:

> I was wondering whether anyone could recommend an IDL routine (or extra keywords) that would allow me to interpolate my data correctly. Here are the constraints:

>

> - input data and output data are on irregular 1D grids

> - NaN is used as the indicator or bad or missing values

> - the input abscissa values always span a broader range than the output values, HOWEVER, sometimes not all of the input locations have ordinate values associated with them. This generally occurs at the top or bottom of the column. In other words, a number of the levels at the top or bottom may be filled with NaNs.

>

> What I'm looking for is a higher order (not linear) interpolation routine that deals gracefully with NaNs and won't interpolate beyond the range of known values.
>
> I tried interpol with /spline. If I use the /NaN option, the program seems to run fine but fails when there are fewer than 4 good values in a row. If I take out the /NaN, it does not fail in this case. However, it turns out that it interpolates beyond where there are any valid input values (i.e., out into the NaN area). If I replace the NaNs with zeros, it does the same thing (which surprised me).
>
> I tried the spline command instead. It failed when I substituted 0s for the NaNs and returned all NaNs when I left them in.

I found most of the built-in IDL interpolation routines to be kind of a joke. The one I use often is SPL_INIT and SPL_INTERP, which are based on the Numerical Recipes interpolation routines. You will have to screen out your NANs manually with WHERE(), but that should not be a big deal.

The IDL Astronomy library has some other nice routines like QUADTERP. I have developed some specialized interpolators for IDL (example: Chebyshev). If you have known explicit derivatives at each sample point, then my CUBETERP or QINTERP might be of use.

Craig

Subject: Re: Interpolation routines
Posted by [laura.hike](#) on Tue, 02 Feb 2016 19:18:33 GMT
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Ah, so when my friends say I should be using Matlab or (better!) Python, they're right..... ;-)

It's funny that I didn't run into these problems sooner.

Subject: Re: Interpolation routines
Posted by [wlandsman](#) on Tue, 02 Feb 2016 20:17:03 GMT
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On Tuesday, February 2, 2016 at 12:34:17 PM UTC-5, Craig Markwardt wrote:

>
> I found most of the built-in IDL interpolation routines to be kind of a joke. The one I use often is SPL_INIT and SPL_INTERP, which are based on the Numerical Recipes interpolation routines. You will have to screen out your NANs manually with WHERE(), but that should not be a big deal.

I don't believe this is true anymore. INTERPOL() used to be biggest problem but since IDL 7.0,

it is a professional level interpolation routine (and certainly more powerful than QUADTERP).

I do agree that your best bet is to probably remove the NAN values (using WHERE and FINITE()). I would use INTERPOL() without the /NAN keyword.

```
g = where(finite(y))
result = interpol( y[g], x[g], xinterp, /spline)
```

> The IDL Astronomy library has some other nice routines like QUADTERP. I have developed some specialized interpolators for IDL (example: Chebyshev). If you have known explicit derivatives at each sample point, then my CUBETERP or QINTERP might be of use.

>

> Craig

Subject: Re: Interpolation routines

Posted by [laura.hike](#) on Tue, 02 Feb 2016 21:31:11 GMT

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On Tuesday, February 2, 2016 at 12:17:06 PM UTC-8, wlandsman wrote:

> I don't believe this is true anymore. INTERPOL() used to be biggest problem but since IDL 7.0, it is a professional level interpolation routine (and certainly more powerful than QUADTERP).

>

> I do agree that your best bet is to probably remove the NAN values (using WHERE and FINITE()). I would use INTERPOL() without the /NAN keyword.

