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Interactive comment on "The Sailor diagram. An extension of Taylor's diagram to two-dimensional vector data" *by* Jon Sáenz et al.

Anonymous Referee #2

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Comments on the manuscript entitled "The Sailor diagram. An extension of Taylor's diagram to two-dimensional vector data" by Sáenz et al. submitted to GMD

Recommendation: Major revision

Summary comment The authors aim to propose a model evaluation method in terms of vector data. They constructed a "Sailor diagram" and claimed that this diagram is an extension of Taylor diagram. In my point of view, it is very farfetched to say the Sailor diagram is an extension of Taylor diagram. The Sailor diagram is not even like Taylor diagram. Two diagrams presents very different statistics. For example, Taylor diagram can illustrate correlation coefficient, standard deviation, and RMSE. However, the Sailor diagram shows the first and second EOF with the semi-major and semi-minor axes of ellipses, respectively. Each ellipse represents one model or observa-

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tional data, the difference between model and observation is judged visually, which is less objective. More importantly, why are the first and second EOFs useful and what is the implication of the EOFs in terms of climate model evaluation? The EOFs between model and observation may represent different patterns. In this case, the comparison between model and observation can give wrong conclusions. These questions were not clearly interpreted (addressed) in the manuscript. Substantial revision is needed before the manuscript can be considered for publication in GMD. Detailed comments are listed below.

1. The title of the manuscript is misleading and should be changed because the Sailor diagram is totally different from the Taylor diagram. Two diagrams present very different statistics and have different implications. For example, Taylor diagram presents correlation coefficient, standard deviation, and RMSE. However, the Sailor diagram was constructed based on the EOF of vector data, which does not explicitly include correlation coefficient and standard deviation. Two diagrams do not look like each other, either.

2. Section 2 introduced five different vector datasets using 3 pages. It's not necessary to use so much dataset and can be reduced since they are all vector data. Only one or two of them should be enough to interpret the diagram. In contrast, methodology (section 3) is the key part of the manuscript which should clearly interpret and explain the method. However, the methodology was not well interpreted and hard to follow. I suggest that the authors interpret the methodology using an example data. Eu, Pu, and EOFs can be illustrated by using the example data to help readers to understand the method. The method and its application should be clearly interpreted in terms of model evaluation. In addition, section 3.1 and 3.2 generally present the same equations and can be merged.

3. Line 49-51 and 78-80: This is not true. The Taylor diagram can be extended to two (even more) dimensional vector data evaluation directly by using a set of statistical quantities defined by Xu et al. (2016). This paper was also cited by the authors.

4. Line 99-101, 109-112: To my knowledge, Xu et al. (2016) did normalize various statistics but no approximation was applied. The author argued that the merit of the Sailor diagram is that no approximation is needed. However, Sailor diagram illustrate the first two EOFs. Each EOF can only explain part of the variability of the original data.

5. Line 220-223: It is confusing that the authors use “U” to represent observation and “V” to represent model because U and V were usually used as the zonal and meridional component of wind. I suggest the authors replace “U” with “O” and “V” with “M” or other appropriate notation to avoid confusion.

6. Line234: How are the principal components of the data standardized?

7. Line 360-361: What is the implication of the relative rotation between EOFs from observations and simulations? Why is it important to model evaluation?

8. Line 361-363: Why the variance explained by each EOF is important in terms of model evaluation? What if the EOFs between model and observation represent different patterns?

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