

## REVIEW OF DAR AND GHOSH

### GENERAL COMMENTS

The paper of Dar and Ghosh present an interesting “toy-model” of atmospheric transport over the Bay of Bengal between Bangalore and Kolkata. Based on meteorological and stable isotope observations they infer that the Bay of Bengal contributes 77% of the rainfall in June and that this contribution diminishes to 19% in September. This paper was also presented at the 8<sup>th</sup> EGU Leonardo Conference 2016 in Ourense. I attended this oral presentation and found it really fascinating to see what we can learn from the application of isotopes in hydrology and atmospheric sciences. That being said, I feel that this paper does not do complete justice to the findings of the authors. There is a lot of potentially interesting matter in the research, but it does not always come across well in the paper. I have several suggestions on how to improve the writing style, remove language errors and improve the organization of the manuscript. However, my main point is that the main results of the paper are not well enough presented. I believe that the main findings are articulated on P6,L5-10, but they are not backed up by any figures or tables, nor are these results compared to previous research, and no outlook on the broader implications is given. Below, I list some questions about matters that were not entirely clear in the paper and I list several other suggestions to improve the manuscript. I look forward to say a revised version of this manuscript.

### SPECIFIC COMMENTS

Nowhere is mentioned how exactly the SW Monsoon period is defined. What does SW stand for? And which months are considered?

“R” is used for precipitation/rainfall and “P” for precipitable water. This may be confusing as “P” is often used for precipitation. I suggest to use “W” for precipitable water instead to avoid confusion.

P1,L2: “generated from a moisture parcel which originates from the Arabian Sea”

I disagree with this choice of words. Generated in my mind implies evaporated from, but it is merely where the HYSPLIT-trajectory calculation ends.

P1,L9-L11: “We assumed based on our observation that the initial isotopic composition of vapor originating from the peninsular continental source is similar to our observation recorded at Bangalore station.”

I guess there are one or more commas missing, as this sentence doesn't seem right to me.

P1,L13-L14: Why aren't the sources of Bay of Bengal and India adding up to 100%, but 100-115% instead? Moreover, why isn't Peninsular India mentioned in the main text at all?

Introduction: Please do not use the awkward term evapotranspiration for reasons explained here: <http://www.earth-syst-dynam-discuss.net/5/C133/2014/esdd-5-C133-2014.pdf>

P1,L20-L22: “The quantitative understanding of all these components; advected moisture, recycled moisture and vapor due to process of Evapotranspiration (ET) is possible using stable isotopic tracers Kendall and McDonnell (2012).”

This should be moved to a few sentence later when isotopes are discussed.

P1,L24: “... regional water balance”

Please provide a reference for this statement

P1, L24-L25: "Globally 40% of terrestrial precipitation originates from land evaporation alone van der Ent et al. (2010)"  
Please state the method used (Eulerian moisture tracking method)

P2,L2: "Stable isotopes of ..."

Start a new paragraph here. Moreover, I think that the authors should expand their literature review to discuss many other papers. I am not an expert in isotope literature, but I know that people like Kei Yoshimura and Camille Risi have published many more papers on this subject which the authors could use as a start for their literature review (Risi et al., 2008, 2013, Yoshimura et al., 2003, 2008).

P2,L20-L21: "There have been repeated attempts to quantify the exact moisture recycling using the isotopic composition of precipitation."

This is an empty sentence as no references are given for these apparent repeated attempts

Which TRMM product is used exactly?

P3,L9-L10: "While most of the air mass trajectories at Bangalore originate from the Arabian Sea"

As mentioned before this is ill-defined, it is just the arbitrary choice for the time length of the backtrajectory calculations with HYSPLIT. This is very different from evaporative origin like used in other papers (Keys et al., 2012, 2014), and this should be clarified.

HYSPLIT calculations should be shortly explained and appropriate references should be given. I believe this is the appropriate latest reference: <http://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-14-00110.1>

P3,L19: "calculated for the dew point temperature at 850 mb"

This seems to be a major assumption. Is the factor valid for all pressures at which the rainout processes occur? Moreover, what is its value?

Equations: Should  $P_1$  not be  $P_{i-1}$  in some, if not all, of the equations? Please explain.

