

Interactive comment on “On the meridional ageostrophic transport in the tropical Atlantic” by Yao Fu et al.

Anonymous Referee #2

Received and published: 20 March 2017

This manuscript provides estimates of the wind-driven meridional mass, heat, and salt transports across zonal lines at 14.5N and 11S in the tropical Atlantic. The authors use a variety of data sets to estimate the transport, most importantly a collection of measurements from CTD casts and ADCP measurements during cruises across each zonal transect. Because of the difficulty and effort involved with acquiring this kind of data set, and the thorough analysis of the data, these results deserve to be published. They will be useful for others estimating transports from observations and for validating numerical model simulations.

The authors have done a good job describing the methodology and presenting the data. It's good to see that similar results are usually obtained for a variety of methods and wind products (after accounting for deviations of winds during the Lagrangian cruises from monthly mean gridded winds). I have two main suggestions for improvement,

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followed by more minor comments and edits.

Main comments:

1. The manuscript contains a lot of description of the data and methodology, and a lot of it is presented in the "Results and discussion" section. For example, the different options for penetration depth of wind-driven currents, level of no motion, methodology for calculating heat and salt transports. I suggest putting most of the data and methodology text into a section (or two) before the results/discussion section. This will improve the flow of the manuscript and allow readers to focus more on the important results instead of being led back and forth between results and methods throughout the manuscript. I also suggest trying to shorten the data/methodology description wherever possible. I give some suggestions in my minor comments below.

2. The discussion of the "bigger picture" can be improved. The authors mention the importance of meridional transport for the AMOC and the connection to the STCs, and there are some comparisons to previous transport estimates, but to a large extent the manuscript presents a detailed set of calculations along two latitude lines during specific times of the year. Error estimates based on aliasing of inertial currents are given, but one also wonders about longer-timescale fluctuations in winds (seasonal, interannual) and how representative the authors' estimates are for annual, seasonal, and monthly climatological mean transport. Some discussion of these considerations would improve the manuscript.

Minor comments:

Section 1: At the end of this section it would be helpful for the authors to describe how their study differs from others (data used, time of year of measurements, etc.).

Section 2: At the beginning of this section (and in figure 1) please indicate the exact dates when each section was occupied.

Section 2.3: Why use two different bulk formulas for wind stress? Can you use the

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same for in situ and satellite winds? Same comment for lines 15-16 on p. 19.

Section 3.2: I suggest moving the discussion of reference depth (p. 15, lines 10-25) before description of the geostrophic velocity calculation in the preceding paragraph.

p. 16-18: To focus the manuscript more, I recommend removing, or at least shortening considerably, the parts dealing with the removal/identification of the velocity signal below the TTP since it does not affect the transport calculations.

Section 4: Some discussion of seasonality would be useful. What do you think are the error bars on your estimates, considering seasonal changes in winds and stratification, for example? Or what are the error bars for your weekly/monthly estimates considering interannual variability?

Figure 1: It's difficult to see the CTD locations in the N. Atl. transect. Maybe plot them a little above/below the uCTD marks? Also, maybe add black and white shading of mean zonal wind stress as background and make uCTD marks a different color?

Language edits:

p. 2, line 11: change 'has' to 'have'

p. 2, line 17: change 'they' to 'and'

p. 2, line 20: add hyphen between 'Ekman' and 'driven'

p. 3, lines 3-4: change 'is' to 'was' (two instances)

p. 4, line 1: change 'application' to 'applications' and 'approach' to 'approaches'

p. 4, line 8: delete 'of the direct approach'

p. 7, line 6: delete 'of' before '+/-0.001'

p. 7, line 14: change 'sink' to 'sinks'

p. 7, line 26: change comma to period and begin new sentence with "We..."

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p. 7, line 27: change comma to semicolon

p. 7, line 28: change 'allow water passing' to 'allowing water to pass'

p. 8, line 10: change '...leading) and' to '...leading), which'

p. 8, line 20: change 'a' to 'an'

p. 9, line 7: delete 'to'

p. 9, line 15: delete 'the' before 'three'

p. 10, line 1: change 'compare' to 'compared'

p. 11, line 17: insert 'the' after 'from'

p. 12, line 20: change 'isotherm' to 'isotherms'

p. 14, line 14: change 'flew' to 'flowed'

p. 15, line 2: change 'At' to 'Along the'

p. 15, line 7: insert 'and' after 'choice,'

p. 17, lines 26-27: delete comma after 'waves', insert 'a' before 'near-inertial', and insert comma after 'forcing'

p. 18, line 2: delete comma

p. 18, line 20: insert 'and' after comma

p. 18, line 21: change 'decrease' to 'decreases'

p. 18, line 22: change 'appears being' to 'appears to be'

p. 19, line 11: change 'of' to 'in'

p. 19, line 13: insert comma after first 'stress'

p. 19, line 14: change to '...wind speeds from the ship and satellite are very...'

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- p. 19, line 19: change 'anomalous' to 'anomalously'
- p. 19, line 20: change 'were' to 'was'
- p. 20, line 5: change 'arises' to 'arise'
- p. 20, lines 27-28: delete commas and insert 'of' after 'because'
- p. 21, lines 6-7: change to '...motion and therefore...'
- p. 21, line 8: insert 'Because' at beginning of sentence
- p. 21, line 13: change 'constant as' to 'to equal'
- p. 21, line 26: change '...question followed...' to '...question that follows...'
- p. 21, line 28: change 'not conclusive' to 'inconclusive'
- p. 23, line 10, change 'observation' to 'observations'
- p. 23, line 19: insert 'the' after 'that'
- p. 23, line 23: change 'estimate based' to 'estimates based on'
- p. 23, line 27: change 'fluctuation' to 'fluctuations' and 'this is' to 'which are'
- p. 25, line 13: change 'were' to 'was'
- p. 26, line 1, change 'estimated' to 'estimate'
- p. 27, line 25: change 'is' to 'are'
- p. 30, line 12: change 'meridional' to 'zonal'?

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