

## ***Interactive comment on “An empirical stochastic model of sea-surface temperature and surface wind over the Southern Ocean” by S. Kravtsov et al.***

**S. Kravtsov et al.**

kravtsov@uwm.edu

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We agree with the reviewer that the main thrust of the paper is methodological, while possible applications of the model so developed are only touched upon more succinctly; the physical conclusions of the application provided may thus be considered to be preliminary. The abstract uses specifically the word “preliminary,” as opposed to “conclusive,” in its last sentence and we are thus at a loss as to how to improve either the abstract or the paper in this respect.

We are not at all sure what is meant by the “presentation is verbal”: there are many equations - both displayed and in the text - as well as plenty of technical details in the

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main text and the two Appendices. Two Tables and ten Figures, some of them multi-panel, should be quite sufficient for the interested reader to “draw any clear conclusions by themselves.”

Moreover, we cannot help but disagree with the notion that our demonstration of the utility of our empirical models is flawed. There is always a degree of ambiguity in the choice of any empirical model, and there are limitations related to the inevitably limited amount of data available for model construction. We show, however, quite unambiguously how, given the choice of the parametric model, to regularize the model operator and avoid sensitivity of the model to controlled changes in the size of the training data set; such sensitivity, were it present, would indicate overfitting. This regularization - which is the thrust of Appendix A - effectively removes statistical “ambiguity” in the behavior of our empirical models. The optimal “model order” turns out to be large indeed, due to the complexity of air–sea interaction over the Southern Ocean, which involves processes with many degrees of freedom. The model order is a function of the problem at hand and has turned out to be either smaller or larger than here in previous work by some of the same authors; this work is cited when appropriate in the paper’s six pages of references and the variability of the model order thus confirms the “generality of the findings,” rather than casting doubt on it.

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