

1 Response to the interactive comment C1514 – C1517 by Anonymous Referee #1 to the manuscript, osd-9-3593-
2 2012, “A comparison between gradient descent and stochastic approaches for parameter optimization of a
3 coupled ocean-sea ice model” by H. Sumata et al.

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5 We would like to thank the anonymous referee #1 for providing a thoughtful assessment on our work, which will
6 certainly help to improve explanations and presentations of results in the manuscript.

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8 Response to Specific Comments:

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10 1. Choice of sea ice model and cost function:

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12 We put the following sentences to draw reader's attention to the fact that the response of the model (or the cost
13 function) is dependent on model's parameterization of physical processes and therefore a different
14 parameterization leads to different interrelations of respective parameters.

15 section 2.3, the 3rd paragraph: “It should be mentioned that the choice of parameters is particular to this study
16 and other Hibler (1979) class of models. A different parameterization of sea ice mechanics and
17 thermodynamics (like in Hunke and Lipscomb, 2001) naturally leads to a different set of parameters and thus
18 different optimization results.”

19 In addition, we put an additional sentence to explain the drag formulation used in the model. (section 2.3, the
20 3rd paragraph).

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22 2. Physical meaning of parameter space obtained:

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24 We added the following discussions regarding estimated parameters in the 3rd paragraph of section 3.3.

25 “It should be noted that the estimated parameters are not necessarily applicable to a long term simulation
26 and/or to assess physical processes of the model, regardless of the reduction of the cost and the convergence
27 of the estimated parameters. This is mainly due to the assimilation window used in our test case being shorter
28 than the spin-up time of the sea ice – ocean system. For example, extremely high albedo values (~0.99) are
29 probably due to the strongly biased ice concentration and thickness found in the original model run (Fig. 14
30 (a) and (g)). The algorithm leads to more ice on the Eurasian Basin side by reducing sea ice melt in summer
31 with extremely high albedo values. For realistic parameter estimation, the assimilation window should be at
32 least the spin-up time of the sea ice-ocean system, i.e. at least about 7 years. This work will be done in a
33 forthcoming paper.”

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35 3. Comment on physical consistency of models:

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37 The smth-code does not hurt any physical laws in the model. The smoothing introduces a subgrid-scale
38 parametrization of a step function to allow differentiation. It is introduced for instance with regards to the ice
39 advection for velocities around zero.

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41 4. A minor point on the title.

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43 We changed the title to focus on “sea ice model” as Referee #1 suggested.

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46 Technical Corrections:

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48 1.- 4. We thank the reviewer #1 for grammatical corrections.

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50 Figures: We rearranged the figures 10 and 12 as the reviewer #1 suggested. As a result of this rearrangement,
51 the numbers of the figures 10, 12, 13 and 14 were changed.