>

> g = where(finite(y))

> result = interpol(y[g], x[g], xinterp, /spline)

Thanks for the comment, wlandsman. I tried the "finite" method and got the same result as when I left the NaNs in and included the /NaN keyword. The interpolation works correctly (except when there are fewer than 4 valid points left, so I would have to write a trap for this in any case), but it continues beyond the end of the input range, becoming extrapolation instead of interpolation. This is completely invalid, so I specifically want to prevent it. I show an example below in order to be clear. Yes, this is a vertical profile in pressure coordinates, for anyone who cares:

Input abscissa Pin:

0.187500	0.362500	0.675000	1.26250	2.02500	2.98750	4.47500	6.75000
8.40000	8.98750	9.62500	10.2875	11.0000	11.7750	12.6000	13.4875
14.4500	15.4750	16.5750	17.7625	19.0250	20.3875	21.8625	23.4375
25.1250	26.9375	28.8875	30.9750	33.2125	35.6125	38.1875	40.9750
43.9750	46.3375	48.0000	49.7250	51.5125	53.3625	55.2875	57.2875
59.3500	61.4875	63.7000	66.0000	68.3875	70.8625	73.4250	76.0750
78.8250	81.6875	84.6500	87.7125	90.9000	94.2000	97.6125	101.150

104.825	108.637	112.587	116.688	120.938	125.337	129.900	134.638
139.538	144.625	149.913	155.388	161.062	166.938	173.025	179.350
185.913	192.700	199.737	207.038	214.663	222.625	230.888	239.513
248.513	257.913	267.725	277.925	288.575	299.688	311.237	323.100
335.288	347.938	361.050	374.463	388.188	402.400	417.025	432.087
447.612	463.550	479.925	496.812	514.300	532.287	550.725	569.738
589.312	609.463	630.287	651.825	NaN	NaN	NaN	NaN
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
NaN	NaN	NaN	NaN	NaN	NaN	NaN	

Output abscissa Pout:

0.100000	0.300000	0.400000	0.500000	0.700000	1.00000	2.00000
3.00000	4.00000	5.00000	7.00000	10.0000	20.0000	30.0000
40.0000	50.0000	70.0000	100.000	150.000	200.000	250.000
300.000	350.000	400.000	450.000	500.000	550.000	600.000
650.000	700.000	750.000	775.000	800.000	825.000	850.000
875.000	900.000	925.000	950.000	975.000	1000.00	

Values obviously occur in Pout that are beyond the range of Pin.

Ordinate in SWin:

0.000156151	0.000173488	0.000207377	0.000210915	0.000169155	0.000110047		
7.45450e-05	5.23441e-05	3.99181e-05	3.90353e-05				
3.75340e-05	3.97617e-05	3.25255e-05	3.04963e-05	3.44416e-05	2.90153e-05	2.68362e-05	
3.02042e-05	2.54594e-05	2.58893e-05					
2.62765e-05	2.39674e-05	2.39971e-05	2.40214e-05	2.37010e-05	2.34202e-05	2.16869e-05	
2.26950e-05	1.99376e-05	2.16858e-05					
1.91526e-05	1.85088e-05	1.88882e-05	1.80156e-05	1.72226e-05	1.67287e-05	1.73794e-05	
1.56135e-05	1.48229e-05	1.44584e-05					
1.51021e-05	1.45813e-05	1.19285e-05	1.34967e-05	1.10665e-05	1.15942e-05	1.21990e-05	
1.08427e-05	9.58437e-06	1.00086e-05					
8.94639e-06	9.36905e-06	8.25729e-06	8.73890e-06	7.72265e-06	7.45533e-06	6.50589e-06	
6.92547e-06	6.66663e-06	6.42854e-06					
6.20490e-06	5.99692e-06	5.77185e-06	5.05578e-06	4.90454e-06	4.69174e-06	4.99278e-06	
4.37616e-06	3.80173e-06	3.67547e-06					
3.93453e-06	3.40434e-06	3.28958e-06	3.18232e-06	3.06034e-06	2.62840e-06	2.80613e-06	
2.71086e-06	2.02691e-06	2.48816e-06					
1.59571e-06	2.53445e-06	2.43971e-06	3.04975e-06	4.47653e-06	4.95492e-06	6.00842e-06	
7.14583e-06	7.06873e-06	7.76889e-06					
7.85854e-06	8.32823e-06	8.90338e-06	9.45487e-06	9.72611e-06	9.55187e-06	9.46401e-06	
8.91291e-06	9.40596e-06	8.94922e-06					
9.59435e-06	9.93338e-06	9.91535e-06	1.02259e-05	1.02142e-05	1.00091e-05	8.75643e-06	
8.13227e-06	NaN	NaN					
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
NaN							

NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
NaN								
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	

Ordinate out:

```
0.000147821 0.000166955 0.000177699 0.000189441 0.000209155 0.000217363
0.000170853 0.000109465 8.07843e-05 6.65560e-05
4.99181e-05 3.92060e-05 2.45898e-05 2.22732e-05 1.85323e-05 1.68197e-05 1.12288e-05
7.54906e-06 4.98966e-06 3.04681e-06
1.66306e-06 4.97638e-06 7.80974e-06 9.37925e-06 9.38277e-06 9.00669e-06 9.91276e-06
1.01958e-05 8.16361e-06 4.44220e-06
-3.16524e-06 -1.78092e-05 -4.18935e-05 -7.78224e-05 -0.000128000 -0.000194829
-0.000280715 -0.000388062 -0.000519273 -0.000676752
-0.000862904 -0.00108013
```

Values are returned for every Pout, whether it's off the end of Pin or not. If you plot these, they form an arc in the negative going to magnitudes higher than any of the input values. Is there any way to get rid of these short of searching for the max and min values of Pin and excluding Pouts outside this range? How does interpol come up with values out there anyway, given that inputs on either side of the output should be required for the spline function? Adding all these searches and exclusions would make using this function impractical, given that I have to apply it thousands of times. Note that Pin varies over time while Pout is fixed.

Subject: Re: Interpolation routines
Posted by [laura.hike](#) on Tue, 02 Feb 2016 21:48:15 GMT
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I also tried substituting zeros for the SWins where they and Pin are NaNs or only substituting zeros for the NaNs in Pin, and got the same result as with the NaNs in both cases. If I substitute zeros for the NaNs in both SWin and Pin, the result is nonsensical.

Subject: Re: Interpolation routines
Posted by [Paul Van Delst\[1\]](#) on Tue, 02 Feb 2016 22:01:29 GMT
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On 02/02/16 16:31, laura.hike@gmail.com wrote:
> On Tuesday, February 2, 2016 at 12:17:06 PM UTC-8, wlandsman wrote:
>
>> I don't believe this is true anymore. INTERPOL() used to be
>> biggest problem but since IDL 7.0, it is a professional level
>> interpolation routine (and certainly more powerful than QUADTERP).
>>
>> I do agree that your best bet is to probably remove the NAN values
>> (using WHERE and FINITE()). I would use INTERPOL() without the

```
>> /NaN keyword.
>>
>> g = where(finite(y)) result = interpol( y[g], x[g], xinterp,
>> /spline)
>
> Thanks for the comment, wlandsman. I tried the "finite" method and
> got the same result as when I left the NaNs in and included the /NaN
> keyword. The interpolation works correctly (except when there are
> fewer than 4 valid points left, so I would have to write a trap for
> this in any case), but it continues beyond the end of the input
> range, becoming extrapolation instead of interpolation. This is
> completely invalid, so I specifically want to prevent it.
```

Umm, don't you specify the output interpolated pressures? So shouldn't you just truncate them based on the inputs? That is, the maximum output/interpolated pressure is the first value that is less than the maximum finite input pressure. (Does that sound right?)

I interpolate lots of atmospheric temperature and absorber (e.g. H₂O, O₃, etc) profiles and that's what I do. I agree with you that extrapolation is completely invalid (in general), and in my case for T(p) and H₂O(p)/etc profiles it gets non-physical real fast.

