

## ***Interactive comment on “Assimilating water column and satellite data for marine export production estimation” by X. Yao and R. Schlitzer***

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We thank Referee 1 for his/her constructive comments and suggestions that help to improve the manuscript. The poor English in parts of the manuscript will be improved before resubmission.

1. Components of the cost function and error covariance matrices. In chapter 3.4 we will provide full details of the cost function as well as the treatment of data errors. This will be complemented with more details on individual cost function terms in table 2.
2. Issue of identifiability of the parameters estimated using the adjoint method. Concerning the issue of parameter identifiability we have conducted three additional sensitivity runs of Exp B with different initial independent parameter values to investigate

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the degree of variance in the solutions. Results of these runs will be shown in a new chapter 3.6.

3. The derivation of the adjoint model in presence of variable resolution. The derivation of the adjoint equations follows traditional procedures as outlined for instance in Hestenes (1975) or Thacker and Long (1988). For the present model this is described in detail in Schlitzer (2007). In appendix there will be add two schematic figures showing the matrices of partial derivatives of the Lagrange function with respect to dependent and independent parameters.

4. Validation of the adjoint and gradient tests. Actually before running each experiment, a gradient test was performed to check the corrections of the adjoint model. Mathematical theory as well as implementation of this gradient test will be described in a new appendix.

5. English language grammar and style of the entire manuscript will be improved before we resubmit.

Hestenes, M. R., 1975: Optimization Theory. John Wiley and Sons, 447 pp. Thacker, W. C., and R. B. Long, 1988: Fitting dynamics to data. J. Geophys. Res., 93, 1227–1240. Schlitzer, R. (2007). Assimilation of radiocarbon and chlorofluorocarbon data to constrain deep and bottom water transports in the world ocean. Journal of Physical Oceanography 37(2): 259–276.

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