P3,L30: " $\delta_i$  is the Bay of Bengal surface water isotopic composition"

Where is this value taken from, and where can the reader see its value?

P4,L4: "Therefore"

Why "therefore"? As far as I can tell the following Eq. (5) could be written directly after Eq. (2),

It is not entirely clear to me how "F" is defined: is it compared to the original moisture in box 1 or for all boxes separately? It also does not come back in the results later.

P4,L8-L26: This entire section does not refer to figures/tables, which makes it difficult to follow

P4,L14: What are pre-monsoon months? Where do I see results for March?

P4,L27-P5,L11: This should be part of the methods section, not part of the results. Moreover, this section should clearly state the "unknowns" which are being solved by this toy model (in equations).

P5,L4-L6: "Isotopic composition of Bay of Bengal surface water and the kinetic enrichment factor based on the ocean conditions of SST, surface relative humidity and wind speed is used to calculate the isotopic composition of the evaporated Bay of Bengal moisture."

Please provide a detailed calculation

P5,L33: I suggest to start this paragraph with a header named "Validation of the model"

P6,L5-L6: "The model simulation yields varying monthly contribution of the continental branch of the Arabian sea and Bay of Bengal vapour sources."

What does this mean?

P6,L8: so the remaining percentages are continental or Arabian Sea?

The aim of this study reads: "The aim of the present study is quantification of moisture contribution from Bay of Bengal and continental vapour in the rain happening at Kolkata during the SW Monsoon period."

It is a real pity that only a few lines at the end of Section 3 discuss an answer to this aim, and these results are not presented in figures, tables or movies. This is in fact my main point and I feel that this section should be expanded. Specific care should be given to compare results to existing literature, for example: (Dirmeyer et al., 2009; van der Ent and Savenije, 2013; Prodhomme et al., 2014; Tuinenburg et al., 2011), but probably much more literature exists.

P6,L12: "Previous studies have concluded Bay of Bengal to be the sole contributor of moisture towards precipitation at Kolkata."

Which studies?

The value of the paper could be greatly improved if the Conclusions sections would include implications of the results or an outlook of what more could be done.

Table 1 needs some more explanation. Why is 2012 data used? I thought the authors were trying to simulate the 2004 monsoon? Are the H-2 and d-excess values relevant? There is also data from GNIP used, so why is this particular dataset relevant anyway?

Table 2 contains a lot of information, which is probably better to digest when it would be presented in a figure instead.

Figure 1: The names of Bangalore, Kolkata and Kakinada could also be directly shown in the figure.

Figure 2: d-excess is not used in this manuscript, thus why is this relevant? In which months are the individual points observed? Is this not relevant to indicate?

Figure 4: I think this should be split into Bangalore and Kolkata. Is there a big difference in sources during different stages of the monsoon? Can you say something about the relative relevance of each trajectory? I guess the lower level trajectories contain in fact more moisture.

## TECHNICAL CORRECTIONS

All physical quantities, for example,  $E$ ,  $P$ ,  $h$ , etc, should be written in italic, not only in the formulas, but also inline. On the other hand  $\delta^{18}\text{O}$  should not be in italic as O refers to the atom and not the physical quantity.

The word "the" is often missing (e.g. the Craig and Gordon model and the Bay of Bengal in the abstract). Please have your manuscript read by a native English speaker before submitting a revised version.

Reference are always given as Author (year), whereas (Author, year) is in many occasions the correct way.

Many unnecessary abbreviations are defined multiple times in the text, such as BOB, AS and F. Defining an abbreviation once is enough and only if it is ever used stand-alone, which is often not the case, thus there is no need to give an abbreviation at al.

Use hPa instead of mb for pressure

P2,L13: "was" → were

P2,L16: "has" → had

P3,L6: "Backward Airmass Trajectories for the two stations is" → Backward airmass trajectories for the two stations are

P3,L6: "airmass was back tracked" → "airmasses were tracked backward"

P3,L8: "Back trajectory" → Backtrajectory

P3,L20: Should  $f_i$  not be capitalized?

$\delta V_{iBOB}$  → place a comma between i and BOB

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