Also, I don't know what the "SW" data is but, for atmospheric profiles, shouldn't you be interpolating in ln(P) space rather than P?

```
> I show an
> example below in order to be clear. Yes, this is a vertical profile
> in pressure coordinates, for anyone who cares:
>
> Input abscissa Pin:
>
> 0.187500  0.362500  0.675000  1.26250  2.02500
> 2.98750  4.47500  6.75000  8.40000  8.98750 9.62500
> 10.2875  11.0000  11.7750  12.6000  13.4875
> 14.4500  15.4750  16.5750  17.7625  19.0250
> 20.3875  21.8625  23.4375  25.1250  26.9375
> 28.8875  30.9750  33.2125  35.6125  38.1875
> 40.9750  43.9750  46.3375  48.0000  49.7250
> 51.5125  53.3625  55.2875  57.2875  59.3500
> 61.4875  63.7000  66.0000  68.3875  70.8625
> 73.4250  76.0750  78.8250  81.6875  84.6500
> 87.7125  90.9000  94.2000  97.6125  101.150
> 104.825  108.637  112.587  116.688  120.938
> 125.337  129.900  134.638  139.538  144.625
> 149.913  155.388  161.062  166.938  173.025
> 179.350  185.913  192.700  199.737  207.038
```

```

> 214.663    222.625    230.888    239.513    248.513    257.913
> 267.725    277.925    288.575    299.688    311.237
> 323.100    335.288    347.938    361.050    374.463
> 388.188    402.400    417.025    432.087    447.612
> 463.550    479.925    496.812    514.300    532.287
> 550.725    569.738    589.312    609.463    630.287
> 651.825    NaN        NaN        NaN        NaN        NaN
> NaN        NaN        NaN        NaN        NaN        NaN
> NaN        NaN        NaN        NaN        NaN        NaN
> NaN        NaN        NaN        NaN        NaN        NaN
> NaN        NaN        NaN        NaN        NaN        NaN
> NaN
>
> Output abscissa Pout:
>
> 0.100000    0.300000    0.400000    0.500000    0.700000
> 1.00000    2.00000    3.00000    4.00000    5.00000    7.00000
> 10.0000    20.0000    30.0000    40.0000    50.0000
> 70.0000    100.000    150.000    200.000    250.000
> 300.000    350.000    400.000    450.000    500.000
> 550.000    600.000    650.000    700.000    725.000    750.000
> 775.000    800.000    825.000    850.000    875.000
> 900.000    925.000    950.000    975.000    1000.00
>
> Values obviously occur in Pout that are beyond the range of Pin.
>
> Ordinate in SWin:
>
> 0.000156151 0.000173488 0.000207377 0.000210915 0.000169155
> 0.000110047 7.45450e-05 5.23441e-05 3.99181e-05 3.90353e-05
> 3.75340e-05 3.97617e-05 3.25255e-05 3.04963e-05 3.44416e-05
> 2.90153e-05 2.68362e-05 3.02042e-05 2.54594e-05 2.58893e-05
> 2.62765e-05 2.39674e-05 2.39971e-05 2.40214e-05 2.37010e-05
> 2.34202e-05 2.16869e-05 2.26950e-05 1.99376e-05 2.16858e-05
> 1.91526e-05 1.85088e-05 1.88882e-05 1.80156e-05 1.72226e-05
> 1.67287e-05 1.73794e-05 1.56135e-05 1.48229e-05 1.44584e-05
> 1.51021e-05 1.45813e-05 1.19285e-05 1.34967e-05 1.10665e-05
> 1.15942e-05 1.21990e-05 1.08427e-05 9.58437e-06 1.00086e-05
> 8.94639e-06 9.36905e-06 8.25729e-06 8.73890e-06 7.72265e-06
> 7.45533e-06 6.50589e-06 6.92547e-06 6.66663e-06 6.42854e-06
> 6.20490e-06 5.99692e-06 5.77185e-06 5.05578e-06 4.90454e-06
> 4.69174e-06 4.99278e-06 4.37616e-06 3.80173e-06 3.67547e-06
> 3.93453e-06 3.40434e-06 3.28958e-06 3.18232e-06 3.06034e-06
> 2.62840e-06 2.80613e-06 2.71086e-06 2.02691e-06 2.48816e-06
> 1.59571e-06 2.53445e-06 2.43971e-06 3.04975e-06 4.47653e-06
> 4.95492e-06 6.00842e-06 7.14583e-06 7.06873e-06 7.76889e-06
> 7.85854e-06 8.32823e-06 8.90338e-06 9.45487e-06 9.72611e-06
> 9.55187e-06 9.46401e-06 8.91291e-06 9.40596e-06 8.94922e-06

