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Interactive comment on "Towards measuring the meridional overturning circulation from space" *by* D. Cromwell et al.

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Interactive comment on "Towards measuring the meridional overturning from space" by Cromwell et al.

This paper describes a statistical method to predict interannually smoothed MOC-variations in POCM. The model is trained on a period of 10 years, with typically 3-5 degrees of freedom remaining after smoothing, and explains 98% of the variability. When the statistical model omits SSH EOFs that reflect a trend in mass gain the mean square error of the prediction is 0.63 Svˆ2. The authors interpret this result as promising, concluding it to be possible to monitor the MOC using a combination of SSH and bottom pressure measurements.

At first sight, the results of the fit and prediction indeed look very good. I have a few

fundamental problems, however, with the statistical model and the interpretation of the prediction. First, the statistical model is nonlinear with triple products containing 7 and double products containing 4 fitting parameters. The model of eq. (5) contains 58 fitting parameters, the model of Eq. (6) 61 fitting parameters. Training these on an interannually-smoothed dataset of about 4 degrees of freedom is tremendously overfitting and it does not come as a surprise that 98% of the variability can be explained by such a model. Also, the chance that by chance an arbitrary 61-parameter model may predict the next interannually-smoothed 10 years (containing 4 degrees of freedom) is nowhere estimated, so the value of this model absolutely cannot be assessed from this exercise. Second, the result that the root mean square error in the prediction is 0.63 Svˆ2 may sound good, but should be compared to the variance that is contained in the time-series. This seems of the same order of magnitude, implying that a model with only one parameter; the average MOC-value, might have given the same result. Also, the authors do not give the correlation between the predicted and observed timeseries, so they have not even made an attempt to quantify the strength of their predictive model.

The basic methodological error resides, however, in fitting and predicting 4-5 point timeseries with a 61-parameter fit. This is unsound science. The method followed by the authors could have been valid when applied to timeseries of a few hundred to thousand years as can be extracted from model runs made for the IPCC and from ensemble experiments with coupled climate models. Such exercise, however, should be accompanied by a much firmer statistical assessment of the predictive skill of the model than shown here. The present paper, which basically describes a 61-parameter fit to a timeseries of about 4 independent points and a subsequent prediction of another timeseries with about 4 independent points cannot be published in the scientific literature.

Interactive comment on Ocean Sci. Discuss., 3, 1623, 2006.