Subject: Direction of Wind Vectors: A bug?
Posted by David Fanning on Wed, 18 Feb 2015 18:32:42 GMT
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Folks,

Someone was harassing my retirement reveries this morning by claiming that cgDrawVectors was drawing vectors incorrectly, in the wrong directions. He cited as evidence the output of the lovely NASA program, PartVelVec.

Upon looking into this, I discovered that the two programs produce vectors in exactly the same direction if the the plot they are being output on has the same scale in the X and Y direction. (Other things, such as vector length and whether the location specifies the end of the vector or the middle, etc, are different, but irrelevant here.)

If the scale is different on the output plot, the two programs calculate the end-point of the vector differently. As it happens (maybe you saw this coming), I believe cgDrawVectors is doing things right and PartVelVec is doing things wrong.

You will need a recent version of cgDrawVectors to test this. You can download the latest here:

http://www.idlcoyote.com/programs/cgdrawvectors.pro

Unfortunately, I am only about 75% convinced cgDrawVectors is right. I need reassurance from some IDL experts. God only knows how many papers have been written using output from PartVelVec as supporting evidence!

Here is my thinking. Suppose you tell me at some spot on the Earth, the wind is blowing 10 mph in the X direction and 10 mph in the Y direction. Clearly, if I place, say, an arrow at that location, I will have to point it at a 45 degree angle to the location I am standing on to indicate the wind vector direction at that location.

OK, see, my confidence has already eroded to less than 50%, just by writing what I have so far! :-(

As you can see from the test program below, cgDrawVectors preserves this instantaneous vector angle (45 degrees) no matter what the plot scale, while PartVelVec does not. But, I can also see someone explaining PartVelVec by saying, "Look, forget the angle of the vector for a moment. Walk from the starting point of this vector to the end of this vector, and note the coordinates of the two points. Calculate the angle from that. It is 45 degrees, even though it doesn't look like it on the plot because the scale is screwed up."

So, here is my question. Are both of these programs "right"? If not, why not? And, which would convey the "true wind direction" more convincingly on a plot?

Here is the test program.

```
;************************************************************ *****
Pro Vector_Bug
   cgdisplay, wid=1, aspect=1.0, Title='Scale Same in XY'
   cgplot, [-180, 180], [-180, 180], /NoData
   partvelvec, [10,10], [10,10], [-45, -45], [50,-50], $
      /over, veccolor='red', length=.5
   cgdrawvectors, [10,10], [10,10], [-45, -45], [50,-50], $
      /over, veccolor='blue', length=0.1

   cgdisplay, wid=0, aspect=1.0, Title='Scale Different in XY'
   cgplot, [-180, 180], [-90, 90], /NoData
   partvelvec, [10,10], [10,10], [-45, -45], [50,-50], $
      /over, veccolor='red', length=.5
   cgdrawvectors, [10,10], [10,10], [-45, -45], [50,-50], $
      /over, veccolor='blue', length=0.2
END
;************************************************************ *****
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Cheers,

David

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Coyote's Guide to IDL Programming: http://www.idlcoyote.com/
Sepore ma de ni thue. ("Perhaps thou speakest truth.")