```

```

> 9.59435e-06 9.93338e-06 9.91535e-06 1.02259e-05 1.02142e-05
> 1.00091e-05 8.75643e-06 8.13227e-06      NaN      NaN NaN
> NaN      NaN      NaN      NaN      NaN      NaN
> NaN      NaN      NaN NaN      NaN      NaN
> NaN      NaN      NaN      NaN      NaN      NaN
> NaN NaN      NaN      NaN      NaN      NaN
> NaN      NaN      NaN
>
> Ordinate out:
>
> 0.000147821 0.000166955 0.000177699 0.000189441 0.000209155
> 0.000217363 0.000170853 0.000109465 8.07843e-05 6.65560e-05
> 4.99181e-05 3.92060e-05 2.45898e-05 2.22732e-05 1.85323e-05
> 1.68197e-05 1.12288e-05 7.54906e-06 4.98966e-06 3.04681e-06
> 1.66306e-06 4.97638e-06 7.80974e-06 9.37925e-06 9.38277e-06
> 9.00669e-06 9.91276e-06 1.01958e-05 8.16361e-06 4.44220e-06
> -3.16524e-06 -1.78092e-05 -4.18935e-05 -7.78224e-05 -0.000128000
> -0.000194829 -0.000280715 -0.000388062 -0.000519273 -0.000676752
> -0.000862904 -0.00108013
>
> Values are returned for every Pout, whether it's off the end of Pin
> or not. If you plot these, they form an arc in the negative going to
> magnitudes higher than any of the input values. Is there any way to
> get rid of these short of searching for the max and min values of Pin
> and excluding Pouts outside this range? How does interpol come up
> with values out there anyway, given that inputs on either side of the
> output should be required for the spline function? Adding all these
> searches and exclusions would make using this function impractical,
> given that I have to apply it thousands of times. Note that Pin
> varies over time while Pout is fixed.
>
>

```

Subject: Re: Interpolation routines

Posted by [laura.hike](#) on Tue, 02 Feb 2016 22:38:15 GMT

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On Tuesday, February 2, 2016 at 2:01:35 PM UTC-8, Paul van Delst wrote:

Yes, this is the only solution that I've found. It seems ridiculous to have to do this manually -- surely the interpolation function should handle this, or at least have it as an option. Cutting the range does have the drawback of not assigning a value to a point that is barely outside the input range. Could throw in a little margin for that, I suppose.

SWin is related to density, which is linear in P.

>
> Umm, don't you specify the output interpolated pressures? So shouldn't
> you just truncate them based on the inputs? That is, the maximum
> output/interpolated pressure is the first value that is less than the
> maximum finite input pressure. (Does that sound right?)
>
> I interpolate lots of atmospheric temperature and absorber (e.g. H2O,
> O3, etc) profiles and that's what I do. I agree with you that
> extrapolation is completely invalid (in general), and in my case for
> T(p) and H2O(p)/etc profiles it gets non-physical real fast.
>
> Also, I don't know what the "SW" data is but, for atmospheric profiles,
> shouldn't you be interpolating in ln(P) space rather than P?
>
>
>> I show an
>> example below in order to be clear. Yes, this is a vertical profile
>> in pressure coordinates, for anyone who cares:
>>
>> Input abscissa Pin:
>>

