**1. What are some phenomena that vector variables describe?**

Vector variables describe phenomena that have both magnitude and direction, such as wind, topography, oceanic currents, or electromagnetic waves.

**2. If Y in figure 11.1 had a vector of magnitude 8 pointing south in the southwest pixel and a zero vector in the southeast pixel, then what would be the components of mean absolute deviation for magnitude and direction?**

Giving Y in figure 11.1 a vector of magnitude 8 pointing south in the southwest pixel and a zero vector in the southeast pixel would not change the components of mean absolute deviation, given that there would still be a net magnitude of 8 pointing south for Y.

To calculate the mean absolute deviation quantity component for magnitude, you would take the absolute value of the difference between the sum of X and the sum of Y (equation 11.10). In this case, that would be ~ -3.0. To calculate the mean absolute deviation allocation component for magnitude, you would use the maximum function to subtract the magnitude quantity deviation from the summation of adding the X and Y vectors and dividing them by the number of vectors. In this case, that would be ~ 0.4. To calculate the mean absolute deviation quantity component for direction, you would take the absolute value of the sum of the direction deviation between the mean vectors In this case, that would be ~ -59.5. To calculate the mean absolute deviation allocation component for direction, you would use the maximum number to ensure a positive result. Then you would subtract the direction quantity deviation from the summation of each direction deviation i over the number of vectors. In this case, that would be ~ 29.5.

**3. Under what circumstances does equation 11.14 produce a negative number of degrees?**

The equation 11.13 produces a negative number of degrees when the angle’s mean vector for Y is counterclockwise from the mean vector for X.

**1. What would motivate a scientist to commit one of the deadly sins of this chapter?**

Pre-existing norms within their field, usage of metrics in other literature, desire to publish are all reasons why a scientist might commit one of the deadly sins of this chapter. Another reason scientists might commit one of the deadly sins of this chapter would be selecting metrics based on the software available to commute it instead of how much it relates to the research question.

**2. Some authors recommend universal rules to anoint particular values of a metric as excellent, good, acceptable, or poor. Do you endorse such rules? Why or why not?**

No, I do not endorse such rules. Acceptability should be defined with respect to the research question each study is asking -- therefore, to use the words excellent, good, acceptable or poor, authors must define those words in context of the research question, which can get complicated. It is clearer to define what is acceptable for your research question and base your analysis there.

**3. How do the meanings of the word “significant” and “random” in casual conversation differ from their meanings in scientific communication?**

In casual conversation, both significant and random can refer to pretty much anything deemed arbitrarily significant or random by the speaker, whereas in scientific communication, these terms refer to specific mathematical thresholds and definitions to their narrow range of meaning. For example, in scientific literature “significant” indicates a small p-value; in regular conversation, it means things like “important”. In scientific literature, “random” means in mathematical terms that each pixel being sampled has an equal chance of being chosen. In other words, it refers to a specific pattern which often requires a random number generator to be practically implemented. “Random” in regular conversation can mean anything not particularly ordered or whose pattern isn’t yet understood.

**4. How did you or other audience members respond when you saw a scientist commit one of the deadly sins of this chapter? What was the reason for the response or lack of response? How will you respond next time you see a colleague commit a sin?**

Audience members, including myself, might initially feel uncomfortable calling out or questioning one of the deadly sins committed in this chapter. Uncertainty of their own knowledge, unwillingness to violate field norms or lack of self-confidence all might explain the lack of response. I know a fear of being wrong myself or a fear that I’ve misunderstood the author is something that I would be concerned about in this situation. However, it is important moving forward for me to make an effort to question why author’s have made the choices they have made, especially if they are committing one of the deadly sins of this chapter. By asking them to explain their choice instead of harshly criticizing them, or criticizing them without offering an alternative, you can hurt their feelings or offend them. Therefore, in the future, I will endeavor to question instead of criticize the usage of these deadly sins mentioned in this chapter. Questioning people also forces them to think about their own choices, enabling them to come to the same conclusions as you on their own. It’s important to think about how you would like to be treated were you to make a mistake when addressing the mistakes of your colleagues and peers.