

Interactive comment on “Sea–air CO₂ fluxes in the Indian Ocean between 1990 and 2009” by V. V. S. S. Sarma et al.

Anonymous Referee #2

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General Comments:

In this paper Sarma et al. describe a comparative study of annual, seasonal and inter-annual CO₂ flux variability for the Indian Ocean derived from interpolated observations, ocean biogeochemical models and atmospheric and ocean inversions. These comparisons are made over the entire Indian Ocean and also for specific subregions.

The introduction to this paper provides a good overview of previously published estimates of CO₂ fluxes for the Indian Ocean, commenting on the agreement (or lack of agreement) between them, and the strengths and weaknesses of the various methods that have been employed.

The primary conclusion of this paper is very encouraging, i.e., that there is remark-

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ably good overall agreement between the CO₂ flux estimates derived from different methods for the entire basin, albeit with some significant regional and seasonal discrepancies. The latter are discussed extensively and insights are provided into why these discrepancies arise.

This is a well-written paper that will very likely become a benchmark for studies of CO₂ flux variability in the Indian Ocean for many years to come. I recommend publication with only minor revision as specified below.

Specific Comments and Technical Corrections:

Page 10762, Line 1: Should read “...of [the] globe...”

Page 10762, Line 21: Should read “receives [a] significant amount...”

Page 10763, Line 17: Poorly sampled with respect to CO₂, or in general? Please reword to clarify.

Page 10764, Line 1: Modify punctuation as follows: “...who, using underway pCO₂ data, estimated...”

Page 10764, Line 15: The Indian Ocean Dipole Zonal Mode (IODZM) is now almost universally referred to as just the Indian Ocean Dipole (IOD).

Page 10764, Line 26: No need to redefine the IOD acronym here. It is defined in line 15.

Page 10765, Line 2: Should read “...in [the] Arabian Sea...”

10765, Line 23: Change to “Because of the paucity of sampling in this important region, interpolated...”

Page 10766, Fig. 1: Need to add latitudes and longitudes to the axes.

Page 10766, Line 8: Need to include latitude range for the southern portion of the northern Indian Ocean.

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Page 10766, Lines 3-9: The authors should say something about the basis for dividing up the basin into these specific broad latitudinal zones for calculating CO₂ fluxes. Although this becomes obvious further on (i.e., based upon where the annual observed CO₂ fluxes switch from positive to negative at 18 degrees S), it seems rather arbitrary at this point in the manuscript.

Page 10766, Line 12-13: Should read "...which [includes] datasets from..."

Page 10766, Line 22: Should read "...variability a challenge..."

Page 10766, Line 23: Should read "...3 million measurements of..."

Page 10773, Line 21: Overestimated is one word.

Page 10774, Line 23: Should read "...except [the] tropical Indian Ocean..."

Page 10777: There do not appear to be any references to Fig. 5.

Page 10778, Line 19: Should refer to Fig. 9 rather than Fig. 7.

Page 10779, 1st paragraph: Switching back and forth between boreal and austral is confusing. Please choose one or the other reference frame and use it exclusively.

Page 10779: Fig. 10 needs a color key of some kind that specifies which inversion models are represented by each colored line.

Page 10780, Line 5: I think this should say "...a strong [negative] sea-air CO₂ flux..."

Page 10780, Lines 22-25: This sentence seems to contradict itself, first stating that simulated pCO₂ values were higher than observations by 10 uatm during all seasons (which, by the way, they are not as they switch from about 10 uatm higher to 10 uatm lower seasonally), then stating that the difference is only present during the Austral Summer. Also need to add Figure references here so that the reader knows exactly which Figures are being referred to.

Page 10781, Line 7: Should read "...additionally, given the fact that..."

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Page 10782, Line 4: Should read "...also [to] have..."

Page 10782, Line 29: This sentence isn't right "...with strong positive sea-air anomalies are simulated..."

Page 10783, Line 20: Should be "IODZM", but switch all to IOD as suggested above.

Page 10785, Line 17: Should read "...driven [by] poor simulations..."

Interactive comment on Biogeosciences Discuss., 10, 10759, 2013.

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