>> 0.187500	0.362500	0.675000	1.26250	2.02500	
>> 2.98750	4.47500	6.75000	8.40000	8.98750	9.62500
>> 10.2875	11.0000	11.7750	12.6000	13.4875	
>> 14.4500	15.4750	16.5750	17.7625	19.0250	
>> 20.3875	21.8625	23.4375	25.1250	26.9375	
>> 28.8875	30.9750	33.2125	35.6125	38.1875	
>> 40.9750	43.9750	46.3375	48.0000	49.7250	
>> 51.5125	53.3625	55.2875	57.2875	59.3500	
>> 61.4875	63.7000	66.0000	68.3875	70.8625	
>> 73.4250	76.0750	78.8250	81.6875	84.6500	
>> 87.7125	90.9000	94.2000	97.6125	101.150	
>> 104.825	108.637	112.587	116.688	120.938	
>> 125.337	129.900	134.638	139.538	144.625	
>> 149.913	155.388	161.062	166.938	173.025	
>> 179.350	185.913	192.700	199.737	207.038	
>> 214.663	222.625	230.888	239.513	248.513	257.913
>> 267.725	277.925	288.575	299.688	311.237	
>> 323.100	335.288	347.938	361.050	374.463	
>> 388.188	402.400	417.025	432.087	447.612	
>> 463.550	479.925	496.812	514.300	532.287	
>> 550.725	569.738	589.312	609.463	630.287	
>> 651.825	NaN	NaN	NaN	NaN	NaN
>> NaN	NaN	NaN	NaN	NaN	NaN
>> NaN	NaN	NaN	NaN	NaN	NaN
>> NaN	NaN	NaN	NaN	NaN	NaN
>> NaN	NaN	NaN	NaN	NaN	NaN

```

>> NaN
>>
>> Output abscissa Pout:
>>
>> 0.100000  0.300000  0.400000  0.500000  0.700000
>> 1.00000  2.00000  3.00000  4.00000  5.00000  7.00000
>> 10.0000  20.0000  30.0000  40.0000  50.0000
>> 70.0000  100.000  150.000  200.000  250.000
>> 300.000  350.000  400.000  450.000  500.000
>> 550.000  600.000  650.000  700.000  725.000  750.000
>> 775.000  800.000  825.000  850.000  875.000
>> 900.000  925.000  950.000  975.000  1000.00
>>
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>>
>> Ordinate in SWin:
>>
>> 0.000156151 0.000173488 0.000207377 0.000210915 0.000169155
>> 0.000110047 7.45450e-05 5.23441e-05 3.99181e-05 3.90353e-05
>> 3.75340e-05 3.97617e-05 3.25255e-05 3.04963e-05 3.44416e-05
>> 2.90153e-05 2.68362e-05 3.02042e-05 2.54594e-05 2.58893e-05
>> 2.62765e-05 2.39674e-05 2.39971e-05 2.40214e-05 2.37010e-05
>> 2.34202e-05 2.16869e-05 2.26950e-05 1.99376e-05 2.16858e-05
>> 1.91526e-05 1.85088e-05 1.88882e-05 1.80156e-05 1.72226e-05
>> 1.67287e-05 1.73794e-05 1.56135e-05 1.48229e-05 1.44584e-05
>> 1.51021e-05 1.45813e-05 1.19285e-05 1.34967e-05 1.10665e-05
>> 1.15942e-05 1.21990e-05 1.08427e-05 9.58437e-06 1.00086e-05
>> 8.94639e-06 9.36905e-06 8.25729e-06 8.73890e-06 7.72265e-06
>> 7.45533e-06 6.50589e-06 6.92547e-06 6.66663e-06 6.42854e-06
>> 6.20490e-06 5.99692e-06 5.77185e-06 5.05578e-06 4.90454e-06
>> 4.69174e-06 4.99278e-06 4.37616e-06 3.80173e-06 3.67547e-06
>> 3.93453e-06 3.40434e-06 3.28958e-06 3.18232e-06 3.06034e-06
>> 2.62840e-06 2.80613e-06 2.71086e-06 2.02691e-06 2.48816e-06
>> 1.59571e-06 2.53445e-06 2.43971e-06 3.04975e-06 4.47653e-06
>> 4.95492e-06 6.00842e-06 7.14583e-06 7.06873e-06 7.76889e-06
>> 7.85854e-06 8.32823e-06 8.90338e-06 9.45487e-06 9.72611e-06
>> 9.55187e-06 9.46401e-06 8.91291e-06 9.40596e-06 8.94922e-06
>> 9.59435e-06 9.93338e-06 9.91535e-06 1.02259e-05 1.02142e-05
>> 1.00091e-05 8.75643e-06 8.13227e-06 NaN NaN NaN
>> NaN NaN NaN NaN NaN NaN
>> NaN NaN NaN NaN NaN NaN
>> NaN NaN NaN NaN NaN NaN
>> NaN NaN NaN NaN NaN NaN
>> NaN NaN NaN
>>
>> Ordinate out:
>>
>> 0.000147821 0.000166955 0.000177699 0.000189441 0.000209155

```

```
>> 0.000217363 0.000170853 0.000109465 8.07843e-05 6.65560e-05
>> 4.99181e-05 3.92060e-05 2.45898e-05 2.22732e-05 1.85323e-05
>> 1.68197e-05 1.12288e-05 7.54906e-06 4.98966e-06 3.04681e-06
>> 1.66306e-06 4.97638e-06 7.80974e-06 9.37925e-06 9.38277e-06
>> 9.00669e-06 9.91276e-06 1.01958e-05 8.16361e-06 4.44220e-06
>> -3.16524e-06 -1.78092e-05 -4.18935e-05 -7.78224e-05 -0.000128000
>> -0.000194829 -0.000280715 -0.000388062 -0.000519273 -0.000676752
>> -0.000862904 -0.00108013
>>
>> Values are returned for every Pout, whether it's off the end of Pin
>> or not. If you plot these, they form an arc in the negative going to
>> magnitudes higher than any of the input values. Is there any way to
>> get rid of these short of searching for the max and min values of Pin
>> and excluding Pouts outside this range? How does interpol come up
>> with values out there anyway, given that inputs on either side of the
>> output should be required for the spline function? Adding all these
>> searches and exclusions would make using this function impractical,
>> given that I have to apply it thousands of times. Note that Pin
>> varies over time while Pout is fixed.
>>
>>
```

Subject: Re: Interpolation routines

Posted by [lecacheux.alain](#) on Wed, 03 Feb 2016 09:34:05 GMT

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Le mardi 2 février 2016 23:38:18 UTC+1, laura...@gmail.com a écrit :

> On Tuesday, February 2, 2016 at 2:01:35 PM UTC-8, Paul van Delst wrote:

>

> Yes, this is the only solution that I've found. It seems ridiculous to have to do this manually -- surely the interpolation function should handle this, or at least have it as an option. Cutting the range does have the drawback of not assigning a value to a point that is barely outside the input range. Could throw in a little margin for that, I suppose.

>

> SWin is related to density, which is linear in P.

>

>

>

Spline is well known for extrapolating badly (even extremely badly !).

In your case, assuming some stationarity of your data, an autoregressive model (e.g. TS_FCAST in IDL) might give better result (of course after truncating your series by using some where(finite(...)).

alx.

>>

>> Umm, don't you specify the output interpolated pressures? So shouldn't

>> you just truncate them based on the inputs? That is, the maximum

```

>> output/interpolated pressure is the first value that is less than the
>> maximum finite input pressure. (Does that sound right?)
>>
>> I interpolate lots of atmospheric temperature and absorber (e.g. H2O,
>> O3, etc) profiles and that's what I do. I agree with you that
>> extrapolation is completely invalid (in general), and in my case for
>> T(p) and H2O(p)/etc profiles it gets non-physical real fast.
>>
>> Also, I don't know what the "SW" data is but, for atmospheric profiles,
>> shouldn't you be interpolating in ln(P) space rather than P?
>>
>>
>>> I show an
>>> example below in order to be clear. Yes, this is a vertical profile
>>> in pressure coordinates, for anyone who cares:
>>>
>>> Input abscissa Pin:
>>>
>>> 0.187500  0.362500  0.675000  1.26250  2.02500
>>> 2.98750  4.47500  6.75000  8.40000  8.98750 9.62500
>>> 10.2875  11.0000  11.7750  12.6000  13.4875
>>> 14.4500  15.4750  16.5750  17.7625  19.0250
>>> 20.3875  21.8625  23.4375  25.1250  26.9375
>>> 28.8875  30.9750  33.2125  35.6125  38.1875
>>> 40.9750  43.9750  46.3375  48.0000  49.7250
>>> 51.5125  53.3625  55.2875  57.2875  59.3500
>>> 61.4875  63.7000  66.0000  68.3875  70.8625
>>> 73.4250  76.0750  78.8250  81.6875  84.6500
>>> 87.7125  90.9000  94.2000  97.6125  101.150
>>> 104.825  108.637  112.587  116.688  120.938
>>> 125.337  129.900  134.638  139.538  144.625
>>> 149.913  155.388  161.062  166.938  173.025
>>> 179.350  185.913  192.700  199.737  207.038
>>> 214.663  222.625  230.888  239.513 248.513 257.913
>>> 267.725  277.925  288.575  299.688  311.237
>>> 323.100  335.288  347.938  361.050  374.463
>>> 388.188  402.400  417.025  432.087  447.612
>>> 463.550  479.925  496.812  514.300  532.287
>>> 550.725  569.738  589.312  609.463  630.287
>>> 651.825      NaN      NaN      NaN      NaN      NaN
>>> NaN      NaN      NaN      NaN      NaN      NaN
>>> NaN      NaN      NaN      NaN      NaN      NaN
>>> NaN      NaN      NaN      NaN      NaN      NaN
>>> NaN      NaN      NaN      NaN      NaN      NaN
>>> NaN
>>>
>>> Output abscissa Pout:
>>>

```

```

>>> 0.100000 0.300000 0.400000 0.500000 0.700000
>>> 1.00000 2.00000 3.00000 4.00000 5.00000 7.00000
>>> 10.0000 20.0000 30.0000 40.0000 50.0000
>>> 70.0000 100.000 150.000 200.000 250.000
>>> 300.000 350.000 400.000 450.000 500.000
>>> 550.000 600.000 650.000 700.000 725.000 750.000
>>> 775.000 800.000 825.000 850.000 875.000
>>> 900.000 925.000 950.000 975.000 1000.00
>>>
>>> Values obviously occur in Pout that are beyond the range of Pin.
>>>
>>> Ordinate in SWin:
>>>
>>> 0.000156151 0.000173488 0.000207377 0.000210915 0.000169155
>>> 0.000110047 7.45450e-05 5.23441e-05 3.99181e-05 3.90353e-05
>>> 3.75340e-05 3.97617e-05 3.25255e-05 3.04963e-05 3.44416e-05
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>>> 9.55187e-06 9.46401e-06 8.91291e-06 9.40596e-06 8.94922e-06
>>> 9.59435e-06 9.93338e-06 9.91535e-06 1.02259e-05 1.02142e-05
>>> 1.00091e-05 8.75643e-06 8.13227e-06 NaN NaN NaN
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>>>
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```

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